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HOSPITAL WASTE MANAGEMENT

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HAZARDOUS WASTE MANAGEMENT

Prepared By

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For

The Natural Resources & Environmental Policy Project/
International Resources Group

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HOSPITAL WASTE MANAGEMENT

2

NATURAL RESOURCES AND ENVIRONMENTAL POLICY PROJECT
INTERNATIONAL RESOURCES GROUP LTD.

MEMORANDUM

TO : Malcolm F. Baldwin, Chief of Party, NAREPP/IRG

FROM : Peter Schmidt and Jim Stouch (Malcolm Pirnie, Inc.)

DATE : May 12, 1993

SUBJECT : HOSPITAL WASTE MANAGEMENT IN SRI LANKA

At your request we made inquiries to determine the current status of hospital solid waste management in Colombo. Past reports had estimated the total volume of hazardous waste generated by the Colombo group of hospitals at about 2.5 tons per day[1] (not including those materials diverted from the waste stream such as plastic, etc.). In 1992 a proposal to build a Rs 56 million incinerator for hospital waste and other wastes was shelved and the appropriated monies returned to the treasury general fund. Most hospital waste is currently managed as solid waste by area hospitals. Only one hospital in the Colombo area had an incinerator (Sri Jayawardunapura). This incinerator was built with the intent of handling the majority of the burnable hospital waste from a 700 plus bed facility.

In our investigation of the hospital waste issue we met with the following organizations:

Colombo Municipal Council
Solid Waste Management Division
N.S. Jayasundera
L.R.L. Wickramaratne

General Hospital of Colombo
Rehabilitation Project
Dr. Lucian Jaysuriya

Sri Jayawardunapura Hospital
Dr. Sanath Gunesekera
Mr. S. Jayasinghe

In addition we toured the Wellampitiya landfill to observe the daily operations. We were unable to review the terms of reference and the winning proposal for the aborted 2.5 ton per day incinerator.

Shenuka Chanmugam Dec. 1992 Background Report on Hazardous Waste Management in Sri Lanka, NAREPP/IRG staff report.

Findings

While some hospital's have plans in place to segregate their waste streams, none of the hospitals in the Colombo area were segregating all classes of hospital wastes.

Most hospitals recognize the importance of collecting the used sharps separately. Sharp disposal practices varied from disposal in the regular solid waste to burning them separately..

Pathology wastes are generally buried.

In the two hospitals we observed, the workers handling the solid waste stream did not wear heavy gloves while handling the wastes. In both hospitals all the waste was sent to a central point for consolidation prior to being burned or sent to the municipal landfill. Workers would then sort out the plastic and other recyclables.

Infectious wastes are commingled with the other wastes. From conversations held with personnel at both hospitals the actual infectious waste volumes generated are quite small, on average much less than one bag of infectious waste per ward or department per day.

Both hospitals were very concerned with having the means to properly control and dispose of used sharps.

The new incinerator at Sri Jayawardunapura Hospital was improperly designed and or managed to promote complete and safe burning of the hospital wastes. During our visit, the stack plume was very dark indicating incomplete combustion. Additionally it was reported that while burning plastic and food wastes, smoke would enter the hospital areas.

At Sri Jayawardunapura Hospital a large number of the syringes were observed to have been recapped after use, thus exposing the nurse or doctor to a greater risk of a needle stick and potential transmission of a bloodborn pathogen.

Recommendations

Medical or hospital waste is broadly defined to include all wastes produced by hospitals, medical offices, and medical research facilities. Infectious waste is defined to include those wastes which are capable of producing an infectious disease. When defining a waste as infectious a number of factors must be taken into account: presence of a pathogen of sufficient virulence, dose, portal of entry, and resistance of the host to the pathogen[2].

Key to the cost effective management of hospital wastes is the source separation of the various waste streams based on the physical, chemical, and infectious characteristics of the wastes. Well established (and for the most part cost effective) treatment technologies exist for the management of most solid, liquid, chemical and radioactive wastes generated by hospitals. The designation of what is infectious waste and the associated risks is less well defined. The USEPA defined seven categories of waste that should be defined has hazardous for the Medical Waste Tracking Act. These waste streams are:

- Microbiological wastes - cultures and stocks of infectious waste and associated biologicals that can cause disease in humans.
- Human blood and blood products
- Pathological wastes of human origin
- Contaminated animal wastes
- Isolation wastes - wastes form humans or animals known to be infected with a highly communicable disease.
- Contaminated sharps
- Uncontaminated sharps

The greatest risk of infection in the management of the hospital wastes is to the workers responsible for managing the waste as they are exposed to the waste shortly after its generation. They also have extensive interaction with the waste and if not properly protected, present an exposure route for the pathogen (e.g. puncture, open wound, inhalation).

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[2] U.S. Environmental Protection agency, *Guide for Infectious Waste Management*, EPA/530-SW-86_014 (Washington, DC: May 1986)

While it is conceivable that some pathogens could survive and migrate from incineration or landfilling operations the greatest risk of transmission pathogens from medical waste occurs during its handling/storage. Based on our findings the following recommendations are made:

- Most of the waste management issue discussions revolved around the need for incineration to manage the infectious waste streams. While incineration is attractive for its ability to handle all wastes produced in a hospital, and for the reduction in waste volumes their are other technologies that might make better sense for resolving the hospital waste issues in Sri Lanka. Due to the relatively low volume of wastes generated, lower cost capital waste treatment systems should be considered, including:

  - Autoclaves (steam sterilization)
  - Microwave (thermal treatment)
  - Chemical disinfection
  - Landfilling

  Use of these systems requires that the chemical waste streams (all options) and pathological wastes(with the exception of the landfilling option) be segregated.

- A large percentage (upwards of 90%) of the hospital waste is food waste. This waste stream should be considered for composting.

- Hospital workers handling the wastes should be trained in the use of protective equipment. At a minimum, this equipment should include protective footwear, heavy gloves and safety glasses. Additionally, training should be provided for the proper handling of these wastes. Where possible, source segregation should be practiced to remove potentially recyclable/re-useable items from the waste stream to minimize the sorting of the waste by the workers.

- The CMC should require that sharps disposed of in the solid waste stream be packed in a labeled, secure and closed container that can be handled separately from the remaining waste to assure that it is securely buried.

- Until other waste management issues are resolved the CMC should give serious consideration to the segregation of infectious waste from other solid waste and the prompt burial of this waste to prevent the improper scavaging/recycling of this material. Both hospital representatives mentioned that they have plans in place to be able to start to provide for source separation of infectious materials.

HAZARDOUS WASTE MANAGEMENT

NAREPP / IRG

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MEMORANDUM

TO	:	Hazardous Waste Workshop Participants
FROM	:	NAREPP/IRG
DATE	:	June 9, 1993
SUBJECT	:	Summary of Results of the Hazardous Waste Management Workshop for Regulatory Agencies, April 1, 1993 at the Taj Samudra Hotel

INTRODUCTION

This interactive workshop, led by Peter Schmidt and James Stouch, of Malcolm Pirnie, Inc. was held to discuss practical approaches to improving hazardous waste management in Sri Lanka. Approximately 30 people attended who represented central government agencies (including CEA, BOI, M/EPA, MEIP, CISIR, NBRO, M/IST), local authorities, USAID, and local authorities. A list of participants is contained in Annex I.

Short presentations were given by a representative of each organization about their ongoing programs, responsibilities, and problems associated with hazardous waste. The remainder of the meeting was spent in an interactive discussion to explore and obtain feedback from the government agencies that addressed the following issues:

- What is a hazardous waste in Sri Lanka?
- How do these wastes relate to specific industries which generate them?
- What infrastructure is lacking in Sri Lanka to deal effectively with these waste streams?
- What treatment technologies are being implemented to address the volume and hazards associated with the waste?
- How are these technologies applied and what factors affect or constrain application?
- What are ways to overcome constraints on technology application?
- What are the ongoing programs from the agencies represented at the meeting and which area of "infrastructure need" identified earlier is being addressed by each program?

One waste water treatment plant design and construction project was examined for factors which can block successful environmental control project implementation (see Annex V). The consensus of the group on the most important factors contributing to a successful environmental project in Sri Lanka were:

- Regular monitoring
- Tax incentives for proper operation
- Self monitoring of effluent with checks by CEA
- Must meet final parameter
- Awareness of "moral" responsibility
- Accountability for design and construction
- Penalties/enforcement

- **What treatment technologies are being implemented to address the volume and hazards associated with the waste and what factors are constraining promotion and implementation of successful technologies?**

A range of treatment technologies are currently being used, including physical, chemical, and biological systems. Factors and solutions affecting implementation of these and other technologies were discussed (see Annex VI). Some of these include developing and publicizing demonstration projects, more technical training for enforcement agencies, greater use of the mass media to promote environmental awareness, improving awareness of policy makers, a need for phased regulatory implementation, and providing an industrial segment focus for regulations.

- **What programs are already in place to respond to some of these needs?**

Each agency represented was asked to highlight its ongoing programs and how they relate to the factors identified in the foregoing discussion. A total of 36 agency programs were identified which apply to one or more of these factors (see Annex VII).

One conclusion from this discussion was that improvemed information and technology transfer among programs would help promote synergy among programs and would better leverage the effort and money spent.

Evaluation forms completed by the participants provided feedback on desired topics for future workshops. These topics are shown in Annex VIII.

SUMMARY

1. Sri Lanka has a unique hazardous waste situation, both by definition and according to predominant generating industries, media, and volume.

2. The majority of hazardous waste not generated as a waste water constituent is managed on site. Attention is required to provide cost effective options to encourage the safe handling, treatment, and disposal of these wastes.

3. Waste water is the most important environmental media in terms of volume and infrastructure requirements.

4. While numerous infrastructure and policy issues exist, responses that focus on the following areas were identified as having the greatest impact:

   - awareness / information
   - regulatory strength (technical and political)
   - technical capability improvement for laboratories, university degree programs, industry organizations, the design and construction community, etc.

5. There are numerous ongoing government programs. Effort should be made to find a way to improve information and technology transfer to exploit synergies among programs.

Annex I

HAZARDOUS WASTE MANAGEMENT WORKSHOP FOR REGULATORY AGENCIES

LIST OF ATTENDEES

CENTRAL ENVIRONMENTAL AUTHORITY:

Amaratunga, Mr. G. K.

Ratnatunga, Ms. Shirani

Bandaratilleke, Mr. K. G. D.

Ellepola, Mrs. R.

Muthukudarachchi, Mr.

Susiripala, Mr.

Manoharan, Mr.

Nanayakkara, Mr. E. A.

BOARD OF INVESTMENT OF SRI LANKA:

Fernando, Mr. M. S. B.

Muruganathan, Mr. G.

CEYLON INSTITUTE FOR SCIENTIFIC & INDUSTRIAL RESEARCH:

Mathes, Dr. A. P.

Mubarak, Dr. A. M.

Wickramaratne, Mrs. Shamini

METROPOLITAN ENVIRONMENTAL IMPROVEMENT PROGRAM:

Pilapitiya, Mr. S.

Thiruchelvam. M.

NATIONAL BUILDING RESEARCH ORGANIZATION

Balasuriya, Mrs.

COLOMBO MUNICIPAL COUNCIL

Jayasundera, Mr. N. S.

Nallainathan, Mr.

Wickramaratne, Mr. L.

MINISTRY OF INDUSTRIES SCIENCE AND TECHNOLOGY

Abeyratne, Mrs. P. G. P.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

Jayatilleke, Mr. Avanthi

LOCAL AUTHORITIES

Wanigeskene, Mr. A. B. C. R.

Jayasooniye, Mr. D.

Annex II

HAZARDOUS WASTE MANAGEMENT WORKSHOP FOR REGULATORY AGENCIES
April 1st, 1993

CHARACTERISTICS OF HAZARDOUS WASTES IN SRI LANKA

- Pathway to ground water
- Risk to workers
- Impact on surface water
- Impact on atmosphere
- Impact on soil
- Biodegradability - persistency
- Fire hazards
- Transportation of emergency response
- Radioactivity
- Heavy metals
- PCBs
- Carcinogenic compounds
- Aromatic compounds
- Chlorinated solvents
- Infectious waste
- Corrosive waste
- Asbestos
- Cyanides
- Lead compounds
- Industrial solvents
- Pigments and dyes (toxic)
- Paints/coatings
- Biocides
- Drier and fixers

Annex III
PATHWAYS FOR HAZARDOUS MATERIALS TO IMPACT THE ENVIRONMENT IN KEY INDUSTRIES

Industry	Pathways				
	Surface Water	Ground Water	Soil	Air	Health
♦ Textiles • 75 inds • 250 emp	•Pigment •Heavy metal •Corrosives -acid -basic •Suspended solids •Solvents **	•Through improper discharge of effluent and sludges •Toxic compounds in sludges •Leachability	•Toxic compounds in sludges •Leachability	•Volatile compounds (aromatic) •Flue gases	•Skin irritation (Chemical reaction) •Respiratory problems (from dust/fibers; VC, corrosives) •Noise
♦ Pesticides • 12 inds • 50 emp	•Pesticide compounds -containers/ washing •Spills and off specs product handling and disposal **	•Pesticide compounds -containers/ washing	•Pesticide compounds -containers/ washing •Spills overuse	•Pesticide compounds -containers/ washing	•Pesticide compounds -Improper use of containers •Spills and off spec product handling and disposal •Overuse **
♦ Tanneries • 14 inds • 50 emp	•Cr (VI) •Suspended solids •BOD •COD •Sulfides •Salts **	•Cr(VI) •BOD •COD •Sulfides •General solid waste	•Cr(VI) •General solid waste	•Odor	•Cr(VI)
♦ Electro - plating • 45(approx) inds in Colombo	•Heavy metals •Cyanides •Solvents •pH •Oil & grease **	•Heavy metals •Cyanides •Solvents •pH •Oil & grease	•Leachability •Heavy metals •Cyanides •Solvents •pH •Oil & grease	•Volatiles •Polishing dust	•Heavy metals •Cyanides •Solvents •Ph •Oil & grease
♦ Fluorescent Light Bulbs • 4 inds • 200 emp		•Hg •Pb	•Hg •Pb •Thorium nitrate •Barium •On site waste disposal		•Hg •Pb •Thorium nitrate •Barium

Annex IV

HAZARDOUS WASTE MANAGEMENT

Infrastructure Needs Identified For Sri Lanka

1. Analytical

- Instrumentation for trace quantities
- Training in instrument use
- Sampling protocol
- Lab accreditation and quality assurance/quality control and training
- Number of laboratories
- Calibrant materials (demand driven)

2. Design/Build/Maintenance

- Number of (design) engineers
- Design capability and capacity (accreditation)
- Contract responsibility needs clarification (who is to blame when the equipment fails to meet specification?)
- Construction monitoring/management
- Design requirements underestimated
- Maintenance: - Training
  - Management focus

3. Economic/Financial

- Cost of analysis
- Cost of retrofitting pollution control
- Competitive concerns
- Tax credit incentives
- Lab/space constraints

♦ Key Priorities Among the Above Items

- Implementation costs of pollution control
- Space
- Awareness - workers
  - community
  - management
- Monitoring

Annex V
REVIEW OF A SPECIFIC CASE OF TECHNOLOGY APPLICATION

Waste Water Treatment

EG: Pugoda Textile Factory - Biological

Positive

- Plant designed for textiles
- Management initiative
- Govt financial assistance
- Public pressure - water use downstream
- Combined with domestic sewage
- Relatively cheap

Negative

- Improper operation to save operating cost
- Accumulate sludge removal
- Improper operation

Strategy to Promote Success

- Regular monitoring
- Tax incentives for proper operation
- Self monitoring of effluent with checks by CEA
- Must meet final parameter
- Awareness of "moral" responsibility
- Accountability for design and construction
- Penalties/enforcement

Annex VI
HAZARDOUS EFFLUENT TREATMENT

Treatment Technologies Currently Used in Sri Lanka

- Precipitation - some
- Flocculation - some
- Oxidation
- Reduction
- Neutralization - some
- Solvent recovery
- Hydrolysis

Factors Affecting or Constraining Application of Technology

- Technical and experience base (design capability)
- Hazardous waste awareness training
  - waste minimization
  - other issues
- Investigate impact on modern segments
- Prioritization of hazardous waste generators and enforcement actions by sector
- Development of Treatment, Storage, and Disposal (TSD) services capability & industry
- Enforcement and penalties
- Demonstration models
- Information

Solutions to Factors/Constraints

Technical and Experience Base

- University programs should include this in their MSc programs
- Short duration focused training
- Demonstration projects
- Technical exchange - information
  - engineers
- Private sector joint venture
- Environmental specialists in industry
- Research and development
- Technical training for enforcement and other agencies
- Strengthening, monitoring and analytical capabilities

Hazardous Waste Awareness

- Public
- Industry

- Technical advisory groups
- Radio and TV spots
- Pre investment environmental awareness - plan for regulations
- School programs
- Labor unions
- Community based programs
- NGOs
- Government sponsored workshops and newsletters
- Planning authority training - industry awareness
- Chambers of Commerce
- Industrial research institution outreach programs
- Professional association
- Pollution prevention plan for each industry

Enforcement and Penalties

- Identify responsible agencies
- Development of standards
- Training for enforcement agencies
- Legal - law and regulation advertised and promoted
- Penalties to provide incentive
- Interagency coordination
- Mechanism for changing technology
- Criminal penalties vs civil
- Political will

Investigate Regulations Impact

- Information
- Need for phase in
- Industrial segment focus
- Balance between what is possible and practical
- Demonstration project and guidelines prior to regulation
- Technology exchange
- Industry group consortium

Annex VII

EXISTING PROGRAMS WHICH ADDRESS INFRASTRUCTURE NEEDS

Analytical

- **CEA:** Lab accreditation
  Consultant accreditation
- **CISIR:** Analytical support for textile, agro and chemical industries
  OJT - lab instruction
- **MEIP/WB:** Funding for lab equipment

Technology

- **CEA:** 2 pilot WWT plants for rubber industry
  Waste minimization for textiles
- **CISIR:** Process design for textile, agro and chemical industries OJT --> design
- **MOI:** Information/technology network
  TIPPS
  Common treatment facilities - industrial estates and neighbors

Institution

- **NBRO:** Mixed wastes and landfill siting studies
- **CEA:** Training local authorities
  Toxic chemical inventory
  Pollution control guidelines for 7 sectors
  Emergency preparedness evaluation - large, hazardous industries
- **MEIP:** Link consultants with CEA staff and programs
- **MOI:** Management of industrial estates

Financial

- **CEA/MEIP:** "Scope" - studies and loans

Regulatory

- **NAREPP:** Industrial siting guidelines
- **CEA/MEIP:** Standards phase in program

Information

- **NAREPP:** Lead content in people in Sri Lanka
  Pesticides in vegetables and fruits
  Environmental awareness survey
- **CEA:** Industrial awareness programs
  School environmental club facilitation
  Local authority libraries
- **CISIR:** Kaluganga river effluent toxicity study
  Moratuwa industrial estate effluent study
  Textile industry effluent treatment
  Vehicle emission survey
  Impact study - agrochemicals
- **MOI/CISIR:** Library
- **Water Resources Board:** Ambient water quality study

ANNEX VIII

PARTICIPANT FEEDBACK ON TOPICS FOR FUTURE PROGRAMS

- Problems of the industries and laboratories
- Views of economists
- Laboratory QA/QC in hazardous waste analytical work
- Hazardous waste management technologies
- Seminar on hazardous waste management with the government and the private sector
- More specific discussion on hospital waste
- Detailed discussion or program on a strategy for Hazardous Waste Management in Sri Lanka
- A more comprehensive study on treatment plant designing for agencies involved in hazardous waste management
- Solid and hazardous waste disposal methods
- Risk assessment methods
- Treatment technologies relevant in Sri Lanka
- Infrastructure required to support hazardous waste management in Sri Lanka
- Treatment technologies