Mechanism for "Assessment of Damage to Air Quality", "Damage Assessment of Health Issues" and "Agricultural Production Loss" w.r.t Stone Crushers, in compliance of Hon'ble NGT Order dated 30.05.2019, in the matter of O.A. No. 739/2018; Residents of Gram Panchayat Varahiya versus State of MP

Mechanism for Assessment of Damage:

The requisite mechanism has been developed for the following parameters relevant to stone crushers:

1. Damage to the Air Quality
2. Damage Assessment of Health Issues
3. Agricultural Production Loss.

1. Damage to the Air Quality:

For calculating the damage to air quality, the following details are needed:

i. Total Load of particulate Emissions (PM_{10} and $PM_{2.5}$) beyond prescribed limitsi.e.$Load_{PM10}$ and $Load_{PM\ 2.5}$
ii. Environmental Price of Particulate Emissions (PM_{10} and $PM_{2.5}$)i.e.EP_{PM10} and $EP_{PM2.5}$
iii. A Formula to calculate Damage to air quality in monetary termsi.e.$Damage_{AQ}$

1.1 Calculation of Total Load of Particulate Emissions($Load_{PM10}$and$Load_{PM\ 2.5}$) beyond prescribed standard:

1.1.1 Calculations for Load of PM_{10} Emissions ($Load_{PM10}$):

The load of PM10 emissions may be calculated by using the following details and methodology:

Limit of PM_{10} as per prescribed standard (A): a μg/m3

Average measured Concentration of PM_{10} in the ambient Air in the affected site (B): b $\mu g/m^3$. The sampling and analysis of ambient air will be required at various distances from the stone crushers, to determine the affected area and average concentration.

Concentration ofPM_{10} emissions in excess of prescribed limit (C): B-A = cμg/m3

Concentration of PM_{10} emissions in excess of prescribed limit in Kg/m3 (D): d Kg/m3
(e.g. if the Concentration in mg/l i.e C is cμg/m3, the concentration in Kg/m3 is:cE-9)

Mixing height of air in the affected Site (E): e meters

Area of the affected site (F): fm2

Volume of Ambient air in Affected area (G): = E x F = g m3

Total Load of PM_{10} in excess of the prescribed limit in the affected site (H): D x G= h Kg

Since depending on the wind speed, the air in a particular area is being replaced continuously with the new air. Since we, need to calculate the total Load of PM_{10} Emissions per day, a replacement factor needs to be derived as follows:

Let's suppose:

Radius covered for ambient air monitoring: 2 Km

Average wind speed: 1 Km/h

Then, Air replacement factor (I) : 1/2 x 24 =12

Total Load of PM_{10}in excess of the prescribed site in the affected site (Load $_{PM10}$): H x I = i kg/day

As an alternative to the above method, the load of particulate emissions from the different stone crushers may also be calculated by using emission factor for stone crushers.

1.1.2 Calculations for Load of $PM_{2.5}$ Emissions:

Limit of $PM_{2.5}$ as per prescribed standard (K): jµg/m3

Average measured Concentration of$PM_{2.5}$in the ambient Air in the affected site (L):kµg/m3. The sampling and analysis of ambient air will be required at various distances from the stone crushers, to know the affected area and average concentration.

Concentration of$PM_{2.5}$emissions in excess of prescribed limit (M): L-K = lµg/m3

Concentration of $PM_{2.5}$emissions in excess of prescribed limit in Kg/m3 (N): m Kg/m3
(e.g. if the Concentration in mg/l i.e Mis lµg/m3, the concentration in Kg/m3 is:lE-9)

Mixing height of air in the affected Site (O): n meters

Area of the affected site (P): o m2

Volume of Ambient air in Affected area (Q): = O x P= p m3

Total Load of $PM_{2.5}$in excess of the prescribed limit in the affected site (R): M x Q= q Kg

Since depending on the wind speed, the air in a particular area is being replaced continuously with the new air. Since we, need to calculate the total Load of $PM_{2.5}$Emissions per day, a replacement factor needs to be derived as follows:

Let's suppose:

Radiuscovered for ambient air monitoring: 2 Km

Average wind speed: 1 Km/h

Then, Air replacement factor (S): 1/2 x 24 =12

Total Load of $PM_{2.5}$in excess of the prescribed site in the affected site (Load $_{PM\,2.5}$): R x S = j Kg/day

As an alternative to the above method, the load of particulate emissions from the different stone crushers may also be calculated by using emission factor for stone crushers.

1.2. Environmental Price of Particulate Emissions($EPPM_{10}$ and $EP_{PM2.5}$):

To calculate the environmental prices of particulate emissions i.e. PM_{10} and $PM_{2.5}$, "Environmental Prices Handbook EU28 version" Methods and numbers for valuation of environmental impacts, Bruym, S.T. et al,2018, Delft, CE Delft was referred. The environmental prices are the constructed prices for pollution or social cost per Kg Emissions. In other words, environmental prices represent the loss of economic welfare that one additional Kg. of the Pollutant ($PM_{10}$and $PM_{2.5}$ in the present case) is introduced into the environment. The Environmental Prices Handbook EU28 version and the associated webtool provide environmental prices for over 2500 pollutants. The value for environmental price given for pollutant level i.e value for emissions on environmentally damaging substances (PM_{10} and PM $_{2.5}$ in the present case) have been considered in the proposed mechanism.

The values for the Environmental Prices for average particulate Emissions (PM_{10} and $PM_{2.5}$) as reported in the above hand book are as follows:

Pollutant	Environmental Price for average atmospheric Emissions(**€ /kg Emissions, 2015**)		
	Lower	Central	Upper
Particulate Matter (PM_{10})	19	26.6	41
Particulate Matter ($PM_{2.5}$)	27.7	38.7	59.5

The values per Kg of average particulate emissions were recalculated specific to India by considering the Central values, Exchange rates and inflation factor (2015 to 2019)as follows:

Environmental Price for Average Particulate Emissions (Rs./Kg. Emission)= Environmental Price per Kg Emission x Exchange Rate x inflation factor

1. Environmental Price for Average Particulate Emissions, $PM_{10}(EP_{PM10})$: 26.6 x 79.59 x 1.19= Rs. 2519.34/Kg Emission
2. Environmental Price for Average Particulate Emissions, $PM_{2.5}(EP_{PM2.5})$: 38.7 x 79.59 x 1.19= Rs. 3665.36/Kg Emission

1.3. Formula to calculate the damage to Air Quality / day ($Damage_{AQ}$)in monetary terms:

The formula/equation for calculating the damage to the air quality ($Damage_{AQ}$) is derived by using the following values:

i. Total Load of PM_{10} in excess of the prescribed site in the affected site in Kg/day($Load_{PM10}$)
ii. Total Load of PM2.5 in excess of the prescribed site in the affected site in Kg/day ($Load_{PM2.5}$)
iii. Environmental Price for Average Particulate Emissions, $PM_{10}(EP_{PM10})$: Rs. 2519.34/kg Emission
iv. Environmental Price for Average Particulate Emissions, PM 2.5 i.e.($EP_{PM2.5}$):Rs. 3665.36 /kg Emission

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Damage to Air Quality in Monetary Terms /Environmental Price Rs. /day:

$$Damage_{AQ}\ (Rs/day) = (Load_{PM10} \times EP_{PM10}) + (Load_{PM2.5} \times EP_{PM2.5}) \quad Eq\ (1)$$

Note:

a) The value obtained from this formula should be multiplied by the number of days depending on the time period for which environmental damage is to be calculated.

b) The sites/areas where many types of the industries are co-existing, % contribution of stone crushers for PM_{10} and $PM_{2.5}$ in the ambient air, may be calculated based on source apportionment studies. In such cases, the contribution of the stone crusher may be calculated by multiplying the Damage AQ with the contribution factor for stone Crushers.

2. Damage Assessment of Health Issues:

The major health issues associated with the pollution caused by stone crushers are respiratory infections such as aggravation of asthma, respiratory symptoms and increase in hospital admissions. PM_{10} and $PM_{2.5}$ emissions have high risk of mortality and morbidity impacts on the human population in the vicinity of stone crushers.

For assessing the damage caused to health by the stone crushers, the data with respect to respiratory illness/symptoms in the affected area, needs to be obtained from the Health Centres serving the affected sites. Since, all the cases of these health impacts are not reported to medical facilities, health survey of the affected area with the help of questionnaire needs to done simultaneously to have realistic data of the affected people.

Once the above data is obtained the damage assessment may be done based on the cost of illness approach. The reference document used for developing the mechanism for damage assessment of health issues is Srivastava, A and Kumar, R (2002). "Economic Valuation of health impacts of Air Pollution in Mumbai". Environ. Monit. Assess. 75: 135-143.

The cost of Illness due to respiratory illness/diseases in the affected area is estimated by considering the base estimate reported in the reference study, by using per capita income of both the cities i.e. Mumbai as reported in the reference document and the affected area in question, by using the following details:

No. of cases of respiratory illness/diseases reported based on the data obtained from Medical facilities serving the affected area and health survey: X

Cost of Illness per person in Mumbai area (COI_{Mumbai})in Rs.: Rs. 14378 as of 1997

*Per capita income of the affected area for the year 1997 in Rs. ($Inc_{Affected\ area}$)

*Per capita income of Mumbai for the year 1997 in Rs. (Inc_{Mumbai})

Cost of Illness per person in the affected area ($COI_{Affected\ area}$)in Rs:

$$COI_{Affected\ area} = COI_{Mumbai} \times \frac{Inc_{Affected\ area}}{Inc_{Mumbai}}$$

(Note: if per capita income of both the cities for 1997 is not available, the values of any year having per capita income for both the cities may be taken and the COIMumbai may also be inflated to that year to calculate COI affected area)

The cost of illness determined from the above formula may be inflated to requiredyear.

Damage to the health due to respiratory diseases may be calculated with the following formula/Equation:

Damage to Health due to Respiratory diseases ($Damage_H$) in Rupees:

$Damage_H$ (Rs): No. of cases Reported (X) x $COI_{Affected\ area}$ Eq (2)

Note:
The sites/areas where many types of the industries are co-existing, % contribution of stone crushers for Particulate matter in the ambient air, may be calculated based on source apportionment studies . In such cases, the contribution of the stone crusher may be calculated by multiplying the $Damage_H$ with the contribution factor for stone Crushers.

3. Agriculture Production Loss:

Model sensitivity studies carried out in India has identified NOx as the key pollutant causing as much as 93% of the crop loss. Since, NOx emissions are not directly related to stone crusher operation, it is proposed to attribute 100-93 = 7%(say 10%) of total yield loss to particulate matter emissions (PM_{10} and $PM_{2.5}$) to start with. The formula/equation for calculating the agricultural production loss is calculated by using the following details:

Average production yield for Crop A in Tonnes/Acre($Yield_{AvgCrop\ A}$)

Actual Yield of Crop A in the Affected area in Tonnes/Acre ($Yield_{ActCropA}$)

Affected Area in Acres ($Area_{Acr}$)

Total Yield Loss ($Loss_{Yld}$)=($Yield_{ActCropA}$ - $Yield_{AvgCrop\ A}$) x $Area_{Acr}$

Minimum Sale Price of Crop A in Rs/Tonne($MSP_{Crop\ A}$)

Agriculture Production Loss of Crop A (APL_{CropA}) in Rs.:
APL_{CropA} = $Loss_{Yld}$ x $MSP_{Crop\ A}$ Eq (3)

Estimated Percentage Contribution of Stone Crushers in Yield Loss: 10%

Agriculture Production Loss of Crop A by PM_{10} and $PM_{2.5}$ ($APL_{PMCropA}$) in Rs.:
$APL_{PMCropA}$ = APL_{CropA} x 10% Eq (4)

Note:
The sites/areas where many types of the industries are co-existing, % contribution of stone crushers for particulate matter in the ambient air, may be calculated based on source apportionment studies. In such cases, the contribution of the stone crusher may be calculated by multiplying the $APL_{PMCropA}$ with the contribution factor for stone Crushers.

With the help of the following three equations derived in the above mechanism developed by CPCB and the calculations explained in the present document, it is possible to assess the damage caused to Air, public Health and agricultural crops in an affected site/ area by the stone crushers operating illegally or without complying with the prescribed norms.

Damage to Air Quality (Damage $_{AQ}$) in Rs.:
Damage $_{AQ}$ = $(Load_{PM10} \times EP_{PM10}) + (Load_{PM2.5} \times EP_{PM2.5})$

Damage to Health due to Respiratory diseases ($Damage_H$) in Rs.:
$Damage_H$: No. of cases Reported (X) x $COI_{Affected\ area}$

Agriculture Production Loss of Crop A by PM_{10} and $PM_{2.5}$ ($APL_{PMCropA}$) in Rs.:
$APL_{PMCropA} = APL_{CropA} \times 10\%$

If accepted and approved by Hon'ble NGT, the above mechanism developed by CPCB may be used to assess the damage caused by the stone crushers in the matter O.A. No. 739/2018; Residents of Gram Panchayat Varahiya versus State of MP, by the Joint Committee constituted in this matter.

CPCB will keep on updating the mechanism for assessment of the damage caused to the environment, health and agriculture based on the new findings from time to time, to make it relevant and realistic all the time.

Annexure-A

Explanation of the Mechanism in terms of Monetary Calculations

a) Calculation of Damage to the Air Quality:

Formula: $Damage_{AQ} = (Load_{PM10} \times EP_{PM10}) + (Load_{PM2.5} \times EP_{PM2.5})$

Calculations for Load of PM_{10} Emissions ($Load_{PM10}$):

Limit of PM_{10} as per prescribed standard: 100 µg /m3

Let us assume that average measured concentration of PM_{10} in the ambient Air in the affected site is 150 ug /m^3.

Concentration of PM10 in excess of the prescribed limit: 150-100 = 50 ug/m3 i.e 50 x 10^{-9}Kg/m3

Let us assume, Area of the affected site: 100000 m3 and Mixing Height : 500 meter

So, the volume of ambient air in Affected area: = 100000 x 500 = 50000000 m3

Total Load of PM_{10} in excess of the prescribed limit in the affected site = 50000000 x 50 x 10^{-9} = 2.5 Kg

Let us assume that the radius covered for ambient air monitoring: 2 Km

Average wind speed: 1 Km/h

so, Air replacement factor (I) : 1/2 x 24 =12

Total Load of PM_{10} in excess of the prescribed site in the affected site ($Load_{PM10}$): 2.5 x12 = 30 Kg/day

Calculations for Load of $PM_{2.5}$ Emissions ($Load_{PM2.5}$):

Limit of $PM_{2.5}$ as per prescribed standard : 60µg /m3

Let us assume that average measured concentration of $PM_{2.5}$ in the ambient Air in the affected site is 70 ug /m^3.

Concentration of PM2.5 in excess of the prescribed limit: 70-60 = 10 ug/m3 i.e 10 x 10^{-9}Kg/m3

Let us assume, Area of the affected site: 100000 m3 and Mixing Height : 500 meter

So, the volume of ambient air in Affected area : = 100000 x 500 = 50000000 m3

Total Load of $PM_{2.5}$ in excess of the prescribed limit in the affected site = 50000000 x 10 x 10^{-9} = 0.5 Kg

Let us assume that the radius covered for ambient air monitoring: 2 Km

Average wind speed: 1 Km/h

so, Air replacement factor (I) : 1/2 x 24 =12

Total Load of $PM_{2.5}$ in excess of the prescribed site in the affected site ($Load_{PM2.5}$): 0.5 x12 = 6 Kg/day

Environmental Price of Particulate Emissions (PM_{10} and $PM_{2.5}$) i.e. EP_{PM10} and $EP_{PM2.5}$

Environmental Price for Average Particulate Emissions, PM10 (EPPM10): Rs. 2519/Kg Emission
Environmental Price for Average Particulate Emissions, PM2.5 (EPPM2.5): Rs. 3665.36/Kg Emission

Calculation of Damage to air quality in monetary terms i.e. $Damage_{AQ}$

$Damage_{AQ}$ (Rs/day) = ($Load_{PM10}$ x EP_{PM10}) +($Load_{PM2.5}$ x $EP_{PM2.5}$)

$Damage_{AQ}$ (Rs/day) = (30 x 2519) + (6 x 3665)
= 75570 + 21990 = Rs. 97560/day

Let us assume that the contribution of stone crushers in air quality in affected site as calculated from the source apportionment study is 25%

So, the damage to air quality recoverable from stone crushers in monetary terms: 97560 x 25/100 = Rs. 24390 /day

Let us assume the period of damage caused/non-compliance is 20 days.

So, the total damage recoverable from the stone crushers will be:24390 x 20 = Rs. 487800/=

Let us further assume that 10 stone crushers having same capacity were found to be non-compliant in the affected area.

Hence, the environmental damage recoverable from each stone crusher: 487800/10 = Rs. 48780/- (1)

b) Calculation of Damage Assessment of Health Issues:

Formula: $Damage_H$: No. of cases Reported (X) x $COI_{Affected\ area}$Eq

Let us assume that the damage is to be calculated for the year 2018.

Per Capita Income of the of Mumbai (Inc_{Mumbai})for 2017-18 as per Economic Survey of Maharashtra 2018-19 is Rs. 176102.

Cost of Illness per person in Mumbai area (COI_{Mumbai}).: Rs. 14378 as of 1997

Cost of Illness per person in Mumbai area (COI_{Mumbai}) inflated to 2018 is Rs. 54202 (Average Inflation rate 6.52%)

Let us assume Per capita Income of affected area ($Inc_{Affected\ area}$) for the year 2018 is Rs. 50000

So, the cost of Illness per person in the affected area ($COI_{Affected\ area}$)in Rs:

$$COI_{Affected\ area} = COI_{Mumbai} \times \frac{Inc_{Affected\ area}}{Inc_{Mumbai}}$$

$COI_{Affected\ area}$ = 54202 x 50000/176102 =15389/= (Say Rs. 15390/=)

Let us further assume the no. of cases of respiratory illness/diseases reported based on the data obtained from Medical facilities serving the affected area and health survey: 30

So, the damage to Health due to Respiratory diseases ($Damage_H$):

$Damage_H$ (Rs): No. of cases Reported (X) x $COI_{Affected\ area}$

$Damage_H$ (Rs):30 x 15390 = 461700/=

Let us assume that 10 stone crushers having same capacity were found to be non-compliant in the affected area and that the contribution of stone crushers in air quality in affected site as calculated from the source apportionment study is 25%

So, the damage to Health due to Respiratory diseases ($Damage_H$) recoverable from each stone crusher : (461700x 25/100)/10 = 115425/10 = Rs. 11543/- (2)

c) Calculation Agriculture Production Loss:

Formula: $APL_{PMCropA} = APL_{CropA\ x}\ 10\%$

Let us assume crop in the affected area during damage period is wheat.

Let us further assume that:

i) Average production yield for wheat in the affected area ($Yield_{AvgWheat}$)is 2Tonnes/acre

ii) Actual Yield of Crop A in the Affected area in Tonnes/Acre ($Yield_{ActWheat}$)is 1.60 Tonnnes/acre

iii) Affected Area in Acres ($Area_{Acr}$)is 50 acres

So, Total Yield Loss ($Loss_{Yld}$)= (2– 1.6) x 50 = 20 tonnes

Let us assume that minimum Sale Price of Wheat (MSP_{Wheat}) in the affected area is Rs. 18000/- per ton

Agriculture Production Loss of Wheat (APL_{Wheat}) in affected area : $Loss_{Yld}$ x MSP

So, Agriculture Production Loss of Wheat (APL_{Wheat}) in affected area:20x 18000 = Rs. 360000

Estimated Percentage Contribution of Stone Crushers in Yield Loss: 10%

Agriculture Production Loss of Wheat crop by PM_{10} and $PM_{2.5}$ in affected area by stone crushers ($APL_{PM-Wheat}$) = $APL_{CropA\ x}$ 10%i.e 360000 x 10/100= 36000

Let us assume that 10 stone crushers having same capacity were found to be non-compliant in the affected area.

So, the agriculture production loss recoverable from each stone crusher : 36000/10 = Rs. 3600/- (3)

Therefore, Total damage recoverable from each non-compliant stone crusher in the affected site for damage to air quality, public health and agriculture production loss : $Damage_{AQ}$ (1) + $Damage_{H}$ (2) + $APL_{PM\text{-}Wheat}$ (3) *i.e*

Total damage recoverable from each non-compliant stone crusher in the affected area 48780 +11543+ 3600 = Rs. 63923

Annexure-B

Analysis of Mechanism under different Scenarios :

Taking the example of a stone crusher having following details, four scenariosare being analysed below for testing the mechanism under different situations for assessment of damage based on emission factors caused by stone crushers:

Operating Capacity : 40 ton/h
Primary Jaw Crusher: 01 No.
Secondary Crusher: 1 No.
Tertiary Crusher: 1 No.
No. of Screens: 03 Nos.
No. of Conveyor Transfer Points: 04
Operating Hours /day: 10
EPPM10 = Rs. 2519/Kg
EPPM2.5 = Rs. 3665/Kg
Damaqe/Non-Compliance Period: 20 days

Scenario 1:	Only Primary Clushing is done; End product is Primary Crushed stone; One Screen and One conveyor transfer point Operational										
Stone Crushing Equipment	No of Operating Equipments	Operating Capacity, TPH	Operating Hours	Non-Compliance /damage Period, days	Controlled, Kg/ton, PM10	Uncontrolled, Kg/ton for PM10	Controlled Kg/ton, PM2.5	Uncontrolled, Kg/ton, PM2.5	Total Environmental Damage Cost, PM10, Rs.	Total Environmental Damage Cost, PM 2.5, Rs.	Recoverable Damage Cost, Rs
Primary Jaw Crusher	1	40	10	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	18958.24	5107.99	
Secondary Crusher	0	0	0	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	0.00	0.00	
Tertiary Crusher	0	0	0	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	0.00	0.00	
Screens	1	40	10	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	81308.52	7993.19	
Conveyor Transfer Points	1	40	10	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	108412.84	4457.71	
Total									208679.61	17558.89	208679.61

Scenario 2:	Primary & Secondary Clushing done during damage priod; Two Screens and two Conveyor transfer points Operational. End product is combination of primary crushed and secondary crushed material										
Stone Crushing Equipment	No of Operating Equipments	Operating Capacity, TPH	Operating Hours	Non-Compliance/damage Period, days	Controlled, Kg/ton, PM10	Uncontrolled, Kg/ton for PM10	Controlled Kg/ton, PM2.5	Uncontrolled Kg/ton, PM2.5	Total Environmental Damage Cost, PM10, Rs.	Total Environmental Damage Cost, PM 2.5, Rs.	Recoverable Damage Cost, Rs
Primary Jaw Crusher	1	40	10	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	18958.24	5107.99	
Secondary Crusher	1	40	3	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	5687.47	1532.40	
Tertiary Crusher	0	0	0	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	0.00	0.00	
Screen1	1	40	10	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	81308.52	7993.19	
Screen2	1	40	3	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	24392.56	2397.96	
Conveyor Transfer Points 1	2	40	10	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	216825.69	8915.43	
Conveyor Transfer Points 2	2	40	3	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	65047.71	2674.63	
Total									412220.19	28621.59	412220.19

Scenario 3:	Primary , Secondary and Tertiary Clushing done during damage priod; Three Screens and four Conveyor transfer points Operational. End product is combination of primary secondary and tertiary crushed material										
Stone Crushing Equipment	No of Operating Equipments	Operating Capacity, TPH	Operating Hours	Non-Compliance/damage Period, days	Controlled, Kg/ton, PM10	Uncontrolled, Kg/ton for PM10	Controlled Kg/ton, PM2.5	Uncontrolled Kg/ton, PM2.5	Total Environmental Damage Cost, PM10, Rs.	Total Environmental Damage Cost, PM 2.5, Rs.	Recoverable Damage Cost, Rs
Primary Jaw Crusher	1	40	10	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	18958.24	5107.99	
Secondary Crusher	1	40	3	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	5687.47	1532.40	
Tertiary Crusher	1	40	2	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	3791.65	1021.60	
Screen 1	1	40	10	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	81308.52	7993.19	
Screen 2	1	40	3	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	24392.56	2397.96	
Screen 3	1	40	2	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	16261.70	1598.64	
Conveyor Transfer Point 1	1	40	10	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	108412.84	4457.71	
Conveyor Transfer Point 2	1	40	3	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	32523.85	1337.31	
Conveyor Transfer Point 3	1	40	2	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	21682.57	891.54	
Conveyor Transfer Point 4	1	40	2	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	21682.57	891.54	
Total									334701.98	27229.88	334701.98

Scenario 4:	Primary, Secondary and tertiary Clushing done during damage period; End product is tertiary crushed material; All Equipment sopertaional										
Stone Crushing Equipment	No of Operating Equipments	Operating Capacity, TPH	Operating Hours, H	Non-Compliance /damage Period, days	Controlled, Kg/ton, PM10	Uncontrolled, Kg/ton for PM10	Controlled Kg/ton, PM2.5	Uncontrolled, Kg/ton, PM2.5	Total Environmental Damage Cost, PM10, Rs.	Total Environmental Damage Cost, PM 2.5, Rs.	Recoverable Damage Cost, Rs
Primary Jaw Crusher	1	40	10	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	18958.24	5107.99	
Secondary Crusher	1	10	10	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	4739.56	1277.00	
Tertiary Crusher	1	10	10	20	2.70E-04	1.21E-03	5.00E-05	2.24E-04	4739.56	1277.00	
Screens	3	40	10	20	3.70E-04	4.40E-03	2.50E-05	2.98E-04	243925.57	23979.57	
Conveyor Transfer Points	4	40	10	20	2.30E-04	5.61E-03	6.50E-06	1.59E-04	433651.38	17830.85	
Total									706014.31	49472.41	706014.31