8.1 Main Findings

Cement Industry in any country is one of the strong pillars of economy that country. The cement industry being one of the oldest sectors in India plays a major role in the socio-economic development of our country. Demand of cement in infrastructure and industrial activity, real estate business and investment in core sectors make the cement industry significant for the development globally as it has no other alternate in the near future. Cement industry is also one of the seventeen most polluting industries listed by the Central Pollution Control Board. It is the major source of particulate matter, NOx and CO\textsubscript{2} emissions. In other words, cement industry brings economic prosperity on one hand and environmental degradation in the other.

8.1.1 Air Environment

- The cement industry adversely impacts the air environment due to its contribution of pollutants like particulate matter, NOx and CO\textsubscript{2}. With the increase/ expansion in cement industries and subsequent increase in cement production in the recent times, concentration of pollutants, particularly, concentration of particulate matters are also expected to increase in the coming time.

- Movement of heavy trucks/vehicles on the adjacent roads and National Highways generates substantial quantity of dust emission. This also contributes in the pollution of the air environment. The cement industries under study are all surrounded by National Highway 79 from one or the other side thereby adding dust emission to the local air environment.

- The present study reveals that the cement industries are not huge contributors of the gaseous pollutants, under study i.e. SO\textsubscript{2} and NOx, into the air environment. The monitoring results reveal that SO\textsubscript{2} and NOx are well within the prescribed standards of CPCB, 2009 at all monitoring locations.
The present study reveals that the cement industries are great contributors of the particulate matter, under study i.e. SPM and RSPM, into the air environment. The monitoring results reveal that SPM has mostly exceeded the prescribed standards of CPCB, 2009 at all monitoring locations except on few days when the results were found within the prescribed limits. The monitoring results of RSPM indicate that the concentration of RSPM have remained mostly within the prescribed standards at all monitoring locations except on few days when the results exceeded the prescribed limits.

The concentration of RSPM at few monitoring locations such as Near Bus Stand, Nimbahera City; Near Bus Stand, Chittorgarh City; Village Joravar Ji Ka Khera, Sawa, Shambhupura, Chittorgarh and Chanderia, Chittorgarh, have exceeded manifolds vis-à-vis the prescribed standards. This may be due to pollution from automobiles, heavy traffic congestion and partial impact of nearby southern located cement industries near Bus Stand, Nimbahera City; near Bus Stand, Chittorgarh City. Captive limestone mines of Aditya Cement Ltd, impact of Aditya Cement Works seem to aggravate concentration of RSPM in the Village Joravar Ji Ka Khera, Sawa, Shambhupura, Chittorgarh due to which the result have exceeded up to such high levels. Increase in concentration of RSPM at Chanderia, Chittorgarh may be due pollution from automobiles, heavy traffic congestion, pollution from adjacent Chanderia railway siding, adjacent National Highway, and impact of nearby cement industries, i.e. Birla Cement Works and Chanderia Cement Works.

Air dispersion mathematical modeling for the Chittorgarh region has been conducted for major seven Cement Plants in the area i.e. Birla Cement Works, Chanderia Cement Works, Aditya Cement, JK Cement Works Mangrol, JK Cement Works Nimbahera, Lafarge India Pvt. Ltd. and Wonder Cement Ltd. AERMOD was using to know the impact on air quality. AERMOD is based on the Gaussian Plume Dispersion and developed by the U.S. Environmental Protection Agency (USEPA). Modelling results clearly depict that the air environment has clearly changed before and after establishment of two new cement industries i.e. Wonder Cement Ltd. and
Lafarge India Pvt. Ltd. The increase in concentration of air pollutants in the local environment after the commissioning of these industries clearly establishes the fact that cement industries are a major contributor in the air pollution of any region.

• The Noise Level was measured at all the fourteen monitoring locations near cement plants among which, six locations were Commercial and the other eight were Residential zones. Noise Level during day time at all commercial locations, had fluctuated in comparison to the prescribed standards except Near Bus Stand Chittorgarh and Outside Main Gate of Birla Cement Works and Chanderia Cement Works, Chanderia where the noise level had exceeded on all days of monitoring. During night time, the noise levels had fluctuated in comparison to the prescribed standards Outside Main Gate of Birla Cement Works, Chanderia due to commercial activities related to cement industry, movement of heavy vehicles, nearby railway station and railway siding; and Near Bus Stand, Chittorgarh due to commercial activities and movement of vehicles. Noise levels at all other locations were well within the limit.

• Noise Level during day time at all Residential locations, had fluctuated in comparison to the prescribed standards except at Village - Phalasiya and Village - Mungava Ka Khera, Chanderia, Chittorgarh where the noise level remained within the prescribed limits. The noise level during night time was fluctuated the prescribed noise level standards at Chanderia, Chittorgarh due to commercial activities undergoing at the cement industry; movement of heavy vehicles and nearby railway station and railway siding. Noise levels at all other locations were well within the limit.

8.1.2 Water Environment
• The analysis results of surface water samples reveal that all the tested parameters are well within the prescribed limits except Total Hardness as \( \text{CaCO}_3 \) (mg/l) at Gambhari River Near Bus Stand, Chittorgarh and Berach River Near Padmani Hotel, Chittorgarh.
The analysis results of ground water samples reveal that all the tested parameters are well within the prescribed limits except Total Hardness as $\text{CaCO}_3$ (mg/l) at all locations; Alkalinity as $\text{CaCO}_3$, (mg/l) at Nimbahera, Karthana Village and Khor Village; and Chloride as Cl (mg/l) at Nimbahera and Karthana Village.

### 8.1.3 Land Environment
- The cement industry being one of the largest industries in India and require large area for establishment. Limestone is its key raw material and belongs to huge captive mines. Mining activity scraps the top soil and vegetation cover from the land and thereby degrading the land drastically.

- Soil samples were collected from Village - Karthana, Nimbahera, Tilakhera, Mangrol, Phalasiya, Joravar Ji Ka khera, Mungava Ka Khera and Chanderia to know soil quality in the area. The physio-chemical analysis of all these samples reveal that pH (at 25°C) of soil samples ranged from 7.62 to 8.20 and Conductivity $\mu$Mho/cm ranged from 216 to 393 $\mu$Mho/cm.

### 8.1.4 Other Findings
- Availability of raw material in any region attracts industries to establish manufacturing process in that region. With the demand of cement increasing keeping in view the global scenario, more cement industries are expected to establish in the coming times. Chittorgarh being abundant with raw material, availability of sufficient labor force attracts the cement industry to set up their base here.

### 8.2 Projection of Supply and Demand
As per the projections made by Sub-Group-I of the Working Group on Cement Industry for the Twelfth Five Year Plan constituted by the Planning commission, consumption growth during the 12th plan has been projected under four scenarios. The projections say that the growth in the 1st and 2nd year is expected in the range of around 8 to 9.75% and 8.5 to 10.25% respectively under the four scenarios. The 3rd, 4th and 5th years are projected to show a growth in the range of 9
to 10.75% under the four scenarios. Based on this projected growth rate, the approximate cement consumption has also been worked out to be 261.6 to 265.4 MTPA, 283.3 to 292.6 MTPA, 308.8 to 324.0 MTPA, 336.6 to 358.9 MTPA and 366.9 to 397.4 MTPA for the years 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17 respectively. The Projected Production growth has been considered to be much higher than the domestic consumption for meeting export demand and inventory requirements keeping in view the hike in approximate cement consumption. Since, the production would increase, the overall impacts such as pollution of the air environment, water environment, land degradation, impact on biodiversity, health hazards etc., arising due to cement manufacture are also expected at alarming levels.

8.3 Action Plan for Pollution Control

There is a need of a coordinated action plan on the parts of the cement industries as well as the Government/Local bodies as under:

8.3.1 Cement Industries

- All the points of source emission should be essentially attached to bag filters for control of air pollution. Old cement plants using ESPs as pollution control measure should shift from ESPs to Hybrid ESPs or Bag houses in order to minimize air pollution.

- All pollution control equipments should be properly maintained from time to time to achieve the target of abatement of pollution.

- All unloading operations, transfer points, Belt conveyors should be carried out in closed proximity. Airborne dust at all transfer operations / points should be controlled either by spraying water or by extracting to bag filter. Accumulated dust shall be cleaned / swept regularly and water the area after sweeping.

- Proper dust suppression system should be provided in the Cement Industries to spray water. Spraying of water should be done before unloading. Spray water at crusher discharge and transfer points.
• Coal yard / storage area should be clearly earmarked. The pathways in coal yard for vehicle movement should be paved. Coal other than coal stock pile should preferably be stored under covered shed. The coal stock pile should preferably be under covered shed for new plants.

• Clinker, cement and fly ash should be stored preferably in silo/ closed enclosures covered from all sides and should have a venting arrangement along with a bag filter.

• Provide windbreak walls or greenbelt on three sides of open stock piles

• Dry fly ash shall be transported by closed tankers.

• Provide dust extraction arrangement for packing machines.

• All roads on which vehicle movement of raw materials or products take place should be cemented.

• Employ preventive measures to minimize dust build up on roads. Carry out regular sweeping of roads to minimize emissions.

• Proper Green belt should be developed along the road & plant boundary which will attenuate noise level, arrest dust and improve the environment in surrounding. Local species will be planted after consultation with local forest officer and as per CPCB guidelines.

8.3.2 Government and Local Bodies

• Since the Working Group on Cement Industry for the Twelfth Five Year Plan constituted by the Planning commission projects increase in cement production which would degrade the environment at alarming levels, the government authorities are required to make stringent norms for the operation of industries under jurisdiction for the prevention and abatement of environmental degradation.

• The government should come up with some joints with the corporate sector regarding the subsidized modern and efficient technology available for prevention and control of pollution.
• The cement industries of Chittorgarh under study are all surrounded by National Highway 79 from one or the other side thereby adding dust emission to the local air environment. The stretch of road from Putholi, Chittorgarh to Khor, M.P., of the National Highway 79 must be cemented in order to avoid much dust emission to the air environment. The N.H.79 at present is a two-lane stretch and the work of four laning of road is under process, the width of the lanes should be optimum keeping in view the concentration of movement of heavy vehicles and the existent traffic congestion.

• The local bodies should initiate more and more campaigns to promote better house-keeping practices in and around the cement plants, on the roads attached to the industries/adjoining residential colonies and also on the N.H. 79 which would reduce the impact of dust emitted to the air environment.