# 2.0 PRELIMINARY DATA COLLECTION

## 2.1 SAMPLING PLAN CONSIDERATIONS

Supplementary environmental field data were collected at the site to characterize POPs contaminant concentrations in various environmental media relevant to human exposure pathways (diet, dermal contact and inhalation). Much of the investigation occurred on the SPL compound. The Project team also investigated potential off-site media and transport routes, including roads, drainage, ditches and water courses.

The first consideration for sampling design is whether the samples adequately represent the site being investigated. This requires that a sample or group of samples collected from a site accurately reflect the concentration of contaminants at the site. Soil, sediment and biota samples are often collected at selected locations because there is visual evidence of pollution (e.g. discolored soil, oily patches, or the presence of drums or other containers in certain areas of the site). This strategy can lead to biased results suggesting higher contaminant levels than actually present; this bias is often tolerated in an effort to over-estimate risk rather than under-estimate risks.

Background samples were also collected at or near the hazardous waste site in areas not influenced by site contamination. Identifying background locations requires knowing which direction is up-gradient/upwind/ upstream. In general, the direction of water flow tends to be relatively constant, whereas the direction of air flow is constantly changing.

During the field program, sample types included soils, sediments, dust, fish tissue, and human blood. Human exposure questionnaires were administered to workers, staff and some local residents to identify potential human exposure.

All environmental samples were collected in triplicate where possible: "sub-sample A" for export to Canada; "sub-sample B" for Japan; and "sub-sample C" for host country's reference.

## 2.2 ANCILLARY DATA NEEDS FOR EXPOSURE ASSESSMENT

Identification of data needs in the early planning stage helped optimize which data were collected to support the exposure assessment. Examples of ancillary data used in exposure calculations includes:

- Concentration of particles in the air;
- Duration of exposure for individuals;
- Frequency of ingesting fish from the site; and
- Number of days (or weeks) without precipitation per year.

## 2.3 SAMPLING QUALITY ASSURANCE & QUALITY CONTROL

The Project Team used Standard Operation Procedures (SOPs) for collection and analysis of samples for all selected study sites. The use of standardized SOPs facilitated sampling and analysis in a consistent and coordinated manner, and helped foster quality and comparability of the laboratory analytical results.

The POPs Project SOPs for Field Sampling and Sample Analysis were developed based on experience from past projects, and built upon international best-practices using relevant material from the 2007 UNEP Guide Guidance for Analysis of Persistent Organic Pollutants (POPs) and Hatfield's Standard Operation Procedures Manual (2008). They are also built upon Hatfield's first-hand knowledge and experience with similar field assignments in the South East Asia.

The SOPs provided a consistent organizational framework for the collection of site data in selected "hot spots" or study sites in each participating country in order to identify trends, as well as to provide information for integrated risk assessment and capacity building purposes. In addition to striving for simplicity and clarity of the sampling program design, and establishing clear expectations for analytical performance and QA/QC, the SOPs provide a consistent framework for future sample collections. SOPs also help foster inclusiveness and transparency during supplementary data collection through active participation and involvement of the key national stakeholders in the design, implementation, and reporting of field data collection and analysis. These aspects are crucial for developing and maintaining confidence and interest in the final outputs of the POPs Project.

Customized datasheets were created to increase efficiency in the field and reduce the likelihood of potential errors or omissions. Triplicate sample ID labels were applied to datasheets and sample containers to ensure each sample had a unique ID and was not mislabeled. The team leader ensured that samples were collected and stored/shipped as per conditions specified by the analytical laboratory.

Field maps and Quickbird imagery (January 19, 2008) were used for site reconnaissance and sample collection planning with the key stakeholders. Only minor land cover change occurred between the time of image acquisition and the field sampling. The change was documented in photos and field notes. GPS waypoints were collected to record the sampling locations.

## 2.4 TYPES OF SAMPLES COLLECTED

Two field programs were conducted at the selected Case Study Site in Vientiane:

- 12 – 17 May 2008 field program: for collecting environment samples (soil, sediment, and fish/snail), and conducting social and human exposure survey; and
- 5 August 2008 field program: for collecting blood samples from 11 blood donors at the Vientiane 103 Hospital near the Case Study Site.

In total, 33 environmental samples were collected in triplicates (x 3) following homogenization in the field. All samples were collected and handled strictly according to the SOPs.

**Table 2.1 List of Samples Collected, SPL Site, Lao PDR.**

| Location | Site Name | May 20 - 24, 2008 | | | | August 5, 2008 |
|---|---|---|---|---|---|---|
| | | Soil/dust | Sediment | Biota | QA/QC | Blood |
| Vientiane, Lao PDR | Sok Pa Loung SPL Compound | 19 | 9 | 3 | 2 | 11 |

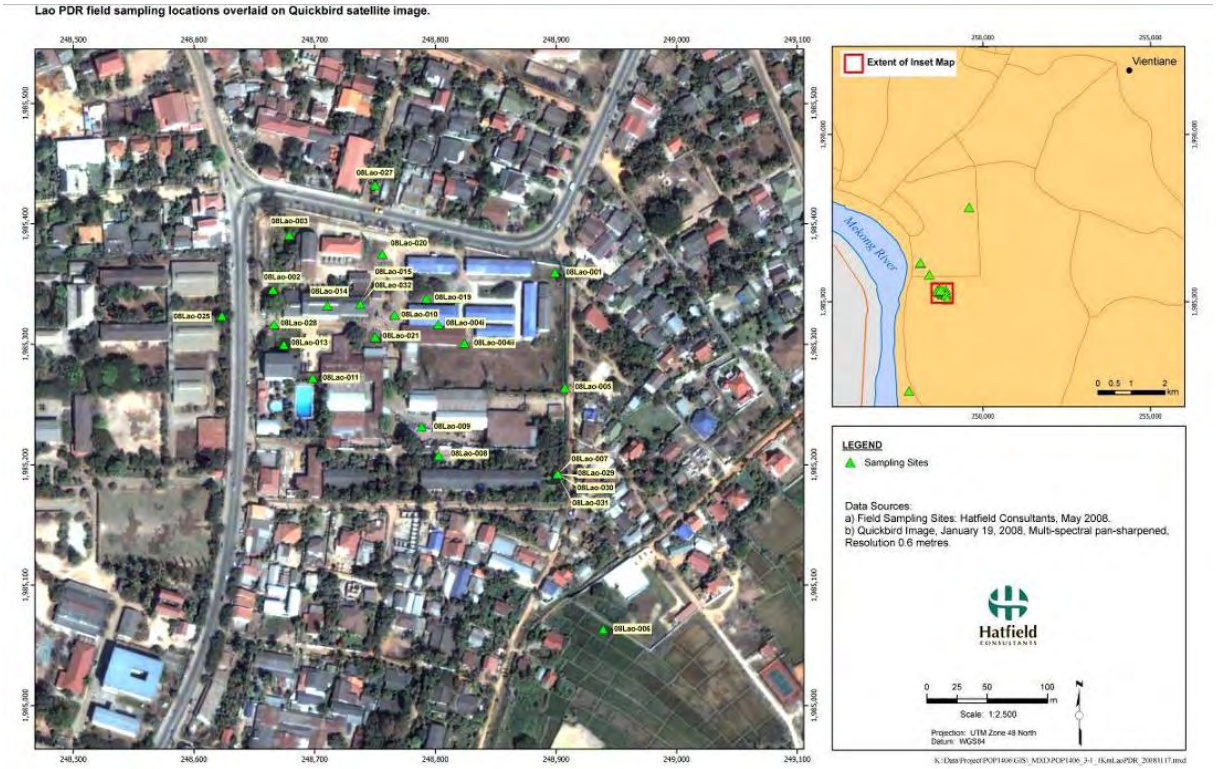
A detailed list of samples collected and analyzed is provided as **Appendix A1**.

## 2.5 SAMPLING SITES

The field data collection and technical training seminar on sampling took place between May 12th and 17th, 2008. National participants from WREA/WREI, EDL and Chemical Department, Ministry of Defense participated in the field sampling and training. Sampling locations were initially selected based on a review of existing topographic maps and satellite data; final sampling locations were determined during the site reconnaissance and consultation with key stakeholders. Ideally greater sample intensity both on site and off site was desired. However, sample intensity for the site was completed to the optimal extent allowed by analytical budget, balancing the need to characterize site contamination for risk assessment and the goal of illustrating the risk assessment process for capacity building.

Sample sites were distributed throughout the SPL site in an attempt to delineate the zone of potential POPs pesticides and PCBs as well as to characterize potential routes of off-site contaminant migration. Sampling intensity was highest in the near-field area (i.e. within the SPL site perimeter). Sample locations included the site itself, roads/ditches/soils off site (in the immediate vicinity), and homes of nearby residents (Figure 2.1).

**Figure 2.1 Map of sampling location at SPL site, Vientiane, Lao PDR.**




## 2.6 LABORATORY ANALYSIS OF ENVIRONMENTAL SAMPLES

All environmental samples were screened for dioxin-like PCBs (DL-PCBs) and dioxins and furans using the CALUX bioassay method by Hiyoshi Corporation (Japan) under separate contract with the World Bank. The CALUX analytical results were then used to guide selection of environmental samples for high resolution gas chromatography/mass spectroscopy (HR-GCMS) analysis at AXYS Laboratories, Sidney, BC, Canada (AXYS). The list of samples and lab analytical parameters are presented in **Appendix A1**, and a summary of analytical methods, laboratory QA/QC and certified laboratory results are provided in **Appendix A2**.

### 2.6.1 CALUX Analysis

Hiyoshi was instructed by the Project Team to analyze the following two contaminant groups: i) Total PCDDs/Fs; and ii) Dioxin-like (DL-) PCBs in all samples collected. CALUX is a USEPA-approved method that directly quantifies dioxin-like chemical concentrations on the basis of 2,3,7,8-TCDD toxicity equivalence (TEQ) without the use of toxicity equivalence factors (TEFs) (USEPA 2008b) required by conventional analytical means.

### 2.6.2 High Resolution Analysis

Following receipt of preliminary CALUX results from Hiyoshi in October 2008, the Hatfield Project Team selected samples for analysis by AXYS using high resolution gas chromatography coupled with mass spectrometry (HR-GCMS.) The selection of samples submitted for high resolution analysis was guided by the following selection criteria/factors:

- Samples selected should cover the spectrum of possible sample types and be representative of different exposure pathways. In addition to soil samples, tissue samples (i.e. dietary pathway), and dust or ash (i.e., inhalation and dermal pathways) were also analyzed;

- Meet required minimum data requirements for evaluation of human health risk risks from POPs of concern based on time and budget constraints;

- Provide enough information to flag other POPs contaminants of concern if they pose significant risks to humans or the environment; and

- Where there was more than one sample media collected (e.g., soil, sediment, tissue), the highest concentration was selected to represent site conditions. Samples with the highest concentrations are more important during risk assessments, because they have a greater influence on the estimated average daily exposure and also provide an indication of the anticipated maximum estimated daily exposure to people.

A total of four environmental samples were selected and sent to AXYS for HR-GCMS in October, 2008. The analyses covered some or all of the following parameters: i) lipid analysis; ii) PCBs 1668A; v) WHO PCBs; iv) dioxin and Furan (PCDD/PCDF); v) organochlorine pesticides (OC pesticides); vi) toxaphene; vii) polybrominated diphenyl ethers (PBDEs); and viii) polyfluorinated chemicals (PFCs).

The list of samples and lab analytical parameters is presented in **Appendix A2**.

### 2.6.3 Blood Sample Analysis by AXYS

All 11 blood samples were analyzed by AXYS using US EPA Method 1668A. Results were reported for all 209 congeners, including total PCBs, PCB homologues, and PCB TEQ (based on the TEFs from WHO, Van den Berg 2006). Lipids were analyzed and reported for all blood samples.

### 2.6.4 Field QA/QC

During field sampling two types of field QA/QC samples were collected, an equipment rinsate, and a split sample.

The equipment rinsate is usually collected immediately after a sample suspected to contain high concentrations of a contaminant. All sampling equipment was washed in a normal manner using soap water, clean water,

acetone and hexane. After the sampling equipment was washed, clean water was used to rinse all sampling surfaces. This rinse water was collected in a four litre brown glass bottle and analyzed. Analytes of concern should be at non-detectable concentrations. If analytes of concern are measurable, it may indicate that equipment cleaning was not sufficient, and residual contamination from one sample may be carried over to the following sample (i.e., cross contamination). Analysis of the water rinsate sample, sample 08LAO018B, was performed at Hiyoshi using CALUX. There were no detectable concentrations of either PCDD/Fs nor dioxin-like PCBs.

The field split sample, sometimes called a field duplicate, is an additional jar collected from one homogenized soil/sediment sample while still in the stainless steel collection tray. One field split was collected at the SPL site and was identified with a unique sample name. The purpose of the field split sample was to assess homogeneity of the sample and the ability of the sampling staff to collect soil/sediment samples in a consistent manner (EC 2005). The sample also assesses the ability of the analytical laboratory to analyze samples in a consistent manner. Analysis of the field split sample, sample 08LAO012B (split from 08LAO011B) indicated a relative percent difference (RPD) of 8.7% for PCDD/Fs. Generally an RPD of 50% or less is preferable, therefore the calculated RPD is acceptable.