

## Executive Summary

The Mandideep Industrial Area having industries like Electro graphite, fabrication (steel & wooden), paints, pesticides formulation, bulk drug & pharmaceuticals, steel & aluminium rolling units, epoxy casting, electrical insulators, battery, food processors, plastics, transformers, detergents, soft drinks, gelatin, thermal power plant, recycled paper, spinning, weaving/dyeing was chosen as the effluent generated during process & utility is being discharged in river Betwa, a tributary of river Yamuna. This industrial area also doesn't have CETPs to treat the industrial waste. To study the presence & accumulation of heavy metals (Pb, Cd, Ni, Cu, Zn & Cr) in water, soil and vegetation (grass) of Mandideep sampling was done in and around (200-1000 metres) of the Mandideep Industrial area in all the four directions with reference to the distance from industrial clusters.

The effluent & sewage generated from Mandideep industrial area finally meets River Betwa. The heavy metal analysis report states that river Betwa is free from toxic heavy metal (Pb, Cd, Ni, Cu & Cr) contamination however the Zn concentration was observed, that is also below the lethal concentration as per the drinking water quality standard (*IS-10500-1991*) the desirable limits of Zn is 5 mg/l (max). The water pollution at *D/s* & *U/s* of river Betwa may be due to stagnancy or lean flow of river water along with the religious activities at the river bank. In between the Mandideep Industrial Area the bio-monitoring was not carried out due to stagnant water body with zero dissolved oxygen.

The availability of minerals as micro & macronutrients is very much necessary for the plant metabolism & healthy growth. The mineral ion concentration in tissue that reduces the dry weight of tissue by about 10% is considered toxic to the plant. The presence of these toxic mineral metals (Pb, Cd, Ni, Cu, Zn & Cr) studied under this project states that Mandideep industrial area has no visible as well as analytical presence of Pb, Cd & Cr in its soil & plant species (*Cynodon dactylon*). However, the presence of heavy metal Ni (2-25mg/kg), Cu (5-35mg/kg) & Zn (25-45mg/kg) was analysed and found beyond their required concentration (less than 10mmol per kg of dry matter) in grass (*Cynodon dactylon*). The uptake of Ni, Cu & Zn is carried out mainly by root systems via passive & active transport & seems that all three soluble metals absorb through the same transport system. The uptake of  $\text{Cu}^{+2}$ ,  $\text{Ni}^{+2}$  &  $\text{Zn}^{+2}$  is competitive in nature. Results states that the Zn concentration is higher than Cu & Ni in grass of every sampling direction suggest the competitive transport system. The higher concentration of Zn in grass may also be due to availability of Zn mineral in soil.

Further a long term study can enhance the cause of presence of heavy metals & their effects on the vegetation.

### *List of abbreviations*

DO	:	Dissolve Oxygen
U/s	:	Upstream
D/s	:	Downstream
BMWP	:	British Biological Monitoring Working Party
BWQC	:	Biological Water Quality Criteria
NRCP	:	National River Conservation Plan
HEG	:	Hindustan Electro Graphite
P&G	:	Proctor and Gamble
AAS	:	Atomic Absorption Spectrophotometer