

APPENDIX B – Reference to Relevant Site Wide Health and Safety Plan (SW HASP)

Project personnel assigned to fieldwork are required to complete the following training (as applicable) (**Table 6-1**). Additional training may be required based on work activities to be conducted. This reference to the Site Wide HASP should be read together with the SW HASP.

TABLE 6-1. TRAINING REQUIREMENTS		
Name of Course	Applies To	Notes
40-Hour Hazardous Waste Operations and Emergency Response (Hazwoper) Training or equivalent	All Project personnel who will work in contaminated areas where exposure is possible Anyone using PPE or respiratory protection on the site	Pre-Work completion is required. Hands-on training with PPE, respiratory protection, decontamination, and general site procedures is required. Tetra Tech will provide the training.
3-Day On-Site Training	All Project personnel who will work in contaminated areas where exposure is possible	Work will be conducted using appropriate PPE and supervised by the CSO unless the training was completed prior to site work. Tetra Tech will provide the training.
Site Orientation Briefing	All site personnel	Conducted by CSO and/or A&E Bien Hoa Contractor LSECS and COP Tetra Tech will provide
Medical Surveillance Program Orientation	Participants of the medical surveillance program (Level 1 and 2); and workers that will be onsite during intrusive or remedial treatment operation activities for less than 30 days (8 hours per day) per year	Conducted by CSO and/or A&E Bien Hoa Contractor LSECS and COP prior to commencement of work activities, and/or before participation in the medical surveillance program Tetra Tech will coordinate and cover the blood monitoring costs.
Emergency Response Plan Training	All site personnel	Conducted by CSO prior to commencement of work activities
Daily “Tailgate” Safety Meetings	All site personnel	Conducted by CSO. Discusses lessons learned from previous day, planned work activities for present day, and special safety considerations
UXO Avoidance Training	All site personnel	Conducted prior to commencement of work activities

Project personnel training information is tracked in **Appendix F** of this Site-Wide HASP. This list will be maintained and supplemented as required by work activities. Additional safety training will be conducted including site orientation training, periodic safety meetings, and emergency response training as discussed in the following sub-sections.

I.1 MEDICAL SURVEILLANCE PROGRAM ORIENTATION

Participants of the medical surveillance program must receive a program orientation briefing before participation in the medical surveillance program and the start of their work activities. The required participants of the medical surveillance program are detailed in section 9.18.1. Workers that are not required to participate in the medical surveillance program but will be onsite during intrusive and/or remedial treatment operation activities for less than 30 days (8 hours per day) per year must receive

the program orientation training. Visitors to the site are not required to receive the medical surveillance program orientation training. At a minimum, the program orientation training will include:

- Health risks related to dioxin exposure,
- Major site exposure routes for dioxin,
- Examinations included in the medical surveillance program,
- Frequency of examinations,
- Action limits for serum dioxin levels,
- Assurance of confidentiality, and
- Data management of anonymous dioxin blood serum results.

I.2 PERSONAL PROTECTIVE AND SAFETY EQUIPMENT, HEARING CONSERVATION, RESPIRATORY PROTECTION PLAN

The use of personal protective and safety equipment (PPE) is a control measure that is to be used only after a hazard evaluation identifies hazards associated with a particular job or activity, and it is determined that the hazards cannot be eliminated and/or controlled to an acceptable level through engineering design or administrative actions. Process and engineering controls shall be utilized before PPE to protect employees.

Selection of PPE is based on:

- Site activities to be conducted;
- Areas of the site where activities will be conducted;
- Weather conditions;
- Physical hazards in the work area; and
- Chemical hazards in the work area.

Each contractor on the site will be responsible for providing the appropriate PPE for each of their employees working on the site and for providing the Personal Protection and Safety Equipment Plan as required for their specific activities. Each contractor will also be responsible for ensuring various sizes of PPE are available to fit all personnel regardless of sex, gender, or disability. The A&E Bien Hoa Contractor LSECS will provide the minimum PPE requirements to the Project Contractors, who will provide examples of the specific choice of PPE in their PPE Plan. The CSO and A&E Bien Hoa Contractor LSECS will review the selection of PPE materials and the PPE Plan for compliance with the Site-Wide HASP. USAID will review and approve the PPE plan prior to commencement of any work activities on the site. For the duration of this Project, the minimum basic PPE requirements are as follows:

- Eye protection – goggles or safety glasses with side shields and/or full-face shield where required;
- Hearing protection – in-ear disposable earplugs, changed at least every day or when soiled;
- Head protection – hard hat as needed or USAID-required;
- Protective footwear – hard-toed boots, ankle high, with overboots or boot covers for wet conditions;
- High-visibility vests;
- Respiratory protection – full- or half-face respirators with appropriate cartridges or disposable dust masks worn with full-face shield where required;
- Hand protection – leather work gloves or, where required, chemical protective outer and inner gloves protected by leather work gloves;

- Personal flotation devices to be worn in areas where work is conducted adjacent to waterways; and
- Chemical protective disposable coveralls.

Specific chemical protective boots, gloves, and coveralls may be recommended by the A&E Bien Hoa Contractor LSECS based on the level of contamination in each work area. Recommended procedures for donning and doffing PPE are included in **Appendix K**. The use of PPE has implications for heat stress which is discussed in Section 9.12.

I.2.1 RESPIRATORY PROTECTION

A written respiratory protection program will be required as part of the Site-Wide HASP, designed to suit each work site and work activity. The program will include requirements for:

- Medical evaluations of employees required to use respirators;
- Fit testing procedures;
- Procedures for proper use of respiratory protection;
- Procedures for cleaning, decontaminating, disinfecting, maintenance, repair, storage, and cartridge changeout;
- Employee training;
- Respiratory hazards potentially present;
- Use and care of respiratory protection;
- Donning and doffing;
- Respirator maintenance, cleaning, decontamination, disinfection, and cartridge changeout;
- Emergency procedures should the atmosphere change;
- Voluntary use guidelines; and
- Periodic evaluation of effectiveness of program.

Each contractor will be responsible for writing their respiratory protection program and submitting it to the A&E Bien Hoa Contractor LSECS for review of compliance with the Site-Wide HASP. Project Contractor's USAID CO and COR will provide final approval of the contract-specific respiratory protection programs.

I.3 PPE REQUIREMENT PROGRAM

As stated in Section 9.8 Personal Protective and Safety Equipment, PPE will be required for intrusive field operations based on the following criteria:

- Site activities to be conducted;
- Areas of the site where activities will be conducted;
- Weather conditions;
- Physical hazards in the work area; and
- Chemical hazards in the work area.

The A&E Bien Hoa Contractor LSECS and HSO will establish minimum required appropriate PPE for work activities and assign the level of protection. PPE levels of protection are discussed below in Section 9-10.1. CSOs are required to review the minimum PPE requirements and determine if additional requirements are needed for their Project Contractor work activities. Project Contractors must include in their SHASP a donning and doffing procedure to suit the level of protection, type of PPE used, and decontamination procedures to be followed. A suggested sequence for donning and doffing PPE is provided in **Appendix K** (PPE Donning

Procedures and Personnel Decontamination Process). The use of PPE has implications for heat stress which is discussed in Section 9.12.

I.3.1 LEVELS OF PROTECTION

The individual components of clothing and equipment must be assembled into a full protective ensemble that both protects the worker from site-specific hazards and minimizes the hazards and drawbacks of the PPE ensemble itself.

Personal protection equipment is divided into four categories based on the degree of protection afforded. The four levels of protection (A, B, C, and D) are based on the widely used USEPA Levels, which are described in Appendix B of the Hazwoper standard (29 CFR 1910.120 and 8 CCR 5192). Level A provides the highest level of protection. Combinations of PPE other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

The situations requiring the four levels of protections and the PPE for each level of protection are listed below. An asterisk (*) behind a listed item indicates that its use is optional for that level of protection.

1. LEVEL C PROTECTION

Level C should be used when the concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators (APRs) are met. Level C protection should be used when:

- A. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;
- B. The types of air contaminants have been identified, concentrations measured, and an APR is available that can remove the contaminants; and
- C. All criteria for the use of APRs are met.

The following constitute Level C equipment; it may be used as appropriate.

- Full-face or half-mask, APRs (NIOSH approved);
- Hooded chemical-resistant clothing (coveralls; two-piece chemical-splash suit; disposable chemical-resistant coveralls);
- Coveralls,*
- Gloves, outer, chemical-resistant;
- Gloves, inner, chemical-resistant;
- Boots (outer), chemical-resistant steel toe and shank;*
- Boot-covers, outer, chemical-resistant (disposable);*
- Hard hat,*
- Escape mask,* and
- Face shield.*

2. LEVEL D PROTECTION

Level D should be used when a work uniform affording minimal protection is needed or for nuisance contamination only. Level D protection should be used when:

- A. The atmosphere contains no known hazard, and

- B. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals

The following constitute Level D equipment; it may be used as appropriate.

- Coveralls,
- Gloves,*
- Boots/shoes, chemical-resistant steel toe and shank;
- Boots, outer, chemical-resistant (disposable);*
- Safety glasses or chemical splash goggles;*
- Hard hat,*
- Escape mask,* and
- Face shield.*

PERSONAL PROTECTIVE EQUIPMENT (PPE) DONNING PROCEDURE

A specific donning or “dress-up” sequence shall be developed as part of each contractor’s SHASP. The sequence will be a progressive, systematic process, developed to maximize the protective qualities of the PPE ensemble.

Prior to using any PPE or respiratory protection, each worker will check the PPE for signs of wear, tears, breaks in seams, functionality of the zippers or other closures, and cleanliness. PPE that is damaged or dirty shall not be used.

In general, if PPE and respiratory protection are being used on the site, the following elements will be required:

- Impermeable disposable coverall
- Outer gloves
- Inner (surgical) gloves
- Disposable boot covers
- Duct tape
- Hard hat
- Respirator with appropriate cartridges
- OPTIONAL: contractor-supplied cotton coveralls to be laundered off site after every use.

NOTE: Respiratory protection will be assigned for the exclusive use of one worker and shall not be shared.

After checking all PPE and respiratory protection for the suggested donning sequence is:

1. Disposable coverall. Check the fit and use duct tape folded in half to make a belt to hold suit in place.
2. Boot covers. Pull suit leg over the top of boot cover and tape in place with duct tape, leaving a folded end for easy removal.

3. Respirator. Ensure that cartridges are properly seated. Perform negative and positive fit checks:
 - a. Cover both cartridges and inhale. Mask should collapse against the face.
 - b. Cover exhalation port and exhale normally. Mask should inflate and no air should escape around the facepiece seal.
4. Inner gloves.
5. Outer gloves. Pull coverall sleeve up to expose wrists. Tape coverall over the top of the glove with duct tape, and fold over the end of the tape to make a tab for easy removal. If working in decon or any area handling liquids where arms will be lifted while wet, an additional outer glove should be placed over the top of the sleeve and duct tape to prevent rinseate from running underneath duct tape.
6. Hard hat. If coverall has a hood, pull it over the hard hat to hold it in place.

PERSONNEL DECONTAMINATION

Personnel leaving the Exclusion Zone (EZ) will be required to perform decontamination (decon) prior to entering the Clean Zone (CZ) for breaks or at the end of the work shift. The sequence of the steps, materials used, and methods for decontamination will vary depending on work tasks performed, materials handled, type of personal protective equipment (PPE) and respiratory protection used, and weather conditions.

The following sequence is a basic guideline to be used by the contractor to develop a specific personnel decon procedure to include in the Supplemental Health and Safety Plan (SHASP) for amendment to this HASP. For a general site layout, refer to Figure 9-2 Site Zones. All personnel decon will be conducted in the Contamination Reduction Zone (CRZ) in an area set up exclusively for personnel decon. Activities shall be conducted under the supervision of the contractor's decon technician, who will assist in the process to ensure completion of the appropriate prescribed steps.

SEQUENCE

1. Place tools, instrumentation, and equipment in the tool drop area inside the CRZ at the hot line.
2. Using absorbent toweling or pads, wipe gross contamination off outer gloves, hard hat, respirator, disposable coverall, and boots or boot covers in that sequence. Place soiled absorbents in waste container.
3. Wash outer gloves and boots in basins or tubs using brushes or other scrubbers provided.
4. Rinse and check outer gloves and boots or boot covers. Re-wash and re-rinse if needed.
5. Remove hard hat. Wash and rinse in basin or tub using brushes or other scrubbers provided. Place hard hat on clean absorbent pads to dry.
6. Remove ankle tape and disposable boot covers, if used.
7. Remove wrist tape and outer gloves, leaving inner gloves in place.
8. Remove disposable coverall, beginning at the neck and shoulders, rolling the suit inside out and turning the sleeves inside out. Continue rolling the suit down the legs, taking care not

to decontaminate clothing or boots. Step out of the suit, which should be inside out at the ankles. Step on the clean inner side of the suit to remove feet from the legs.

9. Roll the suit into a ball, taking care not to touch clothing. Place suit in a container for disposal.
10. Remove respirator. And remove and crush cartridges. Place used cartridges in container for disposal.
11. Wash and sanitize respirator, taking care to thoroughly rinse and re-check all surfaces. Place clean respirator on clean absorbent pads to dry.
12. Remove inner gloves, inside out, one inside the other. Place gloves in a container for disposal.
13. Wash hands and face with clean water and soap.
14. Re-check clothing and boots for signs of contamination. If clothing is soiled, request assistance from decon technician to inspect clothing to determine whether it is “safe” to leave the CRZ.
15. Carry clean respirator and hard hat to showers or to CZ.
16. If showers and dressing rooms with lockers are provided, workers will shower with soap and water before leaving the site. If contractor-provided inner coveralls are used, place the used coverall in the container provided for laundering. Change into regular street clothes after showering and before leaving the CRZ.
17. Store hard hat and respirator in area designated for clean storage.
18. Leave the CRZ as soon as all steps have been completed. Do not re-enter any areas to retrieve dropped equipment or tools. If they are needed, request assistance from the decon technician.

Sampling tools and sample containers will be handled and decontaminated prior to shipment from the site to the laboratory. A decon sequence will be developed to prevent spread of contamination from samples to the CZ. Sample container and tool decon will be conducted in such a way as to prevent cross-contamination of sampled media.

- **HAZARD COMMUNICATION PROGRAM**

A Hazard Communication Program will be required from all contractors working on the Bien Hoa Airbase Area Site. The A&E Bien Hoa Contractor LSECS will request from each CSO a hazardous substance inventory list and copies of SDSs for hazardous substances present, stored, or used by facility personnel and contractors in Project work areas. The Hazard Communication Program must include procedures to establish, clearly designate, and communicate the potential hazards at the Project work areas using signage, fencing, barricades, warning tape, and/or construction cones. At a minimum, signs will be posted at the approved entry points and along the perimeter of each work area. Site personnel will be informed of the hazardous substances they will be working with through Site-Wide HASP review and attendance at daily safety meetings. Project hazard communication procedures shall be referred to for guidance and requirements if hazardous chemical exposure is possible at the work site. Refer to **Appendix H** for details of the Program.

I.3.2 MEDICAL SURVEILLANCE PROGRAM

A medical surveillance program will be required for all personnel working at the site while activities are conducted that could lead to dioxin exposure. Site activities with the potential for dioxin exposure include intrusive activities as well as activities related to remedial treatment operations. The following activities are examples of site activities that could lead to dioxin or other chemical exposure:

- Sampling – soil, sediments, groundwater, and surface water;
- Excavation and on-site transportation – dust generation;
- Brush and tree removal;
- Equipment decontamination;
- Placement of contaminated soil in storage structures;
- Operation and maintenance of remedial treatment system(s); and
- Any other activities that disturb the existing ground surface or increase the risk of exposure to dioxin.

Medical monitoring will include blood serum dioxin monitoring as well as general medical surveillance monitoring for other chemicals. Medical monitoring will be performed at two different levels of effort and intensity:

Level 1 - Workers who will wear PPE while conducting site activities under any of the following conditions:

- a. When exposure is at or above the permissible exposure limit (PEL) for more than 30 days per year;
- b. When a respirator is worn more than 30 days per year;
- c. When a worker performs site activities with a risk of exposure to a chemical without a PEL (e.g., dioxin) for more than 30 days per year;
- d. When employee is injured, ill, or develops symptoms of exposure; or
- e. When employee is a member of a hazardous materials response team.

Level 2 – Workers who will not wear PPE but will work at the site for more than 90 days (8 hours per day) per year while intrusive and/or remedial treatment operation activities are being conducted including:

- a. Office personnel working on site;
- b. Occasional site workers such as subcontractors or vendors who do not enter any disturbed areas; or
- c. Personnel as designated by USAID or GVN.

The medical surveillance program is intended to monitor the employees' health over the course of this Project to ensure that protective measures at the site are appropriate and are being utilized properly by the employees.

Before participation in the medical surveillance program, medical surveillance program orientation training must be provided to all participants including Level 1 and Level 2 workers. Medical surveillance orientation training must also be provided to workers that will be on site during intrusive and/or remedial treatment operation activities for less than 30 days (8 hours per day) per year. Visitors to the site will not be required to receive the medical surveillance program orientation training.

Project Contractors shall include a description of their specific medical surveillance program which meets or exceeds the requirements of this section of the Site-Wide HASP. This will include the requirements of the examinations, frequency of testing, physician's statement of employee fitness to work, medical surveillance program orientation training, and assurance of confidentiality.

I.3.2.1 EXAMINATION REQUIREMENTS

The requirements of the medical examinations shall be determined by the attending physician/nurse practitioner for both levels of surveillance.

For Level 1, the medical examinations must include, at a minimum:

- Medical and work history,
- Hazardous substance handling history,
- Blood testing,
 - Complete Blood Count (CBC)/Sequential Multi-channel Analysis (SMA) blood analysis for organ function and blood quality monitoring,
 - Serum dioxin analysis,
- Other biological systems testing as determined by the attending physician, and
- Cardiopulmonary function testing to determine ability to wear respiratory protection and PPE.

For Level 2, the medical examinations must include, at a minimum:

- Medical and work history
- Blood testing - Serum dioxin analysis

I.3.2.2 FREQUENCY OF EXAMINATIONS

The following schedule of examinations is required:

- Prior to assignment at the site when intrusive activities have begun (baseline physical and testing);
- At least once every 12 months;
- At termination of employment at the site;
- As soon as possible if employee develops signs or symptoms of exposure;
- After any worksite injury;
- After exposure during an emergency; or
- At more frequent times if determined necessary by the examining occupational health physician.

The requirements listed above are the minimum required frequency of examinations. Some site activities may have higher risks for exposure and warrant more frequent examinations. Project Contractors shall determine the appropriate frequency of examinations for their contract activities and include it in their contract-specific medical surveillance program.

I.3.2.3 PHYSICIAN'S STATEMENT OF EMPLOYEE FITNESS

The examining occupational health physician will review the results of the medical examination and laboratory analysis and shall provide the employer, CSO, and the A&E Bien Hoa Contractor LSECS with a written opinion for each employee examined under Level 1. The opinion shall include only the following information:

- Whether the employee has any medical condition that would increase the risk of health impairment due to
 - Hazardous waste handling or exposure,
 - Conditions experienced in an emergency,
 - Use of a respirator for a regular work shift, or

- Use of impermeable PPE for a regular work shift.
- Whether the employee is above the Project dioxin blood serum action limit,
- Any recommended limitations for work assignments, and
- Statement that the employee has been informed of the result of testing and of any conditions which require further investigation.

Specific results of testing or diagnoses shall not be disclosed to anyone but the employee. The dioxin blood serum results will be anonymously compiled and maintained by USAID throughout the duration of the Project. Identifying information related to the dioxin blood serum results will only be shared with the examining occupational health physician and employee.

Since there is no requirement for the use of PPE or respiratory protection, employees examined under Level 2 shall not be required to produce a written opinion from the attending physician/nurse practitioner. However, the examining occupational health physician will review the analysis and provide results as stated above.

I.3.2.4 ASSURANCE OF CONFIDENTIALITY

With the exception of the examining occupational health physician's written statement, no employee medical records will be retained on the site. The physician's written statement shall be maintained on site, in a secured file or in electronic format, with the original stored off site in the employer's offices.

I.3.3 BLOOD SERUM DIOXIN MONITORING

Project personnel involved with site activities that could lead to dioxin exposure or those designated by USAID or GVN shall be part of the medical surveillance program that includes a blood serum dioxin monitoring program as discussed in Section 9.18.1. Participants of the medical surveillance program will receive a program orientation briefing before participation and the start of site activities. The blood serum dioxin monitoring program will begin with baseline monitoring prior to the commencement of intrusive activities at the site, such as sampling, brush clearing, excavation, and haul road construction (or later on, remedial treatment). When baseline blood serum samples are collected, Project personnel will be required to complete the Health and Lifestyle Questionnaire presented in **Appendix L**. This questionnaire will be shared with the attending physician to interpret baseline results and determine the potential for previous dioxin exposure.

I.3.3.1 RESPONSIBILITY

Project Contractors at the work site are responsible for making the testing available to their employees who will be working at the site during intrusive and/or remedial treatment operation activities. Project Contractors shall submit a written plan for compliance with this requirement, to include the following:

- Medical surveillance program orientation training,
- List of employees to be tested,
- Identification of employees work duties and classification as Level 1 or Level 2,
- Date(s) of sample extraction,
- Name of physician/medical facility performing the sample extraction,
- Name of the laboratory performing the serum extraction and preservation,
- Method and date of shipment to the laboratory,
- Name of examining Occupational Health physician who will interpret results and provide employee consultations, and

- Frequency of sampling and analysis.

Employees will be assigned a unique identification number for tracking their results. This number shall be provided to the attending physician, the analytical laboratory, CSO, and the A&E Bien Hoa Contractor LSECS. The associated names will be retained only by the attending physician and the employer. The anonymous dioxin blood serum results must be reported to the CSO and A&E Bien Hoa Contractor LSECS in electronic and tabulated format to be shared with USAID. USAID will compile and maintain the anonymous dioxin blood serum results for the duration of the Project.

I.3.3.2 DIOXIN OR PCDD/F INFORMATION

The term “dioxin” or PCDD/F refers to a group of polychlorodibenzodioxins (PCDDs) and polychlorodibenzofurans (PCDFs). PCDDs are comprised of 75 “congeners,” and PCDFs are comprised of 135 congeners. A “congener” is a variant or configuration of a common chemical structure. Seventeen of the dioxin and furan congeners are considered to be toxic and those are the ones with chlorines in the 2, 3, 7, or 8 positions of their structure with 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD) considered to be the most toxic. Because of this, the concentrations of dioxins/furans are often reported in terms of TCDD toxicity equivalents (TEQ), which are calculated using toxicity equivalence factors (TEFs), and are measures of how toxic each congener is relative to 2,3,7,8-TCDD.

The primary source of dioxin at the Bien Hoa Airbase Area is dioxin-contaminated soils and sediments from past handling, storage, and disposal of Agent Orange and other herbicide compounds. The primary dioxin congener associated with Agent Orange is 2,3,7,8-TCDD. Dioxin causes health effects in humans including chloracne, birth defects, weakened immune systems, kidney defects, increased miscarriage rates, altered hormone levels, reduced sperm production, and cancer.

Dioxin is present at the Bien Hoa Airbase Area in soil, sediment, and surface water. Although not water soluble or volatile, dioxin will attach to soil which becomes airborne as respirable dust, and in surface water as suspended solids. Dioxin, whether from Agent Orange or other sources, is also found in food sources, primarily fish, seafood, meat, and dairy products.

In humans, dioxin is stored in body fat, blood, and breast milk. Because dioxins adhere more readily to fats, serum dioxin testing is performed to assess the level of PCDD/F in blood lipids. On average, serum dioxin levels will decrease by half after seven years with no additional exposure.

I.3.3.3 ACTION LIMITS FOR SERUM DIOXIN LEVELS

Action limits for serum dioxin levels can be based on two types of values, either a reference-based value or a health-based value. A reference-based value is the serum concentration that is expected to be present in the general population who are not exposed to a particular source of dioxins. A health-based value is the serum concentration associated with exposure to a safe dose that is protective of a particular health effect.

I.3.3.3.1 Reference-based Values

For serum dioxin levels, one source of reference-based values is the National Health and Nutrition Examination Survey (NHANES) study (Centers for Disease Control and Prevention [CDC] 2019). For the NHANES study, serum dioxin samples were collected from individuals in the general U.S. population for six (6) different 2-year sampling periods, 1999/2000, 2001/2002, 2003/2004, 2005/2006, 2007/2008, and 2009/2010. For the first three sampling periods, individual samples were analyzed and for the last three, the samples for eight (8) individuals from the same age/gender/ethnicity category

were pooled and analyzed. In general, the 95th percentile calculated using the data from any of these sampling periods represent the upper bound of serum dioxin levels in the general population for the time period that was sampled.

The CDC (2019) report presents 95th percentiles for only the individual congeners for the 1999/2000, 2001/2001, and 2003/2004 sampling periods and not for the TEQ values. Also, for the periods that analyzed pooled samples, 2005/2006, 2007/2008, and 2009/2010, the CDC (2019) only presents the weighted average and unadjusted standard deviations for the individual congeners and not the 95th percentiles. The 95th percentiles are not calculated for the pooled samples due to the complexity of the statistical methods involved. However, other researchers have published the 95th percentile TEQ values for adults older than 20 years of age for the 1999/2000, 2001/2002, and 2003/2004 sampling periods (Lakind et al. 2009) and for the 2005/2006 and 2007/2008 sampling periods (Bichteler et al. 2017) using the same data that are summarized in the CDC (2019) report. The TEQ serum lipid concentrations for the 1999/2000, 2001/2002, and 2003/2004 sampling periods are 27.9, 44.5, and 30.6 picograms per gram (pg/g) lipid, respectively, and for the 2005/2006 and 2007/2008 sampling periods are 40.2 and 39.9, respectively.

I.3.3.3.2 Health-based Values

Health-based values for human serum have been derived by Aylward et al. (2008) based on the Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives (JECFA) tolerable daily intake (TDI) of 2.3 picograms per kilograms per day (pg/kg-day) in TEQ, which is based on adverse effects on the reproductive tracts of prenatally-exposed male rats (Faqi, Dalsenter et al. 1998, Ohsako, Miyabara et al. 2001, JECFA 2002). Aylward et al. (2008) derived human serum values based on this TDI that ranged from 40-70 TEQ pg/g lipid, depending on the assumptions used to extrapolate the maternal concentrations for the rats in the studies to human equivalent concentrations. This internal dose level, maternal rat serum concentration, was used to estimate the human serum concentrations by accounting for species differences without using modeling to convert an external dose to an internal dose.

The previous health-based action limit of 30 TEQ pg/g lipid used for the Danang Sitewide HASP FY 2017 Update (CDM, 2016) is based on a calculation by the American Chemistry Council (ACC) (2003) to be protective of a WHO dioxin tolerable daily intake of four (4) TEQ pg/kg-day. This action limit was derived from the intake of 4 pg/kg-day using a pharmacokinetic model that used conservative assumptions regarding the percent body fat (25%) and the absorption rate of TCDD of 60% and assumed a steady state external intake of 4 TEQ pg/kg-day. The pharmacokinetic model was used to convert an external dose to an internal dose to derive the 30 TEQ pg/g lipid value.

I.3.3.3.3 Project Values

As part of the blood serum dioxin monitoring program, the health-based action limit previously used in Danang of 30 pg/g TEQ lipid from the 2003 ACC report (Table 9-10) will be the Project dioxin blood serum action limit. If this value is exceeded, then the congener-specific concentrations (reported along with the TEQ value) will then be compared to the 2007/2008 NHANES survey 95th percentiles for the individual congeners to identify which congeners are the source of the elevated TEQ (Table 9-11). As stated previously, the primary dioxin congener associated with Agent Orange exposure is 2,3,7,8-TCDD, and, if the serum concentration of this congener is elevated, this may indicate a site-related exposure. The TEQ value of 30 pg/g lipid from the 2003 ACC report was used because it is the most conservative of the available reference-based and health-based dioxin blood serum action limits.

PCDD/F (DIOXIN)	PROJECT ACTION LIMIT
TEQ	30.0 pg/g TEQ lipid

Notes: – TEQ Action Limit value based on 2003 ACC report.

The congener-specific 95th percentile values from the NHANES studies are expected to be representative of the general U.S. population and are consistent with values measured in Vietnamese men over the age of 55 living in Kim Bang near Hanoi (Manh et al. 2014). Manh et al. (2014) evaluated differences in men over the age of 55 years living near the former U.S. airbase in Phu Cat and similar men living in a background location in Kim Bang near Hanoi. In 2010 and 2011, samples were collected from 97 men in Phu Cat and 85 men in Kim Bang and were analyzed for the 17 2,3,7,8 PCDD/F congeners along with dioxin like PCB congeners. The men in the area of Phu Cat were expected to have been exposed to the PCDD/Fs associated with the use of Agent Orange, White, and Blue herbicides at the airbase from 1961 to 1971.

For the men in the background location of Kim Bang, the 50th and 75th percentiles for the PCDD/F TEQ were 8.9 and 11.6 ppt, respectively. The 50th and 75th percentile values from the 2007/2008 NHANES study, which is the data source of the 95th percentile of 39.9 ppt, were 12.8 and 20.7 ppt, respectively. For 2,3,7,8-TCDD serum levels, the men from Kim Bang had 50th and 75th percentiles of 1.5 and 2.0, respectively. Comparatively, both of the 50th and 75th percentiles for TCDD from the 2003/2004 NHANES study were less the limit of detection of 3.8 ppt. In general, the Manh et al. (2014) Kim Bang percentiles for both TEQ and TCDD are lower than the similar percentiles for the NHANES study representing the general U.S. population indicating that background levels in Vietnam are not expected to be higher than those in the U.S.

The use of the 30 TEQ pg/g lipid as the dioxin action limit is conservative compared to the more technically appropriate levels of 40 – 70 TEQ pg/g lipid derived by Aylward et al. (2008). The upper end of the range of background concentrations for some of the older age categories of the general U.S. population may exceed this Project dioxin action limit. For example, the 95th percentile total TEQ concentration for the general U.S. population older than 20 years based on the NHANES 2007/2008 is 39.9 TEQ pg/g lipid, which indicates there is a 5% chance that a person with only background exposures to dioxin in the U.S. will have total serum dioxin concentrations higher than TEQ 39.9 pg/g lipid (Bichteler et al. 2017). This would mean that there is a chance that personnel from the United States or Vietnam may have total baseline TEQ concentrations that exceed the 30 TEQ pg/g lipid action limit without having any exposures to dioxins from the site.

TABLE 9-11. SUMMARY OF 95TH PERCENTILE PCDD/F CONGENER SERUM LIPID CONCENTRATIONS

PCDD/F CONGENER	95 TH PERCENTILE – AGES >20 YEARS FOR THE GENERAL U.S. POPULATION
TCDD	5.30 (4.50; 6.10)
PeCDD	11.3 (10.1; 12.7)
HxCDD, 123478	<11.9
HxCDD, 123678	70.8 (60.7; 82.2)
HxCDD, 123789-	<12.3
HpCDD	95.0 (76.1; 126)
OCDD	784 (665; 978)
TCDF	<6.00
PeCDF, 12378	<7.10
PeCDF, 23478	13.0 (11.4; 14.7)
HxCDF, 123478-	9.50 (8.00; 10.5)
HxCDF, 123678-	9.00 (8.00; 10.1)
HxCDF, 123789-	<8.30
HxCDF, 234678-	<8.20
HpCDF, 1234678-	18.0 (16.0; 20.9)
HpCDF, 1234789-	<8.60

OCDF	<12.0
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Notes:

- Values for individual congeners taken from CDC (2019), Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables.
- () contains 95% confidence interval for the 95th Percentile.
- < indicates the congener was detected and the value is the limit of detection.

Sources:

1. CDC. 2019. Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables. January.
2. Manh HD, Kido T, Okamoto R, Xianliang S, Anh le T, Supratman S, Maruzeni S, Nishijo M, Nakagawa H, Honma S, Nakano T, Takasuga T, Nhu DD, Hung NN, Son le K. 2014. Serum dioxin levels in Vietnamese men more than 40 years after herbicide spraying. Environ Sci Technol. 48(6):3496-503.

I.3.3.4 BASELINE BLOOD SERUM DIOXIN LEVELS

The TEQ and congener values of the blood serum dioxin results will be reviewed every time samples are analyzed. If baseline blood serum dioxin levels are above the 30 pg/g TEQ action limit, the examining occupational health physician will be consulted for recommended further action, which could include:

- Further blood testing and analysis to assess general health condition,
 - Determination of symptoms,
 - Liver and kidney function screening, or
 - Dermal assessment
- Employee consultation with the examining occupational health physician to understand the sampling results and related health risks,
- Sampling and analysis to confirm serum dioxin level,
- Additional or more frequent health monitoring over an extended period,
- Recommendation that the employee be restricted from performing tasks with potential dioxin exposure, or
- Recommendation that the employee not work on the site.

I.3.3.5 INCREASE IN BLOOD SERUM DIOXIN LEVELS

The total TEQ and individual congener concentrations of the blood serum dioxin results will be reviewed every time samples are analyzed. If a periodic (annual, closeout, or post-incident) serum dioxin analysis indicates an increase in total serum dioxin levels (all congeners) or exceedance of the 30 TEQ pg/g action limit, then the congener-specific concentrations will be compared to the 95th percentiles for the individual congeners to identify which congeners are the source of the elevated levels. If the 2,3,7,8-TCDD congener is substantially elevated, this may indicate a site-related exposure, and the A&E Bien Hoa Contractor must lead a review with the CSOs of the implementation and compliance by Project personnel of the Site-Wide HASP. The A&E Bien Hoa Contractor will provide recommend changes to USAID for consideration. The attending occupational health physician will also be consulted for recommended further action, which could include:

- Further blood testing and analysis to assess general health condition,
 - Determination of symptoms,
 - Liver and kidney function screening, or
 - Dermal assessment
- Employee consultation with the attending occupational health physician to understand the sampling results and related health risks,
- Sampling and analysis to confirm serum dioxin level,
- Additional or more frequent health monitoring over an extended period,
- Recommendation that the employee be assigned to another task,
- Recommendation that the employee be restricted from performing tasks with potential dioxin exposure, or

- Recommendation that the employee not work on the site.

In addition, the employee's work habits will be assessed to ensure:

- PPE was used properly and consistently throughout Project assignment,
- Decontamination was performed before departure from the site,
- Worker did not enter the Project site unprotected in areas where PPE was required, and
- Other work habits did not contribute to the elevation of serum dioxin level.

If the worker is deemed fit to continue working at the site, retraining will be given in areas where compliance was weak. The worker will also be closely observed for the first three (3) days on site after retraining. If the worker is not deemed fit to continue with current tasks, an alternate assignment may be considered.

I.3.3.6 SAMPLE PROCESSING AND PRESERVATION

The laboratory requirements for serum extraction and preservation are included in **Appendix L**.

I.3.4 CONTRACTOR AND SUBCONTRACTOR HEALTH AND SAFETY PLAN REQUIREMENTS

All Project Contractor operations shall be conducted in compliance with this Site-Wide HASP. The SHASP shall address the occupational safety and health hazards associated with the Project Contractor's specific site operations. Changes and modifications to the SHASP are permitted to suit changes in operations or changing site conditions. The changes shall be made in writing with the knowledge of the A&E Bien Hoa Contractor LSECS, HSO, and COP and the approval of the USAID CO/COR.

Project Contractors should follow the basic format of this Site-Wide HASP, substituting the Project- and work-specific information for all sections. For non-intrusive activities, such as site reconnaissance activities which do not require entrance into contaminated areas, a Short Form SHASP form is included in **Appendix M**.