Bio-medical waste

Toxics Link
Factsheet
Number 21 / Sep 2004

Disposing immunisation waste in India

India has an extensive network of primary health care infrastructure as well as the world's largest Integrated Child Development Services (ICDS) programme. Childhood immunisations have been an important part of maternal and child health services since the 1940s. BCG immunisation (TB, meningitis and military TB) was started in 1948 and by 1951 was organised on a mass scale to cover all those below 25 years of age. The Fourth Five-Year Development Plan (1969-74) included plans for DPT immunisation of infants and pre-school children.

In 1978, as part of the national health policy, the government announced the Expanded programme of immunisation (EPI) followed in 1985-6 by the Universal immunisation program (UIP). The objective of these programmes was to reduce morbidity, mortality and disabilities by delivering free, easily available immunisation services to all children, as well as tetanus toxic (TT) injections for pregnant women. The targets of the UIP included providing coverage against the six immunisable diseases to at least 85 percent of all infants in the country by 1990. By 1990, all districts in the country were served by the UIP.

Immunisations are delivered at approximately 5.5 lakh outlets in India with 80 percent of these being rural in nature.

Multi-layered system of rural health care

- District hospitals: District hospitals are large hospitals, usually with bed strengths of over 300 beds, which are located at the level of the district headquarters.
- Sub-district hospitals: Sub-district hospitals are usually 100-300 bedded and are located at the level of the divisional headquarters in each district.
- Community Health Centre (CHC): This is a 30-bed hospital, which acts as a referral unit for four Primary Health Centres (PHCs). *There are 3043 CHCs in the country*.
- Primary Health Centre (PHC): A referral unit for six sub-centres. It has

AT A GLANCE

- **Immunisation injections in India amount to about 210 million a year, resulting in huge quantities of immunisation waste.**
- **Current methods of disposal of such waste revolve around incineration and open burning, techniques that release deadly dioxins and furans, as well as other pollutants, into the air.**
- **The planned introduction by the government of auto-disabled syringes will expand this problem greatly, and systemic solutions are needed.**
- **Successful non-burn options have been tried and tested in India.**
- **We need to implement such environment-friendly methods as part of the immunisation systems.**

around 4-6 beds, is manned by a medical officer in-charge and 14 subordinate paramedical staff and caters to a population of 20,000-30,000. *There are 22,842 PHCs in the country.*

- Sub-centre: The most peripheral contact point between the PHC and the community, the sub-centre is staffed by one female MPW (Multi purpose worker)/ ANM (Auxiliary nurses midwives) and one male MPW, and caters to a population of between 3,000 and 5,000. *There are 1,37,311 sub-centres in the country.*

(Source: Rural Health Statistics in India)

Disposal of immunisation waste: a massive challenge

Immunisation is part of the weekly routine of ANMs and is undertaken at various outreach locations under the respective ANMs. As the ANM is a part of the well-established health structure of the country, the waste generated at outreach clinics becomes an integral part of the bio-medical waste generated in sub-centres and PHCs.

Different types of waste generated in the process of immunisation are covered under different categories *(see table below)* in the Bio-medical waste (Management & Handling) Rules, 1998 and should be managed as prescribed.

Each year, some 16 billion injections are administered in deve-loping and transitional countries. Immuni-sation accounts for around 5 percent of all injections, with the remainder being administered for other indications, including injections of blood and blood products, and contraceptives.[1]

India alone administers 4.2 billion injections annually, with immunisation injections amounting to about 210 million. How do we manage the waste from 210 million syringes? Till recently, not much thought was given to managing immunisation waste.

India alone administers 4.2 billion injections annually, with immunisation injections amounting to about 210 million

Primitive technologies such as De Montfort incinerators are operated in India under highly unsafe conditions.

The most common practices resorted to were open burning of syringes at the end of the immunisation session, or burning them in the local incinerator.

The safety boxes made available through agencies such as WHO/UNICEF promoted the practice of dropping the syringe in the box and finally disposing of it by burning. These boxes are burnt either in a small pit or in the open. The final disposal of the box is a matter of concern since burning leads to several types of toxic air emissions, and is not compatible with the Indian Bio-Medical Waste (Management & Handling) Rules, 1998.

Another method used is to install small-scale, low-cost incinerators. But pollutants from incineration include the deadly Persistent Organic Pollutants (POPs) – dioxins and furans, which are especially dangerous because they bio-accumulate, bio-magnify, and are capable of being transported great distances, threatening public health and ecosystems around the world. Very low concentrations of dioxins have been linked to cancer, immune system disorders, diabetes, birth defects and other health effects.

Waste category	Description	Treatment option *(as per Rules/ guidelines)*	Disposal *(as per Rules/ guidelines)*
4	Sharps waste	Chemical disinfection/ autoclave/microwave/ hydroclave and mutilation	Recycling/ municipal landfill/ deep burial
7	Plastic waste	Chemical disinfection/ autoclave/microwave/ hydroclave and mutilation	Recycling/ municipal landfill
6	Bandages/ swabs	Alternate	Municipal landfill

Immunisation waste in the auto-disable era

The most significant development in this scenario is the Government of India's decision to introduce auto-disable (AD) syringes for all immunisation activities by 2005.

UNICEF and UNFPA had signed a joint statement in 1997 on the need to use single-use AD syringes and safety boxes in immunisation campaigns.[2] These single-use syringes ensure the safety of healthcare workers and community at large.

The case for AD syringes was bolstered by a study conducted by

1 www.who.int/mediacentre/factsheets/fs231/en/

2 Safety of injections; WHO-UNICEF policy statement for mass immunisation campaigns, WHO/EPI/LHIS/7.04 Rev.1, replaced by this statement, WHO/V&B/99.25

In-Clen for the Ministry of Health, which reported that around 65 percent of injections administered in India are unsafe. In other words, the country may be faced with 20 lakh new Hepatitis B cases, 4 lakh new Hepatitis C cases and 30,000 new HIV-positive cases, every year, purely from unsafe injections.

The Ministry of Health is also hopeful that, besides increasing the safety of injections, the introduction of AD syringes would help increase coverage from the present 60 percent to at least 90 percent. However, the introduction of AD syringes would mean an additional cost of Rs 36 crore per year on the vaccination programme, almost doubling the present vaccination budget of about Rs 40 crore.

Waste mismanagement in the new situation

The Expert Committee on Bio-medical Waste under the Central Pollution Control Board, which is responsible for approving any new technology for treatment of medical waste other than those already specified in the Rules, has ruled out the use of open burning as the treatment and disposal method for handling AD syringes. In its comments, the Board stated that the problems of emissions due to open burning are well known. Moreover, open burning even of municipal waste (garbage, dry leaves) is prohibited under Schedule-II of the Municipal Waste Rules, 2000.

In a comment made in its report on small-scale incineration, the WHO states that the combustion of sharps alone in small-scale incinerators does not remove all chlorine from the waste stream and prevent dioxin formation. The PVC seal between the metal needle and the polyethylene body remains as the chlorine source.

In the wake of these two observations, it is clear that AD syringes would not be allowed to be burnt in any form in the country.

Immunisation programmes need to design specific healthcare waste management plans

Routine immunisation waste generation has the characteristic of low quantities and scattered generation points. Low-cost treatment options for sharps and other infectious wastes, therefore, have focussed largely on burial, encapsulation and autoclaving (sterilisation by steam and pressure). Shredding of waste and landfill disposal is required following autoclaving.

WHO states that the combustion of sharps alone in small-scale incinerators does not remove all chlorine from the waste stream and prevent dioxin formation. The PVC seal between the metal needle and the polyethylene body remains as the chlorine source

Case studies of successful non-burn immunisation waste management initiatives

Himalayan Institute Hospital Trust, Dehradun, Uttaranchal

Himalayan Institute Hospital Trust (HIHT), a 700-bed multi-disciplinary hospital in Uttaranchal has successfully proven that effective planning can help manage the huge quantity of immunisation waste generated at outreach locations. The Rural Development Institute (RDI) is the rural outreach wing of the HIHT, which has been undertaking immunisation activities since 1994. *The hospital has managed waste generated from approximately 3,34,920 syringes over a period of eight years.*

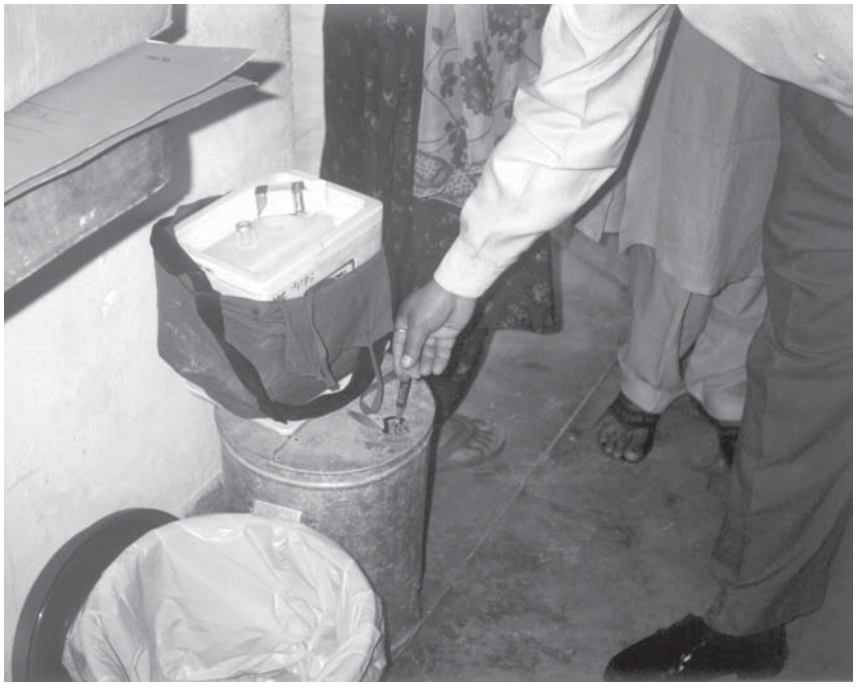
At the outreach clinic, the health workers carry a bucket with yellow liner, to contain the cotton swabs generated, and a sharps container for the injection units. After administering an injection, the injection unit is dropped in the sharps container. Both the containers are brought back to the centre. Cotton swabs are incinerated and contents of sharps containers are autoclaved and shredded.

The treated and shredded waste from the hospital is handed over to the waste contractor every alternate day. The contractor takes this waste to his facility and segregates the plastic from the metal. The plastic is dried and sold to recycling plants and the metal waste is deep buried at an identified site.

Key Strengths

- The system has successfully run for eight years
- Centralised treatment and disposal of waste generated at scattered sources

The sharps container being used at an outreach clinic.



- No extra transportation cost associated with waste management
- Environmentally safe treatment
- Material recovery through recycling plastic
- Economic benefits

Program for Appropriate Technology in Health (PATH) partnership project with Government of Andhra Pradesh

The partnership project between PATH and the Andhra Pradesh government aims at creating a 'model immunisation programme' to incorporate new policies, methods and procedures for modern immunisation systems. The state of Andhra Pradesh (AP) has started using AD syringes in its immunisation programme. In a pilot project spanning six months, PATH introduced 250 Balcan needle-cutters in Mahbubnagar district of AP. It conducted training programmes to make the staff aware of the method to use the cutters and to dispose of the waste generated. The government complemented the efforts of PATH by constructing sharps pits in all the district PHCs, to ensure a place where the sharps collected can be emptied.

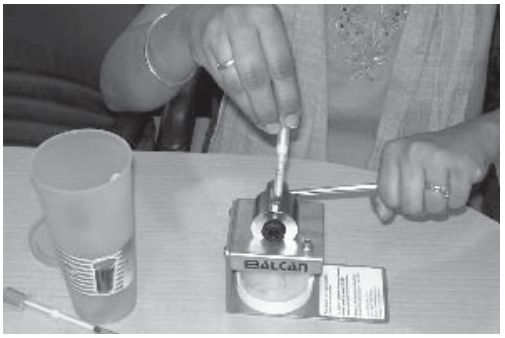
The plastic component of the syringes was collected for six months and at the end of this period the bulk waste was handed over to a centralised facility, which treated and shredded it before disposing of it. *Around 1.7 million syringes were disposed of during the pilot project.*

The needle-cutters are currently made available only at the PHCs. When an ANM does any immunisation at sub-centres/outreach locations, she carries the syringe back (either the same day or the following day) to the PHC in a puncture-proof container. The ANM uses the needle-cutters to destroy the used syringes. The plastic component is stored in red-coloured plastic bags, while the sharps are put into the pit.

There has also been a format designed for reporting a needle-stick injury, and the nurses have been trained on the importance of prevention of such injuries as well as of reporting any which occur.

This model has successfully demonstrated that non-burn solutions work well enough for routine immunisation settings.

The Balcan cutter in use – the puncture-proof sharps container is seen to the left.

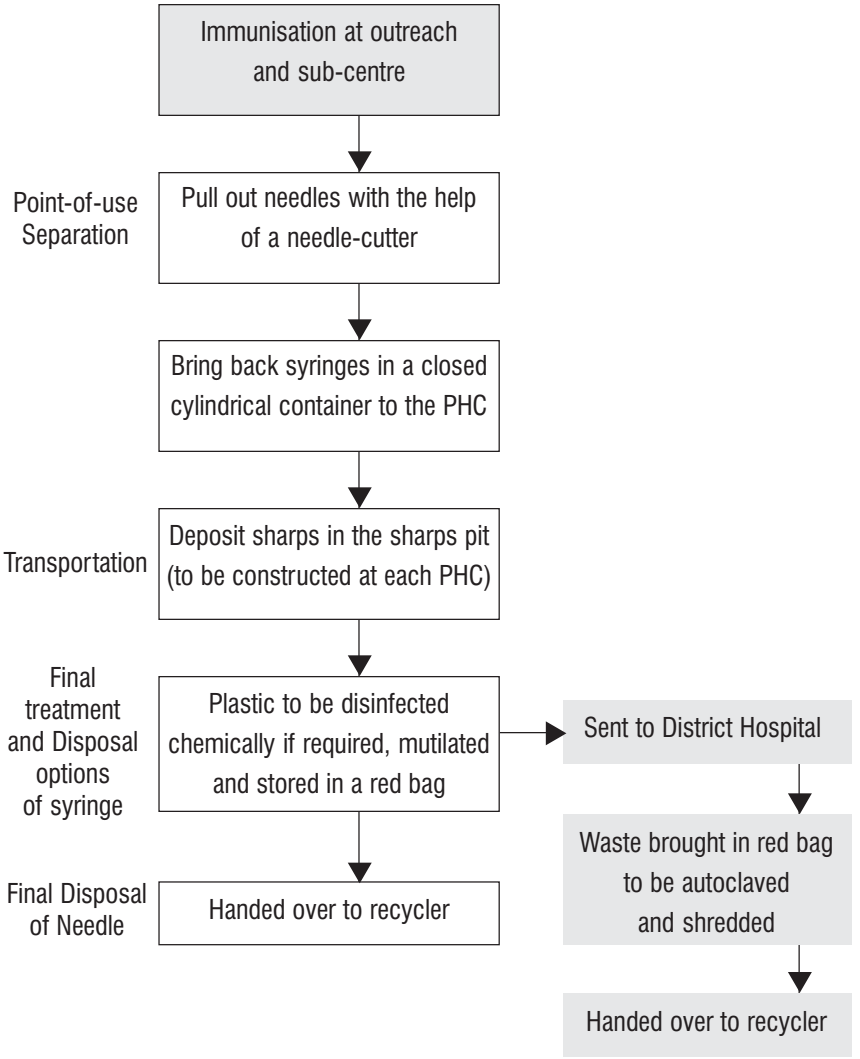


Key Strengths

- Centralised treatment and disposal of waste generated at scattered sources
- Environmentally safe treatment
- Material recovery
- Training of staff on safety issues
- Separation of needle from plastic part of the syringe
- Accident reporting, needle-stick injuries recorded
- ANM-friendly

Burning, which has been used as one of the main methods so far, results in the emission of deadly gases, and needs to be done away with

Recommended immunisation waste management process



The Ministry of Health is also hopeful that, besides increasing the safety of injections, the introduction of AD syringes would help increase coverage from the present 60 percent to at least 90 percent

Comparison of various methods for processing/disposal of immunisation waste[3]

Methods	Strengths	Weaknesses
Encapsulation A process in which full safety boxes or disinfected needles are placed within high-density plastic containers or metal drums. When a drum is full, an immobilising material such as cement or clay is added and the container is disposed of in landfill sites or waste burial pits	▲ Simple ▲ Inexpensive ▲ Low-tech ▲ Prevents unsafe needle and syringe reuse ▲ Prevents sharps-related infections/injuries ▲ Can be effective interim method in rural areas	▼ No volume reduction ▼ Requires land
Needle removal / pullers	▲ Prevents needle reuse ▲ Reduces occupational risks to waste handlers ▲ Plastic and steel may be recycled for other uses after treatment ▲ Manual technologies available	▼ Potential needle-stick injuries during removal ▼ Safety profile not fully established
Autoclave, steam sterilisation	▲ Autoclaves have been used successfully for decades to treat sharps and non-immunisation healthcare waste ▲ Sterilises used injection equipment ▲ Plastic may be recycled for other uses after separation ▲ They cost less than incinerators to build, operate and maintain ▲ Do not need constant supervision ▲ Work well at provincial or district level ▲ They are available in a wide range of capacities ▲ When used with shredders, they remove both physical and biological hazards associated with sharps waste	▼ Higher capital cost than other options ▼ Requires electricity ▼ Higher operational cost ▼ Needs final disposal ▼ Requires further treatment to avoid reuse , (for example, shredding)
Needle destroyer / hub cutters The needle is inserted into a closed box and makes contact with an electrical device that destroys it and/or cuts the plastic hub with the needle	▲ Almost completely destroys the needle ▲ Plastic syringe can be recycled after disinfection	▼ Requires electricity ▼ Sterile piece of the needle remains attached to the syringe in needle-cutters ▼ Various models are available commercially
Sharps pit Pit well-covered, with a narrow opening	▲ Low-cost ▲ Simple ▲ Prevents needle reuse ▲ Prevents sharps-related infections/ injuries to waste handlers/ scavengers	▼ Space availability ▼ Depth of ground water needs to be kept in mind ▼ May fill up faster than expected

3 Environmentally responsible management of healthcare waste with a focus on immunisation waste

International efforts in the field provide similar lessons

Philippines Measles Elimination Campaign

The adverse health and environmental impacts associated with incineration, the Stockholm Convention on POPs, and the banning of incineration under the 1999 Philippine Clean Air Act challenged healthcare providers to seek non-incineration methods for treating medical waste in the Philippines. The Philippines became the first country to deal with waste from a nationwide vaccination programme without resorting to incineration or open burning. The Philippine Follow-Up Measles Elimination Campaign (PMEC) targetted an estimated 18 million children during the month of February 2004. In a little over a month, the PMEC generated an estimated 19.5 million syringes collected in 162,000 safety boxes, amounting to about 810,000 litres or 130,000 kg of sharps waste. Also produced were an additional 740,000 litres or 72,000 kg of non-hazardous waste (empty vaccine vials and ampoules, syringe wrappers, empty vitamin capsules, cotton swabs, syringe caps and packaging).

The measles campaign undertaken by the Department of Health, in collaboration with Health Care Without Harm and the WHO, presented an opportunity to demonstrate and document waste management and disposal without incineration or open burning during a mass immunisation campaign.

The following methods were used for treatment and disposal:

- Treatment in an autoclave facility
- Treatment in a microwave facility
- Encasement in a concrete septic vault
- Burial in a waste pit.

Challenges of immunisation waste in India

- Scattered waste in low quantities, and at remote locations
- Training of staff issues
- More than 550,000 sites nationally
- Adequate supply/manufacture of needle-cutters /needle pullers/sharps pits not assured as yet
- Transportation of waste back from remote areas to PHC or DH

Principles to be followed

- Prevention of needle-stick injury to worker
- Immunisation waste to be treated at point of use where possible, or where collection system is not established
- Immunisation waste to comply with national regulations related to medical waste

In a recent meeting held to discuss waste disposal options, various agencies and the ministry agreed on promoting the use of non-burn technologies to ensure that waste management is in compliance with the Bio-medical Waste (Management & Handling) Rules

Recommended immunisation waste management policies

- Follow national legislation: Immunisation waste, which includes sharps and solid wastes, is covered under category numbers 4 and 7 of the Bio-medical Waste Rules, and should be managed as per the provisions of this Rule.
- Integrated planning and budgeting: The planning for waste management should happen simultaneously with the planning of immunization campaigns. Waste management is a basic public health concern and needs to be integrated from the beginning of the project planning.
- Disinfect/mutilate and recycle: The focus should completely shift from burning of the waste to treating and recycling it wherever possible.
- Outline procedures clearly: A national guidebook/ SOP should be made for details on handling immunization waste in routine immunization/immunization campaigns.
- Use appropriate low-cost and safe disposal: Encourage low-cost environmentally safe treatment technologies for waste management.
- Replicate success models: Adopt successful models of non-burn immunization waste management.
- Handle training issues: Training of immunisation providing staff should be expanded to include safe practices in collection and treatment of waste.
- Product evaluation: Equipments such as needle cutters and pullers need to be standardised, to ensure that they function for an effective period of time, such as a year. Associated issues of costs, production capacity in the country, equipment availability, etc can be evaluated by a group.
- Micro planning: Since there are several types of situations on the ground and various site-specific requirements, the processes should be done through ground level micro-planning which will also ensure involvement of a larger number of local stake-holders.

Compiled and written by Ratna Singh
with inputs from the Toxics Free Health Care team

For more information, please contact:

RATNA SINGH
Srishti/Toxics Link
H2 Jungpura Extension
Ground Floor
New Delhi 110 014
Tel: +91-(0)11-24328006/0711
E-mail: ratna@toxicslink.org

Designed and produced by Splash! Commuications, *e-mail* makeasplash@vsnl.net