

# Green Operations Practice of Hospital Medical Waste Management: A Case Study

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## Article Info

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## Abstract.

Green operations is a concept with regard to environmental management strategies. The purpose of this research is to explore the empirical green operations activities found in the literature, and to develop a framework for formulating appropriate strategies for hospital green operations especially with regard to the management of medical waste it was reviewed with the concept of green operation of hospital. This research will be conducted with a qualitative explorative approach and case study research. The research case is hospital which start to implement green operation in medical waste management. After providing a background discussion on Green Operations Management, case study research conducted in the hospital medical waste management. The case study analysis conducted according to a specific conceptual model of green operations especially in waste management. The results indicate that The hospital has begun to implement green operations specifically with regard to managing medical waste. The suitability of the hospital program with the Decree of the Indonesian health minister No.1204 of 2004, indicated by the fact that at present the hospital has fulfilled 6 of 9 points for minimizing medical waste. In the sorting section, it has fulfilled 4 of 6 points. The hospital has also fulfilled 3 points in the transportation section. There are 7 points that explain how to process, destroy and dispose of hospital solid waste.

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## I. Introduction

High environmental risk industries, including chemical, plastic, automotive, and heavy engineering, have always considered improvements in environmental performance as one of the basic competitive priorities, alongside lower costs, manufacturing lead-time, and quality [1]. Environmental quality has been acknowledged as the major criterion in choosing a healthcare building [2]. Implementing green practices is not just a social obligation but also a catalyst for green environmental regulations and growing demands [3]. Sustainability principles have been rooted in society; citizens include sustainability in their values. During the past decade, citizens have become familiar with green dilemmas and the challenges of social diversity. The assessment of environmental

impacts in healthcare is still at an early stage, both at the level of individual hospitals and of the health system as a whole, and do not yet provide sufficiently detailed information to guide decision making in healthcare [4].

The hospital is a professional health care institution whose services are provided by doctors, nurses, and other medical experts. The hospital is also one of the biggest waste producers that has the potential to cause pollution to the surrounding environment which can harm the community and the hospital itself. Increasing awareness to address environmental issues around business operations has received great attention, both from academics and practitioners, regarding green operation

strategies, such as green design, green purchasing, green supply chain, and green manufacturing. The green operations action also taken by hospitals. The actions can be classified in the following six general categories: reducing paper consumption, reducing fuel consumption, reducing electrical power consumption, reducing hazardous waste, reducing non-hazardous waste and reducing direct GHG emissions. The green hospital concept has an orientation as a building that has environmentally friendly and answers the demands of complete, comfortable services and a safe hospital environment.

Previous studies of green healthcare have investigated different issues arising from its practices, examined the barriers to healthcare waste management and the strategies and tactics that were adopted to surmount them [5]. The green performance indicators have been classified into financial, operational and environmental kinds. The financial kind includes indicators such as profitability and reduced costs. The World Health Organization defined healthcare waste (HCW) as the byproduct generated while delivering healthcare services, which should be treated as a special waste [6].

Hospital waste is one source of contamination and pollution, which can cause disease in living things, especially humans. So special procedures are needed in terms of treatment and disposal methods. Every activity carried out by the hospital has produced various types of waste ranging from liquid, solid, and gas in the form of medical and non-medical activities. This waste will have an impact on the health of patients, visitors to hospitals, communities around hospitals, good hospital officers who handle waste directly or not handling waste, and

the environment. Therefore, a method is needed in managing medical waste. Research on solid medical waste has been carried out in Federal Capital Territory, Abuja, Nigeria. From a survey conducted on 5 hospitals, the results obtained showed that the waste disposal techniques used in the management of solid waste were burning, burial in hospitals, burning in open pit, and disposal of their waste to municipal landfills, microwave irradiation and separation. The results showed that 18% burned solid waste in locally constructed brick incinerators without adequate environmental protection, 36.3% only dumped their waste in the Abuja municipal landfill (this waste was found to be unprocessed before being disposed of in trash in garbage dump). 9.1% bury their solid waste, while the remaining 36.3% are burned in open holes [7].

Based on data from KLHK as of July 2018, of the 2,800 hospitals in Indonesia, only 93 hospitals already have incinerator operating permits with a total installed capacity of 50 tons per day ([www.greeners.co](http://www.greeners.co)). The research was carried out through observation on medical waste handling practices in local hospitals. Furthermore, it will be analyzed how far the hospital has implemented a green operation compare to the handling of medical waste through green operation assessment criteria for handling hospital medical waste.

## **II. Research Method**

This research will be conducted with an explorative qualitative approach, a single case study. Qualitative research is a type of research that produces findings that cannot be achieved using statistical procedures. The research was conducted on the waste management process in a C-type hospital using the green operation concept, focused on all medical waste

processing activities starting from monitoring, collection and storage, sorting, transportation, temporary disposal sites, and final disposal sites. Data collection is carried out through observation of medical waste management processes, interviews with trusted informants such as team leaders of waste management processes, general managers and human resources managers. Secondary data includes implementation reports, recapitulation reports on the amount of medical waste, reports on recapitulation of the number of patients, and laws and regulations in Indonesia.

Figure 1 shows the phases of the research which occupied five stages. The first was preliminary research; the next, identifying the research problem and objectives; then conducting data collection and field observation; Develop a map of the flow of medical waste handling processes; and, finally, the data analysis according to the green operations hospital.

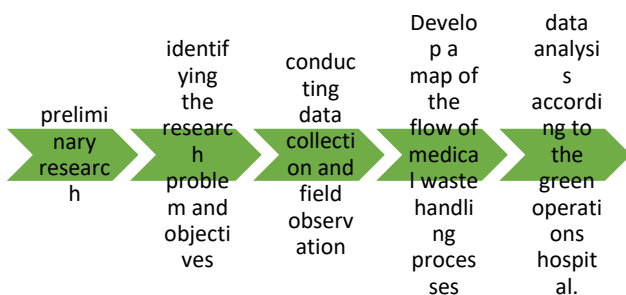


Figure 1 : The research methodology phases

First phase: Preliminary research. Conduct a preliminary survey, by visiting the hospital to get a situation about the condition of the hospital, the waste treatment process carried out by the hospital, and understand the problems to be studied.

Second phases: identifying the research problem and objectives. Determine the purpose of the

research based on the formulation of the problem and the benefits obtained from the research for the Hospital

Third Phases: conducting data collection and field observation. Conduct field studies and related documents, and conduct interviews with research informants consisting of various related internal parties of the hospital.

Fourth Phases: Develop a map of the flow of medical waste handling processes. Make a process flow map starting from the collection of all waste, separation of medical and general waste, separation of hazardous and harmless medical waste, the process of transferring waste to transportation along with travel routes to the location of final landfills, and processing or decomposition of medical waste in final landfills.

Fifth Phase: data analysis according to the green operations hospital. Assessing waste management and hospital environment in accordance with the categories in the Green Operation / Green Hospital. Communities.

### III. Analysis and Result

In this section will present the research result. The result are presented in three parts.

#### *Part-1: The Medical waste management process of case hospital.*

Based on the documentation that has been done, the hospital has UKL\_UPL documents (environmental management efforts and environmental monitoring efforts) and B3 Waste Temporary Storage Site (TPS B3) and Liquid Waste Treatment Plant (IPLC). and has been issued a Technical Recommendation letter from the Department of Environment and Hygiene of local Regency for TPS B3 and

IPLC in 2018. However, when this research was conducted, the UKL\_UPL document was being revised due to a change in nomenclature (title) of the activities of General Hospital which initially type D became Type C General Hospital. The medical waste management policy is also contained in the Standard Operating Procedure (SPO) document. In addition to the documents that have been owned by the hospital, other guidelines that can be used as references in conducting medical waste management and hospital policies.

### **Medical Waste Management Process**

#### **Monitoring,**

The monitoring process is carried out by janitors to see whether medical and non-medical waste has been filled with 2/3 of the trash in one day. Monitoring is carried out thoroughly in every room in the hospital.

"Around 6 o'clock I started to go around all the rooms. After that, the kids collect the garbage."  
(Team leader coordinator)

#### **Waste Collection**

After monitoring, the next activity is collecting waste from each room. The cleaning staff consisting of 2 people pushed the train / trolley containing cleaning tools and a new colored plastic bag to replace the bag that had been filled. Cleaners come using the attributes of complete personal protective equipment, such as masks, disposable gloves, boots, and work clothes. The duration of time needed to collect all waste is around 2-3 hours.

"One cart is carried by 2 people. Come on, immediately collect the garbage. Because it has been separated between the medical and the non-medical, so just stay put and put in a bag

that matches the color. Once collected it is replaced with a bag. Finally, just swept, mopped, cleaned as usual ... "(Team Leader Coordinator)

#### **Sorting.**

Because medical and non-medical waste has been sorted from the source, so the cleaning staff is not preoccupied with sorting waste. But it still has to be done carefully.

*" If our waste has separated from the source. So later it will be distinguished from the yellow plastic bag that is medical, if the usual garbage is plastic bag items. The bag is thick, so the possibility of sticking or other is small. '(HRD and General Manager)*

#### **Transportation**

After medical and non-medical waste is collected and put together according to the color of the plastic bag, the next step is transportation. To facilitate the transport of waste to the dumpsite, a push cart / trolley is needed, the top of which contains a pile of waste plastic bags. The waste that has been taken from each room is transported by the officer to the waste collection facility. Especially for medical waste, it is immediately taken to a temporary storage area which will be transported by a third party, while non-medical waste is taken to a temporary shelter.

#### **Temporary Disposal Site**

Based on observations, a pile of plastic bags was taken to a temporary dump. The location is in the back of the hospital, or  $\pm$  50 meters. Waste collection is carried out every day. Storage of medical waste before being transported by third parties takes 7 days, while

non-medical waste can be transported in 2-3 days after storage.

### Final Landfills.

Final disposal site Owned by a third party. Hospitals work with third parties to transport and process medical waste, because hospitals do not have their own incinerator / combustion devices. The type of vehicle used to transport medical waste is a closed box car. The types of medical waste produced include syringes, syringes, disposable gloves, body tissues, residual blood, intravenous tubes, medicine bottles, alcoholic cotton, cotton or contaminated

gauze, contaminated bandages, scalpels, disposable masks, etc. .

### Part -2 : The analysis of Medical Waste management practice of hospital

#### Minimization of medical waste

According to Keputusan the health minister of the Republic of Indonesia No. 1204 of 2004, waste minimization is an effort to reduce the amount of waste that must be processed and stockpiled resulting from health service activities by reducing the sources and uses of waste such as reuse, recycle, and recovery.

Select materials that produce less waste before buying it	✓
Use as few chemicals as possible	-
Use physical cleansing methods rather than chemically	-
Prevent materials that can become waste such as in maintenance and hygiene activities	-
Monitor the flow of chemical use from raw materials to hazardous and toxic waste materials	✓
Order ingredients as needed	✓
Use materials produced earlier to avoid expiration	✓
Spend material from each package	✓
Check the expiration date of the materials when delivered by the distributor	✓

### 2. Sorting, Arrangement, Reuse and Recycling

Sorting out the types of solid medical waste starting from sources consisting of:	✓
a. infectious waste;b. pathological waste, c. sharps waste; d. pharmaceutical waste; e. cytotoxic waste; f. chemical waste; g. radioactive waste; h. pressurized container waste; i. waste with high heavy metal content	
Solid medical waste storage place:	✓
a. Made of strong material, quite light, rust resistant, waterproof, and has a smooth surface on the inside, such as fiberglass; b. In each source of medical waste producer a separate storage place must be provided with non-medical solid waste; c. Plastic bags are lifted every day or less a day if 2/3 part has been filled with waste; d. For sharp objects, it should be accommodated in a special place (safety box) such as a safe bottle or carton; e. The place for infectious and cytotoxic solid medical waste that is not directly in contact with waste must be cleaned immediately with a disinfectant solution if it will	
Materials or tools that can be reused after sterilization include scalpels, hypodermic needles, syringes, glass bottles, and containers	✓
Other tools that can be reused after sterilization are regulated radionucleides that are durable for radiotherapy such as puns, needles, or seeds	-

If sterilization is done by sterilizing with ethylene oxide, the reactor tank must be dried before ethylene oxide injection is carried out. Because the gas is very dangerous, sterilization must be carried out by trained personnel. While sterilization with glutaraldehyde is safer in operation but is less effective in microbiology	-
Special efforts should be made if there are proven cases of contamination of spongiform encephalopathies	✓

### 3. Temporary waste shelters

For hospitals that have an incinerator in their environment, they must burn their waste no later than 24 hours	-
For hospitals that do not have incinerators, solid medical waste must be destroyed in collaboration with other hospitals or other parties that have incinerators to be destroyed no later than 24 hours if stored at room temperature	✓ New solid medical waste is transported by third parties within 7 days after temporary storage in the hospital

### 1. Transportation

Solid medical waste bags before being put into transport vehicles must be placed in strong and closed containers	✓
Solid medical waste bags must be safe from the reach of humans and animals	✓
Officers who handle waste, must use personal protective equipment consisting of: a. Hat / helmet; b. Mask; c. Eye protection; d. Long clothes (coverall); e. Apron for industry; f. Footwear / boot; g. Special gloves (disposable gloves or heavy duty gloves)	✓

#### 4. Processing, Destruction, and Solid Waste Final Disposal

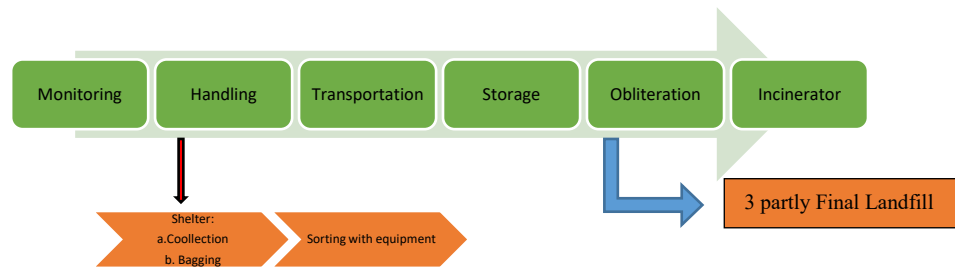
It is stated that there are processing, destruction and final disposal of hospital solid waste, especially infectious and sharp objects, pharmaceutical waste, cytotoxic waste, ordinary chemical waste, mercury / cadmium, pressurized containers, radioactive waste. However, the process cannot be discussed because it concerns the privacy issues of the hospital.

Part -3: Medical Waste Management Assessment with the concept of Green Hospital and Building

Assessment of management of hospital medical waste has been carried out independently and online on the Health Office website. This assessment instrument is used as a prerequisite for the feasibility

of evaluating the implementation of Green Hospital. There are 90 hospitals that have a waste treatment incinerator with a capacity of 3.15 tons / day and 6 processing services with a capacity of 24 tons / day (Alternative Seminar on B3 Waste Management from Health Care Facilities, Jakarta Convention Center, July 20, 2018). Thus, the estimated total capacity is 27.15 tons / day. Third party waste processors serving health facilities are still limited to 6 processing services throughout Indonesia. 5 of these processing services are in Java and 1 in East Kalimantan.

The case of hospital used in this study is a hospital that does not have an incinerator. The medical waste management staff in this hospital consists of Environmental Health Responsible Agency and Sanitation Officer.



**Figure-2. The process of handling Medical Waste in hospital cases**

Monitoring and evaluation have been carried out with the health office online, supported by original documents at the time of verification. If the data has been fulfilled, the assessment team from the Health Office will negotiate the data with the assessment from their side, and be proven by direct observation in the field. This instrument is used as a prerequisite for the feasibility of evaluating the implementation of Green Hospital. The results of monitoring and evaluation produce proposed improvements for future use in accordance with the practice of green hospital.

The total number of patient visits in 2018 IV Quarter was 12,805 patients, with an average visit per day being 141 patients. The daily average medical waste produced by hospitals in the 2018 Quarter IV is 62.15 kg. The types of medical waste produced by hospitals include syringes, syringes, disposable gloves, residual body tissues, blood waste, infusions, intravenous hoses, medicine bottles, alcoholic cotton, cotton and contaminated bandages, scalpels, disposable masks, etc. The hospital's temporary disposal site actually meets the regulatory requirements, but there is a difference in the "... destruction is done no later than 24 hours ..." because a third-party transports medical waste within 7 days. Figure-3 is an overview of the objectives and scope of waste handling, problem approaches and corrective action proposals.

#### IV. Conclusion

This study is limited to 3 (three) case studies only that are potential to be implemented in Indonesia considering those countries have more and less similar to Indonesia's current interests of biodiversity. The 3 (three) case studies above shows that ABS agreements provides valuable financial and non-financial benefit for empowering local communities and its people and increasing bargaining position of marginalized communities. The recognition of the role of local community's knowledge can also be used as a legal basis for benefit sharing arrangement. Therefore, those 3 case studies provides a best practice for Indonesia to develop access and benefit sharing arrangements so that enables this country to maximally utilized its biodiversity for the benefit of local communities.

#### References

- [1] Azzone, G., & Noci, G. 1996 Measuring the environmental performance of new products: An integrated approach International Journal of Production Research 34,11 3055–3078. <https://doi.org/10.1080/00207549608905077>
- [2] Kim, S., & Osmond, P. 2014 Analyzing green building rating tools for healthcare buildings from the building user's perspective Indoor and Built

- Environment23,5 757–766.  
<https://doi.org/10.1177/1420326X13480223>
- [3] Sharma, V. K., Chandana, P., & Bhardwaj, A. 2015 Critical factors analysis and its ranking for implementation of GSCM in Indian dairy industry Journal of Manufacturing Technology Management26,6 911-922.
- [4] McGain, F., & Naylor, C. 2014 Environmental sustainability in hospitals – a systematic review and research agenda. Journal of Health Services Research and Policy 19,4 245–252.  
<https://doi.org/10.1177/1355819614534836>
- Migdadi, Y. K. A. A., & Omari, A. A. 2019 Identifying the best practices in green operations strategy of hospitals Benchmarking26,4 1106–1131.  
<https://doi.org/10.1108/BIJ-09-2017-0242>
- [5] Thakur, V., & Anbanandam, R. 2016 Healthcare waste management: an interpretive structural modeling approach International Journal of Health Care Quality Assurance29,5 559–581.  
<https://doi.org/10.1108/IJHCQA-02-2016-0010>
- [6] Schonberger, R. J. 2018 Reconstituting lean in healthcare: From waste elimination toward ‘queue-less’ patient-focused care Business Horizons61,1 13–22.  
<https://doi.org/10.1016/j.bushor.2017.09.001>
- [7] Basse, B. E., Benka-Coker, M. O., & Aluyi, H. S. A. 2006 Characterization and management of solid medical wastes in the Federal Capital Territory, Abuja Nigeria African health sciences6,1 59-63.