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ENVIRONMENTAL AUDITING AS A RISK MANAGEMENT TOOL: CASE STUDY OF AN AUTOMOBILE AXLE MANUFACTURING INDUSTRY IN INDIA

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Abstract

According to "polluter pays" principle, there is huge burden on the industries to remediate contaminated sites. Mergers and acquisitions of industrial sites is a preferred mode of growth for corporations. The management of the acquiring company should be mindful of potential environmental risks which they may inherit as part of the acquisition and take appropriate risk management actions. If not, they may face financial, reputation and other liabilities due to the "polluter pays" principle. This paper presents a case study of an environmental audit during acquisition of an Indian automobile axle manufacturing facility. This audit serves as a due-diligence process to identify environmental risks due to non-compliance with environmental legislation and potential release of environmental pollutants in the soil or groundwater at the time of transaction. The objective of this paper is to demonstrate that an environmental audit process can serve as an effective due-diligence or risk management tool to identify existing and future environmental liabilities at industrial sites. The environmental audit is thus an important tool to mitigate business risks during mergers and acquisitions, document the baseline environmental conditions at the facility; identify areas for improvement and ensuring sustainable compliance with environmental legislation.

Key words: compliance assessment, due-diligence, environmental site assessment, environmental audit

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1. Introduction

The "polluter pays" principle demands that the polluter bear the burden of remediating contaminated sites. Several corporations are currently faced with huge financial liabilities due to pressure from various stakeholders including regulatory bodies, civil society or non-governmental organization (NGO) to remediate contaminated sites (Ambecy and Ehlersz, 2010). International mergers and acquisitions (M&A) of existing industrial sites is a preferred mode of growth for multinational companies (MNCs). They account for significant Foreign Direct Investment (FDI) across both developed and developing countries (Lall, 2002; UNCTAD, 2012). India has seen an increasing interest from MNCs resulting in increase in M&A activities. The management of the acquiring company should be mindful of potential environmental risks which they may inherit as part of the acquisition (Wang, 2009) and take appropriate risk management actions. If not, they may face financial liabilities due to the "polluter pays" principle.

In the present paper, an environmental audit has been performed for an MNC at the time of acquisition of an Indian automobile axle manufacturing facility. The aim of the environmental audit was identified short- and long-term environmental risks due to non-compliance with legal legislation or potential release of environmental pollutants in the soil and groundwater.

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The aim of this paper is to highlight the importance of the environmental audit process as an effective due-diligence or risk management tool to identify future environmental liabilities at industrial sites, by presenting the above referenced case study.

1.1. Evolution of environmental audit

Environmental auditing started developing at the beginning of 1970s in the United States of America and the Western Europe. In 1970s, the United States environmental legislation covered air and water pollution control, pesticide regulation, control of hazardous and toxic chemicals, better stewardship of public lands and the creation of a "Superfund" (in the Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA) for cleaning up toxic waste sites.

The number of organizations relying on environmental audits has increased exponentially over the past decade (Costoiu et al., 2016; Peglau, 2005). In addition to ISO 14001 (Environmental Management System) framework, many more companies have utilized other types of external environmental audits, implemented internal audits, or adopted both types of auditing schemes (Todea et al., 2011). The Indian Ministry of Environment and Forests (MoEF, 1993) initiated the requirement of environmental auditing by industrial units in India. As per this legal requirement, industrial sites are required to submit an annual Environmental Statement to the concerned State Pollution Control Board in a prescribed format. It covers raw material and water consumption, air emissions, effluent discharges, hazardous wastes, solid wastes, impact of pollution abatement measures on natural resources conservation and production cost.

1.2. Environmental audit during M&A

The historical environmental audit process included in Section 0 focuses on compliance of facility against applicable environmental legislation. It typically includes an Environmental Compliance Assessment to evaluate if the environmental management system at the facility is in compliance with the applicable environmental legislation. In India, the current legislation primarily focuses on air emissions and wastewater discharges. There are no legally applicable standards for soil and groundwater quality. However, discharge of environmental pollutants over a prolonged period can have a cumulative impact on soil and groundwater quality. This impact can give rise to future environmental liabilities.

Hence, in the context of M&A activities, it is important for the acquiring company that the environmental audit process includes identification of substantial environmental liabilities arising from past activities, to establish existing conditions at the facility and to quantify those liabilities.

The audit study should help to document the baseline soil and groundwater quality data onsite. The developed countries which have had a very long industrial history were the first to promulgate laws on soil and groundwater quality. For e.g. the USEPA has come up with its list of soil and groundwater standards for various types of land-use (USEPA, 2014). Also, the Ministry of Housing, Spatial Planning and the Environment of the Dutch government has formulated the Dutch soil and groundwater quality standards (VROM, 2000).

The applicable standards are being used by the MNCs to understand and quantify the environmental liabilities from the M&A process. In the developing world, countries such as China which are ahead in the industrial development race have also come up with their groundwater (PRCNS, 1993) and soil standards (PRCNS, 2007). The standards are helping these developing countries to quantify the liabilities at the time of transactions and ensure sustainable development. India, however, has not promulgated soil and groundwater standards yet.

The Environmental Audit scope of work presented is paper is an effective risk management tool since it involves soil and groundwater investigation at the time of business transaction. It helps the acquiring company to document the baseline environmental conditions at the facility; identify areas for improvement and ensuring sustainable compliance with environmental legislation.

2. Facility details and audit methodology

2.1. Description of the facility

The facility proposed to be acquired has an area of approximately 5000 m^2. The facility has been in operation for approximately eight years. It is involved in manufacturing truck trailer axles. The process involves manufacturing axle beam, brakes and suspensions which are all assembled into a complete trailer axle. The facility has a manufacturing capacity of 200 axles per day.

The main approach road and main entrance to the facility is on the eastern side. The area in the immediate neighborhood of the facility has industrial land-use and some plots were noted to be vacant. Further, no areas of special archaeological significance, ecologically sensitive habitats such as national parks, wildlife sanctuaries or wetlands exist within 10 km of the facility. However, Okhla Bird Sanctuary, an area of ecological significance, is located approximately 20 km from the facility. The facility activities are not estimated to have any impact on the sanctuary.

The facility plot was historically used for agricultural purposes prior to current setup. Since agriculture involves use of agrochemicals, this posed potential for pesticide contamination in the soil and groundwater of the area.

2.2. Scope of work and associated standards

The Environmental Audit scope of work presented is paper includes an Environmental Compliance Assessment and a soil and groundwater investigation at the time of facility acquisition. These components are described in this section.

2.2.1. Environmental Compliance Assessment

An Environmental Compliance Assessment was conducted at the facility to evaluate if the environmental management system at the facility was in compliance with the following applicable Indian regulations:

- Water (Prevention and Control of Pollution) Act, 1974 and Rules, 1975
- Water Cess Act, 2003
- Air Act (Prevention and Control of Pollution), 1981 and Rules, 1982
- Environmental Protection Act and Rules, 1986
- Noise Pollution (Control and Regulation) Rules, 2000
- Hazardous Wastes (Management, Handling and Transboundary movement) Rules 2008
- Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 along with Amendment Rules, 2000
- Gas Cylinder Rules, 1981 as modified in 2004 Motor Vehicles Act, 1988
- The Public Liability Insurance Act & Rules, 1991
- Petroleum Act, 1934 and Petroleum Rules, 2002
- The Static and Mobile Pressure Vessels (Unfired) Rules, 1981
- Ozone Depleting Substances (Regulation) Rules, 2000
- Factories Act, 1948

2.2.1. Phase I: Environmental site assessment

The environmental audit presented in this paper includes a Phase I Environmental Site Assessment (Phase I ESA). It consists of a guided facility walk-around and adjoining area reconnaissance, interviews with facility personnel and review of site-specific information provided by the facility personnel to identify any potential areas of concern (PAOC) from environmental perspective.

The United States Environmental Protection Agency (US EPA) has promulgated standard for performing a Phase I ESA and are based in part on American Society for Testing and Materials E1527-13 standard (ASTM, 2013). This standard was used as a reference for the Phase I ESA at the facility since India does not have an equivalent standard.

2.2.2. Phase II: environmental site assessment

The various facility activities including management of wastewater, hazardous waste, hazardous chemicals, fuel and other utilities represent the PAOC and have potential to impact soil and groundwater quality. Hence, a Phase II Environmental Site Assessment (Phase II ESA) or soil and groundwater sampling and analysis program was included in the Environmental Audit scope to confirm or deny the release of contaminants to the environment and for baseline data collection by conducting sampling at the PAOC identified on site. It consists of soil and groundwater sampling and laboratory analysis with the intention to document the baseline soil and groundwater quality data onsite. The scope of work for Phase II ESA was based on observations during the Phase I ESA and Environmental Compliance Assessment site visit.

The Phase II ESA was conducted as per ASTM E1903-11 standard (ASTM, 2011). It involves detailed soil and groundwater investigation involving chemical analysis for hazardous substances and/or petroleum hydrocarbons in soil and water of the facility.

- *Soil boring and sampling*

At each soil boring, an undisturbed soil sample was first collected at shallow depth of typically 1.5m below ground level (bgl) in steel tubes for analysis of volatile organic compounds (VOCs). Subsequently a second deeper soil sample was collected at terminal depth of typically 3m bgl for analysis of remaining parameters.

- *Groundwater sampling*

Groundwater sample was taken from the existing deep aquifer borewell onsite by drawing a grab sample from a ground level sampling valve on the borewell discharge pipe line.

- *Laboratory analysis*

The soil and groundwater samples were analyzed for various analytical parameters. The analytical parameters and their corresponding methods are summarized in Table 1.

- *Assessment Criteria*

The results of the Phase II ESA have been assessed and evaluated against the most suitable and available standards and guidelines for soil quality assessment. Currently, India does not have applicable environmental standards for comparison of soil or groundwater quality. In this paper, the soil and groundwater analytical results have been compared with the Dutch soil and groundwater quality standards as they have been historically used in India in the absence of Indian soil and groundwater standard.

The Dutch soil and groundwater quality standards include "Target" and "Intervention" values which are based on the consideration of a combination of human and eco-toxicological risks. The Target and Intervention values are defined as follows:

Target value: The Target value ("T") is considered to be the overall long-term clean up goal and representative of "reference" or "typical background" conditions. It indicates the soil quality required for sustainability. Thus, "T" values are characteristic of clean, uncontaminated soils.

Table 1. Soil and groundwater analysis parameters and methodology

Matrix	*Chemical Class*	*Analytical Parameters*	*Analytical Method*
Soil and Groundwater	Semi-Volatile Organic Compounds (SVOCs)	organochlorine pesticides, organophosphorous pesticides, phenols, polynuclear aromatics, phthalate esters, nitrosoamines, nitroaromatics and cyclic ketones, chlorinated hydrocarbons, and anilines and benzidines	EPA 8270
Soil and Groundwater	Total Petroleum Hydrocarbons (TPH)	C6 – C9, C10 – C14, C15 – C28 and C29 – C36 fractions	EPA 8015
Soil and Groundwater	Priority Pollutant Metals (PPM)	antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc	EPA 3051
Soil and Groundwater	Volatile Organic Compounds (VOCs)	monocyclic aromatic hydrocarbons, oxygenated hydrocarbons, fumigants, halogenated aliphatic hydrocarbons, halogenated aromatic hydrocarbons, trihalomethanes, carbon disulphide, etc.	EPA 8260
Groundwater	Heavy Metals	antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc	EPA 3051

Intervention Value: The "I" value is the concentration above which a site-specific risk assessment and some form of corrective action must commence if more than 25 m^3 of soil or 100 m^3 of groundwater are found to be impacted at concentrations exceeding the "I" value. It indicates the quality at which soil is considered to be seriously contaminated. The actual "I" value depends on site-specific levels that are corrected for soil grain size and luteum content.

Groundwater analytical results have also been compared to the Indian Standard for Drinking Water (IS 10500, 2004).

3. Results and discussion

This section lists the results from conducting the environmental audit at the facility including environmental compliance assessment, Phase I ESA and Phase II ESA.

3.1. Environmental Compliance Assessment

Based on the document review exercise, the facility had the requisite environmental permits. Table 2 presents the results of the environmental compliance assessment conducted at the facility with respect to applicable legislation. Table 2 includes the compliance assessment findings against applicable environmental legislation. The facility is required to implement the recommended corrective actions to ensure compliance. The cost for corrective actions can be considered in the M&A negotiation process. The environmental compliance assessment thus helps the acquiring company to quantify the environmental compliance risks.

3.2. Phase I: Environmental Site Assessment (ESA)

The Phase I ESA is typically the first step in the process of environmental due-diligence. It allows identifying the potential sources of environmental contamination without actual testing of soil, groundwater and other sinks. During Phase I, a reconnaissance survey of the facility was completed to identify any PAOCs due to any historical or current activities. These PAOCs are depicted in the site layout map shown in Fig 1. A Phase II soil and groundwater investigation was then conducted at the PAOCs to determine the extent of contamination in these areas.

As shown in Fig 1, the scope of work for Phase II Site Investigation included six soil borings coded S1-S6 and one groundwater sample from existing borewell coded GW. At each of the six soil boring locations (S1-S6), the target total depth of each bore was 3.0 m below the ground level (bgl), unless rock (auger refusal) or water table was encountered earlier. The details of soil and groundwater samples at each PAOC and parameters analyzed are listed in Table 3. It also includes one sample S1 which was considered as a ‘clean location’ to provide background concentration for the facility. It is typically located up-gradient with respect to the estimated groundwater flow direction at the facility and hence is considered unaffected by the facility operations.

3.3. Phase II: Soil and groundwater analysis results

The soil and groundwater sampling program were designed to determine the baseline soil and water quality at the facility. The soil samples were analyzed for various pollutants and the groundwater sample was analyzed for heavy metals as listed Table 3.

3.3.1. Soil analysis results

During soil boring, the sub-surface at all the locations was found to comprise mainly of brown clayey soil. The vulnerability for groundwater contamination is higher for soils with higher permeability (Huddleston, 1996). Permeability of clay soil is lesser (Kwon et al. 2004), suggesting lower potential for groundwater contamination at the facility.

The soil analysis results have been summarized in Table 4. The TPH, SVOC and VOC parameters were reported to be below Laboratory Level of Reporting (LOR) at all the sampling locations and hence are not included in the Table.

Table 2. Environmental Compliance Assessment Result

Media	*Observation*	*Legislation*	*Compliance Finding*	*Corrective Action*
Water supply	Deep aquifer borewell	Water Cess Act 2003	No tracking of water usage onsite	Install water meters to track water consumption and submit monthly cess returns
Wastewater discharges	Sanitary and process wastewater	The Water Act 1974, amended 1988	Visual observation of onsite stormwater drains and septic tank indicated potential for mixing of process wastewater, sanitary wastewater and stormwater.	Segregate different wastewater streams and avoid potential for mixing of the same.
Hazardous wastes	Used oil, Oil contaminated wastes and empty containers of hazardous chemicals	Hazardous Wastes (Management, Handling and Transboundary movement) Rules 2008	Different waste types not adequately segregated, labeled and provided with secondary containment in hazardous waste storage area. Hazardous waste not disposed to authorized waste agency.	Provide adequate segregation, labeling and secondary containment in hazardous waste storage area. Dispose all hazardous waste to authorized waste agency.
Hazardous chemicals	Thinners, paints, primers coolant oils, cutting oils, hydraulic oils, lubricating oils and greases	Manufacturing, Storage and Import of Hazardous Chemicals Rules 2008.	Adequate secondary containment and labeling not provided to all hazardous chemicals stored onsite. All required Material Safety Data Sheets (MSDS) not maintained onsite.	Provide adequate secondary containment and labeling to all hazardous chemicals stored onsite. Maintain copies of MSDS onsite.
Compressed gases	Compressed Gas Cylinders	Gas Cylinders Rules 2004	Gas cylinders lacked adequate labeling.	Provide adequate labeling to gas cylinders onsite. To provide adequate fire safety arrangements and label them appropriately.

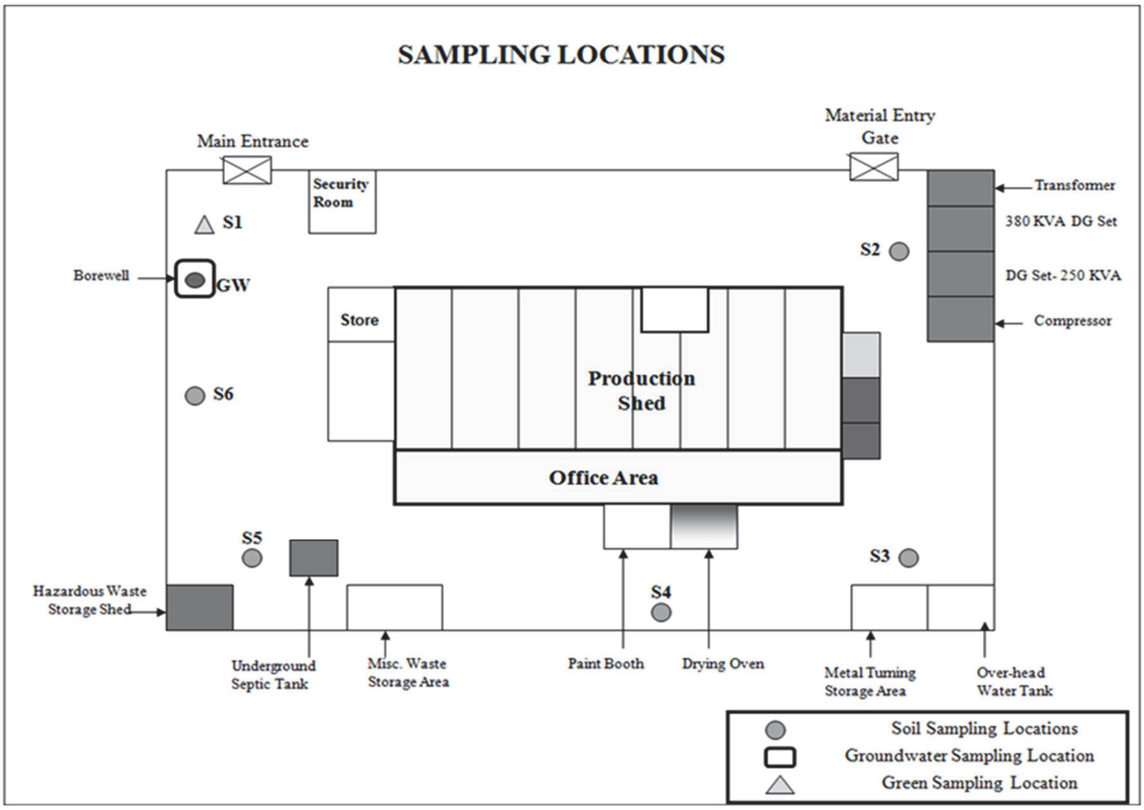

Fig. 1. Facility layout map showing soil and groundwater sampling locations

Table 3. Potential Areas of Concern and associated soil and groundwater sampling

Onsite Location	*Observation/ PAOC*	*Sampling ID*	*Sampling Depth (m bgl)*	*Analytical Parameters*
Facility main entrance in garden area	This location is considered as "clean location" and not expected to have any contamination. It was chosen to provide background concentration for the facility	**S1**	3.0	TPH, PPM & SVOCs
			1.5	VOCs
Diesel generating (DG) set area	Oil stains were observed near the diesel fuel drums stored in this area. Transformer oil stains were observed near adjoining transformer area. The transformer oil had not been tested historically for presence of Poly-Chlorinated Biphenyls.	**S2**	3.0	TPH, PPM & SVOCs
			1.5	VOCs
Metal turnings storage area	Heavily oil stained area– likely due to leaching of oil from oil contaminated turnings stored in the area	**S3**	3.0	TPH, PPM & SVOCs
			1.5	VOCs
Paint booth	Axles and brake assemblies were painted and paint sludge was stored in the area	**S4**	2.4*	TPH, PPM & SVOCs
			1.5	VOCs
Hazardous waste shed; other solid waste storage area; and underground wastewater septic tank	Staining was observed in the area where used oil, paint sludge, oil contaminated waste and other solid waste were stored. The underground wastewater septic tank had potential for overflow – especially during heavy rainfall.	**S5**	3.0	TPH, PPM & SVOCs
			1.5	VOCs
Stormwater drain near northern boundary of facility	White colored spent coolant was observed in stormwater drain. This had potential for discharge on to adjoining open plot to the north of the facility.	**S6**	1.5*	TPH, PPM & SVOCs
			1.0	VOCs
Existing borewell in garden area	Groundwater sample was taken from a ground level sampling valve on borewell discharge pipe line	**GW**	Not applicable	VOCs, TPH, SVOCs, Heavy metals

**Proposed depth of 3m could not be attained due to auger refusal at the listed depth.*

Results for the 13 Priority PPM do not indicate concentrations above corresponding Dutch Target Values in any of the soil samples, except for presence of Nickel in one soil sample. Nickel was detected above laboratory LOR in all the soil samples. In soil sample S6, it was detected at 43.6 mg/kg which is above Dutch Target Value of 35 mg/kg but below Dutch Intervention value of 210 mg/kg. As such, the detected Nickel concentration is fairly consistent in all the soil samples across the facility in the range 20.2 - 43.6 mg/kg and therefore these values appear to be the background concentration of Nickel in the soil in the area.

3.3.2. Groundwater analysis results

The groundwater analysis results are included in Table 5 and compared with the corresponding limits given in the Indian drinking standards (IS 10500) and Dutch Standards. The TPH, SVOC and VOC parameters were reported to be below Laboratory LOR for the groundwater and hence are not included in Table 5. None of the heavy metals were detected above corresponding Indian Drinking Water standard – desirable limit in the groundwater sample. However, the Dutch Standards for metals are generally lower than Indian Drinking Water Standards. Copper, Nickel and Lead were detected above their corresponding Dutch Target Values but below corresponding Dutch Intervention Value in the groundwater sample. Additionally, Zinc was detected above corresponding Dutch Intervention value.

The detected values can be considered as background levels of these heavy metals in the sub-surface due to natural geological origins. However, the same can be confirmed by installing monitoring wells onsite and conducting additional groundwater sampling or sampling additional existing borewells in the site vicinity. The comparison of groundwater results with a more stringent and relevant groundwater quality standard has enabled us to detect certain heavy metals which have eco-toxicological significance, which otherwise would have gone undetected if we had compared the groundwater results with only the Indian drinking water standard.

It may also be noted that the onsite wastewater, chemical, hazardous waste management has potential to impact groundwater quality in the long run and so the facility should implement a sustainable environmental management system onsite to maintain or improve the groundwater quality.

Table 4. PPM analysis results for the soil samples

Parameter	***Dutch "T" Value (mg/kg)***	***Dutch "I" Value (mg/kg)***	***Level of Reporting (mg/kg)***	***Analysis Results (mg/kg)***					
				S1	***S2***	***S3***	***S4***	***S5***	***S6***
Antimony	3	15	0.05	0.26	0.23	0.25	0.26	0.20	0.33
Arsenic	29	55	0.5	7.8	6.0	6.6	7.3	6.1	8.7
Beryllium	1.1	30	0.05	0.64	0.47	0.83	0.76	0.52	0.76
Cadmium	0.8	12	0.01	0.10	0.08	0.08	0.09	0.07	0.13
Chromium	100	380	0.05	26.9	20.7	37.1	35.0	25.7	49.0
Copper	36	190	0.05	19.1	14.5	23.0	23.4	15.6	28.6
Lead	85	530	0.05	12.3	9.70	12.5	16.0	8.69	16.4
Mercury	0.3	10	0.02	0.03	0.03	0.03	0.04	0.02	0.03
Nickel	35	210	0.05	26.3	20.2	34.0	32.1	22.8	43.6
Selenium	0.7	100	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver	-	15	0.05	0.08	0.06	0.12	0.11	0.08	0.13
Thallium	1	15	0.05	0.28	0.22	0.39	0.35	0.26	0.39
Zinc	140	720	0.5	59.5	50.1	71.7	72.4	51.1	78.4

Table 5. Heavy metal analysis results for the ground water sample

Parameters	***IS 10500***		***Dutch Standards***		***LOR (μg/l)***	***Groundwater Sample GW (μg/l)***
	Desirable Limit (μg/l)	**Permissible Limit (μg/l)**	**"T" Value (μg/l)**	**"I" Value (μg/l)**		
Arsenic	10	50	7.2	60	10	< 10
Cadmium	3	-	0.06	6	0.2	< 0.2
Chromium	50	-	2.5	30	1	< 1
Copper	50	1500	1.3	75	1	8
Nickel	20	-	2.1	75	1	4
Lead	10	-	1.7	75	1	3
Selenium	10	-	0.07	160	10	< 10
Zinc	5000	15000	24	800	10	1220
Mercury	1	-	0.01	0.3	0.1	< 0.1

4. Conclusions

The Environmental Audit performed was able to evaluate environmental compliance at the axle manufacturing facility with respect to applicable Indian environmental legislation and recommend appropriate corrective actions. It identified several PAOCs due to historical or current activities. Finally, the soil and groundwater sampling and analysis program was able to deny the release of contaminants to the environment from site operations and allowed for baseline data collection.

In the long run, the facility should continue to adopt improved housekeeping and spill control measures to sustain this soil and groundwater quality. The effectiveness of such measures can be evaluated in the future by comparing any future soil and groundwater investigation results with this baseline data. The baseline data collection exercise at the time of this acquisition involved analysis of soil and groundwater as per establish international and national standards and reporting of the same using adequate quality analysis and quality control. This standardized approach with proper data adequacy evaluation will immensely help during any future transaction involving the facility by providing a quality benchmark for reference.

Thus, the environmental audit case study presented in this paper was able to identify environmental risks due to non-compliance and potential release of environmental pollutants in the soil and groundwater. It reiterates the importance of the environmental audit process as an effective due-diligence or risk management tool to identify existing and future environmental liabilities at industrial sites. The environmental audit is thus an important tool to mitigate business risks and assist in M&A negotiations.

In India, the fast pace of industrial development poses increasing potential for environmental degradation and risks. Due to globalization, the M&A activities involving industrial facilities is on the rise in India. Hence, the environmental audit process is becoming increasingly relevant. In this scenario, it is important for Indian regulatory agencies to promulgate India specific soil and groundwater standards and make environmental auditing including Phase I ESA and Phase II ESA a mandatory requirement for all M&A activities. This can serve as a sound decision making and proactive measure for industry to help them identify and mitigate risks earlier.

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