

CENTRAL POLLUTION CONTROL BOARD

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Development of Environmental Standards and Guidelines for Hot Mix Plants

1. Introduction

Hot Mix Plants are used for mixing of stone aggregates with bitumen for the construction of roads. A hot mix plant usually comprises of aggregate bins, feeder, weighting system, drying drum, bitumen and fuel storage tanks, air pollution control devices, hot mix storage silo, and loading facility. These plants are installed near construction site and highways, and operate for such time till the construction work continues. Hence, many hot mix plants are not of permanent nature. Due to the impermanent nature of these plants, it is not possible to know the precise numbers/location of the Units. However, efforts have been made to collect information about the hot mix plants from State Pollution Control Boards/Pollution Control Committees and some highways construction companies. As per the information so collected, there are 577 numbers of hot mix plants in the country.

There are no specific standards for hot mix plants at present at national level. Hence, the Central Pollution Control Board (CPCB) conducted a scientific study through the National Productivity Council (NPC) to formulate the environmental standards and guidelines.

2. Methodology

Data/information was generated from literature survey, questionnaire responses, preliminary field study and detailed studies including stack emission monitoring. Based on data, profile of the sector and compilation of best practices were made. Standards are proposed based on gravity of environmental concerns, availability of treatment technologies and cost aspect. For prevention and control of pollution, guidelines are also proposed for this sector.

3. Classification

Hot Mix Plants can be classified based on technology adopted in the plant such as batch hot mix plant or drum hot mix plant. The drum type of plants operates either on parallel flow or counter flow of material and hot gases. The hot mix plants can also be classified on the basis of scale of operation viz. small, medium and large. Based on mobility, the plants can be of permanent type of hot mix plants. This type of hot mix plants are stationed at one place and generally have high capacity. Skid mounted or portable hot mix plants, are usually small capacity plants. The criteria classification is given in Table 1.

Table 1: Classification of hot mix plants

S.No.	Criteria	Classification
1	Technology	Batch hot mix plants

		Drum hot mix plants: Parallel flow drum hot mix plants; and Counter flow drum hot mix plants
2	Mobility	Permanent type hot mix plants Skid mounted or Portable hot mix plants
3	Scale of operation	Small (≤ 60 tph) Medium (≤ 100 tph) Large (> 100 tph)

4. Production Process

The main process in the hot mix plants involves preparation of a mixture of stone aggregates and liquid asphalt/bitumen (a product of crude oil distillation). The mixture of stone aggregates is first prepared in desired proportion and heated for drying. The dried mix is brought in contact with hot asphalt/bitumen liquid spray. This process facilitates the coating of the aggregates with a sticky layer of asphalt. The temperature of the mix is maintained about 155 °C. The mix so prepared contains approximately 95% aggregates and 5% asphalt. However, the temperature of mix and ratio of stone aggregates and coarse sand to the bitumen quantity depend on the individual mix requirements suitable to be used for different types of layers and quality of road construction. The hot mix produced by plant is loaded directly in trucks while it is hot and transported to the site of construction and applied in hot condition. Hence, the hot mix plants have to be set up near the construction site.

The plant operation is monitored from the control cabin. The level of automation and electronic control varies from plant to plant. Small plants are operated through simple control mechanism. A fully computerized process control can monitor burner operation, fuel consumption, air, flow and finished mix.

5. Environmental Problems

Preparation of bitumen mix in hot mix plants generates emissions containing particulate matter as well as gaseous pollutants. The primary emission sources in plants are burning of fuel for preparation of bitumen mix, which emit particulate matter (PM) and gaseous pollutants like SO₂, NO_x, CO, CO₂, VOCs etc. Other emission sources found at hot mix plants include handling of aggregates, movement of vehicles and heating of bitumen that emit fugitive emissions. Emissions also result from vehicular traffic on paved or unpaved roads, aggregate storage and handling operations and vehicle exhaust.

6. Pollution Control Measures

The hot mix plants generally have wet scrubber, dual cyclone, multi-cyclone and bag filters as air pollution control measures. These measures are used as single or combination of more than one measures. Stacks heights provided in hot mix plants were observed as 6 to 18 m.

7. Emission Monitoring

Based on the information collected from preliminary field visits and questionnaire survey, 15 Nos. of hot mix plant with different type and size were selected to carry out emission monitoring as shown in Table 2. . Of these, 9 plants are batch type hot mix plants and the remaining 6 are drum type hot mix plants. It can be noticed that all the batch type plate are large Units. The drum type hot mix plants are small as well as medium but not of large scale. The results of stack monitoring are given in Table 2.

Table 2: Stack monitoring results

S. No.	Code of the Unit	Production capacity (tph)	Control measures	Stack emission monitoring results		
				PM (mg/Nm ³)	SO ₂ (mg/Nm ³)	NO ₂ (mg/Nm ³)
<i>Batch type hot mix plants</i>						
1	HMP -4	128	Dual cyclone & bag filter	124	116	93
2	HMP -5	128	Dual cyclone & Bag filter	102	122	767
3	HMP -6	128	Dual cyclone & filter	112	137	83
4	HMP -7	128	Dual cyclone & Bag filter	182	257	143
5	HMP -9	200	Bag filter	99	214	118
6	HMP-11	160	Bag filter	131	151	83
7	HMP -12	100	Bag filter	126	225	209
8	HMP -13	160	Dual cyclone & Bag filter	130	157	87
9	HMP -14	160	Bag house	143	139	89
<i>Drum type hot mix plants</i>						
10	HMP -1	60	Multicyclone & scrubber	306	217	129
11	HMP -2	90	Multicyclone & scrubber	238	158	215
12	HMP -3	90	Multicyclone & scrubber	409	205	133
13	HMP -8	35	Multicyclone & scrubber	317	208	119
14	HMP -10	60	Multicyclone & scrubber	84	115	79
15	HMP -15	90	Multicyclone & scrubber	266	191	108

8. Formulation of Proposed Standards

The environmental standards and guidelines are intended to ensure abatement and control of pollution. The main environmental parameters are particulate matter (PM), SO₂ and NO_x. Water pollution is not a issue for the hot mix plants.

It can be noticed from Table 2 that PM concentration for batch type of hot mix plants is in the range of 99-182 mg/Nm³ with average of 128 mg/Nm³. The PM concentration is less than 150 mg/Nm³ in all batch type plant except one Unit (HMP-7). The batch hot mix plants have adopted bag filters or dual cyclone and bag filters that are capable of reducing the PM level in stack emissions. The Unit (HMP-7) can minimize the PM level by proper maintenance of control measures and possible for this Unit too to achieve PM level of 150 mg/Nm³ and this limit is proposed as standard for batch hot mix plants.

PM concentration for drum type hot mix plants was found as low as 84 mg/Nm³ in one plant (HMP-10) and as high as 409 mg/Nm³ in other plant (HMP-3). Barring these extreme values, the average of the remaining values is 282 mg/Nm³. It is to be noted that drum type hot mix plants are mostly in small/medium scale Units and provided multiclone with scrubber. In view of this, it could be inferred that with proper operation and maintenance of control measures, it is possible to achieve PM concentration of 300 mg/Nm³ by all the drum type hot mix plants. This value is proposed as standard for drum type hot mix plants.

SO₂ concentration is varying form 116 to 257 mg/Nm³ in batch type hot mix plants and from 115 to 217 mg/Nm³ in drum type hot mix plants. The NO_x values were observed as 77-209 mg/Nm³ in batch type hot mix plants and 79-129 mg/Nm³ in drum hot mix plants. It can be noticed that emission level of SO₂ and NO_x are low. However, considering the recent directions from the Hon'ble Supreme Court on different polluting Units, standard of SO₂ is proposed as 250 mg/Nm³ for both types of hot mix plants. Limit for NO_x is proposed as 200 mg/Nm³ for both type of Units. A summary of the proposed standards is given in Table 3.

Table 3: Summary of standards for hot mix plants

S.No.	Type of hot mix plant	Particulate matter (PM), mg/Nm ³	SO ₂ , mg/Nm ³	NO _x ,
1.	Batch type hot mix plant	150	250	200
2.	Drum type hot mix plant	300	250	200

9. Proposed Guidelines

- (a) The hot mix plants should be set as per the siting criteria given in Table 4.

Table 4: Siting criteria for hot mix plants

S. No.	Entity	Minimum distance from the entity (m)
1	Approved habitation, tourist places,	1 to 2 depending local condition

	schools, hospitals, sports centres etc.	
2	Sensitive areas, national monuments and bird sanctuaries	2 to 5 depending upon buffer zone and available green belt

- (b) In case of existing hot mix plants not meeting above siting criteria, the Unit should provide minimum 6 m high compound wall of GI sheets along plot periphery.
- (c) The emission monitoring results shown that batch hot mix plants are less polluting and hence, the new hot mix plants based on batch process should be encouraged.
- (d) Stack height should provide sufficient dispersion of the emissions to keep ambient emission levels within acceptable limits. Generally, the height of a stack varies with the design of hot mix plant and supplier. In general, the effective stake height should vary between 10 to 25 m as may be prescribed by SPCBs/PCCs.
- (e) It was found that no waste water was generated from the process. A practice of recycling of scrubbing water should be followed.
- (g) The hot mix plant should be equipped with appropriate air pollution control devices such as cyclone multi-clones and bag filter/ scrubber and properly maintained so as to ensure optimum efficiency to achieve the standards.
- (h) Measures such as installation of water sprinklers at points of dust emission within premises should be provided. The internal roads, working platform, loading and unloading areas should be paved or concreted and kept clean all times.
- (i) Any process rejects or left over of hot mix should be recycled in the process.
