

IS ALL WELL WITH THE HEALTHCARE SECTOR?



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Wellness and Carbon footprint guide for the Healthcare Industry

Today when the world is talking about climate change and the associated threat to life on planet earth, when sustainability of every activity is being discussed, it is time that healthcare too gets introspective and starts counting its footprints- the carbon footprints.

Each and every activity we undertake has a carbon footprint however, with our intellect and planning we can minimize these. Hospitals are considered big energy, water and chemical guzzlers. It is very important that this sector works out ways to holistically heal itself with respect to the environment. Some things which can have a significant impact on climate change and can be easily worked upon are:

■ Waste Management

Minimum impact waste management, Environment friendly waste treatment and disposal, Yellow bag waste reduction, Waste reduction and recycling, Pharmaceutical and toxic chemical waste management, environmentally preferable purchasing etc.

■ Resource Conservation

Water, Electricity

■ Green building Concept

High performance environmental buildings

Health care in America, including activities such as hospital care, scientific research and the production and distribution of pharmaceutical drugs, was found to produce 8 percent of the country's total carbon dioxide output despite accounting for 16 percent of the U.S. gross domestic product. The analysis found that hospitals were by far the largest contributor of carbon emissions in the health care sector, which was attributed to the high energy demands needed for temperature control, ventilation and lighting in large hospital buildings. The second largest contributor to the overall carbon footprint was the pharmaceutical industry.¹

In the present context we would discuss medical waste management in greater details and not dwell on other aspects though all of these are equally critical.



A 700 bedded hospital managing its waste wisely can reduce its carbon footprint by 1300 MTCO₂/yr.

SITUATION OF MEDICAL WASTE MANAGEMENT IN INDIA

Bio-medical Waste (Management and Handling) Rules have been in force for last fifteen years. For long it's been cited that segregation is the key to medical waste management. Concerted efforts for training of the entire hospital staff to ensure good segregation, lesser dependence on technology, emphasis on the use of non-burn technologies and better material recovery options have been the major focus. All these minor inputs can lead to a major change in the type of impact that these hospitals would be making on their environment and in turn climate change.

Improperly managed waste has grave impact on environment; open dumping and land filling of medical waste not only leads to the spread of infections but also releases methane which is a green house gas. Similarly incineration of waste would lead not only to the formation of dioxins and furans, which are carcinogenic, but also produce green house gases like CO, CO₂, NO₂.

A hospital can minimise its carbon footprints by following few simple steps:

1. Work on the training of its staff to achieve appropriate and maximum segregation.
2. Minimise yellow bag waste and ensure that only the body parts and anatomical tissues go for incineration.
3. Recycle all the recyclable waste after appropriate disinfection.
4. Ensure decentralised management of municipal waste – by adopting procedures like composting and recycling.
5. Minimise generation of toxic and hazardous waste and managing such waste through authorised recyclers.

SEGREGATION

Centralised facilities have long been complaining of receiving mixed waste. There is a lot of plastic in the yellow bag stream. Segregation as envisaged in the rules was taking place in only 29% of the sampled hospitals.²

Several agencies have time and again come out with reports that Hospital waste is 15-20% infectious/hazardous waste and the rest 80-85% is general waste. Thus if the hospitals get their act right and segregate this 80- 85% waste effectively from the infectious waste (and also segregate their bio-medical plastic waste and send it for recycling) and dispose it off through recycling/ composting (depending whether the waste is bio-degradable/recyclable) they end up saving the environment.



CALCULATING CARBON FOOTPRINTS FOR WASTE MANAGEMENT BY A 700 BEDDED HOSPITAL

Considering the said hospital which generates- 2.5 kg/bed/day (municipal waste) 208 gms/bed/day (autoclavable waste), 297 gms/bed/day (incinerable waste) (which comes to 83%, 7% and 10% respectively), judicious waste management would lead to-

- GHG Emissions from Baseline Waste Management Scenario (MTCO₂E): 491
- GHG Emissions from Alternative Waste Management Scenario (MTCO₂E): 809
- Total Change in GHG Emissions (MTCO₂E): -1,300

These calculations are for the waste generated by a 700 bedded hospital and assumes baseline scenario as one in which the hospital mixes everything and throws its waste in the municipal dump from where it is land filled. The alternative scenario is what is practiced in the hospital, i.e. everything is segregated according to the type of material and given for recycling/ composting. These calculations have not accounted for the source reduction and waste minimization drive of the hospital. So the annual reduction in emissions from this single hospital would be to the tune of -1300 MTCO₂E.

INCINERATION AND AIR POLLUTION

In the history of incineration monitoring in India it is evident that these machines have never worked according to the rules, i.e the temperatures are never maintained at the desired levels and quenching requirements are also not met. In India incinerators mostly work at the optimum temperatures for dioxin and furan formation i.e 200-600°C. Mutagenic Emission rates (revertants/kg of waste fed) for medical waste incinerations were as high as 10,000+/-2915 and there was a dramatic increase in mutagenic potential during burner failure.³

Thus considering a rise in cancer rates in the country, a strict control on the amount of waste being incinerated and the temperature conditions at which they run are very critical.

Hospitals should focus on yellow bag waste reduction. Hospitals can also make an attempt to monitor the incinerators of the Centralised facility where their waste is treated.

Switching to alternatives to incineration and providing financing for such a transition has been recommended by UN officials as essential to protecting



the right to health and other basic human rights. The Stockholm Convention on Persistent Organic Pollutants and the World Health Organization also recommend the use of alternatives to incineration to reduce global pollution with dioxins and furans.⁴

YELLOW BAG WASTE REDUCTION

In the Rules incineration is meant for anatomical tissues, body parts and soiled waste, but the Centralised facility guidelines which came some time later, limits incinerator as a treatment option from five to just 3 categories of waste. According to the guidelines soiled waste (i.e. soiled dressings and bandages) should not be incinerated.

Cotton (which is mostly bleached- thus having good enough chlorine content) continues to be incinerated. Emission yields of CO and CO₂ from batch combustion of cotton are respectively, comparable and higher than those from latex, despite the fact that the carbon content of cotton was half that of latex. This is indicative of the more effective combustion of cotton. Yields of NO_x from batch combustions of latex and cotton accounted for 15% and 12%, respectively.⁵

Thus hospitals should ensure that cotton and bandages are put into red bags and autoclaved rather than incinerating them.

India's medical sector would end up saving -272,132MTCO₂E emissions in the environment, by recycling its plastics rather than incinerating it.

Recycling a ton of paper saves about 24 trees, which absorb 250 pounds of carbon dioxide from the air each year

RECYCLING AND RESOURCE RECOVERY OF MEDICAL PLASTIC

Most of the hospitals are segregating their plastic waste and disinfecting it, using bleach/ autoclave/ both (Mutilation is ensured before sending it for recycling to avoid any illegal reuse). Thus generating good revenues for the hospitals.

Some hospitals are trying to maximise their gains by understanding the needs of the recycling sector. After disinfection, plastic waste is segregated into 6-7 different categories and then this segregated plastic is shredded. This is being done on the advice of the recyclers who showed constraints of picking up mixed plastic waste.

Estimated plastic Bio-medical waste generated in India			
Plastic/bed/day (kg)	Total no. of beds in India (CPCB Report 2010)	Plastic (in hospitals) used in India/day (kg)	Plastic used /annum (Ton)
0.208	1420563	296018	110447

Some hospitals and healthcare professionals are not very particular about what they throw in the yellow bags. Comparing the two scenarios – Base-line (all the plastic medical waste is incinerated) and Alternative (all the plastic medical waste is recycled) India's medical sector would end up saving -272,132MTCO₂E emissions in the environment, by recycling its plastics rather than incinerating it. (This is an underestimate because it does not account for a lot of plastic used on OPD patients).

Many technology proponents have time and again proposed methods where one can forego segregation (cited as inconvenient and cumbersome). These technologies mix the entire waste, treat it chemically/ by other methods, shred it and then landfill the entire mix.

Choosing recycling rather than land filling option has major economic gains, saving -124,237 MTCO₂E emissions / year. Thus recycling emerges as the best viable option for management of plastics generated in the hospital.⁶

One ton of recycled plastic saves 16.3 barrels (685 gallons) of oil, 98 million Btus of energy and 30 cubic yards of landfill space (Mississippi Department of Environmental Quality). Recycling a ton of plastic also saves about as much energy as is stored in 197 gallons of gasoline (Ohio Department of Natural Resources).⁷

Similarly glass, cardboard, paper and metal waste are sold to recyclers to get revenues for the hospital and at the same time minimising the footprints of the hospital.

Recycling a ton of paper saves about 24 trees, which absorb 250 pounds of carbon dioxide from the air each year.⁸ Various practices like going paper less on requisitions, leave forms, office memos and notices, shredding and sending confidential documents for recycling can save a lot of paper.

Training as a key to improve your Carbon Index

Training would directly lead to the emission reductions through segregation, but there are several other gains like energy, paper, chemical and water conservation, if these issues are properly addressed in training sessions. Also some practice issues can directly benefit eg a needle stick injury. This may sound weird, but every needle stick injury has a big carbon footprint.

Social, Economic and Carbon footprint of a needlestick injury

Healthcare workers incur 2 million needlestick injuries (NSIs) per year that result in infections with hepatitis B and C and HIV.⁹

World Health Organization identifies a number of factors which may contribute to the occurrence of NSI including the lack of availability of safer needle devices and sharps disposal containers, the lack of access to or failure to use sharps containers immediately after a procedure and the continued recapping of needles after use. Globally,

RESOURCE CONSERVATION

Energy

As a sector, hospitals and health care facilities account for a disproportionate amount of energy use and emissions. Hospitals use about 2.5 times the amount of energy as a similar-sized commercial building, because they are open 24 hours a day and have extra commitments on air filtration and circulation, air cooling and waste management.¹²

Pune-based 350-bed Jehangir Hospital saves an impressive Rs 46.25 lakh per annum due to its energy savings.¹³

Ganga Ram Hospital's endeavour in reducing its energy consumption has led to annual emission reduction of 670MTCO₂.

Through a variety of strategies, hospitals generate and maintain awareness of their energy consumption.

To reduce use of natural resources, some initiatives include¹⁴:

- Upgrading heating, cooling and ventilation systems;
- Installing energy-efficient motors, equipment, lighting fixtures, installing compact fluorescent lamps (CFL) and light emitting diode lamps (LED);
- Using automated control systems that manage energy use;
- Conducting annual comprehensive energy audits; and
- Simply turning off lights when leaving the room or turning off computers at the end of the day.

the report estimates that 0.5% of health care workers are exposed to HIV annually, corresponding to an expected 1000 new HIV infections from occupational exposure.¹⁰

Once an exposure happens the HCWs are advised to report the injury and they might be put on a PEP. Post-exposure prophylaxis (or PEP) means taking antiretroviral medications (ARVs) as soon as possible after exposure to HIV (but certainly within 72 hours), so that the exposure will not result in HIV infection. Treatment with 2 or 3 ARVs should continue for 4 weeks, if tolerated. PEP reduced the rate of HIV infection from workplace exposures by 79%. However, it is still possible for health care workers who take PEP to get HIV infection. PEP costs between \$600 and \$1,000 (depending on the severity of exposure). The medications have serious side effects. About 40% of health care workers do not even complete PEP because of the side effects.¹¹

Thus any needle stick injury is taxing for the recipient, in terms of physical and mental trauma, and is high on its carbon footprint as well. Economically and environ-

mentally a PEP regime costs high. Pharma processes are environmentally taxing, typical E-factors or MI's are greater than 100. That means the typical API process consumes more than 100 kg of materials to produce 1 kg of API.

Thus a needle stick injury should be strictly avoided with proper training and waste disposal practices in place. Two of the hospitals in India, had worked out innovative strategies to counter the menace of unmanaged needles in the ward. One of the hospitals imposed a fine of Rs.50/- on all nurses on duty in a ward where an undestroyed / recapped needle-syringe was found. The other cancelled half day leave of all the staff involved. A single needle stick is a big personal and environment disaster and thus should be taken very seriously.

Other than this the hospitals can think of investing in areas like

- Energy Conservation
- Water conservation
- Green Building concept

Water

Water use in hospitals reflects the services they provide, and varies by as much as 40 to 350 gallons per capita per day, depending on the facility type. Using the Massachusetts data as a representative example, the percentage of water dedicated to specific uses falls into the following categories: 42% Sanitary, 23% HVAC, 14% Medical Processes, 9% Food Service, 5% Laundry.

Some hospital initiatives which encourage water use reduction include:

- Installation of low-flow fixtures and components where possible;
- Using state-of-art washing machines that reduce water consumption and eliminate the need for drying;
- Closely analyzing water treatment for the cooling/heating system; and

Green Buildings

Green buildings offer various environmental, health and economic benefits:

Tangible benefits

- Energy savings : 40-50%
- Water savings : 20-30%

Intangible benefits

- All good aspects associated to green- Better Indoor ambience, Day lighting & views, Improved health and productivity.

Health and Safety benefits

- Enhance occupant comfort.

Improve Productivity of occupants

- 12-15 % improvements documented in schools & other buildings.

SIR GANGA RAM HOSPITAL, Delhi- A Case Study



The hospital has invested a lot of time and energy in managing its environment plans.

Some of the steps that the hospital has taken are -

- **Waste Management** - With diligent planning and training the hospital has managed to achieve good segregation and management of its medical ,municipal and toxic waste, resulting in significant emission reductions.
- **Disposal of E-waste** -Talks are on for hand-

ing over E-waste to an authorised recycler to ensure environmentally friendly recycling.

Mercury free

The hospital has phased out the use of mercury based medical instruments, and the mercury waste has been sold off to equipment manufacturers.

Plastic bags

Hospital is in the process of replacing plastic bags with paper bags for giving reports.

Environment Monitoring Programme

Energy Management
Water Management
Fuel Management
Environment Waste Management

Energy Management

To promote energy saving and conservation of resources, the hospital has made an Energy Management Policy and communicated it to all employees so as to encourage their involvement through training and participation. To achieve reduction in energy, following measures have been adopted: Installation of Solar Water Heating System in new buildings. Installation of VFD in Pumps of Laundry and Water Treatment Plants. Regulating the hours of lighting in various buildings. Installing capacitor bank thereby maintaining power factor at 0.99 on continuous basis. Replacing ordinary lights with CFL / electronic blasts. Centralized AC Plant for old building.

- Research shows patient recovery much faster, Connectivity to outside environment, Better Daylight and Views.

Better Indoor Air Quality

- No sick building syndrome, regular CO₂ monitoring, increased fresh air ventilation

Kohinoor Hospital: Mumbai- Actual benefits achieved:

- 35 % Energy Savings
- Green Power from Wind Mills and Solar hot-water generation

Heat Reclaim System with VAV- Higher efficiency than conventional systems.¹⁵



SOLAR PANELS IN SIR GANGA RAM HOSPITAL, DELHI

Solar Water Heating System and a Centralized AC plant alone led to energy savings accounting to emission reduction of 670MTCO₂/year in the hospital.

Solar Water Heating System of around 30,000 LPD in the hospital leading to energy savings of 5,00,500 units per year and a Centralized AC plant leading to an energy saving of 1,200 units per day on 12 hours operations amount to saving of approx. 4,32,000 units in an year. This translates into 670MT of carbon dioxide emissions saved/year.

Water Management

With the overall objective to reduce water consumption in the hospital a STP has been installed. The capacity of STP is ~1000 KL/day. The treated water is used in horticulture & flushing in new buildings, for which separate

pipes are laid. Efficient cooling towers have been installed and natural draft cooling tower. The hospital has 2 water harvesting plants.

Fuel Management

To reduce fuel consumption (HSD), regular check-ups are done to check the leakages. B-check of DG sets are done at the scheduled timings to achieve best efficiency. Nozzles for fuel spray are regularly cleaned and replaced during annual inspections. Air monitoring of DG sets and boilers are done, as per the government norms.

Air Pollution

All the Chimneys in the hospital's DG sets of 1600 KVA are upto a height of 30 meter as per the norms of DPCC.

Others

Eco-friendly refrigerant are being used in Chillers

Disposal of used oil-The used oil from DG sets, compressors, etc. are given to a dealer, authorized by Delhi Pollution Control Committee for recycling after treatment.

Hospital is No Smoking and No Honking zone and Plantation of trees is an ongoing exercise.

Type of Waste	Amount Generated (Short tons)	Type of Treatment Baseline	Type of Treatment alternative	Estimated Emission Reduction (MTCO ₂ E) / Water Harvesting
Municipal Waste (excluding Bio-med waste)	956.8364	Mixed and landfilled	Segregated (recycled/composted)	1140
Bio-medical plastic waste	58	-	-	59
Area of intervention	Amount Used	Amount saved	Reasons for saving	Estimated Emission reduction (MTCO ₂ E)
Energy	-	932,500 (kWh)	Solar heating, centralised AC plant	670
Water	1000 (KLD)	350(KLD) treated and reused	STP plant	-
Rain water harvesting	Amount harvested	-	-	9018m ³ /year

ENDNOTES

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