ANNEXURE - D.

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REPORT

Thermometer Factory, Hindustan lever Ltd. Kodai Kanal

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Preamble

This environmental impact appraisal is the outcome of a walk through survey and examination of the human and environmental safety issues and past records of Thermometer Factory (100% Export-Oriented) HLL, St.Mary's Road, Kodaikanal, conducted from 16th to 19th March 2001. Based on the past experience in several industrial units in India and abroad, and interacting with governmental regulatory and international agencies and intensive literature search, this consultant has made an objective assessment of the issues of the magnitude of any real reasonable risk today or in the near future and has made suggestions for risk assessment and interventional strategies.

Examination of process details and records

After acquiring the unit HLL has been updating the manufacturing practices to the level adopted in this company's well-acclaimed environmental policy, which is generally as per best by GMP standards. Also some of the shortcomings in the management are being rectified. A major part of the solid waste, Generated has been now put under safe storage conditions for mercury recovery and thereby detoxification to the level that can be disposed within environment friendly way as per TNPCB norms, or recycled The glass waste containing traces of Hg comes under category 4 and since it is likely to be over 5 Kg of metal one year, needs secure land fill as per GOI guidelines (enclosed.). The mercury accountability audit, which was not done earlier, has now been undertaken. Once this process is complete and from day to day records available on waste generated the total waste can be computed and accounted. From this the maximum of mercury that might have been released in total and as everyday average can be calculated. This to my mind is to be very low, to be within permissible limits. With the compliance of the suggestions given in the Environmental Audit Report (CAME dt.15/12/2000) and safety (ISRS) safety audit report (CAME SAS 6th June 2000) and adherence to the HLL Environmental Policy, the chance of occupational and environmental risks will reduce further. Also satisfactory progress has been made in the implementation. Only additional points regarding any ecotoxicological impact of the mercury is given, in view of the importance of the area from the eco tourism and bio diversity points of view. The suggested studies will help to clarify any over sensitized surmises and to take adequate anticipatory action, if needed . The follow up action suggested is for assessing the situation in the site and near vicinity If these studies suggest the need, then only more elaborate EIA is to be done.

Visit of the various units and surroundings

The housekeeping operations are being done efficiently, taking all essential personal and environmental protection measures mandatorily. The collection of glass waste from Hg free and Hg involving area especially cleaning of floor, water treatment and reuse for cleaning are satisfactory. At present the collection and storage of waste and Hg recovery are under satisfactory conditions of safety limits. The data for mercury are within safe limits. Analysis of ambient mercury vapour is done by standard method a id well calibrated with GLP compliance and equipments. The medical examination data regularly monitored also do not show any present indication of mercury exposure risk. This was discussed with Dr.Rajagopal and Dr (Mrs) Pramoela and protocols finalised. Information on exposure dose dependent effects enclosed (ANNEXURE 2)
The activities going on at present at the waste site (mostly glass pieces with or without Hg) are done with all precaution, protection and supervision. Under the present cold, low wind velocity conditions chances of human exposure or environmental contamination appear low. The material is safely packed in plastic bags and stored properly in secured storerooms. The rooms where the floor is damaged any mercury droplets could accumulate in the crevices. Care has to be done to prevent the bags breaking and mercury going down into the soil. The present storage condition in the local climate conditions will not cause any severe volatilization and there appears no fire or reactivity risk. Before the rainy season additional precautions

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may be needed to protect from water entry and any probable leaching and run offs. Along with the samples of the waste dug out, adjacent soil from sites away from this unit has to be collected and analyzed for Hg as well as ecotoxicity as suggested later. The sludge from ETP is at present stored in temporary facility, which is covered and protected from unwarranted entry. This is awaiting Hg recovery detoxification and safe disposal. This area needs improvement, better cordoning and preventing of run offs to the adjacent valley and low land and water bodies. Any water accumulation at the outlet should be analyzed for Hg weekly.

Approach to the problem

The well-concerted objective appraisal of this author is that the manufacturing and house keeping practices used at present are not likely to be of any mercury related potential adverse effect on humans, crops, livestock, wildlife or any other environmental concern. Whether any past releases caused by indirect exposure or inadvertent reasons, can also be appraised by the following approaches and action. It may be pointed out that this author has been consulted in many major issues in the country such as fly ash amended agriculture, treated effluent irrigated farming and aqua culture ecotoxicological testing of effluents and solid waste leacheates. Bhopal gas leakage follow up and many others. Also he has evaluated many such risk assessment studies in the country and provided regulatory know-how to the concerned government agency or corrective measures for industry, in the area of environmental risk assessments/prevention and rehabilitation.

The issues with mercury have many specific problems, which are being addressed to in the light of a major study done by the author in an area of super thermal power stations, where sub clinical mercury exposure has started showing early effects on man and environment. The environmental fate, dynamics, availability and toxicity of elemental, ionic Hg and organic mercury are quite different. The nature of target organs and effects and cumulative nature vary. Analytical parameters and diagnostic tests have to be made according to the current level of knowledge. The collection processing and quantification of Hg also needs additional facilities and expertise and many of the tests done in smaller set ups are not reliable and statistical designs for sampling may be inadequate. Separate estimation of metallic, ionic and organic species of Hg is a problem. Vapour phase analysis is a delicate technique needing expertise (annexure 3). Samples have to be processed chemically to avoid vapourization of Hg. Absorption to or extraction from containers is another problem and all glassware has to be cleared with Nitric Acid. For complex material like biological tissue, matrix correction is needed. Authentic reference standard is another problem. Dr.Pramoda put me in touch with Dr.Bhatt, Bangalore, who is to analyse the samples and I have conveyed these points.

Unfortunately, the impact of Minamata disease and the mercury coated seed consumption episode of Middle East have created an environmental panic of Hg, which is not justified in the light of the current knowledge in the case of this thermometer factory. Even a very common practice of Hg containing dental amalgams and the detection of Hg in the mouth of such persons, several magnitudes below safe limits have been confused with Minamata conditions and added fear to people with different problems. It is ignored that metallic or ionic Hg is not converted into methyl Hg in human tissues, even though ingested methyl Hg may be changed into metallic form. Also the only source of methyl mercury is food from Hg polluted water bodies, especially fishes which accumulate it.

To avoid such unwarranted scare it is essential to anticipate all possible risks, from the present knowledge and expertise and take anticipatory action. Correct scientific data honestly presented can remove unknown risk based fears. This is essential because "what it is not understood, is to be feared what is feared is to be opposed" has become human nature in environmental issues. People have to be educated about this. The purpose of this exercise is to educate the public regarding all truth and nothing but the truth about the problem due to Hg in this particular unit and is not a general review on environmental issues of mercury. Methylation of mercury is due to certain bacteria and fungi. Methylation of Hg in the sediment deposits on the microbial ecology and presence of sulphide or nitrite can inhibit the process. Bioconcentration and biomagnification into fish depend on local food chain characteristics and water quality and is reduced by high calcium in water. That mercury and its compounds can be toxic depending on exposure beyond safe

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limits, is no doubt true, but without specifying the conditions the statement is not all truth or is beyond truth.

The following suggestions are given from this angle and applicable to the thermometer factory of HLL at Kodaikanal only but the tests and methods are surely same as required mandatory under the law of the country and international. State of the art.

Comparison with other situations with Hg contamination and Effects

Ehrenberg et al (1991) had investigated 84 and 79 workers from Hg exposure and Hg free areas of a thermometer manufacturing factory for evidence of chronic Hg toxicity (Poltox 1 of 2 1991-92 Am.J. Ind. Med. 1994) (495 –507 (1991). Personal breathing zone air concentration of Hg ranged from 25.6 to 2.70 µg / m^3 and urinary levels from 1.3 to 344.5 µ/g creatinine. with only 8 exceeding 150 and 3 exceeding 300. The controls had levels below 10 µg /g. However, the health problems of both groups did not show any statistically significant evidence for occupational Hg exposure, even though tendency for static tremor, abnormal Ramberg test, dysdiadochokinesia and difficulty with heel to toe gait was found more on the Hg exposed workers. In the Kodai Kanal unit, the records show lower Hg levels and the above complaints were not felt. In another study abroad, children of thermometer factory workers showed urinary levels of 25 µg/l, as compared to 5 in controls. The workers' houses also showed higher Hg than control houses. However detailed medical examination showed no signs of Hg toxicity in the exposed children. In the Kodai Kanal unit the chances of workers carrying Hg to their houses is unlikely due to protective clothing, after shift showers and change of clothes. Also, in this unit, most of the workers showed urinary levels of below 100 µg/L, as compared to normal value of below 10, and for below the levels of 200 µg/L suggested for shifting the worker to Hg free zone and 300 µg suggested for treatment for Hg poisoning. These levels are suggested by Zenz (1994), who is an authority on occupational medicine. The WHO scaling limit of 139 µg / m^3 for manifestation for renal and neurological effects, average air levels of 80 µg / m^3 and urinary levels of 100 µg /g creatinine for CNS effects are also not likely in the unit. The levels of 25 ,80 µg in air and 30 – 100 µg in urine, cause mild psychometric effects, which are reversible (Patty 1994). Even at these levels , in a glass factory only 6 out of 75 workers exposed to 50 – 100 µg Hg / m^3 reported insomnia, one had tremors and 7 showed hyper excitability. This indicates that even in occupational situations with higher exposure levels, the chances of occupational Hg toxicity are very low. It may be pointed out that Industrial Toxicology Research Centre, Lucknow conducted an exhaustive ecoepidemological study of Environmental Hg and its risks in Rihand dam area of super thermal power station. Two thirds of the population showed blood levels above 5 µg/mL which is considered the critical level, as compared to 10% in a control area. However detailed investigations on the people showed no clear signs of neurological or renal disorders and there was no correlation of the health complaints with Hg level in blood. The early indications of Hg accumulation in hair and sub-clinical exposure effects found by psychometric tests and dental problems were of low magnitude. Thus in spite of continued exposure from contaminated environment (milk, air, water, vegetables, crops showed Hg buildups), the incidence of any specific diseases could not be substantiated. In Kodaikanal unit and vicinity, the amount of Hg involved and environmental releases are far below this situation in Rihand area or in the vicinity of major chloro alkali plants that used the classic mercury cell and any Hg attributable health problem is unlikely..

Suggestions for assessing any present or future risks

Inventory of Hg

The entire Hg reaching the unit is being accounted and the amounts used for products manufactured and sold are recorded. The amounts recovered so far and what will be recovered from the waste also can be

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quantified. From this actual quantitative data which can be verified, it will be clear that even if all the Hg unaccountable are in the environment, this problem is to be negligible in terms of actual amount and dose and time related effects, as compared to Chloralkali, Cinnabar processing or coal fired power generation. Whether there are any other sources of Hg in the Kodaikanal area also has to be assessed. Hg compounds are still used by public as dental amalgam, skin creams, diuretics and alternate system medicines. Also the environmental monitoring for Hg in the soil at the factory site and other points nearly as compared to the other places will show any local build up. From this data and period of time involved, a semi-quantitative model for predicting any chances of further build up with continued production in the unit can be made.

Tests on the workers

The workroom monitoring should continue along with corresponding analysis at Hg free sites in the unit such as Office, Canteen and 4 corners of the plot of land. The data can be compared with known levels of Hg from various surveys elsewhere.

The low and reversible urinary Hg levels indicate that at present there is no exposure risk at present. This should continue. And along with urine, blood analysis should also be done. Along with the workers working in Hg area, there are other people in the factory and surroundings; they should be also examined as controls. Any of the workers are having Hg amalgam dental fillings or not is not clear.

During clinical examinations, dental carries discoloration and other early symptoms of mercury exposure should be done. Further, in those cases, if any effect is shown by Hg analysis and dental data routine test for liver and kidney functions and any neuro behavioural changes should be done. This aspect was discussed in detail with Drs.Mr.Rajagopal and Mrs.Pramoela and supportive literature given. Hair analysis usually done is not suggested because methyl Hg exposure is not involved. Survey proforma was also examined and suggestions made. The values in the present case are within this range. USDHHS compilation of the levels of Hg in human blood and Urine vis-a vis symptoms (appended) also indicate that the present levels encountered in the unit are not alarming and the levels and any effect reversible. The minimal risk levels (MRL) by inhalation of 0.2 mg/am^3 air has been suggested by USDHHS for chronic exposure to vapour. Even for low-level neurological effects upto 5, 15, 24 years of exposure at 0.076 mg/m^3, 0.026 mg/m^3 and 0.014mg/m^3 are needed.

It is essential to create awareness among the workers and general public regarding the Hg problem. The importance of safe level has to be emphasized along with personal protection and pollution prevention practices in the unit. It is a good idea, if the workers and public are told that dietary antioxidants like vitamin C (or citric fruits), carotenoids and Se and Sulphur containing amino acid rich protein diet can retard Hg toxicity and improve Hg clearance. Any difference in Hg levels in vegetarians and non-vegetarians (especially fish eaters) could be tested.

Environmental Monitoring

Sampling points for environmental and ecological risk Assessment

At present any Hg release is confined to the factory premises and a junkyard. Hg is the only item to be considered and there could be other sources for Hg outside the limit. As such a Comprehensive environmental impact assessment as per GOI guidelines and various pollutants and entire biodiveristy is not needed. Only Hg related specific approaches are suggested besides sampling of soil, decided as per Hydrogeological and Meteorological factors and vicinity to Hg involving sites identified by the experts from M/s. Dames and Moore, Singapore. I discussed the requirements for ecotoxicological monitoring and joined them in identifying the sites and marking them. Soil from the sites will be analysed for metallic.

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ionic and organic mercury and will also be used for ecotoxicity evaluation. Biological monitoring will also be done in the vicinity of the sampling points.

Ecological and Biological Monitoring

In view of the rich floral diversity of the area and low magnitude of the Hg releases and duration an exhaustive ecological monitoring and biodiversity index calculation are not needed. Also no visible signs of phytoxic effects of Hg such as Chlorosis, or Necrosis were observed. The only tests needed are Microbial Index (aerobic and anaerobic, total and Nitrogen fixing) in the sites where samples are collected for Hg analysis. The two common species of the area Eucalyptus and Pine from areas near the sampling points should be analyzed for any toxic effects. For this leaves and bark shavings will be analyzed for total Hg in triplicate in each sampling point. (Annexure 4). Analysis of annual rings of trees for toxic metals to trace the history of pollution is a usual practice. This can be done in the case of Eucalyptus trees cut in the factory, near the waste site and analyzed for total Hg. This will clarify whether there is any recent build up or not. Analysis of earthworms is also needed.

Since every issue of Hg is unfortunately linked with Minamata, which occurred half a century back, any effect on fish has to be assessed. It is suggested that atleast 6 samples of 2 edible variety of full grown fish may be collected from the lake and analysed for total and Methyl Hg in the edible portion. The results should be compared with permissible levels, and data available on methyl Hg in fish in several places including Mini Mata. Since methylation is a microbiological process, microbial ecology of the site has to be tested. Lichen, Pine needles and tree barks are well known indicators of heavy metal pollution. Lichen sample can be scrapped from 6 trees at 2 feet height and total Hg estimated. The trees near the sludge and storage sites, further down towards the valley, near the Western Roadside gate and across the Road can be identified. The same can be done with pine leaves at a height of 5 mtrs.

The experience in the vicinity of coal based power plants, industrial and mining areas show Hg level in meat of food animals, milk and poultry products. It is suggested that if such locally made samples can be obtained from nearby shops and analyzed for Hg and compared with permissible levels, any environmental build up of Hg can be tested.

EcotoxityTesting of waste

Leachates of the sludge and the waste recollected from dumps should be prepared by the standard EPA method leachate should be prepared in water and analyzed for Hg. (annexure 5). The EPA protocol tipulates the homogenized solid mass, treated with water with constant shaking for 24 hours in a 1 to 9 ratio (11.e.10% leachate) at local room temperature and filtered. In the present case the glass pieces from Hg free rooms 1 and 2 will serve us controls for those with Hg (3 and 4). Water from the lake or wells and may be bacteriologically contaminated and municipal supply is chlorinated. So, using distilled water is better. Hardness, pH, ionic concentration etc will be adjusted as per EPA protocols. With this leachates at 10%, 25%, 50% and 100% dilution with distilled water, ecotoxicity test should be done by the standard assays with fish, water-flea, earthworm, Algae, Duck weed and seed germination system. The standard OECD Protocols and the Central Pollution Control Board approved dimension less toxicity test with zebra fish are to be used. The protocols will be provided (annexure 6). Along with mortality and morbidity observations under specified periods and test conditions any Hg uptake as a foundation of time by the organism has to be measured and statistical significance evaluated by ANOVA Software.

Simulated pot experiments with the sludge on seed germination, seedling growth in and any Hg uptake should be done, with the solid waste combined with 1:10 washed sand. Fish experiments should with the sludge as sediment and washed sand for control.Toxicity and any Hg uptake to be followed. OECD methods to be provided. Glass collected from 1 and 2 sites will serve as control for Hg containing 3 & 4.

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These tests and analysis have to be done through contracted parties provided with the exact protocols. M/s.Rallis. Bangalore. Vimas. Hyderabad. Fedeics or SG. Chennai. Madurai Kamaraj University. Department of Life Sciences or any laboratory nearby with GLP compliance. ISO rating and NABL accreditation. They can do the job in 30 days.

Approach and concluding remarks

At present there appears no evidence to show any ecological or human risks due to Hg. release from the unit. With the above efforts. even any shadow of doubt based on unknown or imaginary future risks can be removed.

A visit to the site where some of the thermometer glass waste is stored by some scrap dealer. gave the impression that such issues have to be tackled by the governmental departments through regulatory surveillance. A major fire accident in a junkyard area in Delhi also suggested this. The scrap dumps could come under the preview of solid waste sites for which Department of Envrionment and pollution Control Boards have the norms. They should assist the unit in taking back for storage and removal of any mercury. This site has to be monitored for Hg in soil after removal of the waste this will help any help to clear any fear in the public.

This author is confident of his views. which he can defend before any rational forum. for a knowledge backed decision-making He can provide further necessary information and protocols and continued interaction on Ecotoxicology of mercury and other such issues. He can also overview the work of the contracted laboratory on analysis and testing and evaluate reports. He is thankful to HLL for this interaction.

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