MedWaste Treatment
MINIMIZING HARM, MAXIMIZING HEALTH
RESULTS OF THE INTERNATIONAL COMPETITION FOR INNOVATIVE TECHNOLOGIES FOR THE TREATMENT OF MEDICAL WASTE IN RURAL AREAS
Health Care Without Harm (HCWH) is pleased to announce the results of its International Competition for Innovative Technologies for the Treatment of Medical Waste in Rural Areas.

Recognizing the health and environmental threats posed by incineration, HCWH launched the competition in April 2002 in order to promote cleaner, low-cost treatment technologies for rural areas. Based upon an initial evaluation of 58 preliminary design ideas from around the world, the coordinating committee selected 30 contestants from 18 countries to submit complete descriptions of their concepts. From these finalists, the judges selected three winning designs and five honorable mentions. The 1st place was awarded to an Australian team that developed a portable solar-powered autoclave. The 2nd place design was a boiling chamber with a mechanical grinder and compactor, while the 3rd place concept involved lime treatment and encasement of the waste. The five honorable mention designs were: a sterilizer with a solar reflector, a box-type solar cooker for disinfection, a treatment vessel using lime solution, a sterilizing chamber attached to an accumulator and solar collector, and a waste treatment system that used an autoclave with an internal shredder.

BACKGROUND

Many rural hospitals and clinics discard medical waste along with regular trash, which increases the risk of spreading diseases, especially in poor communities that recycle materials from open dumpsites. Other health care facilities use open burning or make-shift incinerators to process their waste. However, in so doing they expose communities downwind to toxic byproducts (such as dioxins, furans, mercury, lead, hydrogen chloride, polynuclear aromatic hydrocarbons, particulates, and other pollutants) and create hazardous ash. As immunization and rural health programs expand in developing countries, the problem of medical waste treatment and disposal becomes critical.

Persistent organic pollutants (POPs) such as dioxins and persistent toxic substances such as mercury can travel long distances, bio-accumulate in living organisms, and pose significant human and ecosystem health risks. Research in the last decade has shown significant links between exposure to incinerator emissions and lung, laryngeal and other cancers. In addition, studies have shown increased risks of ischemic heart disease, and elevated levels of mutagens, various toxic organic compounds, and heavy metals in blood, urine, and/or hair. The Stockholm Convention on POPs promotes the use of alternatives to incineration that avoid the generation of POPs.

Although many non-incineration alternatives—such as large autoclaves, autoclaves with shredders, and microwave devices—are readily available in industrialized countries, poor rural communities, especially in developing countries, have little or no access to these technologies.
Health Care Without Harm launched an international competition in April 2002 to engage students, faculty, health professionals, researchers, inventors and others in the search for cleaner, safer, lower-cost appropriate technologies to treat medical waste in rural areas.

**PROCESS**

Health Care Without Harm initially announced the competition worldwide to thousands of universities, health networks, non-governmental organizations, and World Health Organization contacts. Subsequently, a coordinating committee selected 30 contestants from the scores of applicants who submitted preliminary descriptions of their designs. Contestants were required to transfer intellectual property rights to HCWH, which in turn agreed to place the designs in the public domain.

An international adjudication panel of experts from the fields of medical waste management, infection control, waste disposal, and treatment technologies evaluated the 30 designs using a set of 15 criteria developed with the technical assistance of the World Health Organization. The criteria included, for example, disinfection capability, ease of manufacture, use of readily accessible and low cost components, safety of operation, and environmental impact. Three winning designs, along with the five honorable mention entries, received monetary prizes.

**PARTICIPANTS**

The 30 contestants came from 18 countries in Africa, East Asia and the Pacific, Southwest Asia, Middle East, North and South America and Europe. They represented 18 universities, six engineering teams or private consultants, three health institutions and three non-governmental organizations and environmental advocates.

The purpose of the competition was to search for cleaner, safer, lower-cost technologies to treat medical waste in rural areas.
The top prize went to the team of Rhys Hardwick Jones, Iain Brown, Joshua Przybylko, Sandra Fisher, James Tracey, and Nicholas Russell of Sydney University in Australia. Their design, nicknamed Prometheus, is a completely solar-powered autoclave-style device that can operate in both sunny and cloudy conditions. The treatment system consists of a sterilization chamber directly connected to a set of copper tubes, which in turn are encased in solar collectors to concentrate the sun's energy. The medical waste load sits in a basket inside the chamber where it is treated, at temperatures from 121 to 134 °C, through the use of steam generated in the solar collectors. Because of its efficiency, the device can operate in cold, cloudy and even in rainy conditions, although sunny conditions are obviously optimal. The research team has built a 1.5-liter portable system, as well as a larger, fix-sited 14-liter prototype.
2ND PLACE

Boiling Chamber With Mechanical Grinder and Compactor

Second Place went to Dr. Malcolm G. Holliday of Newcastle upon Tyne Hospitals, NHS Trust Freeman Hospital in England. His simple system consists of a manual grinder with a lid in which the waste is shredded, prior to it being moved by gravity and a tamper into a rectangular treatment chamber. Locally available fuel is used to boil water in the chamber for 50 minutes to treat the waste. The chamber can be tilted to drain off the water for possible recycling. After treatment, the waste is compressed using a manual screw compactor to remove any remaining water prior to final disposal.
3RD PLACE

Lime Treatment and Encasing of the Waste

The third place winning design was submitted by the team of Alissa Willis, Beth Hester, Michael Bestor, Holly Martin, and Professors Mark Bricka and Todd French of Mississippi State University in the United States. Their proposal uses the heat generated by mixing lime and water to treat the waste in a metal drum. The reaction produces heat at temperatures reaching 95 °C. The container is then covered with a mixture of lime and waste fly ash that react to form a cement-like material to encase the waste.
HONORABLE MENTION:
Sterilizer using a Scheffler Reflector
The design of Dr. Wolfgang Scheffler and Heike Hoedt of Solare Bruecke (Germany) and Michael Mazgaonkar of Paryavaran Suraksha Samiti (India) uses a reflector designed in 1982 by Dr. Scheffler, an Austrian physicist, to concentrate the sun’s energy. Depending on several variables, the reflector may be focused onto the bottom of a sterilization chamber to directly heat the waste or on to an iron block through which water is flushed to produce steam to treat the waste in the chamber. Another design option is a small reflector suitable for a small rural clinic. The team also proposed the use of a rotating drum containing stones and other abrasive materials to grind sharps waste.

HONORABLE MENTION:
Box-Type Solar Cooker for Disinfection
The design by Dr. Vikrant Chitnis of the Department of Microbiology of Choithram Hospital & Research Centre in India is a simple box solar cooker made of galvanized aluminum sheet. It has an upper cover with a reflecting mirror and a lower box with a glass sheet to trap the heat and glass wool as bottom insulation. The main heating area is painted black and has the capacity to hold a metal box containing medical waste. Water is added to improve heat penetration. The direction of the reflecting mirror is adjusted every two hours to face the sun.
HONORABLE MENTION: Sterilizing Chamber Using a Solar Collector
The team of Carlos Fortune, Eduardo Chaigneau, Marco Cavalieri, Ana Vera, and Catherine Araya of Universidad de Valparaiso in Chile proposed a sterilizing chamber attached to an accumulator that circulates water through a solar collector to produce steam. On a hot day, the device can heat water to over 150 °C in about 4 hours.

HONORABLE MENTION: Treatment Vessel Using Lime Solution
The team of Laura Robinson, Melanie Chin, and T. Pearce of North Carolina State University in the United States designed a treatment vessel in which medical waste is placed onto a wire mesh and treated using a mixture of lime and water. After treatment, the lime/water solution can be readily drained for reuse due to the vessel's unique cone-shaped bottom. The wire mesh screen makes it easier to remove the treated solid waste. The lime solution wastewater could be reused for farming applications.

HONORABLE MENTION: Autoclave With Internal Shredder
Abhishek Jain, Sumon Datta, and Dr. T. Swaminathan of the Indian Institute of Technology Madras in India developed an integrated medical waste management system in which the waste is first segregated into its components. The constituents are treated in an autoclave with an internal shredder which may be rotated in one direction to shred paper, cloth and other soft waste, or rotated in the opposite direction to crush waste such as glass. At the conclusions of the cycle, the autoclave can be tilted manually to discharge the treated waste.
ABOUT HEALTH CARE WITHOUT HARM

Health Care Without Harm (HCWH) is a broad-based international coalition composed of 416 organizations in 44 countries. Its mission is to transform the health care industry worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment. Among its goals is to promote policies, practices and laws that eliminate incineration of medical waste, minimize the amount and toxicity of all waste generated, and promote the use of safer alternatives.

FOR MORE INFORMATION

To see the design details, lists of materials, steps for construction, operating procedures, safety issues, and other data, go to www.medwastecontest.org. As with all new technologies, care should be exercised in adapting the designs for local use. When considering any medical waste treatment method, careful attention must be given to occupational safety, environmental protection and public health issues. Health Care Without Harm plans to conduct field tests and demonstrations of various designs in the coming period.

You can learn more about Health Care Without Harm at www.noharm.org or by writing to the address below:

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