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IIT(BHU) VARANASI

STUDENTS' NOTES

ENVIRONMENTAL MANAGEMENT IN SURFACE MINES

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EMSM

by Abhijeet

Teacher's Sign / Remarks

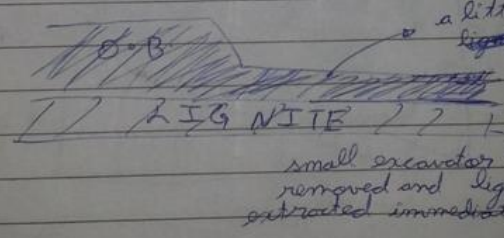
classmate Date 31/12/2013 Page

(NCK Sir)

Environmental issues in Surface mines

1.) Land Reclamation (Biological)
2.) Ground water
3.) Dust Control (Air pollution)
4.) Acid Mine drainage (water pollution)
5.) Fire
6.) Noise pollution
7.) Socio Economic Rehabilitation
8.) EIA
9.) EMP

(*) Lignite is highly ~~spon~~ susceptible to spontaneous combustion so as soon as it is exposed ~~it~~ it catches fire so it ~~can to~~ cannot be left exposed for a longer time. It is the deposit which is mined only by surface mining in India.



a little cover of ~~lignite~~ O.B. is left and just before extraction, through a small excavator, this cover is removed and lignite is extracted immediately.

H.A.D. (*) Proximate values of coal, lignite ~~with~~ with specific reference to Calorific values.

(*) Washery grades of coal and prices

(*) Comparision of coal with [illegible] properties

(*) Comparision of coal with [illegible]

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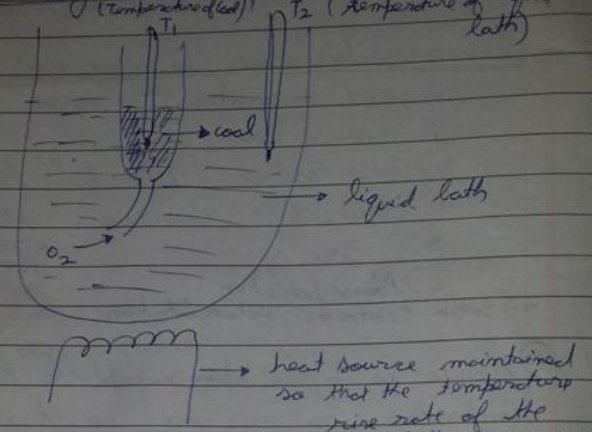
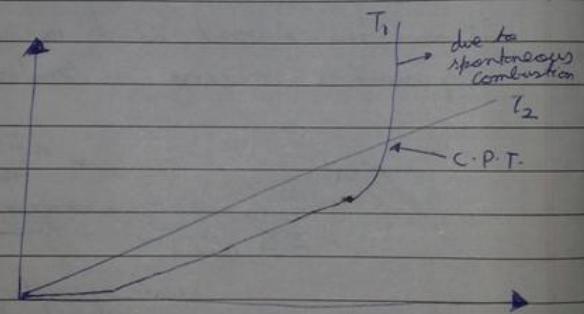
Crossing Point Temperature (CPT)





Susceptibility to spontaneous ~~heating~~ combustion

- High – 120–135°C
- Medium – 135–155°C
- Low – 155–180°C

Lignite has a low susceptibility to [illegible] CPT values. Its CPT = 185°C

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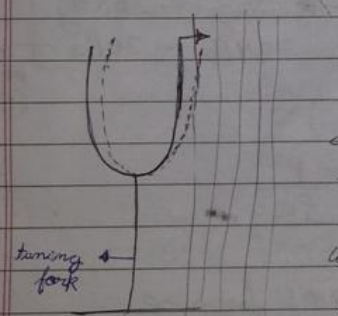
But still it is highly susceptible to combustion. It is because it has a very high moisture content. So on exposure its moisture is lost and it becomes friable (powdery) so its surface area exposed to combustion increases and so its susceptibility to combustion is very high.

2/1/2014 NCK Sir

Noise Pollution →



we assume that the medium is made up of thin layers and when tuning fork hits these layers, they get compressed and then as the fork moves backward suddenly then the immediate layer expands. But as the immediate layer is compressed, this compressed layer compresses the rest layers and then due to compression and rarefaction (elasticity) the disturbance propagates forward upto an infinite

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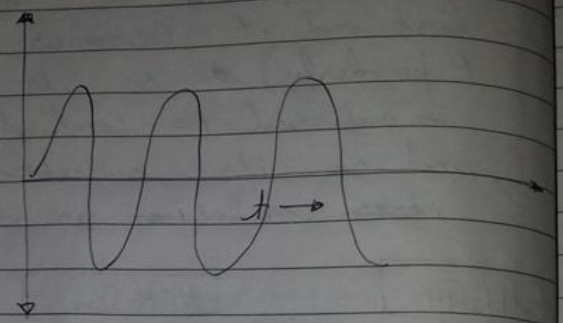
H.A2 → Sound wave generation and its properties



Audible range → 20Hz – 20KHz
20μPa – 20Pa] sound pressure (RMS)

$$\text{Intensity}(I) = \frac{P^2}{\rho C}$$

P → rms pressure
ρ → density of the medium/air
C → velocity of sound through that medium.

I → Sound intensity (W/m^2)

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Sound intensity Level :-

$$I_L = 10\log\left(\frac{I}{I_0}\right) = 10\log\left(\frac{P^2}{P_0^2}\right)$$

$I_0 \rightarrow (10^{-12}\ W/m^2)$

$$SPL = 20\log\left(\frac{P}{P_0}\right)\ dB$$

SPL → Sound pressure level

$P_0 \rightarrow (20\ \mu Pa)$

range of P → 20 μPa to 20 Pa

This range is so large that it it impossible to plot it on a graphical manner.

So mathematician Bell gave that :-

$$\log\left(\frac{Y}{X}\right) = 1\ Bel$$

$$\log\left(\frac{20}{20\times10^{-6}}\right)^2 = 12$$

so range become

0 – 12 Bel

but the range become too small so, It was multiplied by 10.

so range become → 0 – 120 dB

So the unit become deci Bel (dB)

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Note:— 0 dB does not imply no sound. It indicates that sound pressure is 20 μPa.

→ Sound intensity is the amount of energy flowing through unit area in unit time.

→ Sound power is defined as the intensity multiplied by area through which the sound is passing.

$$\text{Sound power} = I \times S$$

Area

Area ~~should~~ depends on source.

Sound Power level:—

$$N_L = \log\left(\frac{N}{N_0}\right) \text{ Bell}$$

$N_0 \rightarrow 10^{-12}$ W

If ~~sou~~ source is hanging in air → $S = 4\pi r^2$ (spherical propagation)

If source kept on a floor with no wall → $S = 2\pi r^2$ (hemispherical propagation)

If source kept along on edge of a wall → $S = \pi r^2$

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If source kept at a corner in the room → $S = \pi r^2/2$ so if a source is placed at one corner of the room, sound is best heard (I is highest.) → (P constant)

03/01/2014 [AKS Sir]

[Water pollution:-]

Water is a precious natural resource for survival ~~of~~ and health of living organism. Water pollution means the presence of any foreign substance organic, inorganic, radiological and biological in water which tends to degrade its quality so as to constitute a hazard or impair the usefulness of water.

[Sources of water pollution:-]

On the basis of their origin the sources of water pollutants can be broadly ~~ca~~ categorized into:-

- Point Sources
- Non-point sources

Point Sources → Where the ~~of~~ effluent discharge occurs at a particular site (e.g. ... municipal area or industry.

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Non-point Sources → where inflow of pollutants occurs over a large area. Eg.) City storm water flow, agricultural run off, constructional sediments are in the non-point sources.

Point source pollution can be effectively checked with appropriate technology whereas non-point source pollution is difficult to control and needs application of control measures on a large scale.

Water pollutants:-

These can be categorised as

(i) biological → In this pathogen, virus, bacteria, protozoa, algal and helminth

(ii) Chemical → Organic chemicals like biocides, polychlorinated biphenyls, inorganic chemicals like phosphates, nitrates, chlorides and in heavy metals like arsenic, lead, cadmium, bromium, mercury

(iii) physical pollutants → Hard water from industries, oilspills from oil carriers

Water pollutants are divided in 8 categories in this:-

(i) Sediment pollution

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(ii) Sewage pollution
(iii) Inorganic plant nutrients
(iv) Industrial waste water
(v) Organic chemicals
(vi) Inorganic chemicals
(vii) Radioactive substances
(viii) Thermal pollution

Effects Of Water Pollution:-

Water pollutants adversely affects the physical, chemical and biological characteristics of the aquatic ecosystem and the quality of ground water. Effects on aquatic ecosystem → organic and inorganic wastages decrease the dissolved oxygen content (DO) of water bodies. Water having DO content below 8 mg/l may be considered as contaminated. Heavily polluted water have DO content 4 mg/l. DO content of water is important for the survival of aquatic organism. The surface turbulence, photosynthetic activity, oxygen consumption by organism and decomposition of organic matter are the factors which determine the amount of DO present in water. Higher amount of organic waste increases the rates of decomposition and oxygen consump- [illegible] a drop in DO

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content of water. The demand for oxygen in directly related to increasing input of organic wastage and is expressed as biochemical oxygen demand (BOD) of water. BOD is a measure of oxygen required by aerobic decompose for the biochemical degradation of organic material in water. Higher the BOD, lower the DO.

Chemical oxygen demand (COD) is another measure of pollution load in water, COD is the measure of oxygen equivalent on the requirement for oxidation of total organic matter i.e. biodegradable and non-biodegradable present present in water. Therefore, contamination of water bodies by pollutants will reduce DO content and sensitive organism like plankton, molluscs and fish will be eliminated. Only a few tolerant species like annealed ~~worm~~ harm tubufex and some insect larva may survive in highly pollutant

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be recognised as indicator species for polluted water. Biocide residues and heavy metals such as mercury, lead, cadmium, Cu, As, can directly eliminate different species of organism. Higher the temperature of water, lower is the rate of dissolution of oxygen in water. Hence, hot water discharge from industries when added to water bodies also lowers its DO content.

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07/01/2014

NCK Sir

Sound power level:-

$$L_N = 10 \log\left(\frac{N}{N_0/N_r}\right) \quad \text{deci Bel}$$

$N_0 = 10^{-12} W$

reference pressure

$P_r = 20 \times 10^{-6}$ Pa.

$$I_0 = I_r = \frac{P^2}{\rho c} = \frac{(20 \times 10^{-6})^2}{1.2 \times 330} = \frac{400 \times 10^{-12}}{(\approx 400)}$$

reference intensity

$$= 10^{-12}$$

Q.1) SPL at 10m from a machine placed on the floor of a large workshop is 118 dB. what is the SPL at 80m. Find the sound power of the machine/source and hence find the SPL at 80m distance.

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At 10 m distance:-

A.1) $118 = 10 \log\left(\frac{I}{I_r}\right)$

$$\frac{I}{I_r} = 6.31 \times 10^{11}$$

$$I = 6.31 \times 10^{11} \underbrace{\times 10^{-12}}_{I_r} = 0.631\ W/m^2$$

$$N = I \times S = I \times 2\pi r^2$$
$$= 0.631 \times 2 \times 3.142 \times (10)^2$$
$$= 396.5\ W$$

NOTE ⇒ Power remains constant for a source.

$$SPL_{80} = (SPL)_{10} - 20 \log\left(\frac{r_2}{r_1}\right)$$

$$= 118 - 20 \log\left(\frac{80}{10}\right)$$

$$= 118 - 20 \log(2^3)$$

$$= 118 - 60 \log 2$$

$$= 118 - 18 = 100\ dB$$

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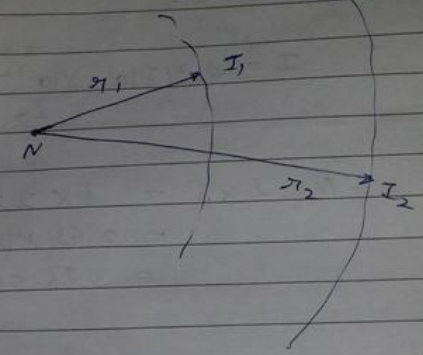
Effect of distance from a noise source:—

$N \rightarrow$ Power of source
$I \rightarrow$ Intensity of sound
$r \rightarrow$ distance from the source



$$I \propto \frac{1}{r^2}$$

$$\frac{I_2}{I_1} = \frac{r_1^2}{r_2^2}$$

$$L_{I_1} = 10 \log\left(\frac{I_1}{I_r}\right) = 10 \log\left(\frac{N}{4\pi r_1^2 \times I_r}\right)$$

$$L_{I_2} = 10 \log\left(\frac{N}{4\pi r_2^2 \times I_r}\right)$$

$$L_{I_1} - L_{I_2} = 20 \log\left(\frac{r_2}{r_1}\right)$$

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$$L_{I_2} = L_{I_1} - 20 \log\left(\frac{r_2}{r_1}\right)$$

Similarly:-

$$SPL_2 = SPL_1 - 20 \log\left(\frac{r_2}{r_1}\right)$$

09/01/2014. NCK Sir

Permissible Noise Level → OSHA
Occupational Safety and Health administration USA

Another Important Organisation:-
MSHA → Mine Safety and health administration, USA

90 dB (A) → limit for 8 hr shift.

If noise level is more than 90 dB:-

Max. exposure (hrs/day)	SPL [dB(A)]
8	90
6	92
4	95
3	97
1.5	100

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1	—	105
1/2	—	110
1/4	—	115

If S.P.L > 115 dB(A), no one should be exposed to such condition even for a minute.

Impact/Impulsive sound → If sound level changes in less than or equal to 1 sec interval then we can go upto 140 dB(A).

(*) NEI (Noise exposure Index)

$$NEI = \frac{t_1}{T_1} + \frac{t_2}{T_2} + \cdots$$

$$= \sum \frac{t_i}{T_i}$$

t_i → time of exposure to a particular noise level

T_i → permissible time of exposure

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If NEI < 1 then permissible
else not permissible.

Q. A person is exposed to noise level as given:-
3 hr at 90 dB
2 hr at 92 dB
1 hr at 96 dB

A. $NEI = \frac{3}{8} + \frac{2}{6} + \frac{1}{x=3} = 1.04$

x can be chosen by as follows:-
→ ~~Average~~ go for immediate upper level of noise

Q. If a person is exposed to different sound level. Find time for which he is permissible for exposure:
3 hr – 90 dB
2 hr – 92 dB
x hr → 99 dB

Find x?? for NEI = 1

$1 = \frac{3}{8} + \frac{2}{6} + \frac{x}{2}$

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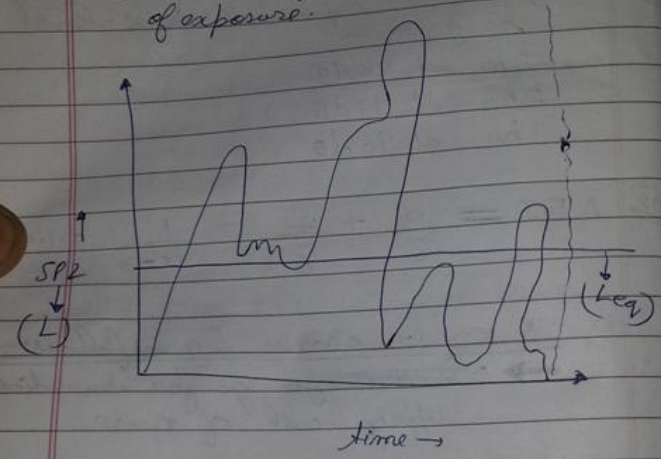
L_{Eq} is the continuous and steady SPL that will have the same total acoustic energy as that of fluctuating SPL(s) during that total time interval of exposure.



$$L_{eq} = \frac{\log F}{0.1} + 90$$

$$F = \Sigma f_i \quad . \quad f_i = \frac{t_i}{8} \text{ antilog}\left[0.1(L_i - 90)\right]$$

F = Total exposure factor ✓
f_i = factional exposure factor ✓
t_i – exposure time (hr)
L_i – SPL for (t_i)

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$F = \frac{3}{8} + \frac{2}{8} \text{ Antilog}[0.1(92-90)] + \frac{1}{8} \text{ Antilog}[0.1(96-90)] = 1.2$

$L_{eq} = 91.034 < 92 \text{ dB(A)}$

Hence permissible.

L_{eq} should not be greater than permissible SPL for that total time of exposure.

Total time of exposure = 6 hrs.

- 3 hr — 90 dB(A)
- 2 hr — 92 dB(A)
- 1 hr — 96 dB(A)

So L_{eq} should not exceed 92 dB(A).

Salient features of Indian regulations:— DGMS circular technical 18/1975

(A) Base of ILO Code of practice

(i) 85 dB(A) : Warning limit below which very little risk of damage to ears for 8 hr shift.

(ii) 90 dB(A): Danger limit for unprotected ear

A worker may be temporarily permitted to exceed this daily dose but only if on the next day he recuperates so that maximum weekly dose should not exceed.

(iii) 115 dB(A) : worker should not be [illegible] without

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protection

(iv) PPE (personal protection equipment) should be used if isolated noise outburst exceeds 130 dB(A)

(v) No entry > 140 dB(A) even with ear protection

10/1/2014 [AKS Sir]

→ Biological Magnification:-

The phenomenon through which certain pollutants get accumulated in tissues in increasing concentrations along the food chain is called biological magnification. Such pollutants are non-biodegradable for example DDT i.e. once they are absorbed by an organism, they cannot be metabolized and broken down or excreted out. These pollutants generally get accumulated in fat containing tissues of the organism. The classic example

of biological
of DDT
which is
to check
After In
, after
for few
of fish
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had in
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relative
water -
D.D.T.
9 to 40
concent
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Phytoplan
25 times
relative
Many o
and
biologic

→ Effect on
Domes
like

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of biological magnification is that of DDT and insecticide which is spread on water bodies to check the growth of mosquitoes. ~~After~~ In long island in U.S.A., after regular D.D.T spraying for few years, the pollulation of fish eating birds began to decline. Later it was found that the concentration of D.D.T had increased about 800 times in the ~~photop~~ phytoplankton relative to the concentration in water. In different fishes the D.D.T. concentration increased 9 to 40 times relative to the concentration in zooplankton. Zooplankton contained about 5 times greater D.D.T. than Phytoplankton. Birds showed about 25 times greater D.D.T Concentration relative to that in fishes. Many other persistant pesticides and radio nuclides also show biological magnification.

Effect on Human Health:-

Domestic Sewage contains pathogens [illegible] bacteria, parasitic

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protozoa and worms. Contaminated water therefore can carry the germs of water borne diseases like jaundice, cholera, Typhoid, amoebiasis. Such contamination may make the water unfit for drinking, bathing and swimming and even for irrigation. Heavy metal contamination for water can cause serious health problems. Mercury ~~poisoning~~ poisoning due to consumption of fish captured from mercury contaminated. Minamata disease was detected in 1952 in Minamata bay in Japan. Mercury compounds in waste water are converted by bacterial action into extremely toxic methyl mercury which can cause numbness of ~~limbs~~ limbs, lips and tongue, deafness, blurring of vision, mental derangment. Cadmium pollution can cause itai-itai ~~disease~~ disease and cancer of lever and lung.

→ Groundwater pollution in India at many ~~the~~ places the

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groundwater is threatened due to seepage from industrial and municipal ~~was~~ wastage and effluents, sewage channels and agricultural run off. Hazardous substances including radioactive compounds, particulates, fertilizers, organic compounds and heavy metals can seep into groundwater from municipal sanitary landfills.

Excess nitrate in drinking water is dangerous for human health and may be fatal for infants. It reacts with haemoglobin and forms non-functional ~~methem~~ methaemoglobin that impairs oxygen transport. ~~so~~ This is called methaemoglobinemia or blue baby syndrome.

Excess fluoride in drinking water causes teeth deformity, hardened bones and stiff and painful joints. At many places in India, groundwater is contaminated with arsenic mainly from naturally occuring arsenic in bed rocks.

Over exploitation of groundwater may possibly initiate leaching

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of arsenic from soil and rock sources and contaminate groundwater. Chronic exposure to arsenic causes black foot diseases. Arsenic Causes diarrhoea, peripheral neuritis and hyperkeratosis and also lung and skin cancers.

16/01/2021 [NCK Sir]

Identification and marking of Risk areas:-

(a) Noise level should be measured where:-
(i) an inspection discloses that risk may exist
(ii) workers complain that they are subjected to uncomfortable noise
(iii) Speech intelligibility is impaired at a distance of 50cm

(b) Marking of following risk areas and equipment should be done to
(i) indicate the equipment producing noise level >85 dB(A)
(ii) To display suitable sign forbidding entry to all except wearing PPE

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Permissible noise for impact Noise:-

SPL [dB(A)]	Permitted No. of Impact per day
120	10,000
125	3,160
130	1,000
135	315
140	100

i.e. if 5 dB ↑, then permissible per day reduced to 1/3rd of the present values.

Effects of noise:-

Assignment:-

Human ear and Auditory effect

www.rnid.org.uk (2004)

(a) **Human Ear and Auditory effect:-**

Ear is a delicate structure which converts sound to Audible energy to electrical energy. Sound causes vibration in non elastic coil known as COCHLEA, which is filled with fluid and tiny cells are present called CORTI (24,000 in number) which receive vibration and respond to all different frequencies and generates electrical signal which sent to the brain.

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Auditory effects:-

→ Exposure to high Noise level cause Permanent threshold shift. Sometimes it may cause numbness. It is temporary threshold shift.

→ High pressure sound may rupture the ear drum, deafness may be the condition of such damage.

Non Auditory effects:-

Physiological effects → increasing blood pressure
→ increasing breathing amplitude
→ increasing blood cholestrol
→ changes in gastric secretion

Psychological effects:-

→ changes in personal and social behaviour
→ Interferes in sleep
→ may loose concentration (source of accident)

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Task interference:-

→ Because of physiological and mental effects as well as sleep effects the performance of workers will go down which will reflect in production rate. Time required to do the task is elongated.

→ Cognitive work/ task ~~to~~ may be affected by high SPL. Even at low level, also at 70-80 dB there is this cognitive effect.

→ Noise has its effect even after exposure (hangovers). It may continue for long time.

→ Noise interference with communication is called masking.

Effects on physical objects:-

- window may open
- value of property may be decreased because no body will be willing to live there.

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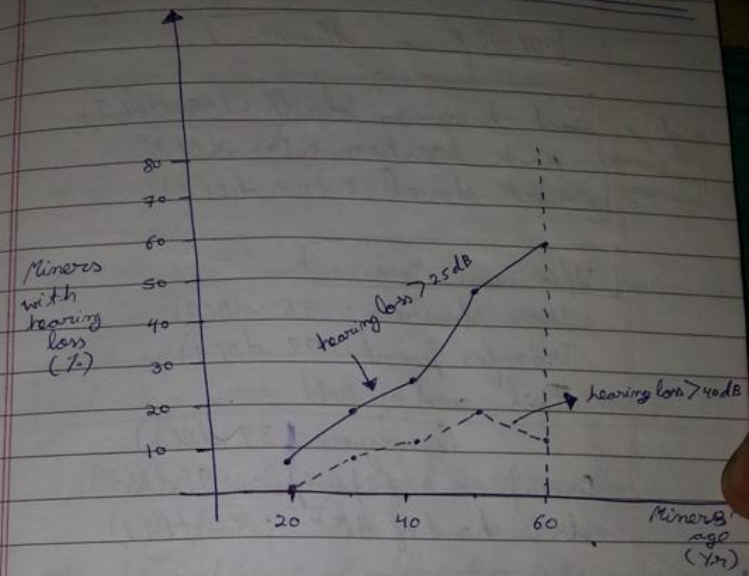
21/01/2014

Severity of Noise Pollution in Mines:-



1.) Allmost all U/G workers specially those in processing units are exposed to high level of noise that may cause permanent ~~damage~~ damage. 2.) HEMM operators are exposed to high level of noise.

3.) In U/G the low noise level also remains for a longer time as it gets multiplied due to multiple reflections (reverberation)

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DGMS Circular 5/1990

Metalliferous Mines:-

High noise producing machinery
- Jack hammer drill : 106 dB(A)
- Rock breaker : 106 dB(A)
- rock shovel : 104 dB(A)

U/G Coal Mines:-

Near shearer : 96 dB(A)
Transfer point : 99 dB(A)
Tail end of Belt Conveyor : 89 dB(A)
Powerpack of pumps : 91 dB(A)
drive head of AFC : 96 dB(A)

Open Cast mines:-

Near drill : 111 dB(A)
dumper cabin while moving : 103 dB(A)
diesel shovel cabin : 89 dB(A)

Noise Control

Principles of noise control:-

1) Control at source
2) Control in transmission path
3) Protection [illegible]

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1.) Systems for controlling noise at the source:-

- most effective approach
- → use of low speed machinery. (But low speed machinery is more costly)
- → proper maintainence reduces lot of noise
- → electric motors are superior to compressed air machines and I-C engine

2.) Reducing transmission of noise:-

- → introducing some attenuation in the path between source and reciever.
- different forms of attenuation in the noise path
  - (a.) increasing the distance $\left(\alpha \frac{1}{d^2}\right)$
  - (b.) altering relative orientation of source and reciever
  - (c.) surrounding the source by impervious enclosure or erected isolation walls
  - (d.) confining machine operator
  - (e.) increasing acoustic absorption in the receiving room
  - (f.) reducing time of Exposure (NEI)
  - (g.) In case of opencast mines, we can have vegetation boundary

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(h.) ~~pa~~ plantation in parallel rows in a staggering manner in opencast mines.

3.) **Personal hearing protection**

Ear plug → Has an exclusive energy absorbing form that has a time delayed expansion so that the plug fits snuggly to the shape of ear passage.
Ear muff

17/01/2014 — AKS Sir

Water Pollution Control:-

Water quality can be improved both by reducing number of contaminants that can ~~either~~ enter into water bodies and cleaning up waste water. Industrial and municipal waste water are treated in effluent treatment plant prior to disposal in water bodies. Generally the following treatments are given ~~to~~ in effluent treatment plant:-

(1.) Primary treatment — This physical

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of large debris followed by sedimentation in tanks or in clarifiers. It however does little to eliminate the organic and inorganic compounds that remain suspended in the waste water.

(2) Secondary treatment:-

This is a biological process and this is carried out by microorganisms. In this treatment the waste water is pumped in slow stabilization or oxidation ponds where the microbial oxidize the organic matter. The process results in release of CO_2 and formation of sewage sludge or bio solid. The sludge is continuously aerated to further its oxidation. Algal grown in the upper lighted zone of the waste water provide aeration by generating O_2. One of the several types of secondary treatment is trickling filters in which waste water trickles through aerated rocks beds that contain bacteria and other micro-organism which degrade the organic material in water.

Tertiary Treatment:-

This physiochemical process removes turbidity in waster water [illegible] the presence of nutrients

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N_2 and phosphorus dissolved ~~oxygen~~ organic metals or phythogen. This state involves chemical oxidation of waste water by strong oxidising agent such as fluorine gas, perchlorate salt, ozone gas and UV radiations. After tertiary treatment the waste water can be discharged into ~~land~~ natural waste and may be used for irrigation.

Disposal of sewage sludge →
A major problem associated with waste water treatment is disposal of the sewage sludge that is formed during primary and secondary treatment sewage sludge can be anaerobically digested into CH_4 and CO_2. CH_4 can be fed and burnt to heat the digested sewage. Sludge being rich in plant nutrient can be dried and used as fertilizer and it can also be used as soil conditioner.

MCLG → (Max Contaminant level goal)

The level of contaminant drinking

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water below which there is no known or expected risk to health. MCLG allows for a margin of safety and are not enforceable public health goals.

MCL (Maximum contaminant level):-
The highest level of contaminant that is allowed in drinking water. MCL are set as close to MCLG as feasible using the best available treatment technology and taking cost into consideration. MCL are enforceable standards, maximum residual disinfectant level goal.

MRDLG (Maximum residual disinfected level goal) →
The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLG do not reflect the benefits of the use of disinfectants to control the microbial ~~contaminants~~ contaminants.

TT (Treatment Technique) → a required process intended to reduce the level of a contaminant in drinking water.

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MRDL → (Max residual disinfectant level)
The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminant.

Units → mg/l or equivalent to ppm

EPA's → Surface water treatment rule requires system using surface water or ground water under the direct influence of surface water through:

(1.) Disinfect the water

(2.) Filter the water or meet criteria for avoiding filteration so that the following contaminents are controlled at the following levels:—

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22/01/2014 [AKS 521]

List of Contaminants and MCL:-

(1) Microorganism

Contaminants	MCL mg/l	Health Effect from Long term Exposure	Sources of Contaminants
Cryptosporidium	0.0	gastrointestinal illness eg:) diarrhoe, vomitting, cramps	human and animal fecal waste
Giardia	0.0	"	"
Legionella	0.0	Legionnair's disease	Found naturally in water
Total Coliform including fecal coliform and E Coli	5%	Not a health threat in itself whether other potentially harmful bacteria may be present	fecal coliform naturally present in H_2O. E Coli only come from human and animal fecal waste

2.) Turbidity → It is a measure of the cloudiness of water. It is used to indicate water quality and filteration effectiveness for example - ~~weather~~ whether disease causing organism are present. Higher turbidity level are often ... deal with higher

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levels of disease causing microorganisms such as virus, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhoea and associated headache and sources may be soil runoff.

3) Viruses → MCL → 0.0
Health effect → gastrointestinal illness
Sources → Human and animal feed waste

4.) Disinfection by products →

	MCL	Health effects	Sources
(a) Bromate	~~0.05~~ 0.010	increased risk of cancer	By product of drinking water disinfection
(b) chlorite	1.0	anemia in infants and in young children nervous system effect	By product of drinking water disinfection
(c) Haloacetic acids	0.06	increased risk of cancer	By product of drinking water disinfection

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5) Disinfectants →

	MRDL (mg/l)	Health effect	Sources
(a.) chloramines as (Cl_2)	4.0	eye, nose irritation and stomach discomfort and anaemia	water additive used to control microbes
(b.) Chlorine as Cl_2	4.0	//	//
(c.) ~~Cl~~ chlorine dioxide as ClO_2	0.8	anaemia in infants and young children, nervous system effects	//

6.) Inorganic chemicals

	MCL mg/l	Health effects	Sources
(a.) Antimony (Sb)	0.006	Increase in blood cholestrol, decrease in blood sugar	discharge from petroleum refineries, fire retardants, ceramics, electronics, solders
Arsenic (As)	0.01	skin damage or problem with circulatory system and may risk of getting cancer	Erosion of natural deposits, run off from glass and electronic production wastage, run off from orchards.

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Barium (Ba)	2.0	increase in blood pressure	discharge of drilling wastage, discharge from metal refineries and erosion of natural deposits
Beryllium	0.004	intestinal lesions	discharge from metal refineries and coal burning factories, discharge from electrical aerospace and defence industries
Cadmium	0.005	Kidney damage	corrosion of galvanised pipes; erosion of natural deposits, discharge from metal refineries, run off from waste batteries and paints

chromium

Copper

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chromium	0.1	allergic dermatitis	discharge from steel and pulp mills, erosion of natural deposits
Copper	1.3	short-term exposure → gastro intestinal distress long term exposure → liver or kidney damage People with wilson's disease should concern their personal doctor if the amount of copper in their water exceeds the action level (i.e MCL)	corrosion of household plumbing systems and erosion of natural deposits

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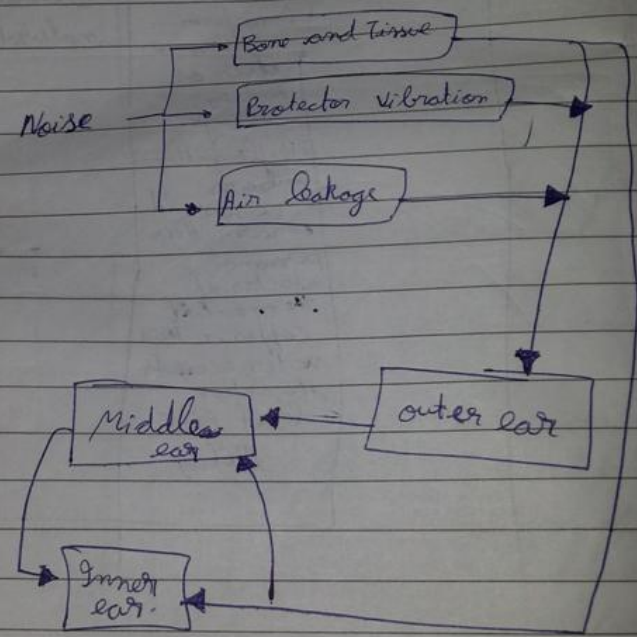
23/01/2014

Noise Control:-

Ear muff → covers the external ear. It is a circumferential device that encloses the entire external ear. It cannot altogether eliminate the sound due to some leakage path.



⇒ Drawbacks of ear plug and ear muff because we cannot make it full proof.

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⊗ efficiency of ear plug and muff is low at low frequencies but at higher frequencies ear muff is better alternative.

⊗ We can attenuate upto 15-35 dB(A)

Drawbacks in mining :-

- Important signals are not effectively recieved
- Not as effective in field as in lab
- Uncomfortable while working
- Communication / talking problem

Sound Measurement :- → Home assignment

→ Basic Components of sound level meter

1.) Microphone
2.) Pre-amplifier
3.) Weighting network
4.) Output amplifier
5.) Indicating meter
6.) output jack

Microphone → It recieves the sound energy for measurement and converts it into electrical signals.

The best type of microphone is condenser

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Pre-amplifier → The amount of sound energy is very feable and as it is converted into electrical signal it becomes still feable. In this case for measurement, pre-amplifier amplifies this signal to make is measurable one.

Weighting Network →

dB(A) → Sound is measured using weighting network (A).

< → is not attenuating. It is a linear scale and is used for

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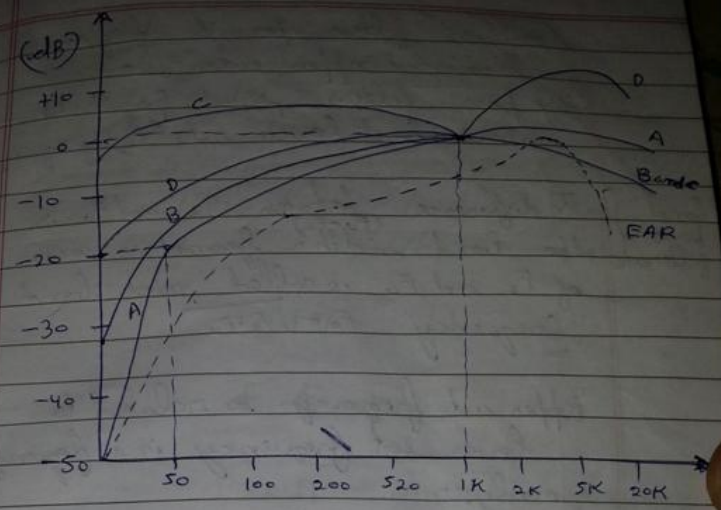

D → is specifically used for aircraft sound measurement.

28/01/2014 NCK Sir

Frequency Analysis →

→ Helps in identifying the "frequency bands" contributing most to the sound level

→ Generally octave band analysis is used but for narrow band analysis we can use 1/3 rd octave band.

→ Consists of Frequency band pass filters

→ Filters may be low pass, high pass or band pass filters

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Low pass filters permit frequencies below and upper cut (F_u).
High pass filters permit frequencies above and lower cut (F_L) frequency.

band pass filters { The difference between F_L and F_u is the band width. ($F_u - F_L$) Geometric mean of F_L and F_u is called mid band frequency $F_0 = \sqrt{F_L \cdot F_u}$.

Upper cut frequency is related to lower cut frequency in a frequency analyser.

$$F_u = K \cdot F_L$$

The value of K decides wheather it is octave band, 1/3rd octave etc.

If $K = 2$ → octave band
If $K = \sqrt{2}$ → one half octave band
If $K = \sqrt[3]{2}$ → one third octave band

If $K = \sqrt[m]{2}$ → $\frac{1}{m}$ (octave band)

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Q) In 1/3rd octave band frequency analyser, high pass filter permitting frequency above lower cut frequency (F_L) is 112 Hz. Find the upper cut frequency (F_U) and the frequency band width and the mid band frequency for this band width.

Ans) $F_U = \sqrt[3]{2}\ (112)$ Hz.

$F_U - F_L \Rightarrow$ band width

$\sqrt{F_U \cdot F_L} \Rightarrow$ mid band frequency.

Q.2) Complete the table for 1/3rd octave band:-

F_L	F_0	F_U
355	—	—
—	500	—
—	630	—

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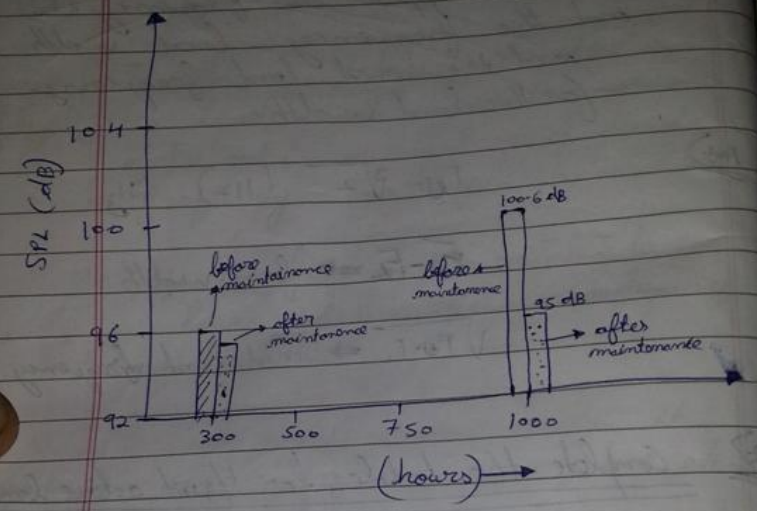
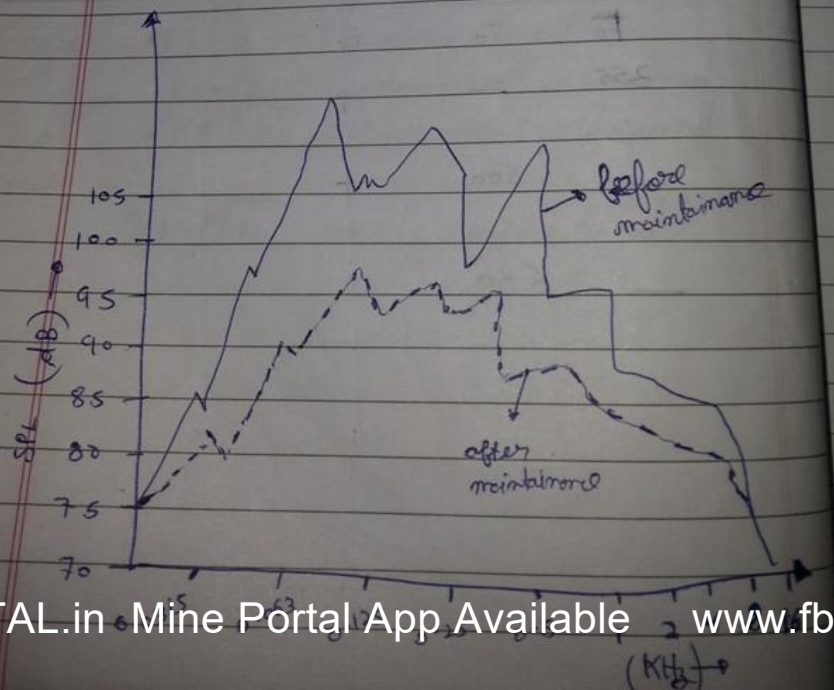
Type of study we can do with the help of ~~frequency analyser~~ sound meter/ frequency analyser.





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29/01/2014.

AKS Sir

	MCL (mg/l)	Health effects	Sources
Cyanide	0.2	nerve damage or thyroid problem	discharge from steel metal factories, discharge from plastic and fertilizer factories
fluoride	4.0	Bone desease; pain and tenderness of the bones	water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminium factories
lead	0.015	delays in physical or mental development, children could show slight defect in attention span and learning abilities; Kidney problems, high blood pressure	Corrosion of household plumbing system and erosion of natural deposits
mercury	0.002	Kidney damage; erosion of natural deposits	discharge from refineries and factories; run off from land fills; erosion of natural deposits

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selenium	0.05	hair or finger nail loss; numbness in fingers or toes; circulatory problems	discharge from petroleum refineries; erosion of natural deposits and discharge from mines.
Thallium	0.002	hair loss; changes in blood; kidney, intestine or liver problem	leaching from ore processing sites; discharge from electronic, glass and drug factories.

7.) Organic Chemicals:-

acrylamide	0.00	nervous system or blood problems; increased risk of cancer	added to water during sewage / waste water treatment
Benzene	0.005	anemia; decrease in blood platelets; increased risk of	discharge from factories; leaching from gas storage tanks and land fills

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Benzopyrene (BAHs)	0.0002	reproductive difficulties; increased risk of cancer	leaching from linings of water storage tanks and distribution lines
Carbofuran	0.04	problems with blood nervous system or reproductive system	leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	0.005	liver problems; increased risk of cancer; discharge from chemical plants and other industrial activities	
Chlordecone	0.1	liver or kidney problems	discharge from chemical and agricultural chemical factories

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dichloro methane	0.005	liver problems, increased risk of cancer	discharge from drug and chemical factories
Endrin	0.002	liver problems	residue of banned insecticides
ethylene dibromide	0.00005	problems with liver, kidney reproductive system, increased risk of cancer	discharge from petroleum refineries

8.) radioactive Contaminants

α-particle	15 picocuries (pci) /l	increased risk of cancer	erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as α-radiation

β-particles and photon emitters

radium-226 and radium-228

Uranium

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B-particles and photon emitters	4 millirems per year	increased risk of cancer	decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and B-radiation.
radium-226 and radium-228	5 pico-curies/l	increased risk of cancer	erosion of natural deposits
Uranium	30 µg/l	increased risk of cancer; kidney toxicity	erosion of natural deposits

30/01/2014 | NCK Sir

EIA:- (Environmental Impact Assessment)

Sustainable development:-

1.) The report "Limits to growth" proposed by Meadows et al claimed that with the existing pattern of resource utilization, the human society is destined to be DOOMED within the next century.

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1

~~Charge Philosophy~~

31/01/2014

AKS Sir

(09) Air Pollution:-

Degradation of air quality and natural atmospheric conditions constitute air pollution. Air pollution is defined as the presence of one or more contaminants such as dust, gas, mist, odour, smoke and smog or vapour in the atmosphere in quantities or characteristics and of duration so as to be injurious to human, plant or animal life or to property or which unreasonably interferes with the comfortable enjoyment of life and property.

Causes, types and effects:-

Air pollution may be:-

- Personal
- occupational
- or at community level. The exposure of an individual to air pollutants due to one's own activity is regarded personal. The exposure of an individual to potentially hazardous [illegible] air pollutant in

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his working environment is known as occupational air pollution. The community air pollution is not only caused by ~~a~~ variety of sources and contominants and may affect ~~may~~ many individuals but can also exert a significant impact on individuals total environment including plants, animals, buildings and property. An air pollutant may be a gas, liquid or particulate matter, that is suspended aerosols composed of solid and liquid. Concentrations of atmospheric pollutants depend mainly on the total mass emitted into the atmosphere and the atmospheric conditions that affect their fate and transport. Even a small concentration may be extremely harmful to life and property.

Air pollutants are of 2 types:-

1.) primary

2.) secondary air pollutants

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Primary pollutants enter the atmosphere directly from various sources however secondary pollutants are formed during chemical reactions between primary air pollutants and other atmospheric constituents such as solar radiations and water vapour. Among the primary air pollutants, most important are particulate matter, Carbon monoxide, hydrocarbons, SO_2, NO_x and fluorides. Particulate matter comprises solid particles or liquid droplets small enough to remain suspended in air. For example, smoke, dust, asbestos, fibres, pesticides, some metals including mercury, lead, copper and iron and also biological agents like tiny dust mites and flower pollen.

Atmospheric particulates having diameter of more than 10 Mm generally settle out in less than one day where as particles with diameter 10 Mm or less can remain suspended in air for weeks. Suspended particulate matter in the lower atmosphere i.e. troposphere causes

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and aggravates human respiratory illness like asthama and chronic bronchitis. Nasal passage prevents coarser particles bigger than 5 μm from entering into the respiratory system. The particles less than 5 μm known as respirable suspended particulate matter (RSPM) reach the alveoli of lungs and damage lung tissues. Soluble aerosols are dissolved in bloods from alveoli while the insoluble aerosols are carried to lymphatic streams. Workers exposed to asbestos particles mostly develop cancer called ~~mesothalmia~~ mesothelioma in the tissue lining abdomen. Lead, the most serious pollutant from automobile exhaust has detrimental effect on children's brains. Particulate matter can cause mutagenic and carsinogenic effects such as lead, cadmium, arsenic, mercury and hazardous organics absorbed on the particulates

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such as polyaromatic hydrocarbons. Particulate pollutants has also adversely affected ~~affected~~ by interfering with gaseous ~~exhan~~ exchange and consequently reducing the yield. Metallic particulate pollutants are particularly toxic to the metabolic activities of ~~the~~ the plants after contaminating the tissues. Use of such contaminated vegetables and crops leads to a variety of human health hazards indirectly caused by particulate pollutants.

Gaseous pollutant:-

Primary Pollutants.

CO:-

Carbon monoxide is a product of incomplete combustion of fossil fuels. Nearly 50% of all CO emissions originate from automobiles. It is also present in cigarette smoke. Carbon monoxide is short lived in the atmosphere and gets oxidized to carbon dioxide. Carbon monoxide is highly poisonous to most animals. When inhaled, CO reacts with Haemoglobin and forms a complex Carboxyhaemoglobin which restricts the uptake of oxygen from lungs

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to cell through reducing oxygen carrying capacity of blood. A packet of cigarette a day produces carboxyhaemoglobin level nearly 5 to 10% in the blood of the smoker, because inhaled cigarette smoke contains about 400 - 500 ppm CO.

Hydrocarbons and volatile organic Carbon:-
(HCS and VOCS)

Hydrocarbons are produced naturally during decomposition of organic matter and by certain types of plants.

Methane, the most abundant hydrocarbon in the atmosphere is evolved from soil in flooded rice field and swamps. Benzene and its derivatives such as formaldehyde are Carcinogens are substances that causes cancer.

SO_2:-

So the major constituent

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in the emission from coal fired electric power plants, smelting industries, manufacture of fertilizers and sulphuric acid and oil refineries. SO_2 does not remain in gaseous state for longer time in the atmosphere. It may be converted through complex reactions to form particulate sulphate or it reacts with atmospheric moisture in presence of sunlight to form sulphuric acid (an important component of acid rain). Oxides of sulphur are the major contributors to lung disease, cough and choking. Higher concentration of SO_2 causes acute or chronic asthama and it is a severe allergenic agent.

NOX (Nitrogen Oxides):-

They are formed mainly from nitrogen and oxygen during combustion of fossil fuels at high temperature in automobile engines. NOX stands for an indeterminate mixture of NO, NO_2 and N_2O. The nitrogen oxides cause the reddish brown haze called brown air in traffic congested city air which contributes to heart

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and lung problems and may be carcinogenic. Nitrogen oxides also contribute to acid rain because they combine with water droplets to produce nitric acid and other acids.

Fluorides and hydrogen fluoride

Fluoride mostly in gaseous hydrogen fluoride form is released into the atmosphere whenever the clays, rocks, ore and coal containing it are heated. Volcanic eruptions contribute significantly as natural source to fluoride pollution. Excess fluoride ingestion /inhalation leads to a disease called as fluorosis. The teeth become weaker and mottled, bone deformations which may become fatal.

Secondary air pollutants:-

1) Photochemical smoke
2) ozone
3) Peroxy acetyl nitrate (PAN)

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4.) Brown air
5.) Gray air
6.) Acid Rain

Control of Air Pollution:-

Important preventive strategies to control air pollution are:-

1.) suitable fuel selection ex.) fuel with low sulphur content and its efficient utilization to reduce pollutant level in emission.

2.) Modification in industrial processes and equipments to reduce emissions.

3.) Correct selection of manufacturing site and zone for industrial set up to ~~disperse~~ disperse pollution sources. The most common methods of eliminating or reducing pollutants to an acceptable level include destroying the pollutant by thermal or catalytic combustion, changing the pollutant to a less toxic form or collecting the pollutant by use of equipment to prevent its escape into the atmosphere

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12/02/2014

AKS Sir

Control of Particulate Matter:-

A variety of settling chambers or collectors are used to control emissions of coarse particulate from industries by providing a mechanism that causes particles in gases to settle out in a location where they may be collected for disposal in landfills. These are also called gravity settling chambers. Principally, 2 devices remove particulate air pollutants, which are arresters or collectors. Arresters or collectors are used ideally to separate particulate matters from contaminated air and the scrubbers used to clean air for both dust and gases by passing it through a dry or wet packing material. Particulate matter arresters may be of different kinds. Cyclonic separators and trajectory separators are commonly used to separe

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from industrial emissions with minimum moisture content. These separators work on the principle of dust separation by centrifugal force and are efficient for coarser dust particles. Filters are also used to collect extremely fine particulate matter. Electrostatic precipitators is the most effective device to remove particulate pollutants from flue gases and is a standard equipment for power plant and big industries. ESP works on the principle of electrical charging of the dust particle and collecting it on a differentially charged platform.

Control of Gaseous Pollutants:-

Combustion, adsorption and absorption techniques are used to control gaseous pollutants. In combustion process, oxidizable gases are completely burnt at higher temperature. Petrochemical, fertilizer and varnish industries use combustion for control of gaseous pollutants.

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In absorption technique, gaseous pollutants are absorbed in a suitable absorbing material, however adsorption technique is applied to control toxic gases, vapours and inflammable compounds that could not be efficiently removed or transferred by the other techniques. Such air pollutants are adsorbed on large solid surfaces.

Control of Automobile Exhaust:-

Efficient engine or) multipoint fuel injection engine can reduce the unburnt hydrocarbons in auto emissions. Good quality automobile fuels can also reduce the toxic contaminants in exhaust. Lead free petrol can also reduce the load of lead in the exhaust. The control of nitrogen oxide from automobile exhaust is ~~complain by~~ accomplished by recirculating exhaust gas, diluting the air to fuel

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the engine. The dilution reduces the temperature of combustion and decreases oxygen concentration in burning mixture thus producing lesser nitrogen oxide. To remove NOX, CO, HCS, emission from automobile, catalytic converters are also used. In this CO is converted to CO_2 and NOX is converted to N_2 and HCS (hydrocarbon) is converted to CO_2 and H_2O.

Some National standards for ambient air quality:-

Pollutants	Time-Weighted average (TWA)	Concentration ($\mu g/m^3$)		
		Sensitive Areas	Industrial Areas	Residential areas
Sulphur	Annual average	15	80	60
SO_2	24 hours	30	120	80
NOX (NO_2)	Annual	15	80	60
NOX (others)	24 hours	30	120	80
SPM	24 hours	70	360	140

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RSPM	24 hours	50	120	60
Lead	24 hours	0.50	1.0	0.75
CO	8 hours	1 mg/m³	5 mg/m³	2 mg/m³

18/02/2014 NCK Sir

Sustainability can be interpreted as the ability of an ecosystem to maintain long-term economic productivity under 'stress' or 'shock'.

Sustainable Development:-
Development within the environmental carrying capacity

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26/02/2014 [AKS Sir]

Substances	TWA (mg/m³)	STEL (mg/m³)
Cr	0.05	—
CO	57	458
Cu fumes	0.2	—
Cu dust and mist	1	—
DDT	1	—
Dieldrin	0.25	—
lead dust and fumes	0.15	—
mercury as alkyl compounds	0.01	—
mica as respirable dust	3	—
Nitrogen oxide as NO_2	3 ppm OR 5.6 mg/m³	5 ppm OR 9.4 mg/m³
Nitrous oxide	50 ppm OR 90 mg/m³	—
oil mist	5 mg/m³	—
paraffin wax fume	2 mg/m³	—
quartz ~~as silica crystalline~~	0.1 ppm OR 0.44 mg/m³	—

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Silica Crystalline as respirable dust	0.05 mg/m³	–
Silica as quartz respirable dust	0.1 mg/m³	–
SO_2	2 ppm or 5.2 mg/m³	5 ppm or 13 mg/m³
Talc containing no asbestos fibres as respirable dust	2 mg/m³	–

Examples of TLV for mixtures:-

The following formula apply only when the components in a mixture have similar toxicologic effect. They should not be used for mixtures with widely differing reactivities.

Additive effect:-

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \text{———} = 1$$

General case where air is analysed for each component, the TLV of mixture is:-

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \text{———} = 1$$

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where C_i indicates the observed atmospheric concentration and T_i, the corresponding threshold limit value. For ex.) air contains 400 ppm of acetone TLV 750 ppm; 150 ppm of butyle acetate, TLV 200 ppm and 100 ppm of methyl ethyl ketone, TLV 200 ppm. The atmospheric concentration of mixture is:-

$$400 + 150 + 100 = 650 \text{ ppm of mixture}$$

and by the additive effect

$$\frac{400}{750} + \frac{150}{200} + \frac{100}{200} = 0.53 + 0.75 + 0.5 = 1.78$$

and threshold limit is exceeded.

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Environmental laws:-

In the constitution of India, it is clearly stated that it is the duty of the state to protect and improve the environment and to safeguard the forest and wildlife of the country. It imposes a duty on every citizen to protect and improve the natural environment, including forest, lake, rivers and wildlife. The constitutional provisions are backed by a number of laws, acts, rules and notifications. Following is the list of the environmental legislations that have come into effect and it is divided into:-

1) general laws
2) forest and wildlife laws
3) water laws
4) air laws

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General laws:-

In 1986 the EPA(environment protection Act), authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources and prohibit or restrict the setting and operation of any industrial facility on ~~industrial~~ environmental grounds.

The 1986 Environmental protection rules lay down ~~prac~~ procedures for setting standards of emission ~~and~~ or discharge of environmental pollutants.

In 1989 the objective of hazardous waste management and handling rule is to control the generation, collection, treatment, import, storage and handling of hazardous waste

In 1989, the manufacturers storage and import of hazardous rule, it defines the terms used in this context and sets ~~of~~ an authority to inspect once in a year the industrial activity connected with hazardous [illegible] dedicated storage facility

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In 1989, the manufacturers use, import, export and storage of hazardous microorganisms genetically or cells rule ~~was~~ was introduced with a view to protect the environment, nature and health in connection with the application of gene technology and microorganisms.

In 1995, the national environmental tribunal act has been created to ~~award~~ award compensation for damage to persons, property and environment arising from any activity involving hazardous substances.

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28/02/2014.

NCK Sir

H.A. Elaboration of stages of EIA

Stages of EIA:-

1.) Screening → ⊛ Whether full scale EIA is to be undertaken or not is decided in this stage.

⊛ Whether the project has likely significant impact.

⊛ Sometimes individual projects are not significant in terms of impact. Such projects are subjected to cumulative effect assesment (CEA)

⊛ In context of developing countries funded by world organizations, a impact assesment report is given to such world organization. Only essential data is considered. It is called Rapid environmental assesment technique (REAT) or Immediate Environment Evaluation (IEE).

→ What are the ~~sensitive~~ sentitive attributes?

→ What is the magnitude of the impact?

→ What is the significance of project?

→ What key impacts are likely to be caused?

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→ In decision making, what was is the significance of the impacts of projects.

Then after assessment a stamp is granted:-

Finding of No significant Impact
"FONSI"

2) Scoping → Scoping establishes Terms of Reference for an EIA by achieving the following
→ identification of concerns and Issues.
→ Determining the varying ~~debts~~ depths of analysis to which the alternatives are to be subjected.
→ Saving on time and effort by focussing the EIA on "real issues".

Screening if conducted properly, it may help in identifying the issues of concern.

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- In scoping public participation is necessary.

3. Baseline Study →

- It gives us the comparison to find the level of impact
- Baseline study program is chalked out only after taking into consideration such data and information that needs assessment, mitigation, prediction of impact
- A study undertaken to give a satisfactory description of the conditions existing at a point of time against which subsequent changes can be detected.
- BLS provides monitoring before and after effect. Changes over time and space can be assessed.

- EIA can be used as an effective planning tool if baseline study is modified to suitably describe the supportive and assimilative capacity of the environment.

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(4) Impact prediction and evaluation:-

Impact prediction:-

* Once likely impacts are found out and feasible options are done then impact prediction and evaluation has to be done for all environmental concerns during development, operation, closure and post closure of projects.

* Error of estimate of impact forecasting can be significantly reduced if the principles are followed:

(i) Existence of sufficient predictive models and site specification data to support quantitative assessment.

(ii) An unambiguous threshold to distinguish between significant and non-significant impact.

(iii) Availability of EIA reports of similar projects located preferably in comparable sites.

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Impact Evaluation:-

* Assessment refers to analysis and evaluation. Analysis includes impact prediction and evaluation refers to determination of significant predicted impacts against total quality of affected environment.

* objective → to assess the value (cost) of quantitative and qualitative changes in the environmental attributes. Impact evaluation should reveal "complete impact compensation possibilities"

5. Impact Mitigation:-

* Mitigation refers to measures to avoid, reduce, remedy and compensate for various impacts associated with the project.

* Mitigation measures includes the following:-

→ avoiding the impact by not to the action.

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→ minimizing the impact by ~~reduc~~ limiting the degree or magnitude of ~~impact~~ impact
→ rectifying the impact
→ rehabilitating or ~~rest~~ restoring
→ repairing
→ Compensating for the impact by replacing or substituting
→ changes in design, process, raw materials, etc.

19/02/2014 [AKS Sir]

(Threshold limit value and time weighted average i.e. TLV and TWA :-)

There are 3 categories of threshold limit values :-

Category I: Threshold limit value and time weighted average :
The time weighted average concentration for a normal 8 hour work in a day and a 40 hour work in a week to which nearly all workers may be repeatedly exposed day after day without adverse effect.

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Category II: TLV and short term exposure limit (STEL):

The concentration to which workers can be exposed continuously for a short period of time without suffering from (i) irritation (ii) chronic or irreversible tissues damage (iii) Narcosis of sufficient degree to increase the likelihood of accidental injury, impairs self rescue and provided that the daily TLV and TWA is not exceeded. It is not a separate independent exposure limit but its suppliments the time weighted average limit where there are recognised acute effect from a substance whose toxic effects are primarily of chronic nature. STEL are recommended only where toxic effects have been reported from high short term exposure in either humans or animals. STEL is defined as 15 minute TWA exposure which should not be exceeded at any time during a work day if the 8 hour TWA is within the TLV and TWA, exposure above the TLV and TWA up to the STEL should not be longer than 15 min and should not occur more than 4 times per day. There should be at least 60 minutes between successive exposures in this range

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Category - III :- Threshold limit value ceiling (TLV-C):
The concentration should not be exceeded during any part of working exposure in conventional industrial hygiene ~~pra~~ practice. If instantaneous monitoring is not possible then TLV-c can be assessed by sampling over a 15 minute period except for those substances which may cause immediate irritation when exposures are short. For some substances for eg. irritant gases, only one category the TLV-c may be relevant. For other substances one or two categories may be relevent depending on their physiologic action.

TWA and c limits:-

TWA permits exertions above the TLV provided they are compensated by equivalent exertions below the TLV TWA during the work day. In some instances it may also [illegible]

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do calculate the average concentration for a work-week rather than for a work-day. The relationship between TLV and permissible exertion is a rule of thumb and in certain cases may not apply. The amount by which the TLV may be exceeded for short period without injury to health depends upon a number of factors such as the nature of contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the effects are cumulative, the frequency with which the high concentrations occurs and ~~dur~~ duration of such periods. All factors must be taken consideration in arriving at a decision as to whether or not hazardous condition exist.

Conversion of TLV in ppm to mg/m³ :-

TLV for gases and vapours are usually established in terms of ppm of substance in air by volume for convinience to the user these TLV(s) are also listed in terms of milligrams of substance

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per m^3 of air. The conversion is based on 760 barometric pressure and 25°c temperature giving a conversion equation of TLV in mg/m^3

$$TLV(mg/m^3) = \frac{TLV\ (ppm) \times M.wt\ of\ substance}{24.45}$$

Substance	TWA	STEL
Ammonia	25 ppm	35 ppm
Asbestos		
amosite	0.5 fibre/cc	–
chrysotile	2 fibre/cc	–
crocidolite	0.2 fibre/cc	–
other forms	2 fibre/cc	–
CO	50 ppm	400 ppm
Cadmium dust and salts	0.05 mg/m^3	–

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20/10/2014 NCK Sir

EIA (Environment Impact Assessment):-

~~Sequence~~ (Activities)

1. Assessment of natural Environmental Capital in terms of resource supplier and regeneration capacity
2. Assesment of natural Environment assimilating capacity within the geographical area
3. Identification and prediction of likely changes in the natural resource stock of the environment due to the proposed human activity
4. Assesment and evaluation of quantity as well as quality of waste to be generated because of the proposed human activity
5. Identification and prediction of any possible change in the natural assimilating capacity due to proposed human activities
6. Identification of all feasible alternatives to the proposed activity and conducting steps 1 - 5 for all the feasible alternatives.

optimum — the efficient one among the possible alternatives.

7. Applying sound Environment [illegible] the cost of changes

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in supporting as well as assimilating capacity.

(8) Possible mitigation measures to restore natural capital. When restoration of natural capital is not possible equivalent investment may be made for substitutable form of capital

Defination:- EIA is the systematic, reproducable and interdisciplinary study of the evaluation of the potential changes in the natural capacity stock likely to occur due to the proposed activity or any of its feasible alternative and evaluation of possible mitigation measures to ensure long term environmental sustainability.

The different stages of EIA process:-

(1) Screening :- ~~where~~ assessment of the need of EIA, whether there is significant stress on the assimilating capacity

(2) Scoping - identification of issues and impact to be considered in the EIA study

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3. Baseline study:- The parameters before a suitable change is done to the environment
4. Impact prediction and evaluation
5. Mitigation planning:- how to reduce the severity of impact
6. Comparison of alternatives
7. Decision making in relation to the proposed action.
8. A report has to be documented.

—X—X—

04/03/2014.

NCK Sir

Comparison of alternatives:-

→ Alternatives means meeting the project objectives.

This includes the sites identified in the "scoping stage" itself. The basic purpose of considering all these feasible alternatives is to ensure that no feasible alternatives are left out. Selection of alternatives considers another site, scale of project, process, layout, operating conditions. And lastly when we should look at "NO ACTION". Comparison of

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alternatives on the basis of environmental consequence vary from simple non-quantitative to high level quantitative.

Documentation and Monitoring:-

EIA study ends with presentation of a report which is scrutinized by appropriate impact assessment authority. If a project is approved then the impacts must be monitored. By Monitoring, fine tuning of the process is possible so that the impacts may be reduced or eliminated.

Steps in EIA Process (GLASSON et. al. 1994)

Project Screening – is an EIA needed?

↓

Scoping – which impacts and issues to consider

↓

Description of project / development action

↓

Description of environmental Baseline

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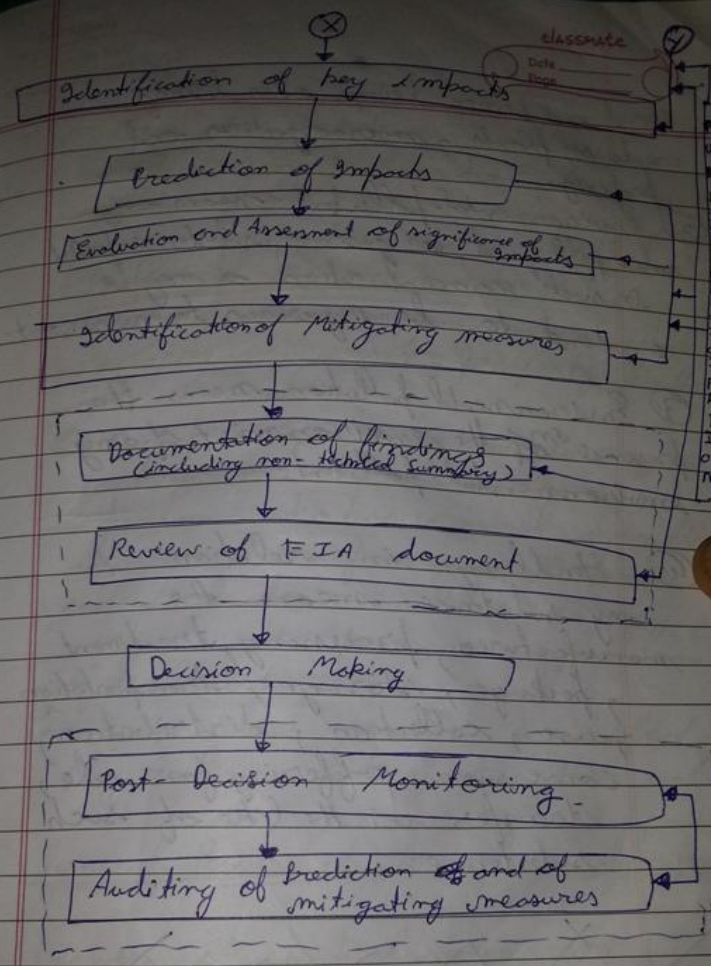

05/03/2014. [AKS Sir]

Environmental Protection Act, 1986

In this act unless the context otherwise requires:-

(1) environment – includes weather, air, [illegible] relationship which exist among and between water,

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land and human beings other living creatures plants, microorganisms and property.

(2.) environmental pollutant means any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to environment.

(3.) Environmental pollution means the presence in the environment of any environmental pollutant.

(4.) Handling in relation to any substance means the manufacture, processing, treatment, package, storage, transportation, use, collection, distribution, conversion offering for sale, transfer or the like of such substance.

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(5) Hazardous Substance means any substance or preparation which by reason of its chemical or physico-chemical properties or handling is liable to cause harm to human beings, other living creatures, plants, microorganisms, property or the environment.

(6) Occupier in relation to any factory or premises means a person who has control over the affairs of the factory or the premises and includes in relation to any substance, the person in possession of the substance.

(7) Prescribed means prescribed by rules made under this act.

General Powers of the Central Government

Powers of central government to take measures to protect and improve environment subject to the provisions of this act, the central government shall have the power to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and

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preventing, controlling and abating environmental pollution.

Appointment of ~~the~~ officers and their powers and functions:-

(1) Without prejudice to the provisions of sub-section 3 of section 3, the central government may appoint officers with such designations as it thinks fit for the purposes of this act and may entrust to them such of powers and functions under this act as it may deem fit.

(2) The officers appointed under sub-section 1 shall be subject to the general control and direction of the central government or if so directed by that government also of the authority or authorities if any constituted under sub-section 3 of section 3 or of any other authority or officer.

~~The Gov~~

Rules to regulate environmental pollution:-

(1) The central government may

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gazette make rules in respect of all or any of the matters reffered to in section 3.

2) In particular and without prejudice to the generality of the foregoing power such rules may provide for all or any of the following matters, namely:-

(a) the standards of quality of air, water or soil for various area and purposes

(b.) the maximum allowable limits of concentration of various environmental pollutants (including noise) for different areas

(c.) the procedures and safeguards for the handling of hazardous substances

(d.) the prohibition and restrictions on the handling of hazardous substances in different areas

(e.) the prohibition and restrictions on the location of industries and the carrying on of processes and operations in different areas

(f.) the procedures and safeguards for

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the prevention of accidents which may cause environmental pollution and for providing for remedial measures for such accidents.

H-A1) Acid mine water and its management. Short notes.

H-A-2) Air pollution problem in surface mine and its amendment or management.

AKS Sir

06/03/2014

NCK Sir

EIA Methodology:-

A Classification:-

In an ascending order of resource requirement we can classify it as :-

- Checklists
- Interaction matrices
- Overlay mapping
- Networks
- Simulation modelling

Checklist:

This methodology presents a specific list of environmental

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for any possible impacts. EIA study team selects the parameters likely to have significant impact and evaluates the impact from the project situation. Checklists do not establish cause-effect ~~lit~~ link to the project activities. Major types of checklists include:-

(a) Simple checklists
(b) Descriptive checklists
(c) quantitative checklists
  (i) Scaling checklist
  (ii) weighting - Scaling checklist.
  (iii) weighting - ranking checklist

Simple checklist → It comprises a listing of potentially affected environmental parameters. No guidance is provided on specific data requirements, measurement methods or impact prediction or assessment. No numerical ranking is used. Simple checklist includes a questionnaire with question like:

- indirect impact
- Mitigation measures
- Scale for ranking impacts.

Simple checklist can be a good impact identification tool and therefore may

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be used for ~~screening~~ screening and scoping. Simple checklist do not involve quantitative analysis much. Their requirement of resources (time, money, data, etc) is low. Wilpin in 1994 presented 9 daughter checklists in addition to the mother checklists. The 9 daughter checklists are:

- Air quality impact
- Ecological impact
- Economic impact
- Environmental health impact
- Hazards and risk impact
- noise impact
- Social impact
- Urban impact
- Water quality impact.

Descriptive Checklist → It comprises a list of environmental factors along with necessary information on the measurement and predictive techniques. Adequate guidance is provided for assessment of impacts. Because of its inbuilt impact identification criteria, mitigation measures can be assessed effectively. Instead of a numerical scale, an alphabetical

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is given to identify the level of details at which impacts are to be assessed. Hence impact summarization is poor and therefore selection of preferred alternatives is difficult. Significant features of this methodology are:-

- It is cost effective
- Provides analytical methods for cause - effect relationship
- Comprehensive methodology
- Provides information regarding environmental laws and regulations
- It includes information about abatement and mitigation measures.

<u>Quantitative Checklist</u> → This has received wide acceptability mainly because of their ability to summarize Environmental impacts in terms of a single numerical value, which facilitates the ranking among the alternatives. However in many cases subjective assessment are given "Arbitrary numerical values".

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11/03/2014.

NCK Sir

Quantitative Checklists:

(i) Scaling checklist → ~~Sc~~

* Impact on 11 points (-5 to +5)

* Since no weightage scheme is adopted, all parameters assume equal importance.

* Impact of m out of n is +ve: m/n is the impact of comparison.

* Algebraic Sum:-

$$IS = \sum_{i=1}^{m} EI_i$$

EI_i → environmental impact on ith parameter.

IS → Total Impact Score

~~Addition the~~

* Some suggested to find the average impact score of each parameter. $\left(\frac{IS}{m}\right)$

⇒ Impacts are assessed for all alternatives under consideration

⇒ There is no explicit criteria for ranking of alternatives, hence ultimate selection of alternatives is left to the

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wisdom of decision makers.

(ii) ~~Weighting-Scaling checklist~~ →

- Summarizes the impacts of an alternative in terms of an overall index or score.
- Canter (1996) has generalised this index

$$\text{Index } J = \sum_{i=1}^{n} (IW_i)(R_{ij})$$

Index J is composite index of Jth alternative, n → no. of decision factors, IW_i → importance weight of ith decision factor, R_{ij} → Scaled rating of jth alternative of ith decision factor.

Steps involved:-

- importance weighting of decision factor
- Scaling, rating or ranking of alternatives
- development of decision matrix
- → Various ~~v~~ weighting techniques importance

used in EIA are:-

1.) Ranking technique
2.) Unranked Pair-wise Comparison
3.) Rating technique
4.) Ranking technique

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5) Multi-variate utility measurements

Unranked Pairwise Comparison:-

While deciding alternatives it must be noted that decision factors are not of same importance

Let there be 4 decision factors for any project to be taken up. The rule of comparison is that all the factors and ~~the~~ a dummy factor will be considered pairwise

Four decision factors F_1, F_2, F_3, F_4
dummy factor F_5

F_1-F_2, F_1-F_3, F_1-F_4, F_1-F_5
F_2-F_3, F_2-F_4, F_2-F_5
F_3-F_4, F_3-F_5
F_4-F_5

For ~~A~~ no. of factors the no of pairs compared are
$N(N-1)$
2

In pair F_1-F_2:-

If F_1 is more important than

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assign value of 1 to F_1 and 0 to F_2
0 does not mean that F_2 does not have any impact, it only says that it is less important than F_1. Similar can be done for any pair chosen.

Need of dummy:-
It is always assigned zero. So all the factors will have atleast one non-zero value in some pair.

$F_1 > F_2$; $F_1 > F_3$; $F_1 > F_4$;

$F_2 > F_3$; $F_2 < F_4$; $F_3 < F_4$

Rank	Factor	Assignment of weight										Sum	FIC
		F_1 – (F_2, F_3, F_4, F_5)				F_2 – (F_3, F_4, F_5)			F_3 – (F_4, F_5)				
I	F_1	1	1	1	1							4	0.4
II	F_2	0				1	0	1				2	0.2
IV	F_3		0			0			0	1		1	0.1
II	F_4			0			1		1		1	3	0.3
	F_5				0			0		0	0	0	0.0
	Total											10	1.0

FIC → Factor importance coefficient

$\left(\frac{\text{Sum}}{\text{total}}\right)$

$\sum FIC = 1.0$

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$$FIC_i = \frac{Sum_i}{\frac{N(N-1)}{2}} \qquad i = 1, 2, 3, \ldots (N-1)$$

$N \rightarrow$ including dummy

$$\sum_{i=1}^{(N-1)} FIC = 1.0$$

→ Depending on FIC, Rank the factors

$F_1 > F_4 > F_2 > F_3$

order of importance of factors

This technique is called "Rank Ordering". This technique does not convey how much better one decision factor than the other, simply it gives the relative order.

Scaling of alternatives:-

Let, there be B alternatives A_1, A_2, A_3 to be evaluated relative to 4 decision factors F_1, F_2, F_3, F_4 for which the FIC has [illegible]

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Calculated earlier. Unranked pair comparison technique would involve preparation of table showing the ranking of alternatives relative to each of the factors.

Table for Comparison:-

Decision Factors	A_1	A_2	A_3
F_1	↓ 5% in air quality	↓ 20% in air quality	↓ 12% in air quality
F_2	↓ water quality by 10%	↓ water quality by 15%	↓ water quality by 5%
F_3	↓ 25% in land productivity	↓ 15% in land productivity	↓ 10% in land productivity
F_4	Ambient noise 65 dB(A)	Ambient noise 60 dB(A)	Ambient noise 60 dB(A)

Table: Ranking of alternative relative to decision factor F_1

Alt	Assignment of desirability						Sum	ACC
A_1	1	1	1				3	0.50
A_2	0			0	1		1	0.17
A_3		0		1		1	2	0.33
A_4			0		0	0	0	0.00
Total		A_1			A_2	A_3	6	1.00

dummy

$i = 1, 2 \ldots (n-1)$

$n \rightarrow$ including dummy

$$ACC = \frac{Sum_i}{(n-1)}$$

Alternative choice

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Similarly:-

Table-2 Ranking of alternative relative to F_2

Table-3 Ranking of alternative relative to F_3

Table-4. Ranking of alternative relative to F_4

NOTE → For tie in desirability → assign 0.5 and 0.5 to each alternative

Table-5 FIC and ACC values

Decision Factor	FIC values	ACC values		
		A_1	A_2	A_3
F_1	0.4	0.5	0.17	0.33
F_2	0.2	?	?	?
F_3	0.7	?	?	?
F_4	0.3	?	?	?

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Table-6 Final Product Matrix

Decision factors	$FI_C \times A_C$ values		
	A_1	A_2	A_3
F1	0.2	0.068	0.132
F2	?	?	?
F3	?	?	?
F4	?	?	?
Total	?	?	?

The cumulative value will give us the ranking of alternatives.

02/04/2014. AKS Sir

Continued → (EPA, 1986)

Prevention, Control and amendment of Environmental pollution:-

1.) Persons carrying on industry operation not to allow emission or discharge of environmental pollutants in excess of the standards.

2.) Persons handling hazardous substances to comply with procedure safeguards.

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3.) Furnishing of reformation to authorities and agencies in certain cases.

4.) Powers of entry and inspection subject to the provisions of this section, any person empowered by the central government in this behalf shall have a right to enter, at all reasonable times with such assistance as he may consider necessary.

5.) Power to take sample and procedure to be followed in connection there with. The central government or any officer empowered by it in this behalf shall have power to take for the purpose of analysis, samples of air, water, soil or other substances from any factory premises or other place in such a manner as may be prescribed and the result of any analysis of ~~self will~~ sample taken under sub-section (1) shall

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in any legal proceedings unless the provisions of sub-section (3) and (4) are complied.

6.) Environmental laboratories :→ The central government may by notification in the official gazette establish one or more environmental laboratories.

7.) government analyst → The Central government, may be notification in the official gazette, appoint or recognise such persons, as it thinks fit and having the prescribed qualification to be government analyst for the purpose of analysis of samples of air, water and soil.

8.) Reports of government analysts.

9.) Penalty for contravention of the provisions of the act and the rules, order and directions.

10.) Offences by Companies → where any offence under this act has been committed by a company, every person who at the time the offence was committed was directly incharge of and was responsible to the company for the conduct of the business of the company shall be deemed to be

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guilty of the offence and shall be liable to be proceeded against the punished accordingly.

11.) Offences by government departments → where any offence under this act has been committed by any department of the government, the head of the department shall be deemed to be guilty of the offence and shall be liable to be proceeded against the punished accordingly.

12.) Miscellaneous :→ (i) Protection of action taken in good faith

(ii) Cognizance of offences →
No courts shall take cognizance of any offence under this act except on complain made by.

(iii) information reports or returns

(iv) Members, officers and employs of the authority constituted under section (3) to be public ~~servants~~ servants.

(v) Bar of Jurisdiction — no civil court shall have jurisdiction

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or proceeding in respect of anything done, action taken or order or directions issued by the central government or any other authority or officers ~~of~~ ~~confere~~ in persuance of any power conferred by or in relation to its or his functions under this act.

(vi) Power to deligate

(vii) Effect of other laws

(viii) Power to make rules – The Central government may by notification in this official gazette may make rules for carrying out the purposes of this act.

(ix) Rules made under this act to be laid before parliament – Every rule made under this act shall be laid as soon as may be after it is made, before each house of parliament while it is in session for a total period of 30 days.

SEE Environment Protection Rules, 1986

In exercise of power conferred by section 6 and 25 of the environment protection Act 1986, the Central government hereby makes the following

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rules :-

(i) short title and commencement - These rules may be called the environment protection rules, 1986

(ii) Definitions :- (See)

Central board, state board, government analyst, prohibited substance, standards (See)

(iii) Standards for emission and discharge of pollutants :- (See)

(iv) Directions.

(v) Prohibitions and restrictions on the location of industries and the carrying on processes and operations in different areas.

(vi) Procedure for taking sample (See)

(vii) Service of notice — The central government or officer empowered shall serve on the occupier or his agent or person incharge of the place. A notice then and there ~~conform~~ ~~ege~~ ~~of~~ ~~the~~ his intension to have the sample analysed.

(viii) [illegible]

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for analysis and the form of laboratory report there on.

(ix) functions of environmental laboratories

(x) qualifications of government analyst

(xi) Manner of giving notice

(xii) Furnishing of information to authorities and agencies in certain cases.

(xiii) Prohibition and restriction on the handling of hazardous substances in different areas.

(xiv) Submission of environment statement - Every person carrying on industry operation or process requiring consent under section 25 of the water prevention and control of pollution act, 1974; under section 21 of the air prevention and control of pollution act, 1981 or both or ~~under~~ authorization under the hazardous water rule 1989 issued under the Environment protection act, 1986 shall submit an environmental statement for the financial year ending on the 31st march ~~in the~~ in ~~form~~ form V to the concerned state pollution Control board ~~xxx~~ ~~xxx~~ on or before the 13th

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day of september every year.

[AKS Sir]

04/04/2014

EMP – Environmental Management Plan

These days it is mandatory to have to ~~project~~ a ~~project~~ plan for environment management.

~~Accordingly these days~~

Accordingly for each project O/C or U/G, Mine environment management plan EMP is prepared for submission to the ~~mist~~ ministry of environment and forest to obtain the approval of department of environment to undertake mining operation.

An EMP contains some ~~the~~ mine heads :-

1.) Introduction
2.) Summary data
3.) Status of the project and mining technology
4.) Pre-mining ~~envir~~ environmental scenario
5.) Environmental Impact Analysis
6.) Environmental Control Measures
7.) Environmental control and

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monitoring organisation

8.) Economics and implementation programme

9.) Information on a set of standard questionaire

Part A → General Information about Mining operations:-

- Name and address of the mine
- Name and address of the owner of mine
- Date of opening of mine
- Mineral exploitation details
  - (i) reserves, proved and estimated in the above location of each mineral ore in tons
  - (ii) average daily production of various minerals
  - (iii) Nature of mining operations
- For opencast mines only:
  - (i) stripping ratio i.e. O/B to ore/mineral ratio
  - (ii) details of machinery used
- For underground mines only:-
  - (i) depth of the working
  - (ii) Mode of entry (shaft/adit/incline)

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(iii) details of machinery used at face, for transportation, any other purposes.

(iv) Types of stopes in case of metalliferrous mines only.

* For underground coal mines:-

(i) method of mining, if longwall then whether advancing or retreating longwall

(ii) Method of depillaring

(iii) Are you carrying out ancilliary operations for processing of the minerals/ores mines, if yes, please specify.

Part-B — Environment

* General

(i) location
- total lease area in hectare
- elevation above mean sea level
- indicate general topography of the land
- area based for mining in hectares
- What of the following features exist within 10 Km of the site:-
  - (a) human settlements
  - (b) agricultural land, specify crops
  - (c) grazing land
  - (d) nalla, stream, river, ~~tank~~ lake, dams, estuary/sea, pond
  - (e) fisheries, industries
  - (f) hill, mountain, forest sanctuary, national park, tourist spot
  - (g) monuments
  - (h) national, state, district highway

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(ii) climate

- rainfall (yearly average and range)

(iii) Manpower employed

- average number of person employed everyday
- pollulation of the township/housing colony for the employs
- distance from township to mine

Pollution

(i) water

- Source of water
- average daily quantity of water consumed
- waste water discharges per day from
  - (i) mines
  - (ii) township
  - (iii) total
- point of final discharge
- Do you treat wastewater before discharging, if yes, specify treatment method
- characteristics of the discharge water
  - (i) color (ii) pH (iii) hardness
  - (iv) TS (v) TDS (vi) COD

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(ii) Solid water

- quantities of solid waste ex:) overburden, waste rock, tailings from mining and ore processing operations
- Nature of solid waste
- waste disposal method practised like landfilling, dumping.
- Are there any problem of pollution of air, water or land at the place of disposal of solid waste, if yes indicate nature of pollution, and abatement measures used.

(iii) Air

- Is there any emission of dust or gases like CO, CO_2, SO_2, NOx and methane from your mining/ore processing operations into the atmosphere, if yes, specify nature and concentration and steps to control such air pollution

(iv) Health Hazards

- Is there any potential health hazard from dust/gases in the U/G mine atmosphere, if yes, specify nature of such hazards and measures to

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(v) other types of pollution :- Various operations in mines / plants causes noise pollution or any other types of pollution if yes, what measures are taken to control it

(vi) Management :- Have you had your mine / ore processing plant monitored for environmental pollution / hazard at any time : If yes, keep details. Do you propose to reclaim excavated / subsided area after completion of mining operation, if yes, indicate general feature of scheme.

For preparation of environmental impact assessment matrix for environmental management plan for a large o/c mine. In India rudimentary form of a quantitative matrix is in use in the coal mining centre. A Joint committee of CMPDIL and MoEF proposes the matrix in year 1986. This specific matrix is on 11X14 form showing activities in rows and environmental attributes in columns. The activities considered are :- (i) site preparation (ii) Mine construction (iii) coal o/B extraction (iv) coal o/B transportation (v) OB formation / solid waste (vi) CHP / coal preparation (vii) workshop (viii) Fan house / structure (ix) Land reclamation (x) Afforestation / plantation (xi) community development.

Environmental attributes :-

(i) Land use (150)
(ii) Forest / Flora and fauna / Ecology (125)
(iii) Air quality (100)
(iv) surface water (50)
(v) ground water (100)
(vi) [illegible] (100)
(vii) Noise (75)
(viii) Ground vibration (50)
(ix) Health (75)
(x) [illegible] (125)
(xi) [illegible] / migration

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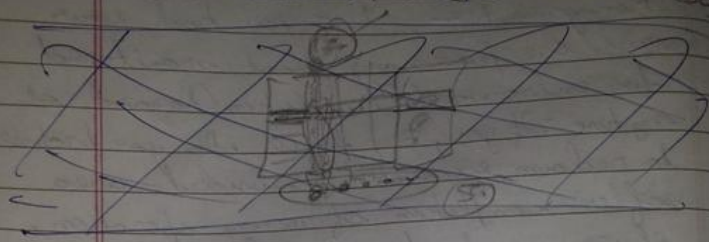
(xi) Employment (75) (xii) Literacy (50)
(xiii) Services (50) (xiv) Aesthetic value (50)



A Total weightage of 1125 is distributed to the above environmental attributes.
For ex.) For land use, it is 150, for ecology and forest weightage is 125, for air quality it is 100, for surface water it is 50, for ground water it is 100, water quality it is 100, ground vibrations 50, noise it is 75, Health it is 75, population/migration 75, Employment 75, Literacy 50, Services 50, Aesthetic value 50.

The CMPDIL matrix measures magnitude using a scale of 0 to 4. The impact values are fixed depending on the intensity of impact i.e. 0 for no appreciable impact, 1 for appreciable impact, 2 for significant impact, 3 for major

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impact, 4 for severe impact. The values are given + or − sign. The + sign shows beneficial impact and − sign shows −ve impact. The last column shows the scores on different items. All the scores are added to assess the impact of mining with protective measures. If the total score are less than −4000, the project is not suitable and alternative sites must be considered. The total impact score is interpreted as − upto 1000 no appreciable impact on the environment and project will get clearance from MoEF; upto 1001 − 2000 appreciable but reversible impact, mitigative measures required and project will get clearance after implementation of mitigating measures; upto 2001 − 3000 significant impact mostly reversible after a short period, mitigative measures crucial; project may get clearance after submission of supporting documents; upto 3001 − 4000

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major impact, mostly irreversible, mining technology is to be reviewed to get clearance from MoEF; Lastly good and above permanent irreversible impact, clearance will not be granted from MoEF.

Environmental Control Measures:

The environmental problems created by mining are by and large, the same whatever the mining method but the nature and magnitude of the degradation of environment depends largely on the method of mining whether opencast or U/G mining and control measures are designed accordingly.

Lab assignment:

Q.1: To prepare an environmental impact matrix for EMP for a large o/c coal mine with and without mitigating measures.

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10/04/2014

NCK Sir:-

C.S.R → Corporate Social Responsibility

The world Business council for sustainable development in its publication "making good business Sense" by Lord Holme and Richard Watson used the following defination:-

CSR is the continuing Committment in business to behave ethically and contribute to economic development while improving the quality of life for the workforce and families as well the local community and society at large.

Traditionally in U.S.A :- CSR has been defined much more in terms of philanthropic model. Companies making Unhindered profit except fulfilling the duty of paying taxes and then they donate a certain share of the profit to charitable causes as if the company is not getting any benefit out of this charitable act. There is no binding on the company side.

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"European Model" → It appears to be focussed on ~~efficiency~~ operating the core business in a socially responsible way complemented by investment in communities for ~~reli~~ solid business reasons. This model is more sustainable because :-

(i) social responsibility becomes an integral part of wealth creation and maximize the wealth creation to society

(ii) At hard-times, there is tendency to practice CSR in a better way.

CSR – (Indian Personalities)

1.) JN-Tata – founder of Tata group In a free enterprise, the ~~co~~ community is not just another a stake-holder in the business but infact the very purpose of its existence.

2.) Monoj Chakraborty (GM, corporate affairs, titagh industries) – CSR should be in the DNA of [illegible] practices

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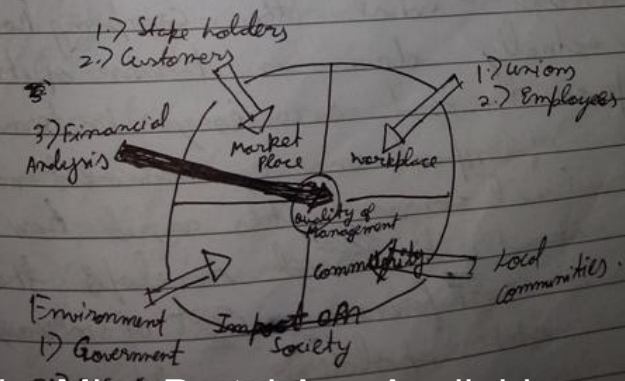
should be alligned so as to benefit the society. If Society prospers so shall the organization.

3.) B. Muthuraman (M.D., Tata Steel)
— He announced that TISCO would not deal with any Company which did not match their CSR standards.

4.) JRD – Tata → Stated in the guiding mission of Tata group — no success of achievement in material terms is worthwhile unless it serves the needs or interest of the country and its people.

Concepts of CSR according to Mallen Baker :-



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CSR is about how companies manage the business processes to produce an overall +ve impact ~~in the~~ on the Society.

The above diagram illustrates that the company has to assess:-

1.) Quality of Management - In terms of people and processes.

2.) Nature and Quality of Impact on Society in various areas as depicted.

3.) Outside stake-holders are taking an increasing interest in the activity of the company.

Most people look to the outer circle - what the company has actually done in terms of its product and services, in terms of impact on environment and local communities and how ~~its~~ it treats and develops the work force. Out of various stake-holders, it is

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is predominantly focussed on
QOM as an indicator of future
~~progr~~ performance.

Socio-Economic Rehabilitation:-

1) Project affected family (PAF) - It means a family whose primary place of residence or other property or source of livelihood is adversely affected by the acquisition of land for a project.

OR

Any tenure holder tenant, ~~lessee~~ lessee, or owner of other property who on account of acquisition has been involuntarily displaced from such land.

OR

Any agricultural (~~or~~ non-agricultural labourer, land less person, rural artisan, small trader or self employed person, who has been residing or engaged in trade for a period not less than 3 years and who has been deprived of his earning because of acquisition of land or being involuntarily displaced due to acquisition of land.

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2.) Family — It includes a person, his spouse, minor sons, minor sisters, unmarried sisters, ~~fathers~~ father, mother and other relatives dependent on him for his livelihood.

11/04/2014 [AKS Sir]

Environmental Control Measures for Opencast Mining:-

The environmental control measures for open-cast mining addresses the following:-

1.) Socio-economic measure
2.) Land-use
3.) Land Reclamation
4.) Afforestation
5.) Air pollution
6.) Noise abatement
7.) Water Pollution

1.) Socio-Economic Measures: Socio-economic measures as per guidelines issued by the department of public enterprises, Ministry of Industry, dated 3/2/1986, the following measures are taken:-

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in offering ~~jobs~~ jobs in group C and D

(ii) Suitable persons are trained for self employment in jobs like poultry, piggery, small farming, diary, cottage Industry. This is done in co-operation with the state authorities or social service organisation.

In the case of ~~the~~ settlement of people losing their home, land community development is provided and provisions are made in terms of road, electricity, water improved sanitation, health and education, also job facilities are provided for long term and short term projects.

2) Land use → It has to be planned for ~~the~~:

(i) Operational stage

(ii) post mining stage

(i) operational stage → land is used for building roads, the quarry zone, ~~ete~~ industrial complex, external overburden dumps and for residential areas. Also land has to be used for plantation and creation of green

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(ii) post-mining → quarry and internal dump, external dumps, industrial structure is dismantled, service buildings are sometimes used for some specific purposes

3:) Land reclamation and Afforestation →
The first step in the process of open-cast mining is to scrape the top soil and keep it aside for future use. Experience shows that the soil if stored, more than one year loses its nutrients, hence this soil is utilized in the colliery, take-for afforestation plantation and it is not stored for use after the quarrying operation. The reclamation procedure is planned in 2 aspects :-
(i) technical reclamation
(ii) Biological Reclamation

(i) technical Reclamation → The top of the dump is graded and levelled by dozers. The top of the ground is divided into different plots and it is so graded that the stall

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water will run in a pre-determined manner into channels.

(i) Biological reclamation → Schemes are prepared for afforestation

5) Air pollution Control → Arrangements are made for the following to control air and noise:-

(i) Water spraying of the roads, overburden dumps and coal piles

(ii) Water spraying in coal handling plants and at dust generating source.

(iii) ~~flat top~~ Black topping of roads

(iv) Mechanized coal transport system

(v) Dust destruction and arresting

(vi) Controlled blasting

(vii) Improved maintenance of plant and machinery

(viii) Green belt around the colony, quarry, industrial area and colony roads.

6) Noise abatement → The ILO recommendations are followed in respect of noise levels to which workers are exposed. eg.) At Neyveli lignite opencast mine site. the

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noise ~~level~~ limit is kept 85 dB(A) for an eight hour exposure.
The measures adopted for noise control are :-

(i) Use of HEMM with sound proof cabin
(ii) Use of equipment with silencer
(iii) Use of ear muffs
(iv) improved maintenance of plant and machinery
(v) Controlled orientation of noise generating source
(vi) Green belt around noise generating source.

7.) Water pollution Control → Arrangements are made for the following:-

(i) Cess pools and soak ways for the treatment of domestic effluents and provision of toilet and ~~soak~~ soak ways in each house.

(ii) Treatment of Industrial ~~wa~~ water, before it goes into water bores.

(iii) For the treatment of mine-water,

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in the pit to settle the suspended particles. The water may be allowed to stand for 2 days before pumping out so that suspended particles donot get pumped out.

(iv) As for the surface run-off water flowing from the old O/B dump. It should be collected in a catch drain which would lead it into surface lagoons where the suspended particles would be separated and clear water, allowed to pass.

In U/G mining:-

Like O/C mining U/G mining creates socio-economic problems, land degradation, deforestation, water, air and noise pollution and in some situations vibration cause pollution due to blasting in shallow ground.

The control measures against these are almost similar to those in O/C mines. However ground subsidence and fire, if it occurs in shallow U/G working then special control measures should be adopted.

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For control of fire and redamation, the following methods are used:-

(i) surface seeding
(ii) drenching
(iii) digging out
(iv) Injection of nitrogen for rapid extinction of fire

For the redamation of land:-

(i) Capping the ground with matti to cut out feeding of oxygen to the fire
(ii) ~~the for~~ Afforestation over the area capped with matti

The EMP should specify the control measures as to suite for the specific site.

15/04/2014. [NCK Sir]

Resettlement → (Just movement)
Rehabilitation → (How to earn livelihood Back to original state.

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PAP → Project affected person
PAF → Project affected Family.

Resettlement and Rehabilitation Policy (R&R) of CIL – 2008

(*) It recognises all the adult entities as its members.

(a) Eligibility Criterion for economic Rehab Benefit :-

- The benefit will be given to entitled PAP's.
- PAP's ~~shall~~ shall be one of the following Categories :-

(i) Persons from whom land has been acquired including tribals & cultivating land under traditional rights.
(ii) persons whose Homestead is acquired
(iii) share croppers, land lessies, tenants, daily labourer
(iv) Tribals depending on Forest produce (Honey, Firewood, Fodder, Gum)

(b) Eligibility Criteria for Resettlement Benefit :-

1.) Only a "Displaced persons" are eligible for this benefit
2.) A family or person shall be termed displaced :-
(i) If such family / person had been a permanent resident and ordinarily

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residing in the project area on the date of publication of notification under section 4(1) of Land acquisition Act, 1894 or notification under section 7(1) of C.B.A (acquisition and development Act, 1957) and on account of acquisition his/her home stead is displaced from such area.

2.) He/she is a homested less or landless family/person who has been / is required to be displaced.

3.) The person/family who does not ordinarily reside on the homsted land acquired by the project can be termed displaced but he will be eligible for compensation only for homsted land/structure.

(c.) Eligibility and Compensation :-

Eligibility → Evidence to the effect that the person is a legitimate PAP will need to be provided in the form of a possession land/

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document such as a revenue officer's certificate, electoral roll, Pedigree card or school records.

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17/04/2014 NCK Sir

Compensation and Rehabilitation:-
(Entitlement Options for different Categories of PAP's)

(I) Persons from whom land has been acquired, all land owners will recieve monetary compensation for the land acquired from them. The value of the land is determined on the basis of prevailing legal norms.

In addition to the above, the following shall apply:-

(i) subject to suitability and availability of opportunities, company should provide employment, at the rate 1 employment/2 acres.

(ii) Employment shall be released to actual landusers or their dependent as prescribed in R&R Policy notified by ministry of rural development.

(iii) The dependents shall be taken in at a consolidated stipend of Rs 5500 per month for 2 years

(iv) actual land loosers or their dependents shall

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employment or a cash compensation as prescribed. below:-

1) Subsidiary companies shall offer monetary compensation/ one time cash grant/ financial package as announced by concerned state document.

2) In case there is no policy of state government, the monetary compensation shall be paid on following basis:-

→ 2 lakh for 1st acre on Prorata basis subject to a minimum of 0.5 lakh

→ Rs 1.5 lakh on Prorata basis for Second and 3rd acre.

→ Rs 1 lakh on Prorata basis beyond 3 acres.

(I) Persons whose homestead is acquired:-

(i) Alternate house site measuring 200 sq. meter per family and compensation for shifting, etc - shall be as per the rate notified by Ministry of Rural Development (MORD)

(ii) Each affected family that is [illegible] as cattle

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shall get financial assistance of Rs 15000 for construction of cattle shed.

(iii) Each affected family shall get one time assistance of Rs 10,000 for shifting family and belongings.

(iv) Each affected person shall get one time assistance of Rs 25,000 for construction of working shed or shop.

(v) Each affected displaced family will get "subsistence allowance" of 25 days MAW per month for one year. ~~or one time lumpsum~~

(vi) OR one time lumpsum amount of 1 lakh.

III Share croppers, land lessees, tenants, day labourers:-

The subsidiary will assist PAP to establish non-farm self-employment through the provision of infrastructure, petty contracts or formation of cooperation OR jobs with contractors wherever feasible.

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(IV) Land less tribals, tribals dependent on forest produce :-
The subsidiary will assist PAP to establish non-farm self employment through provision of infrastructure petty contracts OR jobs with contractors wherever possible. In addition (i) the subsidiary will shift the tribal community as a unit and will provide facilities to meet the specific needs that will allow them to maintain their unique culture. (ii) One time financial assistance of 500 days MAW for loss of customary rights or usage of forest produce.
(iii) Tribal affected families resettled out of the district shall be given 25% higher resettlement and rehabilitation benefit.

Socio-Economic development of Communities through CSR policy of CIL, 2008:-

(i) Budgetary provisions shall be created to intensify CSR activities in and around the villages where land

is being acquired.
Initially 1% of earnings of ECL and BCCL shall be year wise as corpus fund to intensify CSR activities. For other subsidiary 1 – 2.5% earning to be utilized depending upon the requirement.

(ii) Top priority will be given to the persons displaced as a result of land acquisition.

(iii) Involvement of PAP's particularly the land loosers shall be carried in the CSR project. The fund shall be utilized for social development in the following manner:

(a) creation of social assets such as community centers, educational institution, arrangement of drinking water, medical facilities, etc.

(b) developing infrasture for better QOL such as roads, rain water harvesting, etc.

(c.) creating institutions to impart vocational training for acquiring an upgraded technical skills with a view to enhance employability

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(d) Conduct program relevant for women.

(e) Role of rel companies or the separate institutions as ~~and~~ and when created shall be initially to facilitate interaction among various groups to decide the package and thereafter implement the same in a time bound manner.

XXX

Stages of EIA:-

2nd Last stage:- → (Decision Making)

~~It is the process the~~

In general a decision maker has 3 choices:-

(a) accepting one of the project alternatives

(b) Returning the EIA with a request for further study in certain specific areas.

(c) Totally rejecting the proposed project along with alternative versions

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