

Advancing Hazardous Waste Characterization and Remediation Capacity in a Developing Country: Agent Orange Case Study in Vietnam

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Background/Objectives. Large volumes of Agent Orange, a defoliant containing 2,3,7,8-tetrachlorodibenzo-p-dioxin, were used during the U.S.-Vietnam War. The former U.S. military base at Danang, now a Vietnamese military airbase and the primary civil airport in Central Vietnam, is one of the most contaminated sites in the country and is a Government of Vietnam (GVN) priority area for remediation to eliminate the risk of human exposure to dioxin. The GVN requested assistance from the US to remediate the Danang Airport. The U.S. Agency for International Development (USAID) is the lead U.S. agency implementing the remediation program in Danang. USAID's GVN counterpart for the project is the Ministry of National Defense (MND) in coordination with the Office of the National Steering Committee 33. In late 2009, USAID's team began the process of selecting, designing, and implementing the most appropriate strategy to contain or destroy the dioxin contamination, to achieve consensus with GVN stakeholders, and to contribute to a lasting capacity for characterization and remediation of dioxin and other hazardous environmental contaminants in Vietnam.

Approach/Activities. Achieving technical and regulatory consensus for the remediation approach, as well as scientific capacity building, required a comprehensive communication and training program for a wide variety of stakeholders. At least ten GVN ministries were engaged in the environmental assessment and remedy design processes. Achieving consensus with these stakeholders was a primary goal, in addition to providing training for GVN staff on site characterization and remedy selection techniques. Another key stakeholder group for capacity building was the local Danang community. The primary goals in this context were to train a workforce for sampling and remediation activities at hazardous waste sites, and to provide construction health and safety training consistent with U.S. standards. More than 60 workshops were conducted with GVN stakeholders in Hanoi and Danang. These included slide presentations and facilitated discussions simultaneously in English and Vietnamese. Tours of the Danang site as well as active remediation sites in the U.S. helped stakeholders understand the options being proposed and the important project drivers. Treatability studies helped build confidence in innovative technologies. GVN personnel and site contractors were trained extensively in soil and sediment sampling techniques. For site workers, extensive health and safety training was performed, including developing and implementing a HAZWOPER training program in Vietnamese.

Results/Lessons Learned. In 2012, GVN approved the selection of In-Pile Thermal Desorption as an innovative remediation technology for treatment of the highly contaminated soil and sediment. Construction was performed in 2013 and 2014 largely by Vietnamese subcontractors, and treatment began in 2014. Active treatment was completed in 2017, with 90,000 m³ of soil and sediment treated to far below the cleanup standards for dioxin in Vietnam. Significantly, more than 400 workers were trained to perform remediation and construction activities at the site, and no significant injuries have occurred during approximately four years of field activities.