

# Study of Bar Code System for Effective Management of Bio-medical Waste

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**Abstract** –Hospitals produce waste on daily basis and the nature of wastes produced from healthcare facilities is complex in nature. It includes toxic and contagious waste as well and a variety of materials right from cotton to plastic and metallic materials. It is important to segregate waste and bar code system is a way to manage the complexity of handling the medical waste. The barcode system is required to be established by operator of common biomedical waste treatment facility with mandatory participation of health care facility. Afore-said rules also mandate Central Pollution Control Board to prepare technical guidelines for uniformity in establishing system of barcode tracking across the country. The barcode system services important tool for regulatory authorities specially for tracking of biomedical waste from source of its generation to its ultimate disposal the barcode system also helps regulatory agencies in getting instantaneous data on biomedical waste management of a particular health care facility or common bio-medical waste management facility. Barcode system would also help in controlling the age of recycle label biomedical waste. These guidelines provide information on aspects relating to barcode system which include desired specifications for the barcode label, barcode scanner, mobile barcode scanner, type of data to be captured, generation of barcode labels, barcode software etc. including the guidance for implementing barcode system.

**Keywords** - Health Care Facility (HCF), Central Pollution Control Board (CPCB), Common Bio-Medical Waste Treatment Facility (CBWTF), Bio-Medical Waste, Bar Code, Ministry of Environment, Forest and Climate Change(MoEF&CC), Ministry of Health and family Welfare(Moh&FW), State Pollution and Control Boards(SPCBs).

## I. Introduction

The Bio - Medical Waste Management Rules, 2016 as amended stipulate that it is the duty of every healthcare facility to establish a barcode system to account and track the waste being sent out of the premises and disposed through common biomedical waste treatment facility. Bio-medical Waste Management Rules, 2016 notified on 28.03.2016 and as amended thereof under the Environment (Protection) Act, 1986, stipulates that it is the duty of every Health Care Facility (HCF) to establish a bar code system for bags or containers containing bio-medical waste (BMW) to be sent out of the premises or place for any purpose, by 27.03.2019. Also, Rule 5 of the BMW Rules, 2016 stipulates that it is the duty of the every Operator of Common Bio-medical Waste Treatment Facility (CBWTF) to establish bar code system for handling of bio-medical waste.

These guidelines have been prepared to facilitate and provide guidance to both the Occupier as well as Operator of CBWTF to establish bar code system and also to have uniformity in adoption of the bar code system throughout the country, thereby ensuring effective enforcement of the BMW Rules, 2016.

## II. Need for Bar Code System

- i. Tracking of biomedical waste from source of generation to intended destination for final treatment and disposal;
- ii. Daily check on the Occupier, transporter Operator of a CBWTF;
- iii. Preventing pilferage of bio-medical waste at HCFs as well as during transportation of waste
- iv. Keeping record of visits made by CBWTF to the member HCFs for collection of waste;
- v. Identification of source of generation of bio-medical waste
- vi. real time online monitoring of waste generation, collection, transportation, treatment and disposal
- vii. Quantification of bio-medical waste generated, colour coding-wise waste handed over to the CBWTF operator by the Occupier and waste collected daily by the Operator of a CBWTF from the member HCFs for further treatment and disposal.

## III. Stakeholders responsible for Implementation of the Bar Code System

According to BMW Rules, following stakeholders are responsible for implementation of the Bar Code system as detailed below:

**(a) Prescribed Authority:** The State Pollution Control Board (SPCB) in respect of the State, Pollution Control Committee (PCC) in respect of the Union Territory (UT) and Director General, Armed Forces Medical Services (DGAFMS) in respect of Armed Forces Health Care Establishments.

**(b) Health Care Facility:** The person having administrative control over the institution.

**(c) Operator of a Common Bio-medical Waste Treatment Facility (CBWTF):** The person who owns or controls a Common Bio-medical Waste Treatment Facility (CBWTF).

## IV. Bar Code Label

Bar code labelling may be of two types as given below:-

- a) Bar code or QR code label can be pre-printed directly on the designated colour coded bags /containers.
- b) Bar code or QR code labels can be pasted on the designated colour coded bags/ containers, which can be procured by the HCF either through the Operator of a CBWTF providing treatment services to the HCF or through Vendor.

In both cases, thickness of colour coded bag used for segregation and handling of bio-medical waste should be equal to or more than 50  $\mu$ .

**Specifications of Bar-code or QR Code label:-** The Bar code label for use on the colour coded bags or containers for handling bio-medical waste should have following specifications:

**a) Colour mark on the label:** A colour mark or text is required on bar code label for easy identification of the bar code with designated colour coded bag or container. The bar code should have a colour mark (in Yellow/Red/White/Blue) in the form of block of size at least 7 mm X 7 mm or Text of font size 12 specifying the colour of the BMW in the bags or containers. The colour mark or Text shall be placed at the top left corner of the bar code label.

In case of cytotoxic drugs, the alphabet 'C' should be printed on yellow colour block.



In case of B/W label, colour mark can be specified in the form of 'Text' specifying the colour of BMW waste as "YELLOW" / "RED" / "WHITE" / "BLUE" printed on top left side of the bar code label.



**b) Unique Number of the HCF and its specification:** Unique number to each HCF shall be developed and provided by concerned SPCB/PCC/DGAFMS. Unique number can be produced based on following criteria:-

- i. **Name of the Health Care Facility (HCF):** The name of the HCF shall be indicated by first five alphabets in the name of the by the HCF. In case the name of HCF is less than 5 letters, the rest of spaces may be filled with \*. (E.g., All India Institute of Medical Sciences-ALLIN). Followed by;
- ii. **Name of the Place where HCF is located:** Name of the place where HCF is located shall be indicated by 6 digit local Pincode provided by Postal department. Followed by;
- iii. **Name of the State/UT :** Name of the State/UT should be in the form of two digit alphabetical number. Followed by;
- iv. **Type of HCF:** Type of HCF should be in the form of alphabetical number in capital but not more than two letter i.e., first two letters of a type of HCF/first letter in two words of a HCF) as given below:  
**BH - Bedded Hospital, CL – Clinic, DI – Dispensary, HO – Homeopathy, MH - Mobile Hospital, SI – Siddha, UN – Unani, VH - Veterinary Hospital, YO – Yoga, AH - Animal House, BB - Blood Bank, DH - Dental Hospital, NH - Nursing Home, PL - Pathological Laboratory, FA - Institutions/Schools/Companies etc. with First Aid facilities, HC - Health Camp** and followed by;
- v. **Numerical Number of the HCF:** Numerical number of the health care facility shall not be more than five numerical numbers to be assigned to the HCF in between i.e., 00001 to 99999.
- vi. Concerned SPCB/PCC shall upload a list of HCFs along with their unique number of HCF at their website. In case of long list, SPCBs may provide search option on their website for retrieving unique code vis-à-vis name of HCF.

**c) Label sequence Number:** CBWTFs should use central software to generate unique label sequential number. The operator of CBWTF should provide range of such sequence numbers to label vendors to produce labels or produce labels by themselves. The records of label sequence numbers and to whom allotted should be maintained for verification of SPCBs/PCCs.

**d) Specifications for the bar code label:** In addition to the specification of Bar code as given at Sl.No. 4 (a), the bar code label should have following specifications as detailed below:

- i. The bar code label should be pasted only at the centre or close to centre of the colour coded bag or container prescribed under the BMWM Rules, 2016 and further amendments made thereof.
- ii. Size of bar code label should be such that it should be able to accommodate desired information specified in this section.
- iii. The bar code / QR code should be black in colour and its back ground should be white colour and it should be clearly legible on the label.
- iv. The bar code label should be tamper proof, water proof and its colour should not be faded in due course of at least for 48 hours after its use.

- v. The bar code label should be able to resist the prevailing atmospheric temperatures and should not fade its colour till its end of life.
- vi. Bar code labels should not have any traces of heavy metals or any other objectionable chemical constituent.
- vii. All bar coded labels should be of good quality preferably every chromo paper label having specifications prescribed under these guidelines.
- viii. The adhesive used for bar code label should be pressure sensitive, tear resistance and should be of acrylic based adhesive and after use of labels on the colour coded bag (s) or container (s), the label should not peel off on its own or by normal abrasion during handling.

## V. Implementation of Bar Code Based Waste Management System

Implementation of the bar code system is the joint responsibility of the Occupier as well as Operator of a CBWTF. Bar Code Based Waste Management software should be installed and operated by the CBWTF who is providing services of bio-medical waste treatment and disposal. Each member HCF shall obtain access to the Bar Code Based Waste Management System from the facility operator. Requirements of barcode based waste management system and the role of HCFs and the Operator of CBWTF are given below:

### (a) Healthcare Facilities

- i. In case of Health Care Facilities (HCFs) having 30 or more no. of beds shall have to procure their own digital weighing machine and bar code scanner. The weighing machine and scanner unit shall have wired or wireless connection and the data pertaining to the weight of the scanned bags should get transferred automatically. Also, the HCF is required to scan all the bar coded bags containing bio-medical waste. Upon scanning of all the bags by the HCF, the data shall be transmitted to the data base of bar code waste management system, however, the data gets lodged into the data base only after the operator of the facility accepts the waste on his console and generates waste acceptance receipt. The waste acceptance receipt shall be printed on the spot and handed over to the HCF before departure of the transportation vehicle from the premises. Such receipt can also be generated digitally and sent by e-mail to all the concerned.
- ii. Whereas, HCFs having < 30 no. of beds as well as all other Occupiers are not required to scan their bags containing bio-medical waste. Same shall be done by the CBWTF operator on arrival at the premises. The CBWTF shall always carry scanning and weighing machines alongwith portable printer. The Occupier shall obtain receipt printed by facility operator prior to his departure from HCF premises. The data gets lodged into the data base once the waste picker (CBWTF Operator) generates waste acceptance receipt.
- iii. Obtain access Login and password for Bar Code Based Waste Management System software from the CBWTF Operator.
- iv. Collect proof (counter signed by the CBWTF Operator) of waste collection or Waste acceptance receipt comprise of date, time, no. of bags, total weight of colour coded bags/containers.
- v. Generate reports from Bar Code Based Waste Management System and maintain records periodically and update in the website.
- vi. In case of non-availability of wireless weighing machine, the scanner system should have an option of manual entry of data pertaining to weight of scanned bags using conventional weighing machine.

### (b) Operator of CBWTFs

- i. The Operator of a CBWTF should purchase and operate Bar Code Based Waste Management System software. The software should support multiple user logins for each HCF (Occupier), admin login and regulatory login for respective SPCB/PCC/DGAFMS, CPCB, MoEF & CC, Central/State Health Departments. Such logins should be provided to the regulatory authorities voluntarily without any charges. The application software should be loaded at any cloud server or servers of SPCB/PCC as per the discretion of SPCBs/PCCs.
- ii. The CBWTF Operator shall procure dedicated bar code scanners or develop suitable app for scanning with mobile phone and integration with central software.
- iii. In case of hospitals i.e., < 30 no. of beds and other HCFs as defined under the BMW Rules, 2016 and further amendments made thereof, the Operator of a CBWTF providing treatment services to such HCFs shall scan the bar coded bags/containers containing bio-medical waste.
- iv. The CBWTF Operator shall have to carry scanner along with printer and weighing machine in its transportation vehicle while it is used for collection of waste from member HCFs in accordance with BMW Rules, 2016 and further amendments made thereof and the CBWTF Operator shall maintain all the records as per BMW Rules.

- v. Upon completion of scanning and weighing all bags/containers, the scanner system should generate print of a waste receipt automatically which shall be signed and handed over to the HCF immediately. The Operator shall also send the daily waste collection statement or monthly comprehensive statement by e-mail periodically to the Occupier and such data to be maintained in the bar code waste management system.
- vi. Upon receipt of the waste at the facility, each bag shall have to be scanned by the CBWTF Operator prior to its treatment so as to ensure no pilferage during transportation between HCFs and CBWTF premises and updating of data in the bar code waste management system. For this purpose, the CBWTF operator may explore possibility of installation of automatically scanned verifiers if feasible.
- vii. In case of failure to re-scan of waste at CBWTF for more than 24 hours after collection, an alert should be sent to SPCBs/PCCs.
- viii. The Operator of a CBWTF should have adequate hardware and all necessary provision for maintaining the bar code based waste management system.
- ix. The CBWTF Operator shall have to maintain all the records for a period of five years as per BMW Rules, 2016.

#### **VI. Specifications of the Bar code Scanner and/or App based mobile scanner:**

Dedicated Bar code Scanner and /or Bar Code Scanner Based Mobile App should have the following provisions:

- i. The bar code scanner should have the provision of data storage for its retrieval, as and when required. Once the server system is restored, stored data should be transferred immediately to the server.
- ii. Bar code Scanner and /or Bar Code Scanner Based Mobile App. should preferably have connectivity with the digital weighing machine.
- iii. For each bag scanned by the Bar code scanner and /or Bar Code Scanner Based Mobile App. should automatically transfer the information (which include label information, date, time and weight of each bag/container) to centrally located Bar Code Based Waste Management System software. There should not be any scope for manual intervention of the Occupier/Operator of a CBWTF with respect to the data transfer.
- iv. If the barcode scanner/app has any breakdown due to problem in network or app or scanner software in transferring the data to the server, in such a case there should be a provision for updating the information through alternate means with prior intimation by the Operator of a CBWTF to SPCB/PCC/DGAFMS.
- v. Upon scanning the barcode label, the software system should capture fixed barcode label data (sequence number of label, name of HCF, code of HCF, type of HCF, colour code of waste and location) along with dynamic data pertaining to weight, date, time and GPS coordinates of each bag/container scanned.
- vi. There should preferably be wire or wireless based connectivity between bar code scanner and weighing machine. The Bar code waste management system should also support manual data entry only in case of weight input, where digital weighing machines could not be provided by CBWTF operator or procured by the Occupier.
- vii. Upon receipt of waste by the CBWTF operator, the system should generate print out of waste receipt at the designated waste collection point or shall send auto-generated receipt by e-mail to the concerned Health Care Facility.

#### **VII. Responsibility of the Occupier/Operator of a CBWTF**

Responsibility of the Occupier and Operator of a CBWTF with regard to the implementation of Bar Code system is discussed in the subsequent paras:

##### **(i) Responsibility of the Occupier w.r.to the Bar Code System**

- Procurement of the Bar Coded Labels or Pre-printed colour coded Bags and containers fulfilling the specification as given under these guidelines from the vendor (s) or the operator of CBWTF on charge basis is the sole responsibility of the occupier;
- Intimate prescribed authority about the bar coded labels or pre-printed bar coded bags or containers as and when procured.
- Ensure use of bar coded label or pre-printed bar coded and specified colour coded bag or container for segregation of waste at source of its generation.
- A representative of HCF to ensure that all the bags and containers are scanned at waste collection point. He shall also collect waste collection receipt generated by waste picker (CBWTF Operator).
- In case of Health Care Facility (with less than 30 beds) or clinics or laboratories, concerned HCF /Clinic/Laboratory is not required to pre-scan the bags, the same shall be carried out by waste picker after arrival at site.
- In case of Health Care Facility (with more than 30 beds) it is the responsibility of the Occupier to scan the bags containing bio-medical waste.



- In any State/UT, where CBWTF is not accessible to the HCFs, in such a case, the respective HCF is required to scan the bar coded bags on their own prior to disposal at their captive facilities. In such case, the bar code waste management system operated by SPCB/PCC / DGAFS shall receive the data.
- While scanning the bar coded bags (more than 30 bed HCFs), it shall be ensured that the waste handlers shall have adequate PPEs (gloves, goggles, mask, aprons and safety shoes).

#### (ii) Responsibility of the Operator of CBWTF w.r.to the Bar Code System

- Supply of Bar Coded Labels or Pre-printed colour coded Bags and containers fulfilling the specification as given under these guidelines to the Occupier (s) or member HCFs of the facility, on charge basis, and on demand. However, the Occupier may also opt to procure directly from the vendors.
- Intimate prescribed authority (i.e., SPCB/PCC) about the launch of bar coded based waste management system.
- To accept only the specified colour coded bags or containers labelled with indicated bar code system or pre-printed bar coded specified colour coded bag or container.
- Scan all such bio-medical waste collected in the specified colour coded bags or container at the waste collection point only and generate waste acceptance receipt.
- Ensure that all the data should be stored and made available to all the users or member HCFs, at least for a period of five years.
- Access to the software system should be provided to the prescribed authority voluntarily.
- To ensure procurement of standby or spare hardware like Bar-code scanners and weighing balance etc. to ensure hassle free collection of bio-medical waste in case of break-down.
- In case of bedded Health Care Facility (with more than 30 no. of beds), the hospital authorities are responsible for scanning of all the bar coded bags/containers containing bio-medical waste.
- The Operator is required to re-scan all the bags at the facility to report the activity of final treatment or disposal.
- While scanning the bar coded bags (more than 30 bed HCFs), it shall be ensured that the representative of the CBWTF Operator (waste pickers) shall have adequate PPEs (gloves, goggles, mask, aprons and safety shoes).

#### (iii) Responsibility of the supplier or vendor of the Bar Code System:

The vendor can supply bar coded label or Pre-printed bar coded Bags and containers fulfilling the specification as given in these guidelines. Such labels should be printed only in consultation with CBWTF Operator who has installed bar code based waste management software.

### VIII. Conclusion

It is expected that these guidelines would facilitate and provide guidance to health care facilities as well as operators of common bio medical waste treatment facility in establishing barcode systems well within the stipulated timelines. State pollution control boards / pollution control committee and concerned departments of governments are expected to ensure your effective implementation of these guidelines for ensuring environmentally sound management of biomedical waste in the country.

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