Five-year Review Report
Second Five-year Review

Ordot Landfill Site
Territory Of Guam

U.S. Environmental Protection Agency
Region IX

September 2002

EPA APPROVAL PAGE

Approved by:

Date: 9/30/02

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Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CDM	Camp Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act as Amended
CWA	Clean Water Act
DOJ	Department of Justice
Guam DPW	Guam Department of Public Works
Guam EPA	Guam Environmental Protection Agency
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
µg/L	micrograms per liter
NAAQS	National Ambient Air Quality Standard
OMP	Operations and Monitoring Plan
PCB	polychlorinated biphenyl
PCR	PCR Environmental, Inc.
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SMCL	Secondary Maximum Contaminant Level
SVOC	semi-volatile organic compound
TBC	To Be Considered
TRV	Toxicity Reference Value
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
VOC	volatile organic compound
WERI	University of Guam, Water and Environmental Research Institute of the Western Pacific

Executive Summary

A second five-year review of the Ordot Landfill Superfund Site in the Territory of Guam was completed in September 2002. The five-year review documents the evaluation of whether the September 1988 no action Record of Decision (ROD) remains protective of human health and the environment. The triggering action for the review was the previous five-year review for this site, conducted in September 1993.

The September 1988 ROD for the site prescribed not to take action under the Comprehensive Environmental Response, Compensation, and Liability Act as Amended (also known as CERCLA or Superfund), but to defer cleanup of the site to the Clean Water Act (CWA) program. The determination was based primarily on the fact that the site is still an operating municipal landfill and that data, although too limited for comprehensive conclusions, had not demonstrated any imminent and substantial endangerment to human health or welfare or the environment.

On March 26, 1986, the United States Environmental Protection Agency (USEPA) issued an Administrative Order under the Clean Water Act, 33 USC Section 1251 et seq., that requires the Guam Department of Public Works (DPW) to cease discharge of leachate from the site to the Lonfit River.

The previous five-year review for the site conducted in 1993 did not indicate any apparent areas of noncompliance with regard to the no action ROD; however, the extent of compliance achieved by the Guam DPW in response to the CWA Administrative Order was not evaluated. Due to the failure of the Guam DPW to comply with the Administrative Order, the United States Department of Justice (DOJ), acting on behalf of USEPA filed a lawsuit on August 7, 2002 to force the closure of the landfill.

The five-year review process consisted of a document review, a site inspection, interviews with members of the local community, interviews with technical participants regarding the remedy, a regulatory review, and a preliminary ecological and human health risk evaluation.

The results of this second five-year review indicate that the no action ROD is not functioning as intended, and is not protective of human health and the environment. It is recommended that the landfill be closed as an operating municipal landfill in accordance with applicable solid waste landfill closure requirements and guidance. After actions are taken pursuant to the CWA, it is recommended that a complete site characterization and formal risk assessment be performed to evaluate current ecological and human health risks at the site.

Five-year Review Summary Form

SITE IDENTIFICATION		
Site name: Ordot Landfill Superfund Site		
EPA ID: GUD980637649		
Region: IX	**Territory:** Guam	**City:** Ordot/Chalan Pago
SITE STATUS		
NPL status: Final		
Remediation status: Cleanup deferred to CWA		
Multiple OUs?* No	**Construction completion date:** 1992	
Has site been put into reuse? No		
REVIEW STATUS		
Lead agency: USEPA Region IX		
Review period: 09 / 28 / 1993 to 09 / 28 / 2002		
Date(s) of site inspection: 06 / 26 / 2002		
Type of review: Post-SARA		
Review number: 2 (second)		
Triggering action date: 09 / 30 / 1993		
Due date: 09 / 30 / 1998		

* "OU" refers to operable unit.

Recommendations and Follow-up Actions

Proper landfill operation procedures at the site, including the placement of daily cover material and proper waste compaction, have not been conducted. To date, several operations plans have been prepared for the site but none have been implemented. On August 7, 2002, DOJ, acting on behalf of USEPA filed a complaint against the Government of Guam to force action whereby "Guam must properly close and contain the Ordot Dump and open a new landfill that better protects public health and the environment." After actions are taken pursuant to the CWA complaint, a complete site characterization and risk assessment are recommended to evaluate current ecological and human health risks at the site. Future sampling efforts for collecting additional analytical data should be conducted with the appropriate field and laboratory quality assurance and quality control measures to provide reliable data for ecological and human health risk evaluation purposes.

Protectiveness Statement

The results of the five-year review indicate that due to the ongoing discharge of leachate into the Lonfit River, the no action ROD is not functioning as intended. Therefore the remedy is not protective of human health and the environment.

1.0 Introduction

The United States Environmental Protection Agency (USEPA) has conducted a second five-year review of the no action Record of Decision (ROD) implemented at the Ordot Landfill Site (the site), in the Territory of Guam (Figure 1).. This report has been prepared in accordance with USEPA's Guidance Document, *Comprehensive Five-Year Review Guidance* (USEPA, 2001).

In September 1988, USEPA issued a Final ROD (USEPA, 1988) not to take an action under the Comprehensive Environmental Response, Compensation, and Liability Act as Amended (CERCLA, also known as Superfund), but to defer cleanup of the site to the CWA program. The determination was based on several facts:

1. The site is an operating municipal landfill.
2. All but approximately 4 to 7 acres of the site were downgradient of or immediately adjacent to active waste disposal areas.
3. Any remedy for the inactive areas likely would have been affected by activities at the active waste disposal areas or continued leachate flows through the landfill.
4. The bulk of any environmental impacts from the landfill result from activities at the active waste disposal areas.
5. On March 26, 1986, USEPA issued an Administrative Order under the CWA, 33 USC Section 1251 et seq., that requires the Guam Department of Public Works (DPW) to cease discharge of leachate from the site to the Lonfit River.
6. The landfill, by applying standard operating practices (daily cover, etc.) to control landfill leachate, would effectively reduce or eliminate the surface flow of leachate to receiving waters.
7. USEPA data, although too limited for comprehensive conclusions, had not demonstrated any imminent and substantial endangerment to human health or welfare or the environment.

The purpose of the five-year review process is to evaluate whether the ROD for the site is protective of human health and the environment. The methods, findings, and conclusions of the review process are documented in five-year review reports. In addition, the five-year review reports identify deficiencies, if any, found during the review and provide recommendations for addressing them. This review is required by statute. USEPA must implement five-year reviews consistent with CERCLA Section 121(c), as amended, which states:

> "If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented."

The first five-year review of the no action ROD was conducted by USEPA and signed on September 30, 1993 (USEPA, 1993). No apparent areas of noncompliance were noted with regard to the no action ROD; however, the extent of compliance achieved by the Guam DPW in response to the CWA Administrative Order was not evaluated.

This report presents the findings of the second five-year review for the site. Because the first five-year review of the site was completed in 1993, this second five-year review report will actually address a 9-year period of activities at the site.

1.1 Five-year Review Process

This second five-year review consisted of a review of relevant documents; interviews with members of the local community; interviews with USEPA Region IX and Guam EPA technical staff, Guam DPW staff, former technical consultants familiar with the site, University of Guam personnel, and United States Geologic Survey (USGS) staff; a regulatory review; and a site inspection.

2.0 Site Chronology

The chronology of key events for the Ordot Landfill Site are provided below.

Chronology of Key Events

Event/Document	Date
Dumping Ground used by Japanese and U.S Naval military forces	1940's
Transfer of site from U.S Navy to the Government of Guam	November 1, 1950
Remedial Investigation of Insular Territory Hazardous Waste Sites	November 8-12, 1982 (draft report May 20, 1983)
Site Placed on National Priorities List	September 8, 1983
US EPA CWA NOV and Order to Guam DPW	March 26, 1986
Initial Site Characterization Report	November 18, 1987
No Action Record of Decision	September 1988
US EPA Clean Water Act Administrative Order to Guam DPW	July 24, 1990
First Five-year Review Report	September 30, 1993
Superfund Emergency Reponse to Ordot Tire Fire	December, 1998
DOJ files complaint against Guam for CWA violations	August 7, 2002
Continued use as Guam's only Municipal dump	Present

3.0 Site Background

The site is located near the Village of Ordot on the Island of Guam. Figure 1 presents a regional map showing the location of the site. The Island of Guam is located in the western Pacific Ocean, approximately halfway between Japan and New Guinea. The island has an area of approximately 212 square miles, with a length of 30 miles and a width ranging between 4 and 11.5 miles.

3.1 Former and Current Land Use

The Ordot Landfill was established in a ravine which slopes steeply to the Lonfit River. The site has been a dumping ground since the 1940's, serving as Guam's primary landfill for industrial and municipal waste. The site is currently operated by the Government of Guam through the Guam DPW. Current operations at the facility use almost the entire waste disposal area with only approximately 4 to 7 acres of the oldest portion of the landfill not in use. The 1988 ROD has stated that the area covered by the landfill is 47-acres, however using both the topographic map and aerial photograph from 1994, the total acreage is calculated to be approximately 23 acres. One inactive area forms the steeply sloping toe of the landfill. The depth of disposed waste at the time of the ROD was approximately 100 feet (USEPA, 1988). During more recent site visits, it was observed that there were 16 lifts of waste at the site, each measuring approximately 8-10 feet in depth. The toe of the landfill is approximately 1,000 feet from the Lonfit River and leachate streams emanate from points along the contact of the landfill toe and the clay soils comprising the banks of the Lonfit River.

3.2 Climate

Guam's average annual rainfall is 95 inches, and the average temperature is 81° F (Camp Dresser & McKee [CDM], 1982; Tracey et al., 1964). The wet season in Guam, including the typhoon season, typically lasts from July through December. Average rainfall during the wet season is 10 to 15 inches per month. During the dry season in Guam (January through June) average precipitation is 5 inches per month. The prevailing wind direction is easterly, but may reverse direction during the wet season.

3.3 Topography and Surface Water Drainage

The site is located in a basin between two ridges in a volcanic upland region near the center of Guam at an elevation of 200 feet above mean sea level. Surface water consolidates near the northeastern boundary of the site and flows into and beneath the landfill. Runoff primarily exits south of the site into the Lonfit River, which merges with the Sigua River to form Pago River, which then drains into Pago Bay.

3.4 Geology

The Island of Guam is divided into two distinct geologic divisions: a southern half comprising rugged volcanic upland of the Alutom Volcanic Series, and a northern half characterized by a limestone plateau of the Mariana Limestone, Agana Argillaceous Member. The site is situated in the center of the island, near the divide between the northern limestone and southern volcanic provinces.

The site is underlain with a few feet of very fine-grained volcanic sediments with a high clay content. Typically, these deposits range in color from gray to light orange in fresh exposures and gray-green to dark red in weathered exposures. The parent bedrock underlying these surficial deposits comprise tuffaceous shales and sandstones. These rock formations can range in thickness from several feet to tens of feet thick, particularly in the tuffaceous shales. Weathering is prominent to depths ranging from 10 to over 30 feet below ground surface (bgs). Both weathered and unweathered rocks appear to have extremely low permeability due to their fine-grained matrix. A major northwest-southeast trending fault is located north of the site (Tracey et al.,1964). This fault is believed to divide the northern limestone plateau from the southern volcanic province where the site is located.

3.5 Hydrogeology

Historically, groundwater underlying the site has been encountered at depths ranging from 28 to 60 feet bgs. (CH2M HILL, 1988) In the northern part of the site, groundwater generally flows south along the natural bedrock contact underlying the landfill, towards Lonfit River. This shallow aquifer is perched atop the underlying unfractured volcanic bedrock. In the southern part of the site, groundwater likely flows parallel with the Lonfit River towards the east within the river alluvium (CDM, 1987).

Drinking water from the volcanic region is obtained from surface water upgradient of the site and groundwater from the northern limestone aquifer (the Northern Guam Water lens). Groundwater in the limestone aquifer north of the site is encountered between 120 and 330 feet bgs. No interconnection between the aquifer located in the volcanic formation beneath the site and the Northern Guam Water lens has been documented**.**

3.6 History of Contamination

The site has been in operation beginning in the 1940's, serving as an industrial and municipal landfill for a variety of uncontrolled wastes, including spent industrial and commercial chemicals, polychlorinated biphenyl (PCB)-contaminated oils from transformers, and munitions. Unfortunately, records documenting the nature and quantity of hazardous wastes disposed at the site have not been maintained. Potentially responsible parties that could be identified as contributing to the contamination at the site include the US Navy, and the Government of Guam (USEPA, 1988).

3.7 Initial Response

In November 1982, USEPA performed a remedial investigation to identify existing and potential problems caused by wastes at the site (Black & Veatch, 1983). The results of the

investigation indicated low levels of contamination detected in leachate, surface water, and sediment samples attributable to the landfill. The investigation also indicated that the site poses little hazard to the Northern Guam Water lens; therefore, remedial actions were not recommended. However, the investigation report noted that due to the uncontrolled discharge of leachate from the site, the potential existed for increased pollution of Lonfit and Pago Rivers and, subsequently, Pago Bay. The report also indicated that exposed hazardous materials at the landfill are a human health and ecological concern. Ongoing surface water sampling, air monitoring, proper landfill operations and management, and vector controls were recommended.

The site was proposed for the National Priorities List at the request of the Governor and was finalized on September 8, 1983. In March 1987, USEPA conducted a initial site characterization to further delineate the potential release of hazardous materials at the site (CDM, 1987). Results of the initial site characterization indicated a slight degradation in groundwater quality due to the landfill but little potential for the landfill impacting the Northern Guam Water lens. The investigation report recommended instituting measures to control leachate, including a cover system, perimeter drainage collection system, and/or cutoff walls.

4.0 Remedial Actions

The following sections summarize the selection and implementation of the no action ROD selected for the site.

4.1 Remedy Selection

In September 1988, USEPA decided not to take an action under CERCLA, but to defer cleanup of the site to the CWA program. The determination was based on several facts:

1. The site was an operating municipal landfill.
2. All but approximately 4 to 7 acres of the site were downgradient of or immediately adjacent to active waste disposal areas.
3. Any remedy for the inactive areas likely would be affected by activities at the active waste disposal areas or continued surface flows through the landfill.
4. The bulk of any environmental impacts from the landfill are a result of activities at the active waste disposal areas.
5. USEPA had issued an Administrative Order in 1986 under the CWA, 33 USC Section 1251 et seq., that required the Guam DPW to cease discharge of leachate from the site to the Lonfit River.
6. By applying standard operating practices to control landfill leachate, Guam DPW could effectively reduce or eliminate the surface flow of leachate.
7. USEPA data, although too limited for comprehensive conclusions, had not demonstrated any imminent and substantial endangerment to human health or welfare or the environment.

EPA concluded that threats to human health and the environment were due to poor operation and maintenance practices. The appropriate mechanism for implementing improved practices at the landfill, including improved leachate control measures, would be through enforcement of the Clean Water Act.

EPA also decided, as a part of the preferred alternative, “to gather additional data to identify any adverse impacts on human health or welfare or the environment attributable to the landfill not currently identified and remediated by the improved landfill operation practices." As part of this continued monitoring program at the site, EPA would monitor to detect as early as possible any migration of contaminants from the landfill toward the sole source aquifer. The design of the program was to be based upon further hydro geological investigations at the site and in the vicinity of the site to characterize geologic and hydrologic features necessary to define the monitoring program.

4.2 Remedy Implementation

The Final ROD recommended no action under CERCLA but deferred cleanup of the site to the CWA.

In July 1992, USEPA installed two monitoring wells (MW-01 and MW-02)near the contact between the southern volcanic province and the northern limestone province (URS Consultants, 1992) (Figure 2). These wells were installed to monitor potential impacts from the landfill to the Northern Guam Water lens. The casing of MW-02 was crushed during installation by rubble from a collapsed contact zone; therefore, its effective screen interval in this well is uncertain. Analytical data collected from these two wells could not be validated, due to the field and laboratory quality control issues (see Section 6.4.2).

In October 1992, USGS installed two monitoring wells (OMW-1 and OMW-2) approximately 500 feet north of existing landfill boundary (Figure 2). Analysis of groundwater samples collected from these wells did not detect contaminants (Mink and Yuen Inc, 1995).

5.0 Progress Since Last Five-year Review

From the time the ROD was issued in 1988 to 1993, when the first five-year review was performed, Guam DPW reduced the discharge of leachate from the site by installing a diversion ditch upgradient of the landfill that diverted water from an artesian spring away from the landfill prism. Waste cover practices were improved, and toe of the landfill was stabilized (USEPA, 1993).

The previous five-year review report (USEPA, 1993) noted no apparent areas of noncompliance with regards to the no-action ROD; however, the extent of compliance achieved by the Guam DPW in response to the CWA Administrative Order was not evaluated. It was recommended that monitoring of groundwater wells be continued to confirm that contaminants from the site were not migrating towards the Northern Guam Water lens.

Since the last five-year review, little additional work has been done by Guam DPW to comply with the CWA Administrative Order to eliminate the discharge of leachate from the site. During a Guam EPA site inspection (Guam EPA, 1997), it was noted that daily cover was only placed along the side slopes of the waste prism and only on a few older, inactive cells. During a 1997 inspection, leachate and runoff were still observed. In November 1997, Guam DPW issued the *Operations and Monitoring Plan (OMP) for the Ordot Landfill* (Guam DPW, 1997) that outlined specific guidelines for waste compaction and placement of daily cover material, and proposed implementing a leachate and surface water monitoring program for a period of 1 to 2 years. Guam DPW proposed not to perform any design of a leachate collection or diversion system, pending the collection of reliable and validated analytical data from the monitoring program.

On December 25, 1998, a tire pile at the site caught fire, and ignited refuse on an open landfill face adjacent to the tire fire (Ecology and Environment, 1999). The refuse fire was mitigated by dumping clean fill onto the landfill face. On January 1, 1999, Guam EPA's contractor PCR Environmental, Inc. (PCR), conducted initial air monitoring at the site for volatile organic compounds (VOCs), carbon monoxide, and oxygen. Air monitoring performed by PCR did not detect VOC analyses above Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). USEPA provided air surveillance and cleanup assistance at the site through the Superfund Technical Assistant and Response Team (START). Additional air monitoring data were collected by START from January 16 to 18, 1999, during the ongoing burning of the tire pile. Air was monitored for particulate matter (PM_{10}), polynuclear aromatic hydrocarbons (PNAs), metals, carbon monoxide, oxygen, and VOCs. The preliminary data collected by START during normal burn conditions indicated no elevated risk to landfill employees or nearby residents with regard to respirable particulates, heavy metals or PAHs. The field screening carbon monoxide data indicated elevated levels at one sample location located at the landfill. It was thought by the START that those emissions were most attributable to gases being emitted from within the landfill. START assisted Mr. T. Thalhamer of the California Integrated Solid Waste Management Board (IWMB), who was brought in by EPA's Emergency Response Team, in the assessment of emissions from the subterranean fire on the face of the landfill

adjacent to the tire fire. This area had visibly subsided as the trash was combusted. There were open spaces and several vents in the surface in addition to visible stress cracks in the landfill face (Ecology and Environment, 1999) . Smoke was observed to be emanating from the vents. Thermal monitoring by Mr. Thalhamer indicated that temperatures in the vents exceeded those expected to normally exist in a landfill. START was unable to collect data from within the vents due to safety hazards associated with the instability of the landfill face. The data collected by START and IWMB as well as visual observations provided evidence of a subterranean fire at the Ordot Landfill.

Due to continued non-compliance with the CWA Order, on August 7, 2002, DOJ, acting on behalf of USEPA , filed a complaint in the United States District Court for Guam, against the Government of Guam for violating the CWA at the site (Radway, 2002). Through the complaint, the USEPA and DOJ are seeking civil penalties and actions to achieve CWA compliance and closure of the site. A primary concern for EPA is that the landfill has produced leachate which has been discharging into the Lonfit River. The following inorganic constituents have been detected above surface water quality goals in the Lonfit River: aluminum, barium, boron, copper, cyanide, iron, lead, and manganese, mercury and silver. Inorganic constituent concentrations are also typically greater in leachate samples than in the Lonfit River, and are typically greater downstream than upstream in the Lonfit River. This trend indicates that the landfill is impacting the water quality of the Lonfit River. The current condition of the site raises other concerns for EPA, including the possibility of above-ground and underground fires, accumulation of carbon monoxide at lower elevations near the site, and the presence of rats and mosquitoes (vectors).

6.0 Five-year Review Process

The following sections discuss the process for the five-year review for the Ordot Landfill Site.

6.1 Administrative Components

From April 24, 2002 to August 15, 2002, the following components of the Five-year Review Process were performed:

- Community Outreach Efforts
- Document Review
- Data Review
- Site Inspection
- Local (and other) Interviews
- Five-year Review Development

6.2 Community Involvement

Copies of a fact sheet describing the five-year review process were distributed locally during the site visit in the week of June 24, 2002. Upon completion of the Five-year Review Report, fact sheets describing the report findings will be developed and distributed by USEPA.

6.3 Document Review

As a part of the five-year review process, a brief review of numerous documents related to site activities was conducted. The documents chosen for review primarily focused on issues that have occurred during the past 9 years, but ranged in publication date from 1983 to the present. Appendix A provides a summary of the reports, memorandums, and other correspondence reviewed and serves as the reference list for documents cited in this report.

6.4 Data Review

The following sections summarize contaminant conditions at the site, based on historical leachate, surface water, groundwater, and sediment sampling events conducted since 1980. These sections also discuss analytical data trends and compare analytical data collected since the last five-year review (September 1993) with applicable or relevant and appropriate requirements (ARARs) and other standards to be considered (TBC), as discussed in Section 7.2.1. Analytical data were compiled from the following documents/sampling events:

- *Remedial Investigation, Insular Territory Hazardous Waste Sites* (Black & Veatch, 1983)
- *Revised Workplan Memorandum for Ordot Landfill, Guam* (CDM, 1985)

- *Final Initial Site Characterization Report, Ordot Landfill, Island of Guam* (CDM, 1987)
- *Leachate and Surface Water Sampling Results from USGS Funded Study*, 1986 to1987 (WERI, no date)
- *The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam Mariana Islands* (WERI, 1989)
- USEPA/Guam EPA Sampling Event, November 1997 (USEPA, No Date)
- Leachate and Surface Water Sampling Results from Trace Metals Sampling Program, 1990 to 1994 (WERI, No Date)
- *Surface Water Sampling Report, Ordot Landfill, Ordot, Guam (February, March, and September 1998)* (Unitek Environmental, 1998a, b, and c)

The locations around the site that have been sampled for surface water, groundwater, and sediment are presented in Figure 2. The available analytical data for the site have been compiled and are presented in Table 1 (surface water), Table 2 (groundwater), and Table 3 (sediment).

6.4.1 Leachate and Surface Water

During previous investigations at the site, leachate samples and surface water samples from the Lonfit River were collected and analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides and PCBs, petroleum hydrocarbons, metals, and water quality parameters (Table 1). Over the last 9 years since the last five-year review, several metals routinely exceeded chronic and acute toxicity reference values (TRVs). A complete analysis is provided in the Ecological and Human Health Risk Assessment Evaluation provided in Appendix E. The inorganic constituents for which results showed potential risk trends to both human health and the environment include: aluminum, barium, boron, copper, cyanide, iron, lead, manganese, mercury and silver. Constituent concentrations vary widely over time and typically do not show an increasing or decreasing trend. Constituent concentrations are also typically greater in leachate samples than in the Lonfit River, and are typically greater downstream than upstream in the Lonfit River. This trend indicates that the landfill is impacting the water quality of the Lonfit River. All organic compounds in leachate samples have either not been detected or have been detected at trace levels

6.4.2 Groundwater

Some groundwater analytical data was available from two sampling events conducted in 1982 (Black & Veatch, 1983) and 1987 (CDM, 1987). Samples from on-site monitoring wells, off-site monitoring wells, and municipal wells were collected and analyzed for VOCs, SVOCs, pesticides and PCBs, metals, and water quality parameters (Table 2). Additional sampling for pesticides and PCBs were conducted by University of Guam, Water and Environmental Research Institute of the Western Pacific (WERI) in 1989. The analytical data show the following inorganic constituents at concentrations above groundwater water quality goals: aluminum, iron, manganese, and mercury. With the exception of mercury, all constituents exceeding water quality goals were detected in downgradient monitoring wells, indicating that the landfill is impacting groundwater quality at the site, but not affecting drinking water resources, including the Northern Guam Water lens. All organic compounds in groundwater samples have either not been detected or have been detected sporadically or at trace levels. One detection of bis(2-ethylhexyl)phthalate in 1987 exceeded

the water quality goal (Table 2). Because the compound was detected in a background well upgradient of the landfill, this detection likely was due to laboratory contamination.

As discussed in Section 5.0, USEPA installed two post-ROD monitoring wells (MW-01 and MW-02) near the contact between the southern volcanic province and the northern limestone province in July 1992. Groundwater samples collected from these wells contained low concentrations of VOCs that could not be verified (see Table 2), due to the fact that VOCs were also detected in field blanks. Furthermore, some of the VOCs detected could have been associated with chlorination byproducts from the tap water used to develop the wells. Subsequent sampling of these wells has not been performed.

In October 1992, USGS installed two monitoring wells (OMW-1 and OMW-2) approximately 500 feet north of the existing landfill boundary. Analysis of groundwater samples collected from these wells by the USGS reportedly did not detect contaminants.

6.4.3 Sediment

Soil and sediment sampling was only performed during a single event in 1982 (Black & Veatch, 1983). Samples were analyzed for metals only (Table 3). Since human health ARARs were not established for sediment, data were compared to ecological Toxicity Reference Values (TRVs) for freshwater sediment (see Appendix E, Table E2). Chromium, copper, iron, manganese, mercury, and nickel were detected in sediment samples at concentrations exceeding TRVs. In general, these constituent concentrations only marginally exceeded the TRVs. Furthermore, TRV exceedances were detected in sediment samples collected from upstream river sediments, as well as leachate pond sediments and downstream river sediments.

6.5 Site Inspection

Representatives of USEPA, Guam DPW, and CH2M HILL took part in a site inspection on June 25, 2002. The purpose of the inspection was to assess the protectiveness of the no action ROD and to evaluate conditions of the site with respect to compliance with the CWA Administrative Order. The site inspection checklist and photographs taken during the site inspection are provided in Appendix B.

Weather conditions during the inspection were overcast with scattered showers, with temperatures around 95 degrees Fahrenheit. At the landfill, waste was mounded high above natural topographic elevation. Approximately 16 waste lifts were observed, with each lift measuring approximately 8 to 10 feet in thickness (the 1997 OMP specified that waste lifts should be compacted to a 2-foot thickness). Previous site visits performed by Guam EPA have indicated that approximately 30 percent of the waste at the site has been compacted (Guam EPA, 1997). Daily cover material was observed primarily along the side slopes of the waste prism, with most of the waste in active cells (along the top of the landfill) exposed (Appendix B2, photograph 4). A puddle of used motor oil or waste oil was observed near the bottom slope of the landfill (Appendix B2, photograph 7). There was no leachate control system in place at the site. The discharge of leachate from the toe of the landfill and the presence of vectors (flies and feral hogs) continue to be an problem at the site.

Although historically, several operation plans have been generated for the site (GMP Associates, Inc., 1981; Guam DPW, 1997), no such document was found at the site during

the inspection. A formal health and safety program is not currently implemented at the site . In addition, the facility does not have a current National Pollution Discharge Elimination System permit for discharging leachate into the Lonfit River, nor a current permit for solid waste disposal operations under Subtitle D authority. The facility currently keeps logs documenting wastes brought to the landfill by large companies.

6.6 Community Interviews

Four residents from the local community of Ordot/Chalan Pago were interviewed regarding their knowledge of, or concerns about, historical and current site operations and management practices. The following people were interviewed:

- Mr. Vicente I. Aguon, Mayor or Ordot/Chalan Pago (interviewed on June 26, 2002)
- Mr. Amancio S. Hitosis (interviewed on June 26, 2002)
- Mr. and Mrs. Juan Sablan (interviewed on June 26, 2002)

Copies of the completed interview forms are provided in Appendix C. The following section summarizes the key comments from the community interviews.

6.6.1 Key Comments From the Community Interviews

All of the interviewed members of the community expressed a feeling of frustration and helplessness regarding the status of the landfill. Mr. and Mrs. Juan Sablan both felt that the Guam EPA is not effectively enforcing Guam DPW regarding landfill operations and management. The biggest concerns shared by the community include the odor and visual nuisance, landfill fires which force evacuations up to twice a year, and decreased property values. The interviewees indicated that they would like to see the landfill closed or capped.

Mr. Aguon, Mayor of Ordot/Chalan Pago, also expressed concerns about the poor administration and enforcement of laws which would prevent the disposal of inappropriate substances at the landfill, and the setting of fires. The Mayor also indicated that he would like to ensure that no further impacts occur to the Lonfit River.

6.7 Technical Interviews

The following individuals were interviewed regarding their knowledge of, or concerns about, technical aspects of the 1988 no-action ROD and about issues related to current operation and maintenance of the landfill:

- Mr. Ben Machol - USEPA Region IX, Pacific Islands Office, Guam Program Manager (July 30, 2002)
- Mr. Michael Lee – USEPA Region IX, Pacific Islands Office, Water (July 30, 2002)
- Mr. Ramon Mendoza – USEPA Region IX, Pacific Islands Office, Solid and Hazardous Waste (July 30, 2002)
- Mr. Rick Sugarek – USEPA Region IX, Superfund Division (July 30, 2002)
- Mr. Betwin Alokoa – former Inspector Guam EPA, Air and Land Division (June 28, 2002)

- Mr. Francis Damian – Guam EPA, Air and Land Division (June 27, 2002)
- Ms. Conchita Taitano – Guam EPA, Director of Air and Land Division (June 21, 2002)

- Mr. Victor Wuerch – Guam EPA, Hydrogeologist (June 27, 2002)
- Mr. John D. Charfauros – Guam DPW, Ordot Landfill Supervisor (June 26, 2002)
- Mr. Jesse G. Garcia – Guam DPW, Acting Director (June 25, 2002)
- Mr. James L. Canto – PCR Environmental, Inc. (PCR), Vice President and Senior Project Manager (June 26, 2002)
- Mr. Greg Ikehara – Anderson Air Force Base Remedial Project Manager, Installation Restoration Program; former USGS Hydrogeologist (June 27, 2002)
- Dr. Gary Denton – University of Guam , Water & Energy Research Institute (WERI), (June 21, 2002)

Copies of the completed interview forms are provided in Appendix C. The following section summarizes the key comments from the technical interviews.

6.7.1 Key Comments From the Technical Interviews

USEPA Region IX

USEPA staff generally felt that very little has been done by Guam DPW to comply with the CWA Administrative Order. Specifically, proper landfill management and operation practices have not been followed, except for daily cover placement in certain areas. Although work was done to develop an operations plan, no such plan was ever implemented. Leachate continues to be a problem; however, Mr. Machol indicated that leachate sampling at the toe of the landfill has been prohibited by USEPA due to the potential build-up of carbon monoxide in the valley and to instability of the landfill side slope. There is no routine surface water or groundwater monitoring program in place.

In August of 2002, DOJ acting on behalf of USEPA, filed a civil complaint seeking unspecified civil penalties and actions against Guam DPW for violations of the CWA involving Ordot.

The USEPA staff all felt that the site should be closed properly and that an alternative municipal landfill site should be selected. Most of the staff were unsure whether enforcement under Superfund would be more effective than the current enforcement under the CWA.

Guam EPA

Guam EPA staff also felt that very little has been done by Guam DPW to comply with the CWA Administrative Order. Mr. Damian pointed out that the site is not run like a sanitary landfill and has never been in compliance. The staff recommended that additional surface water, groundwater, sediment, and air sampling be performed at the site to evaluate environmental impacts from the landfill.

Guam EPA continues to perform quarterly Site inspections. Numerous Notices of Violations (NOVs) have been issued by Guam EPA to Guam DPW, with little effect. NOVs were issued mainly for insufficient daily cover, little or no compaction, improper segregation of waste, standing leachate, and no vector (rats and flies) controls. Furthermore, Guam EPA has received numerous telephone calls reporting fires, illegal dumping at night, and dumping outside of the site gates.

The Guam EPA staff all felt that the site should be closed as soon as possible. Mr. Alokoa indicated that the Guam DPW staff are not trained to operate the landfill appropriately, and that a private company should operate a new landfill.

Guam DPW

The interviewed Guam DPW staff were not aware of the 1988 ROD. Most of their concerns regarding the site are centered around controlling fires, trying to maintain daily cover (consisting of dirt and coral), and operator safety. Both interviewees indicated that a lack of funding has limited Guam DPWs ability to comply with landfill best-management practices or to employ a sufficient number of certified and properly trained operators.

Mr. Charfauros indicated that there is 24-hour security on site to prevent vandalism. He further pointed out that the white goods (refrigerators, etc.), tires, batteries, and liquids are not accepted at the site, and that they have spotters to make sure these items are not dumped.

PCR

PCR was hired by Guam EPA to monitor fires at the site. Mr. Canto indicated that since the ROD was issued, site operations have marginally improved in that there is now 24-hour security against vandalism and illegal dumping, and that the landfill is no longer accepting tires.

PCR performed ongoing air monitoring during tire fires in late 1999, early 2000, and 2001. Air was sampled for VOCs, SVOCs, polynuclear aromatic hydrocarbons, metals, and particulate matter. Results of air monitoring indicated that particulate matter was the only parameter that exceeded air quality standards.

USGS

Mr. Ikehara indicated that, based on the groundwater analytical data, deep groundwater underlying the landfill does not migrate towards the Northern Guam Water lens. However, he feels that the presence of the landfill has diverted the natural flow of surface runoff. He also noted that suppression of interior landfill fires is sometimes accomplished by drilling into the refuse and pumping in water.

University of Guam, WERI

Dr. Denton feels that no significant actions have been taken to address the problems at the site. He indicated that USGS is funding WERI to evaluate the leachate streams for toxic compounds, and that an approved proposal was supplied for sampling in March 2002 through February 2003 (There was no evidence that this study had been conducted, however). He recommended that additional studies need to be performed to determine the nature of the refuse in the landfill (including the presence of unexploded ordnance) and to delineate groundwater impacts. He also recommended that the site be closed, and that more pro-active efforts are necessary to create a new landfill.

7.0 Technical Assessment

The following sections provide a technical assessment of the data collected during the five-year review, as well as conclusions and recommendations.

7.1 Functioning of the Remedy as Intended by Decision Documents

The ROD for the site called for no action under CERCLA and deferred cleanup of site threats to the CWA program. The rationale for the no action ROD was that with proper landfill management and operation practices, the leachate discharge problem at the site would be eliminated. Another rationale for no action was that, based on the limited analytical data available, there was no imminent and substantial endangerment to human health and welfare or the environment.

Due to the fact that Guam DPW has not complied with the CWA Administrative Order and that leachate from the site continues to be discharged into the Lonfit River, it appears that the no action ROD is not functioning as intended. Furthermore, as explained below in Section 7.2.2, leachate from the site has resulted in contamination in excess of water quality goals and thus the remedy is not protective.

7.2 Current Validity of Assumptions Used During Remedy Selection

The assumptions used to implement the no action ROD are generally unchanged from the time of the remedy selection. Several chemical-specific ARARs and TBCs have only changed slightly since the last five-year review (Section 7.2.1). Overall, land usage at and around the site has not changed significantly since the ROD was issued, and is not expected to change in the near future.

However, leachate discharge at the toe of the landfill continues due to the ongoing lack of proper landfill management and operations at the site. Therefore, the original assumption that leachate discharge would cease at the site under the CWA Administrative Order is no longer valid. The leachate from the landfill contains inorganic contaminants at concentrations exceeding water quality goals and poses a potential ecological and human health risk.

7.2.1 Regulatory Review

This section provides a review of ARARs and TBCs for the selected remedy at the site.

ARARs

"Applicable" requirements are standards and other substantive environmental protection requirements promulgated under federal and state law that specifically address a circumstance at a CERCLA site, such as a hazardous substance, pollutant, contaminant,

remedial action, or location. "Applicability" implies that circumstances at the site satisfy all jurisdictional prerequisites of a requirement. "Relevant and appropriate" requirements are standards and other substantive environmental protection requirements promulgated under federal or state law that address situations sufficiently similar to a CERCLA site to be of use. "Relevance" implies that the requirement regulates or addresses situations sufficiently similar to those found at the CERCLA site. "Appropriateness" implies that the circumstances of the release or threatened release are such that use of the standard is germane.

TBCs

TBCs are non-promulgated federal or state advisories or guidelines that are not legally binding and do not have the status of ARARs. However, TBCs may play an important role in the development of site-specific cleanup standards.

Changes to ARARs and TBCs

ARARs were previously presented or considered in the ROD, previous Five-Year Review Report, and the *Preliminary Endangerment Assessment* (CH2M et. al., 1988). ARARS were reviewed for any changes, additions, or deletions as part of the five-year review. A complete ARARs review, including the list of ARARs and TBCs for the site, is provided in Appendix D.

Chemical-specific ARARs that are appropriate or TBC for the site include the Safe Drinking Water Act primary and secondary maximum contaminant levels (MCLs and SMCLs), maximum contaminant level goals (MCLGs), Guam Water Quality Standards (including MCLs, SMCLs, and Numerical Criteria), and Ambient Water Quality Criteria (AWQC). Changes to the chemical-specific ARARs since the Preliminary Endangerment Assessment are presented in the following table.

Chemical-specific ARARs and TBCs

Constituents of Concern	Guam Primary DW Standards for G-1 and G-2 waters (µg/L) [a]	Guam Secondary DW Standards for G-1 and G-2 waters (µg/L) [a]	Previous SDWA MCL [b] (µg/L)	New SDWA MCL [c] (µg/L)	Previous SDWA SMCL [b] (µg/L)	New SDWA SMCL [c] (µg/L)	MCLG [c] (µg/L)
Aluminum	-	50-200	-	-	-	50-200	-
Barium	2,000	-	1,000	2,000	-	-	-
Chromium (Total)	100	-	50	100	-	-	-
Chromium III	-	-	120	-	-	-	-
Chromium VI	-	-	50	-	-	-	-
Cobalt	-	-	-	-	-	-	-
Copper	1,300	1,000	-	1,300	1,000	1,000	1,300
Cyanide (as free cyanide)	200	-	200	200	-	-	-
Iron	-	300	-	-	300	300	-
Lead	15	-	50	15	-	-	0
Manganese	-	50	-	-	50	50	-
Potassium	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-
Zinc	-	5,000	-	-	5,000	5,000	-

Constituents of Concern	Guam Numerical Criteria for Freshwater Organisms Chronic (µg/L) [a]	Guam Numerical Criteria for Freshwater Organisms Acute (µg/L) [a]	Previous USEPA AWQC for Freshwater Organisms Chronic (µg/L) [b]	New USEPA AWQC for Freshwater Organisms Chronic (µg/L) [d]	Previous USEPA AWQC for Freshwater Organisms Acute (µg/L) [b]	New USEPA AWQC for Freshwater Organism (µg/L) [d]
Aluminum	1,000 (maximum limit)	-	-	87	-	750
Barium	-	-	-	-	-	-
Chromium (Total)	-	-	-	-	-	-
Chromium III	210	1,700	210	74	1,700	570
Chromium VI	11	16	11	11	16	16
Cobalt	-	-	-	-	-	-
Copper	12	18	12	9	18	13
Cyanide (as free cyanide)	5.2	22	5.2	5.2	22	22
Iron	3,000 (maximum limit)	-	1,000	1,000	-	-
Lead	3.2	82	3.2	2.5	82	65
Manganese	-	-	-	-	-	-
Potassium	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-
Zinc	110	120	47	120	320	120

a. Guam Water Quality Standards.
b. Preliminary Endangerment Assessment for the Ordot Landfill, September 15, 1988.
c. 40 CFR 141 and 40 CFR 143.
d. Ambient Water Quality Criteria (AWQC). USEPA April 1999. National Recommended Water Quality Criteria – Correction. EPA822-Z-99-001.
(µg/L) = micrograms per liter.

Primary MCLs for barium, chromium, copper, and lead were revised as of July 1, 2001. Copper was given an MCL and lead obtained a more stringent MCL, whereas barium and chromium were revised to higher MCLs. However, because the groundwater beneath the site is not being used as a drinking water source and is hydrologically isolated from the Northern Guam Water lens, the standards protective of drinking water quality are TBC for the site. Therefore, none of the changes in the primary MCLs alter the effectiveness of the preferred alternative.

Location-specific ARARs that are appropriate or TBC for the site include the Federal Endangered Species Act, the CWA, and the Fish and Wildlife Coordination Act. The proximity of the site to the Lonfit River and the previous identification of an endangered bird, the Guam Gallinule, at the landfill render these acts applicable.

Action-specific ARARs that are appropriate or TBC for the site include the Federal Water Pollution Control Act, the Guam Annotated Water Pollution Control Act, RCRA, the National Primary and Secondary Ambient Air Quality Standards (NAAQS), the Guam Department of Public Works Well Drilling and Well Operating Permit Requirements, and the Guam Solid Waste and Litter Control Act. The leachate discharging to Lonfit River renders the water pollution control acts applicable, whereas RCRA and NAAQS are TBC if any actions at the site require hazardous waste disposal or affect air quality. The Guam Solid Waste and Litter Control Act pertains to all actions performed during the operation of the Ordot Landfill, and the Well Drilling and Well Operating Permit Requirements are TBC in the event additional wells are drilled on the landfill site.

7.2.2 Ecological and Human Health Risk Evaluation

As part of this five-year review, an evaluation of current conditions at the site was performed with respect to ecological and human health risk. The evaluation included a semi-quantitative evaluation of potential risks to ecological and human receptors based on the available data, a listing of data limitations and data gaps, and conceptual frameworks for completing a screening ecological risk assessment and human health risk assessment. The primary potential ecological and human health concerns of the site are:

- Uncontrolled leachate streams which discharge to the Lonfit River either directly or via tributaries.
- Subsequent pollution of the Pago River and Pago Bay.
- Methane gas fires in the landfill and subsequent generation of carbon monoxide at lower elevations.
- Exposure of aquatic and terrestrial plants, invertebrates, and wildlife to contaminated surface water, sediment, and soils.
- Bioaccumulation of contaminants in the aquatic and terrestrial food chain.
- Consumption of potentially-contaminated aquatic and terrestrial plants and wildlife by humans.
- Direct contact with contaminated surface water, sediment, and soil by humans.
- On-site hazards to workers and/or persons trespassing to scavenge.

Risk evaluations were based on historical analytical data for the site. However, the quality and comparability of the data obtained from the various studies are not consistent. The studies conducted have focused on collection of surface water and groundwater. Sediment samples were collected during a single study. The locations around the site that have been sampled historically for surface water, groundwater, and sediment are presented in Figure 2. The available analytical data for the site has been compiled and is presented in Table 1 (surface water), Table 2 (groundwater), and Table 3 (sediment).

The complete preliminary risk evaluation, including a data gap summary and conceptual frameworks for completing ecological and human health risk assessments, is provided in Appendix E. A summary of the preliminary risk evaluation is presented in the following sections.

Ecological Evaluation

Potential risks to aquatic organisms exposed to surface water and sediment were evaluated by comparing historical analytical data with preliminary TRVs (Appendix E, Tables E-1 and E-2).

In surface water, several inorganic constituents (aluminum, barium, and iron) routinely exceeded chronic and acute TRVs, while other metals (boron, copper, cyanide, lead, manganese, mercury, and silver) sporadically exceeded TRVs. Concentrations of these constituents are typically greater in leachate-related samples than in the Lonfit River, but concentrations are also typically greater downstream than upstream in the Lonfit River. This trend indicates that the landfill is impacting the water quality of the Lonfit River. The detection limits for several non-detected metals exceeded TRVs, and therefore could not be assessed for potential risks. Potential risks due to organic chemicals could not be assessed for the majority of the reported analytes because detection limits exceeded TRVs.

In sediment samples, chromium, copper, iron, manganese, mercury, and nickel concentrations exceeded TRVs. Potential risks due to organic chemicals were not assessed because sediment samples at the site historically have not been analyzed for organic constituents.

Human Health Evaluation

Human health risks were evaluated through two exposure pathways: ingestion of groundwater and ingestion of organisms inhabiting contaminated surface waters. Potential risks were evaluated by comparing historical analytical data with applicable water quality goals, including: MCLs; Guam Water Quality Standards; risk-based drinking water values representing a reference dose of 1.0 for non-carcinogens and a lifetime risk of 1×10^{-6} for carcinogens; and taste and odor thresholds (Appendix E, Table E-3).

In groundwater, inorganic chemicals that exceeded water quality goals consisted of aluminum, iron, manganese, and mercury. Inorganic chemicals that could not be assessed because their detection limits exceeded water quality goals consisted of antimony, arsenic, cadmium, and thallium. Although a majority of organic compounds analyzed for were not detected in groundwater, potential risks due to these compounds could not be assessed due to detection limits exceeding water quality goals.

Risks due to ingestion of aquatic organisms were evaluated through comparisons to the Guam Numerical Criteria and USEPA AWQC for human consumption of aquatic organisms (Appendix E, Table E-3). Inorganic chemicals that exceeded the water quality goals consisted of manganese and mercury. Similar to the groundwater evaluation, a majority of organic compounds analyzed for were not detected in surface water, but potential risks due to these compounds could not be assessed due to detection limits exceeding water quality goals.

There is no regular program in place for conducting air surveillance, although during the 1999 tire fire some air monitoring was conducted by both Guam EPA and the US EPA. The results indicated no elevated risk to landfill employees or nearby residents with regard to respirable particulates, heavy metals or PAHs.

7.3 Recent Information Affecting the Remedy

By conducting the evaluation of current conditions at the site with respect to ecological and human health risks, there appears to be evidence that an imminent and substantial endangerment may be present. However, until a complete site characterization and formal risk evaluation are conducted, this determination cannot be made.

8.0 Conclusions and Recommendations

Proper landfill operation procedures at the site, including the placement of daily cover material and proper waste compaction, have not been conducted at the site. To date, several operations plans have been prepared for the site but none has been implemented. The landfill has produced leachate which has been discharging into the Lonfit River. The landfill is impacting the water quality of the Lonfit River. There have been fires at the dump which have required the temporary evacuation of nearby homes. EPA has concerns about the dangers from above-ground and underground fires, including accumulation of carbon monoxide in nearby lower elevations. Since 1986, the EPA has attempted to get Guam to address the problems at the dump through negotiations and then by issuing administrative orders and filing administrative complaints. Those efforts have failed to stop the illegal discharges to the Lonfit River, because Guam has failed to comply with the orders and its agreements. On August 7, 2002, DOJ, on behalf of USEPA, filed a complaint against the Government of Guam seeking both civil penalties and injunctive relief for Guam's violations of the CWA. DOJ has requested the Court to order Guam to cease all non-permitted discharge and to comply with the CWA. The resounding opinion of the local community members and technical personnel interviewed during the five-year review was also that the landfill should be closed.

Dependent upon the actions implemented pursuant to the CWA and as part of the formal closure process, a complete site characterization and formal ecological and human health risk assessments are recommended to evaluate current risks at the site. The guidelines for performing ecological and human health risk assessments presented in Appendix E should be followed. As explained in the *Data Limitation and Data Gaps* section in Appendix E (Section E.3), future sampling efforts for collecting additional analytical data should be conducted with the appropriate field and laboratory quality assurance and quality control measures to provide useable data for ecological and human health risk evaluation purposes. Media sampled during future risk assessment efforts would include groundwater, surface water, sediment, soil, aquatic biota tissue, and terrestrial biota tissue.

9.0 Protectiveness Statement

The remedy is not protective of human health and the environment. The results of the five-year review indicate that due to the ongoing discharge of leachate into the Lonfit River, the no action ROD is not functioning as intended. DOJ, on behalf of USEPA, has filed a complaint against the Government of Guam seeking both civil penalties and injunctive relief for Guam's violations of the CWA. DOJ has requested the Court to order Guam to cease all unpermitted discharges and to comply with the CWA. Given that the basis of the remedy was that actions would be taken to address operational problems at the landfill under the CWA, EPA will be able to evaluate whether additional remedial actions are necessary pending the Government of Guam's implementation of the measures required by this enforcement action.

10.0 Next Review

The next (third) five-year review for the Ordot Landfill Superfund Site will be conducted in 2007, and a report will be issued in September 2007.

TABLES

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	aluminum	µg/L	11/10/82		--	**591**	<200 (591)	<200	**358**	**2,560**	**174**
			3/12/87	f	--	**80**	**75**	**466**	**3,583**	--	**150**
			11/7/97		**329**	171 j	--	**4,580**	--	--	**1,240**
			2/10/98		<100	<100	**530**	**160**	--	--	**130**
			3/20/98		**320**	<100	<100	<100	--	--	**270**
			9/9/98		**180**	<100	**200**	**110**	--	--	**170**
	antimony	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			3/12/87	f	--	<20	<20	<20	<20	--	<20
			11/7/97		<20.2	<20.2	--	<20.2	--	--	<20.2
	arsenic	µg/L	10/81		--	--	--	**0.0154**	--	--	--
			11/10/82		--	nd	nd	nd	nd	nd	nd
			1/84		--	--	--	--	--	**0.0157**	--
			8/84		--	--	**0.0092**	--	--	--	--
			4/85		--	**0.106**	--	--	--	--	--
			3/6/86		--	**3.27**	--	**2.89**	--	--	--
			4/21/86		--	**5.01**	--	**5.98**	--	--	--
			7/23/86		--	**2.67**	--	**3.33**	--	--	--
			9/26/86		--	**13.7**	--	**9.1**	--	--	--
			12/22/86		--	**8.03**	--	**8.3**	--	--	--
			3/12/87	f	--	<10	<10	<10	<10	--	<10
			3/25/87		--	**4.47**	--	**3.75**	--	--	--
			6/3/87		--	**3.81**	--	**4.38**	--	--	--
			10/14/87		--	**4.88**	--	**3.61**	--	--	--
			12/9/87		--	**3.85**	--	**3.17**	--	--	--
			11/7/97		<70	<70	--	<70	--	--	<70
			2/10/98		<10	<10	<10	<10	--	--	<10
			3/20/98		<10	<10	<10	<10	--	--	<10
			9/9/98		<10	<10	<10	<10	--	--	<10

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Analyte		Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	barium	µg/L	10/81	--	--	**0.0625**	**0.4494**	--	--	--
			11/10/82	--	<100	<100	**111**	**240**	**199**	**138**
			8/83	--	--	--	--	--	**0.0625**	--
			10/83	--	**0.625**	--	--	--	--	--
			3/6/86	--	**41.7**	--	**52.1**	--	--	--
			4/21/86	--	**62.5**	--	**72.9**	--	--	--
			7/23/86	--	**45.5**	--	**273**	--	--	--
			9/26/86	--	**45.5**	--	**227**	--	--	--
			12/22/86	--	**45.5**	--	**227**	--	--	--
			3/12/87 f	--	**5**	**4**	**54**	**307**	--	**113**
			3/25/87	--	**27.8**	--	**153**	--	--	--
			6/3/87	--	**153**	--	**13.9**	--	--	--
			10/14/87	--	**190**	--	**17.2**	--	--	--
			12/9/87	--	**207**	--	**17.2**	--	--	--
			11/7/97	**149**	7.8 j	--	**132**	--	--	**178**
			2/10/98	**160**	<10	**25**	**110**	--	--	**170**
			3/20/98	**160**	<10	<10	**94**	--	--	**270**
			9/9/98	**90**	<10	**11**	**140**	--	--	**190**
	beryllium	µg/L	11/10/82	--	<5	<5	<5 (11)	<5	<5	<5
			3/12/87 f	--	<0.2	<0.2	<0.2	<0.2	--	<0.2
			11/7/97	<0.2	<0.2	--	<0.2	--	--	<0.2
	boron	µg/L	11/10/82	--	<100	<100	**458**	**4,980**	**960**	**1,020**
	cadmium	µg/L	1/81	--	**0.0133**	**0.0128**	--	--	--	--
			11/10/82	--	nd	nd	nd	nd	nd	nd
			8/83	--	--	--	**1.19**	--	--	--
			1/84	--	--	--	--	--	--	--
			3/6/86	--	**4.39**	--	**2.63**	--	--	--
			4/21/86	--	**2.27**	--	**4.55**	--	--	--
			7/23/86	--	**1.28**	--	**2.56**	--	--	--
			9/26/86	--	**6.41**	--	**7.69**	--	--	--

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Analyte		Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	cadmium (continued)	µg/L	12/22/86		--	**8.89**	--	**2.22**	--	--	--
			3/12/87	f	--	<4.3	<4.3	<4.3	<4.3	--	<4.3
			3/25/87		--	**7.4**	--	**3.7**	--	--	--
			6/3/87		--	**3.57**	--	**4.76**	--	--	--
			10/14/87		--	**4.76**	--	**4.76**	--	--	--
			12/9/87		--	**2.38**	--	**3.57**	--	--	--
			9/27/90		--	<0.2	<0.2	--	--	--	<0.2
			9/27/90	f	--	<0.2	<0.2	--	--	--	<0.2
			10/25/90		--	<0.2	<0.2	--	--	--	<0.2
			10/25/90	f	--	<0.2	<0.2	--	--	--	<0.2
			6/8/93		--	<0.2	<0.2	--	--	--	<0.2
			6/8/93	f	--	<0.2	<0.2	--	--	--	<0.2
			6/22/93	f	--	<0.1	--	--	--	--	<0.1
			7/13/93	f	--	<0.1	<0.1	--	--	--	<0.1
			7/28/93	f	--	<0.1	--	--	--	--	<0.1
			8/17/93	f	--	<0.2	<0.2	--	--	--	<0.2
			8/27/93	f	--	<0.2	--	--	--	--	<0.2
			9/3/93	f	--	<0.2	--	--	--	--	<0.2
			9/10/93	f	--	<0.2	--	--	--	--	<0.2
			9/17/93		--	--	--	--	--	--	<0.1
			9/17/93	f	--	<0.1	na	--	--	--	<0.1
			9/24/93		--	<0.1	--	--	--	--	<0.1
			9/24/93	f	--	<0.1	--	--	--	--	<0.1
			10/1/93		--	<0.2	--	--	--	--	<0.2
			10/1/93	f	--	<0.2	--	--	--	--	<0.2
			10/8/93		--	--	--	--	--	--	<0.2
			10/8/93	f	--	<0.2	--	--	--	--	<0.2
			10/15/93	f	--	<0.2	--	--	--	--	<0.2
			12/2/93		--	<0.2	<0.2	--	--	--	<0.2
			12/2/93	f	--	<0.2	<0.2	--	--	--	<0.2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
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	Analyte	Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	cadmium (continued)	µg/L	6/6/94 f		--	<0.1	<0.1	--	--	--	<0.1
			11/7/97		<1.3	<1.3	--	<1.3	--	--	<1.3
			2/10/98		<1	<1	<1	<1	--	--	<1
			3/20/98		<1	<1	<1	<1	--	--	<1
			9/9/98		<1	<1	<1	<1	--	--	<1
	calcium	µg/L	3/12/87 f		--	**42,150**	**42,720**	**66,200**	**85,870**	--	**103,700**
			11/7/97		**78,800**	**41,000**	--	**62,100**	--	--	**94,800**
			2/10/98		**80,000**	**42,000**	**55,000**	**67,000**	--	--	**77,000**
			3/20/98		**120,000**	**44,000**	**48,000**	**73,000**	--	--	**100,000**
			9/9/98		**87,000**	**35,000**	**38,000**	**7,100**	--	--	**110,000**
	chromium (total)	µg/L	6/80		--	--	**0.0083**	--	--	--	--
			11/10/82		--	nd	nd	nd	nd	nd	nd
			8/83		--	--	--	**0.092**	--	--	--
			11/83		--	**0.06427**	--	--	--	--	--
			10/84		--	--	--	--	--	**0.013**	--
			3/6/86		--	**5.56**	--	**27.8**	--	--	--
			4/21/86		--	**4.76**	--	**4.76**	--	--	--
			7/23/86		--	**4.17**	--	**4.17**	--	--	--
			9/26/86		--	**8.33**	--	**8.33**	--	--	--
			12/22/86		--	**9.52**	--	**4.76**	--	--	--
			3/12/87 f		--	<3.7	<3.7	<3.7	**11**	--	<3.7
			3/25/87		--	**5.56**	--	**5.56**	--	--	--
			6/3/87		--	**7.14**	--	**7.14**	--	--	--
			10/14/87		--	**9.52**	--	**4.76**	--	--	--
			12/9/87		--	**9.52**	--	**4.76**	--	--	--
			9/27/90		--	**0.5**	**0.9**	--	--	--	**2.3**
			9/27/90 f		--	<0.3	<0.3	--	--	--	**1.9**
			10/25/90		--	<0.3	<0.3	--	--	--	**1.9**
			10/25/90 f		--	<0.3	<0.3	--	--	--	**1.5**
			6/8/93		--	<0.3	<0.3	--	--	--	**1.2**

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

				Sample Identification and Location						
Analyte		**Units**	**Date**	**SW-0** Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	chromium (total) (continued)	µg/L	6/8/93 f	--	<0.3	<0.3	--	--	--	**1.2**
			6/22/93 f	--	<0.3	--	--	--	--	**2.2**
			7/13/93 f	--	<0.3	<0.3	--	--	--	**1.9**
			7/28/93 f	--	<0.3	--	--	--	--	**2.1**
			8/17/93 f	--	<0.3	<0.3	--	--	--	**1.3**
			8/27/93 f	--	<0.3	--	--	--	--	**2**
			9/3/93 f	--	<0.3	--	--	--	--	**1.8**
			9/10/93 f	--	<0.3	--	--	--	--	**2.4**
			9/17/93	--	--	--	--	--	--	**2.4**
			9/17/93 f	--	<0.3	<0.3	--	--	--	**2.4**
			9/24/93	--	na	--	--	--	--	**2.6**
			9/24/93 f	--	**0.6**	--	--	--	--	**1.1**
			10/1/93	--	**1.8**	--	--	--	--	**1.3**
			10/1/93 f	--	**0.9**	--	--	--	--	**1.8**
			10/8/93	--	--	--	--	--	--	**3.8**
			10/8/93 f	--	<0.3	--	--	--	--	**4.1**
			10/15/93 f	--	<0.3	--	--	--	--	**5**
			12/2/93	--	<0.3	<0.3	--	--	--	**1.2**
			12/2/93 f	--	<0.3	<0.3	--	--	--	**1.4**
			6/6/94 f	--	<0.3	<0.3	--	--	--	**2.1**
			11/7/97	<1.7	<1.7	--	**8.2**	--	--	**3.1**
			2/10/98	<10	<10	<10	<10	--	--	<10
			3/20/98	<10	<10	<10	<10	--	--	<10
			9/9/98	<10	<10	<10	<10	--	--	<10
	cobalt	µg/L	11/10/82	--	nd	nd	nd	nd	nd	nd
			3/12/87 f	--	<6.8	<6.8	<6.8	**13**	--	<6.8
			11/7/97	**4.8**	<2.1	--	**5**	--	--	**4**
	copper	µg/L	11/1/82	--	**84**	<50 (69)	<50	**159**	**86**	**101**
			3/12/87 f	--	<5.9	<5.9	**10**	**31**	--	<5.9
			9/27/90 u	--	**0.8**	**1.5**	--	--	--	**3.3**

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
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Analyte		Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	copper (continued)	µg/L	9/1/90	f	--	**0.3**	**0.6**	--	--	--	**2.1**
			10/25/90		--	**0.9**	**1**	--	--	--	**6.7**
			10/25/90	f	--	**0.4**	**0.4**	--	--	--	**4.9**
			6/8/93		--	**1**	**1**	--	--	--	**2.5**
			6/8/93	f	--	**1**	**1**	--	--	--	**2.6**
			6/22/93	f	--	**4.1**	--	--	--	--	**2.2**
			7/13/93	f	--	**0.4**	**0.4**	--	--	--	**2.4**
			7/28/93	f	--	**0.4**	--	--	--	--	**3**
			8/17/93	f	--	**0.3**	**0.3**	--	--	--	**10**
			8/27/93	f	--	**0.3**	--	--	--	--	**30.8**
			9/3/93	f	--	**0.3**	--	--	--	--	**30**
			9/10/93	f	--	**0.3**	--	--	--	--	**21.2**
			9/17/93		--	--	--	--	--	--	**13.5**
			9/17/93	f	--	**1**	na	--	--	--	**12**
			9/24/93		--	**4**	--	--	--	--	**18.4**
			9/24/93	f	--	**1.7**	--	--	--	--	**6.2**
			10/1/93		--	**1.7**	--	--	--	--	**36**
			10/1/93	f	--	**1.2**	--	--	--	--	**8.5**
			10/8/93		--	--	--	--	--	--	**17.1**
			10/8/93	f	--	**0.8**	--	--	--	--	**6.1**
			10/15/93	f	--	**0.8**	--	--	--	--	**4.6**
			12/2/93		--	<0.3	<0.3	--	--	--	**2.6**
			12/2/93	f	--	<0.3	<0.3	--	--	--	**2.1**
			6/6/94	f	--	**2**	**2**	--	--	--	**1.7**
			11/7/97		**13.1**	<1.5	--	**10.5**	--	--	**12**
	iron	µg/L	11/10/82		--	**1,030**	**258**	**659**	**9,660**	**6,360**	**1,470**
			3/12/87	f	--	**106**	**223**	**639**	**39,260**	--	**243**
			9/27/90		--	**500**	**566**	--	--	--	**2,056**
			9/27/90	f	--	**14.5**	**17.3**	--	--	--	**52.3**
			10/25/90		--	**43.5**	**21.3**	--	--	--	**1,222**

Table 1
Historical Leachate and Surface Water Analytical Data
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Analyte		Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1 [PGRL-1] {Site 2}** Lonfit River Upstream	**SW-2 (SW-11) [PGRL-2] {Site 3}** Lonfit River Downstream	**SW-5 [PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9 [LFL-3]** Leachate Stream Southeast	**SW-10 (SW-3) {Site 1}** Leachate Stream West
Metals	iron (continued)	µg/L	10/25/90	f	--	**4.5**	**4.7**	--	--	--	**33.5**
			6/8/93		--	**11.3**	**107**	--	--	--	**194**
			6/8/93	f	--	**4.9**	**26.6**	--	--	--	**69.4**
			6/22/93	f	--	**5**	--	--	--	--	**86.8**
			7/13/93	f	--	**1**	**12.4**	--	--	--	**79**
			7/28/93	f	--	**1**	--	--	--	--	**12**
			8/17/93	f	--	**8.8**	**14.4**	--	--	--	**106**
			8/27/93	f	--	**1.5**	--	--	--	--	**154**
			9/3/93	f	--	**9.5**	--	--	--	--	**83.1**
			9/10/93	f	--	**10.9**	--	--	--	--	**141**
			9/17/93		--	--	--	--	--	--	**149**
			9/17/93	f	--	**10.1**	na	--	--	--	**51.7**
			9/24/93		--	**1,024**	--	--	--	--	**769**
			9/24/93	f	--	**23**	--	--	--	--	**53.6**
			10/1/93		--	**1,858**	--	--	--	--	**938**
			10/1/93	f	--	**38**	--	--	--	--	**55**
			10/8/93		--	--	--	--	--	--	**4,713**
			10/8/93	f	--	**36**	--	--	--	--	**646**
			10/15/93	f	--	**16.4**	--	--	--	--	**254**
			12/2/93		--	**154**	**163**	--	--	--	**1,625**
			12/2/93	f	--	**14.7**	**33.3**	--	--	--	**122**
			6/6/94	f	--	**18**	**22.8**	--	--	--	**160**
			11/7/97		**1,190**	**189**	--	**4,680**	--	--	**3,330**
			2/10/98		**1,200**	<100	**1,100**	**220**	--	--	**4,100**
			3/20/98		**2,500**	<100	<100	<100	--	--	**14,000**
			9/9/98		**360**	**140**	**240**	**170**	--	--	**530**
	lead	µg/L	10/81		--	**0.0326**	--	--	--	--	--
			1/83		--	--	**0.0815**	**0.0463**	--	--	--
			11/10/82		--	<5	<5 (8)	<5	**24**	**10**	<5
			4/84		--	--	--	--	--	**0.0287**	--

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Historical Leachate and Surface Water Analytical Data
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Analyte		Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	lead (continued)	µg/L	3/6/86		--	**83.3**	--	**75**	--	--	--
			4/21/86		--	**19**	--	**66.7**	--	--	--
			7/23/86		--	**33.3**	--	**26.7**	--	--	--
			9/26/86		--	**33.3**	--	**33.3**	--	--	--
			12/22/86		--	**24**	--	**48**	--	--	--
			3/12/87	f	--	<5	<5	<5	**18**	--	**5.3**
			3/25/87		--	**6.67**	--	**6.67**	--	--	--
			6/3/87		--	**7.4**	--	**7.4**	--	--	--
			10/14/87		--	**24**	--	**33.3**	--	--	--
			12/9/87		--	**33.3**	--	**22.2**	--	--	--
			9/27/90		--	**0.7**	**0.3**	--	--	--	**2.1**
			9/27/90	f	--	**1**	<0.3	--	--	--	**3.1**
			10/25/90		--	**0.7**	**0.3**	--	--	--	**2.1**
			10/25/90	f	--	**1**	<0.3	--	--	--	**0.3**
			6/8/93		--	<0.6	<0.6	--	--	--	<0.6
			6/8/93	f	--	<0.6	<0.6	--	--	--	<0.6
			6/22/93	f	--	<0.6	--	--	--	--	<0.6
			7/13/93	f	--	<0.5	<0.5	--	--	--	<0.5
			7/28/93	f	--	<0.5	--	--	--	--	<0.5
			8/17/93	f	--	<0.3	<0.3	--	--	--	<0.3
			8/27/93	f	--	<0.3	--	--	--	--	<0.3
			9/3/93	f	--	<0.3	--	--	--	--	<0.3
			9/10/93	f	--	<0.3	--	--	--	--	<0.3
			9/17/93		--	--	--	--	--	--	<0.6
			9/17/93	f	--	<0.6	na	--	--	--	<0.6
			9/24/93		--	<0.6	--	--	--	--	<0.6
			9/24/93	f	--	<0.6	--	--	--	--	<0.6
			10/1/93		--	**4.8**	--	--	--	--	**3.4**
			10/1/93	f	--	<0.3	--	--	--	--	<0.3
			10/8/93		--	--	--	--	--	--	**3.1**

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	Analyte	Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2 (SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10 (SW-3)** **{Site 1}** Leachate Stream West
Metals	lead (continued)	µg/L	10/8/93	f	--	<0.3	--	--	--	--	<0.3
			10/15/93		--	<0.3	--	--	--	--	<0.3
			12/2/93		--	<0.6	<0.6	--	--	--	<0.6
			12/2/93	f	--	<0.6	<0.6	--	--	--	<0.6
			6/6/94	f	--	<0.6	<0.6	--	--	--	**4**
			11/7/97		**1**	<0.5	--	**2.6**	--	--	**1.4**
			2/10/98		<5	<5	<5	<5	--	--	<5
			3/20/98		**13**	**9.5**	<5	**7.9**	--	--	**6**
			9/9/98		<5	<5	<5	<5	--	--	<5
	magnesium	µg/L	3/12/87	f	--	**8,745**	**9,210**	**54,290**	**60,290**	--	**23,580**
			11/7/97		**22,500**	**8,430**	--	**44,300**	--	--	**24,200**
			2/10/98		**25,000**	**9,300**	**11,000**	**58,000**	--	--	**20,000**
			3/20/98		**32,000**	**9,000**	**11,000**	**64,000**	--	--	**28,000**
			9/9/98		**19,000**	**7,000**	**8,200**	**61,000**	--	--	**25,000**
	manganese	µg/L	11/10/82		--	**39**	**24**	**636**	**772**	**1,280**	**604**
			3/12/87	f	--	**20**	**5**	**142**	**3,161**	--	**224**
			9/27/90		--	**28.1**	**60.2**	--	--	--	**364**
			9/27/90	f	--	**12.6**	**40**	--	--	--	**337**
			10/25/90		--	**28.3**	**33.9**	--	--	--	**766**
			10/25/90	f	--	**20.8**	**25.4**	--	--	--	**966**
			6/8/93		--	**44.2**	**67.4**	--	--	--	**100**
			6/8/93	f	--	**36.1**	**52.3**	--	--	--	**100**
			6/22/93	f	--	**41.7**	--	--	--	--	**307**
			7/13/93	f	--	**8.3**	**8.3**	--	--	--	**524**
			7/28/93	f	--	**11**	--	--	--	--	**306**
			8/17/93	f	--	**16.4**	**16.9**	--	--	--	**205**
			8/27/93	f	--	**85.4**	--	--	--	--	**159**
			9/3/93	f	--	**30.3**	--	--	--	--	**167**
			9/10/93	f	--	**33.6**	--	--	--	--	**83.4**
			9/17/93		--	--	--	--	--	--	**101**

Table 1
Historical Leachate and Surface Water Analytical Data
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	Analyte	Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	manganese (continued)	µg/L	9/17/93	f	--	**6.1**	na	--	--	--	**83.3**
			9/24/93		--	na	--	--	--	--	**161**
			9/24/93	f	--	**122**	--	--	--	--	**87.3**
			10/1/93		--	**52**	--	--	--	--	**220**
			10/1/93	f	--	**12**	--	--	--	--	**151**
			10/8/93		--	--	--	--	--	--	**1,113**
			10/8/93	f	--	**12.5**	--	--	--	--	**915**
			10/15/93		--	**10.8**	**--**	--	--	--	**582**
			12/2/93		--	**9**	**33.2**	--	--	--	**832**
			12/2/93	f	--	**3.8**	**17.4**	--	--	--	**733**
			6/6/94	f	--	**8.1**	**22.8**	--	--	--	**795**
			11/7/97		**305**	**8.6**	--	**283**	--	--	**568**
			2/10/98		**280**	**25**	**880**	**80**	--	--	**520**
			3/20/98		**1,100**	**29**	**53**	**48**	--	--	**660**
			9/9/98		**240**	**16**	**23**	**88**	--	--	**140**
	mercury	µg/L	11/10/82		--	**77**	**6.2**	**3.4**	**32.8**	**7.1**	**2.9**
			1/83		--	--	**0.0018**	--	--	--	--
			8/83		--	**0.0105**	--	**0.014**	--	**0.0208**	--
			3/6/86		--	**0.22**	--	**0.467**	--	--	--
			4/21/86		--	**0.824**	--	**1.13**	--	--	--
			7/23/86		--	**1.107**	--	**0.756**	--	--	--
			9/26/86		--	**0.915**	--	**0.976**	--	--	--
			12/22/86		--	**0.45**	--	**0.5**	--	--	--
			3/12/87	f	--	<0.2	<0.2	<0.2	<0.2	--	<0.2
			3/25/87		--	**0.45**	--	**0.82**	--	--	--
			6/3/87		--	**0.51**	--	**0.306**	--	--	--
			10/14/87		--	**0.625**	--	**0.4**	--	--	--
			12/9/87		--	**0.774**	--	**1.012**	--	--	--
			9/27/90		--	<0.3	<0.3	--	--	--	<0.3
			9/27/90	f	--	<0.3	<0.3	--	--	--	<0.3

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
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				Sample Identification and Location						
Analyte		**Units**	**Date**	**SW-0** Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	mercury (continued)	µg/L	10/25/90	--	<0.3	<0.3	--	--	--	<0.3
			10/25/90 f	--	<0.3	<0.3	--	--	--	<0.3
			6/8/93	--	nd	nd	--	--	--	nd
			6/8/93 f	--	nd	nd	--	--	--	nd
			6/22/93 f	--	nd	--	--	--	--	nd
			7/13/93 f	--	nd	nd	--	--	--	nd
			7/28/93 f	--	nd	--	--	--	--	nd
			8/17/93 f	--	nd	nd	--	--	--	nd
			8/27/93 f	--	nd	--	--	--	--	nd
			9/3/93 f	--	nd	--	--	--	--	nd
			9/10/93 f	--	nd	--	--	--	--	nd
			9/17/93	--	--	--	--	--	--	nd
			9/17/93 f	--	nd	nd	--	--	--	nd
			9/24/93	--	nd	--	--	--	--	nd
			9/24/93 f	--	nd	--	--	--	--	nd
			10/1/93	--	nd	--	--	--	--	nd
			10/1/93 f	--	nd	--	--	--	--	nd
			10/8/93	--	--	--	--	--	--	nd
			10/8/93 f	--	nd	--	--	--	--	nd
			10/15/93	--	nd	--	--	--	--	nd
			12/2/93	--	nd	nd	--	--	--	nd
			12/2/93 f	--	nd	nd	--	--	--	nd
			6/6/94 f	--	nd	nd	--	--	--	nd
	nickel	µg/L	11/10/82	--	<4	**51**	<4 (46)	<4	<4	<4
			3/12/87 f	--	<23	<23	<23	<23	--	<23
			9/27/90	--	<0.6	<0.6	--	--	--	**6.8**
			9/27/90 f	--	<0.6	<0.6	--	--	--	**4.6**
			10/25/90	--	<0.6	<0.6	--	--	--	**3**
			10/25/90 f	--	<0.6	<0.6	--	--	--	**2.7**

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
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Analyte		Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	nickel (continued)	µg/L	6/8/93		--	<0.6	<0.6	--	--	--	**19.5**
			6/8/93	f	--	<0.6	<0.6	--	--	--	**17.5**
			6/22/93	f	--	<0.6	--	--	--	--	**11.5**
			7/13/93	f	--	<0.6	<0.6	--	--	--	**10**
			7/28/93	f	--	<0.6	--	--	--	--	**16.7**
			8/17/93	f	--	<0.8	<0.8	--	--	--	**10.8**
			8/27/93	f	--	<0.8	--	--	--	--	**22.7**
			9/3/93	f	--	<0.8	--	--	--	--	**17.4**
			9/10/93	f	--	<0.8	--	--	--	--	**22.1**
			9/17/93		--	--	--	--	--	--	**21.4**
			9/17/93	f	--	<0.8	<0.8	--	--	--	**20.3**
			9/24/93		--	<0.8	--	--	--	--	**3.3**
			9/24/93	f	--	<0.8	--	--	--	--	**3.3**
			10/1/93		--	<0.8	--	--	--	--	**11.6**
			10/1/93	f	--	<0.8	--	--	--	--	**7.2**
			10/8/93		--	--	--	--	--	--	**30**
			10/8/93	f	--	<0.8	--	--	--	--	**27.3**
			10/15/93		--	<0.8	**--**	--	--	--	**28.5**
			12/2/93		--	<0.8	<0.8	--	--	--	**23.1**
			12/2/93	f	--	<0.8	<0.8	--	--	--	**16.4**
			6/6/94	f	--	<0.8	<0.8	--	--	--	**33**
			11/7/97		**23**	<11	--	**17.8**	--	--	**12.4**
	potassium	µg/L	3/12/87	f	--	**948**	**948**	**14,740**	**22,220**	--	**15,850**
			11/7/97		**46,900**	**1,380**	--	**68,100**	--	--	**60,500**
			2/10/98		**36,000**	**1,700**	**3,300**	**54,000**	--	--	**28,000**
			3/20/98		**38,000**	**1,600**	**3,300**	**58,000**	--	--	**41,000**
			9/9/98		**24,000**	**1,400**	**3,100**	**92,000**	--	--	**45,000**
	selenium	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			1/83		--	--	--	**0.022**	--	--	--
			10/83		--	**0.0237**	**0.0178**	--	--	--	--

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1 [PGRL-1] {Site 2}** Lonfit River Upstream	**SW-2 (SW-11) [PGRL-2] {Site 3}** Lonfit River Downstream	**SW-5 [PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9 [LFL-3]** Leachate Stream Southeast	**SW-10 (SW-3) {Site 1}** Leachate Stream West
Metals	selenium (continued)	µg/L	4/84	--	--	--	--	--	**0.0146**	--
			3/6/86	--	**5.26**	--	**1.46**	--	--	--
			4/21/86	--	**5.7**	--	**4**	--	--	--
			7/23/86	--	**6.77**	--	**6.06**	--	--	--
			9/26/86	--	**4.78**	--	**4.35**	--	--	--
			12/22/86	--	**4.49**	--	**4.42**	--	--	--
			3/12/87 f	--	<5	<5	<5	<25	--	<5
			3/25/87	--	**3.82**	--	**5.03**	--	--	--
			6/3/87	--	**5.21**	--	**5.45**	--	--	--
			10/14/87	--	**1.54**	--	**1.31**	--	--	--
			12/9/87	--	**1.29**	--	**1.65**	--	--	--
			11/7/97	<125	<125	--	<125	--	--	<125
	silver	µg/L	11/10/82	--	<10	**13**	<10	<10	<10	<10
			1/83	--	--	**0.0023**	--	--	--	--
			8/83	--	**0.00687**	--	--	--	--	--
			10/84	--	--	--	--	--	**0.016**	--
			3/85	--	--	--	**0.00392**	--	--	--
			3/6/86	--	**8.33**	--	**4.17**	--	--	--
			4/21/86	--	**4.44**	--	**6.67**	--	--	--
			7/23/86	--	**2.38**	--	**7.14**	--	--	--
			9/26/86	--	**9.52**	--	**9.52**	--	--	--
			12/22/86	--	**2.22**	--	**8.89**	--	--	--
			3/12/87 f	--	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1
			3/25/87	--	**4.76**	--	**4.76**	--	--	--
			6/3/87	--	**2.22**	--	**4.44**	--	--	--
			10/14/87	--	**6.25**	--	**4.17**	--	--	--
			12/9/87	--	**4.17**	--	**6.25**	--	--	--
			9/27/90	--	<0.1	<0.1	--	--	--	<0.1
			9/27/90 f	--	<0.1	<0.1	--	--	--	<0.1
			10/25/90	--	<0.1	<0.1	--	--	--	<0.1

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
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Analyte		Units	Date		Sample Identification and Location						
					SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	silver (continued)	µg/L	10/25/90	f	--	<0.1	<0.1	--	--	--	<0.1
			6/8/93		--	<0.2	<0.2	--	--	--	<0.2
			6/8/93	f	--	<0.2	<0.2	--	--	--	<0.2
			6/22/93	f	--	<0.2	--	--	--	--	<0.2
			7/13/93	f	--	<0.1	<0.1	--	--	--	<0.1
			7/28/93	f	--	<0.1	--	--	--	--	<0.1
			8/17/93	f	--	<0.2	<0.2	--	--	--	<0.4
			8/27/93	f	--	<0.2	--	--	--	--	<0.4
			9/3/93	f	--	<0.1	--	--	--	--	<0.4
			9/10/93	f	--	<0.2	--	--	--	--	<0.4
			9/17/93		--	--	--	--	--	--	<0.1
			9/17/93	f	--	<0.1	<0.1	--	--	--	<0.1
			9/24/93		--	<0.1	--	--	--	--	<0.1
			9/24/93	f	--	<0.1	--	--	--	--	<0.1
			10/1/93		--	<0.1	--	--	--	--	<0.1
			10/1/93	f	--	<0.1	--	--	--	--	<0.1
			10/8/93		--	--	--	--	--	--	<0.1
			10/8/93	f	--	<0.1	--	--	--	--	<0.1
			10/15/93		--	<0.1	--	--	--	--	<0.1
			12/2/93		--	<0.1	<0.1	--	--	--	<0.1
			12/2/93	f	--	<0.1	<0.1	--	--	--	<0.1
			6/6/94	f	--	<0.1	<0.1	--	--	--	<0.1
			11/7/97		<1.9	<1.9	--	<1.9	--	--	<1.9
	sodium	µg/L	3/12/87	f	--	**17,890**	**19,180**	**126,600**	**119,800**	--	**92,870**
			11/7/97		**159,000**	**14,200**	--	**192,000**	--	--	**169,000**
			2/10/98		**160,000**	**20,000**	**25,000**	**230,000**	--	--	**97,000**
			3/20/98		**250,000**	**22,000**	**31,000**	**260,000**	--	--	**160,000**
			9/9/98		**130,000**	**18,000**	**25,000**	**340,000**	--	--	**200,000**

Table 1
Historical Leachate and Surface Water Analytical Data
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Analyte		Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Metals	thallium	µg/L	11/10/82	--	nd	nd	nd	nd	nd	nd
			3/12/87 f	--	<10	<10	<10	<10	<10	<10
			11/7/97	<160	<160	--	<160	--	--	<160
	tin	µg/L	11/10/82	--	nd	nd	nd	nd	nd	nd
			3/12/87	--	<17	<17	<17	<17	<17	<17
	vanadium	µg/L	11/10/82	--	nd	nd	nd	nd	nd	nd
			3/1/87 f	--	**5.4**	**3.6**	<3.1	**12**	--	<3.1
			11/7/97	3.2 j	6.5 j	--	**9**	--	--	5.6 j
	zinc	µg/L	11/10/82	--	**22**	<11 (91)	**19**	**140**	**51**	**35**
			3/12/87 f	--	**9**	**18**	**31**	**73**	--	**9**
			9/27/90	--	**0.7**	**1.4**	--	--	--	**9.5**
			9/27/90 f	--	<0.1	**0.2**	--	--	--	**3.6**
			10/25/90	--	<0.1	**0.2**	--	--	--	**5.1**
			10/25/90 f	--	<0.1	<0.1	--	--	--	**2.6**
			6/8/93	--	**0.3**	**0.1**	--	--	--	**2.3**
			6/8/93 f	--	**0.1**	**0.1**	--	--	--	**2.2**
			6/22/93 f	--	**2.7**	--	--	--	--	**3.9**
			7/13/93 f	--	**0.9**	**0.2**	--	--	--	**1.7**
			7/28/93 f	--	**1.4**	--	--	--	--	**3.1**
			8/17/93 f	--	**0.7**	<0.1	--	--	--	**1.2**
			8/27/93 f	--	**1.1**	--	--	--	--	**6.2**
			9/3/93 f	--	**0.8**	--	--	--	--	**2.2**
			9/10/93 f	--	<0.1	--	--	--	--	**4.8**
			9/17/93	--	--	--	--	--	--	**6.5**
			9/17/93 f	--	**0.1**	na	--	--	--	**6**
			9/24/93	--	**na**	--	--	--	--	**10.6**
			9/24/93 f	--	**10**	--	--	--	--	**2.9**
			10/1/93	--	**3.7**	--	--	--	--	**22**
			10/1/93 f	--	**0.1**	--	--	--	--	**2.9**
			10/8/93	--	--	--	--	--	--	**16**

Table 1
Historical Leachate and Surface Water Analytical Data
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	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1 [PGRL-1] {Site 2}** Lonfit River Upstream	**SW-2 (SW-11) [PGRL-2] {Site 3}** Lonfit River Downstream	**SW-5 [PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9 [LFL-3]** Leachate Stream Southeast	**SW-10 (SW-3) {Site 1}** Leachate Stream West
Metals	zinc (continued)	µg/L	10/8/93 f	--	**0.1**	--	--	--	--	**2.2**
			10/15/93	--	**0.1**	--	--	--	--	**3.5**
			12/2/93	--	<0.1	<0.1	--	--	--	**2.3**
			12/2/93 f	--	<0.1	<0.1	--	--	--	**2.3**
			6/6/94 f	--	**0.2**	**0.2**	--	--	--	**1.4**
			11/7/97	**29.6**	9 j	--	**21.8**	--	--	**40.4**
			2/10/98	<50	<50	<50	<50	--	--	<50
			3/20/98	<50	<50	<50	<50	--	--	<50
			9/9/98	<85	<85	<85	<85	--	--	<85
VOCs	acetone	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
			3/12/87	--	2 jb	2 jb	5 jb	8 jb	--	<10
	2-butanone	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
			3/12/87	--	6 jb	8 jb	**12 b**	<10	<10	<10
	carbon disulfide	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
			3/12/87	--	<5	<5	<5	1 j	<5	<5
	chlorobenzene	µg/L	3/12/87	--	<5	<5	<5	3 j	<5	<5
	chloroethane	µg/L	11/10/82	--	<5	<5	<5	<5	j	<5
	1,1-dichloroethane	µg/L	11/10/82	--	<5	<5	<5	<5	j	<5
	ethylbenzene	µg/L	3/12/87	--	<5	<5	<5	<5	<5	<5
	2-hexanone	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
	4-methyl-2-pentanone	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
	methylene chloride	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
			3/12/87	--	<5	2 jb	<5	<5	<5	<5

Table 1
Historical Leachate and Surface Water Analytical Data
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	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
VOCs	styrene	µg/L	11/10/82	--	j	<5	<5	<5	<5	<5
			3/12/87	--	<5	<5	<5	<5	<5	<5
	toluene	µg/L	3/12/87	--	1 jb	1 jb	1 jb	<5	<5	<5
	vinyl acetate	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
	xylenes	µg/L	3/12/87	--	<5	<5	<5	<5	<5	<5
SVOCs	diethyl phthalate	µg/L	11/10/82	--	<20	<20	<20	<20	j	<20
	bis(2-ethylhexyl)phthalate	µg/L	3/12/87	--	<10	<10	<10	<10	<10	3 jb
	phenol	µg/L	3/12/87	--	<10	<10	<10	<10	<10	3 j
Pesticides & PCBs	aldrin	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	BHC-alpha	µg/L	6/89	<0.16	--	--	--	--	--	<0.16
			7/89	<0.16	--	--	--	--	--	<0.16
			8/89	<0.16	--	--	--	--	--	<0.16
			9/89	<0.16	--	--	--	--	--	<0.16
			10/89	<0.16	--	--	--	--	--	<0.16
			11/89	<0.16	--	--	--	--	--	<0.16

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Pesticides & PCBs	BHC-beta	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4
	BHC-delta	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	BHC-gamma	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Pesticides & PCBs	chlordane-alpha	µg/L	6/89	<0.1	--	--	--	--	--	<0.1
			7/89	<0.1	--	--	--	--	--	<0.1
			8/89	<0.1	--	--	--	--	--	<0.1
			9/89	<0.1	--	--	--	--	--	<0.1
			10/89	<0.1	--	--	--	--	--	<0.1
			11/89	<0.1	--	--	--	--	--	<0.1
	chlordane-gamma	µg/L	6/89	<0.1	--	--	--	--	--	<0.1
			7/89	<0.1	--	--	--	--	--	<0.1
			8/89	<0.1	--	--	--	--	--	<0.1
			9/89	<0.1	--	--	--	--	--	<0.1
			10/89	<0.1	--	--	--	--	--	<0.1
			11/89	<0.1	--	--	--	--	--	<0.1
	4,4'-DDD	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Pesticides & PCBs	4,4'-DDE	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	4,4'-DDT	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4
			2/10/98	<0.1	<0.1	<0.1	<0.1	--	--	<0.1
			3/20/98	<0.1	<0.1	<0.1	<0.1	--	--	<0.1
	diazinon	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	dieldrin	µg/L	11/10/82	--	<0.1	<0.1	<0.1	<0.1	<0.1 (0.21)	<0.1
			6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	endosulfan sulfate	µg/L	11/10/82	--	<0.1	<0.1	<0.1	<0.1	<0.1 (0.135)	<0.1
	endrin	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	ethion	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	heptachlor	µg/L	6/89	<0.24	--	--	--	--	--	<0.24
			7/89	<0.24	--	--	--	--	--	<0.24
			8/89	<0.24	--	--	--	--	--	<0.24
			9/89	<0.24	--	--	--	--	--	<0.24
			10/89	<0.24	--	--	--	--	--	<0.24
			11/89	<0.24	--	--	--	--	--	<0.24
	malathion	µg/L	6/89	<4	--	--	--	--	--	<4
			7/89	<4	--	--	--	--	--	<4
			8/89	<4	--	--	--	--	--	<4
			9/89	<4	--	--	--	--	--	<4
			10/89	<4	--	--	--	--	--	<4
			11/89	<4	--	--	--	--	--	<4
	methoxychlor	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	naled	µg/L	6/89	<2	--	--	--	--	--	<2
			7/89	<2	--	--	--	--	--	<2
			8/89	<2	--	--	--	--	--	<2
			9/89	<2	--	--	--	--	--	<2
			10/89	<2	--	--	--	--	--	<2
			11/89	<2	--	--	--	--	--	<2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Pesticides & PCBs	parathion, ethyl	µg/L	6/89	<2	--	--	--	--	--	<2
			7/89	<2	--	--	--	--	--	<2
			8/89	<2	--	--	--	--	--	<2
			9/89	<2	--	--	--	--	--	<2
			10/89	<2	--	--	--	--	--	<2
			11/89	<2	--	--	--	--	--	<2
	parathion, methyl	µg/L	6/89	<2	--	--	--	--	--	<2
			7/89	<2	--	--	--	--	--	<2
			8/89	<2	--	--	--	--	--	<2
			9/89	<2	--	--	--	--	--	<2
			10/89	<2	--	--	--	--	--	<2
			11/89	<2	--	--	--	--	--	<2
	PCB-1016	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1221	µg/L	2/10/98	<2	<2	<2	<2	--	--	<2
			3/20/98	<2	<2	<2	<2	--	--	<2
	PCB-1232	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1242	µg/L	11/10/82	--	<0.1	<0.1	<0.1 (3.84)	<0.1	<0.1	<0.1 (1.12)
			2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1248	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1254	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1260	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
TRPH		µg/L	2/10/98	<1,000	<1,000	<1,000	<1,000	--	--	<1,000
			3/20/98	<1,000	<1,000	<1,000	<1,000	--	--	<1,000

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Other Parameters	ammonia	mg/L	11/7/97	**32.2**	<0.06	--	**27.1**	--	--	**42.5**
	BOD_5	mg/L	2/10/98	**14**	**2.2**	**5.1**	**2.7**	--	--	**15**
			3/20/98	**14**	**23**	**1.1**	**1.6**	--	--	**20**
			9/9/98	**14**	**0.93**	**4.2**	**10**	--	--	**4**
	COD	mg/L	2/10/98	**100**	<10	<10	**76**	--	--	**61**
			3/20/98	**140**	**20**	<10	**56**	--	--	**110**
			9/9/98	**98**	<10	**67**	**170**	--	--	**160**
	cyanide	µg/L	3/12/87	--	<10	<10	<10	<10	--	**19**
	nitrogen as nitrate	mg/L	7/80	--	--	**0.23**	--	--	--	--
			12/80	--	**0.32**	--	--	--	--	--
			5/81	--	--	--	**1.67**	--	--	--
			2/10/98	**0.5**	<0.05	**0.6**	**11**	--	--	**0.8**
			3/20/98	**0.77**	<0.05	**0.52**	**6.8**	--	--	**0.54**
			9/9/98	**13**	<0.05	**0.68**	**14**	--	--	**36**
	nitrogen as nitrite	mg/L	7/80	--	--	**0.05**	--	--	--	--
			8/81	--	--	--	**0.343**	--	--	--
	nitrogen as nitrate+nitrite	mg/L	11/7/97	**3.8**	<0.03	--	**7.1**	--	--	**2.4**
			2/10/98	**1.7**	<0.05	**0.6**	**11**	--	--	**0.89**
			3/20/98	**2.1**	<0.05	**0.52**	**6.8**	--	--	**0.65**
			9/9/98	**14**	<0.05	**0.9**	**21**	--	--	**36**
	nitrogen (total Kjeldahl)	mg/L	11/7/97	**41.5**	<0.15	--	**28.9**	--	--	**44.2**
			2/10/98	**38**	<0.75	<0.75	**3.4**	--	--	**25**
			3/20/98	**63**	<0.75	<0.75	**3**	--	--	**83**
			9/9/98	**9.9**	<0.75	**0.8**	**38**	--	--	**22**
	nitrogen (total organic)	mg/L	11/7/97	**9.3**	<0.15	--	**1.8**	--	--	**1.7**
	pH	--	11/10/82	--	8	8	7.7	7.8	7.4	7
			3/12/87	--	7.96	6.85	6.2	--	--	2.75
			2/10/98	7.8	8.2	7.5	6	--	--	7.4
			3/20/98	7.5	7	7.8	7.9	--	--	7.3
			9/9/98	**7.4**	8.1	7.8	7.9			7.3

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	**SW-1** **[PGRL-1]** **{Site 2}** Lonfit River Upstream	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}** Lonfit River Downstream	**SW-5** **[PGRL-0]** Leachate Stream South	**SW-7** Leachate Pond South	**SW-9** **[LFL-3]** Leachate Stream Southeast	**SW-10** **(SW-3)** **{Site 1}** Leachate Stream West
Other Parameters	phosphorus (total)	mg/L	1/80	--	--	**0.77**	--	--	--	--
			8/80	--	--	--	**0.121**	--	--	--
			9/81	--	**0.54**	--	--	--	--	--
			11/7/97	<0.1j	<0.01	--	0.11 j	--	--	**0.09**
			2/10/98	<0.1	<0.1	<0.1	<0.1	--	--	<0.1
			3/20/98	<0.1	<0.1	<0.1	**0.11**	--	--	**0.21**
			9/9/98	<0.1	<0.1	<0.1	<0.1			<0.1
	TDS	mg/L	11/7/97	**862**	**209**	--	**1,040**	--	--	**969**
			2/10/98	**870**	**230**	**280**	**1,100**	--	--	**590**
			3/20/98	**1,100**	<25	**240**	**1,000**	--	--	**900**
			9/9/98	**370**	**170**	**270**	**1,500**			**1,400**
	TOC	mg/L	11/7/97	**45.3**	**2.8**	--	**41.6**	--	--	**48.8**
			2/10/98	**36.4**	<1	**3**	**29.3**	--	--	**19.8**
			3/20/98	**39**	<1	**1.79**	**19.9**	--	--	**27**
			9/9/98	**23**	**1.2**	**2.2**	**47**			**48**
	TSS	mg/L	11/7/97	<10	<10	**--**	**66.5**	--	--	**21**
			2/10/98	**2.2**	**1**	**1.3**	**1.8**	--	--	**11**
			3/20/98	**19**	**220**	<1	**1.6**	--	--	**27**
			9/9/98	**2.3**	**1.3**	**3.7**	**3**	--	--	**5.3**

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

Analyte	Units	Date	Sample Identification and Location						
			SW-0	**SW-1** **[PGRL-1]** **{Site 2}**	**SW-2** **(SW-11)** **[PGRL-2]** **{Site 3}**	**SW-5** **[PGRL-0]**	**SW-7**	**SW-9** **[LFL-3]**	**SW-10** **(SW-3)** **{Site 1}**
			Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West

Sampling Dates:

11/10/82	Black & Veatch. 1983. Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report. May 20.
6/80 through 3/85	Camp, Dresser & McKee, Inc (CDM). 1985. Revised Work Plan Memorandum for Ordot Landfill, Guam. November 20.
3/6/86 through 12/9/87	Water and Environmental Research Institute (WERI) of the Western Pacific University of Guam, USGS funded study
3/12/87	CDM. 1987. Final Initial Site Characterization Report, Ordot Landfill, Island of Guam. November 18.
6/89 through 11/89	WERI. 1989. The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam Mariana Islands. Technical Completion Report No. 72. November.
11/7/97	USEPA/Guam EPA Sampling Event
9/27/90 through 6/6/94	WERI Trace Metals Sampling Program
2/10/98	Unitek Environmental. 1998. Surface Water Sampling Report for February 1998, Ordot Landfill, Ordot, Guam. February 27.
3/20/98	Unitek Environmental. 1998. Surface Water Sampling Report for March 1998, Ordot Landfill, Ordot, Guam. April 27.
9/9/98	UEG Unitek. 1998. Surface Water Sampling Report for September 1998, Ordot Landfill, Ordot, Guam. October 8.

References for Data:

Sample identification given in parentheses is for the corresponding sample location from the November 1982 Remedial Investigation (Black & Veatch, 1983).
Sample identification given in brackets is for the corresponding sample location from the 1980-1985 Guam EPA sampling program (CDM, 1985) and the 1986-1987 WERI study.
Sample identification given in curly brackets is for the corresponding sample location from the 1990-1994 trace metals sampling program (WERI).
Top sample identification is nomenclature used during all other investigations.

Notes:

Detected concentrations are shown in bold.
Concentrations in parentheses are for corresponding duplicate sample, where primary sample result was non-detect and duplicate sample was not.

µg/L = micrograms per liter
mg/L = milligrams per liter
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
PCBs = polychlorinated biphenyls
TRPH = total recoverable petroleum hydrocarbons
BOD_5 = biological oxygen demand (5-day)
COD = chemical oxygen demand
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
f = field filtered sample (all other samples are or presumed to be unfiltered)
j = detected below reporting limit (number, if given, is estimated)
b = constituent also detected in method blank, indicating laboratory contamination
nd = not detected
-- = not analyzed or not established
<5 = not detected (reporting limit listed)

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

			Sample Identification and Location								
Analyte		**Date**	**GW-1** Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
Metals	aluminum	11/10/82	<200	--	--	--	--	--	--	--	--
		3/12/87	**41**	**45**	**77**	**837**	**831**	**831**	**831**	**--**	**--**
	antimony	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<20	<20	<20	<20	<20	<20	<20	--	--
	arsenic	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<10	<10	<10	<10	<10	<10	<10	--	--
	barium	11/10/82	<100	--	--	--	--	--	--	--	--
		3/12/87	**6**	**5**	**9**	**190**	**15**	**15**	**15**	**--**	**--**
	beryllium	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--
	boron	11/10/82	<100	--	--	--	--	--	--	--	--
	cadmium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	--	--
	calcium	3/12/87	**117,900**	**113,800**	**53,930**	**41,610**	**85,060**	**85,060**	**85,060**	**--**	**--**
	chromium (total)	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	--	--
	cobalt	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	--	--
	copper	11/10/82	<50	--	--	--	--	--	--	--	--
		3/12/87	**6**	**10**	<5.9	**6**	**34**	**34**	**34**	**--**	**--**
	iron	11/10/82	<50	--	--	--	--	--	--	--	--
		3/12/87	**75**	**65**	**124**	**631**	**895**	**895**	**895**	**--**	**--**

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

Analyte		Date	Sample Identification and Location								
			GW-1 Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
Metals	lead	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5 (5.9)	<5 (5.9)	<5 (5.9)	--	--
	magnesium	3/12/87	**4,151**	**3,215**	**7,491**	**31,210**	**59,130**	**59,130**	**59,130**	**--**	**--**
	manganese	11/10/82	<15	--	--	--	--	--	--	--	--
		3/12/87	**1**	**4**	**8**	**87**	**92**	**92**	**92**	**--**	**--**
	mercury	11/10/82	**5.3**	--	--	--	--	--	--	--	--
		3/12/87	<0.2	1.06 j	<0.2	<0.2	<0.2	<0.2	<0.2	--	--
	nickel	11/10/82	**77**	--	--	--	--	--	--	--	--
		3/12/87	<23	<23	<23	**32**	<23	<23	<23	--	--
	potassium	3/12/87	<948	<948	<948	<948	<948	<948	<948	--	--
	selenium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	silver	11/10/82	**26**	--	--	--	--	--	--	--	--
		3/12/87	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	--	--
	sodium	3/12/87	**11,110**	**8,674**	**12,880**	**38,650**	**62,130**	**62,130**	**62,130**	**--**	**--**
	thallium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<10	<10	<10	<10	<10	<10	<10	--	--
	tin	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<17	<17	<17	<17	<17	<17	<17	--	--
	vanadium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<3.1	<3.1	<3.1	**3.6**	**6.9**	**6.9**	**6.9**	**--**	**--**
	zinc	11/10/82	**19**	--	--	--	--	--	--	--	--
		3/12/87	**44**	**45**	**20**	**137**	**162**	**162**	**162**	**--**	**--**

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	Sample Identification and Location								
			GW-1 Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
VOCs	acetone	11/10/82	j	--	--	--	--	--	--	--	--
		3/12/87	<10 (4 jb)	3 jb	3 jb	3 jb	3 jb	3 jb	3 jb	--	--
	2-butanone	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<10	**10 b**	<10	**10 b**	9 jb	9 jb	9 jb	--	--
	carbon disulfide	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	chlorobenzene	3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	chloroethane	11/10/82	<5	--	--	--	--	--	--	--	--
	chloroform	7/21/92	--	--	--	--	--	--	--	nd	**30 c**
	1,1-dichloroethane	11/10/82	<5	--	--	--	--	--	--	--	--
	ethylbenzene	3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	2-hexanone	11/10/82	**139**	--	--	--	--	--	--	--	--
	4-methyl-2-pentanone	11/10/82	<5	--	--	--	--	--	--	--	--
	methylene chloride	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	2 jb	<5	3 jb	<5	<5	<5	--	--
	styrene	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	toluene	3/12/87	<5	1 jb	1 jb	<5	1 jb	1 jb	1 jb	--	--
	vinyl acetate	11/10/82	<5	--	--	--	--	--	--	--	--
	xylenes	3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--

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	Analyte	Date	Sample Identification and Location								
			GW-1 Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
SVOCs	diethyl phthalate	11/10/82	<20	--	--	--	--	--	--	--	--
	di-N-butylphthalate	7/21/92	--	--	--	--	--	--	--	--	**5 d**
	2-ethyl-1-hexanol	7/21/92	--	--	--	--	--	--	--	**8 d**	--
	bis(2-ethylhexyl)phthalate	3/12/87	2 jb	2 jb	**88**	2 jb	5 jb	5 jb	5 jb	--	--
	1(3H) isobenzofuranone	7/21/92	--	--	**--**	--	--	--	--	**6 d**	**5 d**
	phenol	3/12/87	<10	5 j	<10	<10	<10	<10	<10	--	--
Pesticides & PCBs	aldrin	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	BHC-alpha	6/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		7/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		8/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		9/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		10/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		11/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
	BHC-beta	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	BHC-delta	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

			Sample Identification and Location								
Analyte		**Date**	**GW-1** Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
Pesticides & PCBs	BHC-gamma	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	chlordane-alpha	6/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		7/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		8/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		9/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		10/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		11/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	chlordane-gamma	6/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		7/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		8/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		9/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		10/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		11/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	4,4'-DDD	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	4,4'-DDE	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	Sample Identification and Location								
			GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
Pesticides & PCBs	4,4'-DDT	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	diazinon	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	dieldrin	11/10/82	<0.1	--	--	--	--	--	--	--	--
		6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	endosulfan sulfate	11/10/82	<0.1	--	--	--	--	--	--	--	--
	endrin	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	Sample Identification and Location								
			GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
Pesticides & PCBs	ethion	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	heptachlor	6/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		7/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		8/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		9/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		10/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		11/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
	malathion	6/89	<4	--	<4	--	<4	<4	<4	--	--
		7/89	<4	--	<4	--	<4	<4	<4	--	--
		8/89	<4	--	<4	--	<4	<4	<4	--	--
		9/89	<4	--	<4	--	<4	<4	<4	--	--
		10/89	<4	--	<4	--	<4	<4	<4	--	--
		11/89	<4	--	<4	--	<4	<4	<4	--	--
	methoxychlor	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	naled	6/89	<2	--	<2	--	<2	<2	<2	--	--
		7/89	<2	--	<2	--	<2	<2	<2	--	--
		8/89	<2	--	<2	--	<2	<2	<2	--	--
		9/89	<2	--	<2	--	<2	<2	<2	--	--
		10/89	<2	--	<2	--	<2	<2	<2	--	--
		11/89	<2	--	<2	--	<2	<2	<2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

			Sample Identification and Location								
Analyte		**Date**	**GW-1** Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
Pesticides & PCBs	parathion, ethyl	6/89	<2	--	<2	--	<2	<2	<2	--	--
		7/89	<2	--	<2	--	<2	<2	<2	--	--
		8/89	<2	--	<2	--	<2	<2	<2	--	--
		9/89	<2	--	<2	--	<2	<2	<2	--	--
		10/89	<2	--	<2	--	<2	<2	<2	--	--
		11/89	<2	--	<2	--	<2	<2	<2	--	--
	parathion, methyl	6/89	<2	--	<2	--	<2	<2	<2	--	--
		7/89	<2	--	<2	--	<2	<2	<2	--	--
		8/89	<2	--	<2	--	<2	<2	<2	--	--
		9/89	<2	--	<2	--	<2	<2	<2	--	--
		10/89	<2	--	<2	--	<2	<2	<2	--	--
		11/89	<2	--	<2	--	<2	<2	<2	--	--
	PCB-1242	11/10/82	<0.1	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

			Sample Identification and Location								
Analyte		**Date**	**GW-1** Municipal Well A-11 Northeast of Site	**GW-3** Municipal Well A-12 Northeast of Site	**GW-4 (Well 9)** Background Well North	**GW-5** Downgradient Well South	**GW-6 (Well 3)** Downgradient Well South	**Well 4** Downgradient Well South	**Well 8** Downgradient Well South	**MW-01** USEPA Well Northeast of Site	**MW-02** USEPA Well Northeast of Site
Other Parameters	cyanide	3/12/87	<10	**16**	<10	<10	<10	<10	<10	--	--
	pH	11/10/82	6.9	--	--	--	--	--	--	--	--
		3/12/87	6.75	6.71	7.26	6.27	6.8	6.8	6.8	--	--

Sampling Dates:
11/10/82
3/12/87
6/89 through 11/89
7/21/92

References for Data:
Black & Veatch. 1983. Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report . May 20.
Camp, Dresser & McKee, Inc (CDM). 1987. Final Initial Site Characterization Report, Ordot Landfill, Island of Guam. November 18.
Water and Environmental Research Institute (WERI) of the Western Pacific University of Guam. 1989. The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam Mariana Islands. Technical Completion Report No. 72. November.
URS Consultants, 1992, Monitoring Well Installation and Sampling Field Forms, October 29.

Sample identification given in parentheses is for the corresponding sample location from the 1989 pesticide investigation (WERI).
Top sample identification is nomenclature used during all other investigations.

Notes:
Detected concentrations are shown in bold.
Concentrations in parentheses are for corresponding duplicate sample, where primary sample result was non-detect and duplicate sample was not.

µg/L = micrograms per liter
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
PCBs = polychlorinated biphenyls
-- = not analyzed or not established
<5 = not detected (reporting limit listed)
nd = not detected
j = detected below reporting limit (number, if given, is estimated)
b = constituent also detected in method blank, indicating laboratory contamination
c = analyte detected in field blank
d = field blank not tested

Table 3
Historical Sediment Analytical Data
Ordot Landfill
Territory of Guam
(all results in mg/kg)

			Sample Identification and Location					
Analyte		**Date**	**SS-1** Lonfit River Upstream	**SS-3** Leachate Stream West	**SS-5** Leachate Stream South	**SS-7** Leachate Pond South	**SS-9** Leachate Stream Southeast	**SS-11** Lonfit River Downstream
Metals	aluminum	Nov-82	**13,700**	**7,440**	**21,500**	**12,200**	**12,900**	**14,000**
	antimony	Nov-82	<1	<1 (1.2)	<1	**1**	<1	<1
	arsenic	Nov-82	**0.9**	**0.5**	**1.1**	**0.6**	**0.9**	**0.9**
	barium	Nov-82	**252**	**91**	**49.1**	**38**	**22.9**	**129**
	beryllium	Nov-82	**0.3**	<0.3	<0.3	<0.3 (0.3)	<0.3	**0.2**
	boron	Nov-82	**16.7**	**23.8**	**31**	**18.8**	**15**	**17**
	cadmium	Nov-82	**0.05**	**0.1**	<0.05	**0.1**	**0.2**	**0.05**
	chromium (total)	Nov-82	**30.8**	**16.4**	**46.1**	**24.3**	**20.3**	**24.1**
	cobalt	Nov-82	**25.2**	**17**	**14.8**	**15.3**	**9.3**	**19.3**
	copper	Nov-82	**33.7**	**23.7**	**29.7**	**30.5**	**26.2**	**28.9**
	iron	Nov-82	**19,400**	**13,000**	**36,600**	**14,900**	**14,600**	**20,800**
	manganese	Nov-82	**1,370**	**2,350**	**936**	**360**	**373**	**402**
	lead	Nov-82	**12**	**32**	**6.8**	**34**	**24**	**11**
	mercury	Nov-82	**3.2**	**2.6**	**4.4**	**3.1**	**2.2**	**1.1**
	nickel	Nov-82	<2 (52.3)	**22.1**	**26.4**	**26.4**	**17.2**	**37**
	selenium	Nov-82	nd	nd	nd	nd	nd	nd
	silver	Nov-82	nd	nd	nd	nd	nd	nd
	thallium	Nov-82	nd	nd	nd	nd	nd	nd
	tin	Nov-82	<1	<1 (1.4)	**1.7**	<1	<1 (1.2)	<1
	vanadium	Nov-82	**47.7**	**27.8**	**58.2**	**42.3**	**30.8**	**34.6**
	zinc	Nov-82	**26.2**	<0.5 (108)	**35.5**	**53.8**	**54.6**	**27**

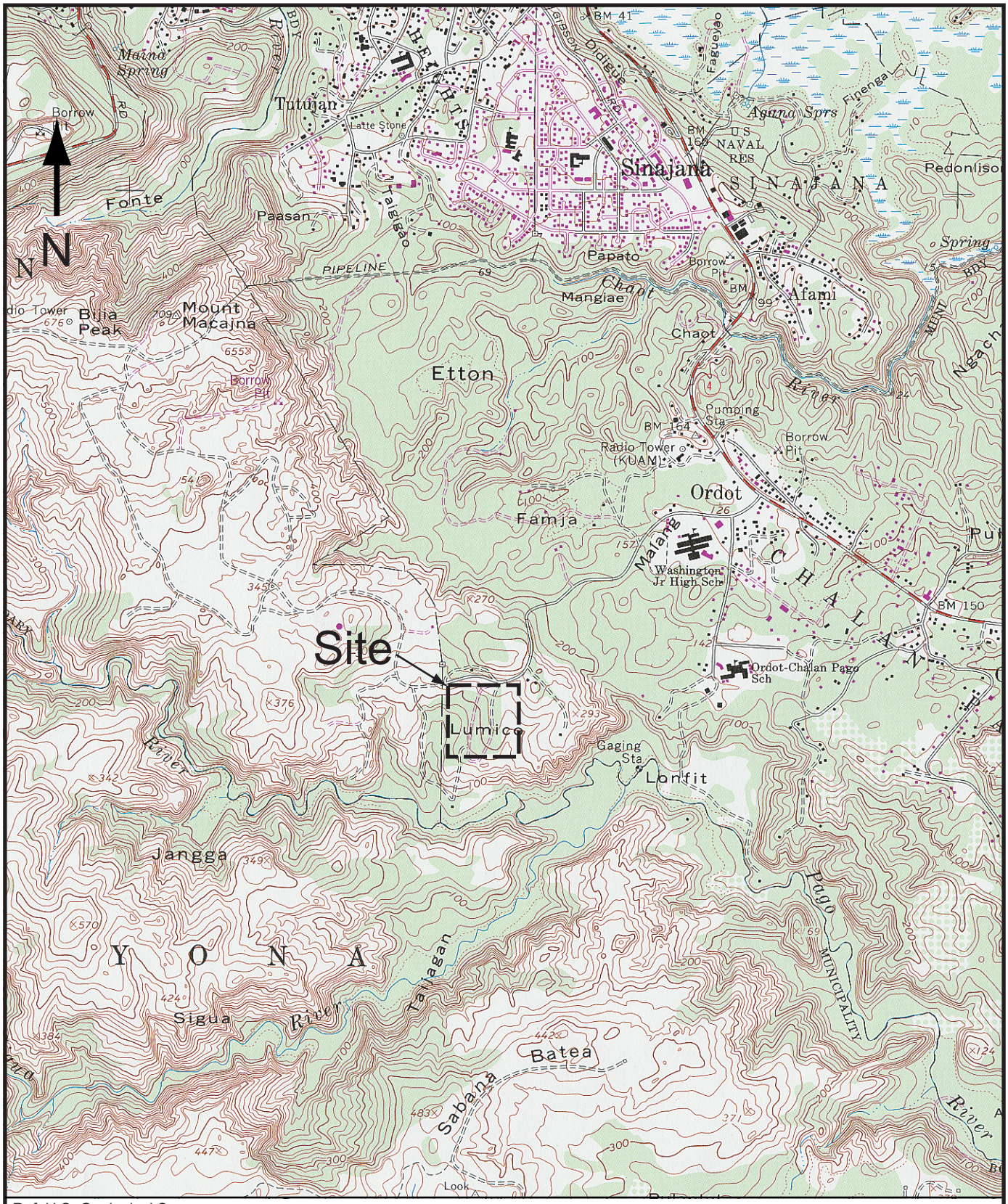
References for Data:

Black & Veatch. 1983. Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report . May 20.

Notes:

Detected concentrations are shown in bold.
Concentrations in parentheses are for corresponding duplicate sample, where primary sample result was non-detect and duplicate sample was not.
mg/kg = milligrams per kilogram
<5 = not detected (reporting limit listed)

FIGURES



Ref: U.S. Geological Survey,
1975 Agana Quadrangle

SCALE: 1" = 2,000'

Figure 1
Site Location Map
Ordot Landfill
Territory of Guam

CH2MHILL

E072002004SFO 172905.FR.01 SiteLocMap 7/26/02 ccc

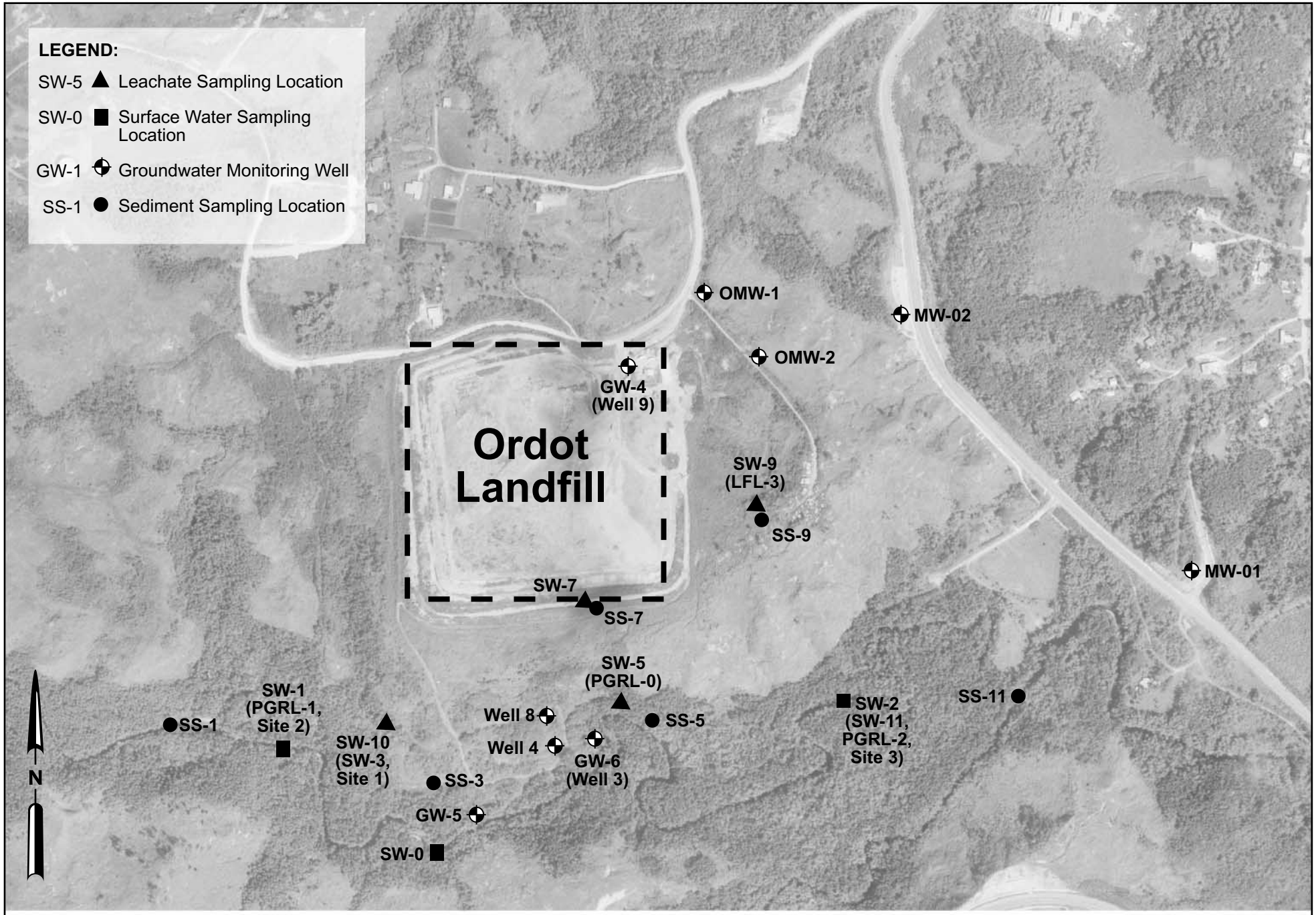


Figure 2

Site Plan

Ordot Landfill, Territory of Guam

Ref: Guam Ortho Photos, Sheet 33,1994

CH2MHILL

E072002004SFO • 172905.FR.01 • Well Locations.ai • 9.11.02 • SFO • mg

APPENDIX A

References/Documents Reviewed

References/Documents Reviewed

Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. 1988. *Draft Health Assessment for Ordot Landfill National Priorities List (NPL) Site*. October 25.

Black & Veatch. 1983. *Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report* . May 20.

Camp, Dresser & McKee, Inc (CDM). 1982. *Final Report, Northern Guam Lens Study, Groundwater Management Program, Aquifer Yield Report*. December.

_____. 1985. *Revised Work Plan Memorandum for Ordot Landfill, Guam*. November 20.

_____. 1987. *Final Initial Site Characterization Report, Ordot Landfill, Island of Guam*. November 18.

CH2M HILL/Black & Veatch/ICF/PRC/Ecology and Environment. 1988. *Draft Risk Assessment (Preliminary Endangerment Assessment), Ordot Landfill Site, Guam*. September .

Ecology and Environment, Inc. 1999a. *Ordot Landfill Tire Fire Air Surveillance Program and Safety Plan Review*. January 25.

_____. 1999b. *Ordot Landfill Tire Fire Emergency Response*. May 20.

GMP Associates, Inc. 1981. *Final Report, Guam Sanitary Landfill Plan*. June.

Guam Environmental Protection Agency. 1997. *Ordot Landfill – DPW Response October 6, 1997, Intra-Agency Memorandum*. October 8.

Guam Department of Public Works. 1997. *Operations and Monitoring Plan for the Ordot Landfill*. November.

Juan C. Tenorio and Associates, Inc (JTA). 1993a. *Environmental Impact Assessment Report for the Expansion of the Ordot Sanitary Landfill*. September.

_____. 1993b. *Feasibility Study for the Expansion of Ordot Sanitary Landfill, Municipality of Chalan Pago-Ordot, Territory of Guam*. Volumes I and II. September.

_____. 1998. *Draft Environmental Impact Statement, Solid Waste Management Facility for the Island of Guam*. March 5.

Mink, John F., Mink and Yuen, Inc. 1995. *A Hydrogeologic Evaluation of Proposed Landfill Site, Island of Guam*. May.

Radway, Scott. 2002. *Feds Sue GovGuam*. Pacific Daily News article. www.guampdn.com/news/stories/20020808/localnews/382954.html. August 8.

Tracey, J. I., S.O. Schanger, J.T. Stark, D.B. Doan, & H.G. May. 1964. *General Geology of Guam*. United States Geological Survey Professional Paper. 403-A.

U.S. Environmental Protection Agency (USEPA). 1986. *EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy*.

_____. 2001. *Comprehensive Five-Year Review Guidance, EPA 540-R-01-007*. June.

USEPA, Region IX. 1988. *Final Record of Decision, Ordot Landfill Superfund Site, Guam*. September 8.

_____. 1993. *EPA Five Year Review of the No Further Action Decision at the Ordot Landfill Superfund Site in Guam*. September 30.

USEPA Region IX and Guam Environmental Protection Agency. No Date. Analytical Results from Leachate and Surface Water Sampling Event, November 7, 1997.

Unitek Environmental. 1998a. *Surface Water Sampling Report for February 1998, Ordot Landfill, Ordot, Guam*. February 27.

_____. 1998b. *Surface Water Sampling Report for March 1998, Ordot Landfill, Ordot, Guam*. April 27.

_____. 1998c. *Surface Water Sampling Report for September 1998, Ordot Landfill, Ordot, Guam*. October 8.

URS Consultants. 1992. *Monitoring Well Installation and Sampling Field Forms*. October 29.

Water and Environmental Research Institute (WERI) of the Western Pacific University of Guam. No Date. Leachate and Surface Water Sampling Results from USGS Funded Study, 1986 to 1987.

_____. No Date. Leachate and Surface Water Sampling Results from Trace Metals Sampling Program, 1990 to 1994.

_____. 1989. *The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam Mariana Islands*. Technical Completion Report No. 72. November.

_____. 1990-1994. No Date. Analytical Results from Trace Metals Sampling Program.

_____. 1998. *Urban Runoff in Guam: Major Retention Sites, Elemental Composition and Environmental Significance*. Technical Completion Report No. 84. December.

APPENDIX B

Site Inspection

Ordot Landfill Superfund Site
Five-Year Review Site Inspection Checklist

I. SITE INFORMATION

Site Name: Ordot Landfill Superfund Site	**EPA ID:** GUD980637649
City/County: Near the villages of Ordot and Chalan Pago, Guam	**Date of Inspection:** June 26, 2002
Agency Completing 5 Year Review: CH2M Hill	**Weather/temperature:** Overcast, scattered showers 95°

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: No further action

Attachments: ☒ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS

Interviewee roster attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

Note: In September 1988, EPA issued a Final Record of Decision (ROD) not to take an action under the Superfund Program, but to defer cleanup of site threats to the Clean Water Act Program. Since there is no remedial action activity which has occurred at this site the documents and records discussed here are related to the current landfill activities and not to any cleanup activities.

1. O&M Documents

☒ O&M Manual:	☒ Readily available	☐ Up to date	☐ N/A
☒ As-Built Drawings:	☒ Readily available	☐ Up to date	☐ N/A
☐ Maintenance Logs:	☐ Readily available	☐ Up to date	☒ N/A

Remarks:

There are several documents that have been generated as Operating Plans for the site. They are the *Guam Sanitary Landfill Plan* dated June 1981, the *Ordot Landfill Operating Plan* undated, and the *Operations and Monitoring Plan for the Ordot Dump* dated November 1997. None of these documents, however, were found at the landfill. The on-site supervisor did not have a copy available to show during the site inspection. The as-built drawing that was provided by Guam DPW was dated 1997 and is the most recent copy available. According to the landfill site supervisor, there are no maintenance records kept.

2. Health and Safety Plan Documents

☐ Site-Specific Health and Safety Plan:	☐ Readily available	☐ Up to date	☒ N/A
☐ Contingency plan/emergency response plan:	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Just now starting a program. No written plan nor procedure. Get customer out, call supervisor, check wind direction, call fire department if necessary, call civil defense if evacuation is required.

3. Training Records

☐ O&M and OSHA Training Records:	☐ Readily available	☐ Up to date	☒ N/A
☐ Other training records:	☐ Readily available	☐ Up to date	☒ N/A

Remarks: SCBA training. Updating of training doesn't really happen.

4. Permits and Service Agreements

☐ Air discharge permit:	☐ Readily available	☐ Up to date	☒ N/A
☒ Effluent discharge:	☐ Readily available	☐ Up to date	☐ N/A
☒ Waste disposal, POTW:	☐ Readily available	☐ Up to date	☐ N/A
☐ Other permits:	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Guam EPA has NPDES authority. An NPDES Permit Application was submitted to GEPA by the DPW on June 19, 1990. GEPA responded on July 12, 1990 that the application was incomplete and that no action would be taken until missing information was clarified on the application. There are no subsequent records indicating that a complete application was ever completed. No NPDES permit is known to have been issued for this site.

Guam EPA has Subtitle D authority. On April 5, 1982 they issued a conditional permit for solid waste disposal operation at the Ordot Landfill. The permit was to expire on April 5, 1984. There was no current permit information found anywhere in the files either at the site or elsewhere.

5. Monitoring Records

☐ Gas Generation Records:	☐ Readily available	☐ Up to date	☒ N/A
☐ Settlement Monument Records:	☐ Readily available	☐ Up to date	☒ N/A
☒ Groundwater Monitoring Records:	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Some groundwater monitoring data is available from investigations that have been conducted in the past. A regular groundwater monitoring program is not established for this site.

6. Leachate Extraction Records

☒ Leachate Extraction Records:	☐ Readily available	☐ Up to date	☒ N/A

Remarks: There is not a leachate extraction system at this site. There has been occasional monitoring of leachate streams conducted at the downslope or toe of the landfill. The leachate streams used to be sampled on a monthly basis, but this sampling ceased due to concerns of instability of the downslope portion of the landfill and other potential dangers to the sampling team.

7. Compliance Records

☐ Discharge Compliance Records:	☐ Readily available	☐ Up to date	☒ N/A

Remarks:

8. Daily Access / Security Logs

☒ Daily Access / Security Logs: ☐ Readily available ☐ Up to date ☐ N/A

Remarks: Large companies are to supply a listing of what they are bringing. These records are kept by the landfill operator for a period of 3 years. These records are occasionally reviewed by Guam EPA.

IV. O&M Costs ☐ Applicable ☒ N/A

1. O&M Organization

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Other:

2. O&M Cost Records

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate: ☐ Breakdown attached

Total annual cost by year for review period if available

From (Date):	To (Date):	Total cost:	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	☐ Breakdown attached
From (Date):	To (Date):	Total cost:	☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period: ☐ N/A

Describe costs and reasons:

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☒ N/A

1. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
Remarks:

2. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☐ N/A
Remarks:

3. Institutional Controls

1. Implementation and enforcement

Site conditions imply ICs not properly implemented: ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced: ☐ Yes ☐ No ☐ N/A
Type of monitoring (e.g, self-reporting, drive by):
Frequency:
Responsible party/agency:
Contact:
Name:
Title:
Date:
Phone Number:
Reporting is up-to-date: ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency: ☐ Yes ☐ No ☐ N/A
Specific requirements in deed or decision documents have been met: ☐ Yes ☐ No ☐ N/A
Violations have been reported: ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Additional report attached (if additional space required).

2. Adequacy ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks:

4. General

1. Vandalism/trespassing ☐ Location shown on site map ☒ No vandalism evident
Remarks:

2. Land use changes on-site ☐ N/A
Remarks:

3. Land use changes off-site ☐ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

1. Roads ☒ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: The road appeared to be adequate, although it was evident that there is a lot of heavy truck usage, since the

pavement is uneven as you approach the landfill entrance.

2. Other Site Conditions

Remarks: As evidence in some of the site photographs attached to this report, there is no or very little daily operations occurring at the site. The trash is mounded up above the original highest topographic elevation.

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

1. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent: Depth:
   Remarks:

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths: Widths: Depths:
   Remarks:

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent: Depth:
   Remarks:

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent: Depth:
   Remarks:

5. **Vegetative Cover**
   ☐ Cover properly established ☐ No signs of stress ☐ Grass ☐ Trees/Shrubs
   Remarks:

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks:

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent: Height:
   Remarks:

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent:
   ☐ Ponding ☐ Location shown on site map Areal extent:
   ☐ Seeps ☐ Location shown on site map Areal extent:

☐ Soft subgrade ☐ Location shown on site map Areal extent:
Remarks:

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent:
Remarks:

2. **Benches** ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks:

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. **Letdown Channels** ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent: Depth:
Remarks:

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type: Areal extent:
Remarks:

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent: Depth:
Remarks:

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent: Depth:
Remarks:

5. **Obstructions** ☐ Location shown on site map ☐ N/A
Type:

Areal extent: Height:
Remarks:

6. **Excessive Vegetative Growth**
☐ No evidence of excessive growth
☐ Evidence of excessive growth
☐ Vegetation in channels but does not obstruct flow
☐ Location shown on site map
Areal extent:
Remarks:

4. **Cover Penetrations** ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ N/A
☐ Active ☐ Passive ☐ Routinely sampled
☐ Properly secured/locked ☐ Functioning ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O& M
Remarks:

2. **Gas Monitoring Probes** ☐ N/A
☐ Routinely sampled
☐ Properly secured/locked ☐ Functioning ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M
Remarks:

3. **Monitoring Wells** (within surface area of landfill) ☐ N/A
☐ Routinely sampled
☐ Properly secured/locked ☐ Functioning ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M
Remarks:

4. **Leachate Extraction Wells** ☐ N/A
☐ Routinely sampled
☐ Properly secured/locked ☐ Functioning ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M
Remarks:

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks:

5. **Gas Collection and Treatment** ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities** ☐ N/A
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs O& M
Remarks:

2. **Gas Collection Wells, Manifolds and Piping** ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings) ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

6. **Cover Drainage Layer** ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks:

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
Remarks:

7. **Detention/Sedimentation Ponds** ☐ Applicable ☒ N/A

1. **Siltation** ☐ Siltation evident ☐ N/A
Areal extent: Depth:
Remarks:

2. **Erosion** ☐ Erosion evident ☐ N/A
Areal extent: Depth:
Remarks:

3. **Outlet Works** ☐ Functioning ☐ N/A
Remarks:

4. **Dam** ☐ Functioning ☐ N/A
Remarks:

8. **Retaining Walls** ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement:
Vertical displacement:
Rotational displacement:
Remarks:

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks:

1. **Perimeter Ditches/Off-site discharge** ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
Areal extent: Depth:
Remarks:

2. **Vegetative Growth** ☐ Location shown on site map ☐ Vegetation does not impede flow
Areal extent: Type:
Remarks:

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent: Depth:
Remarks:

4. **Discharge Structure** ☐ Location shown on site map ☐ N/A
☐ Functioning ☐ Good Condition
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent: Depth:
Remarks:

2. **Performance Monitoring** ☐ N/A
☐ Performance not monitored
☐ Performance monitored Frequency:
☐ Evidence of breaching Head differential:
Remarks:

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

1. **Groundwater Extraction Wells, Pumps, and Pipelines** ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical** ☐ N/A
☐ All required wells located ☐ Good condition ☐ Needs O& M
Remarks:

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ N/A

☐ System located ☐ Good condition ☐ Needs O& M
Remarks:

3. **Spare Parts and Equipment** ☐ N/A
☐ Readily available ☐ Good condition
☐ Requires Upgrade ☐ Needs to be provided
Remarks:

2. **Surface Water Collection Structures, Pumps, and Pipelines** ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical** ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

3. **Spare Parts and Equipment** ☐ N/A
☐ Readily available ☐ Good condition
☐ Requires Upgrade ☐ Needs to be provided
Remarks:

3. **Treatment System** ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers ☐ Filters (list type):
☐ Additive (list type, e.g., chelation agent, flocculent)
☐ Others (list):
☐ Good condition ☐ Needs O&M
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually (list volume):
☐ Quantity of surface water treated annually (list volume):
Remarks:

2. **Electrical Enclosures and Panels (properly rated and functional)** ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

3. **Tanks, Vaults, Storage Vessels** ☐ N/A
☐ Good condition ☐ Proper secondary containment ☐ Needs O&M
Remarks:

4. **Discharge Structure and Appurtenances** ☐ N/A
☐ Good condition ☐ Needs O& M
Remarks:

5. **Treatment Building(s)** ☐ N/A
☐ Good condition (esp. roof and doorways) ☐ Needs Repair
☐ Chemicals and equipment properly stored
Remarks:

6. **Monitoring Wells** (pump and treatment remedy) ☐ N/A
☐ All required wells located ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled
☐ Good condition ☐ Needs O&M
Remarks:

4. **Monitored Natural Attenuation** ☐ Applicable ☒ N/A

1. **Monitoring Wells** (natural attenuation remedy) ☐ N/A
☐ All required wells located ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled
☐ Good condition ☐ Needs O&M
Remarks:

X. OTHER REMEDIES ☐ Applicable ☒ N/A

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.)

The decision for this site was to take no action under Superfund. The environmental issues at this site tend to be more related to current landfill operations including little or no daily cover. Poor landfill management has allowed for the occasional internal combustion of the garbage mass which requires emergency response and sometimes evacuation of the nearby residents. In addition, there is a problem with vectors (flies and such) and the leachate streams which allow contaminated waters from within the landfill to get into the Lonfit River located at the toe of the landfill.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Although several operations plans for this site have been developed through time. It is very evident that the procedures outlined in these plans are not being implemented. In addition, this landfill appears to be operating without a current permit, either for solid waste management or for NPDES discharge.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

NA

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

NA

Photograph 1: Southest corner of landfill, looking southwest.

Photograph 2: Ground surface around monitoring well GW-4 (Well 9) looking east. Wellhead is covered with a 55-gallon steel drum.

Photograph 3: Northern edge of landfill with monitoring well GW-4 (Well 9) in the left foreground, looking southwest.

Appendix B2
Site Inspection Photographs (June 25, 2002)
Ordot Landfill
Territory of Guam

Photograph 4: Northeast corner of uppermost (16th) refuse layer (central mound), looking southwest. Each refuse lift is approximately 8 to 10 feet thick.

Photograph 5: Northeast corner of uppermost (16th) refuse layer (central mound), looking northwest.

Appendix B2
Site Inspection Photographs (June 25, 2002)
Ordot Landfill
Territory of Guam

Photograph 6: Uppermost (16th) refuse layer (eastern mound), looking south.

Photograph 7: Oil puddle located at the 2nd refuse layer along the eastern side slope of the landfill, looking south.

Appendix B2
Site Inspection Photographs (June 25, 2002)
Ordot Landfill
Territory of Guam

APPENDIX C

Interview Forms

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Mayor Vicente Aguon, Ordot and Chalan Pago. (since 1996)

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 26, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251 2888 x: 2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Frustrated with the situation. The Governor of Guam has made promises to close the landfill. But they can not close this landfill until a new one opens. He is depending on EPA. Also he is embarrassed because his constituency is relying on him to get the landfill closed, but he feels very helpless.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: Really concerned. The constituency has tried with each new mayor to get the landfill closed. They have asked senators to help.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Yes, fires and smell. Flies. Mayor has to go rescue people when fires occur. Spending money to put people up in hotels. Had to do twice already this year. 15 families. Concern: landfill slumping. Major would like a copy of the slumping report.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the village regarding the site? If so, please describe purpose and results.

Response: Yes, but not on a regular program. DPW might stop by when they are doing maintenance of the roads. The site where the landfill is located used to be a valley, now is a mountain because the trash has been piled so high. The Leo Palace Resort looks right down onto the landfill. Land values have gone down.

5. Have there been any complaints, violations, or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: He is not in the position to cite violations. Mayor's office gets by-passed. Administration is bad, they don't really follow the rules. Sometimes a person might set a fire or something wrong is put into the landfill, but nothing gets done about it.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: He is supposed to know. Private trucks get checked, but Government doesn't get checked. Guards are not really paying attention. Sometimes DPW does not pick up trash from the neighborhoods, so the mayor will get someone to pick up, but DPW will still charge for it.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are the City's expectations or concerns about future land use at the site?

Response: No, the Mayor does not believe this area could be developed in the future.

8. Are there any local community expectations or concerns about future land use/re-development at the site?

Response: The constituency complains because property values have decreased.

9. Do you feel well-informed about the site's activities and status?

Response: No.

10. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Would like to see it closed, capped, leveled or graded (not a mountain). He has aesthetic concerns and would like to make sure no further impacts occur to the river. If it were safe, he would like to see redevelopment.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam				***Interviewee:*** Amancio S. Hitosis, nearby resident
Site Name		**EPA ID No.**		**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site		EPA ID# GUD980637649		June 26, 2002	Phone ☐ Fax/email ☐ In person ☒
Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: In 1997, Ordot was supposed to be closed down. They were told that they were not supposed to build a house, but they did because that is where they owned the land. They suffer during the rainy season because it smells very bad. He says that he gets headaches from it. He met with the mayors and senators, but nothing happened. They were evacuated 2 years ago during the big tire fire.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: Stayed 5 weeks in a hotel during the evacuation. It affected him personally because he has pets that need to be looked after and he didn't like being away from his own home for that long.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Cannot do anything. He talks all the time to government, but no one is listening. He has been told that there is no money to close the dump or pave the roads. He has property value concerns.

4. Are you aware of any complaints, violations, or other incidents related to the site? If so, please give details of the events and results of the responses.

Response: He has never filed a formal complaint (in writing) and doesn't know of any others. He is aware of the fires.

5. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: No.

6. Are there any local community expectations or concerns about future land use/re-development at the site?

Response: Don't know, land is already subdivided.

7. Do you feel well-informed about the site's activities and status?

Response: No.

8. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Depends on government of Guam. Would like to see it closed.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	***Interviewee:*** Juan and Milagro Sablan, P.O. Box 1390, Hagatna. Nearby residents that moved in July 4th, 1994

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 26, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: This was an ammunition dump in the 1940's. There was an explosion at the dump in 1945 (after the war). There is no cover kept on the dump, there are too many wild dogs. Frustrated, accepts it because it cannot be changed. Some people used to throw garbage right on their property.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: Guam EPA is not enforcing Guam DPW. 18 families are evacuated every May, due to the fires, and have to live for 3 months in studio hotels.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: "Nobody cares". People laugh when they hear they live here, but this is their land. Have been evacuated 4 times.

4. Are you aware of any complaints, violations, or other incidents related to the site? If so, please give details of the events and results of the responses.

Response: When the dump was closed for a period of time, they used to have people dump right in their yard. They have attended some of the public meetings so that they could talk to the government about their concerns.

5. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: People used to dump trash right along the roads. The litter law which has been in effect for 2 years has helped to minimize illicit dumping. They decreased the fine, though and now it is not quite as effective. EPA wears "space suits" when entering the site, even though the people are told everything is okay.

6. Are there any local community expectations or concerns about future land use/re-development at the site?

Response: They think they should turn whole valley into a dump and buy out all the residents.

7. Do you feel well-informed about the site's activities and status?

Response: Yes, they listen and read. Health is endangered as long as they live here. But they are at a point where they don't care anymore.

8. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Have proposed to the governor to buy out the area. Hoping US EPA will do something. Government should have a recycling program. Would like a copy of the follow-up fact sheet directly to their home address.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Ben Machol, Pacific Islands Office – Guam Desk Officer, US EPA Region 9

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	July 30, 2002	Phone ☐ Fax/email ☐ In person X

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	Richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. **What is your overall impression of the work conducted at the site? (general sentiment)**

Response: When the decision was made, it was a good idea to put it into the Clean Water Act in order to move things along faster. But DPW has done extremely little to close the landfill and to find a site for a new one. As far as landfill operations, there is very little maintenance occurring.

Notes: Ben has spent the last two years working in the Pacific Islands Office (PIO). He coordinates all environmental programs for the island of Guam. He stated that violations made by the landfill under the Clean Water Act and subsequent enforcement actions were supposed to be the mechanism for getting Ordot Landfill closed and opening a new one somewhere else.

2. **From your perspective, what effect have remedial operations at the site had on the surrounding community?**

Response: There really have been no remedial operations occurring. They did or do some daily cover, but that is about it.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: It seems like there are always newspaper articles which talk about the occasional community concerns. There are some complaints that have come in, but there is no organized group against the landfill.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Pacific Islands Office regarding the site? If so, please describe purpose and results.

Response: There have been no routine inspections conducted by this office. We ceased to allow sampling of leachate at the toe of landfill for fear of someone being overcome by carbon monoxide, which we believe may be building up in the valley. We also have a concern that the landfill may collapse or start sliding downslope due to instability within.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: Nothing recently has come in to this office. EPA, however is filing a complaint against Guam DPW due to non-response to violations under the Clean Water Act which will be referred to the Dept of Justice for ruling.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: This office has worked with Guam EPA to coordinate obtaining contractors for emergency response, especially during the landfill fires. The PIO will obtain grant funds to help with air monitoring during fire events.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are PIO's expectations or concerns about future land use at the site?

Response: This office would like to see it closed properly. Does not know of any plans for

redevelopment.

8. Do you feel well-informed about the site's activities and status?

Response: Yes.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: A new landfill needs to be sited and the old one needs to be closed.

10. In your professional opinion, what do you think should be Superfund's role or scope of involvement at Ordot Landfill?

Response: Doesn't think that the Superfund process could or would be any more effective than processes under the Clean Water Act.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Mike Lee, Pacific Islands Office – Water, US EPA Region 9

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	July 30, 2002	Phone ☐ Fax/email ☐ In person X

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Has mixed feelings, because his group has tried to move things forward by assessing penalties and placing the site on a compliance schedule. The site was supposed to close (find new sites) or partially close, to conduct feasibility studies, etc. But they have found that getting Guam to carry out on these items has been frustrating. There has really been no action.

Notes: Mike came into the Pacific Islands Office in 1987. He has performed NPDES inspections at the site . An administrative order against DPW was issued prior to Mike entering the program. He helped to set up a new compliance schedule and to assess administrative penalties because the site was out of compliance with the original order. His involvement now is considerable less than it was in the past. He is called on occasional to provide historical information about the site or to help in penalty calculation (litigation support).

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: The community had concerns when he was more involved with the site. He said that because nothing was getting done, it brought more awareness to the site. Resolutions to the problems

associated with the site have not happened as quickly as was thought they might.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Just through newspaper articles. Knows there is a general concern that the landfill is about to reach capacity and there is no new site. There are concerns about the fires and about leachate since it is not known what comes out on a routine basis.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Pacific Islands Office regarding the site? If so, please describe purpose and results.

Response: Nothing recently.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: There is the overall continuing leachate problem. There are small volumes that discharge which is in violation of the Clean Water Act. The Government of Guam never would sign a Consent Decree to deal with the problem, so now EPA is filing a complaint with backing from the court.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: There have been some fires that required emergency response, but nothing on a routine basis.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are the PIO's expectations or concerns about future land use at the site?

Response: There has been mention of developing it into a park. But first it must be closed. The design would have to ensure that it is very stable. The main thing is to stop leachate and prevent gas buildup.

8. Do you feel well-informed about the site's activities and status?

Response: Not really, generally know that it is there. No routine inspections are currently being conducted.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Continue on the particular course that they are on but try to keep more up to date on current status.

10. In your professional opinion, what do you think should be Superfund's role or scope of involvement at Ordot Landfill?

Response: Don't really know what Superfund can do or what their program will be allowed to do using "fund" money.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Ramon Mendoza, Pacific Islands Office – Solid and Hazardous Waste, US EPA Region 9

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	July 30, 2002	Phone ☐ Fax/email ☐ In person X

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Work to has not been enough to determine the risk to public health and the environment. There is no routine monitoring and analysis of critical parameters such as gas monitoring, groundwater, surface water. In addition, there is current data on sediment or soil.

Notes: Ramon works in the Pacific Islands Office at EPA providing technical support for solid waste which involves enforcement support and compliance assistance to the US territories in the Pacific Islands.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: Remedial Operations from the 1980's have no positive effect on the surrounding community other than making a determination that the groundwater is not a drinking water resource. See response to #1.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Yes. Based on news, community is frustrated in general that the dump has not closed.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Pacific Islands Office regarding the site? If so, please describe purpose and results.

Response: Not since the case was deferred to the DOJ three years ago.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: The site is in technical violation of the CWA everyday. Our office has been working with ORC and DOJ to enforce the CWA. DOJ is the current enforcement lead under the CWA at this time.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Guam EPA gets calls from time to time form DPW when an illegal load goes in such as medical waste or hazardous waste. The most recent serious incident was the tire fire in the late 1999-2000.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are PIO's expectations or concerns about future land use at the site?

Response: DPW's site conceptual closure has a diagram for the golf course . However NO serious plans for redevelopment have been proposed.. We intend for landfill to be closed.

8. Do you feel well-informed about the site's activities and status?

Response: No. Ben Machol is the lead person in our office for working with ORC. Like before, DOJ is the lead on this case.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Although I have confidence that DOJ will file the complaint against the Government of Guam soon. I have no confidence that DOJ (Guam office) will seriously enforce the CWA once Gov Guam falls behind schedule and fails to implement a real solution to the problem.

10. In your professional opinion, what do you think should be Superfund's role or scope of involvement at Ordot Landfill?

Response: Superfund should complete its 5 year review and conduct additional remedial investigation to properly characterize the site. Data gaps exist in assessing risks to public health and the environment from uncontrolled release of landfill gases, leachate, solid waste (and hazwaste) , & debris, vectors (rats, flies). In addition the extent of the subsurface fire and the risks it poses to on-site and Ordot residents has not been characterized.

Due to inaction on the part of DOJ, EPA is not fullfilling its mission to protect public health at the site and may be sued by third party. Resumption of Superfund Activities will enable EPA to fullfill its mission to protect public heatlh in a more proactive manner. An Superfund Enforcement Strategy must be worked out in coordination with ORC, PIO, and DOJ.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Rick Sugarek, Superfund Division, US EPA Region 9

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	July 30, 2002	Phone ☐ Fax/email ☐ In person ✠

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: This was a no action ROD, because it was determined that this was not a Superfund problem (no imminent and substantial endangerment threat). At the time, it was thought that if the landfill were operated consistent with standard practices, it would be okay. Work was done toward developing an operations plan, but it was never implemented. In addition, it has taken a very long time to do most things at the site. It took over a year just to install a drainage diversion ditch (to get water to flow away from the landfill).

Notes: Rick is a former Superfund Project Manager for the site. He was involved at the time the ROD was written and signed.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: Because this is no action under Superfund, there are no effects from remediation. However, since operations at the landfill continue in an improper manner, there are environmental issues.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Have not really been involved in the last 10 years.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Superfund Division regarding the site? If so, please describe purpose and results.

Response: Not currently involved.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: Not currently involved.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Not currently involved.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are Superfund's expectations or concerns about future land use at the site?

Response: Not currently involved.

8. Do you feel well-informed about the site's activities and status?

Response: Not currently involved.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Since it hasn't really progressed, the same recommendations from the past would apply. Further detail may now be required because so much time has passed. Still need to take action.

10. In your professional opinion, what do you think should be Superfund's role or scope of involvement at Ordot Landfill?

Response: Unless things have changed, don't think this is appropriate as a Superfund problem.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Betwin Alokoa, former Guam Environmental Protection Agency; Air and Land Solid Waste Management Program

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 28, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: When I started at Guam EPA in 1991, there were existing problems. The DPW was cited under a Federal Administrative Order under the Clean Water Act (CWA). It doesn't seem like anything has happened. Perhaps it was not the right thing to defer the decision to the Clean Water Program, should have made a decision (to do something) under Superfund.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: As far as impacts to the surrounding environmental community, there are definitely affects on the Lonfit River. The local government hasn't done anything. Feels like if US EPA had kept it that wells and monitoring might have been kept up. (He thinks that) the Lonfit River is especially impacted.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: There are many concerns by residents. They have had a public meeting to discuss fires, vectors, and property value.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Guam EPA regarding the site? If so, please describe purpose and results.

Response: Public meetings happened as a result of fires and complaints. These would provide status on daily cover, closure, compaction, and the fact that there are no permits A public oversight hearing was conducted 2 years ago. People don't feel good about Guam EPA. They don't feel like the Notices of Violation have been very effective.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: Numerous NOV's have been written. US EPA cited the DPW under the CWA. Guam EPA was cited under the Guam Disposal Rules (approved under USEPA). Guam's Solid Waste Disposal Rules and Regulations are similar to Subtitle D.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Yes, numerous calls were made in the middle of the night and day reporting dumping inside (no night dumping is allowed and fumes from chemicals were detected). Also calls were made about the landfill fires. On numerous occasions, there has been dumping outside the gate.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are GEPA's expectations or concerns about future land use at the site?

Response: A law was established regarding future land use. It says that when closed, the landfill should be turned into a park or a golf course. This is not a good idea because of the burning trash in the subsurface which could lead to instability.

8. Do you feel well-informed about the site's activities and status?

Response: Wasn't really aware that the site is a Superfund site until later. But felt pretty well informed under other programs like the CWA.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Yes. Ordot should be closed immediately. There is no permit to operate. Since enforcement action is being taken against private companies, why is it not here? The landfill currently exceeds its capacity, and its location allows for leachate to go directly into the Lonfit River. DPW has not proven that they can operate a landfill (employees are not trained). Ordot should be closed and DPW should move out. A private company should run a new (environmentally safe) landfill.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Francis Damion, Guam Environmental Protection Agency

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 27, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: The site has never been in compliance. It is not run like a sanitary landfill.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: The fires are affecting the community. They are more frequent today than in the past.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: The Dept of Public Works (DPW) has not been monitoring leachate discharges or for hazardous constituents in groundwater or surface water. Guam EPA used to sample the leachate on a quarterly basis and that resulted in finding DPW in violation of the Clean Water Act.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Guam EPA regarding the site? If so, please describe purpose and results.

Response: During my time – up to 1997 – Guam EPA undertook monthly inspections.

Notes:

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: Guam EPA has produced numerous Notices of Violation (NOVs) for Ordot. The violations have mainly been for 1) not enough cover, 2) no or improper segregation of the waste, and 3) no vector controls.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: People would dump at night.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are the City's expectations or concerns about future land use at the site?

Response: At one time, a proposal was made to create a park. Also, some property on Ordot is private land.

8. Do you feel well-informed about the site's activities and status?

Response: Not applicable, his position with Guam EPA has changed so he is no longer involved with the site.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Needs to be closed soon.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Conchita Taitano, Guam EPA (13 years)

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 21, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL / SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: The landfill is not being operated as it should be. Subtitle D operations are not compliant. There are problems relating to leachate discharges and vectors. Housekeeping requirements are not being met. Lonfit River and groundwater monitoring has not been done.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: Since we receive many complaints from the community such as odor in the rainy season, not covering the waste and about the fires, I would say that the landfill operations and maintenance have had a negative effect on the community.

Notes: The Record of Decision for the site was to conduct no further action under the Superfund Program, therefore no "remedial operations", as such, have occurred. The landfill continues to receive waste because it is the only municipal landfill on the island.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Yes, we get complaints about the site.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by US EPA regarding the site? If so, please describe purpose and results.

Response: Guam EPA conducts quarterly inspections at Ordot and violations continue with respect to operations. There is continually 1) standing leachate; 2) little or no daily cover; 3) little or no compaction.

Notes: Guam EPA has copies of the quarterly reports, but is not sure if they are releasable.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: In about 1997 or 1999, the legislature made a presentation as to why landfill was not closed during an oversight hearing. The Ordot Mayor also attended this hearing. A copy of the presentation is available.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: I am aware of the fires that have required emergency response. There has also been illegal dumping at the site.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are the City's expectations or concerns about future land use at the site?

Response: During the past year, this area has been considered for possible redevelopment. I do know that there have been some plans put forth for renovation.

8. Do you feel well-informed about the site's activities and status?

Response: The quarterly inspections are being conducted as part of the compliance monitoring requirements, which help keep us somewhat informed. There is a lack, however, of surface water and ground water sampling. In addition, no air sampling work has been done.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response:	Close Ordot. Landfill. It is long overdue.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Victor Wuerch, Hydrogeologist, Guam Environmental Protection Agency

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 27, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Hadn't really thought about it. By default went from CERCLA to Clean Water. Site needs to be closed.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: From hydrogeologic data, no impacts to groundwater. Manganese and one other metal are at higher levels downstream of the Lonfit River.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Not aware of any relating to groundwater and surface water issues.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Guam EPA regarding the site? If so, please describe purpose and results.

Response: Thinks monitoring has been done by another group but nothing has been asked from him lately. Region 9 might have report. In 1992, one well was not constructed properly.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: Not in terms of groundwater. There might have been leachate violations.

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Emergency response related to landfill fires.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are the City's expectations or concerns about future land use at the site?

Response: No.

8. Do you feel well-informed about the site's activities and status?

Response: There was a time when he was, because he was studying the site. But not now. There is no RAB (Restoration Advisory Board).

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Recommends sampling sediments along the Lonfit River as a starting point. Then, if there is evidence of contamination, move farther down river toward the recharge area for the sole source aquifer.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	***Interviewee:*** John D. Charfauros, Ordot Landfill Supervisor, Guam DPW

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 26, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the remedial action work conducted at the site? (general sentiment)

Response: There is no safety equipment nor training for the operators when they start on the job there. The only equipment provided was a dust mask. He is trying to focus a little more on safety in personal protection and operations.

Notes: He has been here for 10 years, since 1992. He was an operator for 5 years before becoming the supervisor.

2. From your perspective, what effect have remedial actions at the site had on the surrounding community?

Response: Since nothing has happened, really no effect.

3. Do you have any concerns regarding the remedy at the site?

Response: Yes. He is concerned that no monitoring is going on.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the Department of Public Works regarding the site? If so, please describe purpose and results.

Response: Betwin Alokoa of Guam EPA used to come out to do quarterly inspections, then Joe Cruz took over and now Jose Esteves does it. The last time he can remember any on-site wells being sampled was in 1995. They have been trying to upgrade their access issues by diverting commercial traffic and residential traffic to different parts of the landfill.

:

5. Do you have any plans to develop the site or change the land use at the site?

Response: He tries to enforce the daily cover, but sometimes there are budget constraints. Four or five months ago, there was an alternate site meeting. A location at Agat was the number one alternative. Cannot close Ordot until a new landfill is opened.

6. Are you aware of any community concerns regarding the site, its administration, or future land use?

Response: Very much. The villagers don't want it here. Need to find a new location.

7. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: They have 24-hour security on-site. Every 2 hours the security guard makes rounds. He is currently not aware of any trespass or vandalism. About 2 months ago, a small fire broke out. In May 2001, there was a fire that took 2-4 weeks to extinguish.

8. Do you feel well-informed about the site's condition and status?

Response: Yes, he works with the fire department: 3500 gallons of water are stored for use in dust control and fire prevention.

Notes: Lance asked about older records, but some documentation was burned up during a fire. White goods, tires, batteries, liquids are not accepted. They have spotters to make sure that these things are not getting dumped.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Way overdue to be closed. The landfill is full and should be closed. They are short of staff.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Mr. Jesse G. Garcia, Guam DPW – acting Director together with Eleanor F. Borja. DPW is current operator of the landfill since 1951.

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 25, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL/SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the remedial action work conducted at the site? (general sentiment)

Response: He is not aware of the Record of Decision. He doesn't really know much about the Superfund process. DPW had hired a consulting firm to respond to the tire fire. They used PCR and the contact there was Paul Patgear. They capped the fire with coral and dirt to put it out.

2. From your perspective, what effect have remedial actions at the site had on the surrounding community?

Response: He cannot really comment on that. He has talked with the Mayor and the nearby residents. He coordinates with the civil defense at times when the landfill might catch fire. He tries to maintain a cover (dirt & coral).

3. Do you have any concerns regarding the remedy at the site?

Response: His main concern is to maintain daily cover.

4. **Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by the US EPA regarding the site? If so, please describe purpose and results.**

Response: Communication with Betwin Aloka, formerly with Guam EPA. EPA does monthly inspection on site at the landfill. John Charfauros has been the landfill manager for 12 years.

:

5. Do you have any plans to develop the site or change the land use at the site?

Response: Waiting to build the new landfill site. There are some potential sites, but there are problems with the US National Parks. Yes, they are trying to lead toward closure.

6. Are you aware of any community concerns regarding the site, its administration, or future land use?

Response: There are private properties around the landfill. No further development will occur until the landfill is closed. A public meeting was held in February 2002 to discuss the siting of the new landfill.

7. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: The landfill is always on fire. Some ventilation pipes along the edge of the landfill have been installed to allow for off-gassing.

8. Do you feel well-informed about the site's condition and status?

Response: No. The daily operations are not under Jesse's control. Jesse might get calls for emergency situations or be asked to get a Purchase Order for supplying more dirt and coral for the daily cover.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: We need money. Jesse recommends that people get trained in proper landfill operations. Currently, there are no certified operators. No recycling, no separation of trash occurs. Although they won't allow white goods (refridgerators, etc.) and metals. There can be no closure plan until opening up new

landfill. This is between legislature and the administration.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Mr. James L. Canto, VP and Senior Project Manager for PCR Environmental, Inc. (formerly worked at Guam EPA in the air program. Joined PCR around 1996 when it started)

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 26, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL / SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Jim agrees with the remedy since the landfill causes a water quality problem. There are air pollution issues when the landfill is on fire. It should be closed by Government of Guam. It is really not being operated as a landfill (in compliance with Subtitle D regulations), it is being operated as a dump (no real operations and maintenance).

2. Is the remedy functioning as expected? How well is the remedy performing?

Response: This is not a Superfund (CERCLA) site and no remedy, as such, has been applied. There were some investigations conducted to make the determination that this was not Superfund site (i.e. no imminent and substantial endangerment, prior to the 1988 ROD).

3. What are the current landfill operation practices, and how do they differ from the ones that were in place at the time the ROD was issued?

Response: More security, they used to just lock the gate. Now, there is 24-hour security.

4. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Response: No access to any monitoring data other than air data from fires. PCR conducted monitoring for fires (late 1999, early 2000, 2001): volatiles, semivolatiles, metals, PAHs and particulate. The particulate was the only parameter that exceeded any standards at the time. In 1991 or 1992, Jim was with another firm (no name given) and did the monitoring at that time.

5. Have there been any new findings regarding the geologic situation of the site since the ROD? If yes, please describe.

Response: He doesn't know, since he has been more focused on air issues.

6. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Response: DPW implemented not accepting tires anymore.

Notes:

7. Have any problems been encountered which required, or will require, changes to this ROD?

Response: No, goes back to the fact that he agrees with the decision of no action under CERCLA.

8. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Community concerns are that the dump is located there. There are odors when the wind direction changes. There is also the smoke from fires. The dump catches on fire once every 2 years or so. PCR was hired by Guam EPA to monitor the fires.

9. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Just the fires. The last one he recalls occurred in 2001. PCR has been involved with the air monitoring.

10. Do you feel well-informed about the site's activities and status?

Response: No.

11. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Yes. The site should be closed and monitored for a certain period after the closure. He believes the leachate will be a big problem and that the landfill will be difficult to close.

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Mr. Greg Ikehara, Andersen AFB (former USGS)

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 27, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL / SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Based on the results from USGS groundwater sampling (within the underlying volcanics at 100 feet bgs) that was focused on potential migration toward the fault, there is no problem. But USGS was not tasked to look at the toe of the landfill situated by the Lonfit River.

2. Is the remedy functioning as expected? How well is the remedy performing?

Response: There is no evidence to either confirm or deny this. Knows there are big issues associated with closure of the landfill. If closure happens soon, it is going to cost a lot. The depositing of refuse here has changed the natural flow of water.

3. What are the current landfill operation practices, and how do they differ from the ones that were in place at the time the ROD was issued?

Response: Although not involved really involved with the site prior to issuance of the ROD, it appears that operations have remained status quo through time.

4. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Response: A one-time sample was taken where the results were non-detect for all of the analytical parameters (none specified). He did not recall, however, the quantitation limits. The data was supplied to the district office in Hawaii and then it was forwarded to Region 9, EPA.

5. Have there been any new findings regarding the geologic situation of the site since the ROD? If yes, please describe.

Response: No, he doesn't think any further evaluations have occurred.

6. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

Response: No sampling since he can remember.

7. Have any problems been encountered which required, or will require, changes to this ROD?

Response: The gradient has changed and this could subsequently change the subsurface conditions. Due to this gradient change, overland transport of materials might allow for it to spread radially.

8. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: He has heard and read in papers that the community is concerned about fires. Usually, fires occur when there is a heavy rain season followed by a very dry season.

9. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Fire suppression. Drilled into landfill to pump water in.

10. Do you feel well-informed about the site's activities and status?

Response: Yes, because he looks for it and has an interest in it.

11. Do you have any comments, suggestions, or recommendations regarding the site?

Response: Close it!

Five-Year Review Interview Record Ordot Landfill Near the villages of Ordot and Chalan Pago, Guam	**Interviewee:** Dr. Gary Denton, University of Guam, WERI

Site Name	**EPA ID No.**	**Date of Interview**	**Interview Method via**
Ordot Landfill Superfund Site	EPA ID# GUD980637649	June 21, 2002	Phone ☐ Fax/email ☐ In person ☒

Interview Contacts	**Organization**	**Phone**	**Email**	**Address**
Lance Richman	US EPA, Region 9	(415) 972-3022	richman.lance@epa.gov	75 Hawthorne Street San Francisco, CA 94105
Caroline Ziegler	CH2M HILL / SFO, as rep of EPA	(510) 251-2888 x:2204	cziegler@ch2m.com	155 Grand Ave, Suite 1000 Oakland, CA 94612

Interview Questions (Please address period since beginning of remedial action in 1988)

1. What is your overall impression of the work conducted at the site? (general sentiment)

Response: Nonexistent.

2. From your perspective, what effect have remedial operations at the site had on the surrounding community?

Response: No significant actions have been taken. Some cover work has been undertaken. But overall it is a bloody nuisance, and fills the air with stench.

3. Are you aware of any ongoing community concerns regarding the site or its administration?

Response: Yes. The Ordot Mayor is very active. Closure of dump and movement to another location.

4. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by WERI regarding the site? If so, please describe purpose and results.

Response: From 1991 through 1995, WERI conducted periodic sampling of leachate for heavy metals. The USGS funded study to evaluate leachate streams for toxic compounds. An

approved proposal was supplied for 3/2002 to 2/2003.

5. Have there been any complaints, violations (e.g. Clean Water Act) or other incidents related to the site that required a response by your office, if applicable? If so, please give details of the events and results of the responses.

Response: Not Applicable

6. Are you aware of any events, incidents, or activities that have occurred at the site, such as dumping, vandalism, trespassing, or emergency response from local authorities?

Response: Fires have occurred during wet seasons and salt water has been used to try and stop fires.

7. Is your office aware of any plans to develop the site or any changes in land use at the site? What are the City's expectations or concerns about future land use at the site?

Response: Closure was proposed prior to 1990. There have been different considerations, such as 1) closure of Ordot, 2) expansion of Ordot, and 3) closure to include a new landfill site. One of the new landfill sites that was considered is along the Taelayag River in Agat.

8. Do you feel well-informed about the site's activities and status?

Response: No, not at all.

9. Do you have any comments, suggestions, or recommendations regarding the site?

Response: 1) We need to know what is in there
2) Ground water impacts
3) What about unexploded ordinance

1) Close dump
2) Figure out what is inside
   a) If capped, air monitoring should be done
   b) sample and monitor leachate and ground water
   c) Identify key contaminants
   d) Evaluate key contaminant health risks
3) Proactive attempts are necessary to create a new landfill – need good baseline data to start – chemical, biological survey

APPENDIX D

Evaluation of Applicable or Relevant and Appropriate Requirements

Appendix D
Evaluation of Applicable or Relevant and Appropriate Requirements for the Ordot Landfill Superfund Site

This evaluation of applicable or relevant and appropriate requirements (ARARs) has been prepared to support five-year review activities at the Ordot Landfill in the Territory of Guam (site). Generally, an ARARs review is applied during the five-year review process to ascertain if any changes to standards identified as ARARs or assumptions about contaminant characteristics and potential exposure have occurred. The purpose of this ARARs evaluation is to identify ARARs that should be considered for the evaluation of the protectiveness of the preferred alternative which was selected for the site. This analysis identifies changes to the ARARs considered in the Record of Decision (ROD), signed on September 28, 1988, and the first *EPA Five Year Review of the No Action Decision*, signed September 30, 1993, as well as new potential ARARs.

Basic ARAR Concepts

Section 121(d) of CERCLA, 42 U.S.C. §9621(d) requires that remedial response actions selected under CERCLA attain a level or standard of control of hazardous substances that complies with ARARs of federal environmental laws and more stringent state (or territory) environmental and facility siting laws. ARARs are an important part of this process and once identified, will need to be attained to the extent practicable.

Applicable requirements are those cleanup standards, criteria, or limitations promulgated under federal or state law that specifically extend to the situation at a CERCLA site. A requirement is applicable if the jurisdictional prerequisites of the environmental standard show a direct correspondence when objectively compared with the conditions at the site.

If a requirement is not legally applicable, the requirement may be evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well-suited to the conditions of the site. The criteria for determining relevance and appropriateness are listed in Title 40, Code of Federal Regulations, Section 300.400(g)(2) [40 CFR 300.400(g)(2)].

Pursuant to EPA guidance, ARARs generally are classified into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to help identify ARARs, some of which do not fall precisely into one group or another. These categories of ARARs are defined below:

- **Chemical-Specific ARARs** include those laws and requirements that regulate the release to the environment of materials possessing certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limitations for specific hazardous substances. If, in a specific situation, a chemical is subject to more than one discharge or exposure limit, the more stringent of the requirements should generally be applied.
- **Location-Specific ARARs** are those requirements that relate to the geographical or physical position of the site, rather than the nature of the contaminants or the proposed site remedial actions. These requirements may limit the placement of remedial action, and may impose additional constraints on the cleanup action.
- **Action-Specific ARARs** are requirements that define acceptable handling, treatment, and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

A requirement may not meet the definition of ARAR as defined above, but still be useful in determining whether to take action at a site or to what degree action is necessary. This can be particularly true when there are no ARARs for a site, action, or contaminant. Such requirements are called to-be-considered (TBC) criteria. TBC materials are nonpromulgated advisories or guidance issued by federal or state government that are not legally binding, but may provide useful information or recommended procedures for remedial action. Although TBCs do not have the status of ARARs, they are considered along with ARARs to establish the required level of cleanup for protection of health or the environment.

Potential Chemical-Specific ARARs

Potential chemical-specific ARARs for the Ordot Landfill were identified on the basis of the chemicals of potential concern (COPCs) at the site and the media impacted. The following sections present a discussion of potential chemical-specific ARARs and identify why these chemical values are potentially applicable or potentially relevant and appropriate. Potential chemical-specific ARARs for the site are summarized in Table D-1.

Beneficial Use Determination – Safe Drinking Water Act

In determining which chemical-specific ARARs apply to the groundwater at the Ordot Landfill, the groundwater classification and beneficial uses must first be identified. EPA's policy for groundwater classification is set forth in the preamble to the NCP (55 Federal Register 8752-8756). This policy uses the groundwater classification system provided in the EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy (USEPA, 1986). Under this policy, groundwater is classified in one of three categories (Class I, II and III) according to ecological importance, replaceability, and vulnerability considerations. Irreplaceable groundwater that is currently used by a substantial population or groundwater that supports a vital habitat is considered Class I. Class II groundwater consists of groundwater that is currently being used or water that

might be used as a source of drinking water in the future. Groundwater that cannot be used for drinking water because of insufficient quality (e.g., high salinity or widespread naturally occurring contamination) or quantity is considered Class III.

Under 40 CFR Section 146.4, an aquifer or a portion thereof that meets the criteria for an "underground source of drinking water " (USDW) may be considered an exempted aquifer if it does not currently and cannot in the future serve as a source of drinking water or if the total dissolved solids (TDS) content is more than 10,000 mg/L. In addition, if the water source does not provide a sustained yield of more than 150 gallons per day (gpd), the water source is not considered a suitable water supply.

The groundwater below Ordot Landfill does not currently serve as a public water supply. The Initial Site Characterization Report (CDM 1987) concluded that groundwater at the site appears to be hydrologically isolated from the limestone aquifer which is the main drinking water source for the island of Guam. For this reason, chemical-specific ARARs related to drinking water sources (e.g., Safe Drinking Water Act Maximum Contaminant Levels) are considered TBC.

Maximum contaminant level means the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. Primary MCLs are protective of human health. Secondary maximum contaminant levels (SMCLs) which apply to public water systems are not derived from health-based criteria, and often relate to taste and odor quality. The SMCL means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of public water system. SMCLs are non-enforceable federal contaminant levels intended as guidelines for the states/territories.

Maximum contaminant level goal (MCLG) means the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. Maximum contaminant level goals are non-enforceable health goals.

Guam Water Quality Standards

Section 303(c)(2)(B) of the Clean Water Acts (CWA) requires that states adopt numeric water quality criteria for priority pollutants as part of the state's water quality standards. The Guam Water Quality Standards (Appendix A) includes a matrix of numeric criteria for 126 CWA Section 307 (A) Toxic Pollutants, as well as a table of several additional pollutants. The Ordot Landfill leachate currently discharges to the Lonfit River, which could be considered in the S-2 category of medium quality surface water used for recreational purposes, including whole body contact recreation, for use as potable water supply after adequate treatment is provided, and propagation and preservation of aquatic wildlife and aesthetic enjoyment. Therefore, the Guam Water Quality Standards Numerical Criteria for Toxic Pollutants are considered applicable.

In addition to the numeric criteria, Guam Water Quality Standards contain groundwater quality standards similar to federal MCLs and SMCLs to protect drinking water quality. These standards are considered TBC, as mentioned above, since the groundwater at the site is not a current drinking water source.

National Recommended Water Quality Criteria

The NRWQC were developed pursuant to Section 304(a) of the CWA. The criteria provide guidance to the states in adopting water quality standards under Section 304 (c) of the CWA, and to interpret narrative toxicity standards (water quality objectives in California). The most current criteria are published in the December 7, 1998 Federal Register. The criteria include priority and non-priority toxic pollutants. These criteria are updated periodically to reflect the latest scientific knowledge. [Note: A correction to these NRWQC was published in April 1999 (EPA, 1999)]. These criteria are not regulations, and do not impose legally binding requirements on the states. However, states are expected to adopt the new or revised numeric water quality criteria into their standards within 5 years of being published by EPA. For this reason, these criteria will be considered as potentially relevant and appropriate. The NRWQC do not supercede the Guam Water Quality Standards but should be tracked because the NRWQC values could eventually be adopted by the States/Territories.

Potential Location-Specific ARARs

Location-specific ARARs are those requirements that relate to the geographical position or physical condition of the site. The major location-specific ARARs that could affect the Ordot Landfill are briefly described below. Potential location-specific ARARs for the site are summarized in Table D-2.

Clean Water Act

Section 404 of the CWA, 33 U.S.C. §1344, requires a permit from the U.S. Army Corps of Engineers for the discharge of heterogeneous dredged or fill material into waters of the United States. Section 402 of the CWA requires a permit from the U.S. EPA for the discharge of homogeneous dredged or fill material into waters of the United States. The Lonfit River adjacent to the Ordot Landfill is considered "waters of the United States." Substantive CWA requirements are potentially applicable to activities that may occur at the site.

Potential activities at the site may trigger Section 404 (e.g., runoff from earth moving activities into the wetlands). The *Guidelines for Specification of Disposal of Sites for Dredged or Fill Material* [40 CFR Part 230, Section 404(b)(1)] define requirements that limit the discharge of dredged or fill material into the aquatic environment or aquatic ecosystems. These guidelines specify consideration of activities that have less adverse impacts and prohibit discharges that would result in exceedance of surface water quality standards, exceedance of toxic effluent standards, and jeopardize threatened or endangered species. Actions that can be taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem are specified in Subpart H of 40 CFR 230, and include:

- Confining the discharge's effects on aquatic biota
- Avoiding disruptions of periodic water inundation patterns
- Selection of disposal site and method of discharge
- Minimizing or preventing standing pools of water

Potential Action-Specific ARARs

Action-specific ARARs are requirements that set performance, design, or other similar action-specific controls on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since the preferred alternative currently at the Ordot Landfill is no action, many of the action-specific ARARs are TBC in the event that a remedy is undertaken at the site. The major action-specific ARARs that could affect the Ordot Landfill are briefly described below. Potential action-specific ARARs for the site are summarized in Table D-3.

Resource Conservation and Recovery Act and Guam Solid Waste and Litter Control Act

The action-specific ARARs that affect waste characterization and disposal include the Resource Conservation and Recovery Act (RCRA) requirements for identification of hazardous waste found in 40 CFR Part 261. A hazardous waste is a RCRA hazardous waste if it exhibits any of the characteristics of ignitability, corrosivity, reactivity, or toxicity. These limits are presented in 22 CCR 66261.24 (a)(1). If actions at the site lead to the need for disposal of hazardous wastes RCRA will need to be considered.

In addition, substantive requirements of Subtitle D apply to Ordot, relating to the operation of a municipal landfill.

Other action-specific ARARs that are appropriate or TBC for the site include the Federal Water Pollution Control Act, the Guam Annotated Water Pollution Control Act, the National Primary and Secondary Ambient Air Quality Standards (NAAQS), the Guam Department of Public Works Well Drilling and Well Operating Permit Requirements, and the Guam Solid Waste and Litter Control Act. The leachate discharging to Lonfit River renders the water pollution control acts applicable, whereas RCRA and NAAQS are TBC if any actions at the site require hazardous waste disposal or affect air quality. The Guam Solid Waste and Litter Control Act pertains to all actions performed during the operation of the Ordot Landfill, and the Well Drilling and Well Operating Permit Requirements are TBC in the event additional wells must be installed as part of remedial action at the landfill site.

References

Camp, Dresser, and McKee. 1987. *Final Initial Site Characterization Report*. September 18.

ICF/Clement. 1988. *Preliminary Endangerment Assessment for the Ordot Landfill, Guam*. July 8.

U.S. Environmental Protection Agency. 1988. *CERCLA Compliance with Other Laws Manual, Draft Guidance, EPA/540/G-89/006*, Office of Emergency and Remedial Response, Washington DC. August.

U.S. Environmental Protection Agency. 1986. *EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy*.

TABLE D-1
Chemical-Specific ARARs and Performance Standards

Source	Citation	ARAR Status	Description of ARARs
Federal Safe Drinking Water Act (42 USC 300)	40 CFR Part 141 Subparts B & G	TBC	National primary drinking water standards are health-based standards for public water systems (maximum contaminant levels [MCLs]). MCLs are only relevant and appropriate for groundwater determined to be a current or potential source of drinking water. Groundwater at the Ordot Landfill is not currently being used as a potential drinking water source.
Federal Safe Drinking Water Act (42 USC 300)	40 CFR Part 143	TBC	SMCLs are nonenforceable federal contaminant levels intended as guidelines for the states. SMCLs are only relevant and appropriate for groundwater determined to be a current or potential source of drinking water. Groundwater at the Ordot Landfill is not currently being used as a potential drinking water source.
Federal Safe Drinking Water Act (42 USC 300)	40 CFR Part 141, Subpart F	TBC	Maximum contaminant level goals [MCLGs] pertain to known or anticipated adverse health effects (also known as recommended maximum contaminant levels). MCLGs are not federally enforceable. MCLGs are only relevant and appropriate for groundwater determined to be a current or potential source of drinking water. Groundwater at the Ordot Landfill is not currently being used as a potential drinking water source.
Guam Water Quality Standards	Section 5103, B, Water Quality Criteria for Groundwater G-1 and G-2	TBC	Contains groundwater quality standards to protect drinking water quality. To be considered, since groundwater at the Ordot Landfill is not currently being used as a potential drinking water source.
Guam Water Quality Standards	Section 5103, 11B, Numeric Criteria	Applicable	Contains a matrix of numeric criteria for 126 CWA Section 307 (A) Toxic Pollutants, as well as a table of several additional pollutants. The Ordot Landfill leachate currently discharges to the Lonfit River, which could be considered in the S-2 category of medium quality surface water used for recreational purposes, including whole body contact recreation, for use as potable water supply after adequate treatment is provided, and propagation and preservation of aquatic wildlife and aesthetic enjoyment. Therefore, the Guam Water Quality Standards Numeric Criteria for Toxic Pollutants are considered applicable.

TABLE D-1
Chemical-Specific ARARs and Performance Standards

Source	Citation	ARAR Status	Description of ARARs
Federal Ambient Water Quality Criteria (National Recommended Water Quality Criteria)		Relevant and appropriate	The criteria include priority and non-priority toxic pollutants. These criteria are not regulations, and do not impose legally binding requirements on the states. However, states are expected to adopt the new or revised numeric water quality criteria into their standards within 5 years of being published by EPA. The NRWQC do not supercede the Guam Water Quality Standards but should be tracked because the NRWQC values could eventually be adopted by the States/Territories.

ARAR Applicable or relevant and appropriate requirements
CFR Code of Federal Regulations
USACE U.S. Army Corps of Engineers
USC United States Code

TABLE D-2
Location-Specific ARARs and Performance Standards

Source	Citation	ARAR Status	Description of ARARs
Federal Endangered Species Act	Endangered Species Act of 1973; Section 7 (16 USC § 1536); 50 CFR Part 402	Applicable	Contains lists of endangered or threatened species, requires action to ensure that any action is not likely to jeopardize the continued existence of endangered or threatened species or adversely affect its critical habitat, including consultation with the U.S. Fish and Wildlife Service as required. The Guam Gallinule is an endangered bird previously identified at the landfill.
Federal Clean Water Act	Section 404, Section 402, 33 U.S.C. §1344	Applicable	Requires a permit from the U.S. Army Corps of Engineers for the discharge of heterogeneous dredged or fill material into waters of the United States. Section 402 of the CWA requires a permit from the U.S. EPA for the discharge of homogeneous dredged or fill material into waters of the United States.
Fish and Wildlife Coordination Act	Fish and Wildlife Coordination Act (16 USC § 661 et seq.); 40 CFR 6.302	Applicable	Requires consultation with Department of Fish and Wild life prior to any action that would alter a body of water in the United States. This requirement could be applicable to any action that would result in modification of the San Pedro River.

TABLE D-3
Action-Specific ARARs and Performance Standards

Source	Citation	ARAR Status	Description of ARARs
Federal Water Pollution Control Act	Water Pollution Control Act of 1972, Public Law #92-500, 33 USC § 1342	Applicable	Must comply with substantive National Pollutant Discharge Elimination System requirements for discharge of treated ground water to navigable waters of the United States.
Guam Code Annotated Water Pollution Control Act	Title 10, Chapter 47, §47106, as amended by Public Law Number 17-87	Applicable	Must comply with Guam equivalent of National Pollutant Discharge Elimination System requirements for discharge of treated ground water to navigable waters of Guam. May require Section 401 certification.
Guam §401 Water Quality Certification	Guam Water Quality Standards, Section 5106	TBC	An applicant for a federal license or permit to conduct any activity including the construction or operation of facilities which may result in discharge into waters of the United States, shall provide the licensing agency a 401 certification from the Guam EPA certifying that the discharge will comply with Guam Water Quality Standards.
Resource Conservation and Recovery Act	Subtitle D	Applicable	Provides substantive requirements for operation of a municipal landfill.
Resource Conservation and Recovery Act	40 CFR Part 261	TBC	If any wastes are created, they must be managed as hazardous wastes if they are listed wastes or exhibit a hazardous waste characteristic; RCRA “empty” containers may be managed as non-hazardous wastes.
National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR Sections 50.4 - 50.12	TBC	Standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead). Not an ARAR; Federal NAAQS are nonenforceable standards. May be a TBC for site remediation activities (i.e. earthwork activities such as excavation and grading).
Guam Department of Public Works Well Drilling and Well Operating Permit Requirements	Chapter 46, Title X of GCA	TBC	An application form should be obtained from GEPA for the installation and operation of any new wells at the landfill site.
Guam Solid Waste and Litter Control Act	Title 10, Chapter 51	Applicable	Provides substantive requirements for operation of a solid waste landfill. Design, operation, maintenance, substantial alteration,

TABLE D-3
Action-Specific ARARs and Performance Standards

Source	Citation	ARAR Status	Description of ARARs
			modification, or enlargement of solid waste management facilities require a permit. Facilities are subject to inspections at all reasonable times to insure compliance with Territory laws.

APPENDIX E

Ecological and Human Health Risk Assessment – Evaluation and Recommendations

Appendix E
Ecological and Human Health Risk Assessment – Evaluation and Recommendations

This appendix consists of an evaluation of current conditions at the Ordot Landfill with respect to ecological and human health risk. It includes a semi-quantitative evaluation of potential risks to ecological and human receptors based on the available data, a listing of data limitations and data gaps, and conceptual frameworks for completing a screening ecological risk assessment (EcoRA) and human health risk assessment (HHRA).

This section is organized into the following subsections:

- E.1 Introduction
- E.2 Evaluation of Potential Risks
- E.3 Data Limitations and Data Gaps
- E.4 Conceptual Approach for a Screening Ecological Risk Assessment
- E.5 Conceptual Approach for a Screening Human Health Risk Assessment
- E.6 References

E.1 Introduction

The Ordot Landfill (Landfill) is located near the Villages of Ordot and Chalan Pago on the Island of Guam (Figure 1). It is currently operated as a public municipal landfill by the Guam Department of Public Works. It has been in operation since World War II, receiving military, industrial, and municipal wastes. There are no records that document the type or quantities of wastes disposed in the Landfill. It is suspected that wastes could have included military ordnance, PCB-contaminated transformer oils, as well as other industrial and commercial wastes.

The Landfill is in a rural agricultural area with scattered residences. The nearest residences are approximately 1,500 feet from the Landfill. It is located in a ravine that slopes southeast toward the Lonfit River. It is approximately 47 acres in size with estimated depths ranging from 100 to 200 feet. Most of the Landfill is still actively used. Only 4 to 7 acres of the oldest portions of the site are no longer in use. These portions are located downgradient or adjacent to current operations. On the southern edge of the Landfill, an inactive portion forms a steeply sloping toe which is approximately 1,000 feet from the Lonfit River.

The entire Landfill lies within the Lonfit River drainage basin which is part of the Pago Bay watershed (Juan C. Tenorio & Associates [JTA], 1993 and 1998). The average rainfall in this area is 92-100 inches, of which around 60 inches becomes surface water runoff into streams. The remaining rainfall either evaporates or infiltrates below the surface. Most of the runoff occurs during the wet season extending from July through November (JTA, 1993). Surface water runoff from the Landfill flows downgradient towards the Lonfit River. The Lonfit

River discharges to the Pago River and eventually flows into Pago Bay. Rainwater is not diverted off the Landfill and most surface waters are not diverted around the Landfill. As such, considerable surface water percolation can occur down into the trash prism resulting in leachate generation. Leachate streams have been observed from several locations around the Landfill, entering small springs and streams which flow into the Lonfit River. However, flow and locations of the leachate streams vary by season and year (ATSDR, 1988; Unitek Environmental, 1998a&b). A diversion ditch was installed upgradient of the trash prism to divert water from an artesian spring which was previously flowing into the trash prism (USEPA, 1993). This reduced the number of leachate springs from the Landfill. Leachate streams from the toe of the Landfill have been observed throughout the year and enter both the Lonfit River and an unnamed tributary to the Lonfit River which flows along the western boundary of the Landfill (Lee, 1998; Unitek Environmental, 1998a).

The Landfill is located in the Alutom geologic formation which consists of submarine deposited shales, sandstones, conglomerates and greywackes interbedded with limestone fragments, pillow lava flows, and dykes (JTA, 1998). It is underlain by fine-grained volcanic deposits with low permeability and the resulting groundwater flow typically follows the surface topography (ATSDR, 1988; JTA, 1998). The depth to groundwater beneath the Landfill ranges from 10 to 20 feet. Geological studies indicate that the Landfill does not connect hydrologically with the limestone sole source aquifer to the north which is used to supply drinking water. Groundwater flow from beneath the Landfill is from north to south toward the Lonfit River. Groundwater flows follow the alluvial deposits to Pago Bay (CDM, 1987; ATSDR, 1988).

Waters in Guam, including surface water, groundwater, and marine water ,are classified into basic categories. These categories are used to determine use and applicability of water quality standards (GEPA, 2001). Surface waters in the vicinity of the Landfill are classified as Category S-2 (Medium) (JTA, 1998). Waters downstream of the Landfill in the Lonfit River just upstream of Pago Bay are classified as Category S-3 (Low), and Pago Bay is classified as Category M-2 (Medium). S denotes Surface waters and M denotes Marine waters. Groundwater beneath the Landfill is within the Groundwater Management Protection Zone (JTA, 1998), which is included in both categories, G-1 (Resource Zone) and G-2 (Recharge Zone).

E.2 Evaluation of Potential Risks

The historical and current use of the Landfill as well as the physical, geological, and hydrological aspects of the Landfill contribute to several ongoing ecological and human health concern. The primary ecological and human health concerns of the Landfill are:

- Uncontrolled leachate streams which enter the Lonfit River either directly or via tributaries
- Subsequent pollution of the Pago River and Pago Bay
- Methane gas fires in the Landfill
- Exposure of aquatic and terrestrial plants, invertebrates, and wildlife to contaminated surface water, sediment, and soils

- Bioaccumulation of contaminants in the aquatic and terrestrial food chain
- Consumption of potentially contaminated aquatic and terrestrial plants and wildlife by humans
- Direct contact with contaminated surface water, sediment, and soil by humans
- On-site hazards to workers and/or persons trespassing to scavenge

Several studies have been previously conducted at the Landfill. However, the quality and comparability of the data obtained from the various studies is not consistent. The studies conducted have focused on collection of surface water and groundwater. A single study also collected sediment. The list of analytes evaluated also varies widely between the studies. A comprehensive sampling effort based on collection of all potentially impacted media and selection of analytes based on potential wastes has not been conducted.

The locations around the Landfill that have been sampled for surface water, groundwater, and sediment are presented in Figure 2. The available analytical data for the Landfill has been compiled and is presented in Table 1 (surface water), Table 2 (groundwater), and Table 3 (sediment). Data were not statistically evaluated as part of this report, primarily due to the lack of comparability between the data sources (as discussed in the following section). A semi-quantitative risk evaluation was conducted for aquatic organisms and humans. The results of this preliminary risk evaluation are presented below.

E2.1 Ecological Evaluation

A formal ecological risk assessment (EcoRA) has several elements which are evaluated and results of each are used to estimate the potential exposures and risks to ecological receptors. These are described in detail in Section E.4. As mentioned previously, a semi-quantitative evaluation is conducted in this report. It is a very limited evaluation of potential exposure and risks, with a large degree of uncertainty in much of the data collected. As such, it should not be construed to be a comprehensive evaluation of the potential for exposure and risk to ecological receptors in or near the Landfill.

The potential for risk to aquatic and terrestrial receptors within or near the Landfill currently exists due to the uncontrolled operations at the Landfill. In order for an exposure to occur, several specific criteria must be present. These criteria are as follows:

- Contaminant source (e.g., contaminants in surface water, soil, or sediment)
- Mechanism for contaminant release and transport (e.g., surface-water runoff)
- Exposure point (e.g., water)
- Feasible route of exposure (e.g., ingestion)
- Receptor (e.g., aquatic invertebrates, plants, wildlife, etc.)

Potential exposure pathways for ecological receptors that are evaluated in this section include direct contact and ingestion of surface water and sediment by aquatic organisms. Exposure pathways for terrestrial plants and wildlife (invertebrates, birds, and mammals) are not evaluated because data for primary exposure media are lacking (e.g., soil) and comprehensive exposure and effects characterization was not within the scope of this report.

Preliminary toxicity reference values (TRVs) were compiled for surface water (Table E-1) and sediment (Table E-2). The TRVs for surface water include the Guam Numerical Criteria (GNC) for Freshwater Organisms, USEPA Ambient Water Quality Criteria (AWQC) for freshwater organisms, and acute and chronic toxicity data obtained from peer reviewed scientific literature (obtained for chemicals without GNC or AWQC). The GNCs typically mirror the AWQC, however they do not differentiate between total and dissolved fractions for metals like the current AWQC. Hardness values were not reported among the available studies, so a default hardness of 100 mg/L was used in both the GNCs and AWQC. The surface water at the Landfill is classified as Category S-2 and both acute and chronic GNCs are applicable.

Sediment TRVs were compiled from various sources that are typically used in the assessment of freshwater sediment in the United States. Some of these values are from Canada, but they have been peer reviewed and determined to be applicable for screening purposes. Of the available screening benchmarks, a single TRV for evaluation of potential risks was selected. If a threshold effects concentration (TEC) from MacDonald et al. (2000) was available, then it was selected. If a TEC from this source was not available, then the most conservative of the remaining values was selected as the TRV.

Potential risks to aquatic organisms exposed to surface water and sediment were assessed through comparison of historical analytical results to the TRVs. As was stated previously, detailed data evaluation and statistical analyses including determination of data distribution (normal vs. lognormal), and calculation of means and 95 percent upper confidence limits were not conducted. This semi-quantitative assessment used the data that were available, some of which would not be considered usable in a formal risk assessment. Results are discussed for surface water and sediment in the following subsections.

E2.1.1 Surface Water

Analytical results from surface waters were available from sampling events conducted from 1982 through 1998, however, much of the sampling efforts concentrated on two sampling locations and on the analysis of metals.

Assessment of inorganic contaminants indicates that several metals routinely exceeded chronic and acute TRVs. In addition, the detection limits for some chemicals and/or sampling events exceeded the TRVs making it impossible to truly assess the potential risks. Results and trends are discussed by chemical below. Potential risks for calcium, magnesium, potassium, and sodium were not assessed because these elements are generally considered essential nutrients.

Aluminum. Most of the detected concentrations of aluminum exceeded the chronic AWQC and concentrations in the leachate pond (SW-7), southeast leachate stream (SW-9), and west leachate stream (SW-10) also exceeded acute AWQC and the maximum limit under GNC. Detection limits for sampling conducted in 1982 and 1998 exceeded the chronic AWQC.

Antimony. Antimony was not detected in any of the sampling events and detection limits were below TRVs.

Arsenic. Arsenic was not detected in any of the sampling events and detection limits were below TRVs.

Barium. The majority of the detected concentrations of barium exceeded chronic and acute TRVs that were obtained from the open literature. Concentrations in the Lonfit River upstream (SW-1) and downstream (SW-2) of the Landfill were typically lower than the leachate streams and ponds. Detection limits for the 1982 and 1998 sampling events were greater than the chronic TRV.

Beryllium. Beryllium was not detected in any of the sampling events, however the detection limits for the 1982 sampling event were almost equal to the chronic TRV.

Boron. Boron was only analyzed during the 1982 sampling event. Concentrations in the leachate streams (SW-5, SW-7, SW-9, and SW-10) exceeded both chronic and acute TRVs. The remaining sample locations were non-detect, but the detection limit exceeded both the chronic and acute TRV.

Cadmium. Cadmium was not detected in any of the sampling events, however the detection limits either exceeded or were very close to the chronic AWQC.

Chromium. Detected concentrations of chromium and detection limits for non-detects did not exceed TRVs.

Cobalt. Detected concentrations of chromium and detection limits for non-detects did not exceed TRVs.

Copper. Concentrations of copper exceeded chronic and acute TRVs for the south leachate pond (SW-5), southeast leachate stream (SW-7), west leachate stream (SW-10) and upstream Lonfit River (SW-1) in 1982; and in the leachate streams/pond (SW-7 and SW-9) in 1987. Sampling events after 1987 showed no exceedances until late 1993, during which most of the samples collected from the west leachate stream (SW-10) in August, September, and October exceeded both chronic and acute TRVs. Samples collected during this time at the upstream Lonfit River location (SW-1) did not exceed any TRVs. Samples collected in 1997 again exceeded chronic TRVs (both GNC and AWQC) in the south leachate stream (SW-5), west leachate stream (SW-10), and the confluence of SW-10 with the Lonfit River (SW-0). Samples were not collected (or reported) for the downstream Lonfit River location (SW-2) for this sampling event.

Cyanide. Cyanide exceeded the chronic TRV at the west leachate stream (SW-10), however, all other sampling stations had detection limits that also exceeded the chronic TRV.

Iron. Iron exceeded the GNC maximum limit and/or the chronic AWQC during the 1982, 1987, 1990, 1993, 1997, and 1998 sampling events. Concentrations were generally greater in the leachate streams/pond than in the Lonfit River, and greater downstream in the Lonfit River (SW-2) than upstream in the Lonfit River (SW-1).

Lead. Lead concentrations exceeded chronic TRVs (both GNC and AWQC) sporadically in 1982, 1987 1993, 1994, and 1998. Concentrations were generally greater in the leachate streams than in the upstream Lonfit River with the exception of the 1998 sampling event. However, detection limits for the 1982, 1987, and 1998 sampling events were greater than the chronic TRVs so potential risk for those samples/locations reported as non-detect could not be evaluated.

Manganese. Manganese concentrations exceeded the chronic TRV only twice in 1982 and 1987 at SW-7 and SW-9. In general, concentrations were higher in the leachate samples than in the Lonfit River, and concentrations were higher downstream in the Lonfit River than upstream in the Lonfit River.

Mercury. Mercury concentrations exceeded both the chronic and acute TRVs at all sampling stations evaluated in 1982 and 1997. All other sampling events were reported as non-detect with detection limits given for some, but not all of the samples. Detection limits that were reported for 1987 and 1990 were greater than the chronic GNC.

Nickel. None of the detected concentrations of nickel exceeded TRVs. Detection limits were below TRVs.

Selenium. Selenium was reported as non-detect for all samples, however the detection limits exceeded chronic TRVs (1987) and acute TRVs (1987 at SW-7 and 1997).

Silver. Silver was reported as detected in only one sample collected in 1982 (at SW-2). This value exceeded both chronic and acute TRVs. Detection limits for some of the sample locations collected in 1982, 1987, 1993 and 1997 exceeded the chronic TRV.

Thallium. Thallium was not detected at any of the sampling locations/events. Detection limits for the 1997 sampling event exceeded the chronic TRV.

Vanadium. Detected concentrations and non-detect detection limits for vanadium did not exceed TRVs.

Zinc. Detected concentrations and non-detect detection limits for zinc did not exceed TRVs.

Analysis of organic contaminants was generally limited to the confluence of SW-10 with the Lonfit River (location SW-0) and the western leachate stream (location SW-10). Sporadic evaluation of organics was conducted at the other sampling locations. Although the majority of the analytical results show non-detects, the detection limits for most of the reported analytes are higher than the chronic and/or acute TRVs. In some cases (e.g., pesticides), the detection limits are 2 and 3 orders of magnitude higher than the chronic TRV. Since the detection limits are greater than the TRVs, the risks due to these chemicals can not be assessed and likewise they can not be discounted as having no potential impact. Organic chemicals for which the detection limits exceed the chronic TRVs are listed below (those that exceed chronic GNC and/or AWQC are indicated by an asterisk *).

- BHC-gamma *
- Bis(2-ethylhexyl)phthalate
- Carbon disulfide
- Chlordane – alpha *
- Chlordane – gamma *
- 4,4'-DDD
- 4,4'-DDT *
- Diazinon *
- Dieldrin *
- Diethyl phthalate
- Endrin *
- Heptachlor *

- Methoxychlor *
- Parathion – ethyl *
- Parathion – methyl *
- PCBs – total *

Organic chemicals for which the detection limits exceed acute TRVs (all of which were either GNC or AWQC, as noted by an *) include:

- Diazinon *
- Endrin *
- Ethion *
- Malathion *
- Methoxychlor *
- Parathion – ethyl *
- Parathion – methyl *

In summary, there are several inorganic chemicals which exceed chronic and acute TRVs. Concentrations are typically greater in leachate-related samples than in the Lonfit River, but concentrations are also typically greater in downstream in the Lonfit River than upstream from the Landfill. This trend indicates that the Landfill is impacting the water quality of the Lonfit River. Chemicals that exceed both acute and chronic TRVs consist of aluminum, barium, boron, copper, lead, manganese, mercury, and silver. Cyanide and iron exceeded chronic TRVs, but not acute TRVs. Potential risks due to organic chemicals could not be assessed for the majority of the reported analytes because detection limits exceeded TRVs.

E2.1.2 Sediment

Evaluation of potential risks to sediment were limited to metals data collected during a single sampling event in 1982. Comparisons to the TRVs presented in Table E-2 indicated that chromium, copper, iron, manganese, mercury, and nickel exceed effects thresholds. There were no observed trends in concentrations. Leachate springs/pond, upstream river, and downstream river samples all had similar concentrations for the detected metals.

Chromium. Chromium exceeded the TRV at only one location, the south leachate spring (SS-5).

Copper. Copper exceeded the TRV only in the upstream Lonfit River location (SS-1).

Iron. Iron exceeded the TRV at the south leachate spring (SS-5) and downstream in the Lonfit River (SS-11).

Manganese. Manganese exceeded the TRV in the upstream Lonfit River location (SS-1) as well as two leachate springs (SS-3 and SS-5). Exceedances were from two to five times the TRV.

Mercury. Mercury exceeded the TRV at all sampling locations and had the greatest exceedances ranging from 6 to 24 times the TRV. The highest concentration was measured in the south leachate spring (SS-5).

Nickel. Nickel exceeded the TRV in the south leachate spring (SS-5), the south leachate pond (SS-7), and downstream in the Lonfit River (SS-11). The highest concentration was measured in the downstream Lonfit River location.

Potential risks to aquatic receptors are greatest from mercury and manganese based on the limited data available. More recent data has not been collected. Also, potential risks due to organic contaminants could not be assessed because samples for these chemicals were not collected or analyzed.

E2.2 Human Health Evaluation

Potential risks to humans typically involves detailed exposure and effects evaluations prior to estimating potential risks. This ensures that potential risks are only estimated for those receptors that would actually have the potential for exposure to contaminants. The full procedures for evaluating potential human health risks is described in Section E.5.

A brief, semi-quantitative evaluation was conducted as part of this report and the results should not be interpreted as being a comprehensive evaluation of potential exposures and risks. The only exposure pathways evaluated consist of ingestion of groundwater as a drinking water source and ingestion of organisms inhabiting contaminated surface waters.

The water quality goals compiled for evaluation of groundwater consist of Guam Water Quality Standards, both primary and secondary, USEPA Primary and Secondary Maximum Contaminant Levels (MCLs), risk based drinking water values representing a reference dose of 1.0 for non-carcinogens and a cumulative lifetime cancer risk of 1×10^{-6} , and taste and odor thresholds (Table E-3). Comparison of groundwater data from wells near the Landfill to the water quality standards in Table X-3 are only applicable to sample location GW-1 (municipal well A-11) and location GW-3 (municipal well A-12) as all other wells are not used for drinking water purposes. However, for purposes of this semi-quantitative evaluation, chemical results from all groundwater wells are compared to the available water quality goals.

The water quality goals compiled for evaluation of surface water are based on its classification as Category S-2. The applicable water quality criteria consist exclusively of the Guam Numerical Criteria and USEPA AWQCs for ingestion of aquatic organisms (Table E-3).

The results of this semi-quantitative evaluation are presented for groundwater and surface water in the following subsections.

E2.2.1 Groundwater

Historical groundwater data collected are limited to sampling for semi-volatiles, volatiles, and metals in 1982 and 1987; pesticides/PCBs in 1989; and volatiles and semi-volatiles in 1992.

Inorganic chemicals that exceeded water quality goals consisted of aluminum, iron, manganese, and mercury. Inorganic chemicals that could not be assessed because their detection limits exceeded water quality goals consisted of antimony and thallium (MCLs) and arsenic and cadmium (IRIS reference dose only).

Aluminum. Aluminum exceeded the secondary MCLs at the north Background Well (GW-4), and the south downgradient wells (GW-5, GW-4, Well 4, and Well 8). Concentrations were very similar between the downgradient wells and were greater than the Background well.

Iron. Iron exceeded the secondary MCLs at the four south downgradient wells (GW-5, GW-4, Well 4, and Well 8). Concentrations were very similar between the downgradient wells.

Manganese. Manganese exceeded the secondary MCLs at the four south downgradient wells (GW-5, GW-4, Well 4, and Well 8). Concentrations were very similar between the downgradient wells.

Mercury. Mercury exceeded primary MCL at the municipal well (GW-1). It did not exceed water quality goals at any of the wells downgradient of the Landfill.

Organic chemicals that exceeded water quality goals consisted of bis(2-ethylhexyl)phthalate and chloroform. Concentrations of bis(2-ethylhexyl)phthalate exceeded Guam and USEPA primary MCLs and IRIS drinking water values in the north Background Well (GW-4). The IRIS drinking water value was also exceeded at 3 southern downgradient wells (Well-4, GW-6, and Well-8). Chloroform exceeded the IRIS drinking water value at the USEPA well (MW-02) located northeast of the site.

The majority of organic contaminants analyzed for were reported as non-detects. Similar to the ecological evaluation, several of the detection limits exceeded the groundwater water quality goals. Chemicals for which the detection limits exceeded water quality goals are listed below.

- Aldrin
- BHC - alpha
- BHC – beta
- BHC – gamma
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- Dieldrin

Potential risks due to these chemicals could not be assessed, as such, these chemicals can not be dismissed as not resulting in any risk simply because they were reported as non-detect.

E2.2.2 Surface Water

Potential risks due to exposure to surface water were evaluated through comparisons to the GNC and AWQC for human consumption of aquatic organisms. This was the only applicable standard since surface water is not a source of drinking water in the area.

Inorganic chemicals that exceeded the water quality goal consisted of manganese and mercury.

Manganese. Manganese exceeded the water quality goals during at least one sampling event for all the sampling locations. Concentrations in the leachate streams for exceeded that measured in the Lonfit River (both upstream and downstream).

Mercury. Mercury exceeded the water quality goal during the 1982 and 1997 sampling events for every sampling location. However, samples collected during the years between 1982 and 1997 had detection limits that were greater than the water quality goal.

Inorganic chemicals for which the detection limits exceeded the water quality goal consisted of arsenic, mercury, and thallium.

None of the detected organic chemicals exceeded the water quality goal. Most of the organic chemicals were reported as non-detects. The detection limits for several of these chemicals exceeded the water quality goal. The potential risks due to these chemicals (listed below) could not be assessed.

- Aldrin
- BHC – alpha
- BHC – beta
- BHC – gamma
- Bis(2-ethylhexyl)phthalate
- Chlordane – alpha
- Chlordane – gamma
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- Dieldrin
- Heptachlor
- PCBs - total

E.3 Data Limitations and Data Gaps

The are several major limitations to the available data that impact its use in a risk assessment. In addition, there are several data gaps that should be addressed prior to performing a formal ecological risk assessment or human health risk assessment.

The data limitations include, but are not limited to, the following:

1. The quality assurance/quality control (QA/QC) procedures were not available for most of the sources of data. QA/QC information that was missing for some or all of the studies included analytical methods, method detection limits, reporting limits, collection of field duplicates, and collection matrix spike/matrix spike duplicate (MS/MSD) samples.

2. Not all samples were collected using standard techniques, sample containers, and sample preparation.

3. Detection limits for most of the organic chemicals analyzed and some of the inorganic chemicals exceeded applicable screening criteria. Detection limits associated with current laboratory methods are much lower than those reported in the historical data. To the extent possible, the detection limits and reporting limits should be set below the screening criteria.

4. The quantity and quality of leachate emanating from the Landfill has not been fully characterized. It is expected that the nature (e.g., concentrations and types of contaminants) would vary seasonally along with the quantity of leachate. As such, it is unknown whether the historical data represent the "worst-case" scenario.

Data gaps consist of several items that should be completed prior to conducting a formal ecological and human health risk assessment. And most especially, should be completed prior to concluding that the Landfill does not pose a threat to the environment or to human health.

1. Soil samples have not been collected from the Landfill or in the surrounding areas. Collection of soils should be conducted to evaluate the potential risks to terrestrial receptors including plants, invertebrates, birds, mammals, and humans.
2. Sediment samples were limited to a single sampling event in 1982 with metals as the only analytes. Lack of sediment data is the most significant data gap. Although surface waters may show limited impacts, the conclusion that the site does not pose a threat to the environment based exclusively on surface water evaluations is very short-sighted. It is often the case that surface waters show no risk because of dilution and settling out of contaminants, yet the sediments show substantial risks. Sediments act as a sink for many pollutants, and given the large amount of rainfall and dilution that can occur to surface waters in Guam, it is highly likely that much of the pollution carried out of the Landfill via leachate streams is deposited in the sediment.
3. Media sampled should consist of groundwater, surface water, soil, sediment, aquatic and terrestrial biota. Contaminants that should be analyzed for, using more current laboratory methods and detection limits, include the following (additional analyte groups, such as munitions should also be considered based on the history of the site):
    - Groundwater – metals, pesticides, PCBs, polycyclic aromatic hydrocarbons (PAHs), dioxins and furans
    - Surface water – metals, pesticides, PCBs, PAHs, dioxins and furans
    - Sediment – metals, semi-volatile organics, pesticides, PCBs, PAHs, dioxins and furans
    - Soil – metals, volatile organics, semi-volatile organics, pesticides, PCBs, PAHs, dioxins and furans
    - Aquatic biota tissue – metals and organochlorine pesticides
    - Terrestrial biota tissue – metals and organochlorine pesticides

The brief semi-quantitative evaluation indicated a potential risks to ecological and human receptors due to metals in surface water, sediment, and groundwater. However there were significant data limitations and data gaps. It is recommended that a formal EcoRA and HHRA be conducted upon completion of fulfilling the above listed data gaps. A conceptual approach for completing a EcoRA and HHRA are presented in the following sections.

E.4 Conceptual Approach for a Screening Ecological Risk Assessment

The EcoRA will be conducted in phases as recommended by the USEPA (1997 and 1998). This EcoRA will correspond to a Screening EcoRA as defined by USEPA (1998b). The EcoRA

will review available information to identify chemicals, habitats, and receptors of concern; identify complete exposure pathways; screen chemical concentrations against available criteria, standards, or effect levels; and estimate potential risks using conservative exposure models.

If the estimated risks indicate that remedial action is required, the EcoRA results will be used to aid in the development of realistic ecological preliminary remedial goals (PRGs).

If the results of the EcoRA indicate that there is no risk to ecological receptors via a specific exposure pathway, then that particular exposure pathway will be recommended for no further ecological investigation or remediation.

If the results of the EcoRA indicate potential for risk, but data gaps are present, then further evaluation and data collection may be proposed.

The guidance, assumptions, and methods used to characterize potential exposures and effects and to estimate potential risks to ecological receptors are described in the following subsections.

E.4.1 Guidance

The EcoRA will be performed in general accordance with the following guidance provided by USEPA:

- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment, Interim Final (USEPA 1997a)
- Framework for Ecological Risk Assessment (USEPA 1992a)
- ECO Updates, Volume 1, Numbers 1 through 5 (USEPA 1991a, 1991b, 1992b, 1992c, 1992d)
- ECO Updates, Volume 2, Numbers 1 through 4 (USEPA 1994a, 1994b, 1994c, 1994d)
- ECO Updates, Volume 3, Numbers 1 and 2 (USEPA 1996a, 1996b)
- Final Guidelines for Ecological Risk Assessment (USEPA 1998)
- Ecological Risk Assessment and Risk Management Principles for Superfund Sites (USEPA 1999a)
- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (USEPA 2001)

E.4.2 Ecological Management Goals, Assessment Endpoints, and Measures

The identification of ecological management goals, assessment endpoints, and measures is critical to the EcoRA process. They provide the focus of the EcoRA, link the EcoRA with the RI/FS (if one is conducted), and ensure that the methodologies and results of the EcoRA are technically sound. Most importantly, they ensure that the values of the site are considered from an ecological standpoint in the remedial decision making process.

The ecological management goals state the desired ecological conditions for the site. They must be established based on a realistic assessment of the current status of the ecological

community and potential current and future land uses at the Landfill. Suggested ecological management goals for the Landfill could be as follows:

> *Maintenance of soil, sediment, water quality, food source, and habitat conditions capable of supporting ecological receptors including special-status species likely to be found on the Landfill and in downstream areas impacted by the Landfill.*
>
> *Creation of sediment, water quality, and habitat conditions capable of supporting ecological receptors including special-status species that would potentially use areas downstream from the Landfill.*

Assessment endpoints are an expression of the important ecological values that should be protected at a site (Suter 1990, 1993; Suter et al. 2000; USEPA 1998). The assessment endpoints are developed based on known information concerning the contaminants present, the site, and the ecological management goals.

The measures used in this EcoRA will be predictive of the assessment endpoints (USEPA 1998). Criteria considered in the selection of measures are as follows:

- Corresponds to or is predictive of an assessment endpoint
- Can be readily measured or evaluated
- Appropriate to the scale of the site
- Appropriate to the temporal dynamics
- Appropriate to the exposure pathway
- Associated with low natural variability
- Minimally disruptive to ecological community and species variability.

E4.3 Development of the Ecological Conceptual Site Model

The ecological conceptual site model (CSM) is used to provide an overall picture of potential site-related exposures and will be used to focus the evaluations conducted in this EcoRA. The ecological CSM is developed by combining information on potential ecological receptors, exposure pathways, and media and chemicals of potential ecological concern with the ecological management goals, assessment endpoints and measures.

E4.3.1 Identification of Ecological Receptors and Representative Species

Ecological receptors that have been observed or are expected to occur near the Ordot Landfill will be identified. Representative species will be selected based on several criteria, as follows, to facilitate evaluation of risks:

- Receptor is a special-status species (e.g., threatened or endangered).
- Receptor has a small home range.
- Receptor is representative of an ecological guild.
- Receptor is susceptible to bioaccumulation or biomagnification of site-related contaminants(e.g., higher trophic-level predators).
- Receptor is likely to be exposed to contaminants.
- Receptor occurs at the site or habitat is available to support the selected receptor.

- Receptor is known or suspected to be sensitive to contaminants.
- Receptor is ecologically important.

Representative species will typically be assessed at one of three different levels: individual-level, population-level, and community-level. Species that will be assessed at the individual-level consist of special-status species. Species that will be assessed at the population-level include birds, mammals, and fish for which protection of populations is important. Receptor groups that will be assessed at the community-level consist of terrestrial and/or aquatic plants, invertebrates, and microbial process which provide forage/prey for higher trophic levels and require protection at a community level.

E4.3.2 Evaluation of Exposure Pathways

Exposure pathways refer to the media and routes through which inorganic and organic contaminants may reach ecological receptors. Potential exposure pathways must meet specific criteria for an exposure to occur. Aside from necessary habitat for ecological receptors, a complete exposure pathway must satisfy the following elements:

- Contaminant source (e.g., chemicals in soil, water, other)
- Mechanism for contaminant release and transport (e.g., surface-water runoff)
- Exposure point (e.g., water)
- Feasible route of exposure (e.g., ingestion)
- Receptor (e.g., plant, bird, other)

Potential exposure pathways for the Ordot Landfill will be summarized along with the rationale for inclusion/exclusion in the quantitative and qualitative evaluations.

E4.3.3 Identification of Media and Chemicals of Potential Ecological Concern

The media of concern for this EcoRA will include soil, sediment, and surface water. For purposes of this EcoRA, soils will be segregated based on depth and potential for exposure by ecological receptors. Surface soils are defined as soils from 0 to 1 foot bgs and near-surface soils occur from >1 to 4 feet bgs. Media of concern will be used to estimate potential risk to representative species as follows:

- Surface soil (0-1 foot bgs) – soil microbial processes, terrestrial plants and invertebrates, and burrowing and non-burrowing birds and mammals.
- Near-surface soils (>1 to 4 feet bgs) – terrestrial plants, and burrowing birds and mammals..
- Sediment – freshwater aquatic plants, benthic macroinvertebrates, and semi-aquatic birds and mammals.
- Surface water , freshwater aquatic plants and organisms, terrestrial and semi-aquatic birds and mammals.

Chemicals of potential ecological concern (COPECs) will be identified as all chemicals detected in surface soil, near-surface soil, sediment, and surface water that meet data evaluation requirements (USEPA 2000), exceed ambient inorganic levels, and are not considered essential nutrients or common constituents of saltwater (as was described in

Section 1.2). In addition, Toxicity Equivalency Factors (Van den Berg et al. 1998) will be applied to detected dioxin, furan, and selected polychlorinated biphenyl (PCB) congeners to produce a 2,3,7,8-TCDD equivalent. The TEFs for fish, birds, and mammals will be used to derive receptor-specific TCDD equivalents. The TCDD equivalents within a given sample will be summed to derive a "total equivalent TCDD" value for use in risk estimates.

Statistical evaluation of the chemicals detected in each medium of concern at each site will be performed and will include number of detects, number of samples, frequency of detection, minimum and maximum detected and nondetected values. In addition, the mean and 95 UCL of the mean will be calculated for each chemical using both untransformed data (assumed normal distribution) and log-transformed data (assumed lognormal distribution). The results of these evaluations will be used in determining exposure point concentrations (described in Section 3.5).

Final chemicals of ecological concern (COECs) will be determined through the quantitative and/or qualitative risk estimation procedures presented in the following sections.

E4.4 Exposure Characterization

The nature and magnitude of the interaction between COPECs in environmental media and ecological receptors will be described and quantified in the Exposure Characterization. Because receptors differ in their mobility and ultimately in the exposure they receive to contaminants via abiotic media, receptors will be evaluated using a reasonable maximum exposure. The reasonable maximum exposure for each representative species will be used to select the exposure point concentrations, and will be either the maximum detected concentration or the 95 UCL assuming either a normal distribution or a lognormal distribution depending on the distribution of the data for each medium and site.

In order to determine the proper 95 UCL to use as the exposure point concentration, the statistical distribution (i.e., normal vs. log-normal) of the data will be determined using the Shapiro-Wilk test of normality. The Shapiro-Wilk test will be applied to the untransformed data when testing for normality and to the log-transformed data when testing for lognormality. The exposure point concentrations will then be selected based on the following criteria:

- If the data are lognormally distributed, the lognormal 95 UCL will be selected.
- If the data are normally distributed, the normal 95 UCL will be selected.
- If the data follow **both a normal and lognormal** distribution (referred to as a false positive) or clearly **follow neither** (referred to as a false negative), the "best fit" distribution will be selected based on the W-statistic from the Shapiro Wilk test.
- If the 95 UCL exceeds the maximum detected value, the maximum detected value will be selected.

Exposure point concentrations (EPCs) for various receptor groups will typically be selected using conservative assumptions as follows:

- Exposure for soil microbial processes and terrestrial invertebrates is limited spatially and considered to extend from 0 to 1 foot bgs. The EPCs for these receptors are the maximum detected concentrations of COPECs in surface soils.
- The EPCs for rooted plants are best represented by maximum COPEC concentrations in surface (0-1 ft bgs) and near-surface soils (1-4 ft bgs) (terrestrial plants) and sediments (aquatic plants).
- Aquatic invertebrates and fish are more mobile and the medium they reside in is more variable. EPCs for these receptors are best represented by the 95 UCL in sediments (aquatic invertebrates) and surface water (fish).
- Birds and mammals have greater mobility. EPCs for non-burrowing species will be the 95 UCL in surface soils (0-1 ft bgs). EPCs for burrowing species will be the 95 UCL in surface soils (0-1ft bgs) and near-surface soils (1-4 ft bgs).

Birds and mammals are exposed to contaminants through multiple pathways including soils, food items, and surface water and require exposure modeling to estimate an overall exposure dosage. Parameters of this modeling include the EPCs (as described above), life history parameters, bioaccumulation factors, and area use factors.

Site-specific bioaccumulation factors will be used if they are available. For those COPECs without site-specific bioaccumulation factors, literature-derived bioaccumulation models and values will be used to estimate concentrations in wildlife foods. Log-linear uptake models for plants, earthworms, and small mammals (Bechtel-Jacobs 1998a; Sample et al. 1998a, 1998b, 1999) can be used to estimate biota concentrations for several inorganics. Models and values from USEPA (2000a) and Bechtel-Jacobs (1998b) can also be used to estimate bioaccumulation factors (BAFs) for terrestrial and aquatic plants, terrestrial and aquatic invertebrates, fish, and small mammals. In some cases, literature values may be used when models are not available or favorable. A default value of 1 will be used when no other source can be identified.

Many wildlife species are highly mobile, covering large areas in search of food, water, and shelter. The exposure that individuals experience depends on the amount of time they spend at a contaminated site. Site use depends on the size of the site relative to an animal's home range. An area use factor (AUF) will be incorporated in the exposure equation to give a more realistic estimation of overall exposure. Representative species whose home range is less than the site size have an AUF of 1.

The exposure model that will be used for birds and mammals is based on exposure to contaminants through multiple pathways including soils, food items, and surface water. The following generalized exposure model, modified from Suter et al. (2000), will be used.

$$E_j = [Soil_j * P_s * FIR] + [\sum_{i=1}^{N} B_{ij} * P_i * FIR] + [Water_j * WIR] * AUF$$

where:

E_j = total exposure (mg/kg/day)

$Soil_j$ = concentration of chemical in soil (mg/kg)

$Water_j$	=	concentration of chemical in water (mg/L)
P_s	=	soil ingestion rate as a proportion of diet
FIR	=	total food ingestion rate for the representative species (kg_{diet}/kg BW/day)
WIR	=	total water ingestion rate for the representative species (L/kg BW/day)
B_{ij}	=	concentration of chemical (j) in biota type (i) (mg/kg)
P_i	=	proportion of biota type (i) in diet
AUF	=	Area use factor

E4.5 Ecological Effects Characterization

The Ecological Effects Characterization consists of an evaluation of available toxicity or other effects information that can be used to relate the exposure estimates to a level of adverse effects. Toxicity reference values (TRVs) that relate a specified effect to a given chemical concentration will be used to characterize potential ecological effects.

TRVs will be selected based on the assessment level of the representative species as follows:

- For representative species assessed at the individual level (e.g., special-status species), any exposure resulting in effects greater than expected at background chemical concentrations or exceeding a no observed adverse effect levels (NOAELs) is considered unacceptable.
- For representative species assessed at the population level (all other representative birds and mammals, and fish), the maximum adverse effect level is approximately a 20 percent reduction in the measured attribute. This corresponds to the measurement limits for many field and laboratory tests. Lowest observed adverse effect levels (LOAELs) and lowest observed effect concentrations (LOECs) correspond to a 20 percent reduction in the measured attribute (e.g., reproduction, growth).
- For representative species assessed at the community level (aquatic and terrestrial plants and invertebrates and soil microbial processes), the maximum adverse effect level is also a 20 percent change in the measured attribute (i.e., LOECs). This is the limit of detection for assessing aquatic communities using EPA rapid bioassessment protocols and other community assessments (Suter et al., 2000). In addition, changes in natural populations/communities of less than 20 percent cannot generally be differentiated from "noise" of measurements.

TRVs will be obtained from a variety of sources including those used above in the semi-quantitative evaluation (Tables E-1 and E-2).

E4.6 Risk Characterization

The Risk Characterization will evaluate the evidence linking exposures to COPECs with their potential ecological effects for the representative species identified for the Ordot Landfill. There are three main components that comprise the Risk Characterization: the Risk

Estimation, the Risk Description, and the Uncertainty Analysis. These three components will be used together to identify the final chemicals of ecological concern (COECs).

The Risk Estimation will be conducted using the 'forward calculation' methodology in which the exposure point concentration (for plants, invertebrates, soil microbial processes, and fish) or the exposure dosage (birds and mammals) is divided by the respective TRVs to determine the hazard quotient (HQ).

Cumulative risks from exposure to multiple chemicals will be evaluated by assuming additive effects and calculating a hazard index (HI) following DTSC guidance (Cal/EPA 1992) in that only chemicals with the same target organ or mechanism of toxicity will be considered together.

A HI or HQ greater than unity will be used to indicate potential adverse ecological impacts, and the results will be further evaluated qualitatively. The qualitative evaluations will include an assessment of chemical information (magnitude of HQ and frequency of detection, bioavailability), species information (foraging range), and incremental risk, using less conservative assumptions to predict a more reasonable potential for exposure and effects.

The Risk Description will incorporate the results of the quantitative and qualitative evaluations along with any other available and appropriate lines of evidence to evaluate potential chemical impacts on ecological receptors in and around the Landfill.

Uncertainties and limitations of the data and/or assumptions used in the EcoRA will be discussed qualitatively.

If the results of the EcoRA indicate that there is no risk to ecological receptors via a specific exposure pathway, then that particular exposure pathway will be recommended for no further ecological investigation or remediation.

If the estimated risks indicate that remedial action is required, the EcoRA results will be used to aid in the development of realistic ecological preliminary remedial goals (PRGs) for the COECs.

If the results of the EcoRA indicate potential for risk, but data gaps are present, then further evaluation and data collection may be recommended.

E.5 Conceptual Approach for a Screening Human Health Risk Assessment

The objective of the HHRA is to characterize any potential human health risks due to current and future exposure to chemicals detected in environmental media at the Ordot Landfill or in areas downstream from the Landfill. Ultimately, the results of the HHRA will be used to identify any areas of potential human health concern and determine if any additional corrective or risk management measures are needed.

E5.1 Baseline Risk Assessment Process and Guidance

USEPA's objectives (USEPA, 1989a) for the baseline risk assessment are to:

- Analyze the baseline risk (the risk that could occur if no action is taken to remediate the site), and assess the need for remedial action.
- Provide a basis for determining levels of chemicals that can remain onsite and still be adequately protective of public health.
- Provide a basis for comparing potential health effects of various remedial alternatives.
- Provide a consistent process for evaluating and documenting public health threats at Superfund sites.

The baseline risk assessment process involves the following steps:

- Data Evaluation – Data are evaluated and chemicals of potential concern (COPCs) are selected for quantitative risk calculations.
- Exposure Assessment – Receptors, exposure pathways, and exposure scenarios are identified and quantitative estimates of exposure are made. An exposure pathway includes contaminant sources, ways for contamination to migrate, and people that could contact the contamination through their activities in these areas. Exposure scenarios include descriptions of the people who may contact contaminated soil, sediment, surface water , groundwater , and biota and the circumstances under which they may be exposed to contaminated materials.
- Toxicity Assessment – Toxic effects of the COPCs are summarized and appropriate toxicity reference values are identified for the COPCs.
- Risk Characterization – Quantitative estimates of cancer and noncancer risk are made and uncertainties associated with the risk estimates are summarized.

The methodology used to conduct the HHRA will be based primarily on guidance provided in the following documents:

- Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part A). Interim Final (USEPA, 1989a)
- Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part B: Development of Risk-Based Preliminary Remediation Goals) (USEPA, 1991c)
- Supplemental Guidance for Human Health Multimedia Risk Assessment of Hazardous Waste Sites and Permitted Facilities (CalEPA, 1992)

E5.2 Data Evaluation

This section summarizes the procedures that will be used to characterize the chemical data collected from the Landfill and the selection of chemicals of potential concern (COPCs). The COPCs will be selected from the data meeting evaluation criteria (presented earlier in Section E.4).

Exposure point concentrations (EPCs) for human health exposure will be determined using a reasonable maximum exposure (RME) scenario. The RME for potentially exposed persons is best described by the upper 95 percent confidence limit (95 UCL) on the mean. The 95UCL will be calculated as was previously described in Section E.4 The 95 UCL will then be

compared to the maximum concentration for each data set and the lesser of the two values will used to represent the EPCs.

E5.3 Exposure Assessment

The Exposure Assessment is used to identify potentially exposed populations and exposure pathways to be included in the quantitative risk assessment. Based on human activity and land-use patterns, exposure assessment also involves the estimation (qualitative or quantitative) of the magnitude, frequency, duration, and routes of exposure. The compilation of this information forms the basis by which calculations are conducted to estimate risks.

A conceptual site model (CSM) is used to show the relationship between chemical sources, exposure pathways, and potential receptors for the Landfill. The CSM identifies suspected chemical sources and the potentially impacted environmental media (e.g., soil, groundwater), which may contact on-site and off-site human receptors. The CSM also illustrates how that contact is likely to occur (e.g., swallowing, breathing, touching).

E5.3.1 Potentially Exposed Populations and Exposure Pathways

An exposure scenario is a description of the potentially exposed population(s), the media of interest, and potential exposure pathways. For the Ordot Landfill, exposed populations consist primarily of on-site workers, persons trespassing to scavenge, and persons off-site who may contact contaminated media or consume contaminated biota downstream from the site.

In order for exposure to occur, a pathway to the COPC must exist. Exposure pathways may be influenced by environmental conditions, the potential for a chemical to move from one medium to another, and the general lifestyles of the potentially exposed individuals. Although several potential pathways may exist, only a few may actually be complete (i.e., have the potential to result in an exposure). For an exposure pathway to be complete, each of the following elements must exist (USEPA 1989a):

- A source and mechanism for release
- An environmental transport medium (e.g., air, soil, and water)
- A point of potential human contact with the medium
- A human exposure route at the contact point (e.g., inhalation, ingestion, and dermal contact).

All complete, or potentially complete exposure pathways, are not equally likely to occur. All four elements of an exposure pathway may exist under some plausible conditions, but actual conditions often make an individuals likelihood for exposure to be negligible or small. Exposure pathways for the Landfill and downstream areas may include the following:

- Incidental ingestion of soil or sediment
- Dermal contact with soil or sediment
- Inhalation of soil particulates
- Inhalation of volatile gasses emitted from the Landfill
- Incidental ingestion of surface water

- Dermal contact with surface water
- Ingestion of fish and shellfish

E5.3.2 Fate and Transport Modeling

Specific fate and transport modeling may be required to evaluate some exposure pathways. These may include blood-lead modeling and modeling of partitioning of chemicals into fish and shellfish.

Blood Lead Modeling

Potential risks for lead are developed differently than for other chemicals. To maintain consistency with the toxicological reference data, lead intakes must be derived in terms of µg of lead intake per day and combined with blood-lead slope factors to yield a blood-lead concentration (µg/dL). Blood-lead slope factors (µg/dL per µg lead intake/day) relate exposure to expected blood-lead concentrations. Potential risk for lead will be evaluated based on DTSC's LEADSPREAD model (CalEPA, 1992). Children are the most sensitive subpopulation, and represent the greatest potential risk due to exposure to lead. The lead whole-blood level of concern for children is 10 µg/dL of whole blood. Values for recreational receptors will be derived by adjusting the number of days per week exposed. The incidental water ingestion can also be accounted for by increasing the daily water ingestion from 2 liters per day (the drinking water rate) to 2.05 liters per day (to account for an ingestion rate of 50 milliliters per swimming incident).

Fish Ingestion and Partitioning of Chemicals into Fish

If fish and shellfish tissues are not collected (most likely from the Lonfit River) and analyzed directly for contaminants, then exposure to fish and shellfish must be modeled. Estimates of bioaccumulation into fish tissue will preferentially be based on site-specific benthos trophic transfer factors (TTF) when available. When TTFs are not available, bioaccumulation factors (BAFs), or biota to sediment accumulation factors (BSAFs) will be used. The following equations can be used to calculate the concentrations in fish tissues:

$$C_f = TTF \ x \ C_s$$

or

$$C_f = BAF \ x \ C_w$$

or

$$C_f = \frac{BSAF \ x \ C_s \ x \ \%Lipid}{f_{oc}}$$

where:

C_f = concentration in fish tissue, mg/kg tissue

C_w = concentration in water, mg/L water

C_s = concentration in sediment, mg/kg sediment

TTF = site-specific TTF, mg/kg tissue per mg/kg sediment

BAF = bioaccumulation factor for chemicals lacking a BRAC-specific TTF, mg/kg tissue per mg/L water

$BSAF$ = biota to sediment accumulation factor for dioxins and furans, mg/kg tissue per mg/kg sediment

f_{oc} = fraction organic in the sediment, g/g

$\%Lipid$ = percent lipid

Exposure parameters for fish ingestion are based on RME case guidance from USEPA (1989a, 1997d). For example, the seafood ingestion rate used is 13.6 grams (g)/day and is based on data from USEPA's recommended intake of finfish for recreational marine anglers is 6.8 g/day. (This value is the age weighted average for all of the potential receptors.) This number will be doubled to take into account the intake of shellfish for which there is no recommendation. The rate of 13.6 g/day is also consistent with peer-reviewed literature values.

E5.4 Toxicity Assessment

The purpose of the Toxicity Assessment is to collect the dose-response data that will be used to calculate the noncarcinogen and carcinogenic risks. The hierarchy of sources for toxicity factors used in this task is as follows:

- CSFs, Reference Doses (RfDs), and Reference Concentrations (RfCs) developed by the USEPA and listed in the Integrated Risk Information Service (IRIS) (USEPA 2000b)
- Nonpromulgated USEPA CSFs, RfDs, and RfCs listed in the USEPA Health Effects Assessment Summary Tables (HEAST) (USEPA 1997d), and
- Nonpromulgated USEPA RfDs and RfCs recommended by USEPA's National Center for Environmental Assessment (NCEA).

Lead will also be evaluated through use of the DTSC model LEADSPREAD (Cal/EPA 1992) as was outlined above. No other toxicity factors will be derived for this assessment.

Toxicity evaluation of polycyclic aromatic hydrocarbons (PAHs), dioxins, and furans will be modified by TEFs for dioxins, furans, and specific polychlorinated biphenyls (PCBs) (Van den Berg et al. 1998) and for PAHs (Cal/EPA 1994).

In addition to the dosage-based toxicity values described above, numerical criteria for exposure to surface water and groundwater (if applicable) will be used. These values were previously used in the semi-quantitative evaluation (Table E-3).

E5.5 Risk Characterization

Incremental lifetime human cancer risk (ILCR) and noncarcinogenic hazard indexes will be calculated to determine potential risks to human receptors. Further analysis may include classification of risk-driving chemicals by toxicological response, estimating risk by target organ system, conducting further risk characterizations via other methods, and evaluating uncertainties in the risk characterization.

E5.5.1 Estimation of Carcinogenic Risks

Incremental lifetime human cancer risks will be estimated for all carcinogenic compounds. Cancer risks will be calculated as the product of exposure to the chemical (mg/kg-day) and the slope factor for that chemical $(mg/kg\text{-}day)^{-1}$, as follows:

$$Risk = Intake \times Slope\ Factor$$

In evaluating the calculated exposure from a potentially carcinogenic COPC, a reasonable level of risk must be selected. Typically, an ILCR (also referred to as excess cancer risk) range would be from 10^{-6} to 10^{-4}. As implemented under the NCP, pathway risks greater than 10^{-6} ILCR must receive risk management consideration. The quantitative risk assessment is one of many factors that are considered in the decision-making process for remediation. Therefore, there is no single risk value that defines "acceptable" and "unacceptable" risk. The purpose of this risk assessment is to present quantitative and qualitative estimates of potential risk; thus, all pathway risks greater than the lower bound of 10^{-6} will be examined.

Cumulative site ILCRs will be developed to include all media and pathways that are appropriate to combine. Combined pathways occur when there is potential for an individual to be exposed to multiple pathways at the same given instant in time. Where the cumulative ILCR to an individual based on the RME is less than 10^{-4}, action generally is not warranted unless there are adverse environmental impacts (USEPA 1991d).

E5.5.2 Estimation of Noncarcinogenic Risks

Potential noncancer human health risks associated with exposure to contaminants will be evaluated by calculating a hazard quotient (HQ), the ratio of the calculated daily intake of the chemicals to the reference dose (RfD), as follows:

$$HQ = Intake / RfD$$

A hazard quotient that exceeds unity indicates a potential for adverse health effects associated with exposure to that chemical.

A Hazard Index (HI) is calculated to assess the potential for noncarcinogenic effects posed by more than one exposure route. The hazard index is equal to the sum of the hazard quotients, and is calculated as follows:

$$HI = HQ_{ingestion} + HQ_{dermal}$$

where $HQ_{ingestion}$ is the Hazard Quotient for the ingestion route and HQ_{dermal} is the Hazard Quotient for the dermal route. When the HI exceeds unity, it is the numerical indicator of the transition between acceptable and unacceptable exposure levels, and there might be concern for potential adverse health effects.

The HHRA will include information describing the methodology and the calculations required for assessing risk as well as uncertainties, limitations, and/or additional data gaps. Areas that may require risk management strategies will also be identified.

E.6 References

Agency for Toxic Substances and Disease Registry (ATSDR). 1988. Health Assessment for Ordot Landfill National Priorities List (NPL) Site, Island of Guam. U.S. Public Health Service. October 25.

Bechtel Jacobs Company LLC. 1998a. Empirical models for the uptake of inorganic chemicals from soil by plants. Bechtel Jacobs Company LLC, Oak Ridge, TN. BJC/OR-133.

Bechtel Jacobs Company LLC. 1998b. Biota sediment accumulation factors for invertebrates: review and recommendations for the Oak Ridge Reservation. Bechtel Jacobs Company LLC, Oak Ridge, TN. BJC/OR-112.

California Environmental Protection Agency (CalEPA). 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. Sacramento, California. July.

CalEPA. 1994. Memorandum. To: Cal/EPA Departments, Boards, and Offices. From: Standards and Criteria Work Group, Office of Environmental Health Hazard Assessment. Subject: California Cancer Potency Factors. November 1.

CalEPA – Regional Water Quality Control Board (RWQCB). 2000. A Compilation of Water Quality Goals. August, with periodic updates.

Canadian Council of Ministers of the Environment (CCMOE). 1999. Canadian Sediment Quality Guidelines for Protection of Aquatic Life: Summary Table, In: Canadian Environmental Quality Guidelines. Canadian Council of Ministers.

CH2M HILL/Black & Veatch/ICF/PRC/Ecology and Environment. 1988. *Draft Risk Assessment (Preliminary Endangerment Assessment), Ordot Landfill Site, Guam*. September .

Department of Toxic Substances Control (DTSC). 1996. Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities. California Environmental Protection Agency, DTSC, Human and Ecological Risk Division. July 4.

Guam Environmental Protection Agency (GEPA). 2001. Guam Water Quality Standards – 2001 Revision.

Lee, M. 1998. Pacific Insular Area Program NPDES Inspection Report: Ordot Landfill, Guam Department of Public Works; Ordot, Guam. Inspection Date – November 6, 1997. USEPA, Region 9. April 2.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

NOAA. 1999. NOAA Screening Quick Reference Tables. NOAA HAZMAT Report 99-1. Seattle WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration. 12pp.

Persaud, D. and R. Jaagumagi. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment. August.

Sample, B., J.J. Beauchamp, R. Efroymson, G.W. Suter II, and T. Ashwood. 1998a. Development and validation of bioaccumulation models for earthworms. Oak Ridge National Laboratory. ES/ER/TM-220.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory, Oak Ridge TN. 89 pp, ES/ER/TM-219.

Sample, B. E., G. W. Suter II, J. J. Beauchamp, and R. A. Efroymson. 1999. Literature-derived bioaccumulation models for earthworms: development and validation. Environ. Toxicol. Chem. 18:2110-2120.

Suter, G.W., II. 1990. Endpoints for regional risk assessments. Environmental Management 14:9-23.

Suter, G. W., II. 1993. Ecological Risk Assessment. Lewis Publ. Co., Boca Raton, Fl. 538 pp.

Suter, G.W., II., R.A. Efroymson, B.E. Sample, and D.S. Jones. 2000. Ecological Risk Assessment for Contaminated Sites. Lewis Publishers, Boca Raton, FL.

Suter, G.W., II and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. ES/ER/TM-96/R2. Health Sciences Research Division, Oak Ridge, Tennessee.

Tenorio J.C. & Associates Inc. 1993. Feasibility Study for the Expansion of Ordot Sanitary Landfill, Municipality of Chalan Pago-Ordot, Territory of Guam. Volumes I and II. September.

Tenorio J.C. & Associates Inc. 1998. Draft Environmental Impact Statement, Solid Waste Management Facility for the Island of Guam. March 5.

United States Environmental Protection Agency (USEPA). 1989a. Risk Assessment Guidance for Superfund. Volume I-Human Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. December.

USEPA. 1989b. Exposure Factors Handbook. EPA/600/8-89/043. May.

USEPA. 1990. Guidance for Data Usability in Risk Assessment. Washington, D.C.

USEPA. 1991a. Ecological Assessment of Superfund Sites: an Overview. Office of Solid Waste and Emergency Response, Eco Update. Vol. 1, No. 2, Publication 9345.0-05I. December.

USEPA. 1991b. The Role of the BTAGs in Ecological Assessment. Office of Solid Waste and Emergency Response, Eco Update. Vol. 1, No. 1, Publication 9345.0-05I, September.

USEPA. 1991c. Risk Assessment Guidance for Superfund. Volume I-Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). Publication 9285.7-01B. December.

USEPA). 1991d. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 285.6-03. March 25.

USEPA. 1992a. Framework for Ecological Risk Assessment, Risk Assessment Forum, EPA/630/R-92-001. Washington, D.C.

USEPA. 1992b. The Role of the Natural Resource Trustees in the Superfund Process. Office of Solid Waste and Emergency Response, Eco Update. Vol. 1, No. 3, Publication 9345.0-05I. March.

USEPA. 1992c. Developing a Work Scope for Ecological Assessments. Office of Solid Waste and Emergency Response, Eco Update. Vol. 1, No. 4, Publication 9345.0-05I. May.

USEPA. 1992d. Briefing the BTAG: Initial Description of Setting, History, and Ecology of a Site. Office of Solid Waste and Emergency Response, Eco Update. Vol. 1, No. 5, Publication 9345.0-05I. August.

USEPA. 1993. EPA Five Year Review of the No Action Decision a the Ordot Landfill Superfund Site in Guam. USEPA Region 9. September 30.

USEPA. 1994a. Using Toxicity Tests in Ecological Risk Assessment. Office of Solid Waste and Emergency Response, Eco Update. Vol. 2, No. 1, Publication 9345.0-05I, EPA 540-F-94-012. September.

USEPA. 1994b. Catalog of Standard Toxicity Tests for Ecological Risk Assessment. Office of Solid Waste and Emergency Response, Eco Update. Vol. 2, No. 2, Publication 9345.0-05I, EPA 540-F-94-013. September.

USEPA. 1994c. Field Studies for Ecological Risk Assessment. Office of Solid Waste and Emergency Response, Eco Update. Vol. 2, No. 3, Publication 9345.0-05I, EPA 540-F-94-014. September.

USEPA. 1994d. Selecting and Using Reference Information in Superfund Ecological Risk Assessments. Office of Solid Waste and Emergency Response, Eco Update. Vol. 2, No. 4, Publication 9345.0-05I, EPA 540-F-94-050. September.

USEPA. 1996a. Ecological Significance and Selection of Candidate Assessment Endpoints. Office of Solid Waste and Emergency Response, Eco Update. Vol. 3, No. 1, Publication 9345.0-05I, EPA 540/F-95/037. January.

USEPA. 1996b. Ecotox Thresholds. Office of Solid Waste and Emergency Response, Eco Update. Vol. 3, No. 2, Publication 9345.0-05I, EPA 540/F-95/038. January.

USEPA. 1996c. Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella azteca and the midge Chironimus riparius. Assessment and remediation of Contaminated Sediments Program. September.

USEPA. 1997a. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final, Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540-R-97-005. June.

USEPA. 1997b Exposure Factors Handbook, Volumes I to III, EPA/600p-95/002Fb, Washington, D.C.

USEPA. 1997c. Health Effects Assessment Summary Tables (HEAST). Annual.

USEPA. 1997d. Health Effects Assessment Summary Tables (HEAST). Annual.

USEPA. 1998. Final Guidelines for Ecological Risk Assessment, Risk Assessment Forum, USEPA, Washington, D.C., EPA/630/R-95/002F. April.

USEPA. 1999a. Ecological Risk Assessment and Risk Management Principles for Superfund Sites. October 7, 1999. OSWER Directive 92857.7-28P.

USEPA. 1999b. National Recommended Water Quality Criteria – Correction. Office of Water. EPA 822-Z-99-001. April.

USEPA. 2000a. Ecological Soil Screening Level Guidance Draft. Appendix 3-3: Completed Literature Evaluation Scoring Sheets for Studies used to Derive Plant and Soil Invertebrate Eco-SSLs. June.

USEPA. 2000b. Integrated Risk Information Service (IRIS). Available online.

USEPA. 2001. The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments. Office of Solid Waste and Emergency Response, Eco Update. Intermittent Bulletin, Publication 9345.0-14, EPA 540/F-01/014. June.

Unitek Environmental. 1998a. April Visual Site Inspection at the Ordot Dump, Dero Road, Ordot, Guam. May 5.

Unitek Environmental. 1998b. May Visual Site Inspection at the Ordot Dump, Dero Road, Ordot, Guam. June 17.

Van den Berg, M., L. Birnbaum, A.T.C. Bosveld, B. Brunström, P. Cook, M. Feeley, J.P. Giesey, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X.R. Van Leeuwen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ. Health Perspect. 106: 775-792.

Verschueren, K. 1983. Handbook of Environmental Data on Organic Chemicals, 2nd ed. Van Nostrand Reinhold. New York, NY. 1310pp.

TABLE E-1

Toxicity Reference Values for Aquatic Organisms Exposed to Surface Water

Ordot Landfill, Territory of Guam

Chemical	Guam Numerical Criteria for Freshwater Organisms (µg/L)			USEPA AWQC Freshwater Organisms (µg/L)								Chronic Aquatic Toxicity Data				Acute Aquatic Toxicity Data			
				Total Recoverable			Dissolved			[Total] to [Dissolved] Conversion Factors		Toxicity Value				Toxicity Value			
	Chronic	Acute	Maximum Limit	Chronic	Acute	Instant Maximum	Chronic	Acute	Instant Maximum	Chronic CF	Acute CF	(µg/L)	Effect	Test Species	Reference	(µg/L)	Effect	Test Species	Reference
INORGANICS																			
Aluminum	--	--	1,000	87	750	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	--	--	--	30	88	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	150	340	--	--	--	--	150	340	--	1	1	--	--	--	--	--	--	--	--
Barium	--	--	--	--	--	--	--	--	--	--	--	4.0	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	110	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Beryllium	--	--	--	--	--	--	--	--	--	--	--	5.3	chronic toxicity	aquatic organisms	RWQCB, 2000	1.3	acute toxicity	aquatic organisms	RWQCB, 2000
Boron	--	--	--	--	--	--	--	--	--	--	--	1.6	lowest chronic value	daphnia	Suter and Tsao, 1996	30	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Cadmium	1.1 (h)	3.9 (h)	--	--	--	--	0.25 (h)	2.0 (h)	--	0.909 (h)	0.944 (h)	--	--	--	--	--	--	--	--
Chromium	210 (h)	1,700 (h)	--	--	--	--	74 (h)	570 (h)	--	0.86	0.316	--	--	--	--	--	--	--	--
Cobalt	--	--	--	--	--	--	--	--	--	--	--	23	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	1,500	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Copper	12 (h)	18 (h)	--	--	--	--	9 (h)	13 (h)	--	0.96	0.96	--	--	--	--	--	--	--	--
Cyanide	--	--	--	5.2	22	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	--	--	3,000	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	3.2 (h)	82 (h)	--	--	--	--	2.5 (h)	65 (h)	--	0.791 (h)	0.791 (h)	--	--	--	--	--	--	--	--
Manganese	--	--	--	--	--	--	--	--	--	--	--	1,270	lowest reproductive EC_{20}	fish	Suter and Tsao, 1996	2,300	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Mercury	0.012	2.4	--	--	--	--	0.77	1.4	--	0.85	0.85	--	--	--	--	--	--	--	--
Nickel	52 (h)	470 (h)	--	--	--	--	52 (h)	470 (h)	--	0.997	0.998	--	--	--	--	--	--	--	--
Nitrate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phosphorous	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	5	20	--	5	--	--	--	--	--	0.922	0.922	--	--	--	--	13	acute toxicity	aquatic organisms	NOAA, 1999
Silver	--	4.1 (h)	--	--	--	--	--	--	3.4 (h)	--	0.85	0.12	chronic toxicity	aquatic organisms	NOAA, 1999	--	--	--	--
Thallium	--	--	--	--	--	--	--	--	--	--	--	40	chronic toxicity	aquatic organisms	NOAA, 1999	1,400	acute toxicity	aquatic organisms	NOAA, 1999
Tin (as tributyltin)	0.64	0.442	--	0.063	0.46	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--	--	--	--	20	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	280	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Zinc	110 (h)	120 (h)	--	--	--	--	120 (h)	120 (h)	--	0.986	0.978	--	--	--	--	--	--	--	--
ORGANICS																			
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	--	47	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	830	secondary acute value	aquatic organisms	Suter and Tsao, 1996
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	282,170	lowest chronic value	aquatic organisms	Suter and Tsao, 1996	5,600,000	96-hour TLm	mosquitofish	Verschueren, 1983
2-Hexanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDD	--	--	--	--	--	--	--	--	--	--	--	0.011	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	0.6	acute toxicity	aqutic organisms	RWQCB, 2000
4,4'-DDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,050	acute toxicity	aqutic organisms	RWQCB, 2000
4,4'-DDT	0.001	1.1	--	0.001	--	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE E-1

Toxicity Reference Values for Aquatic Organisms Exposed to Surface Water

Ordot Landfill, Territory of Guam

	Guam Numerical Criteria for Freshwater Organisms (µg/L)			USEPA AWQC Freshwater Organisms (µg/L)								Chronic Aquatic Toxicity Data				Acute Aquatic Toxicity Data			
				Total Recoverable			Dissolved			[Total] to [Dissolved] Conversion Factors		Toxicity Value				Toxicity Value			
Chemical	Chronic	Acute	Maximum Limit	Chronic	Acute	Instant Maximum	Chronic	Acute	Instant Maximum	Chronic CF	Acute CF	(µg/L)	Effect	Test Species	Reference	(µg/L)	Effect	Test Species	Reference
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	1,585	lowest population EC_{50}	fish	Suter and Tsao, 1996	2,200	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aldrin	--	3	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	3.0	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	27	secondary acute value	aquatic organisms	Suter and Tsao, 1996
BHC-alpha	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BHC-beta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BHC-delta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BHC-gamma (lindane)	--	0.95	--	0.08	0.95	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	--	--	--	--	--	--	--	--	--	--	--	0.92	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	17	secondary acute value	aquatic organisms	Suter and Tsao, 1996
Chlordane - alpha	0.0043	2.4	--	0.0043	2.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlordane - gamma	0.0043	2.4	--	0.0043	2.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	50	chronic toxicity	aquatic organisms	RWQCB, 2000	250	acute toxicity	aquatic organisms	RWQCB, 2000
Chloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diazinon	--	--	--	0.05	0.08 (0.09p	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	0.056	0.24	--	0.056	0.24	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	3	chronic toxicity	aquatic organisms	RWQCB, 2000	940	acute toxicity	aquatic organisms	RWQCB, 2000
Endosulfan sulfate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	0.036	0.086	--	0.036	0.086	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethion	--	--	--	--	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	440	lowest chronic value	fish	Suter and Tsao, 1996	32,000	acute toxicity	aquatic organisms	RWQCB, 2000
Heptachlor	0.0038	0.52	--	0.0038	0.52	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Malathion	--	--	--	--	0.43	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methoxychlor	--	--	--	--	0.03	--	--	--	--	--	--	0.019	secondary chronic value	aquatic organisms	Suter and Tsao, 1996	0.78	48 hour LC_{50}	daphnia pulex	Verschueren, 1983
Methylene chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11,000	acute toxicity	aquatic organisms	RWQCB, 2000
Naled	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parathion - ethyl	--	--	--	0.013	0.065	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parathion - methyl	--	--	--	0.013	0.065	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCB 1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs (total)	0.014	--	--	0.014	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons (total recoverable)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	2,560	chronic toxicity	aquatic organisms	RWQCB, 2000	10,200	acute toxicity	aquatic organisms	RWQCB, 2000
Styrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	59,300	96hr-TLm	Fathead minnow	Verschueren, 1983
Toluene	--	--	--	--	--	--	--	--	--	--	--	1,269	lowest chronic value	fish	Suter and Tsao, 1996	17,500	acute toxicity	aquatic organisms	RWQCB, 2000
Vinyl acetate	--	--	--	--	--	--	--	--	--	--	--	810	lowest chronic value	fish	Suter and Tsao, 1996	18,000	96 hour TLm	bluegill sunfish	Verschueren, 1983

TABLE E-1

Toxicity Reference Values for Aquatic Organisms Exposed to Surface Water

Ordot Landfill, Territory of Guam

	Guam Numerical Criteria for Freshwater Organisms (µg/L)			USEPA AWQC Freshwater Organisms (µg/L)								Chronic Aquatic Toxicity Data				Acute Aquatic Toxicity Data			
				Total Recoverable			Dissolved			[Total] to [Dissolved] Conversion Factors		Toxicity Value				Toxicity Value			
Chemical	Chronic	Acute	Maximum Limit	Chronic	Acute	Instant Maximum	Chronic	Acute	Instant Maximum	Chronic CF	Acute CF	(µg/L)	Effect	Test Species	Reference	(µg/L)	Effect	Test Species	Reference
Xylenes (total)	--	--	--	--	--	--	--	--	--	--	--	2,680	lowest reproduction EC_{20}	aquatic life	Suter and Tsao, 1996	42,000	96 hour LC_{50}	fathead minnow	Verschueren, 1983

Sources:

Guam Water Quality Standards. Guam Environmental Protection Agency (GEPA). 2001 Revision

Ambient Water Quality Critieria (AWQC). USEPA. 1999b. *National Recommended Water Quality Criteria - Correction* . Office of Water. EPA 822-Z-99-001. April

Notes:

acute and chronic toxicity data were obtained primarily for those chemicals without any other screening values.

(h) Hardness-dependent criteria. Value listed assumes a hardness of 100 mg/L.

(p) Proposed value

-- Not available.

AWQC - Ambient Water Quality Criteria

EC_{20} - Effective concentration; 20% adverse effect.

EC_{50} - Effective concentration; 50% adverse effect.

LC_{50} - Lethal concentration; 50% mortality.

PCB - Polychlorinated biphenyl

TLm - Median tolerance limit.

µg/L - Micrograms per liter.

USEPA - United States Environmental Protection Agency

TABLE E-2
Toxicity Reference Values for Freshwater Sediment
Ordot Landfill, Territory of Guam

Analyte	Sediment Benchmarks (mg/kg DW)													Sediment TRV (mg/kg)
	MacDonald et al., 2000 [A]		NOAA [B]				ARCS [C]			Environment Canada [D]		Ontario ME [E]		
	TEC	PEC	Lowest ARCs H. Azteca TEL	TEL	PEL	UET	TEC	PEC	NEC	ISQG	PEL	Low	Severe	
INORGANICS														
Aluminum	--	--	25,000	--	--	--	--	58,030	73,160	--	--	--	--	25,000
Antimony	--	--	--	--	--	3 M	--	--	--	--	--	--	--	3
Arsenic	9.79	33	10.8	5.9	17	--	12.1	57	92.9	5.9	17	6	33	9.79
Barium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Boron	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	0.99	4.98	0.583	0.596	3.53	3 I	0.592	11.7	41.1	0.6	3.5	0.6	10	0.99
Chromium	43.4	111	36.2	37.3	90	95 H	56	159	312	37.3	90	26	110	43.4
Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	31.6	149	28	35.7	197	86 I	28	77.7	54.8	35.7	197	16	110	31.6
Iron	--	--	188,400	--	--	40,000 I	--	--	--	--	--	20,000	40,000	20,000
Lead	35.8	128	37	35	91.3	127 H	34.2	396	68.7	35	91.3	31	250	35.8
Manganese	--	--	630	--	--	1100 I	1673	1081	819	--	--	460	1110	460
Mercury	0.18	1.06	--	0.174	0.486	0.56	--	--	--	0.17	0.486	0.2	2	0.18
Nickel	22.7	48.6	19.5	18	35.9	43 H	39.6	38.5	37.9	--	--	16	75	22.7
Selenium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	--	--	--	--	--	4.5 H	--	--	--	--	--	--	--	4.5
Thallium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	121	459	98	123.1	315	520	159	1532	541	123	315	--	--	121

Notes:

If a TEC was available that was selected as the TRV. If no TEC was available then the most conservative value from the remaining benchmarks was selected.

[A] MacDonald, D.D., C.G. Ingersoll, T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

TEC = below which harmful effects are unlikely to be observed

PEC = above which harmful effects are likely to be observed

[B] NOAA, 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages.

TEL = Threshold Effects Limit

PEL = Probable Effects Limit

UET = Upper Effects Threshold

I = Infaunal community impacts

TABLE E-2
Toxicity Reference Values for Freshwater Sediment
Ordot Landfill, Territory of Guam

Analyte	Sediment Benchmarks (mg/kg DW)												Sediment TRV (mg/kg)
	MacDonald et al., 2000 [A]		NOAA [B]				ARCS [C]			Environment Canada [D]		Ontario ME [E]		
	TEC	PEC	Lowest ARCs H. Azteca TEL	TEL	PEL	UET	TEC	PEC	NEC	ISQG	PEL	Low	Severe	

H = Hyalella azteca bioassay

M = microtox bioassay

AET- Apparent Effects Threshold-this benchmark is for marine sediment and was used only for chemicals that had no fresh water benchmarks

[C] USEPA. 1996c. Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella azteca and the midge Chironimus riparius. Assessment and Remediation of Contaminated Sediments Program. September

TEC= threshold effect concentration

PEC = Probable Effect Concentration

NEC = high No Effect Concentration from EPA (1996)

[D] Canadian Council of Ministers of the Environment (CCMOE). 1999. Canadian Sediment Quality Guidelines for Protection of Aquatic Life: Summary Table. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Minis

ISQG = Interim freshwater sediment guidelines

PEL = probable effect level

[E] Persuad D. and R. Jaagumagi. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment. August.

Low-lowest effect level and is the 5th percentile of the screening level concentration except when noted

Severe-severe effect level and is 95th percentile of the screening level concentration except where noted, source document is Persaud et al. (1993); values for organic chemicals were normalized assuming 1% TOC

TABLE E-3

Water Quality Goals for Human Health via Exposure to Groundwater or Surface Water

Ordot Landfill, Territory of Guam

	Groundwater (µg/L)							Surface Water (µg/L)			
	Guam Water Quality Standards		USEPA Clean Water Act		USEPA IRIS Drinking Water Risk			Guam Numerical Criteria		USEPA AWQC	
Chemical	Primary	Secondary	Primary MCL	Secondary MCL	Reference Dose	10-6 Cancer Risk	Taste/Odor Threshold	water + aquatic organisms	aquatic organism only	water + aquatic organisms	aquatic organism only
INORGANICS											
Aluminum	--	50-200	--	50-200	--	--	--	--	--	--	--
Ammonia	--	--	--	--	--	--	500	--	--	--	--
Antimony	6	--	6	--	2.8	--	--	14	4,300	14	4,300
Arsenic	50	--	10	--	2.1	0.02 (A)	--	5	--	0.018	0.14
Barium	2,000	--	2000	--	490	--	--	--	--	1,000	--
Beryllium	4	--	4	--	14	--	--	--	--	--	--
Boron	--	--	--	--	630	--	--	--	--	--	--
Cadmium	5	--	5	--	3.5	--	--	--	--	--	--
Chromium	100 (total)	--	100 (total)	--	--	10,500 (CrIII)	--	--	--	--	--
Cobalt	--	--	--	--	--	--	--	--	--	--	--
Copper	1,300	1,000	1,300	1,000	--	--	--	1,300	--	1,300	--
Cyanide	200	--	200	--	140	--	--	700	200,000	700	220,000
Iron	--	300	--	300	--	--	--	--	--	--	--
Lead	15	--	15	--	--	--	--	--	--	--	--
Manganese	--	50	--	50	330	--	--	--	--	--	100
Mercury	2	--	2	--	--	--	--	0.05	0.051	0.05	0.051
Nickel	100	--	--	100	140	--	--	610	4,600	610	4,600
Nitrate	10,000	--	10,000	--	11,000	--	--	--	--	10,000	--
Nitrite	1,000	--	1,000	--	700	--	--	--	--	--	--
Phosphorous	--	--	--	--	0.14	--	--	--	--	--	--
Selenium	50	--	50	--	35	--	--	--	--	170	11,000
Silver	--	100	--	100	35	--	--	--	--	--	--
Thallium	0.5	--	2	--	0.6	--	--	1.7	6.3	1.7	6.3
Tin (as tributyltin)			--	--	2	--	--			--	--
Vanadium	--	--	--	--	63	--	--	--	--	--	--
Zinc	--	5,000	--	5,000	2,100	--	--	9,100	69,000	9,100	69,000
ORGANICS											
1(3H)-isobenzofuranone	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--	--	--	--
2-Ethyl-1-hexanol	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDD	--	--	--	--	--	0.1 (B2)	--	0.00083	0.00084	0.00083	0.00084
4,4'-DDE	--	--	--	--	--	0.1 (B2)	--	0.00059	0.00059	0.00059	0.00059
4,4'-DDT	--	--	--	--	--	0.1 (B2)	--	0.00059	0.00059	0.00059	0.00059
4-Methyl-2-pentanone	--	--	--	--	--	--	1,300	--	--	--	--
Acetone	--	--	--	--	700	--	20,000	--	--	--	--
Aldrin	--	--	--	--	--	0.002 (B2)	--	0.00013	0.00014	0.00013	0.00014
BHC-alpha	--	--	--	--	--	0.006 (B2)	--	0.0039	0.013	0.0039	0.013
BHC-beta	--	--	--	--	--	0.02 (C)	--	0.014	0.046	0.014	0.046
BHC-delta	--	--	--	--	--	--	--	--	--	--	--
BHC-gamma (lindane)	0.2	--	0.2	--	0.2	--	--	0.019	0.063	0.019	0.063
Bis(2-ethylhexyl)phthalate	6	--	6	--	--	3 (B2)	--	1.8	5.9	1.8	5.9
Carbon disulfide	--	--	--	--	700	--	0.39	--	--	--	--
Chlordane - alpha	2	--	2	--	0.42	0.03 (B2)	--	0.0021	0.0022	0.0021	0.0022
Chlordane - gamma	2	--	2	--	0.42	0.03 (B2)	--	0.0021	0.0022	0.0021	0.0022
Chlorobenzene	--	--	100	--	140	--	20	380	21,000	680	21,000
Chloroethane	--	--	--	--	--	--	--	--	--	--	--
Chloroform	100	--	100(t) 80(n)	--		6 (B2)	2,400	5.7	470	5.7	470
Diazinon	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	0.002 (B2)	--	0.00014	0.00014	0.00014	0.00014
Diethylphthalate	--	--	--	--	5,600	--	--	23,000	120,000	23,000	120,000
Di-n-butylphthalate	--	--	--	--	700	--	--	2,700	12,000	2,700	12,000
Endosulfan sulfate	--	--	--	--	--	--	--	110	240	110	240
Endrin	2	--	2	--	2	--	--	0.76	0.81	0.76	0.81
Ethion	--	--	--	--	3.5	--	--	--	--	--	--
Ethylbenzene	700	--	700	30	700	--	29	3,100	29,000	3,100	29,000
Heptachlor	0.4	--	0.4	--	--	0.008 (B2)	--	0.00021	0.00021	0.00021	0.00021
Malathion	--	--	--	--	140	--	--	--	--	--	--
Methoxychlor	40	--	40	--	35	--	4,700	--	--	100	--

TABLE E-3

Water Quality Goals for Human Health via Exposure to Groundwater or Surface Water

Ordot Landfill, Territory of Guam

	Groundwater (µg/L)							Surface Water (µg/L)			
	Guam Water Quality Standards		USEPA Clean Water Act		USEPA IRIS Drinking Water Risk			Guam Numerical Criteria		USEPA AWQC	
Chemical	Primary	Secondary	Primary MCL	Secondary MCL	Reference Dose	10-6 Cancer Risk	Taste/Odor Threshold	water + aquatic organisms	aquatic organism only	water + aquatic organisms	aquatic organism only
Methylene chloride	5	--	5	--	420	5 (B2)	9,100	4.7	1,600	4.7	1,600
Naled	--	--	--	--	14	--	--	--	--	--	--
Parathion - ethyl	--	--	--	--	4.2	--	--	--	--	--	--
Parathion - methyl	--	--	--	--	4.2	--	--	--	--	--	--
PCB 1016	--	--	--	--	--	--	--	--	--	--	--
PCB 1221	--	--	--	--	--	--	--	--	--	--	--
PCB 1232	--	--	--	--	--	--	--	--	--	--	--
PCB 1242	--	--	--	--	--	--	--	--	--	--	--
PCB 1248	--	--	--	--	--	--	--	--	--	--	--
PCB 1254	--	--	--	--	--	--	--	--	--	--	--
PCB 1260	--	--	--	--	--	--	--	--	--	--	--
PCBs (total)	0.5	--	0.5	--	--	0.1 (B2)	--	0.00017	0.00017	0.00017	0.00017
Petroleum Hydrocarbons (total recoverable)	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	4,200	--	300	21,000	4,600,000	21,000	4,600,000
Styrene	100	--	100	10	140	--	11	--	--	--	--
Toluene	1,000	--	1,000	40	1,400	--	42	6,800	200,000	6,800	200,000
Vinyl acetate	--	--	--	--	--	--	88	--	--	--	--
Xylenes (total)	10,000	--	10,000	20	14,000	--	17	--	--	--	--

Sources:

Guam Water Quality Standards. Guam Environmental Protection Agency (GEPA). 2001 Revision

Ambient Water Quality Critieria (AWQC). USEPA. 1999b. *National Recommended Water Quality Criteria - Correction* . Office of Water. EPA 822-Z-99-001. Apri

Clean Water Act (MCLs). California Environmental Protection Agency - Regional Water Quality Control Board (RWQCB) - Central Valley Region. 2000. *A Compilation of Water Quality Goals* . August, with periodic updates.

IRIS Drinking Water Values. RWQCB, 2000.

Taste and Odor Thresholds. RWQCB, 2000.

Notes:

(h) Hardness-dependent criteria. Value listed assumes a hardness of 100 mg/L.

(n) New value - effective 12/17/2001 for systems serving >10,000 people and effective 12/17/2003 for all other systems.

(p) Proposed value

(t) Total for trihalomethanes - sum includes chloroform, bromoform, bromodichlormethane, and dibromochloromethane

-- Not available.

AWQC - Ambient Water Qualtiy Criteria

PCB - Polychlorinated biphenyl

µg/L - Micrograms per liter.

USEPA - United States Environmental Protection Agency