



USAID
FROM THE AMERICAN PEOPLE

| **VIETNAM**

ENVIRONMENTAL REMEDIATION AT DANANG AIRPORT CONSTRUCTION MANAGEMENT AND OVERSIGHT

FINAL FY 2014 and FY 2015 Project Environmental Mitigation and Monitoring Plan (EMMP) Update

September 28, 2014

This document was produced for review by the United States Agency for International Development. It was prepared by CDM International, Inc. (CDM Smith).

Environmental Remediation at Danang Airport Construction Management and Oversight

FY 2014 and FY 2015 Project EMMP Update

FINAL

Prepared by: Alexis Lopez, Randa Chichakli, and Beau Sanders
Organization: CDM International, Inc. (CDM Smith)
Submitted to: James Brown
United States Agency for International Development (USAID)
Contracting Officer's Representative (COR)
USAID Contract No.: AID-EDH-I-00-08-00023
USAID Order No.: AID-486-TO-12-00001
Report Date: September 28, 2014

Contents

SECTION 1	INTRODUCTION.....	1-1
1.1	Background.....	1-1
1.2	Project Description.....	1-5
1.3	Environmental Legislation and Documentation	1-6
1.4	Project Objectives.....	1-8
1.5	Project Challenges.....	1-9
1.6	EMMP Update and Lessons Learned.....	1-10
	1.6.1 Update.....	1-10
	1.6.2 Lessons Learned.....	1-10
1.7	Evolution of the Environmental Process and Supporting Documents.....	1-11
1.8	Regulatory Requirements	1-13
SECTION 2	ROLES AND RESPONSIBILITIES	2-1
2.1	Project Stakeholders.....	2-1
2.2	GVN.....	2-2
2.3	USAID.....	2-3
2.4	Construction Management Contractor	2-3
2.5	Excavation and Construction Contractor	2-4
	2.5.1 Work Responsibilities.....	2-4
	2.5.2 Post-Work Responsibilities.....	2-4
	2.5.3 Submittals.....	2-5
2.6	IPTD Contractor	2-5
	2.6.1 Work Responsibilities.....	2-5
	2.6.2 Post-Work Responsibilities.....	2-6
	2.6.3 Submittals.....	2-6
SECTION 3	Environmental Mitigation Measures and Monitoring Requirements	3-1
3.1	Mitigation Measures and Monitoring During Remediation.....	3-1
3.2	EMMP Reporting.....	3-1
SECTION 4	Gender Considerations.....	4-1
SECTION 5	Revisions to the EMMP	5-1
5.1	Updating the Project EMMP.....	5-1
5.2	Requirements for Flexibility and Adaptability in Implementation of the Project EMMP	5-1
	5.2.1 Unexpected Environmental and Socioeconomic Impacts Triggering Project Design Modifications, Environmental Review of Design Modifications, and Possible Revisions to Project EMMP	5-2
	5.2.2 Review and Possible Revisions to Project EMMP to Strengthen Existing Mitigation and Monitoring Programs.....	5-2
SECTION 6	References.....	6-1

FIGURES

Figure 1	Dioxin Hotspots Identified at Da Nang Airport.....	1-3
Figure 2	Project Areas and Site Layout.....	1-4
Figure 3	Project Organizational Chart.....	2-2
Figure 4	Monitoring Locations for Surface and Wastewater.....	3-8
Figure 5	Monitoring Locations for Groundwater.....	3-9
Figure 6	Monitoring Locations for Air Quality	3-12

TABLES

Table 1	Volume and Area of Contaminated Material.....	1-5
Table 2	Maximum and Average Concentrations of Contaminated Material	1-5
Table 3	Environmental mitigation measures for project impacts on surface water quality and groundwater quality.....	3-3
Table 3A	Surface Water and Wastewater Sampling	3-5
Table 3B	Surface Water Sampling to be Conducted After Remediation is Complete.....	3-6
Table 3C	Groundwater Well Sampling.....	3-7
Table 4	Environmental mitigation measures for project impacts on air quality.....	3-10
Table 4A	Ambient Air Sampling	3-11
Table 4B	IPTD Vapor/Air Sampling.....	3-11
Table 5	Environmental mitigation measures for project impacts on noise levels	3-13
Table 6	Environmental mitigation measures for project impacts on GHG emissions	3-13
Table 7	Environmental mitigation measures for project impacts on terrestrial ecosystems and biodiversity, and wetlands/aquatic ecosystems and aquatic biodiversity	3-13
Table 8	Environmental mitigation measures for project impacts on generation of solid waste.....	3-14
Table 9	Environmental mitigation measures for project impacts on human health.....	3-14
Table 10	Environmental mitigation measures for project impacts related to environmental risks and hazards.....	3-15
Table 11	Other environmental mitigation measures.....	3-15
Table 12	Summary of Environmental Sampling Requirements by Activity	3-16

APPENDICES

Appendix A	List of Vietnamese Standards and Technical Specifications
------------	---

ACRONYMS AND ABBREVIATIONS

ACI	American Concrete Institute
ADAFAC	Air Defense Air Force Command
Airport	Da Nang Airport
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
BEO	Bureau Environmental Officer
BTV	baseline threshold value
CAAV	Civil Aviation Administration of Vietnam
CDM Smith	CDM International Inc.
CFR	Code of Federal Regulations
CMC	Construction Management Contractor
COPC	contaminant of potential concern
COR	Contracting Officer Representative
dBA	decibel (A-weighted measurement)
D&H	Dig and Haul
DONRE	Department of Natural Resources and Environment
dscm	dry standard cubic meter
DU	decision unit
E	effluent
EA	Environmental Assessment
ECC	Excavation and Construction Contractor
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan
EPP	Environmental Protection Plan
ESS	Environmental Scoping Statement
EV	extracted vapors
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulation
GAC	granular activated carbon
GFH	granular ferric hydroxide
GHG	greenhouse gas
GVN	Government of Vietnam
ha	hectare
H&S	health and safety
HASP	Health and Safety Plan
Hatfield	Hatfield Consultants
HCl	hydrochloric acid

I	influent
IBC	International Building Code
IEE	Initial Environmental Examination
IEEE	Institute of Electric and Electronic Engineers
Int	interim
IPTD	In-Pile Thermal Desorption
km/hr	kilometers per hour
km ²	square kilometer
LVTP	liquid vapor treatment plant
m ²	square meter
m ³	cubic meter
MAA	Middle Airports Authority
MAC	Middle Airports Corporation
MCL	Maximum Contaminant Level
mg/m ³	milligrams per cubic meter
mg/L	milligrams per liter
MLA	former Mixing and Loading Area
MND	Vietnamese Ministry of National Defense
MONRE	Ministry of Natural Resources and Environment
MPPE	macro porous polymer extraction
NA	not applicable
NAPL	non-aqueous phase liquid
NDR	peak detected but did not meet quantification criteria
NEMA	National Electric Manufacturers Association
NESC	National Electric Safety Code
ng/L	nanograms per liter
NGO	non-governmental organization
ngTEQ/m ³	nanograms of TEQ per cubic meter
NIP	National Implementation Plan
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
Office 33	Office of the National Steering Committee 33
O&M	Operations and Maintenance
PAH	polycyclic aromatic hydrocarbon
pg/L	picograms per liter
POP	persistent organic pollutant
PPE	personal protective equipment
PISA	former Pacer Ivy Storage Area
ppt	parts per trillion
QAPP	Quality Assurance Project Plan
SA	former Storage Area
SAP	Sampling and Analysis Plan

SVOC	semi-volatile organic compound
TCDD	tetrachlorodibenzo-p-dioxin
TCP	Traffic Control Plan
TCVN	Vietnam National Standard
TEQ	toxicity equivalent
UCL	upper confidence limit
µg/L	micrograms per liter
UL	Underwriters Laboratories, Inc.
U.S.	United States
USAID	United States Agency for International Development
USG	United States Government
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VAST	Vietnam Academy of Science and Technology

Approval/Acknowledgement Page

Beau Sanders, Chief of Party, CDM Smith

Alexis Lopez, CDM Smith Environmental Compliance Specialist

David Liu, Chief of Party, TetraTech

Binh Thanh Nguyen, TetraTech Sampling Technician

Glenn Anderson, Chief of Party, TerraTherm

Tim Burdett, TerraTherm Sampling Technician

Section I

Introduction

Areas within the Da Nang Airport (Airport) property have been referred to as dioxin "hotspots" due to investigations revealing high dioxin concentrations remaining decades after large volumes of Agent Orange and other defoliants were handled at these sites. The Government of Vietnam (GVN) has requested assistance from the United States Government (USG) to remediate dioxin-contaminated soil and sediment at the Airport.

The purpose of this Project Environmental Mitigation and Monitoring Plan (EMMP) is to provide general and site-specific measures for mitigating potentially harmful effects to environmentally-sensitive resources surrounding the Airport during remediation of the Airport.

This Project EMMP will serve as a guidance document for the United States Agency for International Development (USAID), GVN, and the Implementing Contractors (Construction Management Contractor [CMC], Excavation and Construction Contractor [ECC], and In-Pile Thermal Desorption [IPTD] contractor) as remediation proceeds. **The CMC is responsible for ensuring that all activities in the EMMP are fully implemented and documented to USAID.**

I.1 Background

Da Nang City has a population of approximately 825,000 persons as of 2008, with an average population density of about 640 persons per square kilometer (km²). The Airport property (Figure 1) is located within the urban part of Da Nang City and is surrounded by three urban districts: Hai Chau on the northeast and east; Thanh Khe on the northwest and west, and Cam Le on the southwest, south, and southeast. The three districts are densely-populated, with most of the land in these districts used for housing, industrial facilities, transportation, and other facilities. A number of people reside on the western, northern, and northeastern edges of the Airport property in close proximity to the active runways, Sen Lake, and wetlands (Figure 2). These are likely military personnel and their families (USAID 2010a).

The Airport property is located within Da Nang City and is used by both the Vietnamese Ministry of National Defense (MND) and the Middle Airports Corporation (MAC) under the Civil Aviation Administration of Vietnam (CAAV). It has a total area of 820 hectare (ha), of which 150 ha are allocated to civil aviation, and the remaining 670 ha are under the jurisdiction of the MND. It is an international airport, with flights arriving from and departing to cities such as Vientiane, Hong Kong, Phnom Penh, Tokyo and Taipei. MAC is currently expanding the Airport and requires dioxin removal from the northern area of the airport property to allow for extension of the runway and expanded taxiways (USAID 2010a).

Dioxin is a toxic chemical associated with a range of health effects. 2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD) is the most toxic form of dioxin, and was the main congener present in the Agent Orange mixture. In the main hotspot areas of the Airport, TCDD comprises greater than 90 percent of the toxicity equivalent (TEQ), indicating Agent Orange as the source of contamination. GVN has established a national cleanup standard for dioxin of 1,000 parts per trillion (ppt) TEQ in soil and 150 ppt TEQ in sediment (USAID 2010a).

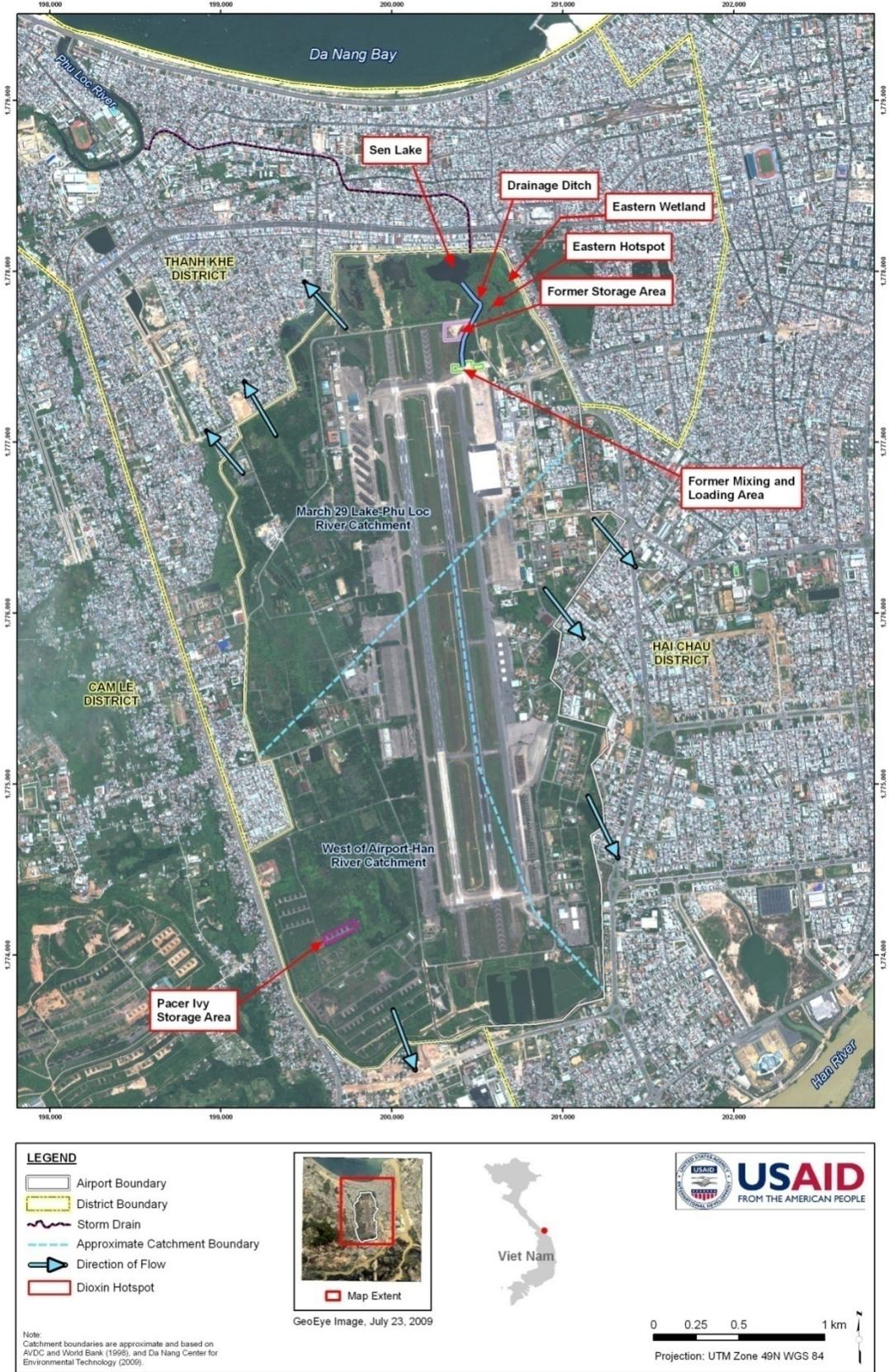
Data from studies conducted from 1997 to 2010 by the 10-80 Division of the Ministry of Health, the Vietnam Academy of Science and Technology (VAST), the Ministry of Natural Resources and Environment (MONRE), MND, Office of the National Steering Committee 33 (Office 33), the United States Environmental Protection Agency (USEPA), Hatfield Consultants (Hatfield), and USAID have been used to characterize the level and extent of dioxin contamination at the Airport. This includes sampling conducted in January 2010 and August 2010 to support the USAID-approved Environmental Assessment (EA) (USAID 2010a) and detailed engineering designs.

Dioxin hotspots identified at the Airport are primarily located in the northern portion of the Airport property (Figures 1 and 2) and include the following areas:

- 1.1 ha former Mixing and Loading Area (MLA)
- 1.8 ha former Storage Area (SA)
- 3.3 ha Drainage Ditch
- 1.9 ha Area between Eastern Wetland and Drainage Ditch (including the Eastern Hotspot)
- 10.8 ha Sen Lake and Eastern Wetland
- 0.3 ha former Pacer Ivy Storage Area (PISA)

Using the GVN dioxin cleanup goals for soil and sediment, the remediation effort will need to address an approximate volume of 109,950 cubic meters (m³) of contaminated material in the six hotspots at the Airport. Table 1 provides the minimum estimated excavation volume (m³) and footprint (square meters [m²]) for each hotspot (not including unforeseen allowances). Table 2 provides the maximum and average dioxin concentrations for each hotspot.

Figure I: Dioxin Hotspots Identified at Da Nang Airport



K:\Data\Project\USAID\451\GIS_MXD\EA\USAID\451_EA_Map_0_ProjectOverview_20100528.mxd

Figure 2: Project Areas and Site Layout

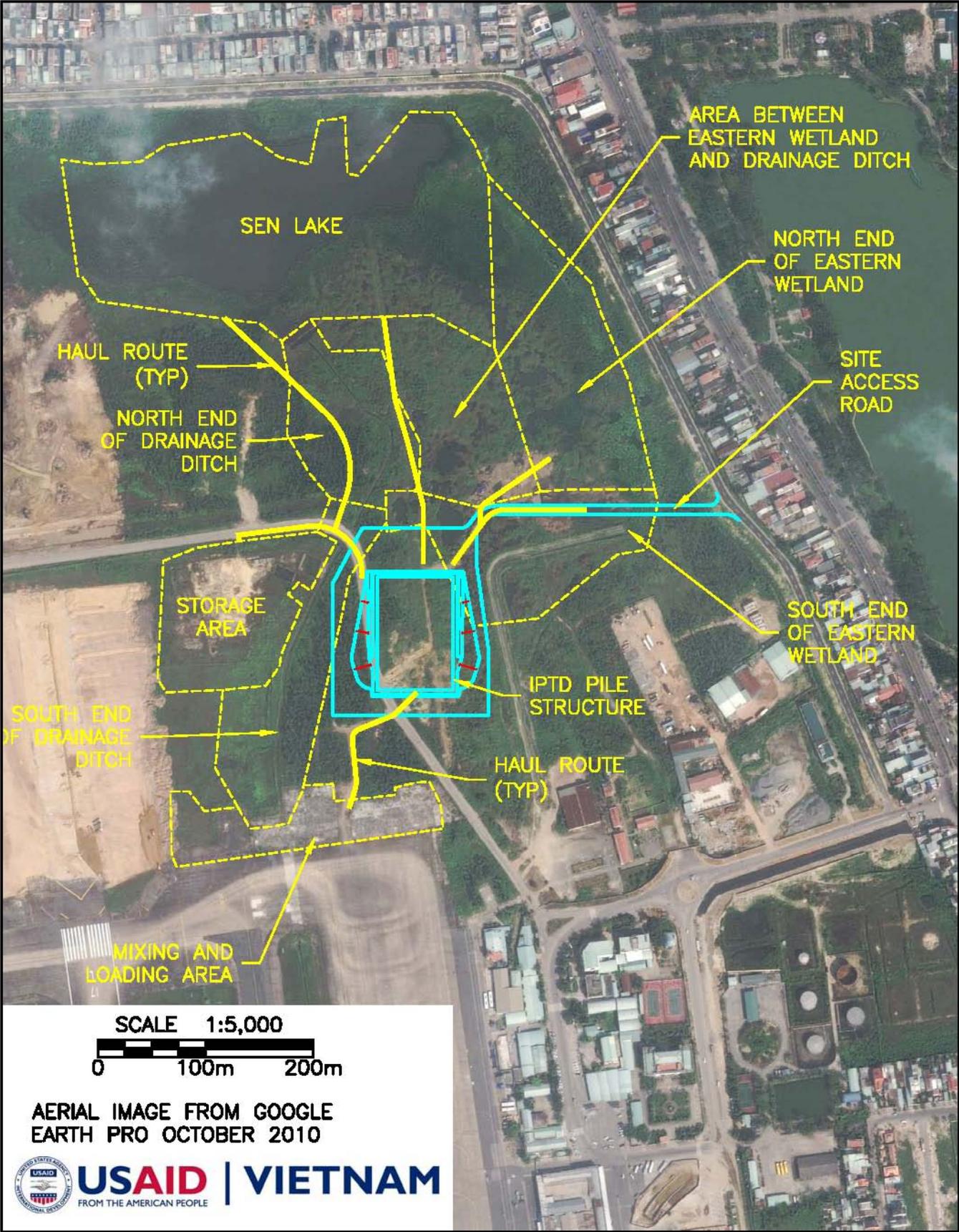


Table 1. Volume and Area of Contaminated Material

Hotspot	Minimum Volume (m ³)	Area (m ²)
MLA	15,600	11,000
SA	18,450	17,500
Drainage Ditch (soil)	16,000	24,600
Drainage Ditch (sediment)	3,13,000	8,300
Area between Eastern Wetland and Drainage Ditch	6,300	18,700
Sen Lake and Eastern Wetland	39,000	107,900
PISA	1,600	3,400
Total	109,950	191,400

Reference: USAID2010a.

Table 2. Maximum and Average Concentrations of Contaminated Material

Hotspot	Maximum 2,3,7,8-TCDD (as TEQ) Concentration (ppt)	Average 2,3,7,8-TCDD (as TEQ) Concentration (ppt)
MLA	365,000	17,500
SA	106,000	9,000
Drainage Ditch	13,100	5,600 (soil), 3,700 (sediment)
Sen Lake, Eastern Wetland, and Area between Eastern Wetland & Drainage Ditch	6,820	1,400
PISA	20,600	1,300

Reference: USAID2010a.

1.2 Project Description

IPTD will be implemented to treat the soil and sediment contaminant of concern (i.e., TCDD) that is present at the Airport due to handling of Agent Orange in Vietnam. The remediation project is separated into three primary components:

- Dig and haul (D&H) (i.e., excavation and construction)
- IPTD pile structure
- IPTD treatment system

The ECC shall be responsible for the first two components, which include the excavation, handling, and transportation of contaminated soil as well as the construction, filling, and emptying of the IPTD pile structure. The IPTD contractor shall be responsible for the installation, operation, and maintenance of the thermal system in the IPTD pile structure. USAID will also retain a CMC who will be responsible for the overall construction management, supervision, and oversight of the remediation activities being performed by the ECC and the IPTD contractor.

In order to treat the large volume of contaminated sediment and soils identified at the Airport, a two-phased approach will be implemented to treat the contaminated soils and sediments incrementally. For Phase I, approximately one-half of the contaminated soil/sediment will be excavated, an IPTD structure will be built (Figure 2) and filled with the excavated soil/sediment (sediments will be stockpiled outside the IPTD structure and allowed to undergo free drainage prior to being placed into the IPTD structure),

and the soils/sediments will be treated using IPTD. Following completion of the Phase I treatment, the treated soils/sediments will be removed from the IPTD pile structure and placed in designated on-site areas by the ECC. For Phase II, the remaining soil/sediment will be excavated and used to refill the IPTD structure, treated, and removed.

1.3 Environmental Legislation and Documentation

This Project EMMP provides general and site-specific measures for mitigating potentially harmful effects to potential sensitive environmental and social attributes/receptors surrounding the Airport. The legal and technical basis for the Project EMMP is as follows.

Laws and Regulations

- United States (U.S.) Foreign Assistance Act (FAA) Section 117 and 22 Code of Federal Regulations (CFR) 216, Automated Directive System (ADS) 201.5 and 204 – Environmental Compliance
- FAA 611(a)(1) – Adequate Planning
- U.S. Brooks Act and U.S. Federal Acquisition Regulation (FAR) Part 36--Engineering Integrity
- USAID ADS 201.3.9.3--Gender Considerations
- USAID Title 22CFR Part 216, Environmental Compliance Procedures
- May 2011 Agreement between USAID and MND, Implementation of the Project on Environmental Remediation of Dioxin Contamination at Da Nang Airport
- Vietnamese Construction Regulation Standard Article 3.3
- Vietnam Labor Code, Article 113 of Chapter X – Gender Restrictions on Employment at Hazardous Waste Sites
- Vietnam National Law on Environmental Protection: No. 52/2005/QH11
- Vietnam National Standard (TCVN) 8183: 2009--Dioxin Thresholds in Soils and Sediments; Decision No. 1762/QD-BKHCHN by Science and Technology Minister dated August 27, 2009
- Vietnam Law on Gender Equality Article 13, Section 1, 3a
- Vietnam Law on Construction No. 16-2003-QH11
- Vietnam Decision No 64/2003/QD-TTg of the Prime Minister of the Government approving the plan for thoroughly handling establishments which cause serious environmental pollution
- Vietnam Decision No. 67/2004/QD-TTg dated 27 April 2004 of the Prime Minister regarding the approval of the Action Plan for the Period of 2004-2010 in Overcoming Consequences of Toxic Chemicals
- Vietnam Decree No 68/2005/ND-CP dated 20/5/2005 and Government Circular No. 12/2006/TT-BCN guiding the implementation of the Decree stipulate that unsafe chemicals must be treated appropriately
- Vietnam Announcement No 69/2002 of the Political Bureau directs the Government to strengthen international cooperation in preventing and overcoming consequences of the use of toxic chemicals in the War

- Decree No. 81/2007/ND-CP, Providing for Specialized Environmental Protection Organizations and Sections in Charge of Environmental Protection in State Agencies and State Enterprises
- Vietnam Decision 155/1999/QD-TTg of the Prime Minister of the Government on promulgating regulation of hazardous waste management
- Vietnam Decision of the Prime Minister No 184/2006/QD-TTg (8/2006) approving the National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants
- Circular No. 05/2008/TT-BTNMT, Guide to Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitment.

Guidance

- U.S. Hazardous Waste Clean Up Process
- U.S. Occupational Health and Safety Administration(OSHA) Standards—29 CFR 1910—for health and safety (H&S) (monitoring activity)
- 40 CFR 264 Hazardous Waste Disposal Regulations
- USEPA’s Draft Recommended Interim Preliminary remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites. December 30, 2009
- USEPA’s Reanalysis of Key Issues Related to Dioxin Toxicity and Response to National Academy of Sciences Comments. February 17, 2012.
- USEPA National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs).
- Vietnam Circular No. 05/2008/TT-BTNM--Guide to Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitment
- Vietnam Decree No. 21/2008/ND-CP-- Amending and Supplementing a Number of Articles of Government Decree No. 80/2006/ND-CP, Detail and Guide to the Implementation of a Number of Articles of the Law on Environmental Protection
- Vietnam Decree No. 80/2006/ND-CP--Detail and Guide to the Implementation of a Number of Articles of the Law on Environmental Protection
- Vietnam Decision No. 60/2002/QD BKHCMNT, guidance for the design of hazardous waste landfills

The list of Vietnamese standards and technical specifications used in the preparation of this Project EMMP is provided in Appendix A and the list of supporting references used in the preparation of this Project EMMP is provided in Section 6.

Vietnam is a signatory to the following international conventions and agreements that are of direct or potential relevance to this Project:

- **Stockholm Convention on Persistent Organic Pollutants.** Vietnam became a signatory to the Stockholm Convention on Persistent Organic Pollutants (POPs) on May 23, 2001 and ratified the Convention on July 22, 2002. Key stipulations and obligations include:
 - **Article 6** requires the reduction of elimination of releases from stockpiles and wastes.

- **Article 7** requires the development of implementation plans to implement obligations under the convention.
- **Article 10** requires the promotion of public information, awareness and education.
- **Article 11** stipulates the requirement for research, development, and monitoring regarding sources and releases into the environment, transport and fate, and effects on human health and environment.
- PCDD and PCDF are covered by the Convention under **Annex C**.
- **Convention on Biological Diversity.** Contains articles on various aspects of biodiversity conservation, identification, and monitoring that will need to be considered as part of the EA. Vietnam ratified the Convention on Biological Diversity on November 16, 1994. Key stipulations and obligations include:
 - **Article 7(c)** requires the GVN to identify processes and activities that have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity.
 - **Article 14** requires the GVN to minimize adverse effects on biodiversity including environmental impact assessment of proposed projects that may affect biodiversity resources.
- **Convention on Wetlands of International Importance (Ramsar Convention).** Provides a framework for the maintenance of ecological character for wetlands through national land-use planning, policies and legislation, management actions, and public education. Vietnam became a signatory to the Ramsar Convention on January 20, 2001. Key stipulations and obligations include:
 - **Article 3 No. 2:** Each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference.
- **World Heritage Convention.** Defines the roles and obligations of ratified states in protecting and preserving areas of cultural and natural heritage. Key stipulations and obligations include:
 - **Article 5** centers on effective and active measures for the protection and conservation of cultural and natural heritage and requires the GVN to take appropriate measures necessary for the identification, protection, conservation, presentation and rehabilitation of its cultural and natural heritage

1.4 Project Objectives

The GVN has established a national cleanup standard for dioxin of 1,000 ppt TEQ in soil and 150 ppt TEQ in sediment per Vietnam National Standard (TCVN) 8183:2009 (National Standard 8183: Dioxins threshold in the soil and sediment). The primary project objective is to remediate all dioxin-contaminated soil and sediment to below GVN national cleanup standards. The project will use the 95 percent upper confidence limit (UCL) of the mean for the IPTD-treated piles to achieve this goal.

The primary project objective, once completed, will drastically improve site conditions and result in a safer environment. However, the potential interim environmental impact of the project during

implementation is substantial as it requires the excavation, transport, and deposition of large volumes of dioxin-contaminated soil and sediment from the hotspots to the treatment area. Impacts to wetlands and terrestrial and aquatic biota are unavoidable over the short term, in order to eliminate the possibility of future dioxin exposure to humans and the environment. While the remediation activities are underway, there are potential environmental impacts to air quality, surface water quality, and/or groundwater quality. These impacts could result in potential adverse effects to terrestrial ecosystems, aquatic ecosystems, workers and/or surrounding residents. As a result, the secondary objective of the project is to ensure potential environmental impacts during implementation are minimized, avoided, or rectified. The mitigation measures presented in Tables 3 through 12 will be employed to accomplish this secondary objective.

1.5 Project Challenges

In order to meet the project objectives, it will be necessary to be continually cognizant of the challenges posed by the site and climatic conditions.

The impact of conducting project activities in the rainy season (September to December of each year) is assessed as the most significant environmental risk and challenge associated with the project. The project implementation schedule is aggressive and some project activities might be undertaken in the rainy season to maintain schedule, such as:

- Removal of treated soils and sediments from the IPTD pile structure;
- Possible stockpiling of Phase I treated soils;
- Partial dismantling of the IPTD pile structure after Phase I treatment;
- Maintenance of the dewatered sediment stockpile; and
- Complete project demobilization.

Slippages in the project schedule will result in an even greater potential when portions of the project are conducted during the rainy season, a time of year with the potential for a number of typhoons and tropical storms, significant amounts of wind, rainfall, and flooding during these events. If the Implementing Contractors decide to work in the rainy season to make up for schedule slippage, possible project activities that would be partially conducted include:

- Initial construction of IPTD pile structure;
- Filling of IPTD pile structure for Phase I treatment; and,
- Phase I and Phase II thermal desorption.

These environmental risks are mitigable and will require explicit consideration of methods to protect project infrastructure, equipment, and facilities over the rainy seasons as well as environmental contingency planning for greater-than-expected project activities being conducted in the rainy season. Implementing Contractors will revise work plans to address slippages and how they propose to realign the work schedule.

No new significant challenges are identified with this EMMP update. However, it is noted that this EMMP, as implemented by USAID's three contractors, and the GVN's Environmental Impact Assessment (EIA), as implemented by MND, are not identical. Further, the confirmatory soil/sediment sampling

methods conducted by USAID's contractors and MND are not identical. While not problematic, these discrepancies do require close coordination for joint field sampling and data analyses comparison and concurrence. Specifically, the Vietnam-Russia Tropical Center (VRTC) and CDM Smith jointly collect confirmatory soil/sediment samples, and Chemical Command and TerraTherm jointly collect liquid and vapor sampling of the IPTD liquid vapor treatment plant (LVTP). The CMC hosts weekly meetings with local GVN stakeholders, including Chemical Command, Department of Natural Resources and Environment (DONRE), MAC and Army Brigade 372, to discuss the project's progress, sampling results and upcoming week's activities.

1.6 EMMP Update and Lessons Learned

This document is an update to the original Project EMMP (USAID 2013e) that was approved by USAID on April 5, 2013. The Project EMMP will continue to be updated on an annual basis by the CMC throughout the duration of the project. This section provides information specific to the key monitoring activities and lessons learned from the project thus far.

1.6.1 Update

Thus far the project has excavated the majority of Phase 1 contaminated soils and sediments and the majority of the design volume excavation of Phase 2 contaminated soils and sediments. As dioxin binds to dust particles, dust monitoring was/is conducted throughout all earth-moving activities. If dust levels exceed the action level, as established in the original EMMP (USAID 2013c) and approved by USAID on April 5, 2013, earth moving activities were/are stopped and corrective actions were/are taken, such as water spraying of soils for dust suppression.

In order to excavate the Sen Lake and the Eastern Wetland portion of the Phase 2 excavation area, the wetlands and lake had to be drained and the groundwater table lowered. As dioxin binds to soil/sediment particles, all water was monitored for turbidity prior to discharge from the Project site. If turbidity exceeds the action level, as established in the original EMMP (USAID 2013e) and approved by USAID on April 5, 2013, pumping was stopped and corrective actions were taken to reduce turbidity levels. For example, initial draining of the lake occurred via a floating surface water pump; as the lake was lowered, pumping from a series of groundwater monitoring wells was initiated to reduce turbidity. The restoration of Sen Lake and the Eastern Wetland are not being performed as part of this project due to Airport development plans that will be implemented in these areas following the completion of remediation. The Airport development plans include constructing aprons and taxiways, buildings, parking areas, and roadways over the Eastern Wetland and portions of Sen Lake. The Eastern Wetland is not officially recognized as a protected wetland under GVN law.

In addition to the ongoing dust/air monitoring of earth moving activities and ongoing monitoring/sampling of the various water management activities, this EMMP update includes monitoring/sampling of the IPTD system. All liquid and vapor emissions from the IPTD system will be sampled by the IPTD contractor and if any contaminants of concern exceed the project action levels, the treatment system will be re-configured and/or stopped as necessary to address any elevated readings.

1.6.2 Lessons Learned

In addition to the dust and turbidity monitoring discussed above, monthly air and water samples were/are collected for dioxin analysis. One lesson learned from the Phase I dust and turbidity monitoring is that a strong correlation between: 1) dust and dioxin concentrations in air, and 2)

turbidity and dioxin concentrations in water, should be established prior to project start up. As data was collected throughout Phase I activities and during the dewatering of Sen Lake, revised correlations based on a larger, more representative sample have been/are being conducted by the CMC. For turbidity, this revised correlation has been completed and the turbidity action level of 29 NTU above background has been affirmed. Likewise, for dust, the action level of 0.186 milligrams per cubic meter (mg/m³) has been affirmed.

Another lesson was learned from Phase I regarding the confirmatory sampling approach. During the Phase I excavations, confirmatory sampling was conducted in each decision unit (DU) following the designed excavation for that DU. If samples indicated that the excavation goal of 1,000 ppt (for soil) or 150 ppt (for sediment) was not achieved, additional excavation was required. Subsequent confirmatory sampling was conducted again after additional excavation activities were completed. The time lag between excavation, confirmatory sampling, shipment to laboratory and final analysis made it difficult for the Phase I excavations and over-excavations to be completed within one dry season. As such, the CMC and USAID have begun collecting confirmatory samples at multiple depths following design volume excavation, as well as multiple “step out” samples from the sidewalls of the design volume excavations, where appropriate. This new approach is currently being applied to Phase 2 excavations.

1.7 Evolution of the Environmental Process and Supporting Documents

The environmental process for the Airport has spanned several years and mitigation/monitoring measures have evolved as more detailed information has become available. One of the resulting products from this evolution is this EMMP. The key documents leading up to this EMMP include the following:

- Initial Environmental Examination (IEE): On May 26, 2009, the Asia Bureau Environmental Officer (BEO) approved the IEE for “Environmental Remediation at Da Nang Airport” (USAID 2009a). This approval included a positive Threshold Determination that pertains to engineering design and remedial action activities, because such activities may pose a significant risk to the environment. Before these USAID-financed activities can proceed, an Environmental Assessment (EA) must be completed and approved by the BEO.
- Environmental Scoping Statement (ESS): In support of the EA, an ESS was prepared for the Project (USAID 2009b) in compliance with Title 22 CFR Chapter 216, which USAID’s Asia BEO approved in February 2010. Scoping sessions were held with stakeholders as part of this process in October 2009 which identified the need to explore a range of viable alternatives for dioxin containment at the Airport. The sessions also helped to identify the environmental issues that the EA must address.
- EA: The purpose of the EA is to fulfill requirements for environmental remediation at the Airport in accordance with 22 CFR 216. The EA provides the basis for selection of the preferred project alternative and includes an initial EMMP for the significant impacts that are identified through the EA process. The EA was approved by the BEO on July 7, 2010 (USAID 2010a).
- EIA: Vietnamese environmental law and its environmental compliance regulations require an EIA for dioxin remediation activities. While USAID’s EA process requires consideration of project alternatives, the GVN EIA procedures are based on a single project proposal, and require

submission of feasibility analyses, designs, and cost estimates. The EIA was prepared by MND with support from USAID and approved by MONRE on May 22, 2012 (GVN 2012).

To develop this Project EMMP, the initial EMMP from the EA was extracted and expanded to include details from GVN's EIA, the Final D&H Design, and the Final IPTD Design. This EMMP is further supported by the documents referenced in Tables 3 through 12, including:

- Final Site-Wide Sampling and Analysis Plan (SAP): The purpose of the SAP, which was approved by USAID on March 31, 2011 (USAID 2011a), is to describe the sampling objectives, locations, measurement methods, and data quality objectives to:
 1. Ensure that proper engineering controls and appropriate work practices are being implemented to limit exposure of all individuals working on or near the site during remedial activities (including project staff and citizens near the site) by monitoring air and dust at the site.
 2. Determine if cleanup goals have been met by sampling soil/sediment at the limits of excavation, and sampling treated soil/sediment in the treatment pile.
 3. Determine contaminant levels in post-decontamination (rinse) water and water from the sediment dewatering pile(s) so it can be disposed of properly.

The sampling activities described in the SAP will be conducted by the CMC.

- Additional sampling will be conducted by the IPTD contractor and the ECC during remediation. These sampling activities are detailed in the IPTD contractor's SAP (USAID 2014d) and the ECC EPP (USAID 2012f).
- Final Site Health and Safety Plan (HASP): The HASP was approved by USAID on March 31, 2011 and updated on January 10, 2013 (USAID 2013a), and presents the H&S program requirements and responsibilities for all site contractors. The HASP details requirements for air and dust monitoring, mitigation measures for exposure to workers, medical monitoring for workers, and work practices and guidelines.
- The ECC and IPTD contractors have provided component specific HASPs in accordance with the requirements detailed in the site-wide HASP. The health and safety documents are provided as the IPTD contractor's HASP (USAID 2012g) and the ECC APP and SSHP (USAID 2012a).
- Final D&H Design: The D&H design was approved by USAID on March 31, 2011 (USAID 2011b). It consists of the engineering drawings and technical specifications that the ECC is required to follow to perform the excavation of contaminated material and construct the IPTD pile structure. In addition to presenting these technical requirements, the D&H design also presents the engineering controls and requirements for stormwater management, erosion and sediment control, dewatering, handling and management of soils and sediments, and environmental protection procedures.
- Final IPTD Design: The 100% IPTD design was approved by MND on November 6, 2013 (USAID 2012d). It consists of the engineering drawings and technical specifications that the IPTD contractor is required to follow to perform the completion of the IPTD pile and treatment of contaminated

material. In addition, the IPTD design also presents the engineering controls and requirements for sampling and analysis of water and vapor from the IPTD pile structure during treatment.

Additional documents have been developed by the ECC and IPTD contractor to support this Project EMMP; Sections 2.5.3 and 2.6.3 provide lists of these documents.

Copies of all the above documents are maintained by USAID and the CMC.

The implementation of the EMMP is the responsibility of the CMC with specific input from the ECC and IPTD contractor. Key performance indicators for the Project include the following:

- m³ of dioxin-contaminated soil and sediment excavated (ECC). Sampling conducted by the CMC is used to determine when excavation is complete (i.e., dioxin concentrations at the limits of excavation are below the project action levels).
- m³ of dioxin-contaminated soil and sediment treated (IPTD contractor). Sampling conducted by the CMC is used to determine whether dioxin concentrations in treated soil and sediment are below the project action levels.

I.8 Regulatory Requirements

All contractors shall comply with the Vietnamese laws, regulations, codes, and standards presented in Appendix A.

Each contractor, along with all equipment, components, and auxiliaries, shall be in conformance with all applicable laws and applicable industry codes and standards in effect as of the date of submission of the contractor's proposal.

Section 2

Roles and Responsibilities

This section outlines the roles and responsibilities of all parties responsible for implementation of each component of dioxin remediation, including the environmental management during remediation, at the Airport. The goal of this section is to establish and define the role and relationship between government and contractor to facilitate site communications, enable more effective implementation of the project, and avoid redundancies.

As discussed in Section 3, the ECC and the IPTD contractor are responsible for certain mitigation and monitoring activities. The CMC is responsible for overseeing these activities, in addition to performing their own EMMP activities. Having a clearly defined relationship structure established as discussed in this section will enable a successful EMMP implementation.

2.1 Project Stakeholders

GVN has requested assistance from the USG to remediate dioxin-contaminated soil and sediment at the Airport. This assistance is being provided by USAID with funding and technical support to design and implement IPTD to reduce dioxin concentrations in the Airport soil and sediment below GVN cleanup goals.

In May 2011, MND and USAID signed an Agreement to confirm their mutual desire to cooperate on efforts to remediate the effects of dioxin contamination at the Airport. The Agreement identifies MND and USAID as the implementing partners for the project. The Air Defense Air Force Command (ADAF) within MND is the Project Owner and the responsible GVN entity for remediation. MND, specifically the ADAF, and USAID will work closely with other GVN entities to coordinate and implement the remediation project. Other GVN project stakeholders are listed below, and Figure 3 provides an organizational chart identifying the lines of authority and communication between the project stakeholders.

- Office 33 is responsible for the implementation of the GVN dioxin policy for Vietnam and will provide technical assistance during construction and operations to ensure that GVN dioxin policy is properly implemented.
- The ADAF within MND is the Project Management Unit (PMU) and Vietnamese agency responsible for the project. All onsite project activities must be coordinated through the ADAF, including but not limited to, gaining the appropriate access permissions for personnel and equipment, storing equipment, site layout plans, and site security. Other units/departments/offices within MND have close involvement in the implementation of this Project – specifically VRTC, which conducts confirmation soil sampling for ADAF, and Chemical Command, which monitors the IPTD system for ADAF.
- The CAAV is responsible for all civil airports in Vietnam. Airports Corporation of Vietnam (ACV) is the designated agency under CAAV that is responsible for civilian property activities at the Airport. All project plans, designs and activities must be coordinated with safety procedures of the ACV and MAC.

In addition, USAID and ADAFC engage with other relevant GVN entities including MONRE at the national level as well as DONRE and the Danang People’s Committee at the local level. MONRE is responsible for the oversight of environmental projects and compliance across the country. DONRE is the local arm of MONRE, responsible for environmental and compliance issues in the city of Danang. The Danang People’s Committee operates as the local government in Danang, helping navigate tax, import/export and licensing issues. USAID and ADAFC work together to communicate to external partners as well such as the local community, interested non-governmental organizations (NGOs), and the media – both local and international. For detailed information about stakeholder engagement/outreach with the various Project stakeholder groups, please see the Project’s FY 14 Stakeholder Engagement & Capacity Building Plan Update (USAID 2014c).

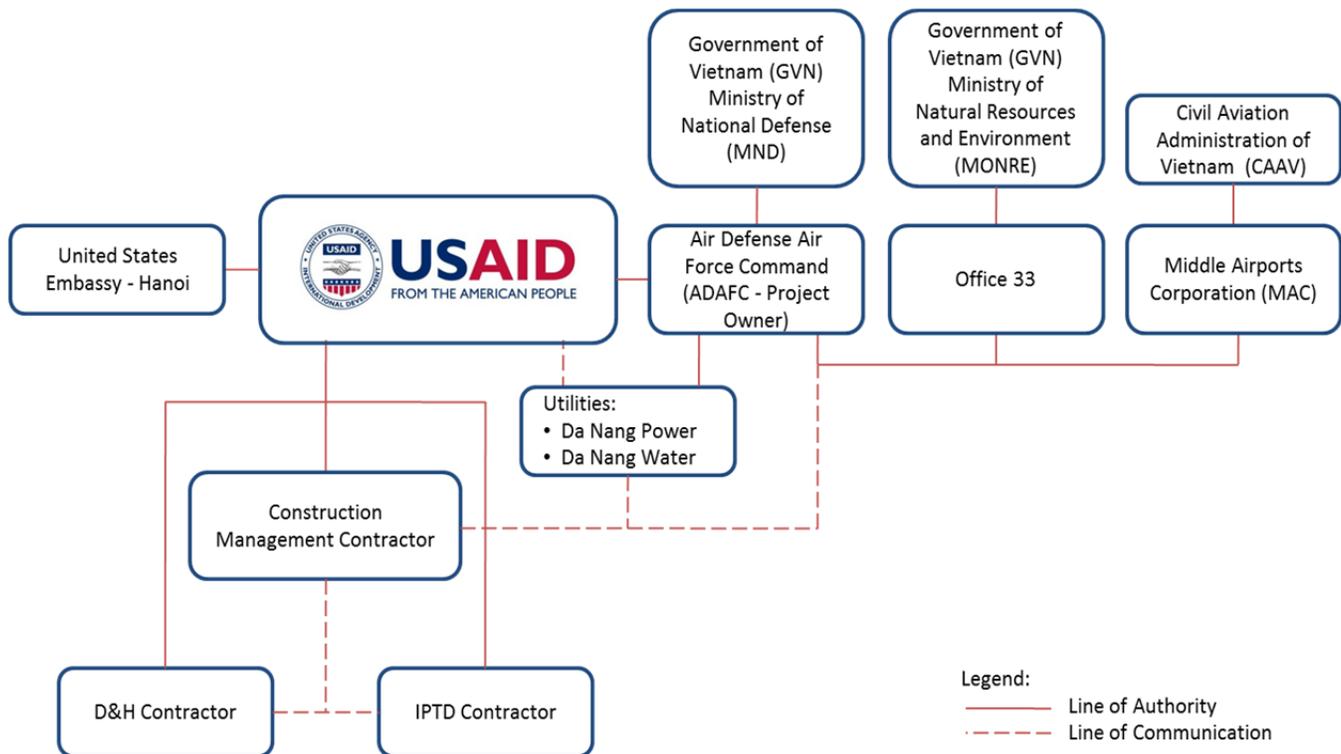


Figure 3: Project Organizational Chart

2.2 GVN

As the Project Owner, the ADAFC within MND is the GVN agency responsible for meeting the requirements of all GVN environmental regulations related to this project. The ADAFC within MND also developed the project EIA, which is a GVN-required document that assesses the impact of the project, identifies environmental mitigation measures, and presents a program for environmental management and monitoring.

MONRE and DoNRE are responsible for all environmental regulatory reviews and approvals of the project, in accordance with the national legal frameworks for environmental protection and management.

2.3 USAID

USAID is the implementing agency for the Airport remediation and has procured the ECC and the IPTD contractor to conduct the remediation activities. USAID has also procured a CMC to oversee and manage the construction activities to ensure the remediation is implemented in accordance with the final design and applicable GVN rules and regulations. The environmental responsibilities of USAID are to ensure that the project complies with all applicable U.S. environmental regulations. USAID will review the environmental aspects of project implementation and problems and issues that are identified will be raised to the CMC as part of the regular project review process. The responsible party at USAID is the Activity Manager for the overall project in coordination with Contracting Officer Representatives (CORs) for each contract, if different from the Activity Manager. The Activity Manager and CORs will carry out their monitoring duties through frequent site visits and project updates throughout the life of the project.

2.4 Construction Management Contractor

The CMC shall provide technical, H&S, and environmental compliance oversight of the ECC's and IPTD contractor's activities. The CMC team includes a full time Chief of Party/Construction Manager, H&S Manager, and Environmental Compliance Specialist. The Environmental Compliance Specialist will undertake the technical and day-to-day aspects of overseeing and reporting on the implementation of all environmental mitigation and monitoring components of the project.

The CMC is responsible for the following site-specific tasks:

- Provide oversight of all construction and operational activities performed by the ECC and the IPTD contractor to ensure compliance with approved project plans (e.g., contract drawings technical specifications, environmental protection plans, H&S plans) and project remedial criteria.
- Maintain a records management system for document control, which will include but not be limited to: correspondence, design modifications, change orders, Request for Information logs, contractor submittals, operation and maintenance instructions, daily inspection records, monitoring results and observations, photo logs, as-built drawings, meeting minutes, etc.
- Provide and document oversight of all environmental mitigation and monitoring activities described in this Project EMMP performed by the three contractors: CMC, ECC, and IPTD contractor.
- Document oversight and H&S activities as necessary to ensure that H&S procedures are followed throughout project activities, and conduct monitoring related to H&S and specific gender issues.
- Evaluate engineering controls (e.g., stormwater controls, dust suppression techniques) and traffic management controls and recommend modifications to work practices as necessary. Notify the ECC if deficiencies exist.
- Implement the Final Site-Wide SAP and this Project EMMP that includes dust and air monitoring, soil and sediment confirmation sampling, post-treatment soil/sediment confirmation sampling, decontamination water sampling, and dewatering discharge sampling.
- Oversee the ECC and the IPTD contractor to ensure that they are fulfilling their obligations. Notify the contractors of any deficiencies and, if necessary, the USAID COR.

2.5 Excavation and Construction Contractor

The ECC shall provide all site controls and construction services related to the D&H and IPTD pile structure components and their associated tasks. The ECC is responsible for actually implementing the project according to the Final D&H Design and therefore is responsible for implementing the environmental mitigation measures specified in this Project EMMP. The ECC will require environmental specialists who will be responsible for mitigation and monitoring components of the project.

The ECC has a number of responsibilities, some of which include the following site-specific tasks:

2.5.1 Work Responsibilities

- Mobilize necessary personnel and equipment to the site.
- Implement necessary elements of the submitted pre-work activity plans.
- Responsible for implementing TCP and EPP at all times, including during seasonal shutdown periods.
- Implement construction of the D&H and IPTD pile structure components in accordance with contract drawings and specifications (USAID 2011b). These activities generally include, but are not limited to:
 - Construct site access roads;
 - Clear and grub;
 - Excavate and haul soils and sediments;
 - Implement landscape restoration in non-aquatic areas, which consists of backfilling excavations with clean fill, grading to reestablish the pre-construction drainage patterns, and grassing to stabilize the surface;
 - Dewater sediments;
 - Construct an IPTD pile structure for the IPTD contractor's use;
 - Place soils/sediments in the IPTD pile structure;
 - Remove soils/sediments from the IPTD pile structure following treatment by the IPTD contractor; and
 - Dismantle the IPTD pile structure at the completion of the project.
- A borrow source for clean fill is not available on the airport property. The ECC shall identify a borrow source that meets the specification requirements and haul the material to the site.
- Maintain as-built record drawings throughout all stages of construction and operation activities.
- Participate in progress meetings.

2.5.2 Post-Work Responsibilities

- Restore all temporarily disturbed areas (i.e., temporary facility pads, equipment storage areas, etc.) to their original condition;
- Provide a final set of as-built records and drawings; and

- Demobilize from site.

2.5.3 Submittals

As presented in their contract and the project documents, the ECC is required to make numerous submittals to USAID. The ECC's scope of work with USAID provides details regarding the content and schedule for submittals. The submittals that are relevant to this Project EMMP are provided below and have been submitted as stipulated in the ECC contract. Information from these documents has been incorporated into this Project EMMP.

- ECC-specific Pre-Mobilization and Equipment Layout Plan (USAID 2012c)
- ECC-specific Implementation Plan (USAID 2013b)
- ECC-specific HASP (USAID 2012a)
- Site-wide Traffic Control Plan (TCP) (USAID 2012b)
- Site-wide Environmental Protection Plan (EPP) (USAID 2012f)
- Additional documents as required by the contract drawings and specifications.

2.6 IPTD Contractor

The IPTD contractor shall provide all site controls and construction services related to the IPTD treatment system component and the associated tasks. The IPTD contractor is responsible for actually implementing the project according to the Final IPTD Design and therefore responsible for implementing the environmental mitigation measures specified in this Project EMMP. The IPTD contractor will require environmental specialists who will be responsible for the actual implementation of the remediation technology for the project.

The IPTD contractor has a number of responsibilities, some of which include the following site-specific tasks:

2.6.1 Work Responsibilities

- Mobilize necessary personnel and equipment to the site;
- Implement necessary elements of the submitted pre-work activity plans;
- Implement construction, operation, and maintenance of the IPTD treatment system in accordance with contract drawings and specifications. These activities generally include, but are not limited to:
 - Installation of heaters, temperature monitoring points, etc.;
 - Installation of wells and piezometers;
 - Monitoring and operation of treatment system performance; and
 - Monitoring of water and vapor discharges.
 - Storage of waste products (e.g. spent carbon, non-aqueous phase liquid (NAPL), etc.)
- Maintain as-built record drawings throughout all stages of construction and operation activities; and,
- Participate in progress meetings.

2.6.2 Post-Work Responsibilities

- Restore all temporarily disturbed areas (i.e., temporary facility pads, equipment storage areas, etc.) to their original condition;
- Provide a final set of as-built records and drawings; and
- Demobilize from site

2.6.3 Submittals

The IPTD contractor is required to make numerous submittals to USAID as required by the contract and project documents. The IPTD contractor's scope of work with USAID provides details regarding the content and schedule for submittal of these documents. The submittals that are relevant to this Project EMMP are provided below and have been submitted to USAID as stipulated in the IPTD contract. Information from these documents has been incorporated into this Project EMMP.

- IPTD treatment-specific Mobilization Plan (USAID 2013c)
- IPTD treatment-specific Implementation Plan (USAID 2013d)
- IPTD treatment-specific HASP (USAID 2012g)
- IPTD treatment-specific SAP/Quality Assurance Project Plan (QAPP) (USAID 2012e and 2014b)
- IPTD Operations and Maintenance (O&M) Manual (USAID 2014a)
- Additional documents as required by the contract drawings and specifications

Section 3

Environmental Mitigation Measures and Monitoring Requirements

This section contains the environmental mitigation measures and monitoring requirements to be implemented to ensure potential negative environmental impacts of the project are minimized, avoided, or rectified. These environmental mitigation measures and monitoring requirements have been developed on the basis of an impact assessment of the project using the Final D&H Design (USAID 2011b) and the Final IPTD design (USAID 2012d).

3.1 Mitigation Measures and Monitoring During Remediation

The tables and figures in this section describe the mitigation measures, mitigation targets, monitoring requirements, and parties responsible for implementing the mitigation measures as they apply to:

- Surface water quality and groundwater quality (Tables 3,3A, 3B, and 3C and Figures 4 and 5)
- Air quality (Tables 4, 4A, and 4B and Figure 6)
- Noise levels (Table 5)
- Greenhouse gas (GHG) emissions (Table 6)
- Terrestrial ecosystems and biodiversity, and wetlands/aquatic ecosystems and aquatic biodiversity (Table 7)
- Generation of solid waste (Table 8)
- Human health (Table 9)
- Environmental risks and hazards (Table 10)
- Other (Table 11)
- Summary of Environmental Sampling Requirements by Activity (Table 12)

As described in Section 2.4 and footnoted in Tables 3 through 12, the CMC will provide oversight of ECC's and the IPTD contractor's activities at the Airport to ensure compliance with implementing mitigation measures and monitoring requirements. The amount of oversight will be in accordance with the approved Implementation Plan and/or USAID direction.

A formal complaints registry has not been established, but the U.S. Embassy has a dedicated phone line for the Project, which is available on all outreach materials, and the Project has a Communications Plan (USAID 2012j) and a Stakeholder Engagement & Capacity Building Plan (USAID 2014c), which manages all public consultation efforts.

3.2 EMMP Reporting

The CMC will submit monthly progress reports and quarterly reports to USAID throughout the duration of remediation activities. These reports will include accounts of all contractors' compliance

with the Project EMMP and identify any issues, problems, or corrective actions taken during the reporting period – any significant noncompliance issues will be reported to USAID immediately. All environmental sampling results will be provided to USAID in the CMC’s quarterly reports.

Table 3. Environmental mitigation measures for project impacts on surface water quality and groundwater quality

Activity	Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation ¹	Monitoring Requirements*	Reference Document(s)
Excavation of contaminated material	Construct and operate water diversion channels and storage ponds to capture/divert surface runoff around entire Project area including excavations, IPTD pile structure, and temporary sediment storage and dewatering area.	Minimization of surface water contacted with contaminated material.	ECC	Visual inspection of all storm water best management practices (BMPs) will be performed weekly and promptly after every rainstorm. An inspection checklist will be completed for each inspection.	ECC's Site-wide EPP(USAID 2012f).
Stockpiling contaminated material in the temporary sediment storage and dewatering area.	The temporary sediment storage and dewatering area will be installed with a bottom system, in accordance with the approved Final D&H Design, including but not limited to impervious bottom liner and leachate collection system. Water from equipment decontamination will be collected. Surface water samples will be collected monthly at the point where Sen Lake discharges offsite.	Project-affected water from untreated sediment storage, dewatering and decontamination area in exceedance of project action limits (see Table 3A) will be treated prior to discharge to Sen Lake.	CMC: water sampling. ECC: water discharge and treatment (as needed).	See Table 3A and Figure 4.	Final D&H Design (USAID 2011b), Site-wide SAP (USAID 2011a), QCVN 40:2011/BTNMT ² , QCVN 08:2008/BTNMT ³ , ECC's Implementation Plan (USAID 2013b).
Loading, containing and treating contaminated material in the IPTD structure.	The IPTD pile structure will be installed with a bottom system, in accordance with the approved final design, including but not limited to impervious bottom liner and leachate collection system. Surface water samples will be collected monthly at the point where Sen Lake discharges offsite.	Project-affected water from IPTD pile structure in exceedance of project action limits (see Table 3A) will be treated prior to discharge to Sen Lake.	IPTD contractor: water sampling, discharge, and treatment (as needed).	See Table 3A and Figure 4.	Final D&H Design (USAID 2011b), IPTD contractor's treatment-specific SAP/QAPP (USAID 2012e), QCVN 08:2008/BTNMT ³ , QCVN 40:2011/BTNMT ² .
Storm events and excavation of contaminated material.	Required erosion and sediment control devices (e.g., mulch, surface roughening, ditches, barriers, sediment fencing, vegetative covers, settling ponds, etc.) to be in place prior to construction. Minimum measures are provided in the D&H design.	No erosion and sediment-laden runoff that does not meet GVN standards.	ECC	Visual inspection of all storm water BMPs will be performed weekly and promptly after every rainstorm. An inspection checklist will be completed for each inspection.	Final D&H Design (USAID 2011b) for minimum required measures, ECC's Site-wide EPP (USAID 2012f).
Excavation of contaminated material.	Schedule all excavation activities during the dry season to minimize time and area of excavation which remain exposed.	No non-compliances reported during the rainy season.	ECC	No monitoring requirements.	ECC's Implementation Plan (USAID 2013b).
Stockpiling of contaminated material.	Protection of all contaminated and clean sediment/soil stockpiled and stored during the rainy season (and any storms/typhoons) to prevent erosion.	No non-compliances reported during the rainy season.	ECC	Stockpile erosion will be managed using BMPs such as tarps, geotextiles, soil stabilizers, fiber rolls, silt fence, hay/straw bales, and sediment traps. All runoff from stockpiling will be directed away from adjacent water bodies and storm water collection facilities.	ECC's Site-wide EPP (USAID 2012f), Site-wide HASP (USAID 2013a).
Erosion during storm events.	Any disturbed areas are to be stabilized in accordance with measures specified in the D&H design if they are to remain in place for greater than 2 weeks.	Minimal erosion and sediment-laden runoff.	ECC	Visual observations.	Final D&H Design (USAID 2011b).
Excavation of contaminated material.	A dewatering system will be used to minimize groundwater seepage in the excavations, and rain proof covers (i.e., plastic sheeting/watertight tarpaulins) will be used to cover open excavations in case of rain. Sediment control measures (e.g., settling pond) will be used to process water within active excavations prior to discharge from the site. Water will be captured and stored with the use of, as appropriate, sumps and ditches, well point systems, vertical sand drains, or cutoffs within the excavation, and ensuring all excavated areas are backfilled before the start of the rainy season.	Groundwater or rainwater that comes in contact with contaminated material is minimized and captured. Turbidity of captured water must not be more than 29 NTU greater than background. Contaminant concentrations in groundwater do not exceed baseline concentrations measured prior to remediation activities (see Table 3C).	ECC: turbidity measurements, discharge, and treatment (as needed). CMC: groundwater sampling.	Visual inspection of all storm water BMPs will be performed weekly and promptly after every rainstorm. An inspection checklist will be completed for each inspection. See Tables 3A and 3C and Figures 4 and 5.	Final D&H Design (USAID 2011b), ECC's Site-wide EPP (USAID 2012f), Implementation Plan (USAID 2013b).
Refueling equipment.	Refueling of equipment must occur well away from natural drainage or watercourses with the exception of designated water movement vessels like barges.	Spills are minimized.	ECC and IPTD	Visual observations.	ECC's Implementation Plan (USAID 2013b), IPTD contractor's Implementation Plans (USAID 2013d).

Table 3. Environmental mitigation measures for project impacts on surface water quality and groundwater quality

Activity	Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation¹	Monitoring Requirements*	Reference Document(s)
Decontamination of vehicles.	Cleaning transportation vehicles and construction equipment following each trip (from excavation areas and backfill source quarry) at a decontamination area.	No complaints or non-compliances.	ECC and IPTD	Visual observations.	ECC's Implementation Plan (USAID 2013b), IPTD contractor's Implementation Plans (USAID 2013d).
Placing material in the IPTD structure.	Daily rain proof covers (i.e., plastic sheeting/watertight tarpaulins) shall be used on the IPTD pile structure prior to cap placement to limit contact with surface water and contaminated material.	Project-affected water from contact with untreated soil/sediment in exceedance of project action limits (see Table 3A) will be treated prior to discharge to Sen Lake.	CMC: water sampling. ECC: water discharge and treatment (as needed).	See Table 3A and Figure 4.	Final D&H Design (USAID 2011b), Site-wide SAP (USAID 2011a), QCVN 08:2008/BTNMT ³ , QCVN 40:2011/BTNMT ² .
Erosion and runoff during storm events.	Employ the above-listed mitigation measures to ensure remediation activities do not have a detrimental effect on the condition of site surface water (Sen Lake and Drainage Ditch).	Contaminant concentrations in Sen Lake and Drainage Ditch after remediation activities do not exceed baseline concentrations measured prior to remediation activities (see Table 3B).	CMC	See Table 3B and Figure 4.	Not applicable
Excavation of contaminated material.	Employ the above-listed mitigation measures to ensure remediation activities do not have a detrimental effect on the condition of groundwater.	Contaminant concentrations in site groundwater wells do not exceed baseline concentrations measured prior to remediation activities (see Table 3C).	CMC	See Table 3C and Figure 5.	Not applicable

Notes:
 1 – CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and the IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.
 2 – QCVN 40:2011/BTNMT - National Technical Regulation on Industrial Wastewater (reference "B" values).
 3 – QCVN 08:2008/BTNMT - National Technical Regulation on Surface Water Quality (reference "A2" values).

Table 3A. Surface Water and Wastewater Sampling

Sampling location	Contractor Responsible for Sampling	Frequency	Turbidity	Organic Vapors	2,3,7,8-TCDD	Benzo(a)pyrene	Zinc	Arsenic	pH	COD	Oil & Grease	Total Phenols	2,4-D	2,4,5-T		
			Field Test	PID	Method 1613B	Method 8270-SIM	Method 6010/6020	Field Test	Field Test	Method 1664	Field Test	Field Test				
			>29 NTU over background ¹	Significant increase (100% increase over baseline)	24.01 pg/L ¹ (BTV for Sen Lake discharge point ²)	200 ng/L ¹ (USEPA MCL)	3 mg/L ¹ (QCVN 40:2011/ BTNMT)	0.1 mg/L ¹ (QCVN 40:2011/ BTNMT)	5.5 - 9 ¹ (QCVN 40:2011/ BTNMT)	150 mg/L ¹ (QCVN 40:2011/ BTNMT)	9.0 - 9.9 mg/L ¹ (QCVN 40:2011/ BTNMT)	0.45-0.495 mg/L ¹ (QCVN 40:2011/ BTNMT)	0.2 mg/L ¹ (QCVN 08:2008/ BTNMT)	0.1 mg/L ¹ (QCVN 08:2008/ BTNMT)		
Dewatering pad discharge	ECC	As-needed prior to discharge (all water will be containerized until sample results confirm that concentrations are below action limits).	✓													
Decontamination water	ECC	As-needed prior to discharge (all water will be containerized until sample results confirm that concentrations are below action limits).	✓													
Water in contact with IPTD pile structure prior to cap placement	ECC	As-needed prior to discharge (all water will be containerized until sample results confirm that concentrations are below action limits).	✓													
Dewatering pad discharge	CMC	As-needed prior to discharge (all water will be containerized until sample results confirm that concentrations are below action limits).			✓	✓	✓	✓								
Decontamination water	CMC	As-needed prior to discharge (all water will be containerized until sample results confirm that concentrations are below action limits).			✓	✓	✓	✓								
Water in contact with IPTD pile structure prior to cap placement	CMC	As-needed prior to discharge (all water will be containerized until sample results confirm that concentrations are below action limits).			✓	✓	✓	✓								
Sen Lake discharge	CMC	Monthly during excavation/earth moving activities.	✓		✓	✓	✓	✓								
IPTD liquid discharge	IPTD Contractor	System Startup (1 week period during both Phase I and Phase II)	2 times/week	I, Int, E	Daily I, Int, E, O	I, Int, E			I, E	Daily I, Int, E, O	I, Int, E	I, Int, E	I, Int, E	I, Int, E		
		Operations (Phase I operations is ~16 weeks; Phase II operations is ~25 weeks)	1 time/week			I, Int, E, O			I, Int, E, O			I, E, O				
			2 times/week	I, Int, E, O												
			As needed									Int				
		100°C Milestone (1 week period during both Phase I and Phase II)	2 times/week	I, Int, E		I, Int, E			I, E			I, Int, E	I, Int, E	I, Int, E	I, Int, E	I, Int, E
		335°C Milestone (1 week period during both Phase I and Phase II)	2 times/week	I, Int, E, O		I, Int, E, O			I, Int, E, O			I, Int, E, O	I, Int, E, O	I, Int, E, O	I, Int, E, O	I, Int, E, O
Post Operations (2 week period during both Phase I and Phase II)	1 time/2 weeks	O, E	O, E	O, E			O, E	O, E	O, E	O, E	O, E	O, E	O, E			

Notes:

1 - Action levels for IPTD liquid discharge apply only to the Effluent ("E") measurements.

2 - The BTV for the Sen Lake discharge point was calculated from surface water samples (total of 10) collected at the point where Sen Lake discharges offsite. The remediation activities that could impact water quality in Sen Lake include discharging project-affected water into Sen Lake and removing contaminated sediments in the Eastern Wetland and Sen Lake. The 10 surface water samples used to calculate the BTV were collected before any sediment removal occurred, and while all project-affected water was contained, sampled, and treated (if necessary) prior to discharge.

For reference/comparison, the USEPA MCL for 2,3,7,8-TCDD is 30 pg/L (ppq).

For the IPTD discharge, if one effluent sample is above 30 pg/L (USEPA MCL for 2,3,7,8-TCDD), then a change in the treatment system will be required. If more than 1 out of 20 of the effluent samples are above 24.01 pg/L (Sen Lake discharge point BTV with 95% upper tolerance limit), then a change in the treatment system will be required.

Acronyms/Abbreviations:

- BTV - baseline threshold value
- CMC - construction management contractor
- E - Effluent: After MPPE, GAC, GFH
- GAC - granular activated carbon
- GFH - granular ferric hydroxide
- I - Influent: Before MPPE bed
- Int - Intermediate: After MPPE bed
- IPTD - in-pile thermal desorption
- MCL - Maximum Contaminant Level
- mg/L - milligrams per liter
- MPPE - macro porous polymer extraction
- ng/L - nanograms per liter
- NTU - nephelometric turbidity unit
- pg/L - picograms per liter
- O - Outfall: water in emergency backup ditch
- QCVN 08:2008/BNMT - National Technical Regulation on Surface Water Quality (reference "A2" values).
- QCVN 40:2011/BNMT - National Technical Regulation on Industrial Wastewater (reference "B" values).
- USEPA - United States Environmental Protection Agency

Table 3B. Surface Water Sampling to be Conducted After Remediation is Complete¹

Analyte	Analytical Method	Action Limit ^{2,3,4}	
		Sen Lake	Drainage Ditch
2,3,7,8-TCDD	Method 1613B	24.01 pg/L	24.01 pg/L
Total Metals			
Aluminum (Al)-Total	Method 6010/6020	0.09835 mg/L	0.0386 mg/L
Antimony (Sb)-Total		<0.00050 mg/L	<0.00050 mg/L
Arsenic (As)-Total		0.0183 mg/L	0.257 mg/L
Barium (Ba)-Total		0.0485 mg/L	0.043 mg/L
Beryllium (Be)-Total		<0.0010 mg/L	<0.0010 mg/L
Boron (B)-Total		<0.10 mg/L	<0.10 mg/L
Cadmium (Cd)-Total		0.000026 mg/L	0.000045 mg/L
Calcium (Ca)-Total		20.45 mg/L	7.82 mg/L
Chromium (Cr)-Total		0.0147 mg/L	0.0119 mg/L
Cobalt (Co)-Total		<0.00030 mg/L	<0.00030 mg/L
Copper (Cu)-Total		0.0013 mg/L	<0.0010 mg/L
Iron (Fe)-Total		1.0195 mg/L	3.16 mg/L
Lead (Pb)-Total		0.000955 mg/L	<0.00050 mg/L
Lithium (Li)-Total		<0.0050 mg/L	<0.0050 mg/L
Magnesium (Mg)-Total		3.21 mg/L	1.31 mg/L
Manganese (Mn)-Total		0.1295 mg/L	0.0639 mg/L
Mercury (Hg)-Total		<0.000020 mg/L	<0.000020 mg/L
Molybdenum (Mo)-Total		<0.0010 mg/L	<0.0010 mg/L
Nickel (Ni)-Total		<0.0010 mg/L	<0.0010 mg/L
Potassium (K)-Total		7.55 mg/L	4.2 mg/L
Selenium (Se)-Total		<0.0010 mg/L	<0.0010 mg/L
Silver (Ag)-Total		<0.000020 mg/L	<0.000020 mg/L
Sodium (Na)-Total		20.45 mg/L	9.4 mg/L
Thallium (Tl)-Total		<0.00020 mg/L	<0.00020 mg/L
Tin (Sn)-Total	0.00487 mg/L	<0.00050 mg/L	
Titanium (Ti)-Total	<0.010 mg/L	<0.010 mg/L	
Uranium (U)-Total	<0.00020 mg/L	<0.00020 mg/L	
Vanadium (V)-Total	<0.0010 mg/L	<0.0010 mg/L	
Zinc (Zn)-Total	<0.0050 mg/L	0.009 mg/L	
Polycyclic Aromatic Hydrocarbons (PAHs)			
Naphthalene	Method 8270-SIM	19.52 ng/L	11.5 ng/L
Acenaphthylene		NDR 2.18 ng/L	NDR 0.511 ng/L
Acenaphthene		1.235 ng/L	NDR 0.559 ng/L
Fluorene		1.575 ng/L	0.578 ng/L
Phenanthrene		3.885 ng/L	1.27 ng/L
Anthracene		0.565 ng/L	<0.213 ng/L
Fluoranthene		2.54 ng/L	1.13 ng/L
Pyrene		3.02 ng/L	4.23 ng/L
Benz[a]anthracene		NDR 0.149 ng/L	NDR 0.106 ng/L
Chrysene		0.788 ng/L	0.887 ng/L
Benzo[b]fluoranthene		0.257 ng/L	0.431 ng/L
Benzo[k]fluoranthenes		NDR 0.119 ng/L	0.277 ng/L
Benzo[e]pyrene		0.356 ng/L	0.445 ng/L
Benzo[a]pyrene		<0.125 ng/L	NDR 0.204 ng/L
Perylene		<0.134 ng/L	<0.13 ng/L
Dibenz[a,h]anthracene		<0.112 ng/L	<0.124 ng/L
Indeno[1,2,3-cd]pyrene		NDR 0.2 ng/L	NDR 0.396 ng/L
Benzo[ghi]perylene		NDR 0.21 ng/L	NDR 0.379 ng/L
2-Methylnaphthalene		9.775 ng/L	9.09 ng/L
2,6-Dimethylnaphthalene		1.975 ng/L	3.27 ng/L
2,3,5-Trimethylnaphthalene		5.61 ng/L	1.78 ng/L
1-Methylphenanthrene		0.9465 ng/L	0.228 ng/L
Dibenzothiophene		NDR 0.571 ng/L	NDR 0.293 ng/L

Notes:

- 1 - This sampling will be conducted by the CMC.
- 2 - The 2,3,7,8-TCDD action levels for Sen Lake and the Drainage Ditch are the BTV for the Sen Lake discharge point which was calculated from surface water samples (total of 10) collected at the point where Sen Lake discharges offsite. The remediation activities that could impact water quality in Sen Lake include discharging project-affected water into Sen Lake and removing contaminated sediments in the Eastern Wetland and Sen Lake. The 10 surface water samples used to calculate the BTV were collected before any sediment removal occurred, and while all project-affected water was contained, sampled, and treated (if necessary) prior to discharge. For reference/comparison, the USEPA MCL for 2,3,7,8-TCDD is 30 pg/L.
- 3 - The metals and PAHs action levels for Sen Lake are the baseline concentrations measured in January 2010 during development of the EA (USAID 2010a). These concentrations were calculated by averaging the results from EA sampling locations SAP 701 and SAP702.
- 4 - The metals and PAHs action levels for the Drainage Ditch are the baseline concentrations measured at sample location SAP703 in January 2010 during development of the EA (USAID 2010a).

Acronyms/Abbreviations:

- < - less than the detection limit; number following this symbol represents the detection limit.
- CMC - construction management contractor
- mg/L - milligrams per liter
- NDR - peak detected but did not meet quantification criteria; number following this flag represents the estimated maximum possible concentration.
- ng/L - nanograms per liter
- pg/L - picograms per liter

Table 3C. Groundwater Well Sampling (Baseline and Annually)¹

Analyte	Analytical Method	Action Limit ²
2,3,7,8-TCDD (pg/L)	Method 1613B	1.0
Total Metals (mg/L)		
Aluminum (Al)-Total	Method 6010/6020	0.217475
Antimony (Sb)-Total		0.0000275
Arsenic (As)-Total		0.00498
Barium (Ba)-Total		0.28915
Beryllium (Be)-Total		0.000125
Boron (B)-Total		0.01575
Cadmium (Cd)-Total		0.00007175
Calcium (Ca)-Total		27.52
Chromium (Cr)-Total		0.0001275
Cobalt (Co)-Total		0.011225
Copper (Cu)-Total		0.000565
Iron (Fe)-Total		0.035
Lead (Pb)-Total		0.0025625
Lithium (Li)-Total		0.0017975
Magnesium (Mg)-Total		6.02
Manganese (Mn)-Total		0.99565
Mercury (Hg)-Total		<0.000010
Molybdenum (Mo)-Total		0.000251
Nickel (Ni)-Total		0.0005525
Potassium (K)-Total		14.1575
Selenium (Se)-Total		0.000485
Silver (Ag)-Total		0.00000375
Sodium (Na)-Total		35.85
Thallium (Tl)-Total		0.00032525
Tin (Sn)-Total	<0.00010	
Titanium (Ti)-Total	<0.010	
Uranium (U)-Total	0.0002065	
Vanadium (V)-Total	<0.0010	
Zinc (Zn)-Total	0.01375	
Polycyclic Aromatic Hydrocarbons (ng/L)		
Naphthalene	Method 8270-SIM	1.80575
Acenaphthylene		0.302
Acenaphthene		0.3715
Fluorene		0.9595
Phenanthrene		0.755
Anthracene		0.32825
Fluoranthene		0.54
Pyrene		0.26675
Benz[a]anthracene		0.09525
Chrysene		0.09425
Benzo[b]fluoranthene		>0.103
Benzo[j,k]fluoranthenes		>0.121
Benzo[e]pyrene		>0.176
Benzo[a]pyrene		>0.19
Perylene		>0.189
Dibenz[a,h]anthracene		>0.124
Indeno[1,2,3-cd]pyrene		0.03925
Benzo[ghi]perylene		0.8875
2-Methylnaphthalene		0.795
2,6-Dimethylnaphthalene		0.26225
2,3,5-Trimethylnaphthalene		0.15175
1-Methylphenanthrene		0.07825
Dibenzothiophene		0.318

Notes:

- 1 - This sampling will be conducted by the CMC.
- 2 - Action limit for dioxin is 1 pg/L. Action limits for all other analytes are the average baseline concentrations measured prior to the start of excavation activities.

Acronyms/Abbreviations:

- < - less than the detection limit; number following this symbol represents the detection limit.
- mg/L - milligrams per liter
- NDR - peak detected but did not meet quantification criteria; number following this flag represents the estimated maximum possible concentration.
- ng/L - nanograms per liter
- pg/L - picograms per liter

Figure 4 Monitoring locations for surface and waste water.



Legend

- Airport Boundary
- Storm Drain
- Excavation Areas

Sampling Locations

Surface Water

- Sample monthly for turbidity, dioxin, PAHs, and metals
- Sample at completion of remediation activities for dioxin, PAHs, and metals.

Wastewater

- Sample water captured from sediment dewatering pad, decontamination areas, and runoff from IPTD pile structure prior to cap placement for dioxin, PAHs, and metals.
- Sample IPTD drainage discharge for pH, COD, metals, oil and grease, phenols, 2,4-D, and 2,4,5-T



Scale: 1:6,000
Projection: WGS 1984 UTM Zone 49N

Imagery: GeoEye Feb 2010 (0.5 m)



Figure 5 Monitoring locations for groundwater.



Legend

-  Airport Boundary
-  Storm Drain
-  Excavation Areas
-  Sample baseline and annually for dioxin, PAHs, and metals in groundwater



0 50 100 200
m

Scale: 1:12,500

Projection: WGS 1984 UTM Zone 49N

Imagery: GeoEye Jul 2009 (1 m)



Table 4. Environmental mitigation measures for project impacts on air quality

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation ¹	Monitoring Requirements*	Reference Document(s)
<p>Contractor-specific mitigation measures for exposure to dioxin-contaminated material include, but are not limited to:</p> <ul style="list-style-type: none"> • Providing adequate training in use of PPE (i.e., respirators, tyvek suits, gloves, etc.) to all workers and obtain feedback to ensure the equipment will be worn. • Medical monitoring for all workers in close contact with dioxin-contaminated material and/or by request of any worker. 	USAID-approved HASPs for all contractors.	ECC, IPTD contractor, and CMC: each contractor responsible for their own workers' H&S.	Each contractor required to implement the H&S monitoring per their specific HASPs.	Site-wide HASP (USAID 2013a), ECC-APP & SSHP (USAID 2012a), IPTD-specific HASP (USAID 2012g).
Frequently spray down excavation areas, excavated material, worksites, and sensitive areas along unsealed transportation routes using water or a biodegradable dust suppressant. Waste petroleum oil shall not be used for dust control.	No complaints or non-compliances from Airport personnel and nearby residents and dioxin/dust levels during excavation remain at/below established baseline.	CMC: baseline and perimeter air/dust monitoring. ECC: engineering controls. IPTD: sampling and treatment of extracted vapors.	See Tables 4A and 4B and Figure 6.	Site-wide SAP (USAID 2011a), Site-wide HASP (USAID 2013a), ECC's Site-wide EPP (USAID 2012f), IPTD contractor's treatment-specific SAP/QAPP (USAID 2012e), QCVN 20:2009/BTNMT ² , QCVN 30:2010/BTNMT ³ .
Cover excavated soil during transportation with tarps or geo-fabrics to avoid windblown dust mobilization.	IPTD system vapor discharge does not exceed project action limits (see Table 4B)			
Cover exposed surfaces overnight or during periods of low excavation activity.				
All vehicles to maintain safe speeds on granular/unsealed roads limiting dust generation.	All vehicles and construction equipment meet GVN emission standards and ambient noise criteria TCVN 5949:1998.	ECC and IPTD	Review vehicles records.	ECC's Implementation Plan (USAID 2013b), IPTD contractor's Implementation Plans (2013d).
Undertake work in favorable weather conditions (i.e., low wind conditions [<30 km/hr]), In windy conditions, all movement of dioxin-contaminated material will be halted until wind conditions decrease.	No complaints or non-compliances.	CMC: weather monitoring. ECC and IPTD	Monitoring of weather conditions through on-site weather station.	ECC's Implementation Plan (USAID 2013b), IPTD contractor's Implementation Plans (2013d).
During removal of soil/sediment from the IPTD pile structure and stockpiling, adequately cover treated soil/sediment until it is re-distributed for future use or stabilized at the stockpile locations with a vegetative cover.	No complaints or non-compliances from Airport personnel and nearby residents and dust levels during removal remain at/below established baseline.	CMC: perimeter dust monitoring. ECC: engineering controls.	During removal: Daily perimeter (north, south, east, west) dust monitoring.	Site-wide SAP (USAID 2011a), Site-wide HASP (USAID 2013a), ECC's Site-wide EPP (USAID 2012f).

Notes:
 1 – CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.
 2 – QCVN 20:2009/BTNMT - National Technical Regulation on Industrial Emission of Organic Substances.
 3 – QCVN 30:2010/BTNMT - National Technical Regulation on Emission of Industrial Waste Incinerators (reference "B" values).

Table 4A. Ambient Air Sampling

Samples	Contractor Responsible for Sampling	Frequency	Dust	2,3,7,8-TCDD
			Field Test	TO-9A
			0.186 mg/m ³ (BTV for dust*)	0.414 pg/m ³ (BTV for dioxin in air*)
Dust Monitoring	CMC	Daily during excavation or other earth moving activities.	✓	
Air Sampling	CMC	* Weekly during 1 st month of excavation. * Monthly during excavation or other earth moving activities.		✓

Table 4B. IPTD Vapor/Air Sampling

Samples	Contractor Responsible for Sampling	Frequency	Dust (PM-10)	2,3,7,8-TCDD	Organic Vapors	Total Phenols	Total Cresols	
			Field Test	TO-9A	PID	Field Test	Field Test	
			0.186 mg/m ³ ** (BTV for dust*)	0.6 ngTEQ/m ³ ** (QCVN 30:2010/ BTNMT)	Significant increase (100% increase over baseline)	19 mg/m ³ ** (QCVN 20:2009/ BTNMT)	22 mg/m ³ ** (QCVN 20:2009/ BTNMT)	
IPTD Vapor	IPTD Contractor	System Startup (1 week period during both Phase I and Phase II)	Daily			EV		
			1 time/week		I	I	I	
			2 times/week	E	E	E	E	
		Operations (Phase I operations is ~16 weeks; Phase II operations is ~25 weeks)	Daily			EV		
			1 time/week	E		I, E	I, E	I, E
			2 times/week		I, E			
		100°C Milestone (1 week period during both Phase I and Phase II)	Daily			EV		
			1 time/week		I	I	I	I
			2 times/week	E	E	E	E	E
		335°C Milestone (1 week period during both Phase I and Phase II)	Daily			EV		
			1 time/week					
			2 times/week	E	I, E	I, E	I, E	I, E
Post Operations (2 week period during both Phase I and Phase II)	Daily			EV				
	1 time/2 weeks	E	E	E	E	E		

Notes:

* The BTVs for dust and dioxin in air were established at the beginning of the project, prior to the start of any remediation activities through the collection of baseline dust and air samples throughout the project site.

** Action levels for IPTD vapor apply only to the Effluent ("E") measurements.

Acronyms/Abbreviations:

BTV - baseline threshold value

E - Effluent: After GAC, before stack

EV - Extracted vapors sampled after quench and scrubber

GAC - granular activated carbon

HCl - hydrochloric acid

I - Influent: After temperature conditioning, before GAC

IPTD - in-pile thermal desorption

mg/m³ - milligrams per cubic meter

NA - not applicable

ngTEQ/m³ - nanograms of TEQ per cubic meter

QCVN 20:2009/BTNMT - National Technical Regulation on Industrial Emission of Organic Substances.

QCVN 30:2010/BTNMT - National Technical Regulation on Emission of Industrial Waste Incinerators (reference "B" values).

TEQ - toxicity equivalent

Figure 6 Monitoring locations for air quality.



Legend

- Airport Boundary
- Storm Drain
- Excavation Areas

Air Quality Monitoring

- Dust and dioxin Phase 1 excavation
- Dust and dioxin Phase 2 excavation
- IPTD vapor discharge monitoring



0 40 80 160 m

Scale: 1:6,000
Projection: WGS 1984 UTM Zone 49N

Imagery: GeoEye Feb 2010 (0.5 m)



Table 5. Environmental mitigation measures for project impacts on noise levels

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation ¹	Monitoring Requirements*	Reference Document(s)
To the extent possible, limit project activities to daylight hours to minimize noise nuisance to airport personnel and nearby residents, advise nearby residents of potential noise-causing activities, ensuring all internal combustion engines are fitted with appropriate muffler systems, and, if necessary deploying acoustical screening to shield dwellings and facilities from project equipment noise.	No complaints or non-compliances from Airport personnel and nearby residents and noise emissions do not exceed: 75 dBA between 6am and 6pm, 70 dBA between 6pm and 10pm, and 50 dBA between 10pm and 6am.	ECC and IPTD	ECC - Ambient noise monitoring conducted around the perimeter of the work area(s) and/or in the districts surrounding the airport.	TCVN 3985:1999 ² , ECC-specific APP & SSHP (USAID 2012a), IPTD-specific HASP (USAID 2012g).
Limit noise within the worksite, with the use of hearing protection, as outlined in the contractors'-specific HASPs.	Noise limits at worksites must not exceed 85 dBA	ECC, IPTD, and CMC: each contractor responsible for their own workers' H&S.	Workers must wear hearing protection when noise exceeds the "rule of thumb" test: a worker must raise his/her voice when talking to someone within 0.75 – 1.5m (2-5 ft)	TCVN 3985:1999 ² , ECC-specific APP & SSHP (USAID 2012a), IPTD-specific HASP (USAID 2012g).

Notes:
1 – CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.
2 – TCVN 3985:1999 Acoustics – Allowable noise levels at workplace. [Replacing TCVN 3985:1985].

Table 6. Environmental mitigation measures for project impacts on GHG emissions

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation*	Monitoring Requirements*	Reference Document(s)
Implementation of the following measures as appropriate: • Use of appropriate biodiesels; • Use of most fuel efficient/newer construction equipment fleets; • Policies to minimize construction equipment idling; • Policies to ensure that trucks only leave with a full load; • Policies to "turn off and unplug" electricity sources when not in use; • Use of energy efficient lighting (indoor and outdoor) for treatment related needs; • If paving, use warm mix asphalt in place of hot mix asphalt; • Recycle and reuse construction debris (minimizes landfill emissions and potential hauling for disposal); and • Install on-site renewable energy systems for treatment process.	Reduction in GHG emissions	CMC, ECC, IPTD	Visual observations.	Not applicable.

*Note: CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.

Table 7. Environmental mitigation measures for project impacts on terrestrial ecosystems and biodiversity, and wetlands/aquatic ecosystems and aquatic biodiversity

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation	Monitoring Requirements	Reference Document(s)
Baseline surveys will be conducted by qualified biologists (trained in identification of endangered or threatened species with habitats located in the geographic area of the project site) prior to commencement of site clearing. If threatened or endangered species are identified, they will be moved out of the project area where possible and/or sensitive ecosystems will be flagged or fenced off if located near the project footprint.	All identified rare and endangered species are moved to a secure location outside of the project area, within similar habitat. No net loss of rare and endangered species or habitat as result of the project.	CMC	No threatened or endangered species were identified in the project area during the baseline survey.	Biodiversity Survey (USAID 2012h), Final EIA (GVN 2012).

Table 8. Environmental mitigation measures for project impacts on generation of waste

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation*	Monitoring Requirements*	Reference Document(s)
Train contractors on waste avoidance.	Waste is minimized on-site.	CMC, ECC, IPTD	Visual observation.	Not applicable.
Provide adequate garbage receptacles for construction and office waste to be disposed of as needed when full.	Garbage is removed from site before it builds up.	CMC and ECC	Visual observation.	Not applicable.
Separate and clearly label/cover receptacles for recyclable materials generated on the worksite. Remove from the worksite when full.	Separate recyclables and garbage bins are present on-site.	CMC, ECC, IPTD	Visual observation.	Not applicable.
Dispose of all solid waste in approved and appropriate solid waste disposal sites.	All solid waste disposed of in approved and appropriate solid waste disposal sites	CMC, ECC, IPTD	Visual observation.	Not applicable.
Prohibitions regarding the burning of refuse or other material, unless otherwise authorized in an air discharge permit as required under applicable regulations.	No air quality issues are reported in regards to burning of refuse.	CMC, ECC, IPTD	Visual observation.	Not applicable.
Storage and disposal of wastes related to IPTD treatment will address the following: <ul style="list-style-type: none"> Hazardous waste management practices (e.g., for spent GAC disposal, if required) will follow procedures for hazardous waste as specified in the Vietnamese Hazardous Waste Management Regulations (1999); Volumes and types of waste; How they are to be stored and transported; and Monitoring records and reporting. 	No environmental impacts result from waste from the IPTD treatment system.	IPTD	Visual observation and record keeping.	TCVN 7629:2007 Circular No. 05/1999/TT-BYT

* Note: CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.

Table 9. Environmental mitigation measures for project impacts on human health

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation*	Monitoring Requirements*	Reference Document(s)
Develop mitigation measures for exposure to dioxin-contaminated material in the contractors'-specific HASPs, which may include, but not be limited to: <ul style="list-style-type: none"> Providing adequate training in use of PPE (i.e., respirators, tyvek suits, gloves, etc.) to all workers and obtain feedback to ensure the equipment will be worn. Medical monitoring for all workers in close contact with dioxin-contaminated material and/or by request of any worker. 	USAID-approved HASPs for all contractors.	ECC, IPTD, and CMC: each contractor responsible for their own workers' H&S.	Each contractor required to implement the H&S monitoring per their specific HASPs.	Site-wide HASP (USAID 2013a), ECC-specific APP & SSHP USAID 2012a, IPTD-specific HASP (USAID 2012g).
Provide sanitary facilities for all site workers including toilets, wash facilities, and a decontamination area for removal of PPE. Sanitary facilities are to be cleaned a minimum of once per week.	No incidences of diseases or complaints from workers related to poor sanitation.	CMC and ECC	Visual observation.	Not applicable.
Potable drinking water to be provided to all workers while on-site.	No incidences of dehydration or workers drinking from the lakes/ponds on-site.	CMC and ECC	Visual observation.	Not applicable.
Develop mitigation measures for exposure to UXO in the contractors' HASP..	USAID-approved HASP including a UXO management plan.	CMC and ECC	UXO clearance prior to work activities; visual observations and appropriate response during excavation.	Site-wide HASP (USAID 2013a), ECC-APP & SSHP (USAID 2012a).
Providing education and mitigation measures for nearby residents, airport personnel and passengers during Project construction.	Provide updated project information to the airport and the surrounding community on a regular basis.	USAID and CMC	No monitoring requirements.	Stakeholder Engagement Plan (USAID 2012i)

*Note: CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.

Table 10. Environmental mitigation measures for project impacts related to environmental risks and hazards

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation*	Monitoring Requirements*	Reference Document(s)
Ensure all final environmental management plans contains explicit consideration of methods to protect project infrastructure, equipment, and facilities over the rainy seasons as well as environmental contingency planning for greater-than-expected project activities being conducted in the rainy season	Integrity of project facilities is maintained during rainy seasons and no environmental incidents occur as a result of extreme rainy season weather events	ECC and IPTD	Visual observation.	ECC's Implementation Plan (USAID 2013b), IPTD contractor's Implementation Plans (2013d).
Storage of hazardous waste (i.e., diesel fuel, oils etc.) must be in designated sealed containers with labels/signage and access restricted to certain responsible personnel.	No non-compliances in regards to hazardous waste occur during the project.	ECC and IPTD	Visual observation.	Not applicable.
Hazardous storage areas must have at a minimum impermeable base and walls, a low point where spills can be extracted, capacity to hold 200% of the volume of the largest container in the area.	No non-compliances in regards to hazardous waste occur during the project.	ECC and IPTD	Visual observation.	Not applicable.
Check work areas for leaks and spills daily and ensure areas are clean/tidy of waste.	No non-compliances in regards to waste occur during the Project.	ECC and IPTD	Visual observation.	Not applicable.

*Note: CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.

Table 11. Other environmental mitigation measures

Mitigation Measure	Mitigation Target	Contractor Responsible for Implementation*	Monitoring Requirements*	Reference Document(s)
Restore and reclaim project area; where practicable, disturbed areas will be re-seeded with grass as soon as possible to prevent surface soil erosion and protect drainage water pathways.	Prevent soil erosion and protect drainage water pathways.	ECC	Visual observation.	Final D&H Design (USAID 2011b), ECC's Implementation Plan (USAID 2013b).
Choose most appropriate route for haul trucks to minimize impacts to road surface in consultation with the Responsible Authorities. Restrict equipment to designated access roads, routes and work areas.	Compliance with designated haul route.	ECC	Visual observation.	ECC TCP (USAID 2012b).
All above and below ground utilities within the construction limits will be located prior to any ground disturbance.	No above or below ground utilities are struck during construction activities.	ECC	Conduct a pre-startup exclusion zone visit to identify and flag/mark these features.	ECC-specific APP & SSHP (USAID 2012a).
Prior to removal from the project area, all existing man-made items which are noted for demolition must be decontaminated to remove any potential contaminated soil/sediment.	No contaminated soil/sediment leaves the project area.	ECC	Visual observation.	ECC Site-wide EPP (USAID 2012f).
Clear signage around the project area will be installed.	Signage is visible in all relevant parts of the project area.	CMC, ECC, and IPTD	Visual observation.	Not applicable.
Restrict land disturbance to the limits of project area as defined in the Final D&H Design.	No land is disturbed outside the limits of the project area.	ECC	Visual observation.	Final D&H Design (USAID 2011b), ECC's Implementation Plan (USAID 2013b).
New site access road design and related environmental mitigation measures as specified in the Final D&H Design.	No environmental impacts result from new site access road construction.	ECC	Visual observation.	Final D&H Design (USAID 2011b), ECC's Implementation Plan (USAID 2013b).
Schedule transportation activities to avoid, where possible, times of maximum congestion and maximum disturbance.	No traffic incidences or complaints during all project stages.	ECC and IPTD	Visual observation.	Not applicable.
Ensure all fish removed from Sen Lake are added to the IPTD pile for treatment.	No fish with elevated dioxin concentrations enter the human food chain.	ECC	Visual observation.	Not applicable.

*Note: CMC will monitor (through daily inspections and 100% oversight at the Airport) ECC's and IPTD contractor's compliance in implementing mitigation measures and monitoring requirements in accordance with the referenced targets/plans.

Table 12. Summary of Environmental Sampling Requirements by Activity

Activity	Media	Sampling Location	Frequency	Analytes	Method	Action Level	Responsible Contractor				
Pre-Remediation	Groundwater	See Figure 5	Once	2,3,7,8-TCDD	Method 1613B	1 pg/L	CMC				
				Total metals	Method 6010/6020	None; this baseline data was used to establish the action level					
				PAHs	Method 8270-SIM						
Throughout remediation, regardless of activity	Groundwater	See Figure 5	Annually	2,3,7,8-TCDD	Method 1613B	1 pg/L	CMC				
				Total metals	Method 6010/6020	See Table 3C					
				PAHs	Method 8270-SIM	See Table 3C					
Excavation, earth moving, and IPTD pile construction	Surface water	Sen Lake discharge	Monthly during excavation and earth moving activities	Turbidity	Field Test	29 NTU over background	CMC				
				2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)					
				Benzo(a)pyrene	Method 8270-SIM	200 ng/L (USEPA MCL)					
				Zinc	Method 6010/6020	3 mg/L (QCVN 40:2011/BTNMT)					
				Arsenic	Method 6010/6020	0.1 mg/L (QCVN 40:2011/BTNMT)					
	Project-affected water / wastewater	Dewatering pad discharge, decontamination water, and water in contact with contents of IPTD pile	As needed prior to discharge	Turbidity	Field Test	29 NTU over background	ECC				
				2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)					
				Benzo(a)pyrene	Method 8270-SIM	200 ng/L (USEPA MCL)					
				Zinc	Method 6010/6020	3 mg/L (QCVN 40:2011/BTNMT)					
	Dust	Perimeter of activity	Daily during excavation and earth moving activities	Dust	Field Test	0.186 mg/m ³ (BTV)	CMC				
				Ambient air	Perimeter of activity	Weekly during first month of excavation, and monthly during excavation and earth moving activities		2,3,7,8-TCDD	Method TO-9A	0.414 pg/m ³ (BTV)	CMC
				Soil				Limits of excavation	Upon completing excavation for each decision unit	Dioxin TEQ	
Sediment					150 pg/g (TCVN 8183:2009)	CMC					

Table 12. Summary of Environmental Sampling Requirements by Activity

Activity	Media	Sampling Location	Frequency	Analytes	Method	Action Level	Responsible Contractor
IPTD system startup (1 week period during both Phase I and Phase II)	Vapor	Extracted vapors	Daily	Organic vapors	PID	NA	IPTD Contractor
	Vapor	At influent; before GAC	Once a week	2,3,7,8-TCDD	Method TO-9A	NA	
				Organic vapors	PID	NA	
				HCl	Field Test	NA	
				Total phenols	Field Test	NA	
				Total cresols	Field Test	NA	
	Vapor	At effluent; after GAC	Twice a week	Organic vapors	PID	100% increase above baseline	
				Dust	Field Test	0.186 mg/m ³ (BTV)	
				2,3,7,8-TCDD	Method TO-9A	0.6 ngTEQ/m ³ (QCVN 30:2010/BTNMT)	
				HCl	Field Test	50 mg/m ³ (QCVN 30:2010/BTNMT)	
				Total phenols	Field Test	19 mg/m ³ (QCVN 20:2009/BTNMT)	
	Liquid	At influent; before GAC and At effluent; after MPPE, GAC, and GFH (Note: action levels apply only to the effluent samples) and At effluent; in backup water trench	Twice a week	Turbidity	Field Test	29 NTU over background	
				Organic vapors	Field Test	100% increase above baseline	
				2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	
				Arsenic	Method 6010/6020	0.1 mg/L (QCVN 40:2011/BTNMT)	
				pH	Field Test	5.5 - 9 (QCVN 40:2011/BTNMT)	
				COD	Field Test	150 mg/L (QCVN 40:2011/BTNMT)	
				Oil and grease	Method 1664	9.0 - 9.9 mg/L (QCVN 40:200/BTNMT)	
				Total phenols	Field Test	0.45 - 0.495 mg/L (QCVN 40:2011/BTNMT)	
				2,4-D	Field Test	0.2 mg/L (QCVN 08:2008/BTNMT)	
2,4,5-T				Field Test	0.1 mg/L (QCVN 08:2008/BTNMT)		
Liquid	At interim; after MPPE	Twice a week	Turbidity	Field Test	NA		
			2,3,7,8-TCDD	Method 1613B	NA		
			pH	Field Test	NA		
			COD	Field Test	NA		
			Oil and grease	Method 1664	NA		
			Total phenols	Field Test	NA		
			2,4-D	Field Test	NA		
2,4,5-T	Field Test	NA					

Table 12. Summary of Environmental Sampling Requirements by Activity

Activity	Media	Sampling Location	Frequency	Analytes	Method	Action Level	Responsible Contractor
IPTD operations (Phase 1 operations is ~16 weeks; Phase II operations is ~25 weeks)	Vapor	Extracted vapors	Daily	Organic vapors	PID	NA	IPTD Contractor
		At influent; before GAC	Once a week	Organic vapors	PID	NA	
				HCl	Field Test	NA	
				Total phenols	Field Test	NA	
				Total cresols	Field Test	NA	
				2,3,7,8-TCDD	Method TO-9A	NA	
		At effluent; after GAC	Once a week	Organic vapors	PID	100% increase above baseline	
				HCl	Field Test	50 mg/m ³ (QCVN 30:2010/BTNMT)	
				Total phenols	Field Test	19 mg/m ³ (QCVN 20:2009/BTNMT)	
				Total cresols	Field Test	22 mg/m ³ (QCVN 20:2009/BTNMT)	
	Dust			Field Test	0.186 mg/m ³ (BTV)		
		Twice a week	2,3,7,8-TCDD	Method TO-9A	0.6 ngTEQ/m ³ (QCVN 30:2010/BTNMT)		
	Liquid	At influent; before GAC and At effluent; after MPPE, GAC, and GFH and At effluent; in backup water trench. (Note: action levels apply only to the effluent samples)	Twice a week	Turbidity	Field Test	29 NTU over background	
				COD	Field Test	150 mg/L (QCVN 40:2011/BTNMT)	
				Total phenols	Field Test	0.45 - 0.495 mg/L (QCVN 40:2011/BTNMT)	
				2,4-D	Field Test	0.2 mg/L (QCVN 08:2008/BTNMT)	
				2,4,5-T	Field Test	0.1 mg/L (QCVN 08:2008/BTNMT)	
			Once a week	2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	
				Arsenic	Method 6010/6020	0.1 mg/L (QCVN 40:2011/BTNMT)	
				Oil and grease	Method 1664	9.0 - 9.9 mg/L (QCVN 40:200/BTNMT)	
			Daily	pH	Field Test	NA	
				Organic Vapors	PID	100% increase above baseline	
		At interim; after MPPE	Once a week	Turbidity	Field Test	NA	
				2,3,7,8-TCDD	Method 1613B	NA	
				Arsenic	Method 6010/6020	NA	
				pH	Field Test	NA	
				COD	Field Test	NA	
				Total phenols	Field Test	NA	
2,4-D				Field Test	NA		
2,4,5-T			Field Test	NA			
As needed	Oil and grease	Method 1664	NA				
Daily	pH	Field Test	NA				
	Organic Vapors	PID	100% increase above baseline				

Table 12. Summary of Environmental Sampling Requirements by Activity

Activity	Media	Sampling Location	Frequency	Analytes	Method	Action Level	Responsible Contractor
100°C milestone (1 week period during both Phase I and Phase II)	Vapor	Extracted vapors	Daily	Organic vapors	PID	NA	IPTD Contractor
		At influent; before GAC	Once a week	2,3,7,8-TCDD	Method TO-9A	NA	
				HCl	Field Test	NA	
				Organic vapors	PID	NA	
				Total phenols	Field Test	NA	
				Total cresols	Field Test	NA	
		At effluent; after GAC	Twice a week	Organic vapors	PID	100% increase above baseline	
				Dust	Field Test	0.186 mg/m ³ (BTV)	
				2,3,7,8-TCDD	Method TO-9A	0.6 ngTEQ/m ³ (QCVN 30:2010/BTNMT)	
				HCl	Field Test	50 mg/m ³ (QCVN 30:2010/BTNMT)	
	Total phenols			Field Test	19 mg/m ³ (QCVN 20:2009/BTNMT)		
	Liquid	At influent; before MPPE, At effluent; after MPPE, GAC, and GFH (Note: action levels apply only to the effluent samples)	Twice a week	Turbidity	Field Test	29 NTU over background	
				2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	
				Arsenic	Method 6010/6020	0.1 mg/L (QCVN 40:2011/BTNMT)	
				pH	Field Test	5.5 - 9 (QCVN 40:2011/BTNMT)	
				COD	Field Test	150 mg/L (QCVN 40:2011/BTNMT)	
				Oil and grease	Method 1664	9.0 - 9.9 mg/L (QCVN 40:200/BTNMT)	
				Total phenols	Field Test	0.45 - 0.495 mg/L (QCVN 40:2011/BTNMT)	
				2,4-D	Field Test	0.2 mg/L (QCVN 08:2008/BTNMT)	
		2,4,5-T	Field Test	0.1 mg/L (QCVN 08:2008/BTNMT)			
		At interim; after MPPE	Twice a week	Turbidity	Field Test	NA	
2,3,7,8-TCDD				Method 1613B	NA		
pH	Field Test			NA			
COD	Field Test			NA			
			Oil and grease	Method 1664	NA		
			Total phenols	Field Test	NA		
			2,4-D	Field Test	NA		
			2,4,5-T	Field Test	NA		

Table 12. Summary of Environmental Sampling Requirements by Activity

Activity	Media	Sampling Location	Frequency	Analytes	Method	Action Level	Responsible Contractor
335°C milestone (1 week period during both Phase I and Phase II)	Vapor	Extracted vapors	Daily	Organic vapors	PID	NA	IPTD Contractor
		At influent; before GAC	Twice a week	2,3,7,8-TCDD	Method TO-9A	NA	
				HCl	Field Test	NA	
				Organic vapors	PID	NA	
				Total phenols	Field Test	NA	
				Total cresols	Field Test	NA	
		At effluent; after GAC	Twice a week	Organic vapors	PID	100% increase above baseline	
				Dust	Field Test	0.186 mg/m ³ (BTV)	
				2,3,7,8-TCDD	Method TO-9A	0.6 ngTEQ/m ³ (QCVN 30:2010/BTNMT)	
				HCl	Field Test	50 mg/m ³ (QCVN 30:2010/BTNMT)	
	Total phenols			Field Test	19 mg/m ³ (QCVN 20:2009/BTNMT)		
	Liquid	At influent; before MPPE, and At effluent; after MPPE, GAC, and GFH and At effluent; in backup water trench. (Note: action levels apply only to the effluent samples)	Twice a week	Turbidity	Field Test	29 NTU over background	
				2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	
				Arsenic	Method 6010/6020	0.1 mg/L (QCVN 40:2011/BTNMT)	
				pH	Field Test	5.5 - 9 (QCVN 40:2011/BTNMT)	
				COD	Field Test	150 mg/L (QCVN 40:2011/BTNMT)	
				Oil and grease	Method 1664	9.0 - 9.9 mg/L (QCVN 40:200/BTNMT)	
Total phenols				Field Test	0.45 - 0.495 mg/L (QCVN 40:2011/BTNMT)		
2,4-D	Field Test	0.2 mg/L (QCVN 08:2008/BTNMT)					
2,4,5-T	Field Test	0.1 mg/L (QCVN 08:2008/BTNMT)					
Post IPTD operations (2 week period during both Phase I and Phase II)	Vapor	Extracted vapors	Daily	Organic vapors	PID	NA	IPTD Contractor
		At effluent; after GAC	Once every two weeks	Organic vapors	PID	100% increase above baseline	
				Dust	Field Test	0.186 mg/m ³ (BTV)	
				2,3,7,8-TCDD	Method TO-9A	0.6 ngTEQ/m ³ (QCVN 30:2010/BTNMT)	
				HCl	Field Test	50 mg/m ³ (QCVN 30:2010/BTNMT)	
				Total phenols	Field Test	19 mg/m ³ (QCVN 20:2009/BTNMT)	
	Liquid	At effluent; after MPPE, GAC, and GFH and At effluent; in backup water trench	Once every two weeks	Turbidity	Field Test	29 NTU over background	
				2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	
				Arsenic	Method 6010/6020	0.1 mg/L (QCVN 40:2011/BTNMT)	
				pH	Field Test	5.5 - 9 (QCVN 40:2011/BTNMT)	
				COD	Field Test	150 mg/L (QCVN 40:2011/BTNMT)	
				Oil and grease	Method 1664	9.0 - 9.9 mg/L (QCVN 40:200/BTNMT)	
				Total phenols	Field Test	0.45 - 0.495 mg/L (QCVN 40:2011/BTNMT)	
2,4-D	Field Test	0.2 mg/L (QCVN 08:2008/BTNMT)					
2,4,5-T	Field Test	0.1 mg/L (QCVN 08:2008/BTNMT)					
Soil / sediment	Inside IPTD pile	Upon completing each phase of treatment	Dioxin TEQ	Method 1613B	150 pg/g (TCVN 8183:2009)	CMC	

Table 12. Summary of Environmental Sampling Requirements by Activity

Activity	Media	Sampling Location	Frequency	Analytes	Method	Action Level	Responsible Contractor
Post-Remediation	Surface water	Sen Lake	Once	2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	CMC
				Total metals	Method 6010/6020	See Table 3B	
				PAHs	Method 8270-SIM	See Table 3B	
	Surface water	Drainage Ditch	Once	2,3,7,8-TCDD	Method 1613B	24.01 pg/L (BTV)	CMC
				Total metals	Method 6010/6020	See Table 3B	
				PAHs	Method 8270-SIM	See Table 3B	
	Groundwater	See Figure 5	Once	2,3,7,8-TCDD	Method 1613B	1 pg/L	CMC
				Total metals	Method 6010/6020	See Table 3C	
				PAHs	Method 8270-SIM	See Table 3C	

Section 4

Gender Considerations

Vietnam has a strong legal framework for gender equality. Men and women are legally entitled to equal rights with respect to economic opportunities, political participation, land tenure, property ownership, marriage and family. Despite the existence of legislated tools, gender inequality still persists in Vietnamese society, due to poverty, lack of empowerment, women's limited knowledge of their rights, cultural norms, as well as poor enforcement of laws.

A Gender Assessment (USAID 2010b) was prepared for the remediation project in order to understand how the project will impact men and women differently, and to identify mitigation strategies for any negative impacts resulting from the project activities. It examined functional labor categories (construction workers, military personnel, airport workers and passengers, residents, informal laborers, and fisherfolk) associated with each step of the environmental remediation process at the Airport to determine whether gender-specific measures are necessary. High dioxin and furan levels in breast milk of women in and around the Airport emphasize the need for mitigation measures to protect breast-feeding mothers, infants, and women of childbearing age against dioxin exposure.

The CMC, ECC, and IPTD contractors will be required to implement this Project EMMP in accordance with the USAID Gender Assessment (USAID 2010b, gender requirements in the GVN's Final EIA, and GVN laws and regulations. In addition to the H&S monitoring requirements listed in Section 3 (such as medical monitoring for employees, and use of personal protective equipment [PPE]), the CMC, ECC, and IPTD contractors are responsible for conducting the following monitoring activities for the mitigation and management of gender issues identified in the project:

- Measure worker's knowledge of potential dioxin pathways and preventive measures. Responsibility: CMC, ECC, and IPTD contractors for their respective employees.
- Measure female worker's knowledge regarding their rights accorded to them under the Vietnam Labor Code (Article 109 and 113, Chapter X). Responsibility: CMC, ECC, and IPTD contractors for their respective employees.
- Monitor the percentage of female workers involved in the construction activities. Responsibility: CMC, ECC, and IPTD contractors for their respective employees.
- Monitor adherence to the proposed ban on scrap metal mining on Airport property. Responsibility: CMC.
- Monitor adherence to the ban on fishing on Sen Lake. Responsibility: CMC.
- Conduct an education and awareness outreach campaign about potential dioxin contamination pathways and risk mitigation strategies. By conducting surveys before and after the outreach campaign, monitor the change in knowledge, attitude and practice of residents to ensure that the education and awareness outreach campaign for residents has been effective. Responsibility: USAID.

Section 5

Revisions to the Project EMMP

The environmental mitigation measures and monitoring requirements in this Project EMMP have been developed on the basis of an impact assessment of the project using the Final D&H Design (USAID 2011b) and the 100% IPTD design (USAID 2012d).

5.1 Updating the Project EMMP

The Project EMMP should be considered a “living document” in that periodic updates may be necessary during the course of the project to reflect design modifications, lessons learned, when agreed milestones have been achieved, or unforeseen site conditions. At a minimum, the CMC will update the EMMP annually.

The CMC will monitor the ECC and IPTD contractors’ compliance with the Project EMMP to determine if the environmental mitigation measures for the project are being implemented properly and are having the intended effects of avoiding, limiting, or rectifying negative environmental impacts. **If mitigation compliance monitoring indicates that mitigation measures are not being implemented effectively, or are not being effective, the CMC will recommend corrective action to USAID.**

5.2 Requirements for Flexibility and Adaptability in Implementation of the Project EMMP

This Project EMMP makes predictions about the environmental impacts of the project based on existing information and understanding of the environmental and socioeconomic resources of the Airport and surrounding area, and the project design as currently defined. While the assessment concludes that the project is environmentally feasible, as with all predictions of environmental impacts, there is uncertainty in the reliability of these predictions; not so much uncertainty as to not proceed with the project, but uncertainty nonetheless:

- The actual impacts that occur as a result of project implementation may be different than the predictions made in this Project EMMP because of the limited data and information available for a number of the environmental and social resources of the project area;
- The recommended mitigation measures may not be able to prevent negative environmental impacts; or
- During project implementation, various factors may require project design modifications whose environmental impacts were beyond the scope of this Project EMMP.

The organizational framework for the project will be sufficiently flexible and adaptable to be responsive to these unexpected situations. It will be able to accommodate numerous situations during construction and operation of the project as described below. This concept of requiring the organizational framework to be adaptable to changing project circumstances is in fact supported by the GVN’s regulatory regime for environmental assessment and management.

5.2.1 Unexpected Environmental and Socioeconomic Impacts Triggering Project Design Modifications, Environmental Review of Design Modifications, and Possible Revisions to Project EMMP

There may be a need for modifications to the project design or implementation in order to ameliorate or reduce unexpected environmental and/or socioeconomic impacts that were not predicted in this Project EMMP. If this scenario were to occur at any stage during implementation of the Project, USAID will ensure that:

- The updated project design will include an environmental review. This environmental review will include a revision of the Project EMMP if necessary, with adjustment of budgets, sampling regimes, and reporting requirements; and,
- The updated project design and the associated environmental review and revised Project EMMP will be reviewed and approved by GVN and USAID. Existing review and approval procedures are sufficient and adequate.

5.2.2 Review and Possible Revisions to Project EMMP to Strengthen Existing Mitigation and Monitoring Programs

Results from implementing the Project EMMP may suggest that there is a need for modification for one of the following reasons:

- Additional mitigation measures are required because the project is having unexpected environmental effects that were not predicted in the Project EMMP, and these effects can be mitigated by modifying project implementation rather than by modifying project design;
- Mitigation measures that were specified in this Project EMMP are not proving to be effective and need to be strengthened or modified;
- Mitigation measures that were specified in this Project EMMP are proving to be too stringent and can be relaxed to improve cost-effectiveness;
- The effects monitoring sampling regime needs to be adjusted to better detect impacts of the project.

If this were to occur at any stage during implementation of the project, USAID will ensure that:

- A revised Project EMMP to suit the revised requirements for environmental protection will be prepared, with adjustment of budgets, sampling regimes, and reporting requirements to suit the new requirements; and
- The revised Project EMMP will be reviewed and approved using the existing review and approval procedures in GVN and USAID.

Section 6

References

- GVN 2012, Report of Environmental Impact Assessment, Environmental Remediation of Dioxin Contamination at Danang Airport, May.
- USAID 2009a. Environmental Remediation at Da Nang Airport: Initial Environmental Examination.
- USAID 2009b. Environmental Remediation at Da Nang Airport: Environmental Scoping Statement, December.
- USAID 2010a. Environmental Remediation at Da Nang Airport: Environmental Assessment in Compliance with 22 CFR 216, July.
- USAID 2010b. Environmental Remediation at Da Nang Airport: Gender Assessment, November.
- USAID 2011a. Final Site-Wide Sampling and Analysis Plan. Environmental Remediation Project Da Nang Airport, March.
- USAID 2011b, Final Design Report, Dig and Haul Component, Environmental Remediation at Da Nang Airport, March.
- USAID 2012a, Accident Prevention Plan and Site Safety and Health Plan, Environmental Remediation at Da Nang Airport: Excavation and Construction, Dig and Haul Component, August.
- USAID 2012b, Site-Wide Traffic Control Plan, Environmental Remediation at Da Nang Airport: Excavation and Construction, Dig and Haul Component, August.
- USAID 2012c, Pre-mobilization and Equipment Layout Plan, Dig and Haul Component, Environmental Remediation at Da Nang Airport, Excavation and Construction, August.
- USAID 2012d, In-Pile Thermal Desorption (IPTD) 100% Design, Danang Airport, Vietnam, October.
- USAID 2012e, Final Sampling and Analysis Plan / Quality Assurance Project Plan, In-Pile Thermal Desorption (IPTD) Design, Danang Airport, Vietnam, October.
- USAID 2012f, Environmental Protection Plan, Environmental Remediation at Da Nang Airport: Excavation and Construction, October.
- USAID 2012g, Final Health and Safety Plan, In-Pile Thermal Desorption Design, Da Nang Airport, Vietnam, October.
- USAID 2012h, Biodiversity Survey at Danang Airport, Environmental Remediation at Danang Airport, Construction Management and Oversight, November.
- USAID 2012i, Final Implementation Plan (includes Final Stakeholder Engagement Plan), Environmental Remediation at Danang Airport Construction Management and Oversight, September.
- USAID 2012j, Draft Communication Plan, Environmental Remediation at Danang Airport Construction Management and Oversight, October.
- USAID 2013a. Site-Wide Health and Safety Plan 2013 Update. Environmental Remediation Project Da Nang Airport, January.

- USAID 2013b, Component-Specific Implementation Plan, Environmental Remediation at Da Nang Airport, Excavation and Construction,
- USAID 2013c, Mobilization Plan, In-Pile Thermal Desorption (IPTD) Services for Environmental Remediation Project at the Danang Airport, May.
- USAID 2013d, Implementation Plan, DRAFT In-Pile Thermal Desorption (IPTD) Services for Environmental Remediation Project at the Danang Airport, *April*.
- USAID 2013e, Project Environmental Mitigation and Monitoring Plan (EMMP), Environmental Remediation at Danang Airport Construction Management and Oversight. March.
- USAID 2013f, FY 2013 Implementation Plan Addendum, Environmental Remediation at Danang Airport Construction Management and Oversight. May.
- USAID 2014a, Operations and Maintenance Manual, In-Pile Thermal Desorption (IPTD) Services for Environmental Remediation Project at the Danang Airport, May.
- USAID 2014b, DRAFT Final Sampling and Analysis Plan/Quality Assurance Project Plan Rev. 1, In-Pile Thermal Desorption (IPTD) Services for Environmental Remediation Project at the Danang Airport, *February*.
- USAID 2014c, Revised Final Version 2 FY 2014 Implementation Plan Update (includes FY 2014 Stakeholder Engagement & Capacity Building Plan Update), Environmental Remediation at Danang Airport Construction Management and Oversight, August 13.

Appendix A

List of Vietnamese Standards and Technical Specifications

General

Circular 04/2007/TT-BKH: Guiding the Implementation of the Regulation on Management and Utilization of Official Development Assistance (to be used in conjunction with Decree 131/2006/ND-CP).

Decree 131/2006/ND-CP: Issuance of Regulation on Management and Utilization of Official Development Assistance.

Circular 03/2007/TT-BKH: Guiding the Organizational Structure, Functions, and Responsibilities of ODA Program or Project Management Units.

Law No. 52-2005-QH11: Law on Environmental Protection, promulgated by the National Assembly Vietnam by Proclamation No. 52/2005/QH11 on November 29, 2005.

Decree No. 80/2006/ND-CP of the Government dated August 9, 2006, detailing and guiding the implementation of some articles of the Environmental Protection Law 2005.

Decree No. 21/2008/ND-CP of the Government dated February 28, 2008, amending and supplementing a number of articles of Decree No. 80/2006/ND-CP detailing and guiding for the implementation of some articles of the Environmental Protection Law 2005

Decree No. 29/2011/ND-CP of the Government dated April 18, 2011, Providing strategic environmental assessment, environmental impact assessment and environmental protection commitment. [Amending Decree No. 80/2006/ND-CP and Decree No. 21/2008/ND-CP]

Circular No. 26/2011/TT-BTNMT, Detailing some clauses of Decree No. 29/2011/ND-CP of the Government dated April 18, 2011, Providing strategic environmental assessment, environmental impact assessment and environmental protection commitment.

Law No. 16-2003-QH11: Law on Construction.

Circular No. 04/2008/TT-BTNMT of Ministry of Natural Resources and the Environment dated September 18, 2008, Guiding the Formulation and Approval or Certification of Environmental Protection Schemes and the Examination and Inspection of Implementation of Environmental Protection Schemes.

Decree No. 81/2010/ND-CP: Civil Aviation Security Requirements for Airport Work.

Decree No. 15/2013/ND-CP of the Government dated February 6, 2013, on construction work quality management. [Replacing Decree No. 209/2004/ND-CP and Decree No. 49/2008/ND-CP]

Circular No. 10/2013/TT-BXD of the Ministry of Construction dated July 25, 2013, Stipulating some details on construction work quality management. [Replacing Circular No. 02/2006/TT-BXD and Circular No. 27/2009/TT-BXD]

Dioxin

Circular No. 05/1999/TT-BYT of the Ministry of Health dated March 27, 1999, Guiding the notification, registration and issuance of certificates of utilization for substances with strict requirements for occupational health. [Dioxin and its derivatives are also covered]

Decision 67/2004/QĐ-TTg of the Prime Minister No. dated April 27, 2004, on Approval of the National Action Plan for the period of 2004-2010 for overcoming caused by Toxic Chemicals used by the US

Army in the Vietnam War.

Decision of the Prime Minister No. 64/2006/QĐ-TTg dated April 24, 2003, on Approval of the plan of thorough handling establishments which cause serious environmental pollution.

Decision No. 184/2006/QĐ-TTg of the Prime Minister dated August 2006 on approval of the National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants.

Decision No. 64/2010/QĐ-QHQTT of the Prime Minister dated January 13, 2010 on approval of the project: "Environmental Remediation of Dioxin Contaminated Hotspots in Vietnam".

Decision No. 908/2010/QĐ-BTNMT of the Minister of Natural Resources and Environment dated May 24, 2010 on approval of the project documents "Environmental Remediation of Dioxin Contaminated Hotspots in Vietnam".

Inter-Agency Circular No. 40/2011/TTLT-BLDTBXH-BYT of the Ministry of Labor, Invalids and Social Affairs and the Ministry of Health dated December 28, 2011, Specifying harmful occupational conditions and jobs in which female workers, female workers who are pregnant or are taking care of children under 12 months old are not allowed. [Female workers who are pregnant or are taking care of children under 12 months old are not allowed to work in direct contact with dioxin.]

Decision No. 29/2013-TT-BCA dated May 10, 2013, Specifying the list of State secrets of secret level in the field of natural resources and environment. [Dioxin data from Vietnamese laboratories not yet publicized or not to be publicized are considered to be State secrets.]

Vietnam Standard TCVN 8183:2009: Dioxin's threshold in the soil and sediment. Decision No. 1762/QĐ-BKHHCN by Science and Technology minister dated August 27, 2009.

QCVN 30:2010/BTNMT National Technical Regulation on Industrial Waste Incinerator. [Total Dioxin/furan (PCDD/PCDF) are covered]

QCVN 41:2011/BTNMT National Technical Regulation on Co-processing of Hazardous Waste in Cement Kiln. [Dioxin/furan (PCDD/PCDF) are covered]

QCVN 43:2012/BTNMT National Technical Regulation on Sediment Quality. [Dioxin and Furan are also covered]

QCVN 45:2012/BTNM National technical regulation on allowed limits of dioxin in soils.

TCVN 9737:2013: Dioxin discharge standards from the treatment activities for the dioxin contaminated site. [Dioxin air and wastewater discharge standards are included]

Air Quality

Decision No. 3733/2002/QĐ-BYT of the Ministry of Health dated October 10, 2002 - Promulgation of 21 Labor Hygiene Standards, 5 Principles and 7 Labor Hygiene Parameters.

QCVN 05:2013/BTNMT National Technical Regulation on ambient air quality. [Replacing QCVN 05:2009/BTNMT]

QCVN 06:2009/BTNMT National Technical Regulation on concentration of hazardous substances in air. [Replacing TCVN 5938:1995, 5938:2005]

QCVN 19:2009/BTNMT National Technical Regulation on Industrial Emission of Inorganic Substances and Dusts.

QCVN 20:2009/BTNMT: National Technical Regulation on Industrial Emission of Organic Substances.
[Replacing TCVN 5940:1995, 6994:2001, 6995:2001, 6996:2001, 5940:2005].

Soil Quality

QCVN 03:2009/BTNMT National technical regulation on the allowable limits of heavy metals in the soils: As, Cd, Cu, Pb and Zn.

Water Resources and Water Quality

Law on Water Resource promulgated by the National Assembly of Vietnam by Proclamation No. 08/1998/QH10 on May 20, 1998.

Decree No. 179/1999/NĐ-CP of Government dated December 30, 1999, on Stipulating the implementation on the Law on Water Resources.

QCVN 08:2008/BTNMT National technical standard on surface water quality. [Replacing TCVN 5942:1995]

QCVN 09:2008/BTNMT National technical standard on underground water quality. [Replacing TCVN 5944:1995]

Wastewater

QCVN 14: 2008/BTNMT National technical standard on domestic wastewater.

QCVN 40:2011/BTNMT National Technical Standard on Industrial waste water.

Solid Wastes

Decree No. 59/2007/ND-CP of the Government dated April 9, 2007 on solid waste management.

TCVN 6705:2000 Non-hazardous solid wastes – Classification.

TCVN 7629:2007 National standard on the threshold of hazardous wastes.

Noise

TCVN 3985:1999 Acoustics – Allowable noise levels at workplace. [Replacing TCVN 3985:1985].

QCVN 26:2010/BTNMT National Technical Regulation on Noise [replacing TCVN 5949:1998]

Decision No. 3733/2002/QĐ-BYT of Ministry of Health dated October 10, 2002, Promulgation of 21 Labour Hygiene Standards, 5 Principles and 7 Labor Hygiene Parameters .

Vibration

TCVN 6962:2001 Vibration and shock - Vibration emitted by construction works and factories - Maximum permitted levels in the environment of public and residential areas.

TCVN 7378:2004 Vibration and shock - Vibration of buildings - Limits of vibration levels and method for evaluation.

QCVN 27:2010/BTNMT National Technical Regulation on Vibration.

Fire Prevention and Fire Fighting

Law on Fire Prevention and Fighting 27/2001/QH10,2001.

Decree No. 35/2003/ND-CP of the Government dated April 4, 2003, Detailing the Implementation of a number of articles of the Law on Fire Prevention and Fighting.

Circular No. 04/2004/TT-BCA of the Ministry of Public Security, Guiding the implementation of Decree of the Government No. 35/2003/ND-CP dated April 4, 2003, Detailing the Implementation of a number of articles of the Law on Fire Prevention and Fighting.

Decision No. 914/QĐ-BKHCHN of the Ministry of Science, Technology and Science dated June 1, 2009, issuing National Standards of fire prevention.

Decree No. 46/2012/ND-CP of the Government dated May 22, 2012, Modifying, amending some articles of Decree No. 35/2003/ND-CP dated April 4, 2003.

TCVN 2622:1995 Fire prevention and protection for buildings and structures – Design requirements.

TCVN 3254:1989 Fire safety - General requirements.

TCVN 3890:2009 Fire protection equipment for construction and building – Providing, installation, inspection, maintenance. [Replacing TCVN 3890:1984]

TCVN 4879:1989 Fire protection - Safety signs.

TCVN 5738:1993 Fire detection and alarm system - Technical requirements.

TCVN 5760:1993 Fire extinguishing system - General requirements for design, installation and use.

QCVN 06:2010-BXD Vietnam National Technical Regulation on Fire safety of buildings and structures.

Chemical Safety

Law on Chemicals promulgated by the National Assembly of Vietnam by Proclamation No. 06/2007/QH12 on November 21, 2007.

Decree No. 68/2005/ND-CP of the Government dated May 20, 2005, on Chemical safety by the Government. [Amended by Decree 108/CP dated October 7, 2008]

Decree No. 108/2008/ND-CP of the Government dated October 7, 2008, Detailing and guiding the implementation of Law on Chemicals.

Circular No. 12/2006/TT-BCN of Ministry of Industry dated December 22, 2006, guiding the implementation of Decree No. 68/2005/ND-CP dated May 20, 2005, on chemical safety. [Replacing Decision No. 136/2004/QĐ-BCN dated November 19, 2004].

Decree No. 90/2009/ND-CP of the Government dated October 20, 2009, on Sanction of administrative violations in the chemical activities by the Government.

Circular 28/2010/TT-BCT by the Ministry of Industry and Trade dated the May 28, 2010, detailing a specific provisions of the Law on Chemicals and Decree No. 108/2008/ND-CP dated October 7, 2008 by the Government detailing and guiding the implementation of some articles of the Law on Chemicals.

Decree No. 26/2011/ND-CP of the Government dated April 8, 2011, Amending Decree No. 108/2008/ND-CP of the Government dated October 7, 2008, Detailing and guiding the implementation of Law on Chemicals.

Occupational Hygiene and Safety

Labor Code No. 10/2012/QH13 dated June 18, 2012.

Law on People Health Protection promulgated by the 9th National Assembly of Vietnam on 30-Jun-1989.

Law of Occupational Hygiene Protection No. 61-LCT/H DNN8 dated September 19, 1991.

Decree No. 06/CP of the Government dated 20-Jan-1995, Stipulating in detail a number of articles on working safety and hygiene of the Law on Labor.

Decision No. 3733/2002/QD- BYT of Ministry of Health dated 10-Oct-2002, Promulgation of 21 Labor Hygiene Standards, 5 Principles and 7 Labour Hygiene Parameters.

Decree No. 110/2002-ND-CP of the Government dated 27-Dec-2002, Amending and Supplementing some Articles of Decree No. 06/CP dated January 20, 1995.

Joint Circular No. 21/2005/TTLT/BYT-BTC of the Ministry of Health and the Ministry of Finance dated July 27, 2005, Guiding the implementation of compulsory health insurance.

Circular No. 37/2005/TT-BLDTBXH of the Ministry of Labor, War Invalids and Social Affairs dated December 29, 2005, Guiding occupational safety and hygiene training. [Replacing Circular No. 08/LDTBXH-TT dated April 11, 1995 and Circular No. 23/LDTBXH-TT dated September 19, 1995]

Circular No. 12/2006/TT-BYT of the Ministry of Health dated November 10, 2006, Guiding medical examination for occupational diseases.

Circular 04/2008/TT-BLDTBXH dated February 27, 2008 by the Ministry of Labor, War Invalids and Social Affairs providing guidelines on the procedures for registration and inspection of machinery, equipment and materials subject to strict occupational safety requirements.

Circular No. 22/2010/TT-BXD of the Ministry of Construction dated December 3, 2010, on Occupational safety in work construction.

Joint Circular No. 01/2011/TTLT-BLDTBXH-BYT dated January 10, 2011, Guiding implementation of occupational hygiene and safety at the work place. [Replacing Joint Circular 14/1998/TTLT-BLDTBXH-BYT-TLDDLVDN]

Joint Circular No. 12/2012/TTLT/BLDTBXH-BYT of the Ministry of Labor, War Invalids and Social Affairs and the Ministry of Health, dated May 21, 2005, Guiding the notification, investigation, statistical compilation and periodical reporting of occupational accidents. [Replacing Joint Circular No. 14/2005/TTLT/BLDTBXH-BYT-TLDDLVDN dated March 8, 2005]

TCVN 3288:1979 Ventilation systems. General safety requirement.

TCXDVN 319:2004 Installation of Equipment Earthing System for Industrial Projects - General Requirements.

Hazardous Substances

Law on Chemicals November 21, 2007.

Law on Atomic Energy No. 18/2008/QH12.

Joint Circular No. 1529/1998/TTLT/BKHCMNT-BXD dated October 17, 1998 of the Ministry of Science, Technology and Environmental and the Ministry of Construction, Guiding the environmental protection requirements in the use of asbestos in the manufacture of products, materials, and construction activities.

Circular No. 02/2004/TT-BCN of the Ministry of Industry dated December 31, 2004, on guidance for the implementation of Decree No. 13/2003/ND-CP dated February 19, 2003, on List of dangerous goods and the land-road transport of dangerous goods.

Decision No. 03/2006/QD-BCN of the Ministry of Industry dated March 14, 2006, Promulgating the list of industrial explosives permitted for production and use in Vietnam.

Decree No. 39/2009/ND-CP of the Government dated April 23, 2009, on Industrial explosive materials. [Amended by 54/2012/ND-CP].

Decree No. 104/2009/ND-CP of the Government dated November 9, 2009, Issuing regulations on dangerous goods and transport of dangerous goods transport by road vehicles.

Circular No. 25/2010/TT-BKHCM of the Ministry of Science and Technology dated December 29, 2010, Guiding the procedures for grant of permits for the transport of dangerous goods, which are oxidizers, organic oxides and corrosive substances, by land road vehicles.

Decree No. 26/2011/ND-CP of the Government dated April 8, 2011, Amending and supplementing a number of articles of the Government's Decree No.108/2008/ND-CP of October 7, 2008, detailing and guiding a number of articles of the Chemical Law.

Decree No. 54/2012/ND-CP of the Government dated June 22, 2012, Amending and supplementing a number of articles of the Government's Decree No. 39/2009/ND-CP dated April 23, 2009, on Industrial explosive materials.

TCVN 5507:2002 Hazardous chemicals – Code of practice for safety in production, commerce, use, handling and transportation. [Replacing TCVN 5507:1991].

Hazardous Wastes

QCVN 07:2009/BTNMT National Technical Regulation on Hazardous Waste Thresholds. [replacing TCVN 6706:2000 and TCVN 7629:2007].

Circular No.12/2011/TT-BTNMT of the Ministry of Natural Resources and Environment dated April 14, 2011, Stipulating hazardous waste management. [Replacing Circular No.12/2006/TT-BTNMT and Decision No. 23/2006/QD-BTNMT; citing QCVN 07:2009/BTNMT].

TCVN 6707:2009 Hazardous wastes – Warning signs. [Replacing TCVN 6707:2000].

Others

Law on Economical and efficient use of energy, promulgated by the National Assembly of Vietnam by Proclamation No. 50/2010/QH12 dated June 17, 2010.

US Agency for International Development

1300 Pennsylvania Avenue, NW

Washington, DC20523

Tel: (202) 712-0000

Fax: (202) 216-3524

www.usaid.gov

US Agency for International Development

1300 Pennsylvania Avenue, NW

Washington, DC20523

Tel: (202) 712-0000

Fax: (202) 216-3524

www.usaid.gov