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ENVIRONMENTAL MONITORING OF HAZARDOUS WASTE DISPOSAL SITE – A CASE STUDY

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ABSTRACT
The purpose of this paper is to discuss the available methods of environmental quality assessment. The need of environmental quality assessment is to assure that concentrations of specific contaminants resulting from hazardous waste site will not exceed the acceptable levels for protection of public health and the ecosystem. The purpose of the study in monitoring hazardous waste sites is to characterize noise air, soil and groundwater pollution in sufficient detail to facilitate proper site management. Site investigations involve the measurement of the physical, chemical and biological parameters that control subsurface and ambient air contaminant transport at a given site. An important factor in understanding and characterizing local and regional hydrological fluxes relates to the frequency of groundwater and surface water sampling. From the detailed analysis of soil, ground water and air it is to conclude that all the analytical parameters are within the prescribed limit.

KEY WORD: Heavy metal, SOx, NOx, Decible, Hazardous waste, air, soil and groundwater pollution

INTRODUCTION

Hazardous Waste Management (HWM) is a very important issue and is assuming significance globally. There is no proper secured landfill facility available in India to dispose of Hazardous Waste (HW) till 1997. Very few industries in India, mostly in large scale and a few in medium scales, own proper treatment and disposal facilities. A common waste treatment and disposal facility such as Treatment, Storage and Disposal Facility (TSDF) for management of HWs generated from industries is one of the useful options under such conditions. Few Guidelines issued by Ministry of Environment and Forests under Hazardous Wastes (Management & Handling) Rules, 1989 promulgated under Environment (Protection) Act, 1986 are available in India for selection of best site for TSDF. The planning for HWM comprises of several aspects ranging from identification and quantification of HW to development and monitoring of TSDF. The purpose of the study in monitoring hazardous waste sites is to characterize noise air, soil and groundwater pollution in sufficient detail to facilitate proper site management. Site investigations involve the measurement of the physical, chemical and biological parameters that control subsurface and ambient air contaminant transport at a given site.

MATERIALS AND METHODS

Environmental monitoring:

Plan & Type of sampling:

The objective of sampling was to collect a portion of material small enough in volume to be conveniently transported to and handled in the laboratory while still accurately representing the material being sampled. This implies, firstly, that the relative portions of the concentration of all pertinent components must be the same in the sample as in the material being sampled and secondly, that the sample must be handled in such a way that no significant change in composition occurs before the tests are performed. The analysis is generally intended to reveal the composition of the samples at the time or over the time or over the period of sampling being carried out. The arrangement should be such that are prevented or at least minimized.

Monitoring of water and soil quality is to give reliable and usable data requires that analytical and other resources are employed the best advantage. The first step in the planning of monitoring was to decide what data is needed and how it is useful. The investigation, purpose of study and anticipated variation are other points to be considered.

Soil & water Analysis:

The first stage of planning of the sampling programme was the selection of the most suitable site to provide the required data. The selection of sampling site was decided by the various uses of water and by their location, relative magnitude and importance. The chance of accidental pollution is also an important factor and should be considered.

Site Location for Soil & Groundwater

In the case selection of site is based upon the purpose so that it could be find out whether any negative impact is happening or likely to being due to the landfill operation within the range of one kilometer or not. That's why four locations are decided to collect soil sample. Water and soil sample are collected not far apart. Although soil samples can be collected from anywhere but water samples can only be collected from where a bore well is available and this facility is available in or near human settlement. Hence, four villages are selected as per human settlement as described below:

Site I: Behind Solar Pond

Site II: Near Tarpura Village
Site III: Borewell B1, B2, B3, B5, B6, B7 **Site IV:** Open dugwell near TSDF and near temple

Soil parameters analyzed & methodology applied

Parameters	Methods/Instruments
pH	Digital pH Analyser
Electrical Conductivity	Digital EC/TDS Analyser
Metals	Atomic Absorption Spectroscopy

Water parameter analyzed & methodology applied

Parameters	Methods/Instruments
pH	Digital pH Analyser
Electrical Conductivity	Digital EC/TDS Analyser
Total Dissolved Solids	Digital EC/TDS Analyser
Sulphate	APHA 4500SO_4^{--} Turbidimetric Method
Nitrate	APHA 4500-NO_3^-B UV Spectrophotometric Method
Alkalinity	APHA 2320B Titration Method
Hardness	APHA 2320C EDTA Titration method
Chloride	APHA 4500Cl"B Argentometric method
Metals	Atomic Absorption Spectroscopy

Ambient Air Quality Sampling and Analysis For Sampling of Sox and Nox

a. 25 ml of absorbing media is taken in impingers and sampling is doe by passing air through high volume sampler

b. Air flow rate is maintained at 1.5m^3/min

c. After sampling the volume is make-up to25 ml distilled and added all the solution in the same way as done for calibration curve.

For Sox and Nox analysis , procedure applied was West & Geake Method

Respiratory Suspended Particulate Matter (RSPM) & Suspended Particulate Matter (SPM)

For RSPM glass filter papers are used. As these particles are of so small in size they cannot be separated out from the air by applying centrifugal force, hence, pre-weighted desiccated filter is placed in the high volume sampler. The pore size of the filter paper is of the change of respiratory particle which an essential parameter of ambient air. After sampling the filter paper is taken out carefully, placed in desiccators and then again weighted. Then difference in initial and final weight of the filter paper gives the value of RSPM in the ambient air.

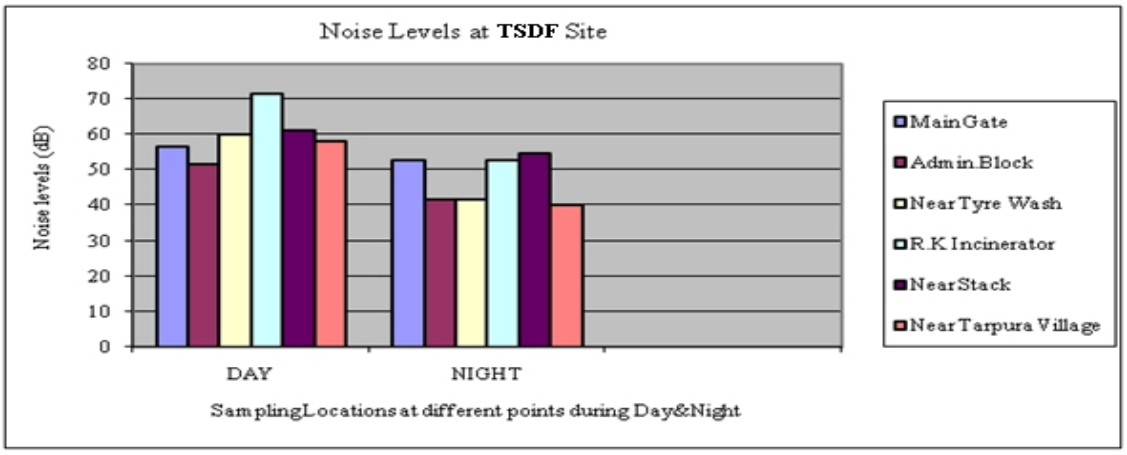
Similarly SPM are those which are separated out after applying centrifugal force and hence a pre-weighted collecting bottle is placed below the cyclone where all the SMP are collected.

RESULT AND DISCUSSION

A. Noise quality level of the site

Noise quality monitoring

S.No.	Location	Day time Reading dB	Night time Reading dB	CPCB Limits dB (Industrial Area)
1.	Main Gate	56.8	52.9	Day Time: 75 Night Time: 70
2.	Admin Block	51.7	41.9	
3.	Near Tyre Wash	60.0	41.9	
4.	Incinerator (R.K.)	71.4	53.0	
5.	Near Stack	61.4	54.7	
6.	Near Tarpura Village	58.3	40.2	

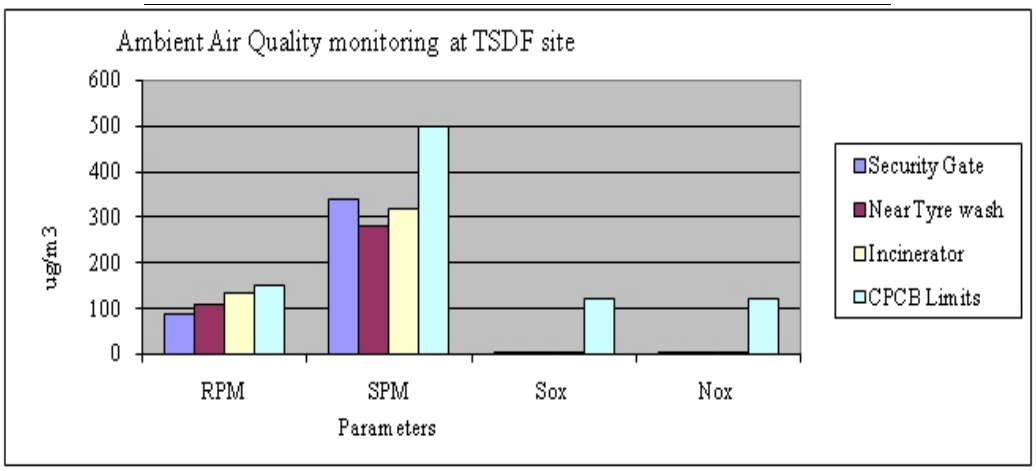


Day and night noise level of various selected locations clearly shows that it is below permissible limit as prescribed by the CPCB. The highest noise level was near incinerator which was under installation

B. Ambient air quality level of the site

Ambient air quality monitoring

LOCATION	SPM	RSPM	SOX	NOX
Security gate	338	87.7	2.5	3.8
Tyre wash	282	108	3.3	3.0
Incinrator	320	134	3.1	3.1
CPCB LIMITS	500	150	120	120

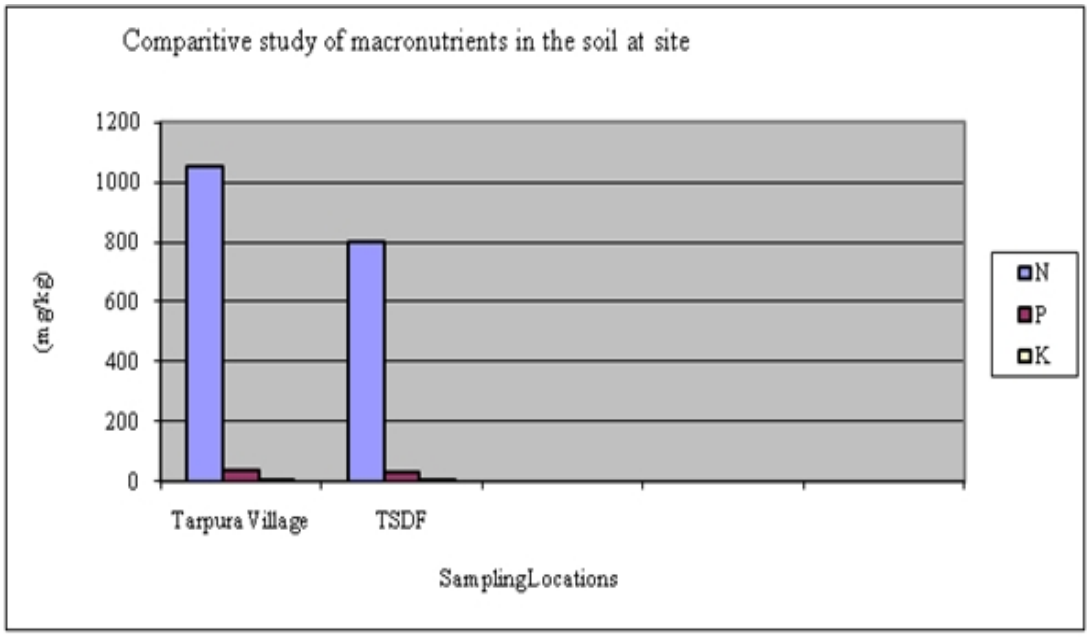


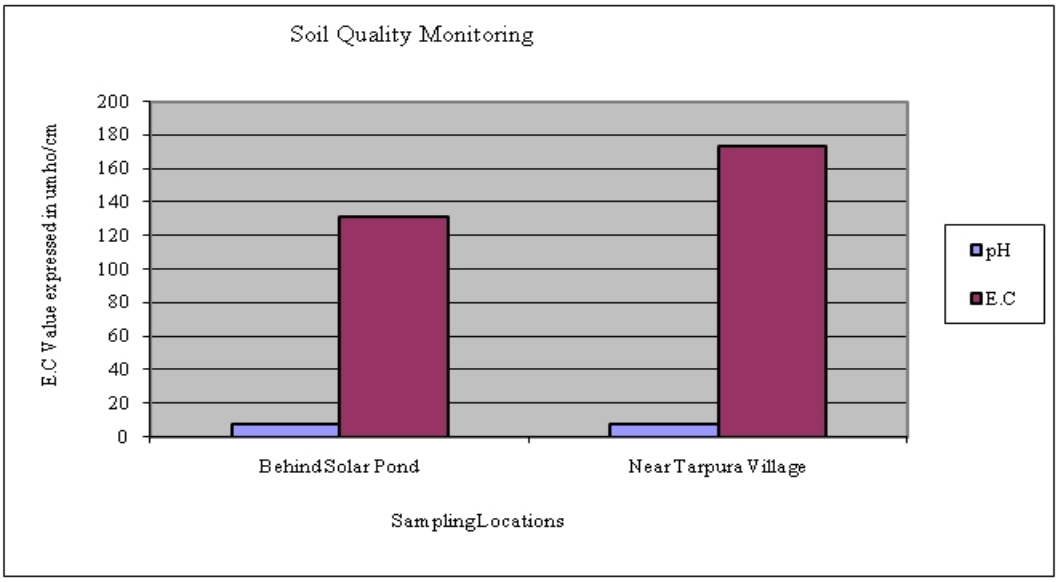
The results also show that level of SPM, RSPM, NOX and SOX are also below the permissible limit.

C. Soil quality level of the site

Soil quality monitoring

PARAMETER	NEAR TARPURA VILLAGE	BEHIND SOLAR POND
Electrical Conductivity	174	132.7
LOD	2.4	2.1
LOI	6.0	9.8
Cl (mg/kg)	13.5	115.0
Na	16.0	43.5
K	2.0	-
N	1050	-
P	39	-





Heavy Metal Analysis of Soil

Location	Cu	Cr	Pb	Zn	Fe	Ni	Mn	Co
Behind TSDF	125	5	ND	240	10,000	65	975	55
Near Vill.	115	5	ND	240	70,000	65	975	35

UNIT = mg/kg

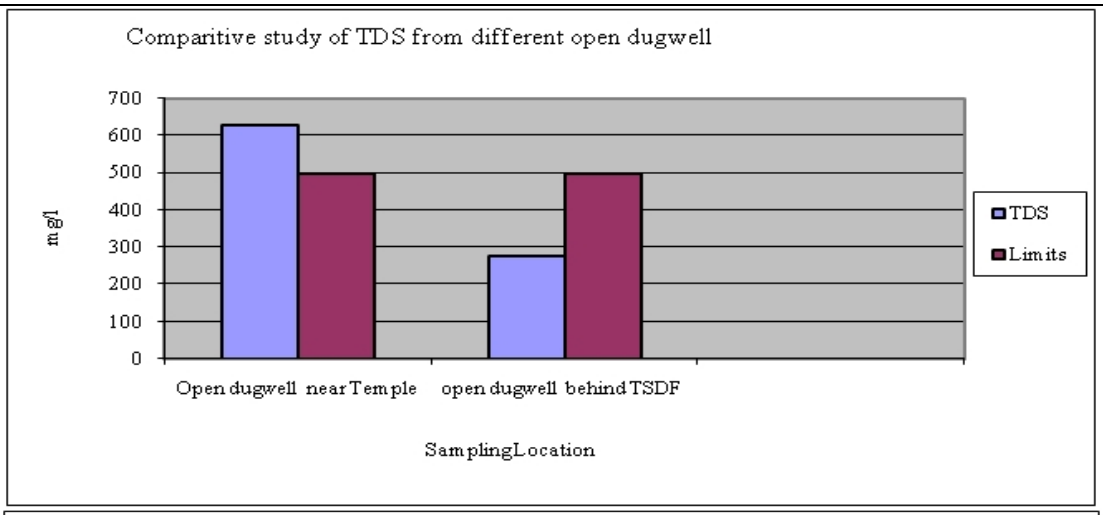
The soil parameter studied shows that N value is very high in soil and heavy metal analysis also shows the concentration of iron is very high as compared tom the other metals.

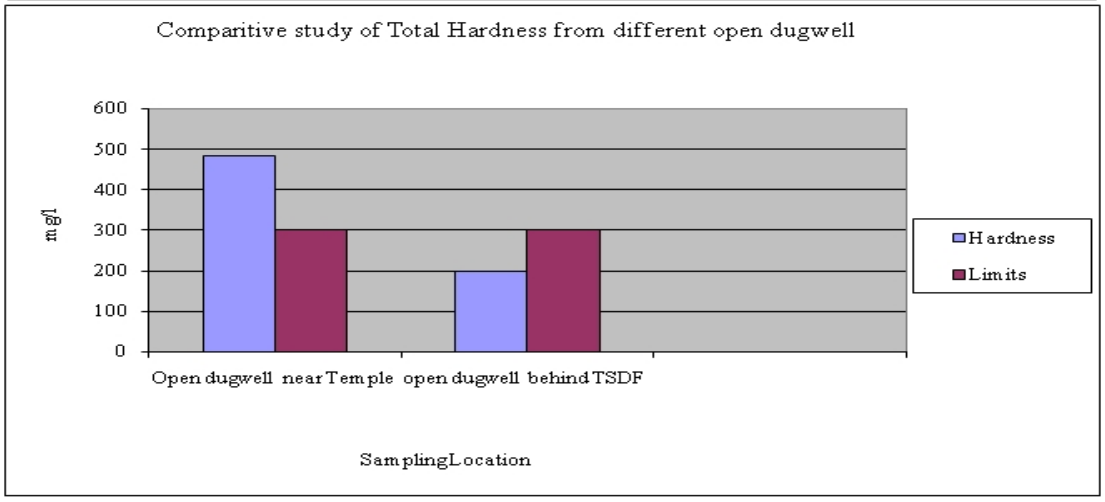
D. Water quality level of the site

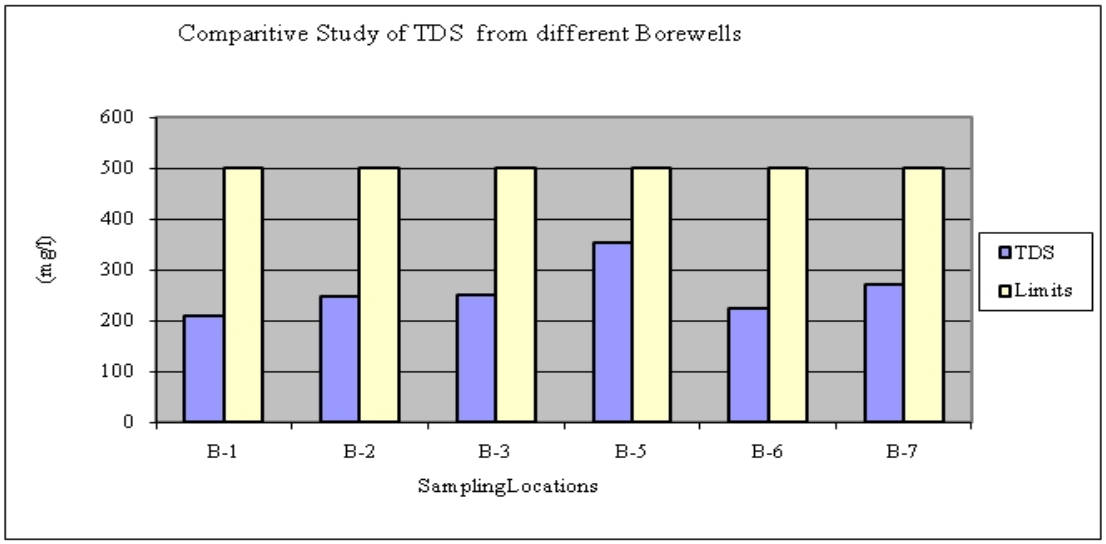
Water quality monitoring

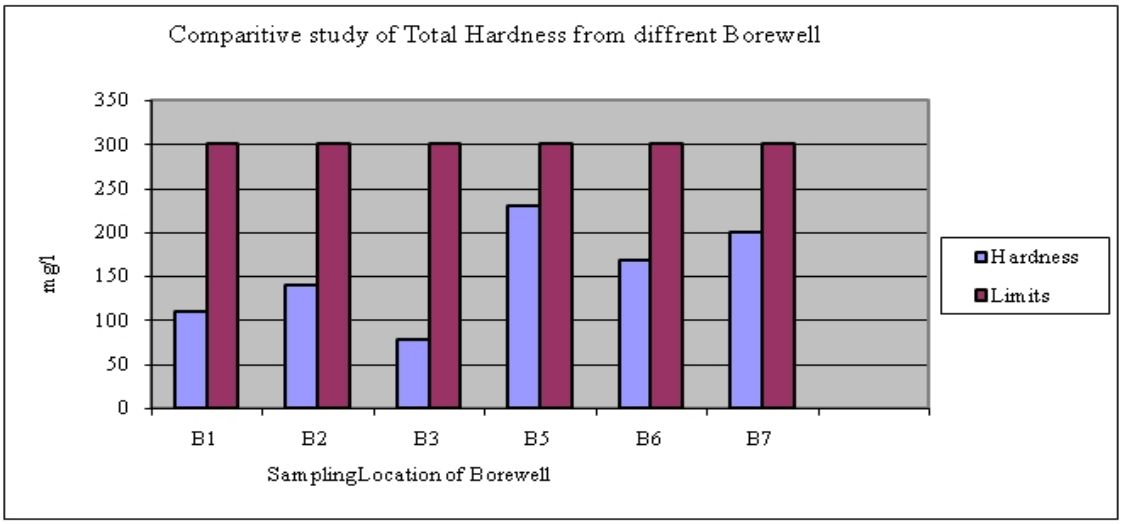
S.No.	Location	Parameters	Results	Drinking water limit
1.	Borewell 1	pH	7.0	6.5-8.5
		EC	370.0 µmho/cm	NA
		TDS	185.2 mg/l	500mg/l
		T. Hardness	139.0 mg/l	300 mg/l
2.	Borewell 2	pH	7.1	6.5-8.5
		EC	489.6 mg/l	NA
		TDS	263.0 mg/l	500mg/l
		T. Hardness	82.0 mg/l	300 mg/l
3.	Borewell 3	pH	7.9	9.6
		EC	634.8 mg/l	NA
		TDS	328.7 mg/l	366.0 mg/l
		T. Hardness	59.0 mg/l	63.7 mg/l
4.	Borewell 5	pH	6.9	7.6
		EC	457.9 µmho/cm	NA
		TDS	228.0 mg/l	236.4 mg/l
		T. Hardness	198.0 mg/l	236.4 mg/l
5.	Borewell 6	pH	6.8	7.3
		EC	599.0 µmho/cm	NA
		TDS	363.1 mg/l	662.0 mg/l
		T. Hardness	190.7 mg/l	437.3 mg/l
6.	Borewell 7	pH	7.2	6.5-8.5
		EC	489.0 µmho/cm	NA
		TDS	230.0 mg/l	500mg/l
		T. Hardness	169.8 mg/l	300 mg/l

7.	Open Dugwell (Behind TSDF)	pH EC TDS T. Hardness	7.5 539.0 µmho/cm 281.0 mg/l 190.0 mg/l	6.5-8.5 NA 500mg/l 300 mg/l
8.	Open Dugwell (Near Temple)	pH EC TDS T. Hardness	7.3 792.0µmho/cm 472.0 mg/l 219.2 mg/l	6.5-8.5 NA 500mg/l 300 mg/l









Heavy metals	Open dugwell behind TSDF	Open dugwell near temple	Drinking water limit
Cd (mg/l)	**Bdl**	Bdl	0.01
Pb (mg/l)	**Bdl**	Bdl	0.05
Cr^{6+} (mg/l)	**Bdl**	Bdl	0.05
Cu (mg/l)	**Bdl**	0.1	0.05
Fe (mg/l)	**0.5**	1.4	0.3
Mn(mg/l)	**0.1**	Bdl	0.1
Ni (mg/l)	**Bdl**	Bdl	-
Zn (mg/l)	**Bdl**	Bdl	5

Heavy metals	B-1	B-2	B-3	B-5	B-6	B-7
Cd (mg/l)	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Pb (mg/l)	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Cr^{6+} (mg/l)	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl
Cu (mg/l)	Bdl	0.1	Bdl	Bdl	Bdl	Bdl
Fe (mg/l)	0.6	0.4	0.4	0.6	1.0	0.6
Mn(mg/l)	Bdl	0.1	Bdl	Bdl	Bdl	Bdl
Ni (mg/l)	Bdl	0.1	Bdl	Bdl	Bdl	Bdl
Zn (mg/l)	Bdl	Bdl	Bdl	Bdl	Bdl	Bdl

Various parameters of water quality for seven borewells and two dugwells shows that level are under permissible limit

CONCLUSION

It should be mentioned that this paper does not address two key aspects related to monitoring and remediation of hazardous waste sites: analytical methods for quantifying pollutant concentrations in soil and groundwater and microbiological characterization of contaminated sites. Both topics are very important considerations for monitoring and remediation and merit a detailed discussion that is beyond the scope of this paper. An important factor in understanding and characterizing local and regional hydrological fluxes relates to the frequency of groundwater and surface water sampling. Unfortunately, the frequency of sampling is typically determined using cost-benefit analysis that often allows for large time gaps between samples, thus omitting trends and events that may be crucial in understanding pollution flux patterns. Another issue is the depth of the sample taken. Misplaced screened intervals may lead to erroneous interpretation of field data and may complicate further hydrologic analysis and interpretation. From the detailed analysis of soil, ground water and air it is to conclude that all the analytical parameters are within the prescribed limit.

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