RISK ASSESSMENT

7.2 Risk Assessment

Assessment of risk and its management is essential to guard against and mitigate the consequences of major accidents. The term, " major accident" means an unexpected and sudden occurrence of event from abnormal developments in course of one's industrial activity leading to a serious danger to public or environment, whether immediate or delayed, inside or outside the installation involving one or more hazardous substances.

Keeping in view the three basic principles i.e. prevention, preparedness (both pro-active and reactive) and mitigation of effect through rescue, recovery, relief and rehabilitation; a comprehensive blue print of risk assessment and management plan will be prepared for Jagannathpur OC incorporating the following:

* Identification and assessment of risks.
* Recommendation of measures to prevent damage to life and property against such risks.

7.2.1 Slope failure in Mine Pit

The exposed ends of the coal seams and OB will be left with a safe slope to avoid slope failure and collapse of benches. Similarly, at the end of mining operation safe terminal pit slope will be provided to avoid failure.

All the working benches will be under the direct supervision of project level officials and all the necessary precautions will be taken to make the workings safe.

The removal of OB and coal winning will be done by leased equipment. The salient features of mining system are as follows: -

i) Height and bench in coal and OB will depend on the size of leased equipment. The provision of coal mine regulations and related circulars shall be strictly followed for designing bench parameters in coal and OB.

ii) Seam gradient - 1^0 to 2^0

iii) Total dump height – 60 m (two benches of 30 m each)

iv) Bench slope -

Coal / OB - 70^0

Spoil - 37^0

Keeping the geo-mining characteristics of the deposit in view shovel – dumper / FE loader – tipper system of mining has been proposed for OB removal as well as coal. Considering, the average mine floor gradient of 1^0 - 2^0, the coal and OB benches are proposed parallel to the seam.

Both coal production and OB removal will be done through outsourcing.

7.2.2 Slope failure in OB Dump

Major part of the overburden will be dumped in internal dumps and the rest will go to external dump. It is suggested to level the dump and grade it properly to avoid water accumulation. The following design criteria have been considered for waste dumps.

(i) OB in external dumps will be stacked in 30 m high benches.

(ii) OB in internal dumps will also be stacked in 30 m high benches.

(iii) The barrier distance between internal dump and coal production bench will be 60m to have smooth functioning of machineries.

(iv) Dump slope for each deck to be at natural repose (37°).

(v) Height of the external dump will be 60m above the original profile of the ground level.

7.2.3 Blasting

For proper blasting and minimising the adverse side effects due to blasting viz noise ground vibration back-breaks, air blast, fly rocks etc. the following precautions have been suggested to avoid dangerous situation :

* The optimal blast design parameters will be implemented.

* A safety zone of 100m beyond the quarry limit is envisaged and controlled blasting will be done keeping this aspect in mind.

* The blasting will be done at a fixed time as far as possible.

* All necessary precautions will be taken while blasting.

* Regular monitoring of vibration will be carried out and necessary precautions will be taken while blasting.

* Before blasting is done, warning siren will be activated so that people can move over to safe places.

* Arrangement will be made to alert the people working for sudden inrush of water by accidental development of fracture connecting the working place to the water bodies/ aquifer.

7.2.4 Explosive Handling

Adherence to relevant statutory safety provisions as stipulated by DGMS, Chief Controller of Explosives and others will be made.

7.2.5 Mine inundation

The mine pit will receive water from three sources namely, direct precipitation over excavated area, surface run-off from the surrounding area and seepage from the strata. During heavy rainstorms, there may be a situation when the mine may get flooded due to ingress of water from the higher ground through natural drainage. This may cause loss of human life, equipment etc. To guard against this eventuality, the following steps will be taken.

* Provision of garland drain around the mine to prevent ingress of precipitation, run off & keeping the same.

* Provision of sufficient number of pumps to pump out mine water during the critical rainfall period.

* Precaution against danger from local stream.

7.2.6 Fire

Accidental fires are causes of large scale loss of property and life. Keeping this in view, adequate firefighting arrangement has been made. Adequate number of fire extinguisher have been provided for store and other service buildings. While calculating total water demand for the project, provision for firefighting has also been made.

7.2.7 Road Accidents

Sufficient arrangements for illumination of road including haul roads will be undertaken. Properly planned and designed road crossing will be implemented to prevent vehicular accidents. Further haul roads have been planned in such a way that the HEMM traffic will be away from the passenger traffic. These are likely to prevent road accidents. All the dumpers are fitted with sound warning while reversing, thereby preventing accident.

7.2.8 Medical Preparedness

For guarding against accidental hazards the following measures will be taken:

1. Emergency Ambulance Service will be kept ready on a 24 hour basis.

2. Doctor and paramedical staff will be made ready during emergency.

3. First Aid Medical facilities will be provided at work place.

The nearby existing mine has already been provided with a dispensary with qualified doctors in addition to a first aid centre. These will meet the medical emergencies arising out of accident.

7.2.9 Other Miscellaneous Measures

* Proper illumination in the quarry, OB dump area, workshop and other workplaces besides roads will be undertaken as mentioned above.

* Efficient communication system to allow communication link amongst various work centers to help in avoiding accidents and handling of emergencies.

* Fire alarm and firefighting system will be provided at project site.

The adoption of preventive measures as enumerated above will ensure that the operation of this project will be safe as well as environment friendly.

7.3 Social Impact Assessment

The project involves total **686.151Ha** of land for quarry, industrial and residential complex, safety zone and external dumps etc. **1500** number of project affected persons has been estimated and the number of project affected families from four villages namely Chaura, Jagannathpur, Pumpapur and Paraswarkala falling within the quarry area, as **390.** The PAF's and PAP's will be rehabilitated and paid economic compensation / employment as per **State Govt. R&R package, national R & R policy& CIL R & R Policy.**

7.3.1 Secondary Employment opportunities

There will be spontaneous economic stimulus in the area with the commencement of opencast mine. Traders and private enterprises will grow in the area with this economic growth. Besides, the State exchequer will derive financial revenues through levy of royalty, sales tax etc. and Central Government will also be benefited by way of Central Sales Tax, Income Tax, Goods and Services tax, Coal Cess etc.

7.3.2 Educational Facilities

There are 48 primary schools, 43 middle schools, 11 secondary schools and 7 sr. secondary schools existing as educational institutions in the study area.

7.3.3 Medical Facilities

There is 4 primary health centers, 17 primary health sub center and 4 maternity and child welfare centers taking care of the population in the study area. Every worker is to be periodically checked up once in every five years keeping proper record of their health profile including X-ray and laboratory tests by establishing and extending pathological facilities. The importance of such periodical medical examination is to detect and prevent occupational diseases like Pneumoconiosis and Tuberculosis. The mining activities expose workers to some injuries and health hazards. Incidence of occupational disease and injuries and health hazards has not been recorded in those health centers / hospitals.

7.3.4 Preventive measures: -

The SECL authorities have adopted following measures to prevent occupational diseases and health hazards.

* Pre-employment, pre-placement and periodic medical examination of employees.

* Regular monitoring of working environment and implementation of safety and control measures, to prevent hazards.

* Use of protective equipment, clothing, helmets, Gas mask, shoes, etc.
* Periodical medical examination of every worker is done once in five years to detect preventable and curable diseases at an early stage.

* Cases suspected having Pneumoconiosis is examined by a Special Board constituted by the Chief Medical Officer. Established cases are suitably compensated and their job is changed if required.

7.4 Ambient Air Quality Impact Prediction Modeling by FDM, USEPA

AAQ modeling based on FDM, USEPA has been used for assessment of impact on ambient air quality at 6 locations termed as receptors, namely, A1, A2, A3, A4, A5 & A6 (Refer Plate X(A)) due to peak production of 3.50 MTY for Jagannathpur OCP. Refer AQIP output data in Section -IV of EIA/EMP.

This model basically determines the incremental PM_{10} levels in $\mu g/m^3$ on the receptor points due to the various mining activities, using calculated emission factors for the various mining activities such as transportation of coal & OB, Wind erosion, Top soil removal, OB dumping, loading & unloading of coal at coal stock yard etc.

The air quality modelling for Jagannathpur OCP has been taken up for its peak capacity i.e. 3.5 MTY. The pollution load at the receptor locations because of the various activities during the coal extraction of 3.5 MTY is modelled.

The input parameters are tabulated vide page AQIM – 1 to 13. The Emission factors calculated based on different mining activities are tabulated at page AQIM-1 to 13. The entire quarry activities have been divided into two major parts: Active mining pit & internal OB dumps. Coal transportation is done through central haul road system shown in the Plate – X(A) as strips C-0-L-1 to C-0-L-2 and C-1-L-1 to C-1-L-3. OB transportation is through roads termed as OB-1-L-1 to OB-1-L-3 and OB-2-L-1 to OB-2-L-4 road series. The pit and Internal OB dumps have also been shown in Plate X(A).

Volume for blasting of OB has been considered as (5m) x (4m) x (10m) Depth = 200 cum per blast. Blasting volume for coal has been considered as (5m) x (4m) x (10m) Depth = 200 cum.
No. of blasting holes and blasted area per day have also been calculated.

The Emission factors (EF) were calculated for PM_{10} generation per day considering following activities:

<u>For OB</u>

1. Drilling - 0.56 Kg/hole blasted
2. Blasting - 0.00022 x (Area blasted) $^{1.5}$ kg

3. Loading of OB - 1.4×10^{-4} kg/te
4. OB Unloading - 5.0×10^{-4} kg/te
5. OB Bulldozing - $0.754 \times (S)^{1.2} / (M)^{1.3}$ kg/hour
6. OB transportation- 0.53 kg/vehicle km travelled
7. Wind erosion - 0.09 kg/Ha/hour (taking the number of calm hours into account)

For Coal

1. Drilling - 0.22 kg/hole blasted
2. Blasting - $0.00022 \times (\text{Area blasted})^{1.5}$ kg
3. Loading of coal - 1.5×10^{-3} kg/te
4. Coal unloading - 1.23×10^{-3} kg/te
5. Coal Bulldozing - $10.324 \times (S)^{1.2} / (M)^{1.4}$ kg/hour
6. Coal transportation - 0.53 Kg./ vehicle km travelled
7. In-pit crushing - 0.056 kg/te (primary)
   - 0.13 kg/te (secondary)
8. Wind erosion - 0.09 Kg/ Ha./ Hr. (taking the number of calm hours into account)

Other aspects

1. Coal and OB extraction will be done by shovel and dumper combination.
2. Only 24 Hourly Micro meteorological data in terms of Wind speed (m/s), direction (Angular, considering North as zero degree and for other directions moving clockwise from North). Wind temperature (in Kelvin), stability class and mixing height have been considered.
3. Emission reduction with the application of water
   - -70% for Drilling (Coal & OB) & OB Unloading
   - -50% for Wind erosion (Coal & OB)
   - -75% reduction for coal/OB transportation with water application more than 2 Liter/m^2/hr
4. Emissions reduced by 70% in for coal crushing arrangement with water application.
5. The calm period is high in winter season.
6. The emission factors are derived on the basis of a CMPDI S&T study entitled "Air quality impact prediction (AQIP) for coal mining projects" conducted in the year 2011-12.

The Emission factors and the incremental values of (PM_{10}) considered in the EIA/EMP for Jagannathpur OCP (3.5 MTY) is tabulated below:

Table – 7.1- Emission factors calculated for different activities during mining

TOTAL EMISSION FACTORS FOR JAGANNATHPUR OC		
	E.F (gm/m2/s) without cont.measures	**E.F (gm/m2/s) with cont.measure)**
EF for Active Mining Pit	**4.79E-04**	**4.60E-04**
EF for Active Internal OBD	**1.52E-05**	**1.45E-05**
EF for OB-1 -L-1 to L3 (gm/m/s)	**1.14E-01**	**2.84E-02**
EF for OB-2 -L-1 to L4 (gm/m/s)	**1.14E-01**	**2.84E-02**

EF for C-0-L-1 to L2 (gm/m/s)	**9.89E-03**	**2.47E-03**
EF for C-1-L-1 to L3 (gm/m/s)	**9.89E-03**	**2.47E-03**
EF for Coal Stockyard	**7.69E-04**	**6.91E-04**
EF for Wind erosion of Passive Zone	**1.29E-06**	**6.43E-07**

Modelling Results:

The results of air quality modelling exercise for PM -10 have been presented in Table - 7.2. The predicted ground level concentration includes the mean value of the background (existing) concentration of PM-10. The modelling exercise reveals the followings:

(i) The maximum incremental value of PM-10 at Chaura (A6), located at a distance of 1.5 km in NE direction from the mine under controlled condition, is 14.82 µg/m3. It is observed when wind is predominantly blowing from SW direction and when Jagannathpur mine is going for a production of 3.5 MTY. The predicted PM-10 value will be 92.92 µg/m3 under controlled condition.

(ii) The maximum incremental value of PM-10 at Jaganathpur (A2), located in core zone of the mine under controlled condition, is 12.23 µg/m3. It is observed when wind is predominantly blowing from SW direction with mine is going for a production of 3.5 MTY. The predicted PM-10 value will be 91.86 µg/m3 under controlled condition.

(iii) The maximum incremental value of PM-10 at Ketra (A5), located at a distance of 1.75 km in SW direction from the mine, is 2.23 µg/m3. It is observed when wind is predominantly blowing from SW direction with mine is going for a production of 3.5 MTY. The predicted PM-10 value will be 78.13 µg/m3 under controlled condition.

Table 7.2 – Increase in PM_{10} levels due to Jagannathpur OC Project – with control and without control condition

Values in (in µg/m3)

S.No.	**Receptor Locations code**	**Receptor Locations name**	**Baseline PM10 values (in µg/m3)**	**Incremental Pollution load (Due to Jagannathpur OCP 3.5 MTY peak production)**		**Net pollution load (in µg/m3)**	
				Without control	With Control	Without control	With Control
1.	A1	Khadgawan	79.33	0.66	0.27	**79.99**	**79.6**
2.	A2 (Core)	Jagannathpur	79.63	27.96	12.23	**107.59**	**91.86**
3.	A3	Dharampur	76.80	0.0	0.0	**76.8**	**76.8**
4.	A4	Manpur	69.70	0.0	0.0	**69.7**	**69.7**
5.	A5	Kerta	75.90	4.73	2.23	**80.63**	**78.13**
6.	A6	Chaura	78.10	34.81	14.82	**112.91**	**92.92**

The isopleth of the incremental PM_{10} levels due to Jagannathpur OCP 3.5 MTY (with control) is shown in Plate No. X(B) –with mine surface features plan and Plate No. X(C) – Study area. The isopleth of the incremental PM_{10} levels due to Jagannathpur OCP 3.5 MTY (without control) is shown in Plate No. X(D) –study area.

Conclusion:

The incremental predicted PM_{10} values due to Jagannathpur OCP (3.5 MTY) have been predicted with strict controlled conditions, specially water application on coal/OB haul road which is more than @ 2 Liter/m^2/hr. On the basis of the AQIP study, the followings may be concluded:

(i) When the coal production from Jagannathpur OCP is increased for its peak capacity i.e. 3.5 MTY, the predicted concentration of PM -10 at various locations is below the National Ambient Air Quality Standards(NAAQS) value of 100 µg/m3

(ii) In this study the impact of various control measures at source level has only been considered. The attenuation of PM -10 concentration due to green cover in and around the mine has not been considered. So, The air pollution (PM_{10}) attenuation by green cover will improve the air quality of the mine.