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Strategies and Technologies:**

A Basic Overview for Developing Countries
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**Medical Waste Treatment
Strategies and Technologies:
A Basic Overview for Developing Countries
By Glenn McRae**

There has been no comprehensive effort to understand how wastes generated by hospitals, clinics and in other health care settings are managed in the "developing world." Most of our knowledge of approaches to medical waste management is anecdotal. Most of our knowledge of the composition of that waste stream in various countries is limited as well. Much of the information that is being used to compose policy and direct investments is speculative at best, blatantly erroneous at worst, such as a recent memo emerging from a listserve with USAID contacts listed which points the finger at medical waste as the chief cause of HIV transmission in India.

Just over a decade ago the same lack of knowledge and understanding dominated the perspective practitioners and policy makers addressing medical waste in the United States. While the situation in the United States has been transformed, and major policies and specific investment strategies are moving into place which can strategically target pollution prevention, better risk management, and treatment and disposal technology choices which favor better environmental outcomes, that body of knowledge has not been extensively drawn on by the international aid or public health community to guide policy and investments in the "developing world."

If the questioning begins with: What technology will be select to treat and dispose of medical waste?, then the series of important questions which need to be asked first to make a logical, safe and cost effective decision become irrelevant. There is a great deal of information on technologies now available. We know more than we ever did about incineration as a technique for treating (it is often erroneously listed as a disposal technology) medical waste and this new knowledge has raised many questions about the viability of this technology for this purpose. In the U.S. it has meant a steady decline in the number of incinerators in use, and a significant rise in the use of non-burn technologies. In a 1997 survey of the U.S. industry, the Environmental Industries Association identified more than

- * 1500 non-burn technologies installed to treat medical waste in the US
- * 400 non-burn technologies supplied by the same companies for use overseas

(See Attached List of "Alternative Medical Waste Treatment Technologies")

There is a wealth of operational, economic and public health data waiting to be collected on these technologies. However little attention has been paid to collecting that data, and even less data is available of where these technologies have been successfully applied in the "developing world."

From recent work in India we do know of three installations using two examples of non-burn technologies.

- Sanjay Gandhi MangolPuri, New Delhi
System: Dedicated Waste Autoclave (Tuttnatuer 66190EP - Israel)
Installed: September 1997
Provisioner: Omron Medical, New Delhi

- Escorts Heart Hospital, New Delhi
System: Dedicated Waste Autoclave and Shredder, 360 Kg./hr. (Tuttnatuer 5590EP - Israel)
Installed: April 1999
Provisioner: Omron Medical, New Delhi
- Tata Memorial Hospital, Mumbai
System: Hydroclave (advanced autoclave using indirect steam sterilisation technology and a rotary flow), (Hydroclave H-25 - Canada)
Installation: June 1999 (unit was delayed in shipping)
Provisioner: Consolidated Waste Management India (P) Ltd., Mumbai
For direct information: cwmwaste@bom7.vsnl.net.in
NOTE: Tata Consultancy services, Pune, have also recommended the Hydroclave for some 203 hospitals to treat their waste in West Bengal. TCS is working under contract to the "Health and Family Welfare Department (HFWD) Govt. of West Bengal".

San-I-Pak, a U.S. based manufacturer of autoclave systems with more than 500 installations in the United States, has also reported installations in Chile, Columbia, and Taiwan with a longer operating history than the systems in India. The systems they have installed in Chile, Columbia, and Taiwan are all used to treat medical waste.

- Chile
Customer: Procesan SA in Santiago
Contact: Francisco Izquierdo
Installed: August 1996
Capacity: 100 pounds/hour
- Colombia
Customer: Chagnon International Ltee in Cali
Contact: Daniel Chagnon
Installed: May 1993
Capacity: 100 pounds/hour
- Taiwan
Customer: Chung Shan Medical & Dental College in Taipei
Contact: Rudy Fu
Installed: June 1995
Capacity: 100 pounds/hour

Additional information on their technology can be found at <www.sanipak.com>

While there are reports of other non-burn technologies in use, specifics on these installations were not available. The two other non-burn methods in place and in common usage, not requiring technology include, deep burial (secure burial in a designated site that is protected from disturbance) and chemical disinfection (spreading of a disinfectant - e.g. chlorine by hand on wastes, or soaking of waste material in a hypochlorite solution prior to disposal by burial.)

RESOURCE: In India, Dr. Rohini Kelkar, M.D., the head of microbiology and infection control at Tata Memorial Hospital (a premier cancer research hospital) in Mumbai, has been involved in investigating non-burn alternatives for the last year. She was responsible for shutting down her hospitals incinerator because of public health concerns, instituting a rigid segregation program at the facility, evaluating using a regional incinerator (rejected) and then selecting a new technology for on-site treatment of wastes. She is an active

member of the Hospital Infection Society of India, and has been a featured speaker at a number of national and regional conferences on approaches to medical waste management.

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Understand the waste first, then pick treatment and disposal technologies

The technologies that are widely available and are starting to be put in place in health care setting in the "developing world" are what one would define as soft technologies. Similar to what we learned in the 1970's in energy management, it made more sense to invest in training, behavior change, and low-cost infrastructure to save energy, rather than to just continue building new power plants. We needed to learn to manage energy just as we now need to manage wastes. Some of these soft technology approaches which have been successfully implemented in a number of hospitals with outcomes such as increased worker safety, a vast reduction in the volume of waste needing special treatment, a lessening of public health risks, and lower costs for waste disposal.

1. **Segregation:** This involves an investment in training, signage and containers and results in waste being sorted into appropriate secure containers which determine treatment and disposal. When properly instituted, a hospital can safely dispose of up to 90% of its waste as municipal solid waste. In particular, if safe and effective segregation of sharps occurs most of the hazards inherent in potentially infectious wastes generated in health care can be managed.
2. **Reduction:** This involves an analysis of what materials are purchased for use at a facility and identifying what packaging or specific items can be eliminated. In other cases it involves a careful analysis of disposable products which could be replaced by reusable ones.
3. **Substitution:** Particularly hazardous materials, needing special management and creating a specific risk to workers and the community can be substituted by less hazardous materials (e.g. mercury based diagnostic technologies, with non-mercury technologies).
4. **Personal Protective:** Most workers in hospitals in "developing countries" do not have Gear and Immunizations, a clear understanding of the principles of disease transmission or the basic steps they can take to protect themselves. To protect workers, health care facilities need to invest in training and education for workers, the purchase of personal protective gear and clothing for clinical and nonclinical staff who are likely to come into contact with potentially infectious or hazardous materials, and to make sure workers receive at least basic immunizations against tetanus or hepatitis.
5. **Secure Collection:** Once waste has been generated and collected it needs to get from and Transportation that point of generation to treatment and final disposal. To do this requires an investment in secure and easily moveable transport containers, protective gear and training for workers, and larger storage containers. The key is keeping the wastes secure and isolated from point of generation to point of disposal so that contact with workers and the public is minimized.

Treatment Technologies in the "Developing World"

The five "soft" technology approaches listed above are in place at a variety of institutions of varying sizes in the "developing world." No matter what "hard" treatment technology choice is selected, without attention to these five areas, risk to workers and the public is still substantial.

For the past 100 years a simple technology for sterilizing instruments and materials to be used in patient treatment, and for disinfecting lab instruments and wastes after use, has been familiar to health care professionals. That technology is the autoclave, a device which uses steam and pressure to disinfect materials. It is a simple straight-forward technology, and many hospitals in the "developing" world have experience in operations and maintenance in their laboratory or central sterile supply departments. This experience, combined with the ease of operation and maintenance, low cost, and modular nature makes it a good choice for waste treatment. Recommendations for using autoclaving for treatment of wastes however must include separate technologies for that purpose, and not combined usage with the autoclave responsible for sterilizing instruments.

Non-burn treatment technologies break down into three basic categories:

1. Chemical
2. High Heat (Plasma Torch, Pyrolysis)
3. Low Heat (Autoclaving, microwaving, hydroclaving)

The 1992 study sponsored by Minnesota Healthcare Partners (St. Paul, MN, USA 612-641-0719), "Study of Non-Burn Technologies for the Treatment of Infectious and Pathological Waste" still provides an excellent overview of the various treatment technologies.

The Washington, DC based Medical Waste Institute, in an industry sponsored association which provides current information on issues and options in the medical waste industry.
4301 Connecticut Avenue, Suite #300, NW; Washington DC 20008
ph. 202-244-4700

Disposal Options in the "Developing World"

It is important to clearly distinguish treatment from disposal. Especially in reference to incineration, this distinction is often lost. In reference to medical waste, incineration is a treatment technology. It does not "dispose" of it. Rather in the process of sterilizing the waste, it reduces the volume and produces at least two additional wastes which require attention. The first is particulates and other airborne emissions, which have been extensively addressed in other documents. The second is residual ash from the combustion process, which in many cases must be treated as a special or hazardous waste. Final disposal always requires some form of land burial. The development of sanitary landfills in the "developing world" needs to be a higher priority than it currently is, because all special waste streams (e.g. medical waste) eventually feed into them.

Recommendations

1. There needs to be a more comprehensive study of waste and practices that generate waste in clinical settings under a variety of conditions.
2. A full survey and study of the operations of non-burn treatment technologies needs to be conducted. Surveys and studies of incinerators have been conducted.

3. Information published by international agencies such as the WHO should provide an overview of and guidelines for the use of non-burn technologies.

Qualifications of author: Glenn McRae, Vice President of CGH Environmental Strategies, Inc, has twenty years of experience in coordinating environmental management programs in urban and rural communities in the United States and abroad. Mr. McRae was a participant in the landmark, Medcycle study of 1990-91, which was the first focused effort to identify the components of clinical waste with the specific intent of identifying opportunities for waste reduction, pollution prevention, risk reduction and recycling. He is the co-author of two manuals on medical waste management published by the American Hospital Association, as well as a number of other monographs and articles on the topic. He has recently been working under the auspices of several NGO's in New Delhi and Mumbai to assist with efforts to develop medical waste management models appropriate for the Indian context, and was a featured speaker at the first national conference on medical waste (February 1999) in Baroda, India.