EXECUTIVE SUMMARY

EIA, EMP & OBTAINING ENVIRONMENTAL CLEARANCE FOR DEVELOPMENT OF NEW SANITARY LANDFILL SITE FOR MSW IN SHILLONG, MEGHALAYA

Submitted to

Meghalaya Pollution Control Board

Prepared by:

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A) INTRODUCTION

Government of India (GoI) through Ministry of Urban Development (MoUD) has proposed to implement a program to improve urban infrastructure in North Eastern Region Capital cities namely Agartala, Aizawl, Gongtok, Kohima and Shillong. The investment program would improve environment and well being of urban residents in the five capital cities, and increase access to better urban services for the people living in these cities by 2014. The Government of India, for the state government of Tripura, Mizoram, Sikkim, Nagaland and Meghalaya has availed assistance from Asian Development Bank (ADB) towards the cost of North Eastern Region Capital Cities Development Investment Programme (NERCCDIP). The primary objective of this project is to upgrade the existing SWM services and to make them scientific and more efficient and also to adopt sanitary land filling for ultimate disposal as per Municipal Solid Waste (Management & Handling) Rules-2000.

As mentioned before, the Ministry of Urban Development (MOUD) is the national executing agency for the proposed project through the State Investment Project Management and Implementation Unit (SIPMIU), Shillong under Urban Affairs Department, Meghalaya Government. SIPMIU is headed by Project Director and being assisted by Design & Supervision Management consultant (DSMC) Consortium who is designing the infrastructure, managing the tendering of contracts, and will supervise construction. Mott MacDonald Pvt. Ltd. is the lead Consultant of the Consortium. The solid waste management component is being implemented under this program in Shillong. It includes improvement in Primary collection system, Secondary collection system, procurement of bins and various vehicles, development of composting facility (150 TPD) with a new sanitary land fill. The facility may also have waste to energy plant as an alternative option for Resource Recovery from the waste. The site for the proposed waste management facility falls under Greater Shillong Planning Area.

Mott MacDonald has hired SENES Consultants India Pvt. Ltd. to carry out the EIA study in accordance with the prescribed ToR issued by Ministry of Environment and Forest. SENES has carried out detailed primary and secondary studies for preparing this EIA report.

As per the Environmental Impact Assessment (EIA) Notification issued by the Ministry of Environment and Forests, Govt. of India in 2006 (and amended thereafter), Common Municipal Solid Waste Management Facilities (CMSWMF) will be considered as Category 'B' projects and will require prior Environmental Clearance. The proposed project is required to obtain environmental clearance from the State Environmental Impact Assessment Authority (SEIAA) based on recommendation of the State Expert Appraisal Committee(SEAC) as per the EIA Notification September, 2006. However, due to non-availability SEIAA and SEAC in the state of Meghalaya, this project will require EC from Ministry of Environment (MoEF).

B) PROJECT DESCRIPTION

i) Project location

The site for the proposed processing and disposal facility falls under Greater Shillong Planning Area. The site has a total area of 54 acres (21.853 Ha), which will be developed on a vacant government land near Umsawli village having distance of approximately 12 km from Shillong. The land belongs to Government of Mehalaya and allocated for the purpose of development of sanitary landfill and waste processing facility. The geographic location of the site falls under the Survey of India's Topo- Sheet No. 78 o/14. The tentative coordinates for the proposed landfill site are as follows:

Latitude: 25°36/50// N; Longitude: 91°56/31// E

ii) Land availability

The total area obtained from the Govt. for the proposed project is 54 acre (21.853 hectares). Out of which 51.89 acre (or 21 Ha) land will be utilized for development of sanitary landfill and treatment facility. As per the Toposheet, the area is demarcated as unclassified forest. However, land cover analysis data shows that site is devoid of any mature trees. Only few shrubs and grasses have been recorded during site visit. Currently the proposed land is basically barren with grasses and shrubs. The land falls under Greater Shillong Planning Area and the land has been allotted by Govt. of Meghalaya for proposed landfill site

iii) Site surroundings

On the eastern side of the proposed site Umsawli, Mawtari, Mawlong, Mawkasiang, Mawdiangdiang villages are located at a distance of approximately 3 km. No major habitation has been observed at the western site, except Mawpat, Mawtawar village. The southern side of the proposed site is surrounded by a number of villages namely Itshyrwat, Diengiong etc. No villages are located at the northern side of the proposed landfill within a distance of 1-3 km.

iv) Environmental considerations for siting

The project site has been evaluated on the basis of the locational critera laid down by the Central Public Health & Environmental Engineering Research Organization (CPHEEO). All the features as described in the criteria proposed by CPHEEO have been investigated for the chosen site.

v) Compost and Landfill Facilities

It has been proposed to install a compost plant of 150 TPD within the integrated waste management facility. The compost plant will require about 2 hectares (4.94Acres) of area and will have a lifespan of 15 years. Following the compost facility, a secured landfill will be developed to receive the inert part of the MSW and the compost rejects.

The basic design characteristics of the proposed landfill are presented below:

- *Proposed design life:* *Approx. 30 years*
- *Height above ground level:* *13-18 m*
- *Volume:* *18,00,000 m^3*
- *No. of daily cells:* *365*
- *Closure and post closure period:* *20 years*

vi) Liner System

The liner system for the proposed SLF has been designed based on recommendation of the Ministry of Environment and Forests for construction of a non-permeable lining system at the base and wall of waste disposal site area. The specifications are as follow:

- *A 900 mm thick compacted clay or amended soil (amended with bentonite) barrier of permeability not greater than 10^{-7} cm/sec; over the base of the landfill; and*
- *A flexible HDPE geo-membrane liner of thickness 1.5 mm placed in intimate contact with the compacted clay or amended soil barrier.*

vii) Leachate generation, collection and treatment

Assuming that the proposed SLF will not receive run-on from outside areas, an approximate estimate of leachate generation has been made using the assumption (recommended in the CEEPHO manual) that it is 25-50% of the precipitation over the active area and 10-15% of the precipitation over closed areas.

The main components of leachate collection system planned for the proposed project are:

1) *A drainage layer of 300 mm thick granular material of permeability not less than 10^{-2} cm/sec installed above the composite liner for collection of the leachate;*
2) *A system of perforated feeder and header pipes that convey the collected leachate to* leachate collection tanks and then pumping out for treatment/final disposal.
3) A part of the generated leachate will be re-circulated in the landfill to reduce volume for treatment and disposal and for increasing the rate of waste stabilization in the landfill. The remaining volume of leachate will be treated in the leachate treatment system.

viii) Landfill gas generation, control and management

MSW to be disposed in the proposed landfill will be predominantly inert processing rejects from the MSW processing facility. Thus generation of very low quantities of landfill gas is envisaged from the proposed project. However, considering accidental scenarios when small quantity of bio-degradable material may enter the landfill as part of the processing rejects, adequate gas control and management systems will be provided. Adequate measures will be taken to restrict uncontrolled migration of landfill gas from the SLF. These measures include:

- *Low permeability containment layers and systems installed on the base and side walls of the landfill which contains the gas within the site and prevents migration outside the landfill;*
- *Gas drainage blanket provided over the solid waste as part of the final cover of a completed phase; and*
- *Vertical gas vents in the gas-drainage blanket for controlled passive venting of the landfill gas.*

ix) Final Cover

The final cover system for the proposed SLF will be based on the recommendations of MoEF and CPHHEO and will be a composite structure comprising of four layers of an engineered seal designed to prevent water ingress and egress of landfill gas and an agricultural cap comprising of subsoil drainage layer. The final cover system will consist of the following components:

- *Vegetative layer of 450 mm thick with good vegetation supporting soil*
- *Drainage layer of 150 mm thick granular material with permeability greater than 10^{-2} cm /sec*
- *Barrier layer of 600 mm thick clay/amended soil with permeability less than 10^{-7} cm/sec*
- *Gas venting layer of 200 mm thick granular material with permeability greater than 10^{-2} cm/sec*

A suitable vegetative cover will have to be established on the closed site to ensure slow surface runoff, promote evapo-transpiration of rainfall, and retain moisture in the cap and enhance the formation of a soil structure in the agriculture soil.

x) Surface water drainage

- *Rainwater running off the slopes above and outside the landfill area will be intercepted and channelled to a storm water reservoir, thus preventing the operational area of the site. The diversion channel will be provided with low permeability lining to prevent leakage into the landfill.*
- *Rainfall on active tipping areas will be collected separately and managed as leachate via the leachate collection pipes and to the leachate treatment and disposal system.*
- *Rainfall on areas within the landfill site but on final covers of phases which have been completed are not actively being used for waste disposal will be diverted away in drainage channels from active tipping areas, and directed to the storm water reservoir.*
- *Drainage channels on the restored landfill surface will be constructed so that they are able to accommodate settlement, resist erosion and cope with localised storm conditions.*

xi) Support facilities

These will include construction of compound wall, site entrance, access roads, vegetative buffer, waste reception facilities, administrative and site offices, welfare facilities such as toilets, bath room, first aid facility, dining facility, and infrastructural services as electricity, drinking water supply, telephone, drainage system and communication services.

xii) Phased development and closure

The landfill will be operated in phases because it allows progressive use of the landfill area, such that at any given time a part of the site may have a final cover, a part being actively filled, a part being prepared to receive waste and a part undisturbed. Each phase will be designed for a period of one year and will consist of daily cells, daily cover, lifts, intermediate cover, liner, leachate collection facility, gas control facility and final cover over the phase. Each phase will be filled from the base to the final/intermediate cover and capped within this period.

After the last set of cells of a phase is placed, an intermediate or final cover will be constructed. Post closure care and monitoring will be provided for a period of 20 years after closure of each phase.

xii) Alternative Option for Waste to Energy

Since the MSW is mixed type and collected from different sources, it may have non-uniform calorific value. Therefore, the MSW would be processed for homogenization, followed by drying and segregation, through RDF process. The MSW after inspection would be fed into a de-dusting cum pre-drying system for fine separation and classification into two fractions: over sized + 150 mm and undersized –150 mm. Thereafter, higher sized material will be shredded and then fed into Rotary Dryer. In Rotary Drier, the hot air is generated in which woody biomass segregated from MSW is combusted. The output from the Rotary Dryer is then fed into the Rotary Trommel to separate the fines through 8 mm screen. The fine fraction so separated has significant quantum of organic matter that is useful as a soil enricher. Then the material is subjected to Air Classification, in which the lighter components are entrained in the air and collected separately. The light fraction thus separated comprises of biomass, paper, textiles and other combustible material and is termed as Refuse Derived Fuel (RDF) Fluff, with an expected average calorific value of 2,800 kcal/kg.

Although RDF is the most conventional technology for Waste to Energy, other options are also available for waste to energy, such as - by bio-methanation or other process of gas generation and ultimately converted to electric power.

The proposal would aim at generation of syngas (synthetic gas) to produce 2.0 MW per hour electric power from 150 MT of MSW per day at Shillong under the BOOT model for 30 years, is an alternative option. The salient features of the process are as under:

- *Amount of non-segregated MSW per day – 150 tonnes (54,750 tonnes per annum)*
- *Net electricity generated-2.0 MW per hour*
- *Rejects to landfill– Less than 15% of the received feed comprising of only construction and demolition debris.*
- *Total Electricity generated per annum– 15,000 MWhrs.*
- *Land Requirement 12,000 meters square (3.0 Acre area);*
- *BOOT (Build, Own, Operate and Transfer) Agreement Period – 30 years;*
- *Electricity generated – Property of the operating company*
- *Carbon Credits (CDM benefits)– Property of the operating company*

xiii) Project cost

The total project cost is approx. INR 415.07 million.

C) BASELINE ENVIRONMENT

Environmental attributes such as micro-meteorology, air quality, water quality, soil quality, ambient noise and flora and fauna were studied by conducting field studies, on-site monitoring and literature review. Attributes such as land use, tectonics, relief and slope, geology, soil and socio-economic environment were studied by literature review.

i) Topography

Shillong falls under the deeply dissected central upland of Meghalaya Plateau. The relief of Shillong city varies from 1400-1900 m above msl. The slope within the city ranges from 5%-10%, except few locations such as Happy valley, Polo Ground area where the slope ranges up to 5%. Site falls in Shillong Plateau or the Meghalaya Plateau. The proposed project site and surrounding areas has irregular terrain with altitude ranging between 1000-1700 m. Table top mountains, mountain slopes and gorges are characteristic of the area. The elevation of the proposed project site ranges between 1380-1580 msl.

ii) Landuse

The existing land-use within 10 km radius area has been examined from the satellite map (Figure 3-8) and it is observed that majority of the site has been classified as forest areas under unclassified forest (57.85%), protected forest (1.26%) and reserve forest (3.32%). The settlements constitute about 16.80% of the total area which includes Shillong municipal area.

iii) Soil

The physical and chemical characteristics of the soil samples are collected from project site. Based on the analysis it has been observed that the soil pH is in the range of 6.5 – 7.0, the EC values for soil samples collected at two sites were found to be 83.6 µS/cm and 540 µS/cm respectively.40 and 83.6 µS/cm, the levels of zinc and copper in the soil were detected at a range between 7.60-8.41 kg/ha and 2.50-2.90 kg/ha respectively.

iv) Seismicity

Project area is located in Zone V of the Bureau of Indian Standards (BIS) 2002, seismic zone map for India.

v) Climate and meteorology

A micro-meteorological station was also set up at Dhankheti (Location: $25^0 33' 57.10"$ N & 91 $^0 53' 17"$ E) and primary data was collected during November-December 2011. Primary micrometeorological data obtained for temperature during winter season revealed the daily maximum and minimum temperature at 30.6°C and 9.9°C respectively. Daily maximum and minimum relative humidity (RH) was recorded at 97.5% and 33.4% respectively during the primary monitoring study undertaken. 1.6 mm of rainfall with only one rainy day was recorded. The predominant wind direction was observed to be from East-North-East with an average wind speed value of 1.08 m/s. The highest wind speed frequency was generally observed in the range of 0.5-1.5 m/s with calm frequency being recorded at 2.70%.

vi) Ambient air quality

The background-monitoring program was carried out as per standard methodologies and accepted protocols as detailed by the MoEF .Parameters selected for monitoring were PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, H_2S & CH_4.. Observed PM_{10} and $PM_{2.5}$ levels were found to be within the NAAQ standard at two locations. Similar to this, all other parameters of AAQ have also observed to be in limits.

vii) Ambient noise

The noise quality in all the monitoring stations was found to be within the permissible limit of both day (55 decibels) and night time (45 decibels) noise standards specified for residential area. One of the major reasons of low noise level within the noise monitoring area is due to absence of any industrial activity.

viii) Road traffic

The traffic count was monitored continuously for 8 hours, once in the entire study period. The traffic survey was done for both way movement of vehicles categorized into heavy vehicles (truck, bus, trailer, lorries etc.) four wheelers (car, matador, jeep etc.), three wheelers (auto, tempo etc.) and two wheelers (motorcycle etc.). The peak vehicular traffic (63 nos) monitored was recorded between 13.00 to 1500 hrs, and the hourly peak was noted at 14.00-15.00 hrs (33 nos). The lowest vehicular traffic load (10 nos) was recorded between 08.00 to 09.00 hrs.

ix) Surface hydrology

The Umkhrah and Umshyrpi Rivers are the two major rivers of Shillong city. These two rivers are running in the centre of the city and it is approximately 12 km away from proposed disposal site. These two rivers finally join with the Umiam Reservoir.

x) Hydrogeology

Pre-monsoon depth to water level (during 2006) at Shillong was found to be 0.60m bgl while the post monsoon levels were found to be 0.14m bgl . As per findings of CGWB, a few pockets of the district are having high concentration of Fe (value ranging from 1.52 to 8.4 ppm).

xi) Water quality

The physicochemical characteristics of ground and surface water samples collected from four locations were compared with IS 10500: Indian Standards for Drinking Water reference values while those of surface water were compared to CPCB's Class C water quality. The result indicate that the Coliform contamination was not significant in the ground water samples. DO level is slightly higher in comparison to the standard (4 mg/l).

xii) Ecology

The East Khasi Hill district falls within the Indo-Burma Biodiversity Hotspot Region as delineated by the International Union for Conservation of Nature & Natural Resources (IUCN) and the area as whole has been accorded international status in terms of conservation of biodiversity. It has the richest reservoir of plant diversity in India and is one of the 'biodiversity hotspot' of the world supporting about 50% of India's biodiversity. All type vegetation like grassland, meadows, marshes, swamps, scrub forest, temperate and alpine are found here the region exhibits the richest diversity in orchids, zingibers, yams, rhododendrons, bamboos, canes and wild relatives of cultivated plants.

The proposed landfill site near Umsawli village is not located in the demarcated forest land i.e. Reserved Forest or Protected Forest. The vegetation in the proposed landfill site mainly consists of shrubs, i.e. pine. There are also some grasses and other shrubs, like Lantana and Eupatorium.

During the terrestrial plant survey, 90 plant species were recorded, which includes 42 species of trees, 15 species of shrubs, 9species of herbs, 8 species of climbers, 5 genus of bamboo, 2 genus of canes and 8 genus of orchids.

There is no ecologically sensitive wildlife habitat like National Park, Wildlife Sanctuary, Biosphere Reserve, Elephant Reserve, Tiger Reserve, Ramsar Sites in the entire study area of the proposed landfill site.

xiii) Socio economic condition

The study area villages comprises of Umsawli, Itshyrwat, Umpling, Tynring, Mawdiang Diang, Mawkasiang, Mawlong, Mawpat, Lumkseh and Mawtawar. Of the study area villages, Umpling has the highest population (9796) followed by Mawpat (4663). The lowest population (147) was found in Itshyrwat village, whereas the lowest household size (4.91) was recorded at Lumkseh village. The average sex ratio of 910 was recorded in the study

area villages which is lesser than the state average of 972 females per thousand males. Over 57% of the population in the study area villages belong to scheduled castes (0.50%) and scheduled tribes (56.90%). The literacy rate in Greater Shillong Planning Area is 88% which is more than the national average of 65.4 %(census 2001). The work participation rate within the Shillong city is 27.6% which is much less than the national average of 39.3%.

D) ENVIRONMENTAL IMPACT ASSESSMENT

This section highlights the negative and positive impacts that are likely to occur due to construction and operation of the proposed processing and disposal facility.

i) Ambient air quality

Particulate matter is expected to be the main pollutant. Fugitive dust will be generated as a result of site clearing and preparation, excavation and vehicular use of unpaved routes. Construction equipments, earth moving machinery and other vehicles will add other air pollutants, viz. carbon monoxide (CO), oxides of nitrogen (NOx), sulphur dioxides (SO2) and unburnt hydrocarbons (HC) due to tailpipe emissions. However, due to absence of any sensitive receptors in the immediate vicinity of the project site, the significance of the impact is considered to be low. Provision of adequate air pollution control measures such as dust suppression in working areas by water sprinkling, paving of permanent roads, carrying out maintenance and pollution check of machineries and vehicles, and planting of green belt will further help to significantly reduce the impact.

MSW to be disposed in the proposed landfill will be predominantly inert processing rejects from the MSW processing facility. Thus generation of very low quantities of landfill gas generation is envisaged. Emissions of fugitive dust, bio-aerosols are quite common from operational activities viz. waste transportation, receipt, unloading, processing and storage. However given that the Indian MSW is characterized by high moisture content and also taking into account that the proponent will be implementing appropriate mitigation measures viz. selection of vehicles with PUC, covered transportation of waste, etc the impact is not considered to be of significance.

ii) Ambient noise

Increase in noise level may be caused by equipment and machines used for grading, excavation and earth-moving, vehicles used for the transportation of equipment, materials and people, and diesel generator sets. The impact on ambient noise levels due to the project activities during both construction and operation phases are expected to be negative, short-term, and reversible by mitigation measures. Preventive maintenance and servicing of equipments and vehicles, provision of noise shields and development of green belt around the project site are some the mitigation measures planned for reducing the noise related impacts.

iii) Traffic density

During construction phase, there will increased vehicular movement. During operation phase, substantial number of transportation vehicle movements to the MSW processing & disposal facility will usually take place. There are no sensitive land uses around the road which may be affected by continuous traffic movement. Thus the overall impact significance due to increase in traffic density is moderate but can be lowered by ensuring that the project-related vehicles follow road safety rules.

iv) Topography and drainage

The proposed developmental activities are not large enough to impact the topography and drainage at the project site. Garland lands will be constructed around the project site boundary to intercept surface water run-on to prevent the water from entering the landfill and causing leachate generation. The intercepted water will be directed to storm water drainage or discharged in surrounding drains in accordance with the natural drainage of the area. The topography of the project site will be altered due to construction of the above and below ground landfill but topography of the surrounding land will not be altered.

v) Water quality

The activities during the proposed development that can impact the quality of surface water, especially during the monsoon season, are as under.

- *Wash out of soil with runoff from the site*
- *Improper disposal of construction debris*
- *Uncontrolled disposal of domestic wastewater from temporary labour camps during construction phase or from constructed latrines during the operation phase*
- *Washout of oil and grease from the fuel storage areas, and vehicle*

Hence avoidance of monsoon season for construction activities, proper management of waste water streams, and proper storage and handling of fuels and other chemicals will be able to prevent any significant impact on the surface water quality.

vi) Ecology

The proposed site and its surroundings do not have any critical animal habitats. There are no notified forests or perennial rivers in the immediate vicinity of the project site that can get affected by the proposed activities. The proposed project site has a few shrubs and trees which may need to be cleared for site preparation. However, the proposed peripheral greenbelt will provide a much better habitat.

vii) Socio economic condition

Potential impacts of construction and activities related to progressive phase development on the local communities are due to generation of noise and dust and increase in traffic density on the PWD road. There is a possibility that such activities and resultant pollution and

disturbance may cause stress level to increase in the nearby residents. However, the existing settlements are sufficiently away from the project site and further development around the project site is planned to be regulated as per Shillong Master Plan so that adverse effects of the project on adjoining community can be minimized. The impact on the socio-economic environment is considered as moderate. Regulation of further development around the project site, management of traffic on the PWD road and protection of occupational health and safety will ensure that the impacts are restricted to as low as possible.

E) ENVIRONMENT MANAGEMENT PLAN

This Environment Management Plan (EMP) is a project specific plan developed to ensure that the proposed development of the processing and disposal facility at Shillong is carried out with adequate environmental mitigation and monitoring measures addressing the environmental risks associated with the different stages of the project.

i) Air emission reduction and control

- *Periodic maintainance of heavy equipment, machinery and vehicles Turning-off machines and equipments when not in use;*
- *Use of tarpaulin for covering construction material ;*
- *Paving of road; dust suppression by water sprinkling on stockpiles and unpaved roads;*
- *Greenbelt development;*
- *Ambient air quality at the landfill site and its vicinity will be monitored for parameters such as CO, SO_2, PM, NO_x, and HC; and*
- *During operation phase of the landfill, collection of minor volumes of landfill gas will be collected in the gas-drainage layer and sent through a collection network to the gas flaring unit, to completely eliminate any risk of methane build-up in the atmosphere over the landfill.*

ii) Noise emission reduction and control

- *Conducting activitiesduring day period;*
- *Construction equipment fitted with noise shields or exhaust silencers;*
- *Use of earplugs/muffs;*
- *Avoiding use of horns;*
- *Periodic maintenance/servicing of equipments and vehicles;*
- *DG sets provided with acoustic enclosures; and*
- *Monitoring of noise levels at fence- line and near noise-generating stationary sources Development of green belt around the project site will further aid in lowering the impact of noise generated inside the site on receptors outside.*

iv) Odour control

- *Adequate compaction of waste layers;*
- *Speedy disposal and burial of malodorous wastes;*
- *Effective use of appropriate types of daily cover;*
- *Progressive capping and restoration;*
- *Use of herbal sprays*
- *Transportation of wastes in closed vehicles*
- *Effective landfill gas management;*
- *Development of greenbelt*
- *Effective leachate management; and*
- *Consideration of prevailing wind direction when planning leachate treatment plants, gas flares, and direction of tipping.*

v) Water quality preservation

- *Provide leak-proof storage for fuel,lubricants and hazardous waste with secondary containment;*
- *Use of soak pits and septic tanks;*
- *Installation of oil water separator for treating waste water from vehicle maintenance and workshop areas*
- *Disposal of treated leachate will be done in accordance with the standards listed in MSW 2000 Rules.*

vi) Soil preservation

- *Excavation to be avoided during monsoon season; and*
- *Loss of earth material in run-off to be avoided by covering stockpiles and providing check dams and garland drains with baffles.*

vii) Green belt development

- *Native plant species to be planted which have good ornamental values, are fast growing with excellent foliage density, large leaf area, hairy surface form a dense canopy cover;*
- *Species to have the ability to withstand conditions like inundation and drought, have soil improving quality, and requiring minimum maintenance.*

viii) Occupational health and safety management

- *Water logging that could lead to breeding of mosquitoesto be avoided;*
- *Spraying of insecticides, rodenticides to control insects, pests;*
- *Regular maintainenece of equipment and vehicle;*
- *Use of helmets, safety footwear and rubber gloves;*
- *Maintenance of sufficient first-aid kits; and*
- *Use of fire extinguishers.*

The approximate cost of implementation of the EMP would be around 31,13,025 INR.

F) DISASTER MANAGEMENT PLAN

Disaster management plan is a well evolved, organised and rehearsed strategy to contain the adverse effects of a possible disaster. It aims to mobilise the internal resources and use these, with minimal dependence on external agencies for the following purposes:

- *To control and contain causes of disasters to the extent possible;*
- *To minimize the effect by localizing spread of the disaster;*
- *To safeguard employees and people in the vicinity in the event of disaster;*
- *To inform employees, the general public and the statutory authorities about the hazards/risks assessed, safeguards provided, residual risk, if any, and the role to be played by them in the event of disaster;*
- *To prevent recurrence of such a disaster;*
- *To preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency;*
- *To work out a plan with all provisions to handle disaster and to provide for emergency preparedness and the periodic rehearsal of the plan.*

The development of an effective disaster management plan ensures that the potential causes of disaster and efforts to prevent and respond to such disasters can be planned in advance. At a landfill site, an emergency can take place at any time due to extreme weather events (such as earthquake or floods) or by major accident in the site (fires or explosions), despite the installation of various safety devices. Though the risk of fire or explosion is considered minimal due to the inert nature of the waste dumped in the landfill, this disaster management plan will be implemented in case of an unforeseen scenario of major fire or explosion.

The key elements of the Disaster Management Plan are pre-disaster preventive measures including maintaining, a fire fighting system and an emergency response team, assigned responsibilities to the emergency response team to tackle an emergenc, and post-disaster investigation and reporting.