

## **<sup>1</sup>STUDY OF ENVIRONMENTALLY FRIENDLY CONSTRUCTION PRACTICES**

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### **Abstract:**

The study has been carried & prepared for the execution of MMRDA MUMBAI Project, As part of the construction activity being carried out by J.KUMAR, a guideline has been established for all employees as well as employees' subcontractors ensuring minimal impact on the environment, property, and human health while on site or on the roads where construction activities are taking place. This study enables the control of Environment, Health & Safety risks and help in the continual improvement of its SHE performance.

**Keywords:** AIR Quality, Noise level, waste management, Environmental monitoring, EHS, Safety etc.

### **1. Introduction:**

An assessment has been made of the environments in which construction site activities are conducted. The study was carried in metro rail project to emphasize the environmental aspects and control measures.

### **2. Air Quality**

Air quality is very important parameter to ensure safety of environment as well as Living thing. Poor Air quality always effect to people and results respiratory illness and several other illness. Good Air quality is beneficial for human and other living thing.

#### **2.1 Control of Dust & air emission**

Using proper equipment's shall control air emissions & machines equipment's maintenance should be carried out at regular interval.

- Every day morning before the site operation starts sprinkle water to the entire site.
- While transferring the fine aggregate/metal in dumpers make it sure that it is covered with tarpaulins in order to control the dust and maintain free board at least 300 mm.
- The point where the cement is transferred or mixer shall be covered with Gunny bags or plastic sheet in order to prevent the accumulation of cement dust particles
- While sprinkling the water, the quantity of water used should not exceed that what is required to control the dust and the concerned person should make it sure that the water used should not affect the Housekeeping of site.

The engineers working at site & Safety personnel should make it sure that the sprinkling is done in a proper manner:

- Care should be taken so that sprinkler is not placed on the top of the cement bags.
- The cycle should be repeated every two hours in order to control dust.
- It is best to carry out landscaping with the least amount of cost possible, since grass can prevent dust from being generated. By examining the soil conditions on the site, this can be practiced.
- Sprinkle water on top of the metal/coarse aggregated which will also help in settling the dust while transferring metal for concreting /batching Site/Plant/crusher.
- The approach road to the site can also be watered using sprinkler system to reduce the dust.
- The top of the fine aggregate/sand can be sprinkled with water in a mild way to ring down the dust under control.

## 2.2 Source of air pollution:

The main pollutants, which will come out from different activities, would be suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM). Air pollution is primarily caused by the following sources:

- The dust coming out from Site activities. i.e., Excavation / movement of vehicle/equipment's.
- Dust generated due to material transportation.

## 2.3 Mitigation Measures:

### a) Control Requirement during Transport of Material

As a result of transporting materials from one location to another, air pollution is generated, which negatively impacts the quality of the environment. Before in operation, all equipment should be well maintained. Vehicle cleaning facility/wheel washing will be provided. Wherever required the vehicles carrying dust generated material will be covered to avoid fly over of the dust.

### b) Control Requirements at Dumping Sites

In order to minimize dust production, materials will be placed in such a manner as to minimize dust production.

The heights from which materials are dropped shall be the minimum practical height to limit fugitive dust generation.

We shall stockpile the material in the properly designed suitable location, with suitable slopes. The speed of the vehicles moving in this area will be controlled through strict speed limits avoid dust generation.

It is essential to utilize dust control methods daily during dry weather, particularly on windy, dry days, to prevent any dust from being blown about. Provide water sprinklers that are required for dust control use. If required the Dust control activities shall continue during work stoppages.

### c) Control Requirements at Site/Plant sites

We shall spray water at Site/Plant Sites as required to suppress dust, during handling of dust generating material. Effective water sprays shall be used during operation of the Site/Plant, when dust is likely to be created and to dampen all stored materials during dry and windy weather.

### d) Control of Dust on Haul Roads:

To reduce the dust generation during the Hauling operation on the Roads, Water Sprinkling Tankers shall be hired by the company. The tankers are contracted to sprinkle water at a defined intervals or all

the Haul Roads in which the activities are going on. The no. of trips, frequency and areas are clearly defined and communicated to the Contractor and also to respective departments.

The driver of the tanker as per defined schedule reports to the concerned departmental supervisor of an area and the no. Of trips made in a particular area is supervised by the respective departmental supervisors. Records of total no. of trips made by the tankers is maintained in the 'Dust Suppression Register'.

In the month each concerned department to personnel and Administration Department in the 'Monthly Report' report the total number of trips made by Water Sprinkler. Effective of the Water Sprinkling tanker for suppressing the dust may also be commented by the respective department to Personnel and Administration Department, which will enable us to evaluate the performance of the Sprinkling Tankers.

## **2.4 Control of Dust during the Construction Operations / Activities:**

- a) The Dust Concentration during the any Operations/Activities shall be kept to a lowest possible extent and the concerned Supervisors shall take the required action as per the requirement.
- b) During such activities the PPEs (Dust mask) shall be provided to the workers.

## **2.5 Control of Dust in the Material storage Area:**

The Material like Aggregates, Fine material etc. when stored shall be done in such a manner that during the High wind the Dust will not fly in the air. This can be done by making low height of the heaps and also making temporary barrier against the wind direction around the storage area. The Sprinkling of water around such storage area, on the Material itself (if feasible) etc. shall be carried out with the help of flexible pipe and the concerned supervisor of such operations shall see that Sprinkling is carried out properly and regularly. A list of areas where personnel working shall wear PPEs during operation/activities is prepared for each site.

## **3) Noise Control Plan**

### **3.1 Effects of Noise:**

Noise at workplaces is a major cause of deafness in India. Excessive noise leads to increased absenteeism and employed turnover, as well as lowered work performance. It can also contribute to workplace injuries and accidents. NHIL sometime causes severe occupational problems leading to tinnitus or ringing in the ears, which cannot be reversed or cured.

## 3. 2 Noise control measures

### General Requirements

- All the Site/Plant and equipment to be used on the site shall be properly maintained in good operating condition and noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means, to avoid disturbance to any nearby noise sensitive receivers.
- From the construction works alone during any 30-minute period, the noise levels measured at 1m from the most affected external façade indicate the noise level at 1m from the most affected external facade of the nearby noise receivers. shall not exceed an equivalent sound level (Leq) of below mentioned dB (A). Unless otherwise specified by the concerned authorities, construction site shall be considered as Industrial area.

**Table-1:** Ambient Air Quality Standards at work areas in Respect of Noise

Type of Area	Noise level, (Leq) dB (A)	
	Morning to Night (06:00 AM to 09:00 PM)	Night to Morning (09:00 PM to 06:00 AM)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

- All the noise hazard areas (noise level exceeding 75 dB) shall be provided with warning sign
- All the noise hazard works shall be strictly adhered to the time restrictions (preferably mid day)
- All the personnel's working in the noise hazard areas shall be provided with personal hearing protectors.

- Adequate training by the competent person/ authority shall be provided to all the employees working in the noise hazard areas
- The layout of the site should be such that noisy activities are separated from quieter ones (isolation) e.g. concrete compressors, pumps and generators in screened-off areas or away from the work to be carried out; workshops, stores etc., away from noisy activities.
- Scheduling noisy activities to take place when the minimum numbers of other nearby workers are present (but noise out of hours needs to be carefully planned to avoid neighborhood annoyance).
- Rotation/Shift of workers to minimize exposure times.

## Prevention of the noise at the source

- All noise-emitting objects generate air borne energy (noise) and structure borne energy (vibrations). Treatment of these noise problems may require modifications, partial redesign or replacement of the noise-emitting object. Some of the engineering control measures, which can be taken at the site level, are
- All vibration shall be prevented by taking suitable control measures such as by
  - Replacing reverts with welds,
  - Metal to Metal contact should be avoid by using plastic bumpers,
  - Providing vibration isolation mountings
  - Lagging (covering or insulating) dampen vibrating surfaces
  - Absorbing shock with wear resistant rubber or plastic coatings
- The Noise shall be prevented by adopting following measures
  - Provision of mufflers or silencers
  - Provision of noise barriers and noise enclosures

## Modifying of the noise at the transmission path

The Modifying noise transmission path is observed as the second line of defense and includes the following methods:

- The distance between source and receiver should be increased.
- Enclosing noisy sources by full enclosures, partial enclosures and barriers and shields.
- The noisy and quiet areas must be separated by partitions.

The amount of sound that will pass through depends on the characteristics of the material used for partitions and most importantly on the mass per unit area. Acoustic materials (curtains, sliding doors) partly or fully could be used at various noise generating areas to reduce noise.

In some cases as specified by the client it would be necessary to construct permanent noise barriers such as increasing the height of compound walls (if existing) or constructing new one, thick site/plantation, providing double glazed glass windows and doors etc. Noise barriers commonly used at the construction site are discussed in the below table.

## **Administrative noise control measures**

The administration control measure is used in situations where it is not practicable to comply with the noise exposure standard through other control measures alone. These measures can reduce the noise to which a person is exposed by means of work arrangement.

- Keeping people out of noisy area, if their job does not require them to be there.
- Sign posting noisy areas
- Periodic rotation of persons working in excessive noisy area shall be carried out.

## **Personal hearing protectors**

Personal hearing protectors shall be used only as an interim measure while control of excessive noise is being achieved by engineering control measures. It is important to note that even short periods of time spent without hearing protectors can significantly reduce their effectiveness and result in inadequate protection.

## **Hearing Protection Areas**

Areas where people may be exposed to excessive noise should be sign-posted, as 'hearing protection areas', and their boundaries should be clearly defined. No person, including visitors, managers and

supervisors, should enter a work zone by wearing the respective hearing protectors. This is regardless of how long the person spends in the hearing protection area.

Where sign posting is not practicable, provide an awareness training & attach prominent warning notices to tools and equipment indicating that personal hearing protectors must be worn when operating them & the different types of hearing protectors available are earmuffs, earplugs, canal caps etc.

Following are the common noise sources.

**Table 2, Equipment & Noise Level (Possibility)**

S.No	Equipment	Noise Level in dB(A)
1	Dumper	85+
2	Excavator	85+
3	Roller	>85
4	Concrete braking	98
5	Shuttering	91
6	Piling operator	85
7	Piling worker	100+
8	Sand blasting	85
9	Concrete pour	97(95 to 98)
10	Carpentry work	92
11	Blasting	100
12	General work	94



- Inspect the area with the calibrated noise level meter (Db Meter) before starting of the activity.
- Carry out the measuring/sample at the source & at different levels, randomly & Note the reading the format.
- Necessary corrective actions must be imparted If the noise level of the equipment/machines/operations are observed above 85 dB (A).

## Control of Noise

- Use of Pneumatic Breaker with the exhaust silencer and also with the dampened chisel.
- Renew dumper trucks exhaust silencer.
- Reroute the movement of the construction vehicles movement through the quieter site areas.
- DG sets should be sound-proofed or treated acoustically to reduce the noise they produce.
- Equipment maintenance must be carried out at regular interval.
- Ear protection like Ear muffs must be worn. If an activity carried at a position at 12-meter distance from the high-level noise equipment/operation an "ear Protection boundary" by using signs.
- In-case of no baseline measurement exists following shall be the maximum at 200 ft from the construction limit or nearest affected building.

Land use	Maximum noise level- Lmax dB(A)	
	Day time	Night Time
Residential	75	65
	<b>At all times</b>	
Commercial	85	
Industrial	90	

**Table 3**

For construction equipment used at night (9 p.m. to 6 a.m.) at 50 feet from the equipment, the maximum emission values must not exceed those provided in the following table.

Equipment Category	Lmax dB(A)
Bar bender	75
Chain saw	81
Compactor	80
Compressor	80
Concrete mixer	85
Concrete pump	82
Crane	85
Front end loader	80
Generator	82
Grader-I	85
Grader-II	85
Paver	85
Pneumatic tools	85
Scraper	85
Tractor	84

**Table 4, Equipment Category**

**Adjustment to the close in value shall be as follows:**

Distance (feet)	Addition to the above value
19-21	8
22-23	7
24-26	6
27-29	5
30-33	4
34-37	3
38-42	2
43-47	1
48-50	0

**Table 5**

#### **4) WASTE MANAGEMENT AND ENVIRONMENTAL MONITORING**

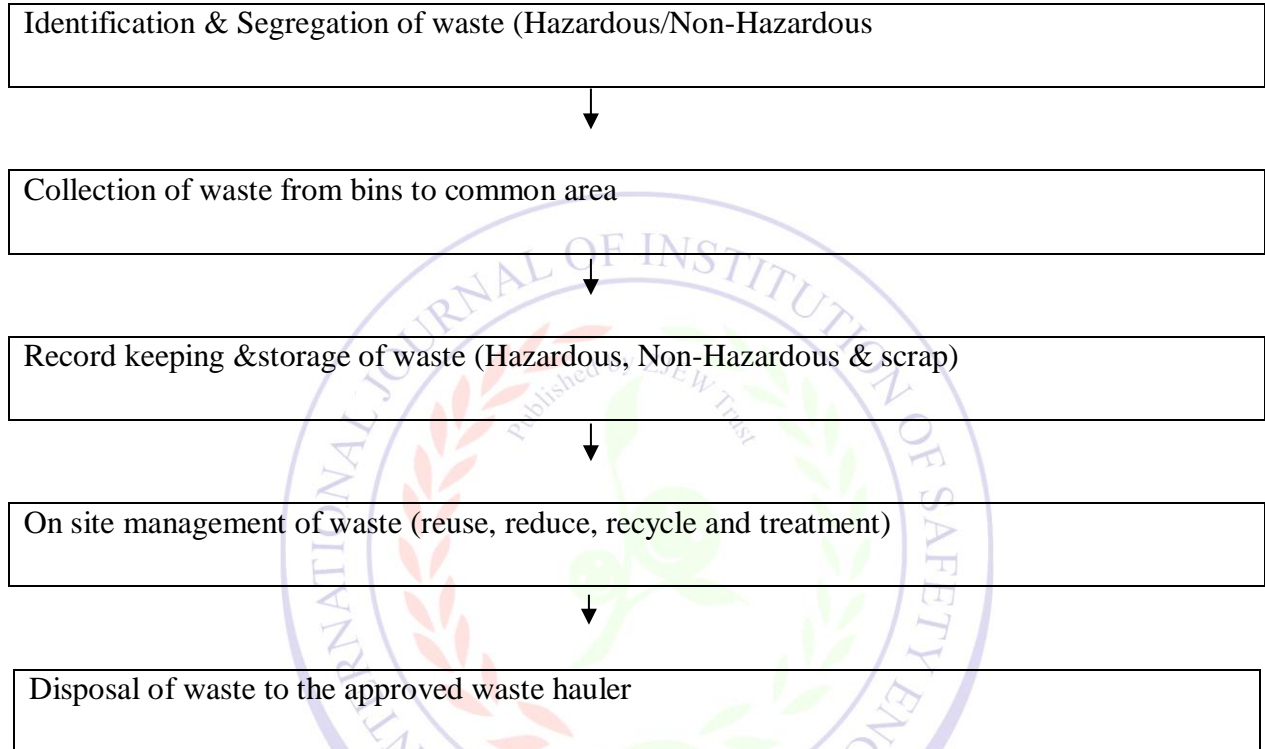
**Overview:** Solid waste (garbage, refuse, sludge, and discarded material etc.) are generated at every stage of construction, from procurement of the material to the completion of the project. This could be Hazardous and Non-hazardous waste. If these waste not effectively managed at various stages, it could emerged as a major environmental irritant.

Following Wastes Generated at our Project:

- Construction Debris
- Scrap Steel /Electrical/Welding Buds
- Used oil / Used Batteries
- Excavated Soil

- Concrete Waste
- Infectious Waste

## 4.1 SOLID WASTE MANAGEMENT



## 4.2 Segregation of waste

Segregation and store waste at the source of generation, after identifying whether it is hazardous or non-hazardous. Collect the segregated waste in various containers and bins as detailed below:

Classification of waste bin	Color of waste bin	Pictogram on waste bin	Type of waste
Food waste	Green	FOOD	Left out food, vegetable and meat waste

Hazardous waste	Red	Battery/bulb	Paint tins, coating material batteries, fused bulbs, used oils, wires, and PPEs.
Recyclable including scraps	Blue	Recycling symbol	Paper, plastic, wood, bottle metal, and rubber etc
Bio-medical waste	Yellow	Bio-medical symbol	Used cotton, bandages, shredded needles, and syringes etc

Segregation bins can be made by cutting oil or admixture barrels into halves. The barrel should be closed with a lid to prevent exposure. The number of segregation bins needed at the work place could depend on the type of waste generated. For instance, the type of waste generated at the workshop could be used cotton, filters, spent oil, used welding rods, used grinding disc or metal bur etc. In such a case, though the number of bins could be six or more, it helps in effective segregation. Better segregation generates more economic value for the waste and makes waste management easy.

#### 4.3 Collection of waste

Collection all the segregation waste in a bin or a container in a common storage area. If required, further segregation should be done, before it is finally treated and disposed of.

#### 4.4 Record keeping and storage of waste

Maintain proper records of the waste generated, classifying its type, characteristics, quantity, the time when waste is generated, how hazardous waste are stored and finally the detail of the waste hauler who collect or process the waste.

#### 4.5 Storage of waste

It is necessary to have four separate storage areas at construction site. They are:

- a) Non-hazardous waste storage area
- b) Hazardous waste storage area
- c) Scrap yard storage area, and

d) Oil storage area (fresh and used waste oil)

Construction details of waste storage area

- Construct the wall with bricks and the roof should comprise of light material such as GI corrugated sheets, which are easily detachable in case of emergency
- The floor should be water proof and un-cracked, sloping toward the collection pit located outside the storage area
- The system and the size of drains should be made in a such way that liquid oozing from fire extinguishers or spillage may flow into the collection pit
- The building should be provided with rain gutters, drainpipes, and drainage basin for management of rainwater
- The building ventilation should be designed in such a way that you can prevent accumulation of toxic/hazardous gases in the room
- The wind holes should be provided with net or such materials that bird and other small animal cannot enter
- Keep at least one meter space between the walls of the building and the dike surrounding the storage parts
- Provide sufficient lighting to enable the storerooms inspection; all electrical switches should be installed outside the building.

***Construction detail of the scrap yard***

*Partitions (chambers) should be made within the scrap yard to sort and segregate the different type of wastes. The scrap yard should be constructed as per the following parameter.*

- The waste should be placed in well compacted soil and above used wooden Planks or sleepers;
- The waste area should have adequate slope to prevent inundation of rainwater, and
- The waste storage area should be fenced to prevent unauthorized entry

## Operation of waste storage area

The storage area for hazardous waste and the scrap yard should be operated and maintained in accordance with the following practices:

- Storage areas should be clearly indicated with sign identifying the type of material or waste being stored.
- Where appropriate, the **Material Safety Data Sheet** (MSDS) should be displayed in closed proximity;
- Suitable fire protection should be provided.
- Access routes should be maintained clearly.
- Storage area should be kept clean and tidy.
- All hazardous waste storage should display symbol and labels showing the type of the hazardous waste.
- All the waste should be weighed before storage to keep track of the records.
- Outside the oil storage area, oil spill kit should be kept ready, to act on spillages.

## Period of Storage of Waste

- Dry waste such as paper, wood, and packing materials should be stored for a maximum of six months or as specified.
- Wet waste (such as food waste) should be stored for not more than a day before composting, to prevent generation of odor.
- Hazardous waste should be stored for a maximum of three months from the date of generation, as specified in the material safety data sheet or mandated by legislation. A maximum 1000 kg (all hazardous waste put together) should be stored at a time.
- Bio- Medical waste from the site operated clinic / dispensary / first aid center should be disinfected and stored for not more than a month before being sent for incineration or appropriate disposal

## Bentonite

Bentonite is used traditionally as a thixotropic (the property of becoming fluid when shaken, stirred or otherwise distributed and setting again when allowed to stand) support and lubricant agent in piling hole in horizontal directional drilling and pipe jacking.

## 5. Conclusion:

Effective Method to carry any activities help to control any potential harm related to environment or health of people. All the activities must be carried with a competent person/authority. Need to implement the ISO 14000:2015 standards through out the work locations. Regular External Audits must be conducted and the same must be monitored by the Client & General Consultant. Time to time conduct different program including Training to aware to people to control environment and health related risk.

## References:

- *MMRDA Tender Document volume 2 Conditions of Health, Safety & Environment manual of Elevated Metro Rail Project.*
- *ISO 14001:2015*
- *Vol. 6, Issue 1, International Journal of Institution of Safety Engineers (India)*

