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Hazardous Waste Management of Transmission Line Tower Manufacturing

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***Abstract*—**The manufacturing transmission line tower parts has being generated hazardous waste which is required proper disposal of waste for protection of land pollution. Manufacturing Process in the manufacturing of steel angle, plates, pipes, channels are passes through conventional, semi automatic and CNC machines for cutting, marking, punching, drilling, notching, bending operations. All fabricated material Coated with thin layer of Zinc in Galvanizing plant where molten zinc is used for coating. Prior to Galvanizing, chemical like 33% concentrated HCl Acid, ammonium chloride and d-oil being used for pretreatment of iron. The bath of water with sodium dichromate is used for cooling and protection of the galvanized steel. For the heating purpose the furnace oil burners are used. These above process the Zinc dross, Zinc ash, ETP sludge and waste pickled acid generated as hazardous waste. The RPG has made captive secured land fill site, since 1997 since then it was using for disposal of hazardous waste after completion of SLF (Secured land fill) site. The RPG has raised height from ground level then now it is being used for disposal of waste as he designed the SLF after in creasing height of from GL it is functional without leach ate or adverse impacts in the environment.

***Keywords*—**Disposal, Drilling, Fabricated. Hazardous waste, Punching.

I. Introduction

HAZARDOUS waste management is an international problem. The management of hazardous wastes has changed dramatically since the 1960's. The term hazardous waste gained acceptance starting about 1970 with the first national study of the issue. The U.S. Environmental Protection Agency took nearby 4 years drom the passage of the nation's first hazardous waste law in 1976 before promulgating regulations that defined hazardous waste [1].

The Minister of Environment and Forests Government of India has notified the Hazardous Waste (Management & Handling) Rules 1989 and their amendments under the Environment (Protection) Act 1986, on 6th of January 2000, major amendments to these rules with re-defined categories of hazardous wastes and harmonizing them with the international laws were notified [2]. In order to facilitate implementation it is felt necessary to provide a set of guidelines on the criteria for hazardous waste land fills for the use of industries, implementing agencies and the general public [3].

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II. Mode Of Storage Within Plant / Method Of Disposal Of Hazardous Waste

A. Zinc Dross

It is collected from the bottom of molten zinc from galvanizing kettle and allowed to solidify in small containers periodically. The solidified dross is in the form of Trapezoidal slab having weight around 25-30 Kgs. This remains in stable solid form at ambient temperature. This is stored in a enclosed storage in a stacked manner. It is a by-product for us and is being sold to various vendors who are possessing authorization from the respective Pollution Control Board. These vendors transport Zinc Dross through trucks [4].

B. Zinc Ash

It is in powder form and is collected in polythene bags. These polythene bags are kept under shed. It is also a by-product and is being sold to various vendors who are possessing authorization from the respective Pollution Control Boards. These vendors transport Zinc Ash begs through trucks [5].

C. ETP Sludge

It is in the form of cake, which is formed at the outlet of Rotary Vacuum Filter (RVF). The cake is formed on a uniform basis and is continuously collected in trolleys kept at the bottom of RVF discharge chute. The trolleys are shifted to Off-site Sludge Disposal Facility developed within plant premises. The trolleys are decanted and sludge is disposed off into the Disposal Facility [6]. The On-site Sludge Disposal Facilities have been constructed as per the MoEF guidelines and as per the approved design (Fig 1).

D. Waste Pickled Acid

In order to minimize the of waste generation in our plant, we had identified M/s Purnima Chemicals, Ankleshwar, Gujrat, to use our spent acid as a raw material for preparation of Iron Applied Materials, like Iron Oxides [7].

E. *Type of hazardous waste generated as 5.1, 6.2, 6.1, 12.9 & 12.1 (cat. As per Defined under these rules; amended rules 2004) Hazardous Waste (Management & Handling) rules 1989 at their amendment*

F. *Quantum of hazardous waste generated: Zinc Dross (6.2) - 400 MT/Y at expanded capacity Zinc Ash (6.1) -1000 MT/Y at expanded capacity ETP Sludge (12.9)–500 MT/Y at expanded capacity Spent Acid(12.1)–2000MT/Yat expanded capacity Waste Oil (5.1) – 15 KL/ Y at expanded capacity [8].*

G. *Mode of storage within the plant, Method of disposal*

1. Zinc Dross

Stored in solid form in GP portion of stores. It is sold to vendors thro' trucks approved by Pollution Control Board.

2. Zinc Ash

Stored in Polythene Bags in GP portion of stores. It is sold to vendors thro' Trucks approved by Pollution Control Board [9].

3. ETP Sludge

It is in the form of cake and is disposed off at off-site sludge disposal facility created within the premises as per MoEF guidelines, and approved by Madhya Pradesh Pollution Control Board [10].

4. Spent Acid

Stored in FRP/ AR Brick lined tanks for neutralization in ETP or disposed to authorized party thro FRP lined Tankers [11].

III. Analysis Report Of Hazardous Waste

TABLE I
ZINC ASH TEST RESULTS

S. No.	Tests	Test value
1.	Zinc (as Zn), % by mass	74.8
2.	Aluminum (as Al), % by mass	0.04
3.	Iron (as Fe), % by mass	0.35
4.	Lead (as Pb), % by mass	4.2

Protocol Used: - Encyclopedia of industrial Chemical Analysis by N.H. Furman guidelines.

TABLE II
ZINC DROSS TEST RESULTS

S. No.	Tests	Test value
1.	Zinc (as Zn), % by mass	87.1
2.	Aluminum (as Al), % by mass	0.04
3.	Iron (as Fe), % by mass	4.5
4.	Lead (as Pb), % by mass	1.3

Protocol Used: - Encyclopedia of industrial Chemical Analysis by N.H. Furman guidelines.

TABLE III
ETP HCL SLUDGE TEST RESULTS

S. No.	Tests	Results (on dry basis)	Protocol/Test Method
1.	Zinc as Zn, mg/kg	2948	APHA
2.	Lead as Pb, mg/kg	111	APHA
3.	Hexavalent Chromium as Cr^{+6}, mg/kg	BDL	APHA
4.	Aluminium as Al, mg/kg	5634	APHA
5.	Iron as Fe, % by mass	17.6	APHA

BDL: Below detection limit.
Detection limit. Cr^{+6}-1 mg/kg.

Note: - The sampling was not carried out by Shriram Institute for Industrial Research. The sample details provided in test certificate are based on declaration by the party

TABLE IV
SPENT ACID TEST RESULTS

S. No.	Tests	Results (on dry basis)	Protocol/Test Method
1.	Zinc as Zn, mg/kg	78	APHA
2.	Lead as Pb, mg/kg	15	APHA
3.	Hexavalent Chromium as Cr^{+6}, mg/kg	BDL	APHA
4.	Aluminium as Al, mg/kg	15	APHA
5.	Iron as Fe, % by mass	11.4	APHA

TABLE V
ANALYSIS RESULT OF WATER SAMPLE COLLECTED FROM PIEZOMETRIC HOLES

S.No.	Parameters	Year	PZM	SLF 1	SLF 2	SLF 3	LCH
1	pH	2004	8.74	7.2	7.4	6.7	8.79
		2005	8.72	7.3	7.2	6.9	8.77
		2006	8.69	7.3	7.5	6.7	8.76
		2007	8.74	7.3	7.4	6.7	8.8
		2008	8.67	7.3	7.3	6.8	8.51
		2009	8.5	7.4	7.2	6.9	8.77
2	Turbidity (NTU)	2004	14	-	-	-	18
		2005	6.8	-	-	-	18.5
		2006	14.3	-	-	-	17.6
		2007	14	-	-	-	18.6
		2008	13.8	-	-	-	17.9
		2009	14	-	-	-	18
3	Specific Conductivity (µ mho/cm)	2004	440	-	-	-	392
		2005	438	-	-	-	394
		2006	441	-	-	-	389
		2007	435	-	-	-	394
		2008	442	-	-	-	390
		2009	442	-	-	-	390
4	Total Alkalinity (mg/ltr.)	2004	50	-	-	-	60
		2005	50	-	-	-	58
		2006	50	-	-	-	59
		2007	50	-	-	-	61
		2008	51.5	-	-	-	59
		2009	51	-	-	-	60
5	Total Solids (mg/ltr.)	2004	1020	4978	3860	3986	3879
		2005	1064	4987	3870	3972	3875
		2006	1032	4988	3974	3968	3873.5
		2007	1085	4981	3972	3961	3858.5
		2008	1086	4881	3974	3963	3874.5
		2009	1152	4985.4	3867.2	3992.9	3887.8
6	Total suspended solids (mg/ltr.)	2004	93	87	92	100	99
		2005	97	88	93	99	98
		2006	87	89	97	98	93.5
		2007	89	92	96	89	98.5
		2008	86	93	95	90	97.5
		2009	96	94	95	91	97
7	Total Dissolve solids (mg/ltr.)	2004	927	4891	3768	3874	3780

		2005	967	4899	3777	3873	3777
		2006	945	4899	3877	3870	3780
		2007	996	4889	3876	3872	3760
		2008	1000	4788	3879	3873	3777
		2009	1056	4791	3887	3891	3769
8	Biological oxygen demand day 27 °C (mg/ltr.)	2004	12.6	-	-	25	12.8
		2005	12.8	-	-	27	12.9
		2006	12.5	-	-	25	12.9
		2007	12.4	-	-	24	12.6
		2008	12.5	-	-	24	13
		2009	12.8	-	-	25	12.9
9	Chemical oxygen demand (mg/ltr.)	2004	120	-	-	236	120
		2005	123	-	-	230	123
		2006	120	-	-	236	124
		2007	130	-	-	235	122
		2008	118	-	-	237	124
		2009	122	-	-	236	121
10	Chloride (mg/ltr.)	2004	699	-	-	1997	2899
		2005	695	-	-	1999	2899
		2006	530	-	-	1998	2873
		2007	695	-	-	1998	2769
		2008	625	-	-	1989	2893
		2009	689	-	-	1988	2897
11	Phosphate (mg/ltr.)	2004	0.03	-	-	-	0.03
		2005	0.03	-	-	-	0.02
		2006	0.03	-	-	-	0.03
		2007	0.02	-	-	-	0.03
		2008	0.03	-	-	-	0.02
		2009	0.03	-	-	-	0.03
12	Total hardness (mg/ltr.)	2004	2350	-	-	-	2560
		2005	2342	-	-	-	2565
		2006	2345	-	-	-	2561
		2007	2334	-	-	-	2591
		2008	2275	-	-	-	2552
		2009	2353	-	-	-	2555
13	Calcium Hardness (mg/ltr.)	2004	1810	-	-	-	1975
		2005	1806	-	-	-	1980
		2006	1815	-	-	-	1985
		2007	1795	-	-	-	2016
		2008	1752	-	-	-	1973
		2009	1815	-	-	-	1972
14	Magnesium Hardness (mg/ltr.)	2004	540	-	-	-	585
		2005	536	-	-	-	585
		2006	530	-	-	-	576
		2007	539	-	-	-	575
		2008	523	-	-	-	579
		2009	538	-	-	-	583
15	Nitrate Nitrogen NO3 (mg/ltr.)	2004	0.22	-	-	-	0.24
		2005	0.23	-	-	-	0.24
		2006	0.22	-	-	-	0.24
		2007	0.21	-	-	-	0.23
		2008	0.2	-	-	-	0.23
		2009	0.16	-	-	-	0.24
16	Zinc (Zn) (mg/ltr.)	2004	N.D.	BDL	BDL	N.D.	N.D.
		2005	N.D.	BDL	BDL	N.D.	N.D.
		2006	N.D.	BDL	BDL	N.D.	N.D.
		2007	N.D.	BDL	BDL	N.D.	N.D.
		2008	N.D.	BDL	BDL	N.D.	N.D.
		2009	N.D.	BDL	BDL	N.D.	N.D.
17	Chromium (Cr+6) (mg/ltr.)	2004	N.D.	BDL	BDL	N.D.	N.D.
		2005	N.D.	BDL	BDL	N.D.	N.D.
		2006	N.D.	BDL	BDL	N.D.	N.D.
		2007	N.D.	BDL	BDL	N.D.	N.D.
		2008	N.D.	BDL	BDL	N.D.	N.D.
		2009	N.D.	BDL	BDL	N.D.	N.D.
18	Iron (Fe) (mg/ltr.)	2004		2.2	1.8	1.09	-
		2005		2.1	1.8	1.08	-
		2006		2.1	1.8	1.08	-
		2007		2.08	1.7	1.1	-
		2008		2.09	1.6	1.09	-
		2009		2.1	1.7	1.1	-

PZM = Piezometric Holes, LCH = Leachate Pits, SLF 1/2/3 = Secured Land Fill Nos. 1/2/3, - = Absent, Zinc, Chromium (Cr+6) is not detectable/ below detection limits.

Before SLF modification | After SLF modification

IV. After Increase Of Height Of Secured Land Fill Site

The height of SLF by 100 cm. with a free board of 30 cm to have an additional capacity for disposal of solid waste, Government Engineering College, Jabalpur examined and from the structural stability point of view it would be safe to provide counter fort retaining wall as [12] Fig – 2 and 3.

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TABLE VI
CAPACITY & VOLUME WILL BE AS UNDER

SLF No.	Existing Capacity	Approx. Increase in Capacity After Proposed Enhancement
SLF – 1	2600 Cu.Mtr.	1545 Cu.Mtr.
SLF - 2	2600 Cu.Mtr.	1545 Cu.Mtr.
SLF – 3	2600 Cu.Mtr.	1545 Cu.Mtr.
Total	7800 Cu.Mtr.	1545 Cu.Mtr.

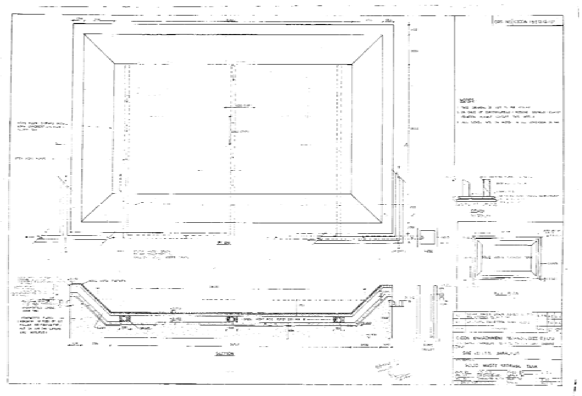

Fig. 1 Design and drawing of secured land fill site after increasing height.

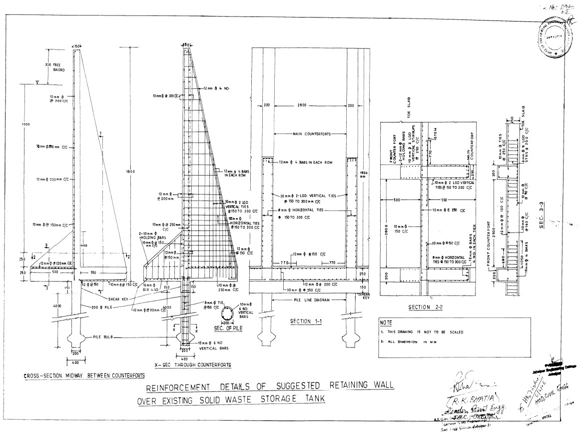

Fig. 2 Design and drawing of secured land fill site after portion of height which was increased

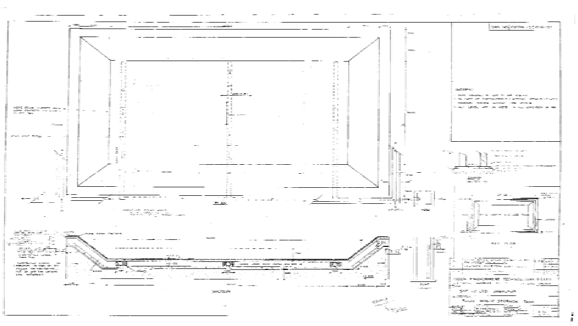

Fig. 3 Design and drawing of secured land fill site without increasing height

The increase of height of above ground level for SLF this will be sufficient for next 6 year on the basis full production capacity of the factory.

V. DISCUSSION

Land fill shall have to be designed and constructed as a secured facility to contain the waste material and any leachate generated during the process. To meet these requirements, the base, slope, liner system of the land fill shall have to be designed and constructed as per the guidelines of MoEF / CPCB (Guidelines for setting up of operating facility Hazardous Waste Management HAZWAMS/11/98-99 and criteria for Hazardous waste land fills HAZWAMS / 17 / 2000-01. The sample has been collected nearby from SLF the result was found within the standards after increasing the height of SLF from ground level. No leachage and seepage is being for SLF. Therefore if the height raised / increase from ground level to increase the capacity of SLF in spite of occupying more land for construction of new SLF, it will save on wastage of earth surface and cost of construction, without affecting ecosystem. The results are not adverse in the Environment. The modification is effective and provides environmentally sound arrangement for handling & storage of Hazardous waste.

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REFERENCES

[1] BC Hydro. 2006. BC Hydro 7 Steps to Electrical Safety. Available online at: http://www.bchydro.com/safety/work/work671.html.
[2] Blackwell B.A., G. Shrimpton, F. Steele, D.W. Ohlson and A. Needoba. 2004. Development of a Wildfire Risk Management System for BC Transmission Corporation Rights-of-Way. Technical Report submitted to British Columbia Transmission Corporation.
[3] Carlisle, S.M., and J.T. Trevors. 1987. Glyphosate in the environment. Water, Air, and Soil Poll. 39:409-20.
[4] California Energy Commission. 2005. Assessment of Avian Mortality from Collisions and Electrocutions. Staff Report prepared June, 2005.
[5] Crowder, Michael R. and Olin E. Rhodes, Jr. 1999. Avian Collisions with Power Lines: A Review. Proceedings of a workshop on Avian Interactions with Utility and Communication Structures Charleston, South Carolina, December 2-3 1999. Edited by Richard G. Carlton. Electric Power Research Institute.
[6] Roberto Rudervall J.P. Charpentier Raghuveer Sharma, High Voltage Direct Current (HVDC) Transmission Systems Technology Review
[7] Gilead, Inc., 2006a. Hazardous Materials Business Plan, 310 Lakeside Drive, Foster City, CA. June 21.
[8] Gilead, Inc., 2006b. Hazardous Materials Business Plan, 320 Lakeside Drive, Foster City, CA. November 22.
[9] Gilead, Inc., 2006c. Hazardous Materials Business Plan, 322 Lakeside Drive, Foster City, CA. June 21.
[10] Gilead, Inc., 2006d. Hazardous Materials Business Plan, 324 Lakeside Drive, Foster City, CA. June 1.
[11] Gilead, Inc., 2006e. Hazardous Materials Business Plan, 335 Lakeside Drive, Foster City, CA. April 1.
[12] Gilead, Inc., 2006f. Hazardous Materials Business Plan, 342 Lakeside Drive, Foster City, CA. April 1 Paper