

Oil and Lubricant Hazard Effects on Human Health

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ABSTRACT

It is estimated that, at present, approximately 50 % of all lubricants sold worldwide end up in the environment via total loss applications, volatility, spills or accidents. More than 95 % of these materials are mineral oil based. In view of their high eco-toxicity and low biodegradability, mineral oil-based lubricants make up a considerable threat to the environment. While, most lubricants and hydraulic fluids based on plant oils are rapidly and completely biodegradable and are of low eco-toxicity. However, in order to compete with mineral-oil-based products, some of their inherent disadvantages must be corrected, such as their sensitivity to hydrolysis and oxidative attack, and their behavior at low temperatures. A loss of energy can be observed in degrading the quality of lubricant for the same machine. Besides, reducing the friction between the two rubbing surfaces, lubricants reduce the wear and tear, act as coolant, prevent corrosion, act as a carrier of dirt and metal particles.

As a matter of fact Oil and Lubricant are also of vital importance in the stationary equipment like Pump, Compressor, Winding Engines, Haulage, Ropes, Drill Rig, Jack Hammer irrespective of motive power being Fuel Oil or Electricity.

Oil and Lubricants waste production was being collected regularly and was burnt periodically and hence the Oil and Lubricant in the mine discharge water was less than 0.01 mg./litre.

Oil and Lubricant constitutes around 33% of total expenses per unit excavation in Heavy Earth moving Equipment. Fuel Oil on combustion gives rise to Nitrogenous fumes, Carbon Monoxide, Carbon Dioxide, Aldehydes, which are considered noxious gases. Besides the above stated gases unburnt fuel oil and carbon particles are found in the exhaust gases of internal combustion engine, water bath exhaust conditioner/Catalytic exhaust conditioner are fitted on exhaust of the engine to absorb nitrogenous fumes, to remove burning particles and to act as a flame arrestor. In catalytic exhaust conditioner, Carbon Monoxide is converted to Carbon Dioxide while unburnt fuel get oxidized to form carbon dioxide and water vapor.

The authors are inclined to highlights the effects of Oil and Lubricants actions and reactions on human health in this paper with aims to minimize it.

Key Words: Constituents, Exhaust gas, Nitrogenous Fumes, Carbon Monoxides, Mining Equipment.

1. INTRODUCTION

A number of ways to improve the undesirable properties of native plant oils are being pursued by various researchers. While governments are putting regulations in place to

enforce the use of bio-based fluids, for use in ecologically sensitive areas. Here effort is made to look at the key impact of additives on human health. The main classes of additives are: succinimide ashless dispersants, calcium sulphonates, calcium phenates, zinc dialkyldithio-phosphates, oxidation inhibitors, and anti-wear inhibitors. Although lubricant additives do not pose a significant health risk to humans, lubricant additives do not readily biodegrade and may persistent in the environment. Manufacturing advances are reducing the release of toxic by-products to the environment. The potential health effects of lubricant additives in humans can be determined in appropriate animal toxicity tests.

High percentage of energy is wasted in friction with the machinery in terms of Frictional Horse Power. Lack of lubrication can result in increase in spare parts consumption due to abrasive wear, heat and corrosion. A loss of energy can be observed in degrading the quality of lubricant for the same machine. Besides, reducing the friction between the two rubbing surfaces, lubricants reduce the wear and tear, act as coolant, prevent corrosion, act as a carrier of dirt and metal particles.

Oil and lubricant is an essential resource requirement in the Mining Industries like opencast mines and iron ore mines. The most

of the Heavy Earthmoving Machineries and assisting equipment are carried out with Fuel Oil as the motive power with matching consumptions of lubricating oil. Around 90% of the internal parts of Earthmoving machineries are lubricated. As a matter of fact Oil and Lubricant is also of vital importance in the stationary equipment like Pump, Compressor, Winding Engines, Haulage, Ropes, Drill Rig, Jack Hammer irrespective of motive power being Fuel Oil or Electricity.

Although, the manufacturer specifies periodic interval of lubrication and quality of lubricant, but if the system appears to be inadequate the site engineer should go for alteration. While economics of machinery and equipment is significantly influenced by Oil and Lubricant, hazards of oil and lubricant should not be under estimated.

Authors describe their experience in their area of operation i.e. in the Collieries, Mechanised opencast operation, Mechanised Underground mining and Mechanised Beneficiation Plant.

2. MINING SYSTEM POLLUTION

Ministry of Environment and Forest (MOEF) prescribes tolerable limit of pollutants for suspended particulate matter, noxious fumes, carbon monoxide and sulphur dioxide in the

general ambient air and work zone air. As the major source of atmospheric pollutant in the mines is due to the use of Oil and Lubricant it is interesting to note the pollution caused in the mine surface in relation to the prescribed norms for the particular mine. The pollution is hardly 20% of prescribed maximum, which indicates the good standard of machinery maintenance. Similarly, MOEF norms prescribe maximum limit of Oil and Lubricant in the water effluent to be 10 milligram /litre. However, in the concerned mine, Oil and Lubricants waste production was being collected regularly and was burnt periodically and hence the Oil and Lubricant in the mine discharge water was less than 0.01 mg./litre.

The data has been collected from the opencast mines from the log book/ records of the register. Some of the data had been collected from the literature of the paper mentioned in references. It was observed that the Oil and Lubricant constitutes around 33% of total expenses per unit excavation in Heavy Earthmoving Equipment. Fuel Oil on combustion gives rise to Nitrous fumes, Carbon Monoxide, Carbon Dioxide, Aldehydes, which are considered noxious gases. Besides the afore stated gases unburnt fuel oil and carbon particales are found in the exhaust gases of internal combustion engine, water bath exhaust conditioner/Catalytic

exhaust conditioner are fitted on exhaust of the engine to absorb nitrous fumes, to remove burning particles and to act as a flame arrestor. In catalytic exhaust conditioner, Carbon Monoxide is converted to Carbon Dioxide while unburnt fuel get oxidized to form carbon dioxide and water vapor.

3. MINING RULES

The bye-law issued by director General of Mines safety (D. G. M. S.) governing the use of underground equipment and diesel locomotive in the underground mines specifies the maximum permissible amount of Noxious gases in the exhaust of the machine when measured one meter away from the mouth of the exhaust pipe and at 1.5 meter height from the floor.

4. THE EFFECT OF OIL AND LUBRICANT ON BODY SURFACE / SKIN

Skin is a delicate structure. Whenever the Oil/ Lubricant comes in contact with skin surface on a long-term basis, biological reaction over the skin takes place and as a result different types of skin diseases appear which may be

mild variety as well as serious types. The diseases depend upon the contact period, type of lubricants, and structure of skin i.e. overall the resistance of body.

The various skin diseases may appear as itching, discoloration of skin, dermatitis, eczema, thickening of skin and xerodama etc. Due to prolonged contact to a particular area of skin, the morphology (structural pattern) of which is changed and the skin becomes ulcerated. Where skin diseases are detected due to the oil and lubricant, the person concerned should be withdrawn from the particular work.

5. THE EFFECTS OF OIL AND LUBRICANT ON HUMAN RESPIRATORY SYSTEM

A sight, which is commonly seen in the mining industry and elsewhere, is the practice of siphoning from the fuel tank by suction through mouth after inserting a rubber tube in the tank. This practice is fraught with the danger of the diesel oil entering the respiratory system. The former may result in Aspiration pneumonia in the Lungs and the latter case, the gastrointestinal system is affected resulting in loose motions, vomiting etc.

Some times these lubricants emit upon combustion some gaseous substance containing hydrocarbon group carbon monoxide, Carbon Dioxide and sulphur dioxide. These gases are poisonous and when inhaled by the individual have poisonous effect to the body causing serious illness. As a matter of fact, some of the petroleum products are volatile in nature and when it enters the respiratory system of human being, do cause irritation to the living tissue.

With prolonged exposure, constant irritation of tissue takes place resulting in damage of the tissues leading to development of diseases like Bronchitis, Bronchopneumonia, Asthma, Emphysema, and Tuberculosis. Many times unnatural growth i.e. tumor may develop which may be benign or malignant in nature.

6. THE FACTORS INFLUENCING CONSUMPTION OF OIL AND LUBRICANT

A.)THE EFFECT OF AGE OF MACHINE ON THE COST OF LUBRICATION

A comparison was made against various types of machinery to find out the consumption of Oil and Lubricant per Horse Power (HP) running of machine with the working

parameters remaining constant that are noted from field records. It was found that the consumption proportionately rises with ageing of the machine reflected in terms of working hours, without any erratic variation. This goes to indicate the need for early replacement of the machine instead of trying to prolong the work in life of the machine with increasing cost of operation, since spare part consumption is also proportional of oil and lubricant consumption.

B.) THE RELATION BETWEEN SPARE PART CONSUMPTIONS

The cost of spare part consumption has been generally 20% that of Fuel and Lubricant consumption. Conversely with increasing wear and tear/ corrosion/ fatigue of spare parts of the Earthmoving machinery, corresponding rise takes place in the fuel /lubricant consumption.

C.) THE EFFECT ON INCREASING THE LIFT OF DUMPER.

The fuel/ lubricant consumption per 3 km running distance increases by arithmetical progression i.e. about 0.2 ltr./30 m lift. While it is understood that lift in the opencast

excavation will have to be tolerated as it is a function of economic limit of opencast operation in a ore body going to great depth the lift in the waste dump is controllable and it will be desirable to keep the dump height within limit and start a fresh dump yard once the dump height limit is reached. There are many turning points that increase the wear and tear of the components, which increases the oil and lubricant consumption of the vehicle.

D.) THE VARIATION DUE TO SEASONAL EFFECTS

Generally Lubricant consumption in Summer is likely to be higher compared to that of Winter primarily due to the fact that increased temperature of atmosphere, reduces the quantity of Air intake against the fixed quantity of fuel injection is Summer due to the reduction in air density resulting in comparatively weaker explosion, leading to development of lesser brake horse power.

E.) VARIATION DUE TO OPERATING POWER

A comparison has been made regarding the extra Lubricant consumption in diesel operated driven machine per unit output which is 5

times more in Diesel driven machine per HP hour running. While the economic aspect may not be considered very significant in such comparison the impact on environment with increased consumption of oil and lubricant cannot be ignored.

Stringent Law on Hazardous Waste (Management and Handling) Rules 1989 (Amended in January, 2000) under Environmental Protection Act is a pointer to the extent of Environmental Degradation that can take place with increased use of oil and Lubricants.

It is concluded that Fuel Oil as motive power in the use of surface machinery, besides being less economical, compared to electricity is a pollutant to environment.

F.) THE AVOIDANCE OF SAFETY MEASURES

Several incidence/ accidents do occur due to Oil and Lubricant and all these accidents emanate from the Fire/ Explosion/ Heat of Oil and Lubricant.

Jack Hammers are provided SERVONIUM-100. Due to shortage of this lubricant HLP-68 lubricants are used. When this jackhammer was operated in a development face below ground, the exhaust of the jackhammer machine produces noxious gases, which caused strong irritation in the throat of the driller. Utmost care is therefore to be ensured while using lubricating oil in below ground mines due to the confined environment.

LIST OF DIFFERENT GASES AND THEIR ALLOWABLE LIMITS FOR USE		
Gas	Maximum allowable concentration	
	Percentage by volume	Parts per million
Carbon dioxide	0.5	5000
Carbon monoxide	0.01	100
Oxides of a nitrogen (NO ₂)	0.001	10
Aldehydes(Formaldehyde)	0.001	10

Cotton Waste material with lubricant should be disposed off by burning out side the plant.

Lubricant flowing out of the maintenance yards are diverted through an oil and grease

trap which have to be periodically cleaned and burnt away in a remote area. The list of equipment consuming oil and lubricant are given below:

LIST OF EQUIPMENT USING OIL AND LUBRICANT IN OPENCAST MINES

- Cutting machines
- Loading machines
- Dozer
- Dumper
- Shovel
- Compressors
- Wagon drills
- Pumps
- Jack hammer
- Locomotives
- Drill machines
- Water tanker
- Tippers
- Jeeps
- Ambulance
- D.G. generator set
- Ventilators motor graders
- Haulage and winders
- L.H.D
- Welding sets

7. CONCLUSION

Irrespective of the various hazards associated with Oil and Lubricant, it is inevitable that the modern civilization cannot survive without Oil and Lubricant. However, due precautions and care is to be exercised for preventing incident/

accident/ occupation health problem as well as for consumption with economy in view.

Detailed study may provide more information regarding Oil and Lubricant hazards. The study may be extended to Iron ore mines to get the relevant information about the said hazards.

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