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PIMS 3685: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
ATLAS VNM10 Award 00057593 Project 00071224

Brief description

Several highly contaminated and extensive dioxin hotspots exist in Viet Nam. The main barriers that have limited Viet Nam in its ability to deal with these hotspots are related to (a) the lack of an overall plan to deal with the hotspots and an overall regulatory framework regarding dioxin contamination; (b) limited availability of high quality data on site contamination and effects on environments and people; (c) technological capacities (essential equipment, knowledge) for problem analysis and for remediation of dioxin contamination; (d) institutional capacities for coordination of national and international partners, and for planning and managing site remediation; (e) financial resources for remediation to internationally accepted norms; (f) capacities for public education and local land use planning to address the sensitive issue of highly toxic materials near populated areas.

Without the project, dioxins accumulated at hotspots will continue to become bio-available and dispersed in the local and global environment, through soil particles and organic materials that bind dioxin and are carried by water currents, wild life, and air. The project will address the barriers described above in order to effectively contain/remediate the highly dioxin contaminated material in the three main hotspots areas and address the technical, institutional, financial as well as societal root causes for enabling Viet Nam to address additional sites of concern.

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Acronyms

APR	Annual Project Report
AWP	Annual Work Plan
CO	Country Office
Committee 10-80	National Committee for Investigating Consequences of toxic chemicals used in the war in Viet Nam
Committee 33	National Steering Committee for Overcoming Consequences of Toxic Chemicals Used in the War in Viet Nam
EIA	Environmental Impact Assessment
FSP	Full Size Project (GEF terminology)
GEF	Global Environment Facility
GoVN	Government of Viet Nam
IP	national Implementing Partner
IR	Inception Report
I-TEQ	Internationally agreed TEQ - 1 g TCDD equals 1 g I-TEQ
IW	Inception Workshop
JAC US-VN	Joint Advisory Committee, USA-Viet Nam
MOD	Ministry of Defense
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
NAP	National Action Plan (on dealing with chemicals used during the war)
NEX	National Execution
NIP	National Implementation Plan (re Stockholm Convention on POPs)
NPD	National Project Director
Office 33	Secretariat of Committee 33, at MONRE
PCBs	Polychlorinated biphenyls
PEB	Project Executive Board (PEB)
PIF	Project Identification Form (GEF terminology)
PIR	Project Implementation Review (annual GEF requirement)
PM	Project Manager
PMU	Project Management Unit (PMU)
POPs	Persistent Organic Pollutants
PPC	Provincial People's Committee
ppt	Parts per trillion
SRF	Strategic Results Framework
STA	Senior Technical Advisor
STAP	Scientific and Technical Advisory Panel (to GEF)
TCDD	2,3,7,8- Tetra Chloro dibenzo-dioxin
TEQ	Total dioxin toxic equivalence (toxicity as if a mixture is pure TCDD)
TTR	Terminal Tripartite Review
UNDP	United Nations Development Programme
UNDP-CO	United Nations Development Programme Country Office
USAID	United States Agency for International Development
USD	United States Dollar
US-EPA	United States Environmental Protection Agency
VAST	Viet Nam Academy for Science and Technology
VRTC	Viet Nam - Russia Tropical Centre (under MOD)

SECTION I : ELABORATION OF THE NARRATIVE

PART I : Situation Analysis

Context and global significance

a. Description of dioxin contamination and related risks

Viet Nam has among the worst TCDD (Tetra-chloro dibenzo-dioxin; aka dioxin) contaminated sites in the world. Studies in Viet Nam and from other highly contaminated sites throughout the world have documented very serious environmental effects and health risks. TCDD contamination in Viet Nam originates from the armed conflict over the period 1961-1971, when herbicides were used to defoliate terrestrial forests and mangroves, to clear perimeters of military installations, and to destroy crops during Operation “Ranch Hand” (May 1964 – January 1971). Several of the herbicide mixtures contained TCDD. They have collectively become known as “Agent Orange”.

The soil dioxin concentration in sprayed areas has declined to background levels (see e.g. Annex 3). However, sites at airports - where large quantities of herbicides were stored or handled - are still highly contaminated hotspots. Without action they will continue to be sources for contamination of the wider environment, and are posing a serious health risk to people, especially through food chains. By international standards these levels of contamination should be remediated. Three such hotspots are target sites of the project (Da Nang, Bien Hoa and Phu Cat). The recently updated conservative estimate of the total dioxin load in the three prioritised hotspots is 1,736 g I-TEQ, and most of this toxicity made up of TCCD (see Annex 1). This is a very large amount by comparison with current emissions across the world, so remediation of these sites would confer very significant global environmental benefits. Certain areas in these hotspots may need to be added based on current and future analysis of soil and sediment contamination.

The three hotspots are the following (see Annex 1 for further detail).

At **Bien Hoa Airbase**, there are at least three areas of very high contamination. The main area, a loading area (aka “Z1 area” – see Annex 1), has dioxin concentrations in the soil surface (0-30 cm layer) as high as 409,818ppt I-TEQ and an estimated average of over 15,864 ppt I-TEQ, with elevated dioxin concentrations found down to at least 1.5m depth. Most of this area is already being treated by the Ministry of Defence through the construction of a landfill where contaminated soil is safely contained. This contaminated soil could be definitely treated and indeed preparations for bioremediation in one of the “cells” (3600 m²) are underway. A second area, the “South of runway area”, of uncertain wartime use, has a maximum dioxin level of 65,500ppt I-TEQ and an estimated average of 5,276ppt I-TEQ. The third area, the “South West runway area”, used during the “Pacer-Ivy” operation to transport barrels out of Viet Nam (December 1971 – March 1972), has dioxin levels as high as 22,800ppt I-TEQ and an estimated average of 2,650ppt I-TEQ. There are also other “sub-sites on the Airbase. The distribution of contamination suggests that there may be contamination beyond the areas that were sampled, so further sampling is required to define the contaminated area precisely.

At **Da Nang Airport and Airbase**, there are three geographically proximate areas of very high contamination. This includes the former “mixing and loading areas”, where maximum dioxin levels reach 365,000ppt I-TEQ and the estimated average is well over 50,000pp I-TEQ. The nearby storage/dumping area has a highest dioxin level of 134,802ppt I-TEQ with the average estimated as 39,883ppt I-TEQ. Surface drainage has also contaminated the drainage canal and the Sen Lake, one of three lakes at the Northern end of the Airbase where dioxin concentrations in Tilapia fat samples reached 3,000ppt,

sediment has been measured with 12,393ppt I-TEQ, and the average top layer of sediment is estimated at 3,161ppt I-TEQ. An area at the Southern end of the Airbase suspected of contamination is being investigated. Further sampling is expected to be needed during implementation of remediation efforts, to ascertain depths and boundaries of contaminated areas.

At **Phu Cat Airport and Airbase**, dioxin concentration in the former herbicide storage area is very high, reaching up to 238,000ppt I-TEQ, and the average toxicity is estimated at 26,248ppt I-TEQ (over 97% of which is TCDD) (see Annex 1). The topography of the site suggests that water flow could have resulted in contamination of three nearby lakes, but samples taken from the drainage canal and lake sediment revealed comparatively low dioxin concentrations. An additional area identified by the US Department of Defense as being likely contaminated also has safe, even if elevated levels of dioxin, with the maximum measured 236ppt I-TEQ whilst typically less than one fifth of that toxicity is attributed to TCDD. Also in Phu Cat, additional samples are required to ascertain conclusions regarding the boundaries of the areas and soil depths that should be treated.

The Bien Hoa and Da Nang Airbases are in densely populated areas, and soil and sediment samples in the surroundings of these Airbases, as well as tissue and blood samples of aquatic creatures, poultry and some local people have demonstrated elevated dioxin levels. Ponds on all three Airbases were and in some cases still are used for fishing by army personnel and local residents, whilst the food chain is a primary risk factor for human contamination. Phu Cat is located in a rural area and also used by army personnel and local residents for grazing of cattle and fishing, whilst local traffic over the Airbase passes along the most contaminated site. The potential for further spread of the contamination at the three hotspots through drainage of contaminated particles, and the food chain has now been restricted through basic measures including fencing and warning signposts. In the Bien Hoa case a contained landfill with appropriate drainage provisions in the most contaminated sub-site is nearly completed. However, as long as the contamination is not fully remediated, risks remain of contact with wildlife and humans, and spread, in the short and the long term.

b. Past & present efforts on dioxin contamination and related risks

The Government has taken various basic containment measures in Danang and Phu Cat over the years, and has committed significant funding towards remediation measures for the Bien Hoa hotspot where a high quality contained landfill is at an advanced stage. Furthermore, hard and soft international commitments have been made, with a focus of the US Government and Ford Foundation on Danang. Since PIF approval the Czech development agency have approved remediation of the most contaminated parts in Phu Cat. The Bill & Melinda Gates Foundation and Atlantic Philantropies committed to creation of a POPs laboratory under the Ministry of Natural Resources and Environment (in the Viet Nam Environmental Protection Agency, VEPA), which is related to the decontamination efforts of these hotspots because it should be operationalised for additional sample analysis, and will be important for addressing other POPs contamination (see Section III for more detail on co-financing commitments).

The project and/ or specific technical elements of it has been discussed with all key Vietnamese experts on the issue, the US-EPA, Ford Foundation, technical experts acting for the Czech Development Agency, and other organizations. The project is building upon work conducted by international organizations or their contracted consultants in association with national partners, all of which are coordinated by “Office 33” in the Ministry of Natural Resources & Environment. The national and international partners all expressed interest in cooperating in the Full Size Project (FSP) phase whilst the Government is promoting UNDP’s role to support international coordination.

The project builds on results from four dioxin contamination assessments. (a) The Z1 (Bien Hoa airbase, 1994/1995), Z2 (Da Nang airbase, 1997/1998) and Z3 (Phu Cat airbase, 1999/2002) project by the

Vietnamese Ministry of Defence; (b) a collaboration between US-EPA and VAST on sampling and contamination analysis; (c) the project “*Assessment of Dioxin Contamination in the Environment and Human population in the vicinity of the Da Nang airbase, 2006/2007*” by Office 33 and Hatfield Consultants Limited (Vancouver, Canada), with funding from Ford Foundation; and (d) soil and sediment samples taken and analyzed under the UNDP preparation project, by the Viet Nam - Russia Tropical Centre (VRTC) under the MOD and Hatfield Consultants (see also Annex 1, where contamination data from all these efforts are summarised).

The project will be linked to other POPs projects in Viet Nam, especially the UNDP/GEF project “*Building capacity to eliminate POPs pesticides stockpiles*”. It will also build links to other projects (some GEF funded), including UNIDO/GEF “*Introduction of BAT and BEP methodology to demonstrate reduction or elimination of unintentionally produced persistent organic pollutants (UPPOPs) releases from the industry in Vietnam*”; a World Bank project on PCB-Management; the GTZ project “*Sound Chemicals Management for a Healthier Environment in Viet Nam*”, and a CIDA funded project on industrial pollution mitigation.

c. UNDP funded Project Preparation Project.

The PIF was approved on 13 December 2007 and STAP stressed the need for improvement of some outputs that appeared outcomes (i.e. too general). The PIF explains that in depth assessment of actual contamination is needed in order to ascertain estimates for dioxin contamination. It explains that the full project will focus on planning, capacity building, optimising coordination efforts amongst donors, and pilot-scale interventions to demonstrate various remediation technologies. Co-financing will be applied to full-scale remediation and land use improvement.

UNDP funded a project from late 2007 to early 2009 on “*Capacity Building and Completion of the Overall National Plan for Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam*”. The objectives were to (i) strengthen capacities for planning, technical assessment, remediation of dioxin-contaminated hotspots, and management of exposure prevention, research, and monitoring of decontamination; and to (ii) help develop an overall national dioxin hotspot remediation plan and formulate specific action plans that will enable to access external, international grants for partial funding of remediation of the three most contaminated dioxin-hotspots, and ensure safe land use in and around these hotspots (Da Nang, Bien Hoa and Phu Cat). This project thus enabled the formulation of the present GEF project document.

Specific activities included: (i) capacity needs assessments; (ii) development of a plan for capacity development; (iii) some activities for capacity development, including awareness raising, training, coordination and mobilization of support, review and development of regulatory frameworks; (iv) plan and undertake additional sample analysis in two hotspots (Bien Hoa, Phu Cat) and define the scope and actual needs for remediation the three hotspots, including Da Nang; (v) prepare the overall national plan for overcoming the consequences of dioxin in hotspots; (vi) develop detailed action-plans for dioxin remediation at three hotspots, including land use and environmental recovery on and near the hotspots, and for comprehensive capacity building and awareness raising; and (vii) prepare a suitable financial framework to support the implementation of the Overall Plan.

The overall national plan (ref. v above) is being developed. Results of all other activities are being fed into that process, and were also used for this GEF project document. These technical inputs are summed up and partially summarised in the annexes, including Annex 1 on contamination data, Annex 2 on remediation technology options, and Annex 3 with summaries of other technical reports.

Barriers analysis

Several barriers have limited Viet Nam in its ability to deal with dioxin hotspots. The main barriers are related to the following.

- a) The lack of an overall plan to deal with the hotspots and an overall regulatory framework regarding dioxin contamination. Viet Nam does not yet have national standards on acceptable levels of dioxin in foods and animal feeds, or soil and sediment for specific land use purposes. This means there are no Vietnamese “triggers” that would prompt authorities at different levels to act on dioxin contamination issues during food quality investigations, monitoring or land planning etc.
- b) Limited availability of high quality data on site contamination and effects on environments and people. Not all locations of hotspots are known. The most severely contaminated areas can usually be identified, for example by lack of vegetation, but less severely contaminated sites may support grasses or other vegetation. Information from historical records is not always correct or correctly interpreted, and many records are missing or incomplete (especially related to crash sites).
- c) Technological capacities (essential equipment, knowledge) for problem analysis and for remediation of dioxin contamination. There is little global experience in treating such intensely contaminated sites, or such large volumes of severely contaminated soil and sediment. Levels of contamination and volumes of contaminated soil and sediment significantly constrain the potential technologies that can be used for treatment.
- d) Institutional capacities for coordination of national and international partners, and for planning and managing site remediation. Forty years or more have elapsed since the contamination occurred. This has allowed the dioxin to disperse over a large area, mostly through movement of particles in surface drainage. For example, at Bien Hoa, high levels of dioxin have been recorded in Bien Hung Lake, which receives surface drainage from the airbase.
- e) Financial resources for remediation to internationally accepted norms.
- f) Capacities for public education and local land use planning to address the sensitive issue of highly toxic materials near populated areas. Some sites have high population densities living adjacent to contaminated areas, leading both to exacerbated health risks, as contaminated biota, especially fish, crabs and snails, also ducks and chickens are consumed by the local population, and problems in treatment of soil and sediment due to the proximity of dwellings.

Most Vietnamese are generally aware of the use of Agent Orange and of the fact that certain residues are still present in the environment. However, levels of awareness of ways to avoid contamination and the health risks are generally low, also amongst the population near the hotspots. For example, surveys undertaken during the project preparatory phase of local residents living around the three hotspots revealed that while 81% of interviewees were aware that there is dioxin contamination of areas around their communities, 31% reported that they are using these areas for different purposes, including 13% who are using the land for housing, and 4% who are using the land for cultivation.

Land use planning and implementation of land use in the context of strict limitations on and around the hotspots requires very careful communication of research findings to the general population, behaviour change, and local monitoring upon implementation of the land use plans. This is particularly important for land with elevated dioxin levels around the main contaminated sites that are to be contained or cleaned up. Land use planning is happening across the country with a degree of

public consultation, but local capacities for such specific and sensitive public education, land use planning, and monitoring are very limited.

Stakeholder analysis

The main beneficiaries of the project activities are the people and communities affected by dioxin contamination in the vicinity of the three hotspots. The health risks for local people (notably from food such as fish and from direct contact with contaminated soil) will reduce once the source of the contamination is contained or removed and other dioxin exposure-minimizing measures take hold. There may be employment opportunities for some local people during remediation activities and for monitoring and environmental recovery activities.

The environmental risks will be reduced in Viet Nam and also internationally, as the dioxin otherwise released would transport through the food chain, wildlife movement, movement of silt and organic matter in for example water, and air; a global public good is thus protected.

Local businesses and the airports will also benefit, especially from redevelopment opportunities that arise from remediation (with a wider economic and social role for the provinces and beyond).

Local communities and businesses, and local authorities including airport authorities, will be involved in land use review and planning, design and implementation of environmental recovery measures, and some re-development activities.

Local officials (province and lower levels) will be key during land use planning, and also implementation of the remediation efforts and re-development of the hotspots and their vicinities. They will benefit from some of the training activities in addition to professional development related to the techniques and approaches that are introduced by the project. Close involvement in the remediation operations will make local environmental officials into resource persons within the localities and country.

The Ministry of Natural Resources and Environment and the Ministry of Defence are the main stakeholders at central Government level. Officials from these ministries will be closely involved at all stages of project preparation, management and implementation. Other ministries will be involved through the project management structures (Committee 33 and working groups) and by taking part in some of the training activities.

Baseline analysis

In the absence of the project severely dioxin-contaminated material will continue to be released and spread in the surroundings where it poses major human health risks and affects the environment. Although the Government of Viet Nam is committed to limiting the risks from POPs contaminated materials, international standards have not been followed to date and the institutional and policy environment is sub-optimal. The first of the barriers listed above (lack of an overall plan) is being addressed with the use of UNDP core funding through the preparation of National Action Plan (NAP) to address the chemical aftermath of the war, including environmental health risks and social issues, i.e. remediation of dioxin contaminated sites.

Without the intervention the dioxins accumulated at the hotspots will become bio-available and dispersed in the local and global environment, through soil particles and organic materials that bind dioxin and are carried by water currents, wild life, and air. The dioxin contamination from the targeted project areas

have direct inter-linkages with International Waters as research shows that at least one of the sites is contaminating a nearby river mouth which runs directly into South China Sea.

PART II : Strategy

The project will effectively contain/remediate the highly dioxin contaminated material in the hotspots and address the technical, institutional, financial as well as societal root causes for enabling Viet Nam to address additional sites of concern.

GEF support will focus on introducing and building capacity to apply international standards and to ensuring that the institutional and policy framework is adequate to support action on dioxins. The GEF project proposal, which is being prepared in parallel with the preparation of the NAP (see above “Baseline analysis” section), will initiate actions to address environmental issues under the overall plan.

Consequently, this project will focus on overcoming barriers (b) to (f) listed in the section “Barriers analysis”, above. However, although the project expects to leverage substantial funds in addition to the co-financing reported in this project document, there is no guarantee that the financial barrier (e) will be fully overcome in the lifetime of this project. This risk is mitigated by the 2-staged remediation strategy agreed with national authorities, and in several Outputs (see also risk analysis below; and Annex 1 and 2).

Institutional, sectoral and policy context

a) Policy context

The National socio-economic development strategy for 2001-2010 sets objectives related to protection of health and environment as “...to increase the average life expectancy to 71 years” – this is one of the objectives aiming to develop the protection and care of the people’s health. And to achieve this objective it is concerned, amongst other things, with management of hazardous waste, including POPs/dioxin.

The strategy for protection and care of the people's health for 2001-2010 (Decision No 35/2001/QD-CP of Prime Minister) has as its objective “All people shall live in safe community, develop well physically and spiritually. To reduce the morbidity rate, enhance physical strength, increase life expectancy and develop our race”. This decision determined the contents on promotion of the prophylactic medicine and health improvement works such as: “To continue realizing the objectives of the national program on elimination of social diseases and dangerous epidemics. To deploy the implementation of programs on prevention and control of non-infectious diseases such as cardiovascular diseases, cancer, and diabetes, hereditary and innate defects and drug addiction.... improve the health and stature of Viet Nam people”.

Agenda 21 of Viet Nam defines priority actions in order to reduce adverse effect by environmental pollution for people’s health as: planning monitoring, collection and treatment of hazardous waste. The implementation of plans must be supervised by environmental protection agencies.

Viet Nam’s ***National Implementation Plan*** under the Stockholm Convention lists as one of 15 priority actions: “*Thorough isolation and treatment of hotspots contaminated with dioxin and toxic chemicals sprayed by the US army during war in Viet Nam*”.

b) Legal context

The ***Law on Environmental Protection (11/2005)*** pays particular attention to hazardous waste management. Articles in this law regulate matters such as codes of management, classification, collection, transfer and treatment of the hazardous waste (Articles 70, 71, 72, 73, 74 and 75). The law

also establishes the responsibility of People's Committees (PCs) at all levels as well as the environment agencies for environmental protection. Section 4 of *Decree No 80/2006/ND-CP* detailing and guiding the implementation of a number of articles of this law stipulates responsibility for management of hazardous waste of State offices (MONRE and Provincial PCs).

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. The Decree also makes explicit reference to the need to treat POPs/dioxin in Viet Nam.

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.

Decision 155/1999/QD-TTg of the Prime Minister of the Government on promulgating regulation of hazardous waste management. This identifies the control and management of wastes as two of the main priorities for environmental protection and requires activities to implement information gathering on, and supervision of hazardous solid wastes, including dioxins, furans and PCBs.

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. This calls for treatment of 439 establishments and sites causing serious environmental pollution, including Bien Hoa, Da Nang and Phu Cat Airbases. Implementation of this Decision has encountered difficulties related to raising awareness, development of cooperation mechanisms; financing, and identification of treatment technologies.

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 Caused by Toxic Chemicals used by the American Army in the Viet Nam War. This Decision includes 2 objectives:

- For people (support on finance, health and care of victims and affected communities' health)
- For environment (isolate and treat the areas polluted by dioxin, especially hot spots)

The Decision covers a number of activities, including supporting victims; isolating contaminated sites; environmental rehabilitation; and collecting evidence of consequences of toxic chemicals. It defines sites affected by Agent Orange that should be remediated, including Bien Hoa, Da Nang, and Phu Cat airbases.

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. The NIP gives priority to safe chemical management and the reduction and destruction of 12 persistent organic pollutants (POPs) including dioxin (polychlorinated dibenzo-*p*-dioxins). The Decision also specifies that areas seriously contaminated by dioxins from war-time must be remediated. The Decision emphasizes strengthening capacities for POPs management.

Project Rationale and Policy Conformity

The GEF goal in the POPs focal area is to protect human health and the environment by assisting countries to reduce and eliminate production, use and releases of POPs, and consequently contribute generally to capacity development for the sound management of chemicals. The project is consistent with SP3, "Generating and Disseminating Knowledge to Address Future Challenges in Implementing the Stockholm Convention". This Strategic Programme aims to support projects that demonstrate environmentally sound practices, or techniques that prevent POPs production, use or release. This includes projects that help enhance the infrastructure of a country to manage POPs (e.g. improving the capacity for POPs elimination), and the demonstration of best available techniques/best environmental practices. This project will pioneer techniques to treat and rehabilitate dioxin hotspots. Although the

origin of dioxin hotspots in Viet Nam is unique, the source of dioxins is irrelevant, as the techniques will be applicable no matter what the origin of the contamination. The project will render harmless, contain (or de-contaminate), very significant amounts of POPs chemicals. This elimination of POPs risk to the surrounding communities stands at the heart of the proposed project. Apart from neutralizing the POPs source, considerable part of the project will focus on the education and risk reduction activities among the communities in the vicinity of the dioxin hotspots after the main cause of contamination is addressed.

Project Goal, Objective, Outcomes and Outputs/activities

The **Objective** of the project is “*to minimise disruption of ecosystems and health risks for people from environmental releases of TCDD contaminated hotspots*”. This will contribute to the broader **Goal**, which is “*to overcome the consequences of toxic chemicals used in the war in Viet Nam*”.

In order to secure the project Objective, three Outcomes are required:

Outcome 1: Dioxin in core hotspot areas contained and remediated

The project will demonstrate cost-effective remediation technologies at the contaminated sites. During the project preparatory phase, a comprehensive review of possible technologies was undertaken. The results were combined with other technology reviews and discussed with the main national and international stakeholders (see Annex 2). Taking into account the site-specific conditions, and particularly the volume of severely contaminated soil and sediment at the sites, it was agreed to consider only on-site containment and destruction of dioxin (i.e. on the Airbase concerned). Furthermore, it is highly unlikely to be feasible to treat the dioxin *in situ* (meaning that no excavation would happen), notably because of high risks to nearby population; high moisture content / ground water levels in some sub-sites; and because of the need to enable land use plans such as airport development.

Importantly, a 2-stage process is envisaged. The first stage is isolation or containment of the contaminated soil and sediment. This is in all three hotspots underway, but is at different stages and involves different measures in the three hotspots. The first stage must be completed as soon as possible, notably by constructing one or more on-site landfills in all three hotspots, based on the experience gathered in Bien Hoa. In stage 2 dioxin in soil and sediment must be destroyed to agreed standards, by a variety of technologies. Several criteria were established for technology shortlisting and (potential) testing, including the need for “closed systems” (i.e. all outputs are contained, and contain no toxic by-products); Destruction Efficiency (DE); potential treatment throughput; system requirements (power, water, chemicals/reagents, infrastructure); costs; and the possibility for technology transfer / capacity building of Vietnamese partners. The shortlist of to be tested destruction technologies that was agreed between national and international experts of the main stakeholders, includes (1) Bio-remediation (various approaches, but not *in situ*); (2) Ball Milling (Mechano-Chemical Destruction – MCD); (3) in-pile Thermal Desorption Destruction; and (4) in-vessel Thermal Desorption combined with Copper Mediated Destruction (CMD) (see Annex 2).

Depending on technological developments and additional assessment, more or other destruction technologies may be tested in stage 2, noting that there is no international experience with remediation of the volumes and degree of dioxin contamination of soils and sediments as found at the hotspots in Viet Nam. The criteria for selection of technologies that will be tested with project funds through tenders for contracting suppliers will be based on the information generated during project preparation (summarized in Annex 2); the potential for capacity building of Vietnamese technicians and experts in the process of testing; the outcomes of tests especially regarding the potential for effective scaling up; as well as the possibility for licensing of technologies by Vietnamese partners and transfer of technology. When scaling up of dioxin destruction will happen depends mainly on costs/ volume and fund availability.

The approach taken to land filling in Bien Hoa will enable a bioremediation test that is currently being prepared, and also the complete destruction of dioxin by other technologies (such as those listed above), as the landfill is constructed in cells that can be independently opened. Engineering of other landfills should be done based on this experience and ensure that a range of dioxin destruction technologies might be employed to different cells with different (average) levels of contamination. Where funds are available simultaneously for stage 1 (in full) and stage 2 (in part or in full) there is likely an efficiency gain, because dioxin in (some of) the soil and sediment would be destroyed prior to land filling, which means that the landfill (-cell) where the concerned outputs would be contained will require lower construction and risk management standards and be cheaper.

The treatment of soil and sediment with proven technologies will be prioritised for the soils and sediments with the highest levels of contamination. For certain sub-sites and lower levels of contamination (but above the set standards of 1,000ppt I-TEQ for soil and 150ppt for sediment) it is possible that “stage 2” may not be applied in the short or even medium term, meaning long term containment / isolation of residual contamination is envisaged. This containment is also a possibility for (stage 1) land fill cells where bioremediation (stage 2) was only partially successful. The choice of foregoing or postponing stage 2 (complete destruction of all dioxin) will require a fully safe contained landfill with an appropriate long term monitoring programmes in place, and should only be justified on the basis of lack of additionally leveraged funds (see also risk analysis below).

In order to secure this Outcome, the following Outputs are anticipated:

Output 1.1: Completed remediation targets and remediation strategy for each hotspot.

For each of the three hotspots, a detailed remediation strategy will be finalized based on lessons from landfilling in Bien Hoa (stage 1) and tests with different technologies (stage 2). The draft strategy per sub-site in each hotspot is outlined in Annex 1 and Annex 2, including remediation target in terms of dioxin concentration following remediation treatment, recommended technology, volume, and estimated cost. Based on analyses conducted during the preparatory process, the following constitute part of the remediation strategy for each hotspot and sub-site:

- No parts of on-Airbase soil exceeds the draft official safety standard of 1,000 ppt I-TEQ and sludge in on-Airbase ponds will be below the safety standard of 150 ppt I-TEQ
- Stage 1: Excavate and put soil that exceeds 1,000 ppt I-TEQ in contained landfill; dredge or drain and excavate from ponds 50 cm sludge that exceeds 150 ppt I-TEQ and air dry; put this in contained landfill, on Airbase
- Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill

Output 1.2: Trained government personnel in selected remediation technologies

Staff of MONRE and MOD Departments and also of Vietnamese companies (subcontractors) will be responsible for supervising and/or implementing the selected remediation technologies at each of the three sites in collaboration with international service suppliers. These officers and technicians will be trained in the technical processes and in monitoring processes in order to ensure that tests are properly monitored and international remediation standards are met at every stage of the remediation process.

Output 1.3: Spatial delimitation of heavily contaminated areas, based on supplementary sample analysis

Several series of sample analysis have been conducted, including during the project preparation phase (see maps/satellite images and summary analysis of contamination in Annex 1). However, whereas the limits of contamination have been clearly established at some sub-sites of the three hotspots, at other sub-

sites additional sampling is required in order to determine the limits of contamination (area and depth). This applies in particular to those sub-sites where surface water flow has distributed dioxin beyond the originally contaminated area.

During preparation of this Full Size Project the Government of Viet Nam advanced on officially setting maximum contamination standards that are specific for the three hotspots concerned, based on international risk assessments and accepted limits in several OECD countries (see Annex 1 and 2). Most internal reviews of the proposals were completed and it is expected that treatment must be done when soils are contaminated above 1,000ppt I-TEQ and sediment above 150ppt.

Output 1.4: Pilot scale remediation with the chosen technologies at each site.

The project will support pilot scale remediation at the hotspots in line with the site-specific remediation strategies (see Output 1.1). It will support formulation of “stage 1” contained landfilling regarding all (additional) sub-sites and support implementation of some sub-sites. Based on agreed criteria a shortlist of technologies has been determined for “stage 2” destruction of dioxin contamination. A bidding process will be applied, and the shortlist may expand at the stage of tendering for implementation of these tests (see above introduction to Outcome 1). Monitoring of the performance of these technologies during tests will be input into the design of full stage 2 remediation (Output 1.5.).

Output 1.5: Implementation plan formulated, funds leveraged, and full scale remediation at all three hotspots implemented to the maximum extent possible.

The total extent of containment in “stage 1” and treatment of dioxin contamination in “stage 2” (i.e. destruction of dioxin) will depend on final assessment of volumes (see Output 1.3), the results of technology tests (see Output 1.4) and the amount of financial resources that can be leveraged through the project in addition to known national and international co-financing. For any site where remediation (stage 2) during the project cannot be completed due to financial constraints, stage 1 contained landfilling will be prioritised and an implementation plan for completion of the remediation work in stage 2 will be prepared.

Through the project the full costs will be calculated for stage 1 and for stage 2, but estimates are summarised in the following table.

Dioxin Load, Volume to be Treated and Total Treatment Cost: Summary of 3 Hotspots

	total dioxin load (gr I-TEQ)	total volume contaminated soil (m3)	total volume contaminated sediment (m3)	total volume (m3)
Bien Hoa	616	121,050	20,500	141,550
Danang	1,063	60,110	28,000	88,110
Phu Cat	57	3,570	1,550	5,120
Total	1,736	184,730	50,050	234,780

Based on the estimated total volume to be put in contained landfill stage 1 and dioxin destruction stage 2, a bidding process will be applied for final selection of technologies, based on the shortlist provided here and tests (see Output 1.4), in which cost will be a key criteria. This will determine the actual cost in combination with further refined estimates of total soil and sediment volumes that must be treated.

Stage 1 is expected to be funded partially by the Government and partially by donors; and dioxin destruction in stage 2 will similarly be a mix. Funds from the present GEF project plus currently known co-financing is expected to be sufficient for stage 1 and a minor part of stage 2, including pilot testing and some stage 2 treatment (Output 1.4 and Output 1.5). However, substantial financing for Output 1.5 is yet to be leveraged, specifically for scaling up stage 2 treatment (see also Section II, Part I.B; and Section III).

Output 1.6: Monitoring system to ensure achievement of remediation goals.

The project will formulate and implement a monitoring system to ensure that all remediation activities are carried out to international standards of safety, and that all contaminated material is effectively treated. The closed systems to be tested in stage 2 will monitor all secondary product streams.

Outcome 2: Land use on and around hotspots eliminates risks and contributes to environmental recovery

Full remediation involves not only treatment of highly contaminated soils (above the expected national standard of 1,000ppt I-TEQ for these hotspots) and sediment (above the expected standard of 150ppt), but appropriate protection of the stage 1 landfills prior to stage 2 treatment; appropriate land use of the post stage 2 landfills; and also appropriate land use of land and ponds with lower contamination, i.e. that does not get landfilled in stage 1 and treated in stage 2.

For the purposes of this Outcome, the “hotspots” are taken to include the airbases and airports where contaminated sub-sites are located, together with any land, canals and ponds in the immediate vicinity of the airbases and airports which have also been affected by high levels of contamination. Studies undertaken during the project preparatory phase have identified optimal subsequent land uses for most sub-sites on the airbases and airports whilst other studies complement that (on the airbases and in the vicinity). In stage 1 all contaminated materials will be contained, based on the experience with the high-standard landfill in Bien Hoa. This is to be followed by a stage 2 where soil and sediment will be treated with bio-remediation or other techniques, and in some cases the contained soil/sediment with residual contamination may be permanently isolated.

Appropriate land uses of the excavated areas; the treated soils and sediments, contained in landfills permanently; and perimeter areas (partly contaminated, though below treatment standards), include airport infrastructure (run-way and taxiway extension, parking facilities), recreational facilities such as sports grounds, and plantations with grasses, shrubs and/or commercial trees, including rubber.

In order to secure this Outcome, the following Outputs are anticipated:

Output 2.1: Completed overall land use plan (including zoning) and an action plan for environmental recovery in each of the affected areas, based on Environmental Impact Assessment (EIA) recommendations.

Prior to any measure taken in the three hotspots including all the contaminated sub-sites, Environmental Impact Assessment (EIA) must be undertaken according to Vietnamese regulation and international practice. EIAs include statements on the most likely and recommended mitigation actions regarding any possible negative environmental impact including environmental health risks and impact on wetlands and wildlife of the measures that are proposed for either stage 1 or stage 2. Subsequently for each of the hotspots, a land use plan and action plan for environmental recovery will be developed.

Based on analyses undertaken during the project preparation phase, the following are likely to constitute part of the land use and environmental recovery plans for specific sub-sites (see Annex 1 for summary of proposals per sub-site, and Annex 3 and 4 with summaries of advisory reports):

- Landfills covered with e.g. grass, shrubs, or low-rise buildings including storage, parking, or sports facilities
- Drainage and protection facilities of the landfills
- New or redeveloped retain retention ponds as protected wetlands
- Storage, sports or parking facilities, on landfills or in areas adjacent to (excavated) highly contaminated sub-sites and landfills
- Commercial tree plantations, e.g. rubber in areas adjacent to (excavated) highly contaminated sub-sites and landfills
- Runway extension, taxiway extension, grass (notably: Danang)

Output 2.2: Implemented environmental recovery action plans and other land use measures in and around each of the three hotspots.

The project will support pilot scale post-treatment redevelopment and appropriate land use at sub-sites in line with the site-specific land use strategies developed in Output 2.1; with potential investment especially in redevelopment of ponds / wetlands. Based also on other experiences and data, full environmental recovery plans will be drawn up and implemented. For any site where redevelopment and appropriate land use during the project cannot be completed, an implementation plan for completion of the work will be prepared. The extent of the environmental recovery activities will depend on the amount of financial resources that can be leveraged through the project as well as (limitations imposed by) investment plans by the Government (such as expansion of various facilities at Danang airport).

Output 2.3: Implemented public environmental awareness /information and education programs in the area surrounding the hotspots.

As determined by surveys during the project preparation phase, although knowledge about dioxin is quite high among the population living nearby the hotspots, there are important gaps in public understanding of dioxin, particularly related to uptake by humans (see Annex 5 for a summary of findings of surveys in this regard). Whereas 97% of respondents considered that dioxin was toxic or very toxic to humans, only 69% knew from what sources dioxin is absorbed by humans, and only 53% knew the methods of absorption. This could be part of the reason why local people still fish and collect other food from lakes and ponds known to be contaminated.

Nearly 51% of respondents listed newspaper, radio and TV as the source of their information on dioxin, and another 39% listed multiple sources. The project will support the development of new educational materials for use by newspapers, radio and TV, covering exposure sources and absorption routes. Materials for other methods of dissemination, such as posters and leaflets, will also be developed.

Outcome 3: Strengthened national regulations and institutional capacities

The national coordination mechanism for dealing with the contaminated hotspots is well established, as Committee 33 and Office 33, and a National Action Plan is underway (NAP; which deals with more than environmental pollution). Substantial national and international financial resources have been mobilized for hotspot remediation, but significantly more is needed (see also comments under Outcome 1 and Output 1.5). In order to achieve full hotspot remediation, the national coordination capacities should be

enhanced further, for effective coordination between Ministries, Departments, localities and contracted enterprises, as well as donor-Government coordination. This is also critical for achieving full funding and appropriate fund channelling. During project preparation in-depth analysis was undertaken of different funding modalities in the context of the NAP as well as (more narrowly) the environmental remediation of hotspots (see Annex 6). This recommended that for the NAP a Trust Fund may be established, but that environmental remediation is a relatively straightforward and technical operation, which can be carried out in a relatively short time period, and the costs can be estimated relatively accurately in advance, for which a project approach to funding and implementation is most appropriate, with different projects coordinated by Office 33.

Although the project will treat the three most severely contaminated known hotspots, there are other known hotspots, believed to have lower levels of contamination, and an unknown number of yet-to-be-discovered (small) hotspots, notably spray-plane crash sites. There are also POPs contaminated sites of industrial origin. Therefore, it is essential to build capacity, particularly among national agencies and organizations to discover and effectively treat additional hotspots. Capacity building is needed at all levels (institutional and individual). For example, although international standards of contamination in soils, sediments and biota will be adopted officially for the purposes of the three main hotspots, such standards need to be reviewed and endorsed for all kinds of POPs contamination in Viet Nam to serve as the basis for future actions. Experiences and lessons generated through this project need to be captured and institutionalized in order to ensure effective responses at additional hotspots. Furthermore, although studies conducted during the project preparatory phase indicated that knowledge of dioxin is high at the contaminated sites and among responsible government officials, further public awareness raising is required, especially to reduce risky public behaviour such as fishing in contaminated water bodies.

In order to secure this Outcome, the following Outputs are anticipated:

Output 3.1: Completed national regulatory framework for maximum permissible dioxin discharges and contamination into/of soil, water and air and contamination of food products/animal /fish feed.

Although there is a regulatory framework for toxic chemicals in Viet Nam, gaps remain. Most significantly, there are no standards for dioxin concentrations in soil, water, or food products. For the purposes of this project the standard of maximum permissible dioxin concentrations in soil of 1,000ppt I-TEQ and in sediment of 150ppt have been used, which is consistent with standards in several industrialized countries for similar (currently expected) land use, and are likely to be formally adopted by Viet Nam for the three main hotspots. However, broadening the adoption of such standards for all sorts of situations including other dioxin contaminated hotspots requires a process of consultation and review. The project will catalyze such activities to ensure the adoption of standards within two years of project initiation.

Output 3.2: Strengthened capacities of Office 33 for coordination, fund mobilisation and experience sharing at all levels.

As noted above, the project will strengthen the coordination capacity of Office 33 as a means to ensuring effective coordination nationally and with international partners, optimise the possibility for full funding of stage 2 destruction of dioxin contamination, and project implementation. Although the project will initiate actions on, and finalize plans for the completion of environmental remediation at the three most prominent hotspots, there are other known hotspots requiring treatment, and there are also believed to be other, yet-to-be-discovered hotspots. Therefore, it is important that lessons from the pilot treatment be recorded, disseminated, and incorporated into future plans and activities. The project will document all such lessons, and will ensure effective dissemination to all stakeholders at the central, provincial and local levels.

Output 3.3: Strengthened institutional and individual capacities for site investigation and contamination analysis, participatory / consultative land use planning, and planning and management of cost-effective remediation.

By investigating and piloting / testing interventions as well as full scale implementation of remediation at the hotspots and engaging all the main stakeholders, especially MONRE (different departments and units), the MOD (also different departments and units), Airbase/Airport authorities, and provincial and district Peoples Committees, the project will develop the capacity for investigation, analysis, planning and management to address other hotspots as well as industrial POPs contaminated sites. Institutional capacity for this will be established by building coordination and cooperation mechanisms among government entities, and a targeted training programme developed and delivered to address identified shortcomings of individual capacities (this also relates to findings on awareness raising needs summarized in Annex 5, but further specific, technical capacity building needs assessment is required prior to formulation of the training programme).

Output 3.4: A communication strategy vis-à-vis national and international industries and consumers implemented.

A communication strategy is very important for several reasons. Firstly, there is a substantial amount of misinformation internationally about the status of dioxin contamination in Viet Nam, which has, or may have a detrimental impact in sectors such as tourism and agricultural exports. The project should serve as a source and vehicle for international dissemination of accurate information, including information regarding the successful remediation of remaining hotspots. Secondly, the project is a valuable pilot for treatment of dioxin contamination which can serve as a guide to other countries, particularly developing countries, in efforts to address similar issues. Therefore the communications strategy will include measures to disseminate lesson learned through existing international networks such as those developed by UNDP and the GEF (for example, through thematic reports and fact sheets to be issued through GEF publications). Finally, as there are many other actual and potential sources of dioxin that could cause serious environmental and human health problems in the future, the communication strategy will target industrial enterprises and the general public in Viet Nam to raise awareness about potential sources of dioxin, the environmental and health impacts that can arise due to dioxin contamination of soil, sediment, water and food, and the responsibilities of all parties.

For more details, see the Strategic Results Framework (SRF) in Section II. UNDP has been working with all key national and international partners in preparation of its own efforts in support of remediation of dioxin contaminated hotspots and related institutional development. It is currently strengthening national dioxin-related capacities. The bulk of the technical information used for this project proposal has been compiled by Office 33 from cooperation with national and international research centres and groups. The Government has made significant efforts to attract interest and mobilize support from all possible sources; however, the sensitivities around the issue have limited the participation of donors and other organizations. UNDP is the first multilateral organization to actively cooperate with Office 33 on the issue. UNDP's core competencies include capacity building and technical assistance, and it has many years of experience in Viet Nam. UNDP is neutral and is trusted by the Government so it can play a catalyst role in building capacities and encouraging other players into the Agent Orange/dioxin forum.

Project Indicators, Risks and Assumptions

The following indicators have been identified to measure progress towards the project Objective and Outcomes. For more information, and for information on Output indicators, please see the SRF table in Section II, Part II.

Objective: To minimise disruption of ecosystems and health risks for people from environmental releases of TCDD contaminated hotspots:

Indicator and target 1: The GEF-project remediated pilot sites and the full remediation with leveraged funds will ensure by the end of the project that the amount of dioxin at the three hotspots that could potentially be released into the environment is negligible.

Indicator and target 2: By the end of the project no more than one third of respondents feel that the level of support on local livelihood development is inadequate

Outcome 1: Dioxin in core hotspot areas contained and remediated

Indicator and target: As a result of the GEF-project and leveraged funds / activities, all contaminated soil at concentrations greater than 1,000ppt and sediment at concentrations greater than 150ppt will have been treated adequately and residual contamination safely land-filled, and thereby 1,736 g I-TEQ dioxin release will be avoided: at Bien Hoa by the end of 2010; at Da Nang by the end of 2012; and at Phu Cat by the end of 2011.

Outcome 2: Land use on and around hotspots eliminates risks and contributes to environmental recovery

Indicator and target: By the end of the project, appropriate land uses have been introduced for at least 10ha at Bien Hoa; 8 ha at Da Nang, and 4ha at Phu Cat

Outcome 3: Strengthened national regulations and institutional capacities

Indicator and target 1: By the end of the project, at least 70% of directly related officials in key ministries, airbase management agencies and local authorities have received training or awareness raising on dioxin and less than 5% of officials are unable to access information on policies and laws related to dioxin.

Indicator and target 2: By the end of the project, less than 15% of respondents are unable to name agencies responsible for management of contaminated areas.

The following uncertainties and risks have been identified:

Risk		Risk Mitigation Measure
The exact area and volume of highly contaminated material at the hotspots.	L	Many scientific uncertainties on the extent of contamination have been answered during the project preparatory project funded through non-GEF sources (UNDP-Core). Further investigations will refine the estimates of area, depth and volume, but that is likely to involve mostly low cost analysis of contamination.
The cost estimates are highly dependent on the correctness of the contamination data.	L	Same as above.
The costs of remediation (stage 2) are dependent on the outcomes of tests and on the effectiveness of tendering.	L	Many uncertainties on technology options have been answered during the project preparatory project funded through non-GEF sources (UNDP-Core), resulting in a shortlist of options. Furthermore, the initial remediation efforts in Da Nang; application of the landfill approach in Bien Hoa; and early testing of the proposed technologies under this GEF project all offer lessons to ensure cost-effective remediation. Tendering is expected to happen in stages (testing; and if successful upscaling)
Receptiveness for capacity strengthening and transfer of know-how on POPs contamination and remediation is not guaranteed.	L	The capacity transfer and integration of POPs contamination investigation and containment knowledge in local and national institutions, beyond a small circle of engaged experts, is among the most challenging aspects of the project. However, the length of the project intervention will enable a gradual and systematic training of the counterpart institutions.
The total funding required for “stage 2” destruction of dioxin contamination or long term containment cannot be fully leveraged through the project (ref barrier e)	M	Substantial co-financing is already reported and more is expected, so “stage 1” containment should be completed for all known sub-sites and have eliminated health risks in the short and medium term, whilst testing of “stage 2” destruction of dioxin will happen with known financial resources as well as at least some scaled up remediation. Mitigation of the risk that full destruction (stage 2) will not be fully funded was addressed during project preparation with an analysis of the best fund channelling options (ODA and national funds; see Annex 6), and is reflected in the overall remediation strategy agreed between national authorities and international partners, i.e. staging. The project will deliver definite plans including costings for full remediation of all known sub-sites on the three hotspots as well as environmental recovery plans, which should be applicable also when national or international funds become available after the completion of the project.
Overall Rating	L	

Incremental reasoning and expected global, national and local benefits

As previously noted, in the absence of the project high levels of dioxin-contaminated materials will continue to affect the environment and communities living around the hotspots. GEF support will therefore focus on introducing and building capacity to apply international standards and to ensuring that the institutional and policy framework is adequate to support action on dioxins.

The project will generate considerable environmental benefits to Viet Nam and globally. Successful implementation will prevent the release of significant quantities of TCDD, with total contamination estimated to be in excess of 1,736 g I-TEQ, which is the current conservative estimate of the total dioxin load in the three prioritised hotspots.

In essence the project will render harmless, contain, destroy (de-contaminate), very significant amounts of POPs chemicals. Without action the severely POPs contaminated material will be further released and spread in the surroundings where it poses a severe risk to human health and the environment. The risk of adverse health effects from POPs will therefore be eliminated for local communities in close proximity to the hotspots.

This reduction of POPs risk to the surrounding communities stands at the heart of the proposed project. Apart from neutralizing the POPs source, a considerable part of the project will focus on the education and risk reduction activities among the communities in the vicinity of the dioxin hotspots after the main cause of contamination is being addressed.

For detail on incremental reasoning, please see Section II Part I.

Country Ownership: Country Eligibility and Country Drivenness

Viet Nam ratified the Stockholm Convention on 22 July 2002, and is eligible to receive funding from UNDP and GEF. The GEF Operational Focal Point has endorsed the proposal – see Section IV, Part 1.

The Government has developed a general policy framework and prioritised the dioxin contaminated hotspots as a specific programme in the National Implementation Plan (NIP) for the Stockholm Convention on POPs. Substantial analysis of contamination has taken place over the past years, with national and international financial and human resources, and more analytical and financial support is being pledged for planning and initial remediation of two hotspots (Da Nang and Phu Cat). In addition, the Government is also reserving financial resources for remediation (notably for Bien Hoa). However, for comprehensive remediation to internationally acceptable standards that comprehensively eliminate health and environmental risks at and around all three hotspots requires substantial additional financial and technical support.

The United Nations Development Assistance Framework for the Socialist Republic of Viet Nam 2006-2010 includes Outcome 1 “*Government economic policies support growth that is more equitable, inclusive and sustainable*”. The UNDP’s Country Programme document explicitly aims to strengthen capacities to ensure that environmental concerns are integrated with poverty reduction and economic growth, “*contributing to fulfilment of obligations under the global environment conventions*” including the Stockholm Convention.

The UN-Viet Nam “One Plan”, which incorporates the UNDAF as well as the UNDP Country Programme document, articulates the role of the UN in the elimination of dioxin contaminated hotspots explicitly. The One Plan Outcome 3 is “*Viet Nam has adequate policies and capacities for environmental protection and the rational management of natural resources and cultural heritage for poverty reduction, economic growth and improving the quality of life*”. And “Expected Result” 3.22.2 is “*Elimination of stockpiles and unintentional production of POPs, notably agro-pesticides and dioxins, and other hazardous chemicals*”.

The One Plan identifies areas where there is scope for better collaboration among UN Organizations participating in UN reform in Viet Nam, including “Elimination of stockpiles of agro pesticides and dioxins (including Agent Orange)”. The lead role is given to UNDP, and projects will draw on expertise

of FAO, UNIDO, and also UNEP (however, the latter is not part of the One Plan since it is not resident in Viet Nam). Concrete collaboration and exchange of lessons between UNDP and other UN organizations is expected to be defined in the inception phase of this project.

Sustainability

The design of all three Outcomes takes into account the need for sustainability. The selection process of appropriate technologies included selection criteria such as suitability to the conditions in Viet Nam, cost effectiveness, and the need to address future sites if and when they are discovered. The piloting of remediation technologies at known hotspots, together with training provided to relevant personnel will ensure sustainability, as future treatment of hotspots will almost certainly involve the same personnel, from the MOD and MONRE.

Similarly, the post-remediation land-use to be developed through Outcome 2 is designed to ensure sustainability at the treated sites, for example, by avoiding land uses that are likely to compromise the landfills. However, the combination of dioxin destruction in the most contaminated soil and sediment through the tested technologies, and permanent land-filling of lightly contaminated soils and sediments further reduces the likelihood of future inappropriate land-use, as the post treatment soil should be devoid of dioxins. The (stage 1) contained landfills will be continuously monitored and contamination levels of (stage 2) treated soils and sediments will be measured (post treatment), in order to ascertain that decontamination has been successful.

Outcome 3 will establish the conditions to ensure that any sites contaminated by dioxin, whether newly discovered sites related to war-time operations or POPs contaminated sites from industrial operations can be treated promptly, effectively and efficiently.

This project is part of a broader initiative to develop and implement the overall National Action Plan (NAP) on dealing with the aftermath of chemicals used during the war. A financial mechanism has been outlined (and summarized in Annex 6), both to address issues not covered by this project (such as health care) and to finance treatment of contaminated hotspots (including lesser dioxin contaminated hotspots and other polluted establishments, some of which are listed in Decision No 64/2003/QD-TTg – see Section I Part II).

Replicability

Piloting remediation of severely contaminated sites with the subsequent scaling up introduction of appropriate land-uses will serve as a valuable demonstration that will be relevant to decontamination of other POPs contaminated sites in Viet Nam and many countries. Because the sites at the airbases are contaminated to a far greater degree than virtually any site elsewhere, technologies that are able to achieve remediation of these sites will certainly be applicable elsewhere. Dissemination and knowledge transfer will mostly be achieved through activities in support of Output 3.4. The comprehensive communication strategy developed through this Output will include regional and broader dissemination of information related to remediation and post-remediation land use.

PART III : Management Arrangements

The project will be managed by the Government-UNDP National Execution Modality (NEX). The project will be managed by MONRE. The implementation structure will include a Project Steering Committee (PSC) and a Project Management Unit (PMU), as follows.

Implementing Partner

As the national Implementing Partner (IP) for the project, MONRE is accountable to the Government and UNDP for ensuring (a) the substantive quality of the project, (b) the effective use of both national and UNDP resources allocated to it, (c) the availability and timeliness of national contributions to support project implementation and (d) the proper coordination among all project stakeholders, particularly national parties.

Responsible Party

As the day-to-day implementer(s) of project activities, Office 33 is responsible for mobilizing all national and international inputs to support project implementation, organizing project activities in accordance with the agreed work plan, and reporting to MONRE and UNDP on the progress as well as financial status of the project. Office 33 is the secretariat of the National Steering Committee for Overcoming Consequences of Toxic Chemicals Used in the War (aka Committee 33) and is housed in and supervised by the Ministry of Natural Resources and Environment (MONRE).

Project Steering Committee (PSC)

The PSC will make all necessary decisions and provide guidance for implementation of project activities, including approval of the overall project work-plan, and budget revisions. The PSC will comprise three members representing MONRE, MOD and Provincial Committee (one representative, on rotational basis, for three provinces of Da Nang, Dong Nai, and Binh Dinh). The representatives from MONRE and MOD should be the same representative in the Committee 33. This helps to ensure overall coordination, consultation and communications with the Committee 33. The PSC member representing MONRE will be the chairperson of the PSC. The PSC will meet every six-months, or more often on an ad-hoc basis, if deemed necessary.

Representatives from GACA (Government Aid Coordination Agencies), including the Office of the Government (OOG); the Ministry of Planning and Investment (MPI); the Ministry of Finance (MOF); and the Ministry of Foreign Affairs (MOFA) will be called on for PSC meetings if deemed necessary. A representative of the UNDP-CO will attend the PSC meeting when necessary in the role of the project donor, on behalf of the GEF. A representative from the National Steering Committee for the Stockholm Convention on POPs (NSC) will be invited if appropriate. The POPs NSC is also chaired by MONRE.

National Project Director (NPD)

The Head of the Office 33 is expected to be the National Project Director, with official appointment by the MONRE. The NPD will be responsible to the PSC for overall management and implementation of the project.

Project Management Unit (PMU)

The PMU will be responsible for the overall coordination, management, implementation, monitoring & evaluation and reporting of all project activities. The PMU will consist of the following positions (TORS of the main positions are given in Section IV, Part III):

- National Project Director (NPD, MONRE appointed senior official, at directorial level, part-time, 30% of working time)
- International Senior Technical Advisor (STA recruited, 36 months, full-time)
- Project Manager (PM, recruited, 48 months, full-time)
- Project Interpreter/Secretary (PIS, recruited, 48 months, full-time)
- Project Accountant / Assistant (PAA, recruited, 48 months, full time)

The PMU will, on a regular basis, consult and work with the Council of Science and Technology of the Committee 33 to have technical advice and guidance. This Council has already been established since

2004 to serve as technical scientific body of the Committee 13. The Council comprises 14 experts in areas such as Medicine, Environment, Ecology, Chemistry and Toxicology.

UNDP Country Office (UNDP-CO) support

The UNDP-CO will be doing close quality assurance and supervise the international Senior Technical Advisor, who will support both the UNDP and Office 33. UNDP-CO will assist Office 33 in mobilization of international inputs, upon official request from the NPD. The UNDP CO will provide the services for tendering of packages of activities, procurement of sub-contractors, recruitment of individual consultants, and contracting, upon the formal request from the NPD. UNDP's prevailing cost recovery policies will apply to these services.

In order to accord proper acknowledgement to GEF and UNDP for providing funding and technical assistance, GEF and UNDP logos should appear on all relevant project publications, including among others, project hardware and vehicles purchased with the project funds. Any citation on publications should also accord proper acknowledgment to GEF and UNDP

PART IV : Monitoring and Evaluation Plan and Budget

Project monitoring and evaluation will be conducted in accordance with established GEF procedures, UNDP regulations in the context of One UN Initiative in Vietnam, Decree 131/2006/ND-CP, Circular 04/2007/TT-BKH, and relevant procedures/regulations of the Government and will be provided by the PMU and the UNDP Country Office (UNDP-CO) with support from UNDP/GEF. The Logical Framework Matrix in Section II provides *performance* and *impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built.

The following sections outline the principle components of the project monitoring and evaluation plan and indicative cost estimates related to M&E activities. A more detailed project Monitoring and Evaluation Plan will be presented in the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities.

Project Inception Phase

A Project Inception Workshop will be conducted with the full PMU, relevant government counterparts, co-financing partners, the UNDP-CO and representatives from the UNDP-GEF Regional Coordinating Unit, as well as UNDP-GEF (HQs), as appropriate.

A underlying objective of the Inception Workshop (IW) will be to assist the PMU to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's logframe matrix. This will include reviewing the logframe (indicators, means of verification, assumptions), imparting additional detail as needed, and on the basis of this exercise finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

The concrete objectives of the Inception Workshop (IW) will be to: (i) introduce project staff with the UNDP-GEF expanded team which will support the project during its implementation, namely the UNDP-CO and responsible UNDP-GEF staff; (ii) detail the roles, support services and complementary responsibilities of UNDP-CO and UNDP-GEF staff vis-à-vis the PMU; (iii) provide a detailed overview of UNDP-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project

Report (APR), as well as mid-term and final evaluations. Equally, the IW will provide an opportunity to inform the PMU on UNDP project related budgetary planning, budget reviews, and mandatory budget revisions.

The IW will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference (TORs) for project staff and decision-making structures will be discussed again, as needed, in order to clarify for all, each party's responsibilities during the project's implementation phase.

Monitoring responsibilities and events

A detailed schedule of project reviews meetings will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for Steering Committee Meetings, relevant advisory and/or coordination mechanisms and (ii) project related Monitoring and Evaluation activities.

Day to day monitoring of implementation progress will be the responsibility of the Project Manager based on the project's Annual Work Plan and its indicators. The PMU will inform the UNDP-CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

The Project Manager and the UNDP-GEF Technical Advisor (based in UNDP-HQ or Regional Centre) will fine-tune the progress and performance/impact indicators of the project in consultation with the full PMU with support from UNDP-CO and assisted by the UNDP-Montreal Protocol / Chemicals Unit (MPU). Specific targets for the first year implementation progress indicators together with their means of verification will also be developed. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. Targets and indicators for subsequent years would be defined annually as part of the internal evaluation and planning processes undertaken by the PMU.

Measurement of impact indicators related to global benefits will occur according to the schedules defined and outlined in the Logical Framework matrix in Section II, Part II. The measurement, of these will be undertaken through subcontracts or retainers with relevant institutions or through specific studies that are to form part of the projects activities or periodic sampling such as with soils/sedimentation.

Periodic monitoring of implementation progress will be undertaken by the UNDP-CO through quarterly meetings with the Responsible Party, or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.

The UNDP-CO and UNDP-MPU as appropriate, will conduct yearly visits to projects that have field sites, or more often based on an agreed upon scheduled to be detailed in the project's Inception Report /Annual Work Plan to assess first hand project progress. Any other member of the Project Steering Committee (PSC) can also accompany, as decided by the PSC. A Field Visit Report will be prepared by the CO and circulated no less than one month after the visit to the PMU, all PSC members, and UNDP-GEF.

Annual Monitoring will occur through the Annual Review of the UN Programme Coordination Group (PCG) on Sustainable Development (PCG-8). The PMU will prepare an Annual Project Report (APR)

and the NPD submits it to UNDP-CO and the UNDP-GEF at least two weeks prior to the Annual Review of the PCG-8.

The APR will highlight policy issues and recommendations for the decision of the Annual Review meeting. The NPD also informs the participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project component may also be conducted if necessary.

The project will be subject to a Terminal Tripartite Review (TTR) in the last year. The TTR is held in the last month of project operations, based on the Terminal Report (see below). The TTR considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results, and acts as a vehicle through which lessons learnt can feed into other projects under implementation or formulation.

Project Reporting

The Project Manager in conjunction with the UNDP-GEF extended team will be responsible for the preparation and submission of the following reports that form part of the monitoring process.

Inception Report (IR)

A Project Inception Report (IR) will be prepared immediately following the Inception Workshop (IW). It will include a detailed First Year Annual Work Plan (AWP) divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This AWP would include the dates of specific field visits, support missions from the UNDP-CO or the Montreal Protocol Unit (MPU) or consultants, as well as time-frames for meetings of the project's decision making structures. The IR will also include the detailed project budget for the first full year of implementation, prepared on the basis of the AWP, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame.

The IR will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may effect project implementation. When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to circulation of the IR, the UNDP-CO and UNDP-GEF will review the document.

Annual Project Report (APR)

The Annual Project Report (APR) is a UNDP requirement and part of the UNDP-CO's central oversight, monitoring and project management. It is a self -assessment report by project management and provides input to the UNDP-CO's reporting process, as well as forming a key input to the Annual Review under the framework of UN PCG-8 Annual Review. An APR will reflect progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to intended outcomes through outputs and partnership work.

The format of the APR is flexible but should include the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome
- The constraints experienced in the progress towards results and the reasons for these
- The three (at most) major constraints to achievement of results

- AWP, CDR, and other expenditure reports
- Lessons learned
- Clear recommendations for future orientation in addressing key problems in lack of progress

Project Implementation Review (PIR)

The Project Implementation Report (PIR) is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a PIR must be completed during the year (July-June).

The individual PIRs are collected, reviewed and analysed by the UNDP-GEF Advisor/Staff prior to sending them to the focal area clusters at the UNDP/GEF headquarters. The focal area clusters supported by the UNDP/GEF M&E Unit analyse the PIRs by focal area, theme and region for common issues/results and lessons. The TAs and PTAs (in UNDP HQ or Regional Centre) play a key role in this consolidating analysis.

The focal area PIRs are then discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings.

The GEF M&E Unit provides the scope and content of the PIR. In light of the similarities of both APR and PIR, UNDP/GEF has prepared a harmonized format for reference.

It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a PIR must be completed by the CO together with the project. The PIR can be prepared any time during the year (July-June) and ideally prior to the TPR. The PIR could then be linked to the AWP (avoiding overlap, contradictions; ensuring complementarity) and should be discussed in the TPR so that the PIR is agreed upon by the project, the executing agency, UNDP CO and the UNDP-GEF.

Quarterly Progress Reports

Short reports outlining main updates in project progress will be provided quarterly to the local UNDP Country Office and the UNDP-GEF by the PMU.

Periodic Thematic Reports

During its lifetime, the project will produce technical reports, education materials/publications, organize workshops and document experience/lessons learnt. The UNDP-CO will provide necessary support, upon official request from the NPD.

As and when called for by UNDP, UNDP-GEF or the Implementing Partner, the PMU will prepare Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the PMU in written form by the UNDP-CO and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. The UNDP-CO will allow reasonable timeframes for their preparation.

Project Terminal Report

During the last months of the project, and at least two months in advance of the TTR, the PMU will prepare the project Terminal Report and submit it to relevant involved parties, including UNDP-CO and UNDP-GEF. This comprehensive report will summarize all activities, achievements and outputs of the Project, lessons learnt, objectives met, or not achieved, structures and systems implemented, etc. It will

also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the Project's activities. It shall be prepared in draft at in order to allow review, and will serve as the basis for discussions in the TTR (see above).

Independent Evaluation

The project will be subjected to at least two independent external evaluations as follows:-

Mid-term Evaluation

An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP-CO based on guidance from UNDP-GEF.

Final Evaluation

An independent Final Evaluation will take place three months prior to the terminal tripartite review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNDP-CO based on guidance from UNDP-GEF.

Audit Clause

The Government will provide the UNDP Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted by the legally recognized auditor of the Government, or by a commercial auditor engaged by the UNDP.

Learning and Knowledge Sharing

Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and forums. In addition:

- ◆ The project will participate, as relevant and appropriate, in UNDP-GEF sponsored networks, organized for Senior Personnel working on projects that share common characteristics.
- ◆ The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identifying and analyzing lessons learned is an on-going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP-GEF shall provide a format and assist the PMU in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

Summary table of Monitoring and Evaluation Work plan

Type of M&E activity	Responsible Parties	Total M&E Budget (US\$) Excluding PMU staff time	Time frame
Inception Workshop	<ul style="list-style-type: none"> ▪ PMU ▪ UNDP CO ▪ UNDP GEF 		Within first two months of project start up
Inception Report	<ul style="list-style-type: none"> ▪ PMU ▪ UNDP CO 	None	Immediately following IW
Measurement of Means of Verification for Project Progress and Performance (measured on an annual basis)	<ul style="list-style-type: none"> ▪ Oversight by Project GEF Technical Advisor and Project Manager ▪ Measurements by regional field officers and local IAs 	To be determined as part of the Annual Work Plans.	Annually prior to APR/PIR and to the definition of annual work plans
APR and PIR	<ul style="list-style-type: none"> ▪ PMU ▪ UNDP-CO ▪ UNDP-GEF 	None	Annually
Annual Review Meeting: Joint review of all projects under UN PCG-8 (sustainable development)	<ul style="list-style-type: none"> ▪ PMU; other Government Counterparts ▪ UNDP CO and other UN organizations in PCG-8 ▪ UNDP-GEF Regional Coordinating Unit 	None	Annually
Steering Committee Meetings	<ul style="list-style-type: none"> ▪ Project Manager ▪ UNDP CO 	None	Following Project IW and subsequently at least once a year
Mid-term External Evaluation	<ul style="list-style-type: none"> ▪ PMU ▪ UNDP- CO ▪ UNDP-GEF Regional Coordinating Unit ▪ External Consultants (i.e. evaluation team) 		At the mid-point of project implementation.
Final External Evaluation	<ul style="list-style-type: none"> ▪ PMU, ▪ UNDP-CO ▪ UNDP-GEF Regional Coordinating Unit ▪ External Consultants (i.e. evaluation team) 		At the end of project implementation
Terminal Report	<ul style="list-style-type: none"> ▪ PMU ▪ UNDP-CO ▪ External Consultant 	None	At least one month before the end of the project
Lessons learned	<ul style="list-style-type: none"> ▪ PMU ▪ UNDP-GEF Regional Coordinating Unit (suggested formats for documenting best practices, etc) 		Annually
Audit	<ul style="list-style-type: none"> ▪ UNDP-CO ▪ PMU 		Annually
Visits to field sites/ including Joint Review between UNDP and the Government/GACA (UNDP staff travel costs to be charged to IA fees)	<ul style="list-style-type: none"> ▪ UNDP-CO ▪ Government Aid Coordination Agencies (GACA) ▪ UNDP-GEF Regional Coordinating Unit (as appropriate) ▪ Other Government representatives 		Annually

PART V : Legal Context

This project document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Socialist Republic of Viet Nam and the United Nations Development Programme signed by the parties on 21 March 1978. The host country executing agency shall, for the purpose of this Agreement, refer to the Government Cooperating Agency described in that Agreement.

The UNDP Resident Representative in Viet Nam is authorized to effect in writing the following types of revision to this project document, provided that s/he has verified the agreement thereto by the UNDP-GEF Unit and is assured that the other signatories of the project document have no objection to the proposed changes:

- a) Revision of, or addition to, any of the annexes to the Project Document;
- b) Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
- c) Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
- d) Inclusion of additional annexes and attachments only as set out here in this Project Document

National Professional Project Personnel: The Government agrees to the recruitment of nationally recruited project professional personnel (NPPP) required for the implementation of this project, in accordance with UNDP policies and procedures established within the United Nations system for this purpose. These services constitute an addition to the regular personnel resources to be provided by the Government and will be available for the duration of UNDP participation in the project. The remuneration of NPPP will be determined on a case-by-case basis in accordance with the policies and procedures of UNDP; it should exceed neither the prevailing compensation for comparable functions in the host country nor remuneration levels applicable within the United Nations system.

SECTION II : STRATEGIC RESULTS FRAMEWORK (SRF) AND GEF INCREMENT

PART I : Incremental Cost Analysis

A. Project Background

Section I, Part I and Annex 1 provide an overview of dioxin contamination, the source of it, and current risks.

The project will effectively remediate the highly dioxin contaminated material in the three targeted hotspot areas, with a currently estimated total dioxin load of 1,736 g I-TEQ, most of which is made up of TCCD (see Annex 1). It will address the technical, institutional, financial as well as societal root causes for Viet Nam to achieve this, and also enable it to assess and remediate additional sites of concern.

GEF support will focus on introducing and building capacity to apply international standards and to ensuring that the institutional and policy framework is adequate to support action on dioxins. The GEF project proposal, which is being prepared in parallel with the preparation of the National Action Plan (NAP) mentioned earlier, will initiate actions to address environmental issues under the NAP.

B. Incremental Cost Assessment

Business-as-Usual

In the absence of the project, the following activities would continue.

Outcome 1: Dioxin in core hotspot areas contained and remediated

Only emergency containment measures, such as installation of a concrete cap, would occur at Da Nang, and contained landfilling and some definitive treatment would occur at Phu Cat, but not completion of “stage 2” destruction of all dioxin. At Bien Hoa the current landfill construction would continue, but without comprehensive treatment of all contaminated soils and sediments in the current landfill, and without landfilling and destruction of dioxin in the contained landfills would occur re the currently landfilled “Z1” area and additional sub-sites on the airbase.

Outcome 2: Land use on and around hotspots eliminates risks and contributes to environmental recovery

EIA in Da Nang and Phu Cat would occur with national and international funds that are part of the baseline, but not in Bien Hoa. Environmental recovery / land use improvement activities at the Bien Hoa landfill would consist of grassing of the “stage 1” landfill and planting of rubber trees on the surrounding perimeter area. No environmental recovery activities would occur at Phu Cat, while at Da Nang extension of airport facilities may occur without prior effective remediation. A lack of knowledge about the uptake pathways and effects of dioxin would continue to expose significant numbers of people to its harmful effects.

Outcome 3: Strengthened national regulations and institutional capacities

No official minimum standards would be adopted, and capacities to analyze and remediate contaminated areas would remain low. Capacities for strengthened coordination, leveraging for fund raising for full

remediation of all hotspots and financial management capacities would remain limited. No capacity for managing additional POPs contaminated sites would be built. Communication regarding the actual situation and risks with and to the tourism and agricultural export industries would remain limited and technical, scientific information sharing about this unique POPs challenge in Viet Nam with other countries would remain limited.

Global Environmental Benefits

Successful implementation will prevent the release of significant quantities of TCDD, estimated to be in excess of 1,736 g I-TEQ, the current conservative estimate of the total dioxin load in the three prioritised hotspots. In essence the project will render harmless, contain (or de-contaminate), very significant amounts of POPs chemicals. Without action the severely POPs contaminated material will be further released and spread in the surroundings where it has already proven to have harmed human health and the environment.

Results Framework

The proposed Strategic Results Framework (SRF) is summarized in the Logical Framework Matrix in Section II Part II. The three Outcomes will ensure that:

- Pilot remediation measures are undertaken at all three hotspots, as part of an overall national action plan, and steps are taken to ensure completion of remediation activities at all sub-sites by addressing all barriers including financial leveraging in addition to currently committed co-financing.
- Based on mandatory EIAs and other assessments, environmentally and socially appropriate post-remediation land uses are introduced in pilot form, and steps are taken to ensure completion of implementation of post-remediation land use plans at all hotspots
- Coordination for effective remediation and financial leveraging will be strengthened and knowledge and lessons learned from the pilot remediation and post-remediation land use planning activities are captured and disseminated both domestically and internationally.

Incremental Reasoning

In the absence of a GEF project, high levels of dioxin-contaminated materials will continue to affect the environment and communities living around the hotspots. GEF support will therefore focus on introducing technology and building capacity to apply international standards and to ensuring that the institutional and policy framework is adequate to support action on dioxins (please see the SRF for full description of results).

Co-financing

The project is building upon work conducted by and / or funded by international organizations with national partners, all of which are coordinated by Office 33 in MONRE. The main international partners are the US Government (State Department, US-EPA and USAID), the Ford Foundation, and the Czech Development Agency. The national and international stakeholders all expressed interest in continuing cooperating in the FSP phase whilst the Government is promoting UNDP's role to support international coordination.

Co-financing will come from the Government of Viet Nam (MOD, MONRE; i.e. from the State Budget),

local authorities, the Government of the Czech Republic, the Government of the United States of America, the Ford Foundation, the Bill and Melinda Gates Foundation, The Atlantic Philanthropies, and UNDP. The project has been discussed in detail with all those stakeholders and their technical experts as well as other organizations at several stages of its development. The summary of agreed co-financing agreements of those stakeholders is as follows (see also Section II.C; Section III; and co-financing letters in Section IV, Part I).

Sources	Total (USD)
<i>GEF</i>	<i>4,977,000</i>
MOD	5,300,000
Government of Viet Nam (expected: remediation)	4,390,000
Local authorities (Da Nang)	200,000
Office 33	110,000
Government of Viet Nam (in kind: management)	1,000,000
Government of Czech Republic	1,500,000
US Government	8,000,000
Ford Foundation	6,000,000
Gates Foundation	2,685,550
Atlantic Philanthropies	2,700,000
UNDP	450,000
TOTAL co-financing (excluding GEF)	32,335,550

It should be noted that several agencies fund more Agent Orange related activities than what is given above. Notably the US Government and the Ford Foundation have stated larger amounts in their co-financing letters (Section IV, Part I), and the Czech Government is funding more than stated in their letter, but for the purpose of this proposal the support to disabled people and (local) community development is not included.

It should also be noted that the expectation is that international and national co-financing commitments should safeguard full implementation of stage 1 containment and partial stage 2 remediation (ref Outputs 1.4 and 1.5). An estimated additional amount of USD 39,000,000 co-financing is required over the coming years for full and definite completion of stage 2. Co-financing commitments are indeed expected to increase further, but that cannot yet be confirmed.

PART II : Strategic Results Framework, SRF Analysis

Result	Indicator	Baseline value	Target	Means of verification	Assumptions
Goal: To overcome the consequences of toxic chemicals used in the war in Viet Nam					
Objective: To minimise disruption of ecosystems and health risks for people from environmental releases of TCDD contaminated hotspots	<ul style="list-style-type: none"> Estimated volume of dioxin in hotspots that could potentially be released to the environment Perception of support for appropriate livelihoods among local communities 	<p>At least 1,736g I-TEQ</p> <p>Two-thirds (67%) of interviewees commenting on level of support on livelihood development in areas surrounding hotspots feel that the level of support is inadequate</p>	<p>By the end of the project the amount of dioxin in the three hotspots that could potentially be released into the environment is negligible</p> <p>By the end of the project no more than one third of respondents feel that the level of support on livelihood development is inadequate</p>	<p>Project reports; on-site monitoring</p> <p>Field surveys/interviews</p>	<ul style="list-style-type: none"> Selection and application of remediation treatments is optimal Land uses are appropriate to eliminate health risks Capacity development activities address actual capacity needs
Outcome 1: Dioxin in core hotspot areas contained and remediated	<ul style="list-style-type: none"> Volume of contaminated soil and sediment contained and remediated 	<p>At Bien Hoa: at least 100,000m³</p> <p>At Da Nang: at least 70,000 m³</p> <p>At Phu Cat: at least 2,500m³</p>	<p>As a result of the GEF-project and leveraged funds / activities, all contaminated soil at concentrations greater than 1,000ppt and sediment at concentrations greater than 150ppt will have been treated adequately and residual contamination safely land-filled, and thereby 1,736 g I-TEQ dioxin release will be avoided: at Bien Hoa by the end of 2010; at Da Nang by the end of 2012; and at Phu Cat by the end of 2011.</p>	<p>Project reports; on-site monitoring</p>	<ul style="list-style-type: none"> Commitment of MOD remains firm All contaminated sub-sites accurately identified Ball-milling technology meets specifications
Outputs for Outcome 1:					
1. Completed remediation targets and remediation strategy for each hotspot.	<ul style="list-style-type: none"> Existence of action plan for each hotspot 	<p>Preliminary action plan only for Bien Hoa</p>	<p>Action plans for each site completed within 4 months of start of project implementation</p>	<p>Project report; action plans</p>	<p>Key stakeholders endorse recommended choice of technology</p>
2: Trained government personnel	<ul style="list-style-type: none"> Number of 	<p>No training except in</p>	<p>At least 50 personnel</p>	<p>Project reports,</p>	<p>Personnel turnover does not</p>

Result	Indicator	Baseline value	Target	Means of verification	Assumptions
in selected remediation technologies	government personnel trained	landfill construction	trained within 12 months of the start of project implementation	training reports	negate benefits of training
3: Spatial delimitation of heavily contaminated areas, based on supplementary sample analysis	<ul style="list-style-type: none"> Completed spatial delimitation of contaminated areas 	Spatial delimitation uncertain in some areas	Additional samples collected and analyzed within 12 months of the start of project implementation	Project reports, lab reports, maps	Additional sampling points encompass contaminated area
4. Pilot scale remediation with the chosen technologies at each site.	<ul style="list-style-type: none"> Initiation of remediation 	Initial operations only at Bien Hoa	Remediation testing initiated at all sites within 8 months of the start of project implementation	Project reports	Capital investments and training completed in a timely manner
5. Implementation plan formulated, funds leveraged, and full scale remediation at all three hotspots implemented to the maximum extent possible..	<ul style="list-style-type: none"> Existence of plan for any areas not remediated during the life of the project 	No plan	A plan for any untreated sub-sites is completed at least 6 months before the end of project implementation	Project reports, action plans	Depends on volume of leveraged funds
6. Monitoring system to ensure achievement of remediation goals.	<ul style="list-style-type: none"> Existence of monitoring plan 	No plan	A monitoring plan is completed no more than 6 months after the start of project implementation	Project reports, monitoring plan	Stakeholders agree to meeting international standards of remediation
Outcome 2: Land use on and around hotspots eliminates risks and contributes to environmental recovery	<ul style="list-style-type: none"> Area of land treated to introduce appropriate land uses Satisfaction among local communities in land use on and around contaminated sites 	Only measures are prohibition on some land uses, e.g., fishing and cultivation	By the end of the project, appropriate land uses have been introduced for at least 10ha at Bien Hoa; 8 ha at Da Nang, and 4ha at Phu Cat	Project reports	<ul style="list-style-type: none"> Cooperation between MOD and local authorities remains positive Macro-economic trends do not undermine local economic development initiatives
Outputs for Outcome 2:					
1. Completed overall land use plan (including zoning) and an action plan for environmental recovery in each of the affected areas, based on Environmental Impact Assessment (EIA) recommendations	<ul style="list-style-type: none"> Existence of action plan for each hotspot 	Preliminary action plan only for Bien Hoa	Action plans for each site completed within 6 months of start of project implementation	Project report; action plans, EIA report	MOD willing to address land within and outside airbases in coordinated fashion

Result	Indicator	Baseline value	Target	Means of verification	Assumptions
2. Implemented environmental recovery action plans and other land use measures in and around each of the three hotspots.	<ul style="list-style-type: none"> Existence of plan for any areas not subjected to land-use modification during the life of the project 	Limited activities only at Bien Hoa	A plan for any areas not subject to land-use modification during the life of the project is completed at least 6 months before the end of project implementation	Project reports, ground surveys, action plans	<p>Remediation measures proceed in a timely manner</p> <p>Depends on volume of leveraged funds</p>
3. Implemented public environmental awareness /information and education programs in the area surrounding the hotspots.	<ul style="list-style-type: none"> Number of local residents having access to information 	4.4% do not know about dioxin; 38% receive information through multiple sources	By the end of the project the percentage of local adult residents who do not know about dioxin is less than 1%, while the percentage who receive information from multiple sources is over 60%	Surveys/interviews	No major immigration of new residents which could distort results
Outcome 3: Strengthened national regulations and institutional capacities	<ul style="list-style-type: none"> Assessment of capacity among government officials Assessment of capacity among local communities 	<p>38% of officials in relevant government agencies have not received training or awareness raising on dioxin, while 29% do not have access to information on policies and laws related to dioxin</p> <p>Over 50% of respondents are unable to name agencies responsible for management of contaminated areas</p>	<p>By the end of the project, at least 70% of officials have received training or awareness raising on dioxin and less than 5% of officials are unable to access information on policies and laws related to dioxin</p> <p>By the end of the project, less than 15% of respondents are unable to name agencies responsible for management of contaminated areas</p>	<p>Surveys/interviews</p> <p>Surveys/interviews</p>	
Outputs for Outcome 3:					
1. Completed national regulatory framework for maximum permissible dioxin discharges and contamination into/of soil, water and air and contamination of food products/animal /fish feed.	<ul style="list-style-type: none"> Minimum standards adopted 	No standards	By the end of the second year of project implementation, a minimum standard of no more than 1000ppt for dioxin contamination of soil and sediment has been officially adopted	Project reports; government papers	Government processing of new regulations proceeds in a timely manner
2. Strengthened capacities of Office 33 for coordination, fund	<ul style="list-style-type: none"> Number of lessons from pilots 	No dissemination	By the end of the project, in a survey of officials	Survey/interviews	Personnel turnover does not negate impacts of

Result	Indicator	Baseline value	Target	Means of verification	Assumptions
mobilisation and experience sharing at all levels.	<p>disseminated at different levels</p> <ul style="list-style-type: none"> • International funds for remediation leveraged in addition to baseline 		<p>outside Dong Nai, Da Nang and Binh Dinh provinces, at least 50% are able to report at least one lesson generated by the project</p> <p>By the end of the project funding for completion of remediation against international standards secured</p>	Reports by Office 33	<p>dissemination</p> <p>Office 33 remains well-staffed</p>
3. Strengthened institutional and individual capacities for site investigation and contamination analysis, participatory / consultative land use planning, and planning and management of cost-effective remediation.	<ul style="list-style-type: none"> • Establishment of new international-standard laboratory 	One laboratory (VRTC) able to conduct analyses	A new laboratory under the auspices of MONRE undertakes state-of-the-art analysis of dioxin contamination and is used by international clients	Project reports; site visit	Depends on volume of leveraged funds
4. A communication strategy vis-à-vis national and international industries and consumers implemented.	<ul style="list-style-type: none"> • Number of domestic communication events • Number of reports produced for international dissemination 	<p>No events</p> <p>No reports</p>	<p>By the end of the project there have been at least 30 domestic communication events</p> <p>By the end of the project at least 4 thematic reports and fact sheets have been produced for international dissemination</p>	<p>Project reports</p> <p>Project reports; publications</p>	Design of communication events and publications is effective in ensuring communication

SECTION III : TOTAL BUDGET AND WORKPLAN

Award ID:	PIMS 3685 Atlas VNM10 Award 00057593 Project 00071224
Award Title:	Viet Nam: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
Business Unit:	VNM10
Project Title:	Viet Nam: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
Project ID: PIMS no.	3685
Implementing Partner (Executing Agency)	Viet Nam Office 33 (MONRE)

Total budget*:	\$ 37,312,550
Allocated resources:	
• Government	\$ 5,300,000
• Regular -TRAC	\$ 450,000
• Other:	\$ 20,885,550
○ GEF*	\$ 4,977,000
• In kind contributions	
○ Government	\$ 5,700,000
○ other	\$ 0
* Note: Doesn't include US\$ 25,000 of PDF-A	

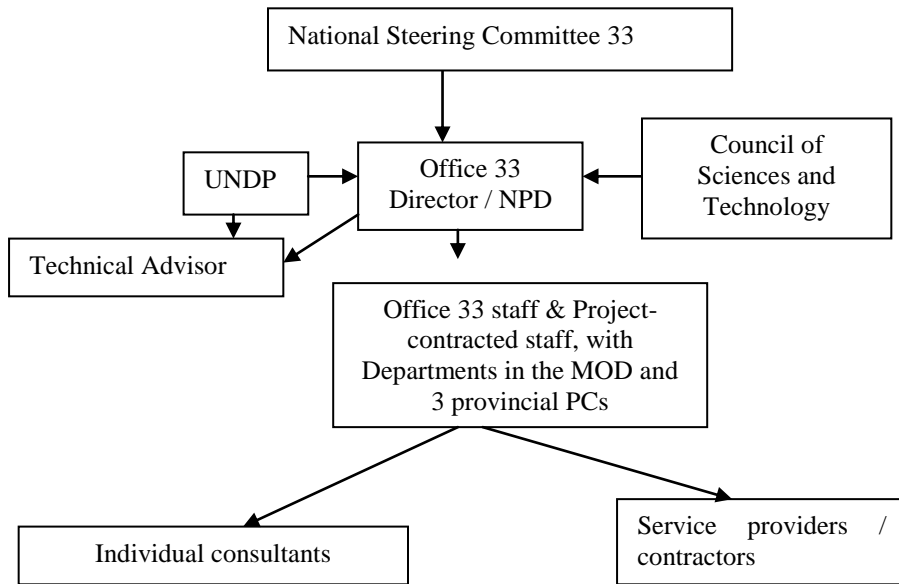
SECTION IV : ADDITIONAL INFORMATION

PART I : Other agreements

See endorsement and co financing letters in a separate file:

1. Letter of Endorsement Government of Viet Nam (GEF Operational Focal Point; 23 October 2007)
2. Co-financing letter Government of Viet Nam
3. Co-financing letter UNDP-Viet Nam
4. Co-financing letter US Government (28 April 2009)
5. Co-financing letter Czech Government (16 April 2009)
6. Co-financing letter Ford Foundation (19 May 2009)
7. Grant agreement “to construct a laboratory to study environmental dioxin and other persistent organic pollutants in Viet Nam” between Atlantic Philantropies and the Government of Viet Nam (Application number 16657; 24 September 2008)
8. Grant agreement for a “dioxin lab” between Bill & Melinda Gates Foundation and the Government of Viet Nam (Grant number 50799; 29 September 2008)

PART II : Organigram of Project



PART III : Job Descriptions and Terms of Reference for project staff and sub-contracts

1. Terms of Reference for National Project Director (NPD) (part-time, 30%)

Function title:	National Project Director (NPD)
Project title &ID:	PIMS 3685: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
Duty station:	Hanoi
Duration:	48 months (appointed by the Government; 30% part-time)
Supervision:	Government

Duties and responsibilities

Overall, the NPD will be accountable to both the Government and the UNDP. The main duties and responsibilities are:

- Ensures that the expected results of the project are of satisfactory substantive quality and that they contribute to the achievement of the intended outcome identified in the UNDP Country Programme Document (CPD). This will be discharged through the (i) approval of project work plans, TORs, reports, (ii) follow-up on the implementation of recommendations made by regular project reviews and/or external evaluations, and (iii) conduct of internal reviews and evaluations as/if needed.
- Ensures that project resources, national as well as international, are effectively utilized for their intended purposes through the (i) verification of project budgets and payments, (ii) approval of budget revisions within the agency flexibility limit, (iii) follow-up on the implementation of recommendations made by external audits and (iv) conduct of internal audits as/if needed.
- Ensures that counterpart funds are made available by the Implementing Partner in sufficient quantities and in a timely manner to support project implementation.
- Ensures that project parties, particularly national parties (including the Implementing Partner) fully participate in project implementation, effectively collaborate in project activities and duly benefit from project results.
- Ensures that the results achieved and lessons learned by the project are properly documented, proactively disseminated to and duly shared with all project parties, particularly national parties.
- Selects, arranges for the appointment of and supervises the Project Manager, in consultation with UNDP, to make sure that the PM and other national project staff are empowered to effectively perform their day-to-day project duties.
- Selects, arranges for the appointment of International Consultants, in consultation with UNDP, to make sure that international project personnel contribute expert inputs of the highest quality to the expected outputs of the project.
- Represents the Implementing Partner at major project reviews, evaluations, audits and other important events.
- Provide regular updates to the PSC.

2. Job Description for Senior Technical Advisor

JOB DESCRIPTION	
I. Position Information	
<p>Job Code Title: Senior Technical Advisor (STA) Environmental Remediation of Dioxin Contaminated Hotspots Position Number: Department: UNDP - Viet Nam Reports to: Deputy Country Director (Programme) Position Status: <i>(non-Rotational)</i> COA: project ID: [.....]</p>	<p>Proposed Grade: ALD 4 Approved Grade: JD prepared by: Position Classified by: Classification Approved by:</p>
II. Organizational Context	
<p>The Senior Technical Advisor (STA) will implement his/her main functions under the supervision of the Deputy Country Director (Programme). The STA will be based in the project <i>Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam</i>. Specific tasks will be agreed with the Head Sustainable Development Cluster UNDP-VN and the National Project Director (NPD) in the Ministry of Natural Resources and Environment (MONRE) (Office 33).</p> <p>In line with UNDP staff rules, the STA's annual performance will be measured by a full Results and Competency Assessment (RCA). The RCA by the Supervisor, with self-assessment of the STA, will be based on inputs from the NPD and will be reviewed by UNDP's Competency Review Group set up by the UNDP Resident Representative. As such, the STA is fully accountable to UNDP.</p> <p>The STA builds capacities of MONRE, MOD as well as local affiliates, together with consultants recruited under the project, especially based on international experience and (national and international) research; plays a central role in supporting /advising project management; is central to maintaining and developing international and national partnerships; actively supports formulation of assessment, design, and implementation of remediation demonstrations and other activities under the project; and is central to monitoring and evaluation. The STA is a key advisor to the project partner (MONRE, MOD and local authorities) as well as the UNDP on technical and policy aspects of dioxin remediation.</p> <p>In exercising his/her role, the incumbent supports the detailed planning, management and monitoring of the project actively by the national Implementing Partner retains the final accountability for that. He/she works in close collaboration with national counterparts as well as with the programme staff in the UNDP Country Office and relevant UNDP-HQs units for ensuring knowledge sharing and the highest possible quality of project outputs. He/she also contributes to capacity building for the national Implementing Partner and Country Office staff in the area of dioxin/Agent Orange.</p>	
III. Functions / Key Results Expected	
<p><i>Summary of Key Functions</i></p> <ul style="list-style-type: none"> ❑ Provide advice on strengthening capacities for dioxin remediation and elimination of health and environmental risks, and provide inputs for capacity building of MONRE, MOD, and personnel of local (provincial) departments on a range of project management and dioxin-remediation aspects. Share remediation and project management experience / good practices that have been acquired elsewhere with relevant stakeholders. 	

- ❑ Actively support **project management**, notably project planning; advice on formulation of relevant assessments, tender documents and TORs of remediation, related capacity building and awareness raising efforts, and implementation procedures under the project; monitor the substance and quality of project activities and actively ensure high quality outputs; and support evaluation of the project.
- ❑ Provide advice and active support to MONRE, MOD and UNDP on **coordination** of dioxin remediation efforts; liaise with international and national partners to avoid overlaps and ensure efficiency, and that lessons are shared
- ❑ Actively support national partners and the UNDP with the formulation of policy positions, responses to media interest, and formulation and dissemination of **public messages** on dioxin contamination and remediation to the highest possible scientific standards and by fully taking into account political, social and economic sensitivities.

1. Advice on and inputs into capacity building.

- ***Capacity assessment and training:*** Provide advice in assessing capacity and knowledge gaps that exist in MONRE and MOD, especially with regards to implementation of remediation and land development plans as well as public education; suggest measures for addressing such gaps; mainstream lessons and best practices learned elsewhere into capacity building activities under the project; and give guidance in organizing such capacity building activities. Review TORs for study tours/fellowships and plans / curricula of trainings and workshops as well as formulation of public communication materials; assist in identifying appropriate training partners/organisations; lead, deliver and provide on-the-job training on dioxin-remediation relevant aspects including project management and activity implementation.
- ***Knowledge sharing:*** Advise the national partners and UNDP in strategically linking project activities with support on POPs remediation by other donors in Viet Nam and internationally. Participate in UNDP's global knowledge networks and other international networks, accumulate and share relevant international experience and knowledge on project management and dioxin remediation with national partners and networks.

2. Advice on and inputs into project management and project quality assurance

- ***Project management, monitoring and evaluation:*** Provide advice to the MONRE and MOD, the NPD and PMU (Project Management Unit) on preparation of high quality quarterly and annual project work plans and budgets, and provide comments on the substantive aspects before approval of work plans by the NPD and UNDP. Provide guidance in developing a project M&E framework, including indicators and baseline as well as inputs in preparing (quarterly and annual progress) project reports focusing on results, learning lessons and documenting best practices in order to improve project performance. Provide comments on the substantive aspects of those reports before approval by the NPD and UNDP. Prepare an end-of-assignment report which focuses on key lessons learned and best practices drawn from project management and capacity building processes as well as major substantive issues that have emerged and that would require further assistance from UNDP in the future.
- ***Activity implementation and reporting:*** Support formulation of relevant assessments, tender documents and TORs of remediation demonstrations, related capacity building, and awareness raising efforts, including formulation of activity implementation and quality assurance procedures; actively monitor their implementation; assure quality of outputs by project partners and consultants through critical analysis, discussion, and also editing of reports and written outputs.

3. Advice on and inputs into coordination

- Provide advice and active support to MONRE, MOD and UNDP on coordination of dioxin remediation efforts, as per the overall national plan to deal with dioxin contamination; actively liaise with international and national partners to ensure the formulation and implementation of assessment

of contamination, detailed remediation design, and implementation of remediation efforts without overlap and with the highest possible efficiency. Ensure that information and lessons from different partners are continuously shared.

4. Advice on formulation and dissemination of public messages

- *Policy and technical advice to national partners*: Provide substantive inputs to MONRE and MOD whenever requested in order to prepare policy or technical statements for important events (e.g. conferences, workshops). Provide substantive technical inputs into the formulation and dissemination of public education messages on dioxin contamination and remediation to the highest possible scientific standards and by fully taking into account political, social and economic sensitivities. Provide inputs into dioxin-relevant strategy documents and plans; TORs for technical activities; technical reports; and public events involving external inputs.
- *Advise UNDP*: Support UNDP to provide policy advice to the Government; help prepare statements for important events (e.g. donor forums) and in responding to media enquiries, and help formulate UNDP's position on particular dioxin remediation issues. Serve as an advocate for UNDP's policy on sustainable human development with a focus on elimination environmental health risks from dioxin.

IV. Impact of Results

Overall performance/impact of the STA will be assessed based on the following criteria:

- Provided high quality advice on capacity building needs and plans
- Provided effective training, with excellent facilitation skills and appropriate delivery skills and styles
- High quality inputs into project progress reports and work plans, and review-comments of high quality and relevance
- Project management advice (planning, monitoring, evaluation) of high quality and relevance
- Appropriate international and national consultants recruited based on appropriate and high quality activity designs, TORs and tender documents; and implemented with high quality of implementation results
- Appropriate partnerships established and reinforced, and effectively coordinated
- Provided effective communication, with appropriate styles in different situations
- Policy and technical advice of high quality and relevance
- Effective and active (knowledge, coordination relevant) networking

V. Competencies and Critical Success Factors

Competencies

- Demonstrated knowledge and experience in working on capacity building.
- Strong knowledge / experience in results based management and results oriented approach to project implementation.
- Strong inter-personal skills, communication, networking and team-building skills; competent in leading teams and creating team spirit, management of inter-group dynamics and conflicting interests of various actors, stimulating team members to produce quality outputs in a timely and transparent fashion.
- Excellent oral communication skills and excellent written communication skills, with analytic capacity and ability to synthesize project outputs and relevant findings for the preparation of quality papers and reports.
- Maturity and confidence in dealing with senior members of national and international institutions, government and non-government; ability to deal with politically sensitive issues
- Results driven, ability to work under pressure and to meet strict deadlines; remains calm and in

control under pressure.

- Consistently approaches work with energy and a positive, constructive attitude.
- Shares knowledge and experience actively, mentors project staff.
- Focuses on result for the client and responds positively to feedback.
- Demonstrates commitment to UNDP’s mission, vision and values.
- Displays cultural, gender, religion, race, nationality and age sensitivity and adaptability.

Critical Success Factors

Whether the STA will be successful depends partly on external factors, such as the progress with overall implementation of the project by the national partners including recruitment of project personnel and procurement of equipment as per the project document. It is also important that the project and its potential results continue to be fully supported by the national leadership on dealing with the aftermath of the war. Success factors that depend directly on the STA include whether the incumbent manages to fully use his/her skills and competencies as per the above, including appropriate self management and effective daily work planning as well as the effective use of practical tools including IT (see also Qualifications, below).

VI. Recruitment Qualifications

Education:	<ul style="list-style-type: none"> • Postgraduate degree (MSc. or Ph.D.) in environmental sciences, project management or communication / public education.
Experience:	<ul style="list-style-type: none"> • At least ten years working experience in development, especially in project management with a focus environmental subjects, donor coordination and / or public communication. • Excellent project management skills are essential • Knowledge of donor policies and funding modalities is essential. • Experience with gender mainstreaming in programmes and projects is an asset • Knowledge of UNDP programming practices is an asset • Previous work experience in Viet Nam, especially within the Government system, is an important asset.
IT requirements:	<ul style="list-style-type: none"> • Excellent skills in standard software (Word processing, spreadsheets) are expected • Experience with GIS / relational databases is an important asset
Language Requirements:	<ul style="list-style-type: none"> • Proficiency in both spoken and written English is a must, including excellent writing skills • Basic knowledge of Vietnamese is an asset

VII. Signatures- Job Description Certification

Incumbent <i>(if applicable)</i>		
Name	Signature	Date
Supervisor		
Name	Signature	Date
Chief Division/Section		
Name	Signature	Date

3. Terms of Reference for Project Manager:

Function title:	Project Manager (PM)
Project title & ID:	PIMS 3685: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
Duty station:	Hanoi.
Duration:	48 months (recruited, full time)
Supervision:	National Project Director

Duties and responsibilities

Overall, the PM will be responsible for the day-to-day running the project, including overall coordination, planning, management, implementation, monitoring & evaluation and reporting of all project activities:

1. Prepare and update project work plans, and submits these to the NPD and UNDP for clearance.
2. Participate in quarterly work planning and progress reporting meetings with the NPD, PMU, and UNDP;
3. Ensure that all agreements with implementing agencies are prepared, negotiated and agreed upon.
4. Prepare TORs for key inputs (i.e. personnel, sub-contracts, training, procurement) and submits these to the NPD and UNDP for clearance, and administers the mobilization of such inputs.
5. With respect to external project implementing agencies/ sub-contractors:
 - a. ensuring that these agencies mobilize and deliver the inputs in accordance with their letters of agreement or contracts, and
 - b. providing overall supervision and/or coordination of their work to ensure the production of the expected outputs.
6. Assume direct responsibility for managing the project budget by ensuring that:
 - a. project funds are made available when needed, and are disbursed properly,
 - b. expenditures are in accordance with the project document and/or existing project work plan,
 - c. accounting records and supporting documents are properly kept,
 - d. required financial reports are prepared,
 - e. financial operations are transparent and financial procedures/regulations for NEX projects are properly applied; and
 - f. s/he is ready to stand up to audits at any time.
7. Assume direct responsibility for managing the physical resources (e.g. vehicles, office equipment, and furniture) provided to the project by UNDP.
8. Supervise the project staff and local or international short-term experts/consultants working for the project.
9. Prepare project progress reports of various types and the Final Project Report as scheduled, and organizes review meetings and evaluation missions in coordination with UNDP.
10. Report regularly to and keeps the NPD and UNDP PO up-to-date on project progress and problems.

Qualifications

- University degree (preferably post-graduate degree) in environment management, chemicals or related fields;
- Knowledge of Result-based management and at least 5 years of experience in project management and implementation;

- Strong analytical skills, good inter-personal and team building skills – Leading skills;
- Full time availability for project management duties;
- Working level of English language is an absolute necessity;
- Familiarity with technical assistance projects and UNDP programme in Viet Nam is an asset.

4. Terms of Reference for Project Interpreter/ Secretary (PIS):

Function title:	Project Interpreter/ Secretary (PIS)
Project title &ID:	PIMS 3685: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
Duty station:	Hanoi.
Duration:	48 months (recruited, full time)
Supervision:	Project Manager

Duties and responsibilities

Under overall supervision of National Project Director, the PSI will work under the direct supervision of and provide support to the Project Manager in the discharge of his/her responsibilities in the overall management of the day-to-day activities of the project. The PSI will work closely with the NPD, the PM, staff from the PMU and other international and national consultants. The main duties of the PSI are relating to secretarial and Interpretation/translation.

a. Responsibilities of the Project Secretary:

1. Provide necessary assistance in the operational management of the project according to the project document and the NEX procedures.
2. Draft correspondence on administrative and program matters pertaining to the Project Office responsibilities;
3. Provide support in preparing project events, including workshops, meetings (monthly, quarterly and annual), study tours, trainings, etc., as required. This also includes preparation of background materials for use in discussions and briefing sessions on project matter;
4. Logistical arrangements. This includes visa, transportation, hotel bookings for project staff, consultants and invited guests coming for project activities;
5. Be responsible for project filing system. This includes setting up the filing, numbering and filing all incoming and outgoing correspondence.
6. Prepare regular list of events for sharing of information within project staff and outside;
7. Assist with project communication activities, including publications;

b. Responsibilities of the Project Interpreter:

1. Providing interpretation services to the Project activities, including meetings, small-scale workshops, and relevant events;
2. Acting as interpreter for NPD and international consultants;
3. Translating project documents, materials, papers, letters etc. from Vietnamese into English and vice versa.

Qualifications

- University degree in English language, administration or related fields;
- Good command of both written and spoken English and at least four (03) years of working experience in the positions of secretary or interpreter/ translator.

- Good secretarial skills and good organizational capacity;
- Knowledge in administrative procedures of the Government
- Good computer skills in common word processing (MS Word), spreadsheet (MS Excel), Vietnamese software;
- Knowledge and experience in working with UN agencies and international organizations is an advantage.

5. Terms of Reference for Project Accountant/ Assistant (PAA):

Function title:	Project Manager (PM)
Function title:	Project Accountant/ Assistant (PAA)
Project title & ID:	PIMS 3685: Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam
Duty station:	Hanoi.
Duration:	48 months (full time)
Supervision:	Project Manager

Main functions and responsibilities

This Project Accountant/Assistant Position has two roles: as an Administrative Assistant and as an Accountant with the following duties

a. As a Project Administrator

1. Provide assistance in the operational management of the project according to the project document and the NEX procedures.
2. Undertake all preparation work for procurement of office equipment, stationeries and support facilities as required;
3. Provide support in preparing project events, including workshops, meetings (monthly, quarterly and annual), study tours, trainings, etc., as required.
4. Take care of project telephone, fax, and email system;
5. Assist with preparation of TORs and contracts for consultants for project activities.

b. As a Project Accountant

1. Prepare quarterly advance requests to get advance funds from UNDP in the format applicable.
2. Assist the PM and NPD in project budget monitoring and project budget revision.
3. Set up accounting system, including reporting forms and filling system for the project, in accordance with the project document and the NEX procedures;
4. Maintain petty cash transactions. This includes writing of receipts, preparation of payment request form, receipt and disbursement of cash and clearance of advances;
5. Prepare cheques and withdraw money from the bank;
6. Prepare project financial reports and submit to PM and NPD for clearance and furnish to UNDP as required;
7. Enter financial transactions into the computerised accounting system;
8. Reconcile all balance sheet accounts and keep a file of all completed reconciliation;
9. Check and ensure that all expenditures of projects are in accordance with NEX procedures. This includes ensuring receipts to be obtained for all payments;
10. Check budget lines to ensure that all transactions are booked to the correct budget lines;
11. Ensure documentation relating to payments are duly approved by the NPD;
12. Bring any actual or potential problems to the attention of the NPD;
13. Follow up bank transfers. This includes preparing the bank transfer requests, submitting them to the bank and keeping track of the transfers;

14. Ensure Petty Cash to be reviewed and updated ensuring that there is up-to-date records;
15. To continuously improve system & procedures to enhance internal controls to satisfy audit requirements.
16. Ensure that bank statements be collected from the banks on the 2nd working day of each month;
17. Ensure that bank accounts should be reconciled and reported on or before 3rd of each month;
18. Prepare monthly bank reconciliation statement, including computation of interests gained to be included into reports.
19. Maintain the inventory file to support purchases of all equipment/assets.
20. Undertake other relevant matters assigned by the NPD.

Qualifications and requirements

- University degree in accounting, finance or related fields;
- Solid experience of budgeting, planning and reporting on foreign funded projects; and experience with international auditing requirements.
- Good secretarial skills and good organizational capacity;
- Knowledge in administrative and accounting procedures of the Government
- Good computer skills in common word processing (MS Word), spreadsheet (MS Excel), and accounting software.
- Appropriate English language skills, both spoken and written.

6. Main packages for outsourcing/sub-contracting

The MOD and provincial authorities, and other partners including contractors and international experts are called other implementing agencies or (other) Responsible Parties (RPs), which are all essential to the success of this project. There will be a number of contractors (or consortia between international and national institutions) that will be mobilized in accordance with the UNDP standard procurement process or Government bidding law/ standard process, as agreed upon by UNDP and the NIP.

Detailed tendering packages will be prepared during the inception phase, based especially on information collected and analysis performed during the project preparation. There are at least three tendering packages anticipated:

Package A: Design and pilot test technology for destruction of dioxin contaminated soil and sediment, especially chosen from the following list (see Annex 2):

- Ball Milling
- Bio-remediation (various approaches, but not *in situ*)
- Thermal Desorption Destruction (in pile, not *in situ*)
- Copper Mediated Destruction (CMD) (with Thermal Desorption)

Package B: Design and complete piloting landfill technology and containment of dioxin contaminated soil and sediment at three hotspots (Da Nang, Bien Hoa and Phu Cat)

Package C: Design and pilot methodology for environmental recovery for the areas after containment and treatment of contaminated soil/ sediment.

7. Project Office Equipment:

The Project shall purchase necessary equipment, software and materials as mentioned in the table below. Specifications for this equipment will be defined in accordance with UNDP prevailing rules/procedures at the time of the procurement. All equipment will be purchased in Viet Nam:

Local	Description	Quantity
Project Office equipment	Notebook:	2
	Desktop:	4
	External Hard Disk + USBs	lump sum
	UPS	4
	Laser Printer (B&W)	2
	Scanner - HP scanjet	1
	External modem	1
	Multi-function Projector	1
	Photocopy machine	1
	Fax machine	1
	Telephone	4
	Desks	4
	Chairs	4
	Cabinet/cupboard	3
Air-conditioner	1	
Other items	To be defined in the inception phase (may include equipment for sample collection, safety, etc...)	4
	EQUIPMENT TOTAL	

PART IV : Technical Annexes

The following Annexes are provided (see separate file):

Annex 1: Dioxin Contamination in Three Airbases in South Vietnam

Annex 2: Review of possible dioxin-hotspot remediation technologies

Annex 3: Dioxin contamination in sprayed areas and hotspots in Southern Viet Nam

Annex 4: Situation and Orientation for Land-Use Plans for Agent Orange/Dioxin Contaminated Hotspots (Da Nang, Bien Hoa and Phu Cat)

Annex 5: Awareness raising and capacity building on dioxin

Annex 6: Financing mechanisms for remediation of dioxin contaminated hotspots

Annex 1 provides a summary of technical studies done under a UNDP preparation project, over late 2007 to early 2009 and other data. The contamination data include an overview of amounts of dioxin imported to Viet Nam and focuses on contamination at the hotspots concerned here.

Annex 2 summarises technology reviews, especially one that was commissioned under the a UNDP preparation project (late 2007 to early 2009) and reflects agreements reached in a round table (technical) meeting between national and international stakeholders on 24-25 February 2009 regarding a phased approach (containment in stage 1, dioxin destruction in stage 2) and a shortlist of preferred dioxin destruction technologies.

Annex 3 provides a summary overview of contamination as a result of spraying in large parts of the centre and south of Viet Nam, and includes a summary of some bio-samples.

Annex 4 summarises advice on post treatment land use provided under the UNDP preparation project.

Annex 5 summarises a survey done under the UNDP preparation project that provided the baseline of awareness of the issue and advice on awareness raising and (local) capacity building that is required.

Annex 6 summarises a report by a national and international consultant under the UNDP project regarding funding levels required and fund flow modalities for addressing dioxin challenges.

Annex 1 Dioxin Contamination in Three Airbases in South Vietnam

References

This annex is primarily based on:

- VRTC with Hatfield (2009). *Evaluation of Contamination at the Agent Orange Dioxin Hot Spots in Bien Hoa, Phu Cat and Vicinity, Viet Nam - Draft Final Report*. Prepared by Viet Nam – Russia Tropical Centre, Viet Nam with Technical Support Provided by Hatfield Consultants, West Vancouver, Canada, for Office 33 and UNDP-Viet Nam
- VRTC (2008). *Mission Report on Additional Evaluation of Dioxin Contamination at Dioxin Hot Spots in Bien Hoa and Phu Cat, and Vicinity*. Report for the Office of the National Committee 33 and UNDP-Viet Nam.
- VRTC (2008). *Report on the results of analysis for 17 POPs in soil and sediment at 3 hotspots, Bien Hoa, Da Nang and Phu Cat* (“báo cáo tổng kết các kết quả phân tích 17 chất độc dioxin, thổ nhưỡng và khí tượng thủy văn tại 3 điểm nóng: Biên Hoà, Đà Nẵng Và Phù Cát”). Report for MONRE under UNDP project nr 00057781 (summarising Z1, Z2, Z3 data and other data). By: Đỗ Ngọc Lanh, Nghiêm Xuân Trường, Nguyễn Thu Hoài, Lê Bảo Hưng, Chu Thanh Bình, Võ Việt Cường
- Hatfield (2007). *Assessment of dioxin contamination in the environment and human population in the vicinity of Danang airbase, Viet Nam*, Report 3: Final Report, April 2007. Vancouver, BC: Hatfield Consultants, for Office 33, MONRE, Viet Nam
- Cao Thi Thu Huong (2008). *Maps of the presence of dioxin in the environment at Da Nang, Bien Hoa and Phu Cat airports*. Presentation to the workshop on assessment of preliminary results for establishment of the overall national plan for environmental remediation in dioxin contaminated hotspots, 30 May 2008.

It is also informed by

- Nguyen Xuan Net (2008). *Assessment of dioxin contamination in Southern Viet Nam, with a focus on the hotspots in Bien Hoa, Da Nang and Phu Cat*, presentation to the Third Meeting of the Viet Nam - US Joint Advisory Committee on Agent Orange / Dioxin, 8-11 September 2008.
- Tran Ngoc Canh (2008). *Agent Orange/Dioxin contaminated areas at three hotspots: Da Nang, Bien Hoa and Phu Cat - situation and orientation for land-use plans*, report for Office 33, MONRE & UNDP-Viet Nam. The Ministry of Defence: Hanoi
- Ron McDowall (2009). *Technology Review for Dioxin Contaminated Soils and Sludge, Viet Nam*, report for Office 33, MONRE / UNDP-Viet Nam. The University of Auckland: Auckland, New Zealand

The above written resources were summarised and discussed in a “round table meeting” on 24-25 February 2009 in Hanoi with national experts and experts from or hired by UNDP, US-EPA (USAID), and the Czech Development Agency. The analysis of contamination data reflected in this annex was broadly endorsed by this meeting.

Introduction

- The use of herbicides by US started in 1962 for defoliation of forests and crop destruction.
- Between 72 – 80 million litres of herbicide mixtures (commonly known as Agent Orange – AO) were used in Operation Ranch Hand, most of which contained dioxin traces (see also annex 3)
- The application was ceased in 1971 and Operation Pacer Ivy followed to re-drum unused herbicides and transport them back to the US (Johnston Island, Central Pacific Ocean)
- Handling caused spillages of AO/dioxin in several military airbases
- The three most contaminated airbases are Da Nang, Bien Hoa and Phu Cat (see maps in annex 3)

Use of Herbicides in Da Nang Airbase

Operation Ranch Hand (May 1964 – Jan. 1971) - total transport and handling:

- Agent Orange: 52,700 barrels (10,961,600 l)
- Agent White: 29,000 barrels (6,032,000 l)
- Agent Green: 5,000 barrels (1,040,000 l)

Operation Pacer Ivy (Dec. 1971 – Mar. 1972)

- Collected and re-drummed 8,220 barrels Agent Orange (1,709,760 l)

Spills of Herbicides in Da Nang Airbase

- Spills and leakages occurred due to handling (loading, washing and re-drumming).

Use of Herbicides in Bien Hoa Airbase

Operation Ranch Hand (Dec. 1966 – Feb. 1970) - total transport and handling

- Agent Orange: 98,000 barrels (20,384,000 l)
- Agent White: 45,000 barrels (9,360,000 l)
- Agent Blue: 16,300 barrels (3,390,000 l)

Operation Pacer Ivy (Apr. 1970 – Mar. 1972)

- Re-drumming of 11,000 barrels Agent Orange (2,288,000 l) and site cleanup occurred

Spills of Herbicides in Bien Hoa Airbase

- December 1969 – March 1970: four large spills from 28,000-liter tanks occurred on the airbase.
- Spills and leakages also occurred due to handling (loading, washing and re-drumming).

Use of Herbicides in Phu Cat Airbase

Operation Ranch Hand (Jun. 1968 – May. 1970) - total transport and handling

- Agent Orange: 17,000 barrels (3,536,000 l)
- Agent White: 9,000 barrels (1,872,000 l)
- Agent Blue: 2,900 barrels (603,200 l)

Spills of Herbicides in Phu Cat Airbase

- Spills and leakages occurred due to handling (loading and washing).
- No Pacer Ivy mission was carried out in Phu Cat

Dioxin contamination data

A collective of national and international experts agreed in February 2009 that there are enough trusted data for general planning and design of remediation at these three hotspots, and for initiating containment and dioxin destruction in many of the sub-sites of the three hotspots. However, some additional sampling and analysis is needed to determine exact boundaries of the sub-sites, depth of contamination, and additional sub-sites (note: there are data being processed concerning additional sub-sites at Danang Airport that are not reported here).

Data presented in this Annex were taken from the following research projects:

- Three assessments for overcoming consequences of herbicides/dioxin in Bien Hoa, Da Nang and Phu Cat airbases (Z1, Z2 and Z3) (MOD Project; 1995–2002)
- Other data collected by VRTC, in 2000
- Assessment of dioxin contamination in environment and human population in vicinity of Da Nang airbase (Project of Hatfield and Office 33; 2006-2007)
- Capacity building and completion of the overall national plan for environmental remediation of dioxin contaminated hotspots in Viet Nam (UNDP-MONRE project, 2008)

Also consulted, but not used in the calculation of mean and median contamination in this Annex, because of a different way of analysis of some of the data, are in:

- Assessment of dioxin contamination in soil and sediment in Da Nang airbase under a project of VAST/US-EPA (2005–2006)

Data tables and images

Below are contamination data in tables and also super-imposed on satellite images.

Some of the data from the three tables per hotspot are also represented on the images.

The summary of the three tables of contamination data per hotspot, and volumes of soil and sediment that must be treated, as well as a broad cost estimate is as follows.

Dioxin Load, Volume to be Treated, and Total Treatment Cost: Summary of 3 Hotspots

	total dioxin load (gr I-TEQ)	total volume contaminated soil (m3)	total volume contaminated sediment (m3)	total volume (m3)	unit cost (USD/m3)	Estimated total cost (USD)
Bien Hoa	616	121,050	20,500	141,550	250	35,387,500
Danang	1,063	60,110	28,000	88,110	250	22,027,500
Phu Cat	57	3,570	1,550	5,120	250	1,280,000
Total	1,736	184,730	50,050	234,780		58,695,000

Note

The unit price of USD250/m³ for treatment of the contaminated soil and sediment is a conservative estimate, on the grounds of large volumes and a staged process – see also Annex 2.

Notes with the summary tables and data on satellite images:

1. We give the median and the mean of different series of data as the main measures to show the need for soil/sediment treatment:
 - **median** is the middle value in a set of values arranged in order of size
 - **mean** = average = the result obtained by adding two or more amounts and dividing the total by the number of amounts
2. The expected standards for action are soil contamination >1000 (ppt I-TEQ) and sediment > 150 (ppt). However, where mean and median are below those standards over a larger area, there is still a reasonable possibility that some parts are over the standards and others below – for this reason additional sampling is required when remediation actions take place. For the purpose of this document percentages have been estimated in order to arrive at total volume that should be treated.
3. These contamination data are from surveys where low -resolution gas chromatography mass spectrometry (GC-MS) instruments were used, or high-resolution gas chromatography with high-resolution mass spectrometric detection (HRGC/HRMS). Because the VAST/US-EPA survey in Danang included data analysed with the Calux method these data have not been included in the calculation of mean and median, and calculation / estimation of total dioxin load. However, they are given along with all the other data at the end of this Annex.
4. The contamination data provided are primarily about the top 30 cm of soil and sediment, which were used for calculation of mean and median. Estimates of deeper contamination have been made based on a limited number of deeper samples. These sample profiles are given in the full data tables at the end of this Annex.
5. Total dioxin load is estimated by taking the given average topsoil contamination over 30 cm depth; assuming that contamination is on average a third of that value in all the deeper layers combined (for this estimation of total dioxin load, but not for remediation design). For the “Z1” area in Bien Hoa, known as an extremely contaminated area because of leaks from storage tanks, the load in the rest of the soil profile is estimated as half the surface-layer total. For sludge the estimates are only averaged over the first 30 cm. These assumptions give a “safe side” (conservatively low) estimate of the total load (1,736 gr for three sites), because some of the depth profiles that were assessed suggest that significant contamination may occur at considerable depth (but there are small numbers of deep samples and additional assessment of contamination is needed):

$$\text{Dioxin equivalent load (grams I-TEQ)(soil)} = 1.333 * (TS * \text{topsoil I-TEQ ppt})/1,000,000$$

$$\text{Dioxin equivalent load (grams I-TEQ) (sludge)} = (TS * \text{sludge I-TEQ ppt})/1,000,000$$
 with $TS = (\text{Area } m^2 * 0.30 \text{ m} * 1.8 \text{ ton}/m^3) = \text{top soil or sludge layer (metric tons)}$
6. The above estimate of total dioxin load only concerns the known on-airbase sub-sites. The contamination analysis for Da Nang excludes the ongoing assessment of contamination at the southern end of the airbase. There is also further sampling and analysis needed on the other two airbases in order to ascertain the estimates in the tables given here, including the possibility for additional sub-sites. Contamination outside the airbases is omitted from the overviews, but land use measures appropriate to contamination levels should also be agreed.
7. The volumes of soil and sediment that are above the stated limits need to be treated or contained in a definite manner. The limits taken here are the maximum contamination limits above which treatment is required, as stated in draft national legislation for the remediation of the three hotspots, which is for soil >1,000 ppt and for sediment >150 ppt TEQ.
8. Land and lakes with lower contamination levels than the stated standard and treated soil and sediment should be given land use that is appropriate to the contamination levels and the planning agreements of the Airbases. Treatment technologies are discussed further in Annex 2.

Dioxin Load, Volume to be Treated, Phased Treatment and Post-Treatment Options: 3 Hotspots

<i>Bien Hoa</i>	Area (m ²)	dioxin 0-0.3m mean (ppt)	medium	Est. soil > 1,000 ppt (m ³)	Est. dioxin load	Desired treatment outcome	Remediation technology: initial plans	Post treatment land use options
<i>[N=nr of surfc sampls]</i>	[treatment depth (m)]	[median (ppt)] [range (ppt)]	[% surface to treat]	Sludge > 150 ppt (m ³)	(gr I-TEQ)	(end phase 2)		(end phase 2)
South of Runway Area	15,000	5,276	soil	18,000	47	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Storage, sports or parking facilities
<i>[N= 14]</i>		343						
	1.2	[19-65,500]	100%					
South-West Runway Area	20,000	2,650	Soil (some sludge)	24,000	38	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase and possibly at this sub-site Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Retain retention pond as protected wetland; landfill covered with e.g. shrubs, grass, storage facilities
<i>[N= 15]</i>		780						
	1.2	[80.3-22,800]	100%					
Z1 Area (landfill under construction)	38,000	15,864	Soil	57,000	488	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase as is currently happening Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Drainage and protection facilities of the landfill; landfill covered with e.g. Grass, shrubs
<i>[N= 61]</i>		2,127						
	1.5	[2-409,818]	100%					
Z1- Perimeter Area	49,000	893	Soil (some sludge)	22,050	32	No parts soil exceeding safety standard of 1000 ppt I-TEQ and sludge to below safety standard of 150 ppt	Stage 1: excavate part and put in contained landfill, other parts used for land filling, trees Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Partly landfill, covered with grass and shrubs; rest commercial trees, e.g. rubber
<i>[N= 44]</i>		102						
	0.9	[2.0-13,300]	50%					
Z1 wetlands /ponds	41,000	495	sludge	20,500	11	all contaminated sludge to below safety standard of 150 ppt I-TEQ	Stage 1: drain, excavate 50 cm sludge and put in contained landfill Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Remain as ponds, protected wetland.
<i>[N= 16]</i>		278						
	0.5	[16-2,240]	100%					

<i>Danang</i>	Area (m ²)	dioxin 0-0.3m mean (ppt)	medium	Est. soil > 1,000 ppt (m ³)	Est. total dioxin load	Desired treatment outcome	Remediation technology: initial plans	Post treatment land use options
<i>[N=nr of surfc sampls]</i>	[treatment depth (m)]	[median (ppt)] [range (ppt)]	[% surface to treat]	Sludge > 150 ppt (m ³)	(gr I-TEQ)	(end phase 2)		(end phase 2)
A: Storage area	13,400	39,883	Soil	20,100	385	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Taxiway extension, grass
<i>[N= 25]</i>		13,300						
	1.5	[183-134,802]	100%					
B: Mixing & loading area	4,700	75,720	Soil	7,050	256	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Taxiway extension, grass
<i>[N= 13]</i>		19,386						
	1.5	[317-365,000]	100%					
D: Mixing & loading area	4,800	47,886	Soil	7,200	165	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Taxiway extension, grass
<i>[N= 11]</i>		4,015						
	1.5	[6-167,000]	100%					
C: between storage and loading sites	40,000	1,961	Soil	7,200	56	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate part and put in contained landfill, on Airbase rest used as planned Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Taxiway extension, grass
<i>[N= 14]</i>		316						
	0.9	[71-11,567]	20%					
Drainage canal area (from D, C, B A, to Sen Lake)	2,900	39,772	soil and sludge	2,900	62	all contaminated soil to below safety standard of 1000 ppt I-TEQ and sludge to below 150 ppt	Stage 1: excavate, air-dry and put in contained landfill; filled with clean soil; drain replaced with eastwards drain to new retention reservoir then northwards drain Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Taxiway extension, grass
<i>[N= 8]</i>		25,678						
	1	[7,014-95,451]	100%					
E: southeast of drain, wetland around Sen Lake	87,000	610	Soil	15,660	38	No parts exceeding safety standard of 1000 ppt I-TEQ	Stage 1: excavate part and put in contained landfill, other parts used for land filling, water retention Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	New retention pond; protected wetland; landfill covered with e.g. grass, shrubs, sports or parking facilities
<i>[N= 15]</i>		58						
	0.9	[2-5,690]	20%					

<i>Danang</i>	Area (m ²)	dioxin 0-0.3m mean (ppt)	medium	Est. soil > 1,000 ppt (m ³)	Est. total dioxin load	Desired treatment outcome	Remediation technology: initial plans	Post treatment land use options
<i>[N=nr of surfc sampls]</i>	[treatment depth (m)]	[median (ppt)] [range (ppt)]	[% surface to treat]	Sludge > 150 ppt (m ³)	(gr I-TEQ)	(end phase 2)		(end phase 2)
F: southwest of drain, wetland around Sen Lake	82,000	52	Soil	0	3	No parts exceeding safety standard of 1000 ppt I-TEQ	none	Taxiway extension, grass
<i>[N= 17]</i>		16						
	0.9	[0-325]	0%					
Lake A (Sen Lake)	56,000	3,161	Sludge	28,000	96	all contaminated sludge to below safety standard of 150 ppt I-TEQ	Stage 1: drain, excavate 50 cm sludge and put in contained landfill. Sen Lake partly hard filled, partly contained landfill Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Partly taxiway extension; landfill covered with e.g. grass, shrubs, sports or parking facilities
<i>[N= 20]</i>		2,926						
	0.5	[63-12,393]	100%					
Lake B	32,000	46	Sludge	0	1	all contaminated sludge to below safety standard of 150 ppt I-TEQ	Drained, hard filled	Runway extension, grass
<i>[N= 4]</i>		42						
	0.5	[30-70]	0%					
Lake C	43,000	17	Sludge	0	0	all contaminated sludge to below safety standard of 150 ppt I-TEQ	Drained, hard filled	Taxiway extension, grass
<i>[N= 5]</i>		15						
	0.5	[3-42]	0%					

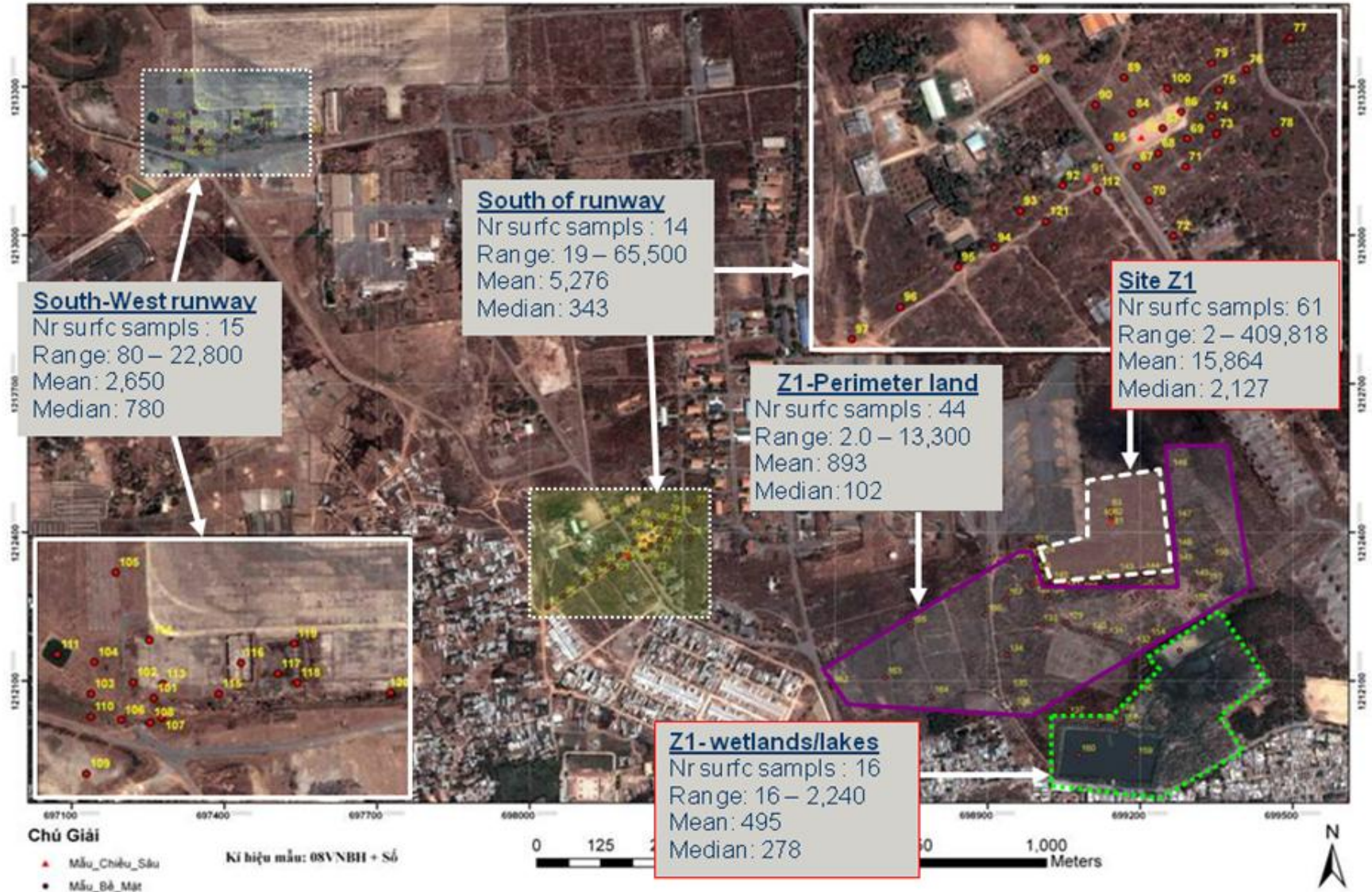
<i>Phu Cat</i>	Area (m ²)	dioxin 0-0.3m mean (ppt)	medium	Est. soil > 1,000 ppt (m ³)	Est. total dioxin load	Desired treatment outcome	Remediation technology: initial plans	Post treatment land use options
<i>[N=nr of surfc sampls]</i>	[treatment depth (m)]	[median (ppt)] [range (ppt)]	[% surface to treat]	Sludge > 150 ppt (m ³)	(gr I-TEQ)	(end phase 2)		(end phase 2)
Z3 (Storage area)	2,200	26,248	Soil	1,980	42	all contaminated soil to below safety standard of 1000 ppt I-TEQ	Stage 1: excavate and put in contained landfill, on Airbase Stage 2: Treat in on-Airbase closed system, or in contained bioreactor landfill	Partly landfill, covered with grass and shrubs; rest commercial trees, e.g. rubber
<i>[N=21]</i>		5,258						
	0.9	[152-238,000]	100%					

<i>Phu Cat</i>	Area (m ²)	dioxin 0-0.3m mean (ppt)	medium	Est. soil > 1,000 ppt (m ³)	Est. total dioxin load	Desired treatment outcome	Remediation technology: initial plans	Post treatment land use options
<i>[N=nr of surfc sampls]</i>	[treatment depth (m)]	[median (ppt)] [range (ppt)]	[% surface to treat]	Sludge > 150 ppt (m ³)	(gr I-TEQ)	(end phase 2)		(end phase 2)
A: Loading area		261		0	0	all contaminated soil to below safety standard of 1000 ppt I-TEQ	none	Grass, shrubs, commercial trees, e.g. rubber
<i>[N= 7]</i>		19						
		[2.6-876]	0%					
B: perimeter area	24,000	482	Soil	1,440	8	No parts exceeding safety standard of 1000 ppt I-TEQ	Stage 1: excavate part and put in contained landfill, other parts used for land filling, water retention system, or in contained bioreactor landfill	Partly landfill, covered with grass and shrubs; rest commercial trees, e.g. rubber
<i>[N=15]</i>		98						
	0.6	[1.5-2,950]	10%					
Drain & sedimentation basin (in Z3 perimeter)	500	122	Sludge	150	0	all contaminated sludge to below safety standard of 150 ppt I-TEQ	Stage 1: dredge 50 cm sludge, air-dry and put in contained landfill; partly hard fill but retain drainage	Retain drainage facility; grass, shrubs, commercial trees, e.g. rubber
<i>[N= 8]</i>		101						
	0.3	[4.1-419]	100%					
C: Washing area	6,000	25	Soil	0	0	No parts exceeding safety standard of 1000 ppt I-TEQ	none	Any land use as part of Airbase re-development
<i>[N= 17]</i>		6						
	0.6	[1.9-218]	0%					
South-East Runway area	4,000	42	Soil	0	0	No parts exceeding safety standard of 1000 ppt I-TEQ	none	Any land use as part of Airbase re-development
<i>[N= 11]</i>		12						
	0.3	[5.6-236]	0%					
Lakes	310,000	43	Sludge	1,550	7	all contaminated sludge to below safety standard of 150 ppt I-TEQ	Stage 1: dredge part, air-dry and put in contained landfill	Remain as ponds, protected wetland.
<i>[N= 23]</i>		34						
	0.5	[1.7-196]	1%					

Dioxin contaminated sub-sites in Bien Hoa Airbase



Dioxin in Soil & Sediment (ppt TEQ) in Bien Hoa Airbase



Dioxin contamination study area on Da Nang Airbase (North)



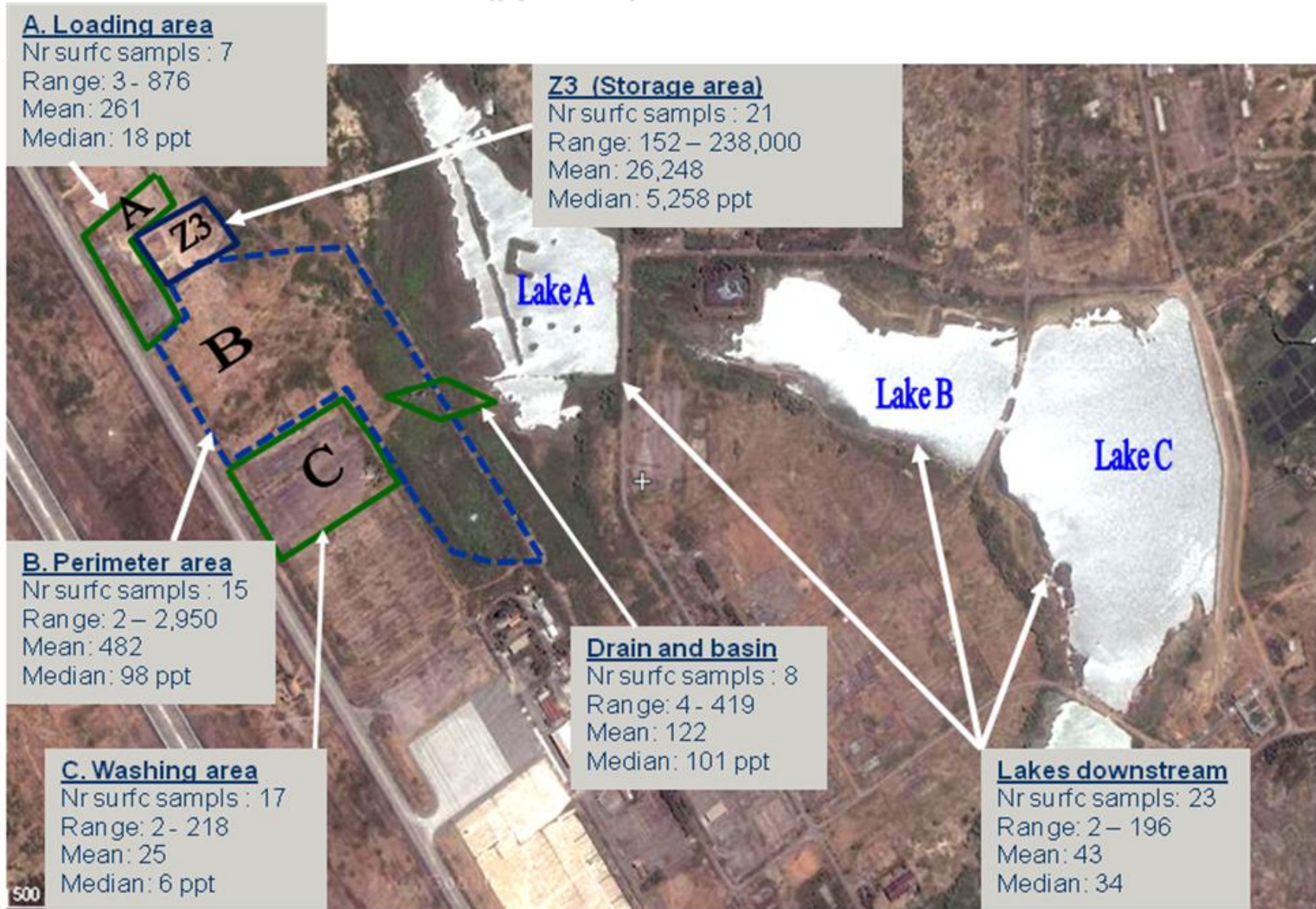
Dioxin Concentration in Soil & Sediment at sub-sites Da Nang Airbase (North)



Dioxin contaminated sub-sites on Phu Cat Airbase



Dioxin (ppt TEQ) in Soil & Sediment on Phu Cat Airbase



Annex 2 Review of possible dioxin-hotspot remediation technologies

References

This annex is primarily based on:

- Ron McDowall (2009). *Technology Review for Dioxin Contaminated Soils and Sludge, Viet Nam*, report for Office 33/ MONRE & UNDP-Viet Nam. Auckland, New Zealand: The University of Auckland
- Pham Ngoc Canh (2008). *Agent Orange/Dioxin contaminated areas at three hotspots: Da Nang, Bien Hoa and Phu Cat - situation and orientation for land-use plans*, report for Office 33/ MONRE & UNDP-Viet Nam. Hanoi: The Ministry of Defence
- BEM Systems (2007). *Mitigating the Impact of Dioxin-Contaminated “Hot Spots” in Viet Nam – assessment of alternative remediation Technologies and Work Plan for a Future Feasibility Study for Da Nang Airport*, report for the US Environmental Protection Agency. Chatham NJ: BEM Systems Inc.
- Czech Development Agency (2 February 2009) *Information on remediation technologies for the removal of persistent compounds in the Czech Republic*

It is also informed by

- Nguyen Van Minh (2008). *Research on Remediation for Dioxin Contaminated Soil in Viet Nam*, presentation to the Third Meeting of the Viet Nam - US Joint Advisory Committee on Agent Orange / Dioxin, 8-11 September 2008.
- Pham Ngoc Canh (2008). *Remediation of dioxin contaminated soil in Viet Nam*, presentation to the Third Meeting of the Viet Nam - US Joint Advisory Committee on Agent Orange / Dioxin, 8-11 September 2008.
- Ron McDowall, Carol Boyle and Bruce Graham (2004). *Review of Emerging, Innovative Technologies for the Destruction and Decontamination of POPs and the Identification of Promising Technologies for Use in Developing Countries*, Final report – GF/8000-02-02-2205, for the Scientific and Technical Advisory Panel of the GEF United Nations Environment Programme. Auckland, New Zealand: International Centre for Sustainability Engineering and Science Faculty of Engineering, the University of Auckland, 15 January 2004.
- Vender information and published articles on specific remediation technologies, including Ball Milling, Vitrification/ GeoMelt, Thermal Desorption Destruction (in-pile and *in situ*), Base Catalysed Decomposition (BCD) and Copper Mediated Destruction (CMD).

These written resources were summarized and discussed in a “round table meeting” on 24-25 February 2009 in Hanoi with national experts and experts from or hired by UNDP, US-EPA (USAID), and the Czech Development Agency. The text in this annex was broadly endorsed by this meeting.

Stages in remediation of hotspots in Viet Nam: containment and destruction of dioxin

Dioxin contamination in hotspots in Viet Nam has been present for roughly 40 years, posing environmental and health risks. As such, Viet Nam's primary concern is that the contamination should, with highest priority, be isolated from wildlife and food chains and other paths of spreading and affecting people and the environment. This explains containment measures taken with limited national financial resources at the three main hotspots, Bien Hoa, Danang and Phu Cat.

The Vietnamese authorities and national and international experts envisage a two-stage process.

The first stage is isolation or containment of the contaminated soil and sediment. This is in all three hotspots underway, but is at different stages and involves different measures in the three hotspots. For example, in Danang there was some capping of contaminated areas and later improvement of drainage provisions (with international funding). In Phu Cat a sedimentation pond with coal filter has been constructed in the main drainage channel downstream of the polluted sub-sites. In Bien Hoa a high quality, 4 ha contained landfill is nearing completion.

The first stage should be completed as soon as possible to satisfactory standards. This means that in all three hotspots one or more on-site landfills are created and/or the dioxin in soil or sediment would have to be immobilised in situ. In Bien Hoa there is now ample experience with a contained landfill that is being covered by clean topsoil and planted with shrubs. This partial completion of stage 1 in Bien Hoa (note: there are newly identified other contaminated sites on the Airbase) is seen as important experience from which the work at the other hotspots must draw lessons, for example on materials used, drainage provisions, worker protection / safety standards applied, etc.

In Bien Hoa a trial with bioremediation in one 3600 m² cell of the landfill is being prepared. This is part of stage 2, where dioxin is destroyed to agreed standards, by a variety of technologies. However, further than this bioremediation trial there has been no actual destruction of the dioxin in soils and sediments in any of the hotspots. The approach taken to land filling in Bien Hoa could enable complete destruction of dioxin in stage 2 by a range of technologies, as the landfill is constructed in cells that can be independently opened. Engineering of other landfills should be done based on this experience and ensure that a range of dioxin destruction technologies might be employed to different cells with different (average) levels of contamination.

Which dioxin destruction technologies will be applied to the contaminated soil in the contained landfills in Bien Hoa, Danang or Phu Cat depends on for example technological developments, as there is no international experience with remediation of the volumes and degree of dioxin contamination of soils and sediments as found at the hotspots in Viet Nam. When dioxin destruction will happen depends mainly on costs/ volume and fund availability. The known technologies have been assessed on their potential, and their cost for the volumes estimated from several sampling/analysis efforts.

Where funds are available simultaneously for stage 1 (in full) and stage 2 (in part or in full) there is likely an efficiency gain, because dioxin in soil and sediment would be destroyed prior to land filling, which means that the landfill (-cell) where the concerned outputs would be contained will require lower construction and risk management standards and be cheaper. The availability of funds for some combination of stages is expected to be the case for internationally funded hotspot remediation projects. But because stage 1 determines what is possible in stage 2, it is agreed that where the stages are not combined the stage must be completed in such a way as to enable tests of a range of dioxin destruction technologies, including bioremediation and a prioritized small set of technologies for full and immediate destruction of dioxin in soil/sediment.

For the purpose of this proposal a conservative estimate for containment and treatment, i.e. total unit cost for stage 1 and stage 2 combined has been set at USD250/m³ – see also Annex 1. This is a conservative estimate when compared to international remediation efforts, because the volumes are

large and actual commissioning of treatment technologies will include international competitive bidding, which should bring unit cost down. Nevertheless, the technology reviews did consider expected costs in comparing and prioritising known technologies as one of the important criteria.

Introduction to technology reviews

All known technologies that could be used for the decontamination of soil and sediment in the three hotspots were reviewed, including technologies for the complete isolation or immobilisation of the contaminants. Incineration and other thermal technologies were reviewed as well as a range of chemical and biological decontamination technologies.

The different reviews accessed materials from international POPs destruction technology literature and seminars, and from technology suppliers. The reviews assumed that a two-step process may be required where the soil/sediment is first decontaminated by extracting the dioxin and then destroying the collected dioxin in another process. In the application of many remediation technologies there is also a need for treatment of residuals / waste during and after the treatment.

Several technologies could be useful either on their own or in combination, but their application to the realities of the contaminated soil and sediment (quantity, type and location) was considered, and risks of failure as well as cost have been taken into account. Technologies were reviewed with a focus on the specific situation at the three main hotspots, as some technologies require inputs that may be difficult to obtain in Viet Nam, such as large amounts of (on site) electric power.

The review by McDowall (2009) is essentially an update of the UNEP STAP report (McDowall et al., 2004), in which all known non-combustion technologies were reviewed, and it also provides specific information and recommendations for the Vietnamese situation.

Basic requirements of the preferred technology mix in “stage 2”

The overall recommendation re “stage 2” dioxin destruction technologies is to agree on a small set of prioritised technologies for full and immediate destruction of dioxin in the most contaminated sub-sites of all three hotspots, in combination with bio-reactor land-filling for soil and sediment with relatively low-levels of contamination (but above the Vietnamese standards that should trigger remediation). Both should be on-site (on the Airbase concerned), and possibly (partially) *in situ* (some techniques do not require excavation). The extent and expected success of bio-remediation in bioreactors should be based on the results of tests in Bien Hoa, Da Nang and possibly Phu Cat, and the experience in Bien Hoa with a contained land fill.

According to the Stockholm Convention, recovery and recycling are not applicable to POPs wastes. This requires that each dioxin destruction and/or management facility should:

- have adequate regulatory infrastructure and enforcement to ensure compliance with applicable regulations;
- be appropriately authorised;
- have waste minimisation/ recovery/ recycling procedures
- be appropriately certified under an applicable Environmental Management System;
- have an appropriate operational monitoring and reporting programme;
- have an operational inspection and recording programme for all input and output materials;
- have appropriate in-house record keeping;
- have an appropriate and verified emergency plan;
- have an appropriate and operative training programme for its personnel; and
- have an adequate financial guarantee for emergency situations and closure.

Under the Basel Convention, “Environmentally sound management of hazardous wastes or other wastes” (ESM) means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against adverse effects that may result from such wastes. The core elements of ESM are evaluation, dismantling, refurbishment, pre-treatment, treatment and disposal of wastes.

Criteria for assessing remediation technologies for field testing are as follows (based on McDowall, 2009; Tran Ngoc Canh, 2008; BEM, 2007; discussions between experts on 24-25 February 2009).

1. Possibility for on-site (on-Airbase) treatment in closed systems, meaning all residues and out flowing streams are contained. For some processes residuals (liquid, solid, gas) are more difficult to capture, contain, and treat than for others. The secondary waste stream should contain no toxic by-products. Technologies that may require releases (e.g. relief valve from high-pressure vessels) or environmental spreading of POPs should be avoided.
2. It is highly unlikely that any in situ technology (no excavation required) is suitable, e.g. because of high groundwater / humidity levels in several sub-sites.
3. Effectiveness, treatment efficiency. In closed systems the common criteria is a Destruction Efficiency (DE) that is greater than 99.99%¹. This criterion is critical for comparing and selecting e.g. chemical and thermal destruction technologies, but would not apply to bioremediation in contained landfills / bioreactors, where such efficiencies may only be reached over a very long period of time.
4. Potential, proven treatment throughput (very large quantities of soil and sediment)
5. Time period required / speed (especially important in Danang where runway expansion is about to happen)
6. System requirements (power, water, chemicals/reagents, infrastructure). The process must handle upsets such as power supply failure, without danger to personnel or equipment; handling and loading of contaminated soils into the process must always be safe, straightforward and controlled; equipment must be robust, and preferably make use of local resources.
7. Demonstrated success / state of development of the technology.
8. Costs, per m³ and per ton soil / sediment. The initial assessment should make conservative estimates, and actual costs will depend on many factors including the effectiveness of commercial bidding.
9. Possibility for technology transfer / capacity building of Vietnamese partners

Preferred technology mix

In each hotspot a large contained landfill should be established (or expanded) as “stage 1”, part of which may also function as a bioreactor (“stage 2”). For stage 1 a realistic time frame to contain contamination should be agreed for each hotspot including all known sub-sites that can be implemented with limited funds. This requires additional (field testing of contamination in order to ascertain the depth and volumes of soil and sludge that should be excavated and dredged. The quality (minimum construction standards) and design of stage 1 containment should be agreed based on experience in Bien Hoa.

In each hotspot a closed on-site Operation for destruction should be set up for “stage 2” destruction of dioxin in soil and air dried sediment. Prior to full scale installation of such an Operation the prioritised, selected technology must be tested. Criteria for selecting technology for on-site testing (stage 2) are given above.

The prioritised closed on-site Operations (stage 2) for testing of on site treatment of the contaminated soils and air-dried sediment are the following technologies:

¹ DE = the total mass of a chemical into a process, minus the mass of the chemical in all products, by-products and environmental releases, divided by the input mass (to give a percentage)

- Bio-remediation (various approaches, but not *in situ*)
- Ball Milling (Mechano Chemical Destruction, MCD)
- Thermal Desorption Destruction (in pile, not *in situ*)
- Copper Mediated Destruction (CMD), preceded by in-vessel Thermal Desorption

Any of these stage 2 technologies must be field tested. Tendering (internationally) is a requirement for application of the technologies except (possibly) some field tests, as companies may offer those for very low costs. However, following successful trials, it is not necessarily the case that cost effective offers are possible from many companies, because some of the technologies / processes are patented, and licensing is restricted to few suppliers. Therefore tenders will include several steps including testing of some technologies whilst scaling up will be conditional on testing success. Testing costs and risk of test failure may thus be partly transferred to suppliers. Tender documents should also specify that patenting / licensing of technologies to Vietnamese companies for application at other hotspots / other contaminated areas in Viet Nam should be an option – and ODA may (partially) fund that.

Treatment technology and post treatment land use in the three hotspots

In annex 1 the general soil/sediment treatment targets are given, and land use options are suggested per known contaminated sub-site on each of the three Airbases. Additional analysis of contamination will be needed to ascertain depths and extent of excavation. Detailed design per Airbase regarding the location of contained landfills (stage 1) and location of (stage 2) Operation is to be done and approved by the authorities. Post treatment land use options need to be studied further as part of the development plans of each Airbase, and approved too. The project is expected to make major contributions to this additional analysis of contamination, containment (stage 1) and actual treatment (stage 2), and land use planning.

Summary matrix of dioxin destruction technologies

The most likely remediation technologies (and technology combinations) are summarised in the following matrix, based on written reviews referred to above, as well as the technical meeting in Hanoi on 24 and 25 February 2009.

Notes with summary matrix:

In “recommended”: p=possible; x=rejected option; 1p=highest rank, possible; 5x=fifth rank, rejected

Technology	Recommended / described by	Advantages	Disadvantages	cost (USD/ m ³)	ranking / sub-site
Containment (stage 1; in stage 2 only if combined with dioxin destruction technologies)	Canh-p; BEM-p; McDowall-p	<ul style="list-style-type: none"> Fast and cheap, locally implementable Experience in Bien Hoa Bentonite makes impervious layer Can be combined with bio-reactor, or other “stage 2” treatment techniques Appropriate land use options 	<ul style="list-style-type: none"> Risk of damage to landfill, and pollution of wider environment Only a permanent solution if bioreaction or other treatment leads to safe levels in reasonable time period after landfill is sealed 	BH: 50/m ²	
Pyrolysis/gasifiers (ex-situ)	BEM-x; McDowall-5x	<ul style="list-style-type: none"> High destruction efficiency (DE) Proven commercial technology 	<ul style="list-style-type: none"> Low throughput capacity High energy costs Low moisture content required Need to manage secondary waste stream 	275	
Thermal Desorption (decontamination <u>and</u> destruction) (ex-situ = ‘in-pile’, in-situ)	BEM-x; EPA-p; Czech-p; McDowall-2p	<ul style="list-style-type: none"> High destruction efficiency (DE) Reported in-situ sites at least 3,000 m² / 13,000 m³ 	<ul style="list-style-type: none"> Need to manage air emissions High power requirements 	110-500	
Vitrification (GeoMelt) (ex-situ, in-situ)	BEM-x; McDowall-3p	<ul style="list-style-type: none"> High destruction efficiency (DE) No pre-treatment needed Reported up to 1000 tons in-situ soil Ex-situ reported 90 ton/day, so throughput is limited 	<ul style="list-style-type: none"> High electricity requirements Low moisture content required Need to manage off gas emissions Very few installations in recent years where GeoMelt has been successful 	225-700?	
Base Catalysed Decomposition (BCD)	BEM-x; McDowall-4x ; Czech-p	<ul style="list-style-type: none"> High destruction efficiency (DE) 20 tons / hour throughput reported By-products / secondary wastes can be recycled (salts, oil) proven technology Off gas emissions and safety risks can be handled well 	<ul style="list-style-type: none"> Requires mechanical soil pre-treatment (max particle size 50mm) Then mixed with liquids (including a POPs carrier oil) to make slurry for treatment reactor Manage sediment dewatering wastewater sodium hydroxide needed (costly) 	300	
Copper Mediated Destruction (CMD)	McDowall-x; Czech-p; EPA-p	<ul style="list-style-type: none"> low temperature (250 °C), safe High destruction efficiency (DE) Limited equipment, inputs: mobile Few intermediary products 	<ul style="list-style-type: none"> Dioxins must be extracted from soils before destruction (Thermal Desorption) Not commercialised, or proven at scale 		

Technology	Recommended / described by	Advantages	Disadvantages	cost (USD/ m ³)	ranking / sub-site
Soil washing	BEM-2p	<ul style="list-style-type: none"> appropriate especially for sediment Hotspots have high sand content 	<ul style="list-style-type: none"> Secondary pollution risks/mangment needs Not effective for silts and clays 40-90% effectiveness 	125	
Solvent extraction	BEM-p	<ul style="list-style-type: none"> High destruction efficiency (DE) 	<ul style="list-style-type: none"> Possibly toxic secondary waste stream Not effective for silts and clays 	225	
Plasma Arc	McDowall-4x	<ul style="list-style-type: none"> High destruction efficiency (DE) Waste products do not need treatment Proven, existing technology 	<ul style="list-style-type: none"> Requires another technology for desorption Low throughput, only cost effective for high concentration wastes 		
Ball milling (Mechano Chemical Destruction – MCD)	McDowall-1p ; EPA-p	<ul style="list-style-type: none"> High destruction efficiency (DE) simple to use single step destruction no pre-treatment needed (air-dry only) Throughput up to 15 ton/hr/machine 	<ul style="list-style-type: none"> Secondary emissions and effluent (reduced organics, salts) contained in closed system Need chemical inputs (hydrogen, magnesium, sodium) 	200-500?	
Solidification /stabilisation	BEM-2p	<ul style="list-style-type: none"> Large scale experience USEPA Reusable residuals 	<ul style="list-style-type: none"> Manage air emissions Unproven in long term for dioxin 	125	
Ex-situ solid waste biotreatment / bioremediation	BEM-1p; McDowall- x/p	<ul style="list-style-type: none"> Good destruction efficiency (DE) Can be combined with contained landfill and on site treatment with other technology 	<ul style="list-style-type: none"> Slow moderate throughput & high cost if in-vessel Manage air emissions 	50-200	
In-situ biotreatment / bioremediation; including DARAMEND	BEM-1p / McDowall-x/p ; Czech/Dakonta-p	<ul style="list-style-type: none"> Can be combined with on site treatment with other technology No secondary waste stream 	<ul style="list-style-type: none"> needs testing of local bacteria, nutrients Long treatment time Only for low-strength waste low efficiency / limited dioxin experience 	50	
Photochemically enhanced microbial degradation; White rot fungi biodegradation	McDowall- x/p ; Czech/Dakonta-p	<ul style="list-style-type: none"> could be cheap 	<ul style="list-style-type: none"> Requires inputs such as fungicide and specific strains of fungi; ultraviolet light Known applications at micro-scale only; needs more research & testing Not proven for TCDD 		
Phytoremediation	McDowall- x; Czech/Dakonta-p	<ul style="list-style-type: none"> could be cheap suitable for long term degradation of low contamination in soils 	<ul style="list-style-type: none"> requires by compost and fungi large scale experience absent could be slow unlikely for high strength POP wastes 		

Annex 3 Dioxin contamination in sprayed areas and hotspots in Southern Viet Nam

This is a summary of parts of

- Nguyen Xuan Net (2008). *Assessment of dioxin contamination in Southern Viet Nam, with a focus on the hotspots in Bien Hoa, Da Nang and Phu Cat*, Report to Office 33 and UNDP, May 2008; presentation to the Third Meeting of the Viet Nam-US Joint Advisory Committee on Agent Orange / Dioxin, 8-11 September 2008

Quantities of herbicides used in Viet Nam

Different quantities of herbicides from various inventories were reported (Table 1). It is noted that Agents Pink, Violet, and Green, which contain very high concentration of dioxin were not reported by Westing (1976). According to According Stellman *et al.*, (2003), 76,954,806 l (77 million litres) or 95,112,688 kg (95 million kilogram) of herbicides were used, of which 67% contained dioxin (= mainly the 49.27 million l or 63,000 tons of Agent Orange).

Table 1 Quantity of herbicides according to different sources (litres)

Reference	Agent Orange	Agent White	Agent Blue	Others: Violet, Pink, Green	Total
Westing (1976)	44,373,000	19,835,000	8,182,000	-	72,390,000
Stellman <i>et al.</i> (2003)	49,268,937	20,556,525	4,741,381	2,387,963	76,954,806
Young (2007)**	48,609,600	21,819,200	6,136,000	2,927,600	79,492,400

**Young (2007): in Operation Pacer Ivy 25,200 drums (5,241,600 l) were taken out of Viet Nam, and therefore, 74,250,800 l of herbicides were used

Investigation of the quantity of dioxin released into the environment in South Vietnam

Amount of dioxin in South Vietnam was investigated based on the use of herbicides and dioxin concentration in these herbicides, which were used in Vietnam over the period 1961 – 1971.

It is recognized that the concentration of TCDD in industrial product of 2,4,5-T during this period is very different from each others (Table 2).

Because of the difference of the quantitative data of herbicides and the concentration of TCDD contained in them, the dioxin content was evaluated differently by different authors: see table 2

Table 2 Dioxin totals released in Viet Nam (different authors)

VA (1981):	109 kg
Westing (1989):	170 kg
Wolfe (ATSDR, 1997):	167 kg
Kramárová (1998):	230 kg
Stellman (2003)	366 kg
Fokin (1983):	500-600 kg
Tác giả (2006):	653 kg

Previously, national and international publications often cited the Westing data, but in recent years Stellman data have been used in many publications.

General risk assessment for environment and human health

95,112,688 kg herbicides was sprayed on 2.63 million hectares, equivalent to 15,2% of Southern Vietnam area. If we consider only herbicides containing 2,4,5-T, the area sprayed with these

compounds, according to Stellman et al. (2003), is 1.68 million hectares (9.7% total area of South Vietnam)

Based on the data above, the sprayed density of herbicides is around 36 kg/ha. For Agent Orange (with the quantity of 49.27 million litres or 63,000 tons), the spraying density is 37.5kg/ha.

More than 2 million hectares inland forest was affected, damaging immediately more than 90 million cubic meter of wood (Boi et al., 2002), 150,000 ha of mangrove forests in Southern Vietnam was destroyed (Hong et al., 2002), and the biodiversity of forest ecosystem in South Vietnam thus destroyed.

NAS (2003) and Stellman (2003) reported that among the recorded 20,585 affected villages, 3,181 villages were directly sprayed and the exposed population was around 2.1 – 4.8 million people. 1,430 other villages were also sprayed but the exposed population data could not be evaluated.

Dioxin contamination in South Vietnam has been studied since the early years of 1970s (Päpke, et al., 2003). It was started by Baughman and Meselson during 1973-1974. They are first researchers analyzing dioxin in fish and shrimp samples.

The National steering committee on overcoming consequences of toxic chemicals used by US during the War in Vietnam was established in October, 1980 (called Committee 10-80). At the second International scientific conference in Hanoi, about “Herbicides in the war” in 1993, there were 9 reports evaluating the persistence of dioxin in various matrix (blood, fat, breast milk, foods, and soils), in which only one report showed the analytical results of 2,3,7,8-TCDD in sediment measured by a Vietnamese laboratory using Gas chromatography – Electron Capture Detector technique (Hue *et al.*, 1993). The rest of reports showed analysis of dioxin was conducted by international laboratories.

In 1995, the analytical laboratory of The Vietnam – Russia Tropical Institute was established. This laboratory analyzes the accumulation of dioxin in the environment for Ministry level projects. Other laboratories were established or strengthened too, with international support. Most recent studies on dioxin contamination in Vietnam have been carried out nationally with international organizations from Canada, Japan, Germany, the USA, etc., sponsored by for example UNDP and the Ford Foundation.

Based on the result of dioxin since 1980s of twentieth century until the end of 2007, Vietnamese scientists and international scientists (Vietnam – Russia Tropical Institute, 1997, 1999, 2000 – 2005; Committee 10-80, 2000; Hatfield/ Committee10-80, 2000, 2006; Hatfield-Office 33, 2007) showed that:

- At the areas sprayed with herbicides containing dioxin (2.63 million hectares), the concentration of dioxin in the environmental matrices is not in the risk range. Most study areas had a concentration of dioxin below or equal to 10 ppt TEQ, and a small number of areas had a concentration of dioxin in over 100 ppt TEQ, but still in the acceptable concentration range depending on land use.
- In contrast, the dioxin contamination is very high at the ‘hot spots’ at the former Bien Hoa, Da Nang, and Phu Cat Airbases, especially the former storage area, former mixing and loading area. The Vietnamese Government approved a general remediation plan for dioxin until 2010.

The research on dioxin contamination were conducted mainly at the main herbicide spraying areas: Gio Linh, Cam Lo (Quang Tri); A Luoi (Thua Thien Hue); Sa Thay (Kon Tum); Ma Da – Tri An (Dong Nai); Tan Uyen (Binh Duong); Tan Bien (Tay Ninh); Phuoc Long (Binh Phuoc); Duyen Hai (Ho Chi Minh city); Ca Mau. The research analyzed soil, sediment, blood, breast milk, fat tissue, and bio-samples.

Dioxin in soil and sediment in sprayed areas

The analytical results of dioxin contamination in soil and sediment in the mentioned intensively sprayed areas are given in Figure 1 and Table 3.

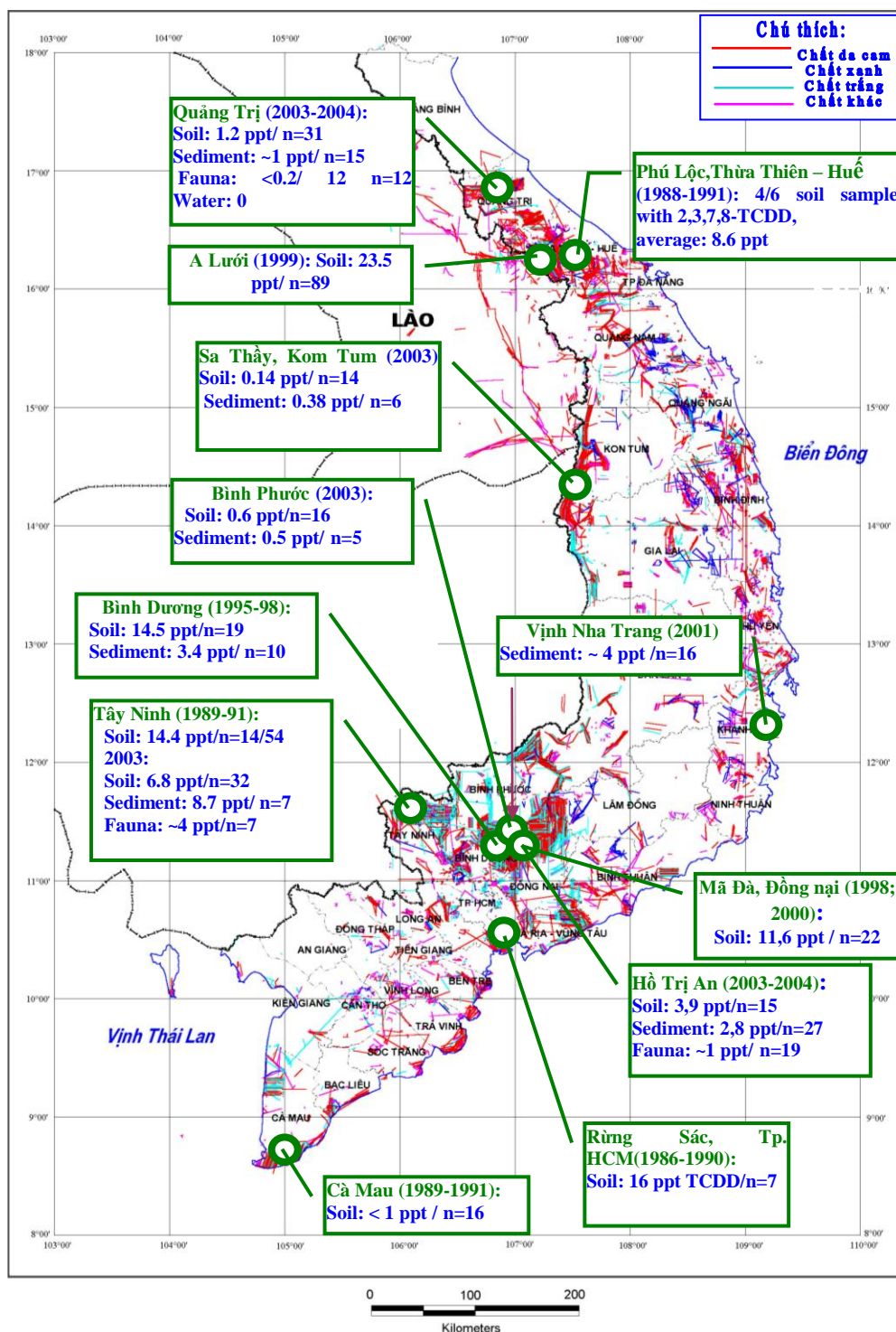


Figure 1: Map showing areas sprayed with herbicide and study sites.

Table 3: Dioxin contamination in soil and sediment in herbicides-sprayed areas

No	Study areas (period)	Matrix	Conc. of dioxin (ppt TEQ)	Reference
1	Gio Linh, Cam Lo, Quang Tri (2003-2004)	Soil water sediment	~1.2 (n=31) 0 (n=2) ~1 (n=15)	Tropical institute Vietnam- Russia (1995-2005)
	Cam Lo, Quang Tri (2004)	Soil	20 (n=10)	Tuan <i>et al.</i> , 2004
	A So Airport (1999) Ta Bat Airport (1999) A Luoi Airport (1999) A Luoi (until 1999)	Soil Soil Soil Soil	123 (n=10) 15 (n=7) 13 (n=9) 23.5 (n=89)	UB10-80+Hatfield (2000)
3	Kon Tum (2003)	Soil sediment	0.2 (n=14) 0.4 (n=6)	Tropical institute Vietnam- Russia (2003d)
4	Phu Loc, Hue city (1993)	Soil	8,6 (n=4)	Matsuda <i>et al.</i> , 1993
5	Tay Ninh (1993)	Soil	14 (n=14)	Matsuda <i>et al.</i> , 1993
	Tan Binh, Tan Bien, Tay Ninh (1995-98)	Soil	14.3 (n=24)	Tropical institute Vietnam- Russia (1995-2005)
6	Rung Sac, HCM city (1986-1990)	Soil phù sa	16 (n=7)	VH1/ HUS
	Tan Son Nhat HCM city (1995-1996)	Soil sediment	4 (n=7)	UB10-80(2000), Tropical institute Vietnam-Russia (1995-2005)
	Tan Son Nhat HCM city (2006)		2.06-341 (n=5)	UB 10-80, 33 Office, 2006
7	Ca Mau (1993)	Soil	<1 (n=16)	Matsuda <i>et al.</i> , 1993
8	Tri An Lake (2002-2003)	Soil sediment	2.2 (n=15) 2.9 (n=27)	Tropical institute Vietnam- Russia (2002b; 2004)
	Ma Đa area (2000)	Soil	10.2 (n=9)	Tropical institute Vietnam- Russia (1995-2005)
9	SB Rang Rang (2004)	Soil	122 (n=1)	Tuan <i>et al.</i> , 2004
			24 (n=5)	
			265 (n=1)	
10	Binh My, Tan Uyen, Binh Duong (1995-1998)	Soil	15 (n=19)	Tropical institute Vietnam- Russia (1995-2005)

Data in table 3 show that in the herbicide-sprayed areas, the concentration of dioxin in soil and sediment is generally below the acceptable level. The concentrations of dioxin in water samples were undetectable.

Dioxin in human blood

The concentration of dioxin in human blood of residents living in herbicides-sprayed areas of South Vietnam is presented in Table 4. The results show that the lowest concentration is in An Giang (the low level of TCDD is 2.9 ppt (13.6 ppt TEQ). In Da Nang, TEQ had the highest value (96.1 ppt) and TCDD concentration was 17 ppt.

Taking data from Hatfield (2000) and Bui Dai (1993), we have developed summary in Table 5 to compare the data on the concentration of dioxin.

Table 4 Concentration of dioxin in human blood (1991–92) (Committee 10-80, 2000)

Area	n	TCDD (ppt)	TEQ (ppt)	T (%)
An Giang	95	2.9	13.6	21.3
Vinh Long	51	4.3	16.9	25.4
Kien Giang	85	7.9	22.4	35.3
A Luoi	35	15	23.0	65.2
Phu Yen	43	6.2	26.4	23.5
Tay Ninh	400	4.9	26.9	18.2
Minh Hai	102	8.8	27.4	32.1
Tra Vinh	48	7.2	27.7	26.0
Ben Tre	34	10.2	29.0	35.2
Nha Trang	50	4.1	29.5	13.9
Cho Ray, HCM	48	10.8	30.0	36.0
Phan Rang	33	2.9	31.7	9.1
Quang tri	50	9.5	34.0	27.9
Pleiku, Gia Lai	50	4.2	34.2	12.3
Song Be	495	11.9	34.3	34.7
Dong Nai	450	15.4	42.1	36.6
Hue	30	11.0	57.0	19.3
Can Tho	154	18.9	78.7	24.0
Da Nang	249	17.0	96.1	17.7
	n =2,492	Ave. = 9 ppt	Ave. = 36 ppt	Ave. = 27%

Table 5 Comparison of dioxin contamination in Human blood

Areas	n	TCDD (ppt)	TEQ (ppt)	T (%)	Time
The Agent Orange/dioxin exposure areas					
Southern Vietnam	2,492	9	36	27	1991-1992
Key areas in Việt Nam	233	18.8	32	57.7	1993
Unexposed					
Northern Vietnam	82	2.7	20	13.5	1993
The World	1,234	3.5	24.7	15.3	before 2000

Dioxin in bio-samples

The concentration of dioxin in bio-samples collected at herbicides-sprayed areas is summarized in Table 6

Table 6: The concentration of dioxin in bio-samples at the herbicide-sprayed areas

1970-1973 (Committee10-80, 2000)		1990 (Committee10-80, 2000)		2001-2003 (Vietnam-Russia Tropical Centre., 2001-03)	
Objects	TCDD (ppt)	Objects	TCD (ppt)	Objects	TCD (ppt)
Carp in Dong Nai river	540	Pig fat, Be river	0.47	Fish in Quang Tri	<0.05-0.26
Catfish in Dong Nai river	665	Chicken fat, Be river	3.13	Meat Quang Tri	<0.05
Catfish in Sai Gon river	70	Fish in Tan Uyen	0.33	Fat, Kon Tum	0.27
Frog in Can Gio, Sai Gon	79	Fish in Tan Thanh	0.46	Fish in Binh Phuoc	0.03
Shrimp Can Gio, Sai Gon	30	Chicken eggs, Tan uyen	0.16	Pig fat Binh Phuoc	0.13
				Fish in Tay Ninh	4.24

The Russian acceptable maximum allowable concentrations are 11 ppt for fish and fish products, 88 ppt lipid for edible parts of fish (average content of lipid in fish is around 3%), 0.9 ppt for fish meat

(3.3 ppt lipid) (Maistrenko, 2004, p.84). Thus the dioxin level in foodstuffs from the herbicides-sprayed areas were lower than Russian acceptable maximum limits, in 1990 and still so in 2001-2003.

Dioxin contaminated areas at Bien Hoa, Da Nang, and Phu Cat airbases and vicinity

During the war 10 airbases in South Vietnam were used for the operation Ranch Hand, i.e. to use herbicides. Large quantities of herbicides were stored, mixed, and loaded on aircraft for aerial spraying at especially Bien Hoa, Phu Cat, and Da Nang airbases. Other Airbases such as Tan Son Nhat (in Saigon/HCM City) and Nha Trang were intermediate stations.

Investigation into the contamination of Agent Orange/dioxin at and around former airbases was conducted since 1992, focusing on Bien Hoa, Da Nang, and Phu Cat airbases but including others. The Department of Defence has conducted various measures to contain and treat the contamination in the three main hotspots. Notably, in Bien Hoa there were some major spills which released 25,000 litres of Agent Orange and 2,500 litres Agent White to the immediate surroundings of storage tanks.

The aims of research of residual dioxin levels at these Airbases are

- a. Determining residual dioxin concentration in soil in contaminated areas in depth and width to define quantity of soil which should be treated.
- b. Identifying scope of dioxin migration from contaminated areas to their vicinity
- c. Assessing treatment' scope and appropriate measures for preventing dioxin migration.
- d. Evaluating impacts of contaminated areas on inhabitants in the vicinity of the Airbases.

Figure 2 indicates the airbases that took part in Operation Ranch Hand and at which investigation of dioxin contamination was conducted.

Details of contamination in the three main hotspots are summarised in Annex 1.

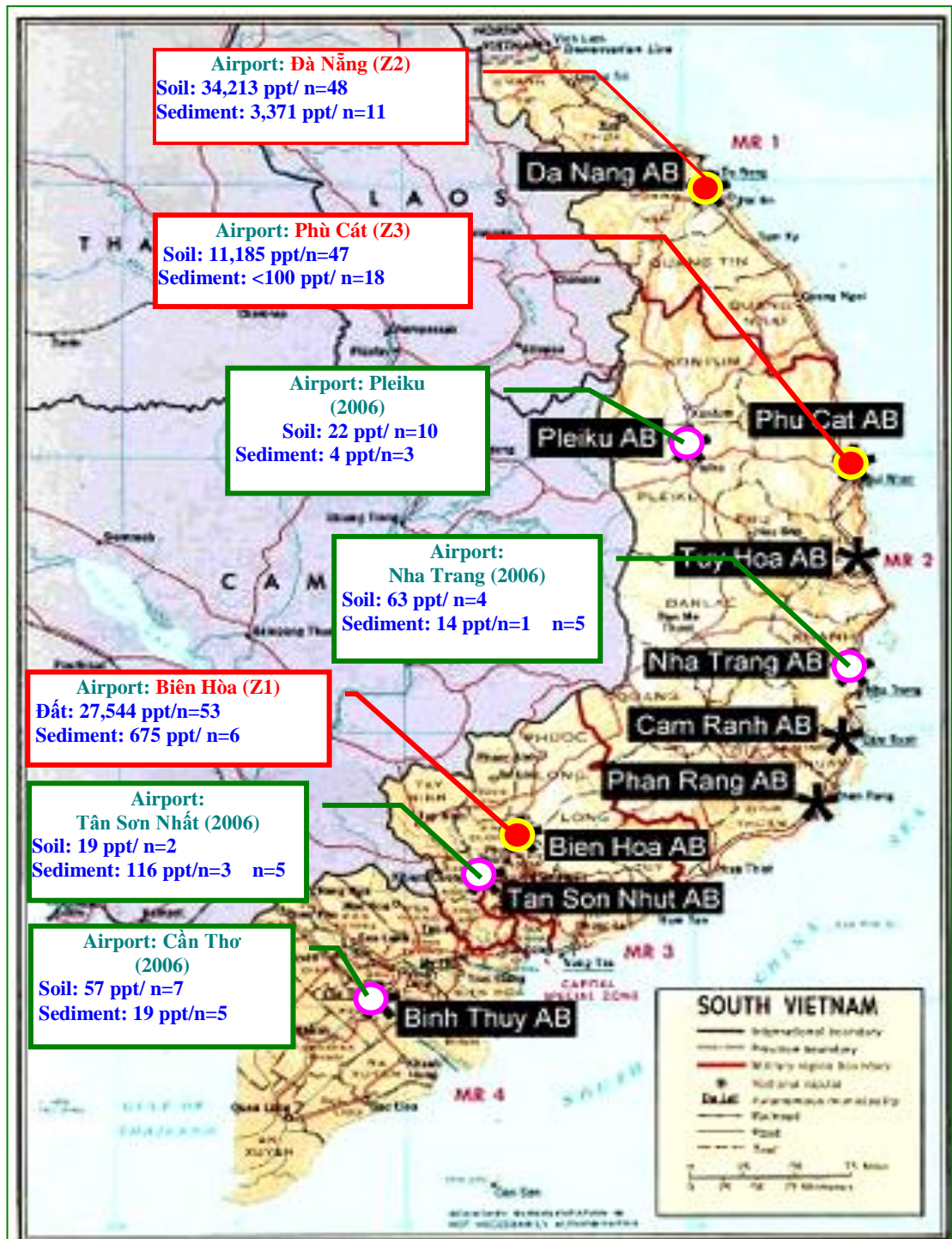
Conclusions and recommendations

In order to evaluate level of dioxin contamination and dioxin migration in Viet Nam, the areas sprayed with herbicides and hotspots where herbicides were handled have been evaluated.

Dioxin is persistent in the environment and in living beings. It breaks down only slowly into less harmful properties because of various processes. It is solid and has a low vapour pressure, has a high melting point, and is hydrophobic (so if dissolved in water it is often below detectable limits). It migrates only slowly (e.g. when absorbed by soil particles or by migrating wildlife).

The soil in herbicide-sprayed areas (2.63 million ha) still have measurably elevated levels of TCDD, including especially the heavily sprayed areas; and heightened levels of dioxin in human blood (and breast milk, fat tissue) and in wildlife have also been observed across South and Central Viet Nam. However, dioxin levels in soil, sediment, blood and human breast milk, fat tissue and food (aquatic organisms, fowls) in sprayed areas are at acceptable levels, i.e. below internationally allowed concentrations.

Southern Vietnam has a tropical wet climate, with strong solar radiation which helps break down toxic agents, including dioxin. Heavy rain and strong wind are common and migration of soil particles, which is how dioxin adsorbed to soil particles may end up in e.g. the sea, and so the concentration of dioxin decreased annually.



Source: http://en.wikipedia.org/wiki/United_States_Air_Force_In_South_Vietnam

Figure 4 Airbases where the investigation of dioxin contamination was conducted

Contaminated sites at hotspots, areas used for herbicide storage, loading, and washing of spraying aeroplanes and other equipment are still heavily contaminated. These sites on mainly military airbases are several hectares per airbase (Da Nang and Bien Hoa), or less than one hectare (Phu Cat).

1. Additional research is needed in order to determine the exact scale and quantity of soil and sediment in contaminated sites in Da Nang, Bien Hoa, and Phu Cat (especially along the drainage routes) and has the main points. This is critical for selecting the most suitable treatment method and estimating the tentative cost for treating these three hotspots.
2. Select the most suitable treatment technology to treat both sediment and soil.
3. Before final treatment, implement measures for prevention of migration of the contamination.
4. Continue research on impacts of hotspots on human health in hotspots areas, and suggest corresponding policy to deal with this issue.
5. Formulate an overall program on treatment of dioxin consequences for the environment and people in areas with hotspots. This should include targets and cost, and form the basis for Government decisions and international cooperation.

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Annex 4 Situation And Orientation for Land-Use Plans for Agent Orange/Dioxin Contaminated Hotspots (Da Nang, Bien Hoa and Phu Cat)

This annex is a summary of parts of

- Tran Ngoc Canh (2008). *Agent Orange/Dioxin contaminated areas at three hotspots: Da Nang, Bien Hoa and Phu Cat - situation and orientation for land-use plans*, report for Office 33, MONRE & UNDP-Viet Nam. The Ministry of Defence: Hanoi

Contaminated areas at Da Nang International Airport

Socio-economic conditions

The Airport in Da Nang is located in a densely populated zone. Until recently local people living adjacent to the north of the Airport could use some of the land but this has recently been disallowed. There are some Airport/Airbase staff living on the Southern side of the base, where contamination is suspected and is currently being investigated.

Da Nang is a key socio-economic and political centre of central Viet Nam. Da Nang has fairly good infrastructure (accessible by air, sea, road and rail), and is aiming to develop a modern industrial economy. Da Nang has made steady progress in upgrading infrastructure, with domestic and foreign investment in hundreds of factories and tourism, and is attracting a large number of tourists. It has a population of approximately 1 million people.

Planning the development of international airport of Da Nang in the coming years

The Air force / Airport Group of Central Viet Nam plans to upgrade infrastructure and expand the international airport of Da Nang, including the construction of a new terminal and upgrading the runway in order to increase the number of passengers from currently about 800,000 to 1.5 million passengers/year in 2015 and 6 million passengers/year in 2025. According to the draft design, the runway and taxiways will be lengthened by 350m to the north; and the technical service area will be expanded to the area adjacent to Sen Lake.

Current state of contaminated area in the north of Da Nang airport

The contamination at the Da Nang site is described in annex 1

Current state of biological resources in contaminated areas

The area surrounding the hotspots, including the less contaminated areas have plantations of eucalyptus and keo trees, aged about 5-10 years planted by residents in accordance with current policies of land and forest allotment. In addition to the planted trees, there are still natural brushwood and weed brushes.

There is no vegetation on severely contaminated areas (about 1 hectare). The ground there is hardened and dark brown. Types of tomentose rose myrtle, savan, and bulbul with a height of less than 1m are found adjacent to the runway.

Sen Lake (approximately 7.3 hectares) and other lakes have long been used by local residents for aquaculture and fishing. Management and collection of flowers, seeds, and roots of lotus, aromatic herbs, and fish were the main activities. Breeding and catching fish in the lakes was recently halted.

Proposed post-treatment land use.

Due to the proposed airport expansion, the following land use options are proposed after treatment.

- The severely contaminated area adjacent to the current runway shall be used for the construction of taxiways after the contaminated soil is excavated and disposed of in an active landfill.

- Sen Lake will also be used for the runway extension and associated infrastructure.
- For other areas two options are proposed:
Option 1: They will be used for car-parks and storehouses; or
Option 2: They will be used for outdoor sport complexes such as tennis and badminton-courts, volleyball courts, etc.

The above proposed option 1 is suitable for short and long term development needs of both the region and city on improvement and modernization of Da Nang airport.

Contaminated areas at Bien Hoa Airport

Regional socio-economic conditions

The Airbase in Bien Hoa is located in a densely populated and industrialised zone. Some air force staff live on the Airbase but have recently been moved away from contaminated zones and separated from the Airbase-proper by a wall.

Dong Nai is one of the most industrialised provinces of Viet Nam, and is industrialising further. There are 24 industrial zones on an area of 6,496 ha; the occupying rate is around 70%. Prime Minister of the Government has agreed the establishment of 6 additional industrial zones in the industrial development plan to the year 2015 (Loc An industrial zone, Binh Son (500 ha); Long Duc industrial zone (280 ha); Ong Keo industrial zone (800 ha); Long Khanh industrial zone (300 ha); Giang Dien industrial zone (500 ha); Dau Giay industrial zone (300 ha)).

Current status of the dioxin contamination areas at Bien Hoa airport

The contamination at the Bien Hoa site is described in annex 1.

Current status of biological resources of the contamination areas

Most of the area surrounding the most contaminated sites on the Airbase was planted with eucalyptus about 5-10 years ago. There are also areas of natural scrub. In heavily contaminated areas no trees can survive and the soil is hardened and brown to dark brown in colour. According to the current plans, hundreds of hectares surrounding the core parts of the airbase will be planted with rubber trees – which have high economic and environmental protection value.

Recommendations for land use after treatment

Considering the technical features and structure of the contained landfill at the Z1 area (see annex 1), the following post-treatment land use is proposed:

- For heavily contaminated zone Z1, after the treatment of 4.3 ha, fertile soil will cover the contained contaminated soil, for planting of rubber, eucalyptus, or industrial crops such as chicken grass for essential oil extraction.
- For ponds and lakes, after all contaminated sediments are moved to the landfill, the ponds and lakes should be restored, for continued use, but closely monitored.
- For the “soccer pitch” area, options for post-treatment ground use are as follows:
Recommendation 1: the post-treatment ground can be used as a car park, or roofed storage / warehouse (a light structure).
Recommendation 2: the area can be used as sport complex (tennis, badminton, volley ball).

Contaminated areas at Phu Cat airport

Socio-economic conditions of the area

The contaminated sites on the Airbase/Airport of Phu Cat are relatively far from residential areas. Some staff of the civil airport and military force staff live on the Airbase.

Binh Dinh is a socio-economic and political centre in the Central Coastal Region of Viet Nam. It has potential for industrial and agricultural development, tourism, and services. In recent years, Binh Dinh has developed infrastructure (airway, seaway, roadway and railway) to meet the requirements of a modern industrial economy.

Current status of the dioxin contamination areas at Phu Cat airport

The contamination at the Phu Cat site is described in annex 1.

Current status of biological resources in the contamination area

The area surrounding the most contaminated sites is covered in natural scrub, and is used by local people for grazing livestock. Trees have recently been planted on parts. The lakes are used for aquaculture by local people as well as harvesting of natural shrimps, fish and mollusc species such as oysters and mussels.

Recommendations for land use in post –treatment contamination areas

For Phu Cat airport, the area contaminated by dangerous levels of dioxin is around 2,000 m²; this is small compared to the total area of over 1,000 ha of the airport. The proposed landfill will not affect much the planning of the entire airport. Nevertheless, due to the location of the contamination area in the route of natural water drainage into the lake and pond system, attention should be paid to the following:

- No construction on the landfill
- No installation of water drainage / sewage pipes or oil pipes through the area
- Ponds and lakes in the contaminated area should be carefully monitored in terms of pollution, especially as they are used for cultivation / aquaculture purposes.

Annex 5 Awareness raising and capacity building on dioxin

Following is a summary of

- Trinh Thi Thanh et al. (2008). *Field report on the need for popular awareness raising and capacity building of officials on dioxin*, report for Office 33 / MONRE & UNDP-Viet Nam
- Trinh Thi Thanh et al. (2008). *The need for popular awareness raising and capacity building of officials on dioxin*, report for Office 33 / MONRE & UNDP-Viet Nam
- Trinh Thi Thanh et al. (2008). *Plan for popular awareness raising and capacity building of officials on dioxin*, report for Office 33 / MONRE & UNDP-Viet Nam

A study team interviewed 154 staff of ministries, departments, agencies and various non-state organizations (65% men, 35 % women); and 270 persons living in or near areas affected by dioxin in Da Nang, Binh Dinh and Dong Nai provinces (divided into 4 age groups, of under 36, 36-47, 48-58, and over 58 years of age). The survey focused on areas near the main dioxin contaminated hotspots, i.e. airfields at Da Nang, Bien Hoa and Phu Cat) and assessed knowledge about dioxin and its effects and capacities of local officials in charge of management and treatment of dioxin.

Interviews with 270 local people demonstrated the following:

- 94% of interviewees have heard of dioxin, and of those 97% know that it is toxic or very toxic whilst 1% thinks that dioxin is not toxic (rest: no answer).
- 81% of interviewees said that there are nearby areas that are affected by dioxin and 4% said that they do not know. 31% of interviewees said that they are using these land areas for different purposes, including housing (13%), cultivation (4%) and for cattle grazing (1%)
- Knowledge about dioxin impacts on human health, wildlife and the environment is widespread, but the depth of knowledge is limited and people are more concerned of impacts on human health than those on domestic animals, wildlife and the wider environment. 69% of interviewees understand mechanisms for environmental accumulation dioxin and 53% understand correctly the different human exposure routes.
- Two-thirds of interviewees feel they can access information on dioxin. However, access to legal documents on dioxin of people is limited: 44% of interviewees stated they have ever read such documents. 54% of interviewees said that the media are main source of information on dioxin, with the younger two groups particularly relying on that, should be taken into account in any awareness raising programme. Provision of information by local authorities and organizations is just 3%. Training and seminars on dioxin were almost not reported by interviewees.
- Popular awareness about dioxin is highest in Dong Nai and is worst in Binh Dinh province.
- Knowledge of treatment and management responsibility re areas affected by dioxin is limited - 44% of interviewees said that they do not know any agencies undertaking treatment activity

Interviews with 154 staff of state and non-state organizations showed the following:

- 97% of interviewees know the origin of dioxin in Viet Nam
- Approximately 80% of interviewees understand correctly the possible negative effects of dioxin on human health and the biological and physical environment, and therefore land use.
- Access to information on dioxin is limited and much also comes from the media. 51% of interviewees have participated in some workshop or seminar on dioxin, which have all been perceived as useful. About 40% of interviewees have done some form of work related to dioxin treatment / management (environmental, health, social and/or land use aspects).
- About 60% of interviewees said they can access the necessary information on dioxin, but 59% explained that the conditions/means to access information is insufficient.
- Only 12% of interviewees said that the quality of information satisfies their work requirements related to dioxin (in this latter group “senior specialists” are over represented whilst researchers are least satisfied with availability of information).

- Only 5% of interviewees say they never accessed legal / policy information on overcoming consequences of toxic chemicals. However, only 4% of interviewees think these documents are effective or very effective. The rest thinks they are ineffective or gave no answer.
- The agencies related to dioxin treatment are facing human resource constraints, and lack finance. Only 7% of interviewees said their agency has sufficient human resources, 40% said not sufficient and 27% said their agency does not have professional staff. 45% of interviewees said their agency has no training programs. Of those who do have training programmes, 46% of interviewees said the trainings are not sufficient.

Following are suggestions for meeting the urgent capacity building needs.

1. Prepare training programme for local communities/ people, with information on dioxin (general); effects of dioxin; dioxin pollution risks to the local communities; and proposed measures to prevent dioxin exposure. These training programs should be carried out in various ways in which the media play a vital role. Local people in Binh Dinh province should be especially considered.

2. Staff of state and non-state organisations should be provided with the necessary conditions to improve access to information on dioxin. Training programs and seminars should be organized periodically to enhance their knowledge and concrete skills, for example in popular awareness raising and management of treatment projects. The infrastructure and equipment available to these staff should be improved.

Outline of capacity building proposal

General objective

To raise awareness and build capacities of officers of State management agencies, social-economic organizations, as well as local communities on dioxin, effects of dioxin, the legal system related to dioxin, methods for exposure prevention; and reduction of dioxin pollution.

Targets to 2010

- 100% of State departments, ministries (MONRE, MOD, MOLISA, MOH, ...), sectors and provinces/cities related to dioxin management have management officers trained on dioxin, including central / provincial offices of mass organisations (Veteran's Association; Women's Union; Farmers Union; Youth Association, Red Cross) and airport management organisations
- 100% of communes affected by dioxin have key officers trained on dioxin
- Organize training of trainers workshops in all three provinces
- Organize at least 3 workshops on dioxin for people of all communes affected by dioxin in Dong Nai, Da Nang and Binh Dinh province
- Study tours for key officials to affected hotspots and surroundings
- Develop annual media program on dioxin in Dong Nai, Da Nang and Binh Dinh province
- Training, study tours and media materials should cover at least the following subjects: the origin of dioxin; environmental impacts of dioxin; exposure routes and human health to dioxin; role of organizations/office in prevention, risk reduction and elimination of dioxin pollution risks; the system of dioxin related legal documents; the state of dioxin pollution and areas affected by dioxin per locality; concrete measures on dioxin exposure prevention for people living in areas affected by dioxin; means of monitoring of behaviour change and effectiveness of environmental remediation measures; land use planning

Annex 6 Financing mechanisms for remediation of dioxin contaminated hotspots

The following are extracts from

- Salmi, Jyrki (2008). *Financing Framework and Mechanism Design*, MISSION REPORT for Project ID: 00057781 Capacity Building and Completion of the Overall National Plan for Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam

Recommended financing framework National Plan

- Government of Vietnam financing is proposed to be channelled through regular budget system directly to projects / activities to be implemented, not through a joint Trust Fund. Target volume of the GoV contribution could be in the order of 50% of the total cost of the implementation of the National Plan.
- Donor financing is proposed to be channelled either through projects, or through a Multi-donor Trust Fund.
- De-contamination / environmental remediation is a relatively straightforward and technical operation. It can be carried out in any of the locations in a relatively short time period, and the costs can be estimated relatively accurately in advance, after the technology / technologies to be used has/have been selected.
- Addressing health and social security issues is much more complex matter with much more longer time frame that is hard to define in advance. Victims of AO/dioxin and their children may need support for many decades. Necessary financing needs are also difficult to estimate in advance.
- Health and social welfare issues have political sensitivities, whereas there appear to be a wide consensus that de-contamination / environmental remediation should be done as soon as possible to prevent any additional poisoning of people living or working in the nearby areas.
- Consequently, the present consultant proposes that two different approaches be adopted in arranging support and financing to the Overall Plan: firstly, project approach for de-contamination / environmental remediation enabling fast action (a number of projects that are coordinated by the Office 33 to avoid overlaps), and secondly, establishment of a long-term Trust Fund for addressing the health and social welfare issues of the AO/Dioxin victims. Experience from other similar multi-donor trust funds in Viet Nam suggest that setting up a fund takes up to three years to become fully operational, and that setting up a well operating fund is a very demanding operation.

Recommended financing mechanism National Plan

Fund establishment

- The Fund will be established through a MOU signed between the National Steering Committee on Overcoming the Consequences of Toxic Chemicals by US during the War in Viet Nam (Committee 33) - representing GoV and representatives from donor agencies.
- The Fund will be established under Committee 33. The business name of the Fund will be XXXX.
- The Fund will have legal status, separate stamp, separate bank account at a commercial bank or state treasury under the state regulations.
- Fund office is located in Hanoi.
- Fund Management and Utilization Regulations will be issued by the Chairman of Committee 33.

Function of the Fund

- The Fund aims to harmonize the requirements of donors, reduce ODA transaction costs and align with the Government's planning and administrative systems in order to support the Overall Plan and priorities defined by the Committee 33.
- Consequently, the main functions and tasks of the Fund are to:

1. Mobilize and receive funding support from international organizations and corporations.
2. Support to implement the Overall Plan.

Organization Structure of the Fund

- The organizational structure of the Fund consists of a Board of Directors (BoD) and a Fund Management Unit.
- The BoD is chaired by MONRE's Vice Minister responsible for Office 33; members are representatives of relevant ministries, and a representative from donors supporting the Fund.
- The BoD performs an executive function and is responsible for decisions on operations, orientation and annual income and expenditure of the Fund.
- The Fund Management Unit is responsible for managing and operating the Fund in accordance with the plan approved by the BoD, with the Fund Management and Utilization Regulations approved by MONRE's Minister, and other provisions specified by the Government as well as commitments signed between the GoV and international donors. The Fund Management Unit will be established by MONRE and staffed with highly professional staff. The Fund Management Unit will operate as an independent unit but in close coordination and cooperation with Office 33.

Fund financing

- The Governments of XXX/ Organizations ZZZ contribute non-refundable ODA funds to the Fund. Governments of YYY provide support through provision of technical assistance for development and operation of the Fund.
- Funds provided by the donors are un-earmarked and earmarked allowing them to be used to support programs, projects and non-project activities to implement agreed priorities under the Overall Plan and priorities defined by the Steering Committee.

Support from Fund

- The Fund provides support in the form of grants either as a sole donor or co-financier to programs, projects and non-project activities.
- The Fund is able to support national organizations and bodies that are legally operating in Vietnam. During implementation of programs or projects, international NGOs and international organizations that are legally operating in Vietnam can participate as technical service providers to a national implementing agency.
- The Fund is able to consider requests for funding on the basis of priorities identified in the Overall Plan and by the Steering Committee and agreed by the BoD.
- One or more organizations can be pre-selected by the Fund to prepare proposals to address such priorities.

Grant agreement

- The grant agreement of program/project/non-project activity signed between the Fund Management Unit and the Recipient is the basis for the two parties to strictly follow the provisions specified in the agreement in terms of financing and receiving grants. Any changes of this legal document shall be discussed and agreed by the two parties, and then annexed to the original grant agreement.
- The Fund uses a specific format for all grant agreements (to be defined later).

Conditions for concluding a grant agreement

- Decision on project/program/non-project activity approval issued by MONRE
- Decision on PMU establishment of program/project (herein after referred to as project) issued by the competent authority
- A separate bank account opened for the project
- For co-financed projects, the recipients shall be responsible for securing co-financing commitments from co-donor to implement the project

- For cases in which the recipient does not fulfil the requirements as mentioned above, within 45 days of the date of approval, the recipient must issue an official letter for submission to the Fund Management Unit to inform the issue which then shall be further reported to MONRE for decision making.

Recommendations for GEF/UNDP Project

- Fast preparation and getting operational
- Office 33 should be the National Implementing Partner (NIP)
- Supervision by the National Steering Committee for Overcoming Consequences of Toxic Chemicals Used in the War (Committee 33).
- Ministry of Defence should be a National Responsible Party (not a subcontractor), through a letter of agreement. The NEX Manual says: “Sub-contracting procedures cannot be used for procuring services ... from Government agencies. They are to be applied only to private firms, universities, academic / research institutions, state enterprises and non-government, non-profit organizations. A national institution which falls under the organizational umbrella of a ministry or another Governmental body, can participate in a project as a National Responsible Party rather than as a subcontractor. In such cases, a letter of agreement should be used in place of a subcontract. This should have been described in the project document as part of the management arrangements.”
- Procurement by either using Vietnamese Procurement Legislation or UN procurement rules (UNDP Procurement Manual); must be decided in advance and specified in the project document. In this regard it should be noted that the NEX Manual says: “...[for] construction work, the guidelines on subcontracting do not apply, but procedures applicable to purchase of equipment should be followed.”

SIGNATURE PAGE

Country: Viet Nam

ONE PLAN II Outcome 3: Viet Nam has adequate policies and capacities for environmental protection and the rational management of natural resources and cultural heritage for poverty reduction, economic growth and improving the quality of life.

Expected OP II Outputs:

Output 3.2 Environmental strategies, policies, plans and regulations developed with broad participation of local people and stakeholders and in line with international environmental conventions.

Output 3.2.2: Capacity strengthened to promote cleaner production, and sustainable management of agro and industrial wastes, pesticides and hazardous substances.

Expected country Programme (CP) Outcome 3: Economic growth takes into account environmental protection and rational use of natural resources for poverty reduction.

Expected CP Outputs: Output 3.2: Sustainable development and environmental legal frameworks developed and implemented with broad participation of local people and stakeholders and in line with international environmental conventions



Implementing partner: Ministry of Natural Resources and Environment (MONRE)/ Office 33

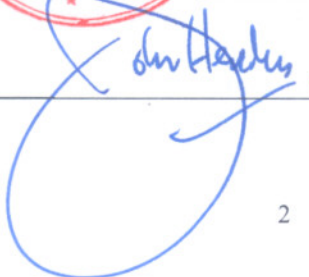
Other Implementing partners: Ministry of Defense, Provincial People's Committees of Da Nang, Dong Nai and Binh Dinh.

Programme Period: UNDP Strategic Plan 2008-2011
Programme Component: Environment and Sustainable Development
Project Title: *Environmental Remediation of Dioxin Contaminated Hotspots in Viet Nam*
Project ID: PIMS 3685 Atlas VNM10 Award 00057593
 Project 00071224
Project Duration: (4 years) 2010-2014

Total budget ^(a) :	\$ 37,312,550
Allocated resources:	
• Government	\$ 5,300,000
• Regular -TRAC	\$ 450,000
• Other:	\$ 20,885,550
○ GEF ^(b)	\$ 4,977,000
• In kind contributions	
○ Government	\$ 5,700,000
○ other	\$ --

^(a): Doesn't include US\$ 39,000,000 unsecured fund (needs to be mobilized in future)
^(b): Doesn't include US\$ 25,000 of PDF-A

Agreed by (Government):   June 28th, 2010
 MINISTER PHẠM KHÔI NGUYÊN

Agreed by UNDP:  JOHN HENDRA, UN RESIDENT REPRESENTATIVE