

Small-Scale Incinerator Construction: Recommendations from the Rwanda Experience

In Rwanda, the Ministries of Health (MOH) and Environment (MOE), the World Bank Multisector AIDS Project (MAP), the Making Medical Injections Safer (MMIS) project through the President's Emergency Plan for AIDS Relief (PEPFAR), and the World Health Organization (WHO) have formed a partnership to support infrastructure and systems development to ensure the safe handling, treatment, and final disposal of infectious medical waste. This document highlights recommendations from the Rwanda experience in an effort to assist stakeholders interested safe disposal of medical waste in Rwanda and other countries to better plan health care waste management infrastructure projects that include small-scale incineration construction.

As part of this partnership model in Rwanda, MAP is financing the construction of the Waste Disposal Unit (WDU), a dedicated infectious waste treatment and disposal area that includes a DeMontfort incinerator, ash pit, needle pit, storage areas, and secure shelter. MMIS brings technical assistance, training, and supervision expertise to the partnership while the MOH and WHO provide program oversight and technical expertise. This strong and active collaboration among partners is critical to the ongoing success of this project

While small-scale incineration technology can be relatively simple, the quality assurance procedures required for its fabrication and construction must be strictly followed to maximize the life of the incinerator and ensure its proper functioning. It must be the joint responsibility of all partners to provide active and technical supervision of the small-scale incinerator construction activities, and stakeholders at provincial- and district-levels must be included early in the decision-making process and engaged during construction oversight.

Evaluation of the initial WDU tender and construction activities by project partners has identified several recommendations to improve future WDU construction quality and cost. Application of these recommendations will ensure quality construction of future small-scale incinerator units in Rwanda that adhere to technical specifications in a cost-effective manner. These recommendations, highlighted below, are equally applicable to health care waste management partnerships in other countries. While the WDU was the technology used in Rwanda to manage medical waste disposal, it should be noted that the general principles outlined below can apply to any health care waste disposal technology.

Recommendation: Form a Strong Collaboration and Partnership

- *Ensure the involvement of Ministry of Health and Ministry of Environment at all levels*
- *Establish a coordination mechanism and supervision team that includes representatives from the Ministry of Health and partner agencies*

Recommendation: Ensure Appropriate Tendering and Technical Resources

- *Retain the services of a consultant engineer, and ensure that the terms of reference are well-defined*

Construction of WDUs or other incinerators should be supervised by a certified engineer. In collaboration with supervisors from the Ministry of Health and other relevant partners, the engineer should ensure that the construction firms hired during the tendering process are working

according to the specified norms and standards for construction. These norms and standards can be found in the WHO *WDU Guidelines: Best Practices in Construction, Use and Maintenance of Small-Scale Incinerators*, available at <http://www.wdu.co.in>. Supervision of this technical nature is required to ensure compliance with the specifications and, consequently, the proper functioning and long life of the WDU. Sample terms of reference for a consultant engineer are available from MMIS.

- ***Involve the technical team in the tendering process***

The proper tendering process is critical to successful implementation of the project. Technical persons (i.e. the trained supervisors and/or the consultant engineer) must be included in the evaluation and vendor selection process. The ‘technical bid’ and ‘commercial offer’ must be separate and reviewed separately. To ensure construction that meets the required specifications, technical capability of the vendor should take priority over the ‘lowest bid’ criteria. Tender for the manufacture of metallic components of the incinerator, the civil work, and assembly of components should be treated separately.

- ***Develop comprehensive tender documents for construction firms, including schedules for construction and inspection***

The bid document must include a copy of the WHO *WDU Guidelines* detailing best practices for construction, use, and maintenance of WDUs, with specific reference to the engineering drawings found in the WHO *WDU Guidelines* available at <http://www.wdu.co.in>. The tender document should also suggest a schedule of fabrication, construction, and stage inspection. It will also be binding on the contractors to have each stage certified by the supervising agency. Supply of spare parts for two years as well as tools and tackles as per the WHO *WDU Guidelines* must be included as part of the tender. A warranty clause and maintenance contract may also be added as a separate item in the bid. The bid should include training by the incinerator manufacturer, if necessary, for new construction firms.

- ***Establish a phased approach to construction, in which firms construct one or two test incinerators and complete the remainder upon approval of the test incinerators***

In order to ensure the quality of the construction by any contracted firm, it is recommended that the construction and approval of one to two test incinerators be required before proceeding. Any further construction should be allowed only after the construction of these test incinerators is supervised and given final approval. This will allow for any major problems to be addressed early in the initial phase and ensure that the contractors understand the process and the technology before continuing with construction on a larger scale.

Recommendation: Implement Strong Supervision and Training

- ***Establish a WDU supervision schedule***

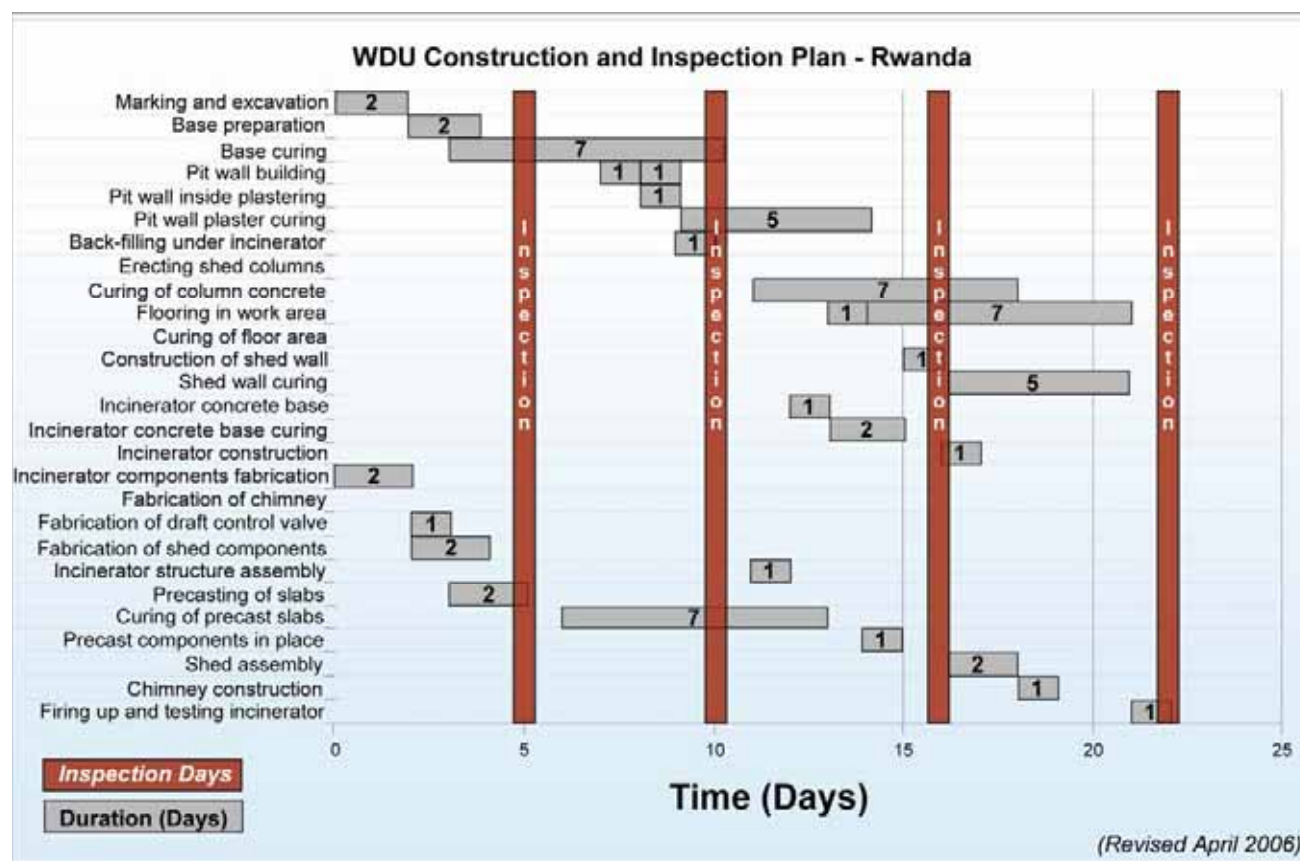
Construction firms should agree to a schedule for supervision for each stage of construction with the supervision team. This supervision schedule should be directly linked to the construction schedule agreed upon during the contract process, so that work can continue to move forward with the appropriate quality checks at select construction milestones.

- ***Develop a WDU construction and inspection schedule***

There should be continuous inspection and certification of the work being done by the contractors. A schedule of construction should be fixed and an inspection of the quality of the raw material and workmanship is a ‘must’ at all stages. In Rwanda, the consultant engineer, representatives of the Ministry of Health, the funding partner organization, district health and environmental agencies, and a WHO staff member form an inspection team. The team visits each

site according to a pre-planned schedule to review and certify the work done at each stage of construction and give clearance for the next phase of construction. Figure 1 is an example of a construction and inspection plan. Sample inspection guidelines are available from MMIS.

Figure 1: Example of WDU Construction and Inspection Plan



- **Ensure that all incinerator operators receive “hands-on” training in operation and maintenance of the WDU**
Each operator should be given an opportunity to conduct ‘waste disposal’ during the training program. At the end of this training, all incinerator operators should be outfitted with appropriate personal protective equipment and essential tools to properly perform their duties.
- **Integrate waste segregation training into in-service and pre-service training for health workers**
Waste segregation improves the ultimate efficiency of the WDU, as minimizing the amount of waste to be incinerated means that the incinerator must be operated less frequently, saving fuel, time, and resources. It also contributes to health worker and support staff safety by encouraging staff to recognize infectious waste and exercise caution when handling it.

Recommendation: Consider WDU Construction Options and Impact on Cost Estimates and Construction Quality

- **Consider procurement of pre-fabricated “kits”**
Metallic materials approximating the required dimensions and refractory bricks are often, but not always, available on the local market. While imported components other than the temperature indicator are not essential to the WDU construction, high quality materials and workmanship are

essential when fabricating the components of the WDU, and a high level of supervision by the coordinating body and the technical staff is highly recommended. If the in-country procurement option is to be viable, close attention must be paid to the tendering process, vendor selection, contracts for vendors, and choice of consultant engineer.

As an alternative to generating the components in-country, the WDU can also be constructed using pre-fabricated “kits,” which can be imported and assembled in-country. This option eliminates some of the quality control issues experienced to date in Rwanda and ultimately may be a more cost-effective option.

It is important to note that cost is not the only criterion when deciding on the procurement strategy. Decisions must be based on the in-country capacity, the confidence partners have in the contractors, the schedule of procurement, any possible delays, the quality of the goods delivered, and, finally, the judgment of the supervisory team.

▪ ***WDU construction costs in Rwanda***

Even if the WDU were to be built in accordance with standards and all of the materials were imported, the estimated costs are much lower than those currently being charged by contractors. Rough calculations indicate that the fully constructed WDU should cost around € 3,500.

The cost of labor (6 persons x 15 days) should be about € 114. The cost of a technician (supervisor) would be about (1 person x 16 days) € 61. The cost of materials required at the site (cement, sand, gravel, etc.) is calculated at a maximum of € 303. The currently quoted prices for Kit III, provided by a manufacturer in India, including transportation and duty in Rwanda, will cost about € 3,018. This adds up to approximately € 3,500. Even if one considers contingencies at approximately 10% for additional transportation and supervision, etc. due to remoteness of some of the construction sites, the price of each WDU should not exceed about € 3,800.

For More Information

For more information on the WDU, including the most up-to-date technical specifications and guidelines for use and maintenance, visit www.wdu.co.in.

For more information on the experience of MMIS/Rwanda and other countries, email info@mmis.jsi.com.

The Making Medical Injections Safer (MMIS) project is a five-year initiative funded by the President's Emergency Plan for AIDS Relief through USAID and the CDC. MMIS is implemented by John Snow, Inc. (JSI) in collaboration with PATH, AED, and the Manoff Group. By the end of the five-year project (2009) and with national counterparts, MMIS will establish an environment where patients, health care workers, and the community are better protected from the medical transmission of HIV and other bloodborne pathogens. The views expressed in this document do not necessarily reflect those of the Office of the Global AIDS Coordinator, the US Agency for International Development, or the HHS Centers for Disease Control and Prevention.