Environmental Pollution at Hindustan Lever's Kodaikanal Plant

By AV Vedpuriswar

In mid-2004, Hindustan Lever Ltd (HLL) executives looked back at the events of the past three years at their mercury thermometer factory in Kodaikanal in the south Indian state of Tamil Nadu. After mercury leakage from the plant had been reported in March 2001, heavy expenditure had been incurred in environmental risk assessment, waste disposal and health monitoring. The expenditure had exceeded the total profits generated by the plant since its inception. But the pressure from NGOs, led by Greenpeace[1], who had been protesting since March 2001 had not subsided.

The NGOs had indulged in novel ways of keeping the issue alive. These included chaining themselves to the HLL branch office in Chennai on 15th November 2002, disrupting the Annual General Meetings (AGMs) of HLL held on 13th June 2003 and 29th June 2004, shouting slogans and brandishing placards and enlisting sympathy from ex-workers and the general public. Greenspace also maintained the pressure on HLL through its website, photo albums, posters, persistent media briefing and seminars. The NGOs had most recently attacked HLL in April 2004 in a seminar in Chennai.

Even as they waited anxiously for the regulator, Tamil Nadu Pollution Control Board's (TNPCB) nod to start decontamination of equipment and remediation of soil, HLL's senior managers believed they had discharged their duties conscientiously. They wondered what more was needed to be done to bring the whole episode to an amicable closure. Why had the events turned out to be far more complicated than anticipated?

Background Note

HLL, a 51% subsidiary of the Anglo-Dutch Conglomerate, had acquired a tremendous reputation as one of India's best-managed companies. Despite being the subsidiary of a Multinational Corporation (MNC), HLL was perceived to be more Indian than foreign, in the way it managed its operations, and HLL's origin went back to 1885 when the Lever Brothers was set up by 'William Hesketh Lever', in England. In 1888, the company entered India by exporting 'Sunlight', its laundry soap. In 1930, the company merged with 'Margarine Unie' (a Netherlands based company, which produced edible fats and margarine), to form Unilever. In 1931, Unilever set up its first Indian subsidiary, the Hindustan Vanaspati Manufacturing Company for production of vanaspati, followed by Lever Brothers India Ltd. in 1933 and United Traders Ltd. in 1935, for the distribution of personal products. In November 1956, the three Indian subsidiaries merged to form HLL in 1956. Unilever decided to offer part of its equity capital to Indian shareholders even

[1] Greenpeace an independent, campaigning organisation believes in creative confrontation to expose global environmental problems, and force solutions for a green and peaceful future. Its goal is to ensure the ability of the Earth to nurture life in all its diversity.

though there was no regulatory requirement. HLL had been a listed and quoted company in India since 1957.

In the 1990s, HLL expanded its operations through both organic growth and mergers and acquisitions. In April 1993, the company acquired its largest competitor, Tata Oil Mills Company (TOMCO), the biggest such deal in Indian industry till that time. HLL formed a 50:50 joint venture with another Tata company, Lakme Ltd in 1995. The venture named 'Lakme Lever Ltd.' marketed Lakme's leading cosmetics and other associated products. (Subsequently in 1998, the Tatas divested their 50% stake in the venture to HLL).

In January 1996, group company Brooke Bond Lipton India Ltd. (BBLIL)[2] merged with HLL. Another group company, Pond's India Ltd, merged with HLL in January 1998[3]. By the late 1990s, the integration of the different Unilever entities operating in India, had been completed by and large. (See Exhibit I for HLL's financial performance in the past 10 years).

How it all began

It was in early March 2001, that news reached HLL's senior management in Mumbai that something had gone wrong at the Kodaikanal thermometer plant. A query from Corporate Watch, an N.G.O, whether there had been any disposal of mercury contaminated waste (along with broken thermometers and ground glass) from the plant, came as surprising news to HLL's top management. HLL management also learnt that a few NGOs had staged protests outside the plant on March 7, 2001.

HLL was not initially convinced about these allegations. Being a 100 % Export Oriented Unit (EOU), no raw materials or finished goods could leave the factory without the knowledge and prior permission of the customs authorities. Despite being confident that mercury or mercury bearing materials could not have left the plant, HLL executives decided to seek a clarification from the unit manager. On March 8th, 2001, HLL Director, Gurdeep Singh held a meeting of senior managers in Mumbai. After learning from the unit manager in Kodaikanal that the glass scrap and broken thermometers containing mercury lying in a nearby scrap yard at Munjikal was indeed from the thermometer factory, it was decided to suspend operations in the plant with immediate effect.

Ashok Gupta, Vice President (Legal and Corporate affairs), recalled[4], "There was a debate within the company regarding suspending the operations since this might send wrong signals. It would be as though HLL was admitting that things had gone wrong." Despite these apprehensions, HLL went ahead and suspended the operations. Dr. Anil

[2] Unilever had acquired Lipton in 1972, and Lipton Tea (India) Ltd. was incorporated in 1977. Brooke Bond had joined the Unilever fold in 1984 through an international acquisition. Brooke Bond and Lipton India merged in July 1993 to form BBLIL. Prior to that TEI & DDI, two tea plantation companies had been merged with Brooke Bond.

[3] Pond's India Ltd. had been present in India since 1947. It became an Unilever group company when Unilever acquired Chesebrough Pond's USA in 1986.

[4] Interview with case writer in Mumbai on May 19, 2004.

Bhaskar, SHE (Safety, Health and Environment) Co-ordinator[5], (Asian Business Groups) explained: "We wanted to freeze the situation and realised unless the operations were frozen it would not be possible to get to the root of the problem. The whole point was to find why a material, which was not supposed to move out of the factory, left the factory. We wanted to find out how if at all the systems and controls had been breached." (See Exhibit II for a summarized account of Unilever's Environment Strategy).

HLL issued a press release on March 8, 2001, to clarify its position: "Allegations that scrap glass generated in the HLL Kodaikanal Thermometer Factory's non-mercury area, purchased by a local scrap dealer more than 15 months back, contains some glass with mercury waste has caused the company enormous surprise and concern since such a possibility is remote given established systems and controls which are in place. However, to rule out any human error, HLL has decided to carry out a comprehensive audit of the operation of the factory, including a comprehensive review of disposal of wastes and glass scrap." HLL indicated it would resume operations only after fully satisfying itself that the continued operation of the factory did not pose any hazard to the local environment. On March 9th, an HLL team consisting of Bhaskar, Ashok Gupta, Vivek Sood, Commercial Manager, (Exports), and B Dave, HLL's Coordinator (Safety, Health & Environment) visited the Kodai plant. The team came to the prima facie conclusion that contaminated waste had indeed moved out of the factory.

The thermometer plant

HLL's thermometer plant in Kodaikanal was a Pond's legacy. In 1983, US-based Chesebrough Pond's, Pond's India's parent company relocated its mercury thermometer factory from Watertown, New York, to Kodaikanal. One of India's most beautiful hill stations, located on the southern tip of the upper Palani hills in the Western Ghats, Kodaikanal was chosen as its climatic conditions were similar to those in Watertown. The low temperatures in Kodaikanal minimized the occupational hazard of mercury vaporization in the workplace. The Tamil Nadu government approved the site for the facility and declared it as an industrial estate. In 1987, the factory came into the Unilever fold when Unilever bought Cheesborough Pond's. In 1998 after Pond's India came into its fold, HLL began to control the factory.

Though thermometers was not a core business, HLL decided to retain it to generate foreign exchange earnings, a top priority for the Indian government those days. Said to be the largest thermometer plant in the world, the factory was located on a ridge whose slopes formed a highly biodiverse forest ecosystem, (known as the Pambar Sholas) which also formed part of a watershed that drained into the picturesque Pambar river. (See Exhibit IV)

The thermometer factory imported mercury mostly from the United States and Spain, and glass from Germany and other countries. The factory cut and exported various types of finished thermometers to customers in USA, Latin America and Europe. The factory was split into two main sections. The first consisting of areas 1&2 took long stem glass and

[5] Interview with case writer in Mumbai on May 19, 2004.

tubes, cut and converted them into empty thermometers. The glass scrap from these areas did not contain mercury. It was packed in corrugated cartons and had either been disposed of or was held in the customs bonded storage area on site. Between 1987 and 1989, approximately 45 tons of mercury free scrap were also buried in four shallow pits on the site, after obtaining the prior written permission of the customs and excise authorities.

The second consisting of areas 3&4 filled the thermometers with mercury, marked the scale, sealed the end and packed the thermometers. The glass scrap from these areas contained residual mercury and during the period 1984 until 1990 had been stored in the rooms of a separate building called bakery on the plant site. This untreated glass scrap contained an estimated 5.97% of residual mercury by weight. Subsequently, HLL had taken steps to recycle this mercury. (See Exhibit V for more details of the manufacturing process).

In 1990, HLL started recovering mercury using a crusher and twin recovery ovens. Approximately 68 tonnes of glass scrap from areas 3 and 4 were processed until 1998. However, this operation was not efficient. After treatment, the residual mercury in the scrap was estimated to be 1.04%. The glass was stored for further processing for mercury recovery. In early 1999, a new crusher and vacuum activated mercury recovery plant was commissioned. This new plant was able to process 80-100 kg/day of scrap glass and reduce the residual mercury to about 0.15%. This scrap too had been stored at site for further mercury recovery.

Sale of glass scrap to industrial glass recyclers commenced in 1992. A total of 98.3 tonnes of scrap was sold during the period 1992-99 and comprised 49.4 tonnes of glass scrap from areas 1&2 which contained no mercury. In addition to this, 43.6 tonnes of mercury recovered glass scrap (approximately 1.04% residual mercury) and 5.3 tonnes of enhanced mercury recovery glass scrap (residual mercury 0.15%) from areas 3&4 were also sold. The last sale in November 1999 of 5.3 tonnes of mercury recovered glass scrap from areas 3 & 4 had been made to a scrap dealer. This was the material found at the scrap yard in Moonjikal.

Handling mercury with care

Mercury needed careful handling in view of its toxic nature. Mercury turned into vapour at ambient temperature. Inhaling mercury vapours or ingesting mercury beyond prescribed limits was likely to cause serious injury to the human body. When inhaled in excess, mercury could accumulate in the kidneys and brain and cause serious disorders of the nervous system and kidneys. The human body excreted mercury slowly. Typically, half of the mercury which might have been taken into the body was excreted in 60 days. If the level of exposure was low to moderate, natural recovery could take place. But high levels of exposure could cause brain or kidney damage.

Under Waste Category No. 4 of the Hazardous Waste (Management and Handling) Rules of 1989, any operation that generated more than 5 kg of mercury per year was considered hazardous. The site management had to ensure proper collection, reception, treatment,

storage and disposal. After an amendment on January 6, 2000, wastes were considered hazardous by the regulatory authorities if the mercury concentration exceeded 50mg/kg. (See Exhibit VI for more details of Indian Environmental laws).

The applicable Occupational Heath and Safety Regulations (Tamil Nadu Factory Rules) prescribed a ceiling of 0.05 mg/m^3 of mercury in the working atmosphere. Since the inception of the Kodaikanal plant, the mercury concentration in the workplace had been monitored regularly[6].

There were about 20 air-monitoring locations spread across the mercury area, non-mercury area, distillation room, crushing room and a few areas outside the workplace. The objective was to control mercury in the atmosphere to less than .05mg/$m^3$of air through a combination of measures. Twenty five exhaust fans had been fitted along the southeastern wall of the mercury area (to turn over the 15,145 cubic metres in the area every 45 minutes for 16 hrs/day for 310 days a year), six exhaust fans along the northeastern wall of the mercury crusher building (for an air change of 288 cubic metres in the area every 5 minutes for 24 hrs/day, 310 days per year) and five exhaust fans had been provided along the southeastern wall of the mercury distillation building (for an air change of 166 cubic metres in the area every 4 minutes for 8 hrs/day, 310 days per year). HLL believed these exhaust fans were more than adequate to keep the mercury levels in the work place sufficiently low.

HLL had put in place detailed systems and controls to deal with disposal /processing of glass scrap and for the storage of wastes. To prevent any mercury from broken thermometers from evaporating, the factory floor was constantly washed with water. The washed water from the plant was led to a dedicated effluent treatment plant, where the sludge was dewatered before being packed in plastic drums and stored on site under cover. Vacuum cleaners equipped with water seals were used to collect broken thermometers whenever breakages occurred. Workers were provided with safety masks to keep out mercury vapors. Finally there was an emergency procedure. All windows were opened and the entire floor cleaned with water, when the mercury vapour concentration in air exceeded 0.05 mg/m^3.

Health Monitoring

To monitor the health of workers, HLL used what it believed to be the most scientific method available – measurement of mercury level in the urine, every month, using an atomic absorption spectrometer, as per WHO standards. Any worker with mercury content in urine exceeding 100 micrograms/litre was kept away from the mercury section to allow mercury content to fall to acceptable levels. Typically, this happened within one or two months.

Employees also underwent a comprehensive annual clinical examination with specific emphasis on the oral cavity, lungs, cardiovascular system, the eyes, skin, kidneys and the central nervous system (See Exhibit VII). The medical tests included blood tests and

[6] Using a gold film mercury vapour analyser [Jerome Sampler], calibrated annually by the manufacturer

routine urine examination for albumin, red blood cells, casts, crystals and sugar. Records of all the 130 employees were available from 1988 onwards. Medical records of 184 employees/casual/contract workers who had left the company and of others whose services had been terminated in the recent past were also available.

Individual and group analysis of biological monitoring over the past 15 years had not revealed any cause for concern. Group means were well below the WHO recommended figure of (mercury in urine) 50μg/L. Over the period 1998 to 2001, they showed an annual range between 13 and 32μg/Lit.

Urine examination conducted in March 2001 revealed that mercury concentrations were well below the limit of 100 micrograms/litre. Of the 255 people (including current employees, ex-employees, contract employees and workers from the Munjikal scrap yard) included in the survey, 3% had between 40 and 60 micrograms/litre, 3% between 30 and 40 and 94% less than 30 μg/lit. A further survey, undertaken in May 2001, also did not reveal any problem relating to the health of workers. As compared to a mean Hg level of 23.1 μg/Lit in March 2001, the levels had come down to a mean of 10.1 μg/Lit in May 2001.

Statutory inspections and health assessments by the factories inspectorate of the government had also not found any mercury-related ill-health problems among the employees. In August 2001, the certifying surgeon, who conducted a health survey concluded: "The overall study reveals that the employees are healthy and sound".

NGO activism

Looking back, the facts seemed to indicate that in January 2001, a drum containing empty mercury bottles in a part of the Shola forests within HLL's property had been discovered by Navroz Mody, a local resident and Greenpeace activist. This discovery seemed to trigger off Greenpeace's activist role in the subsequent months.

On March 7, a few residents of Kodaikanal, and activists of Greenpeace, demonstrated at the factory gates. They cordoned off the scrap yard in Moonjikal, which they alleged, contained tons of mercury-containing toxic wastes from the HLL factory. They confronted the factory management with photographs of visible mercury-contaminated glass scrap and demanded immediate stoppage of mercury use in the thermometer factory. The NGOs wanted a full investigation into the extent and nature of mercury pollution caused by the factory within its premises, and in the surroundings. They insisted on a clean up of the dumpsite. The activists wanted HLL to compensate them for the loss in quality of life and acceptance of responsibility and financial liability for the damage caused to the workers, community and environment of Kodaikanal and the surrounding Palni Hills.

According to the NGOs, the contaminated glass scrap, which had been detected, was not the only toxic waste that had been inadvertently removed from the factory in breach of established procedures. They charged that at least 30 more tons of mercury-containing

wastes had been sold illegally to recyclers in various parts of South India. Some unsuspecting buyers had even used the glass to make marbles for children.

The NGOs quoted one of the dealers who bought scrap from HLL[7], "I went to pick up scrap from the factory, and they [HLL] said I would get the other scrap only if I took the broken thermometers. Nobody told me it was illegal or that mercury is dangerous. Last year, my boys collected about half a liter of mercury but I don't know what happened to it." The toxic waste had apparently been sold to him at about Rs 1250 per ton (US $25)[8].

HLL's response

After the news of the mercury leakage reached HLL headquarters, the management sprung into action and decided to suspend operations at the plant on March 8, 2001. Detailed investigations by HLL revealed that the basic manufacturing process was safe. Indeed, the process had been audited as such both internally by HLL and by the Tamil Nadu State authorities. There were clearly defined systems in place for recycling glass scrap, which took full account of the difference between clean glass scrap (generated in areas 1&2) and glass scrap containing traces of mercury (generated in areas 3&4). But the investigating team consisting of Gupta, Bhaskar, Dave and Sood discovered that these procedures had been violated. This had resulted in disposal of scrap glass containing traces of mercury (about .15%), in November 1999 to a scrapyard in Munjikal. HLL's investigations revealed that the leak had been detected by NGOs in October / November 2000, but they had decided to bring it to the notice of HLL only on 7th March 2001.

With evidence indicating that glass scrap containing mercury had left the factory, HLL immediately informed the relevant statutory body, the Tamil Nadu Pollution Control Board (TNPCB). Those responsible for breaching the clearly laid down procedures (and who by then were working in other units/parts of the company) were identified and subjected to disciplinary action leading to their separation from the company. R John George, who was then based in Hyderabad was appointed as the factory manager. John's brief was to handle the situation in a hands on way, showing full sensitivity to the concerns of the local community. John recalled[9], "I was probably chosen because I had no reason to defend the past. I also knew the local language."

On March 11th 2001, immediately after the decision to suspend operations at the plant, HLL decided to appoint URS Dames Moore, of Australia, for conducting a detailed environment audit. On March 15th, URS representatives arrived in Kodaikanal. By May 2001, URS had submitted its preliminary report.

HLL also engaged the services of Dr. P.N. Viswanathan (Retd) Director Grade Scientist, Industrial Toxicology Research Centre (CSIR-ITRC), Lucknow, to study the

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[7] Nityanand Jayaraman, "Unilever's Mercury Fever," special to Corpwatch, October 4, 2001. www.earthrights.org

[8] According to HLL, Mody a key activist representing Greenpeace at that time, had purchased 60 kgs.of this scrap much before (approximately six to nine months). On HLL's repeated demands he returned a part of the material. HLL added it was not aware of what he subsequently did with the remaining material.

[9] Interview with case writer at Kodaikanal, June 2004.

environmental and health aspects pertaining to Kodaikanal factory. On the basis of his visit to the site and study, Viswanathan came to the conclusion that "there is no evidence to show any ecological or human risks due to mercury release from the unit." His report (submitted in March 2001) explained the reasons for his conclusions[10].

TNPCB set up a Working Committee (See Exhibit XI for composition of the committee and a brief account of the committee proceedings) to monitor the whole episode. In a meeting of the committee, held on May 28-29, 2001, HLL announced it was permanently closing the thermometer factory. HLL maintained that this decision was taken to freeze manufacturing operations to investigate the breach in the systems, if any, due to external pressure. HLL added the decision was also in line with the company's business strategy to withdraw from all non-core businesses. This decision had been made well before the incident in Kodaikanal took place.

After receiving a formal authorisation from the working committee on June 20, 2001, HLL brought back the glass scrap lying at the Moonjikal scrap yard to its factory. This was done under the supervision of the local community and the authorities as per a detailed protocol designed by URS and approved by the Working Committee. A company statement dated June 21, 2001 explained: "Hindustan Lever Limited has retrieved, for secure storage at the site, the 5.3 tonnes of mercury containing glass scrap currently stored on a scrap dealers premises in Kodaikanal, which had been inadvertently removed from the factory in breach of established procedures."

Greenpeace representatives commented that the company's decision to clean up the scrapyard was "a clear admission of its guilt.... the Kodaikanal dumpsite is only a small portion of the company's toxic liabilities. The company's shoddy disposal of mercury wastes exposes its scant regard for the environment in countries like India where the environment regulation is lax." Greenpeace maintained that the amount of damage caused by mercury pollution was far heavier, than was being projected by HLL.

Environment & Health Audit

In March 2001, HLL issued advertisements inviting all connected people to come for medical examination. The examination was conducted on the basis of a questionnaire developed by the US Department of Labor, Mines, Safety and Health Administration for medical surveillance and biological monitoring for miners exposed to Arsenic, Cadmium, Lead and Mercury. The clinical evaluation was supplemented by the analysis of mercury in blood and urine (through Inductively Coupled Plasma Emission Spectrometer (ICP)), the analysis of blood for hemoglobin, urine analysis for albumin and sugar, as well as the estimation of blood urea and serum creatinine (as markers for kidney functions). This clinical evaluation did not reveal any case of individual abnormality attributable to mercury exposure. No cases of gingivitis (inflammation of the gums), stomatitis (inflammation of the mucous membrane of the mouth) or skin conditions attributable to

[10] Dr. Viswanathan, an acknowledged international expert in the eco toxicology of mercury, had been a part of the World Health Organisation's Task Group on Environmental Health Criteria for mercury.

mercury exposure were found. The nervous system examination covering visual disturbance, abnormal reflexes, sensorineural disorders and coordination also did not reveal any abnormality in the employees surveyed.

In May 2001, at the specific instance of Greenpeace and TNPCB, HLL invited a reputed environment consultant and toxicology expert, Tom Van Teunenbroek of TNO-MEP to conduct an environmental and health audit.

In line with Teunenbroek's recommendations, HLL conducted additional tests. Based on the data collected and detailed analysis, Teurenbroek certified that there had been no harmful exposure to mercury amongst the employees of the Kodaikanal factory leading to chronic or acute mercury poisoning. Teunenbroek also expressed satisfaction with the methodology used for biological monitoring.

Teunenbroek concluded that there was no mercury related health risk to the employees: "I have, however, recommended a follow up study of those employees who have shown[11] elevated levels of mercury compared to the mean. This is recommended to ensure if there are other sources of mercury exposure, which could explain these deviations. However, it must be noted that even these results are still well below the WHO recommendations of an upper limit of 100 microgram/litre."

Greenpeace and the other NGOs were, however, not fully satisfied with Teunenbroek's findings. Greenpeace argued that as little as 1 gram of mercury deposited annually in a lake, in the long term, could contaminate a lake spread over 25 acres and make fish from the lake unfit for human consumption. The NGOs charged that HLL's behavior violated the environmental principles of the Global Compact (See Exhibit-III), that required signatories to "support a precautionary approach to environmental challenges" (Principle 7); "undertake initiatives to promote greater environmental responsibility" (Principle 8); and promote the "diffusion of environmentally friendly technologies" (Principle 9). Allegations that the company had employed double standards in relation to worker safety indicated a violation of Principle 6: "the elimination of discrimination in respect of employment and occupation." The bulk of the disposal of glass scrap had occurred before the Global Compact came into existence. However, the NGOs believed at least some of the disposal and all of the denials and "cover up" had taken place after the company joined the Compact.

The NGOs also took issue with the health surveillance findings published by HLL. The NGOs mobilized some former factory workers who criticized HLL's casual attitude towards worker safety on the shop floor[12]. "When I worked there, they used to suck up the mercury from the floor using a vacuum cleaner once a day. In another section, where they heat thermometers in an oven, workers are exposed to gusts of mercury vapor every time the oven door is opened," stated an ex-employee who had been active in organizing the workers against HLL's occupational safety practices.

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[11] HLL's internal documents

[12] Nityanand Jayaraman, "Unilever's Mercury Fever," Special to corpwatch, October 4, 2001. www.earthrights.org

To support their stand, the NGOs drew attention to a preliminary health survey conducted[13] in July 2001, by the Bangalore-based Community Health Cell.[CHC] Based on their survey of 30 workers and ex-workers, CHC had reported that there were many people with "gum and skin allergy related problems, which appeared to be due to exposure to mercury." The survey added that there was a high rate of absenteeism and resignations from the job owing to health problems. "The preliminary assessment... indicates that there is a need to assess all the exposed workers in greater detail for health effects of mercury," the experts[14] concluded. HLL managers mentioned that they had repeatedly asked for the details of this study from the CHC but no details had been received.

The results of the biological monitoring by HLL indicated that the employee group average urine mercury levels had been in the range of 15 -32 μg/Lit. These levels were well within the acceptable group limits of 50 μg/Lit for mercury in urine as laid down by the World Health Organisation (WHO) (See Exhibit-VIII).

The protocol for epidemiological surveillance for this study and for the review of the health surveillance conducted over the life of the factory (biological monitoring, workplace environmental monitoring, shop floor health and safety practices and clinical evaluations), had been independently studied and validated by Teunenbroek.

After Dr T Rajgopal, HLL's Vice President (Medical & Occupational Health) made a detailed presentation to the prestigious All India Institute of Medical Sciences (AIIMS) on the study, Dr Chandrakant S Pandav, a senior professor of AIIMS wrote, "Your presentation was a learning experience for the Post-Graduate and Post-Doctoral students who attended it. We look forward to receive a copy of the report and also urge you to publish the study in an international peer reviewed journal so that the larger fraternity of epidemiologists and occupational health specialists can benefit from your team's systematic and scientific approach to the issue."

Pandav also mentioned in his certificate (dated November 10, 2001), that the occupational health and safety measures in place at the Kodaikanal factory had succeeded in keeping the exposure of the factory employees to mercury within low levels. There was no evidence to suggest any adverse health effects that could be attributed to mercury exposure.

HLL executives also pointed to an expert committee report dated January 10, 2002, prepared by Indian Association of Occupational Health (a team of IAOH had visited the site in December 2001 to assess the situation). This report mentioned, "In view of the comprehensive occupational health measures in place and after a thorough review of the systems, procedures and findings of biochemical and clinical evaluation, the expert group believes that the health complaints like gum and skin involvement attributed to mercury

[13] By Dr. Praveen & Dr, Mohan Isaac, CHC, Bangalore.
[14] Nityanand Jayaraman, "Unilever's Mercury Fever," Special to Corpwatch, October 4, 2001. www.earthrights.org

exposure by some former workers may be unrelated to their past employment in the thermometer factory and other factors may be responsible for such common skin and gum morbidity."

The Final Report of URS also concluded that, based on the available soil and water data and the medical surveillance data, the risks to human health during the operation of the plant had been insignificant and negligible. Tests conducted by URS also confirmed that there had been no mercury accumulation or impact on the ecology of the famous Kodai lake arising from the factory operations. The measurements on fish in the lake indicated that the concentrations of mercury were comparable to typical concentrations in freshwater fish as recorded in published studies (See Exhibit IX).

URS provided a detailed material balance of mercury, to relate the quantity brought into the factory over the last 18 years, the quantity exported out in finished thermometers, quantity of mercury in stock, and quantity of mercury in scrap. The remaining amount represented the mercury spillage into the environment. The material balance took into account the different types of thermometers made, locally purchased as well as imported mercury and the various ways in which mercury could have leaked into the environment. The exhaustive calculations showed that even going by the worst assumptions, less than 1% of the 136.5 tonnes of mercury brought into the factory over the last 18 years had been released into the atmosphere and that too primarily through vaporisation. This translated into a discharge of approximately 75 kg per year (See Exhibit X for more details of the material balance calculations), a figure that compared favourably with the estimated 140 tonnes released every year in USA from sources like coal-fired power stations, incinerators, and chlor alkali production plants.

Remedial Action

HLL announced it was ready to bear all the necessary expenses for exporting the mercury to USA for mercury recovery. HLL also finalized plans to recycle the accumulated scrap containing mercury, the ETP sludge & waste, decontaminate the equipment and dispose it as scrap and undertake site remediation where high levels of mercury in soil had been identified.

The TNPCB Working Committee began to supervise and monitor the remediation activities. The Working Committee accepted the URS report, which also included a detailed plan for the remediation.

URS tests revealed that mercury at concentrations between 0.1 and 10 mg per kg had been found deposited at shallow depths within the factory premises, and in limited areas to the immediate north and the south of the site, primarily from air-borne mercury during the factory's operation over 18 years. URS felt the mercury levels in these areas would decrease naturally over time, and did not require remediation. But there were other spots inside the factory, where the soil did require remediation. HLL decided to remediate the site to 10 mg per kg or lower as per the guidelines prescribed in the Netherlands for land for residential use. These guidelines were considered to be among the most stringent in

the world. The quantity of soil requiring remediation was estimated to be 4000m^3, containing roughly 290kg of mercury.

At the Working Committee meeting on October 11, 2002, HLL submitted that it had been holding discussions with the US based Bethlehem Apparatus Inc., (a company approved by the US Environmental authorities), for exporting mercury containing material, and its subsequent recycling /disposal. HLL offered to export all the mercury containing glass scrap stored at site under Customs Bond ever since the factory had commenced operations in 1983 and the sludge generated in the effluent treatment plant. Raw material elemental mercury at site and finished/semi-finished thermometers would also be exported.

HLL made considerable effort to persuade both the Indian and the US Governments to permit the export. This became necessary since the US was not a party to the Basel Convention. At HLL's request, the two Governments signed a bilateral agreement for the export of mercury and the union Ministry of Environment & Forests, granted permission for the export. HLL drew up with the help of URS, an elaborate protocol for the repacking and labelling of the mercury containing materials and their safe transportation to Tuticorin port in South India for subsequent shipment to the US. Guidelines were also framed to ensure the necessary safety of personnel engaged in this operation and the monitoring of their health. This protocol was submitted to TNPCB, who on March 12, 2003 granted necessary permission for this operation. By the end of May 2003, the company had exported about 300 tonnes of the material for reprocessing.

Bhaskar recalled[15], "We decided to export the waste to the world's best recycler of mercury scrap Bethlehem Apparatus. We incurred heavy expenditure, exporting the entire scrap, the effluent treatment sludge and the elemental mercury. We could have sold the elemental mercury to bonafide users in the country. Many chlor alkali plants, use tons of mercury every year and they all import it since India doesn't produce it."

With the export of hazardous waste duly completed, the focus shifted to dismantling the equipment and soil remediation. For decontamination of contaminated equipment in the factory premises, HLL prepared a detailed protocol, which was validated by environmental expert, Prof. Shyam Asolekar of IIT Bombay, after a first hand assessment of the Kodaikanal factory. HLL planned to store temporarily the excavated soil and the rubble from the demolished buildings within the factory premises until an appropriate site for disposal or intermediate storage pending disposal was identified by TNPCB. Once a suitable disposal site was identified, the drums would be loaded into trucks and transported. The proposal was still pending with TNPCB in mid-2004.

Labour Issues

People who had worked at the site had been requested to participate in the medical testing programme. Many did so and their reports too were available with the Chief Medical Inspector of Factories, Tamil Nadu. On the advice of the Working Committee, the results

[15] Interview with case writer, May 19, 2004

of the Medical Surveillance Study of employees had been shared with the Department of Labour and Government of Tamil Nadu's Chief Medical Inspector of Factories.

The Deputy Chief Inspector of Factories (Certifying Surgeon), Government of Tamil Nadu (Provincial Government for Kodai) who was the appropriate authority in these matters, conducted an independent health survey and concluded in his report that "the overall study reveals that the employees are healthy and sound."

The Working Committee approved HLL's decision to close the factory. It was also agreed that some employees be retained to tidy up the site and to use contractors to build further infrastructure including silt traps to prevent rainwater run-off of any mercury contaminated soil from the site.

The decision not to resume operations at Kodaikanal was communicated to the employees along with an offer to redeploy all of them in another HLL factory in Kandla, Gujarat in western India. Some workers protested at the decision and occupied the factory premises for three days. Even though HLL offered full protection of their current earnings, they were not keen on the redeployment offer. They preferred to reside in Kodaikanal and insisted on a separation package. Some of them were quite bitter at the proposal to transfer them. As one of their representatives mentioned[16], "This act of mass transfer is nothing but an act of victimization. The transfer orders have been issued close on the heels of the persistent demand of all of us to you to disclose the health records of all the workers, which you admittedly maintained over the years."

The matter was referred to the Deputy Labour Commissioner (DLC), Dindigul. Even as the discussions were on, HLL officials sensed that the NGOs were pressing the workers to ask for a higher package. As a senior executive mentioned, "At one stage, the NGOs demanded that even ex employees must be given an ex-gratia payment of Rs. 5 lakhs each". Finally, after the tripartite discussions between the employees, employer and Government, a separation package several times higher than what was provided for in the prevailing statutes, was finalised. Following this, all 130 employees opted for voluntary separation by entering into individual settlements with the company. HLL requested the DLC to invite the certifying surgeon from the factories inspectorate to be present at the time of the signing of the agreement when the medical records were made available to address employee apprehensions on their health. In the settlement signed in the presence of the DLC, the workmen /union expressed satisfaction with their health status.

The road ahead

Despite all the efforts made by HLL to mitigate the impact of mercury leakage into the environment, and the future plans it had announced, the Kodaikanal plant continued to engage the attention of NGOs. At a conference organized by Greenpeace in Chennai on April 10, 2004, Dr Mohan Isaac, President of the Community Health Cell and Head of Psychiatry, National Institute of Mental Health and Neurosciences, Bangalore presented a paper on the Health effects of mercury exposure on HLL thermometer factory workers.

[16] "Take Action for Unilever workers in India exposed to mercury," People's Union for Civil Liberties, November 9, 2001. www.corpwatchindia.org

Isaac's findings were based on a site visit in 2001, during which his team had examined 30 workers of HLL. During this assessment, the team had considered work history, duration of exposure to mercury, history of workers' symptoms and the general physical and mental status of each worker. They reported instances of bleeding / inflamed gums, shaking / falling of teeth, skin problems, besides non-specific, functional symptoms such as weakness and tiredness. They also found some cases of infertility and renal problems. Citing Isaac's findings, the NGOs vociferously criticized HLL[17].

At the seminar, a former employee from the HLL factory, presented statistics to argue that the company had attempted to manipulate data about its mercury balance. HLL had reported total mercury lost into the environment of about 1750kg (1353kg into the Shola and 396 kg in soil and sediment). According to the employee, total mercury lost into the environment was 17,655 Kg. The employee ended his presentation with the demand that HLL must present before TNPCB all documents produced to URS, for verification.

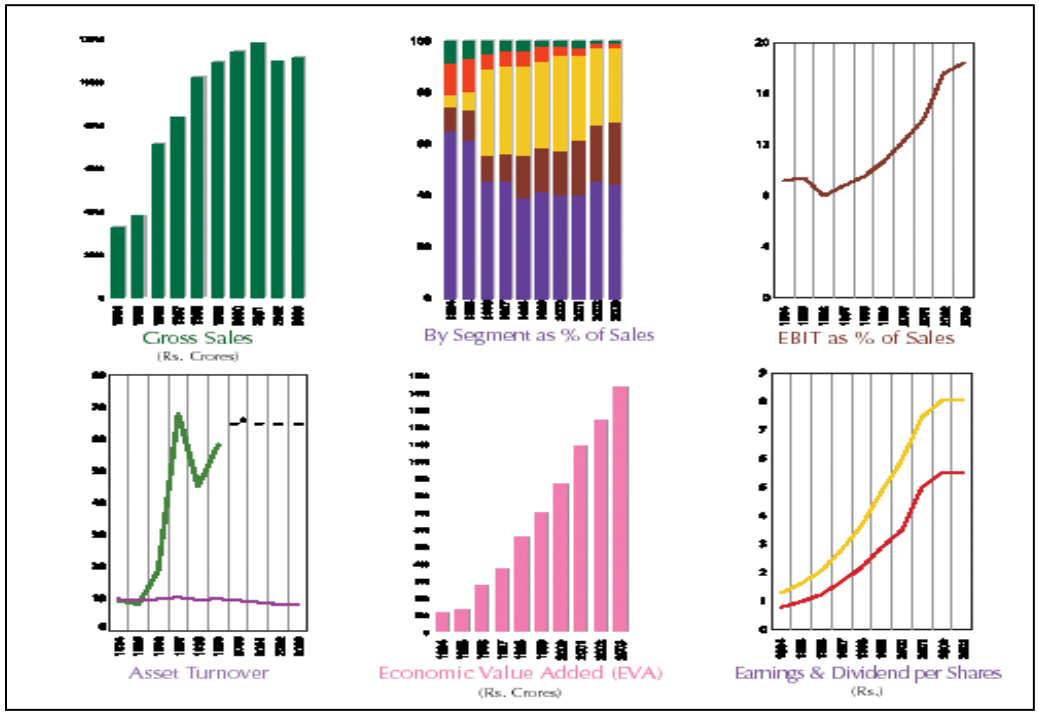
HLL had proposed remediation of soil in line with the Dutch intervention standard of 10 parts per million (ppm). But Greenpeace insisted on bringing it down to 0.3 ppm, the level in virgin forests. HLL felt this was an unreasonable demand because the factory was located in an approved industrial site.

HLL's management believed it had done all it could to bring the incident to a close. The company had invested substantial time and money in responding to the situation that had resulted following the mercury leakage. The amount invested had far exceeded the total profits generated by the plant over the entire period of operations. Yet, things were moving far too slowly. HLL wondered what more was needed to be done to close the Kodaikanal chapter once and for all.

[17] But according to HLL, none in the group of these 30 subjects were found to have major neuro-psychiatric problems. HLL mentioned it had written to the CHC for details of their study but none had been provided.

Exhibit I

Hindustan Lever Ltd: Performance Trends 1994-2003



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
# Gross Sales (Rs. Crores)	3,240	3,775	7,120	8,343	10,215	10,918	11,392	11,781	10,952	1,1096
By Segment % of Sales										
Soaps, Detergents & Household Care	65	61	45	45	39	41	40	40	45	44
Personal Products	9	12	10	11	16	17	17	21	22	24
Foods	5	7	34	34	35	34	37	33	30	29
Chemicals, Agri, Fertilizers & Animal Feeds	12	13	6	6	6	6	4	3	2	2
Others	9	7	5	4	4	2	2	3	1	1
EBIT as % of Sales	9.2	9.4	8.0	8.8	9.5	10.7	12.3	14.0	17.6	18.4
Fixed Assets Turnover (times)	9.9	9.5	9.9	10.5	9.7	10.0	9.5	8.9	8.3	8.1
Working Capital Turnover (times)	9.5	8.3	18.8	68.2	45.2	58.3	~*	~	~	~
Economic Value Added (EVA) (Rs. Crores)	107	126	272	365	548	694	858	1,080	1,236	1,429
E.P.S. of Re. 1 @	1.30	1.64	2.08	2.81	3.67	4.86	5.95	7.46	8.04	8.05
D.P.S. of Re. 1 @	0.80	1.00	1.25	1.70	2.20	2.90	3.50	5.00	5.50	5.50
PAT / Net Sales (%)	5.9	6.3	5.8	7.0	8.2	9.8	11.5	13.1	15.8	16.3
R.O.C.E. (%)	48.5	49.1	52.9	61.1	58.7	61.8	64.6	62.4	59.4	60.2
R.O.N.W. (%)	35.3	37.5	41.6	46.0	48.9	50.9	52.7	53.9	48.4	82.8

Sales before excise duty. @ Adjusted for bonus issue. * Denotes working capital is negative.

Source: HLL Annual Reports

Exhibit: II
Executive Responsibilities and Environmental Management of Unilever

We have an environmental policy that applies to all Unilever companies world-wide. Our policy sets out our commitment to meet the needs of customers and consumers in an environmentally sound and sustainable manner, through continuous improvements in environmental performance in all our activities.

Our environmental strategy focuses primarily on achieving its goals through eco-efficiency in manufacturing, eco-innovation in our products, and our three sustainability initiatives on agriculture, fish and water. Furthermore, we intend to give a sharper focus to three areas:

First, we need to connect better with society on environmental care and ensure that we understand evolving expectations. Make the most of our eco-manufacturing skills across the wider supply chain, including third-party product suppliers, providers of key raw materials, and transportation.

Ensure that environmental sustainability is firmly embedded in everyday decision making. To implement our policy and strategy we have a clear line of responsibility for the environment, starting at the top of the company. The Unilever Chairmen and Executive Committee develop strategic policies for environmental issues, with overall operational responsibility located in the Foods Division and Home & Personal Care Division. Daily responsibility for management and oversight of environmental issues and policy implementation rests with the local management of the operating companies in the respective countries.

Support to the business is provided by:
The Unilever Environment Group (UEG). This is the strategy and policy-making group that carries the environmental responsibility on behalf of the Board. Chaired by Clive Butler, Corporate Development Director, its role is to ensure that we honour our commitment to contribute to the environmental pillar of sustainable development and to continuously improve our environmental performance. The UEG is made up of individuals from the Divisions / Business Groups and corporate expertise on safety, health, environment and communications. In 2002, we had four external advisors in the UEG who contribute valuable independent views on our plans and advise on emerging and long-term environmental issues. Advisors meet twice a year as part of the UEG and individually with senior management and scientists.

Source: www.unilever.com

Exhibit: III
UN Global Compact

In an address to The World Economic Forum on 31 January 1999, United Nation Secretary-General Kofi Annan challenged business leaders to join an international initiative – the Global Compact – that would bring companies together with UN agencies, labour and civil society to support nine principles in the areas of human rights, labour and the environment. The Global Compact's operational phase was launched at UN Headquarters in New York on 26 July 2000.

Through the power of collective action, the Global Compact sought to advance responsible corporate citizenship so that business could be part of the solution to the challenges of globalisation.

Thus Global Compact is a voluntary corporate citizenship initiative with two objectives:

- Mainstream the nine principles in business activities around the world
- Catalyse actions in support of UN goals

The nine principles are:

Human Rights

- Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights within their sphere of influence; and
- Principle 2: make sure that they are not complicit in human rights abuses.

Labour Standards

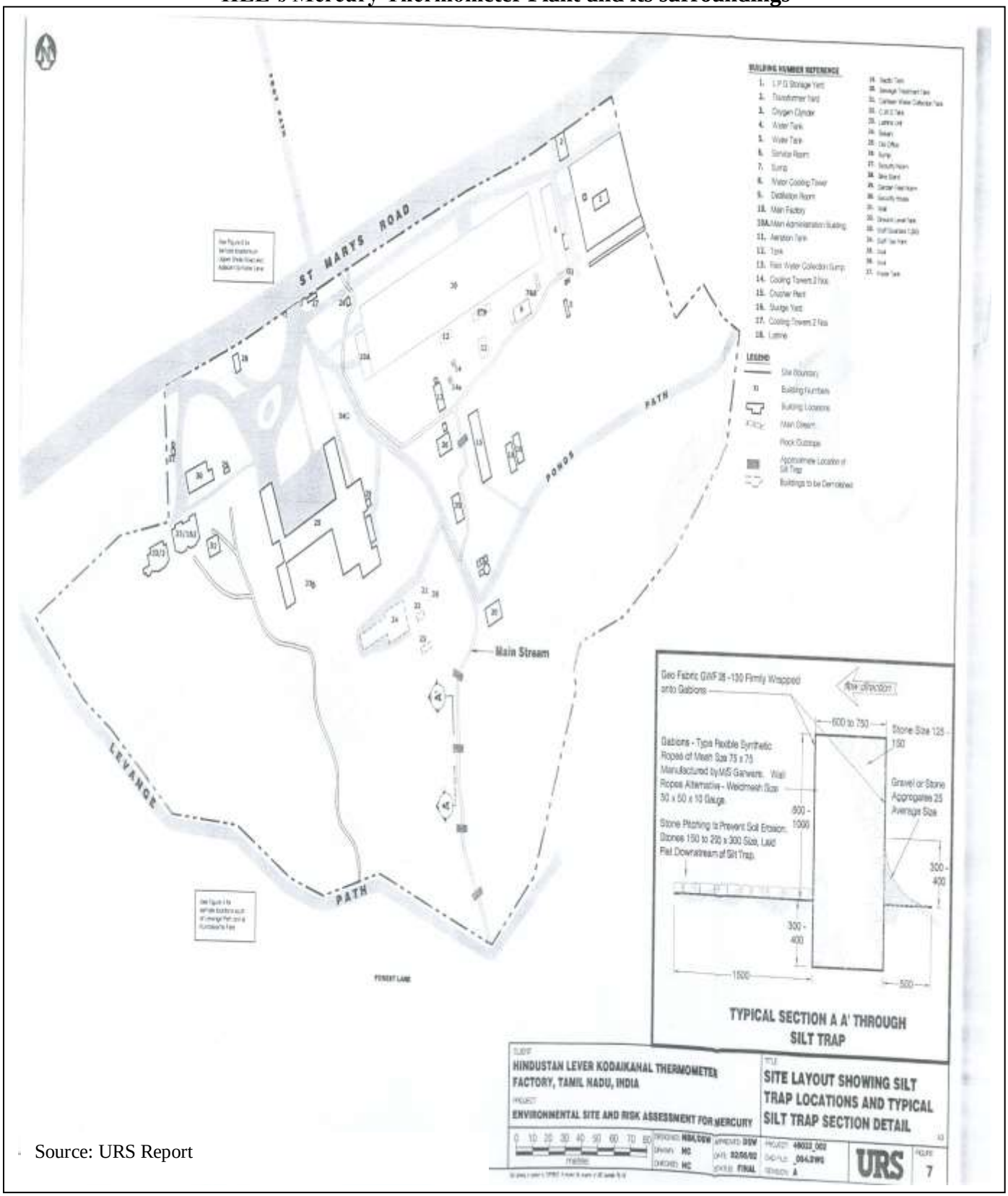
- Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
- Principle 4: the elimination of all forms of forced and compulsory labour;
- Principle 5: the effective abolition of child labour;
- Principle 6: eliminate discrimination in respect of employment and occupation.

Environment

- Principle 7: Businesses should support a precautionary approach to environmental challenges;
- Principle 8: undertake initiatives to promote greater environmental responsibility;
- Principle 9: encourage the development and diffusion of environmentally friendly technologies

Source: www.unglobalcompact.org

Exhibit: IV
HLL's Mercury Thermometer Plant and its surroundings



Source: URS Report

Exhibit V
Details of Glass thermometer manufacturing process

Process #1 (a): Stem cutting

The stem glass with capillary equivalent to 10 thermometers length is cut into five pieces (each of two thermometers length) after nipping the ends. The nipped ends are collected separately.

Process # 1 (b): End opening

Each stem glass is processed in end opening machine to form one "End Chamber", one constriction chamber on either side of the end chamber and a neck at the End chamber zone.

Process # 1 (c): End Cutting

End opened stem glass is then scored at the center of the "End chamber" and cut into two halves. The "End chamber", once cut at the middle, serves as a funnel shaped passage for smooth flow of the liquid from the bulb.

Process # 2 (a): Bulb forming

Bulb glass is cut into required length after nipping the ends. These pre-cut and washed bulbs are attached to the stem glass by heat fusing. Excess length of bulb tubing is then removed and collected separately.

Bulb formed thermometers are packed in a stainless steel pans with open end of stem down and annealed in an oven to relieve internal thermal stress.

Process # 3 (a): Mercury Filling

Stress relieved thermometers are loaded in a vacuum chamber to remove the air from the thermometer. Triple distilled mercury is poured into the pans at vacuum. Chamber is then pressurized with Nitrogen. Due to the pressure differential, mercury is filled in all the thermometers. Chamber is then depressurized through application of vaccum to ambient before opening.

Process # 3(b): Top chambering

A reservoir is then formed on top by sealing the open end of the stem glass and subjecting the hot glass to mercury expansion pressure. Care is taken to keep the mercury column level well below the sealing point.

Process # 3(c): Shake out

As a prerequisite for the next critical operation, viz., contracting, mercury is partially centrifuged into the top chamber.

Process # 3 (d): Contracting

The constriction chamber that is in the form of a blister is constricted (collapsed) from enamel side by applying flame on the enamel side in a controlled manner. This constriction acts as a single sided valve for peak hold mechanism of Clinical Thermometer.

Process # 3 (e): Air Removal

After contracting, mercury is filled back into the bulb by centrifuging. Then the entrapped air in the bulb is removed to the top chamber by various stages of chilling, vibration, warming out, shake off and boiling operation.

Process # 3 (f): Test For Shake

The thermometers are tested for proper shake down (to check the collapsed level of constriction chamber), by warming up to a fixed temperature and then shaking down at a rated force using a centrifuge. The length of the mercury column above the constriction is then measured using a special jig. Only thermometers with the column length as per the standard are sent to the next process and others are reprocessed.

Process # 3 (g): Scale Setting

Thermometers are warmed out to a specified temperature (41 °C) and the mercury column is cut at predetermined distance from the bulb using laser beam. The column above the cut is removed into the top chamber by centrifugal force.

Process #3 (h): Grading

After scale setting, thermometers are shaken down and then warmed out to a temperature (35 °C), other than the scale setting temperature. The column length at this temperature for each thermometer will differ due to the variation in the bulb volume. The difference in expansion is measured with the help of a jig and categorized into various grades.

Process #3 (i): Top Sealing

The graded thermometers are sealed just below the top chamber in order to prevent mercury in the top chamber from getting back to the bulb.

Process # 4(a): Screen Printing:

The thermometers are then printed with scale lines (as per the grade), numbers and brand name. Then the printed thermometers are cured in an oven to make the printing permanent. Curing is done in a specially designed oven that keeps the bulb below 30°C while heating the stem to 450°C.

Process #4(b): Top making:

The top chamber is removed from the printed thermometer by flame heating above the top seal point and different shaped top is formed as per the customer requirement (triangular top, dot top, colored top, etc.)

Process # 4(c): Certification:

Top cut thermometers are inspected for accuracy at various temperatures and for various other parameters such as shake characteristics, printing quality, etc as per the standard and the customer requirement.

Process # 4(d): Mercury Recovery:

All the top cut glass and the broken/off specified thermometers at various stages after mercury filling (called 3 & 4 glass cullets) are crushed. The mercury from the crushed glass-cullets is recovered by multiple processing in vacuum heating oven till such time the mercury content falls below the detectable level (Temperature of 460°C; Cycle time of 12 hours). Then the recovered mercury is reused in subsequent filling process after purification.

Process # 4(e): **Quality Assurance and Packaging:**

Each batch of thermometers is sampled and checked for quality. The thermometers are then classified and packed in different types as per the customer specification.

Source: HLL internal documents collected at Kodaikanal factory.

Exhibit VI
Environmental Legislation in India

General

The following environmental legislation sets out policies and regulations to control environmental pollution in India:

- The Air (Prevention and Control of Pollution) Act, 1981 and subsidiary Rules;
- The Water (Prevention and Control of Pollution) Act, 1974 and subsidiary Rules;
- The Water (Prevention and Control of Pollution) Cess Act, 1977 and subsidiary Rules;
- The Environment (Protection) Act, 1986 and subsidiary Rules.

Under the Environment (Protection) Act, all industries requiring a consent under Section 25 of the Water (Prevention and Control of Pollution) Act or under Section 21 of the Air (Prevention and Control of Pollution) Act or both, or requiring authorisation under the Hazardous Wastes (Management and Handling) Rules, 1989, are required to submit an environmental statement for the financial year ending 31 March in Form V to the State Pollution Control Board on or before 30 September every year.

Air Pollution Control

Air emissions are controlled by The Air (Prevention and Control of Pollution) Act, 1981. The State Pollution Control Boards (formed under Section 3 of The Water Act) are responsible for laying down, in consultation with the Central Board, standards for emissions of air pollutants from industries and any other source. The Environment (Protection) Rules 1986 provide the national standards for emissions and discharges of environmental pollutants from various sources. Since the States have not laid down more stringent standards, the national standards as prescribed in Schedule I of the Rules are applicable.

Prior to its amendment in 1987, The Air Act was enforced through mild court-administered penalties on violators. The 1987 Amendment strengthened enforcement and introduced stiffer penalties. Now, Boards may close down a defaulting industrial plant or may stop its supply of electricity or water. The Boards may also apply in court to restrain emissions that exceed prescribed standards. The Act has been extended to include noise as an air pollutant.

The Environment (Protection) Rules of 1986, with amendments up to April 1999, specify the standards of emission and or discharge of environmental pollutants from 80 industries, operations or processes. No standard has been established for mercury.

Water Pollution Control

The Indian legal system provides four major sources of law for addressing water pollution problems:

- Administrative permit system under the Water (Prevention and Control of Pollution) Act, 1974 and subsequent Rules of 1975 and amendments in 1978
- Provisions under the Environment (Protection) Act and Rules of 1986 relating to water quality standards
- Public nuisance actions
- Common riparian law.

The Water Act empowers the State Pollution Control Boards to:

- Establish and enforce effluent standards for factories discharging pollutants
- Control sewage and industrial effluent by approving, rejecting or conditioning applications for permission to discharge
- Minimise water pollution by advising on appropriate sites for new industry
- Prescribe standards for the discharge of effluent or quality of receiving waters
- Monitor compliance with permitted effluent discharge standards.

Prior to its amendment in 1988, enforcement under the Water Act was achieved through criminal prosecutions initiated by boards, and through applications to magistrates for injunctions to restrain polluters. The 1988 Amendment strengthened the Act's implementation provisions. Now, the Board may close a defaulting industrial plant or withdraw its supply of power or water by administrative order, penalties are more stringent, and a citizens' suit provision bolsters enforcement machinery.
Effluent standards have been stipulated under the Environment (Protection) Rules, 1986. The standards for discharge of mercury are as follows:

- Inland surface water: 0.01 mg/l (max)
- Public sewers: 0.01 mg/l (max)
- Marine coastal areas: 0.01 mg/l (max)

The Water Prevention and Control of Pollution Cess Act of 1977 was passed to help meet the expenses of the Central and State Water Boards. The Act creates economic incentives for pollution control and requires local authorities and certain designated industries to pay cess (tax) for water consumption. These revenues are used to implement the Water Act.

Hazardous Substances

The Manufacture, Storage & Import of Hazardous Chemical Rules, 1989. apply to industries that use or store specified hazardous chemicals. These Rules pertain to directives and procedures for:

- Storage of hazardous chemicals;

- Inventory of hazardous chemicals;
- Identification of major hazards posed;
- Preparation of on-site emergency plans;
- Workers' operational safety;
- Disclosure of product safety information in material data sheets.

Amendments passed in 1987 to the 1948 Factories Act have introduced special provisions on hazardous industrial activities. The 1987 Amendment, among other things, empowers states to appoint site appraisal committees to advise on the initial location of factories using hazardous processes. The Act also requires the occupier of a factory to maintain workers' medical records and employ operations and maintenance personnel who are experienced in handling hazardous substances. A Schedule to the Act prescribes permissible limits of exposure to toxic substances and requires the creation of safety committees to consist of workers and managers who are required to review a factory's safety measures periodically.

A review of the list of specified chemicals indicates that mercury, in the forms of alkyl mercury, mercury fulminate, and methyl mercury, are listed under these Rules.

Hazardous Waste Management

The first comprehensive rules to deal with hazardous wastes were issued in 1989 under the framework of The Environment (Protection) Act of 1986. These rules, The Hazardous Waste (Management and Handling) Rules apply to designated categories of waste generated in quantities exceeding specified limits, and provide for their proper handling, storage and disposal with the requirement for a permit.

Waste Category No.4 under the rules is mercury bearing waste. Any operation that generates more than a total of 5 kilograms per year (calculated as pure metal) must ensure proper collection, reception, treatment, storage, and disposal of this waste. Rule 3i(b) refers Schedule 2 of the Hazardous Waste Rules and was updated on 6 January 2000. Class A, and specifically Class A6, mercury and mercury compounds, is nominated as Hazardous Waste if the concentration exceeds 50 mg/kg.

Air Quality

The Indian Occupational Health and Safety Regulations for air quality in the Workplace specifies a maximum time weighted average of 0.05 mg/m3 of Hg. There are no regulations or guidelines for mercury in air emissions or ambient air.

Source: URS Report

Exhibit VII
Periodical Medical Evaluation
Thermometer Factory Kodaikanal

Serial number **Date**

Employee particulars

Name _____
Age _____ Sex M / F Token number_____
Marital status Single / Married Number of children _____
Height_____ Weight_____ Blood group_____
Current job _____
Years in the current job _____

General Health Questionnaire

Question	Yes	No
1. Do you currently smoke tobacco or have you smoked tobacco in the past one month? If yes year started smoking _____ Average number of cigarettes smoked per day _____ If ever smoked in the past then number of years smoked _____ Average number of cigarettes smoked per day in the past _____ 2. Do you currently chew tobacco or have done so in the past six months 3. Do you drink alcohol How many drinks per day _____ How many days/ week _____ Since when _____ If stopped, since when? _____ 4. Do you currently take any medications [Including indigenous medication] If yes then please list all medications taken _____ _____ 5. Have you ever been hospitalised? If yes please describe Date/Year_____ Reason for hospitalisation _____ Date/year_____ Reason for hospitalisation _____ 6. Family history of relevance Hypertension Heart attack Diabetes Cancer Mental illness Any other		

General Health Questionnaire (contd.)

Question	Yes	No
7. Has a doctor ever told you or are you aware that you have any of the following conditions: Seizures (fits) Diabetes High Blood pressure Past h/o Heart attack Asthma Tuberculosis Difficulty in micturition Blood in urine Kidney stones 8. Have you ever been issued a respirator for your job?		

Specific Health Evaluation

Mouth

Tongue_____ Teeth _____ [Look for caries]
Gingivitis [Y] [N] Stomatitis [Y] [N]

Eyes _____ Ears _____ Nose_____ Throat _____

Skin

Allergies if any _____
Rashes if any _____
Palms / soles any h/o peeling skin _____

Cardiovascular system

Questionnaire

1. Do you have frequent pain or tightness in your chest
2. Pain or tightness in your chest during physical activity
3. Pain or tightness in chest which interferes with physical activity
4. In the past two years have you noticed your heart skipping/missing a beat
5. Heartburn or indigestion that is not related to eating

Clinical evaluation

Pulse rate_____
Blood pressure_____
Heart sounds_____

Physician's comments (if any)

Specific Health Evaluation (contd.)

Respiratory system

Questionnaire

Do you suffer from any shortness of breath
Shortness of breath while walking up hill
Shortness of breadth at ordinary pace on level ground
Shortness of breath on dressing yourself
Any history of coughing which produces sputum
Coughing that wakes you up in the morning
Coughing that occurs while lying down
Cough with blood
Wheezing which interferes with your job

Clinical evaluation

Auscultation _____
Percussion _____
Any results of previous chest X-Ray [if done] _____

Abdomen

Questionnaire

Do you have trouble with diarrhoea
Do you have pain or cramps in your abdomen

Clinical evaluation

Inspection_____ Palpation [Liver] [Spleen] _____
Percussion _____

Genitourinary system

Questionnaire

For women

Do you have trouble with your menstrual periods
Have you had any menstrual irregularities
If yes provide details and treatment taken

For men

Do you suffer from any prostate related problem [elicit through symptoms]

Clinical evaluation

Findings on palpation – for kidneys_____
Any oedema_____

Central Nervous system

Questionnaire

Please elicit the answer as a yes or a no. If the answer to a question is yes, pl. ascertain the duration and magnitude of the problem.

Do you feel more tired than usual
Do you feel usually irritable
Do you have difficulty in remembering things?
Do you have difficulty in concentrating
Do you feel sad or depressed
Do you have trouble sleeping at night
Do you suffer from dizziness
Do you have any headaches
Do you have tingling / numbness in hands
Do you have tingling / numbness in feet
Do you have any tremors in the hands
Do you feel that you have any reduced coordination

Clinical evaluation

Finger nose test _____
Gait testing _____
Tremor testing _____
Reflexes
Biceps_____ Triceps_____ Knee_____
Ankle_____ Plantar_____
Sensory tests [to rule out Glove and Stocking types - loss of sensation]
Color discrimination testing
Vibration testing

Any other finding of significance (history or clinical evaluation)

_____
_____

Biochemical investigations

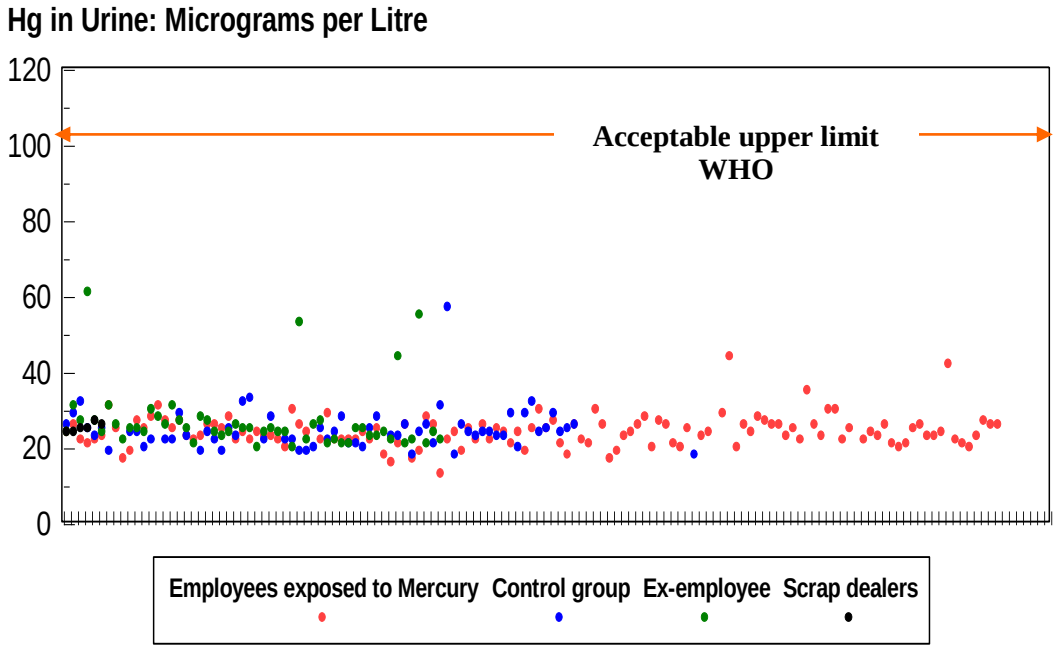
Mercury in Blood _____
Mercury in Urine _____
TC_____ DC_____ Hb%_____
Urine for Albumin _____ for Sugar _____
Blood Urea _____ Serum Creatinine _____

Name and signature of the Examining Physician _____

Source: HLL

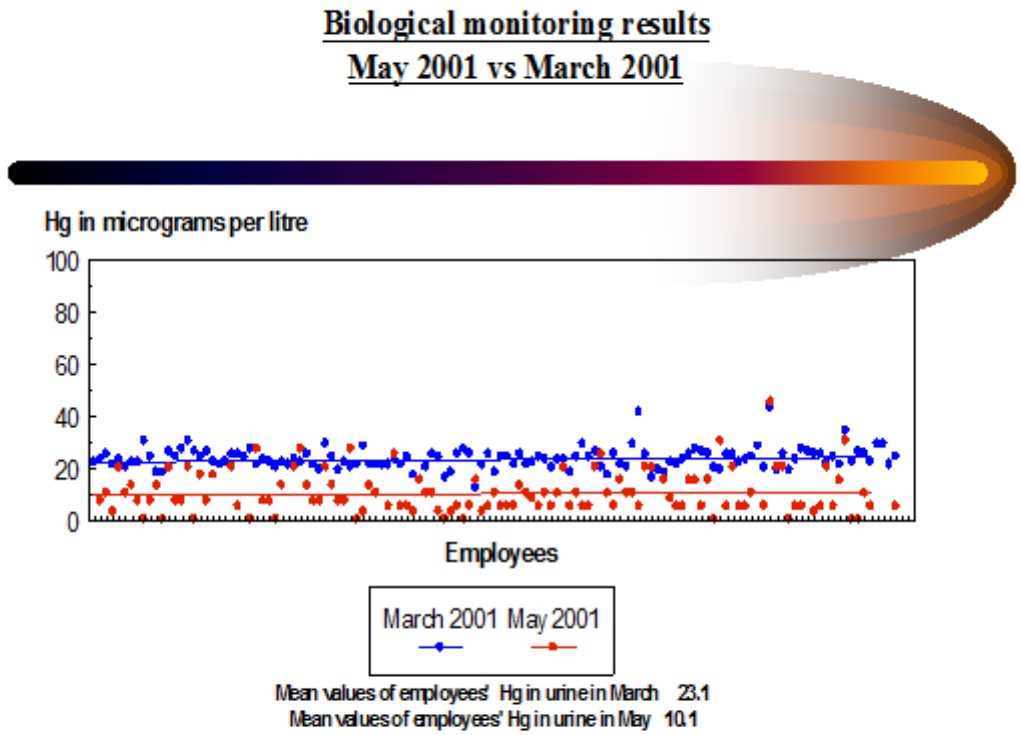
Exhibit VIII
Biological Monitoring of Mercury
March 2001

The following is a graphic representation of the levels of mercury in the urine of examined employees. The graph in the form of a scatter diagram clearly depicts that all employees, ex-employees and scrap dealers' mercury levels in urine are far below the accepted threshold value of 100 µg/Lit. The sample size of the surveyed population comprised of 129 employees [exposed to mercury over the years], 55 ex-employees [exposed to mercury in the past], 65 employees not working in the mercury areas [canteen, transport, security staff, administrative department/office, gardening, MEPZ] and 6 scrap dealer/scrap dealer's employees.



A repeat examination in May 2001 of all current employees has indicated that the levels of mercury in urine has further dropped to a mean level of around 10 µg/Lit [since the operations at the factory has been suspended since the first week of March 2001] as compared to a mean level of around 23 µg/Lit in March.

The following is a graphic representation of the comparison between May 2001 and March 2001.


Biological monitoring results
May 2001 vs March 2001
Hg in micrograms per litre
100
80
60
40
20
0
Employees
March 2001
May 2001
Mean values of employees' Hg in urine in March 23.1
Mean values of employees' Hg in urine in May 10.1

Source: HLL

Exhibit IX
Mercury in Fish: URS Survey

Four samples of edible fish were purchased from fishermen at Kodai Lake at the time of catch and the muscle tissue analysed for mercury. All four fish returned a mercury concentration of 0.04 mg/kg as wet weight. Lake bed sediments, lake water and near shore soils also returned levels of mercury either below detection limit or representative of low level background concentrations.

According to URS, these results confirmed that there had been no measurable impact on Kodai Lake from mercury discharges at the mercury thermometer factory. They seemed to suggest that the recognized main pathway for mercury entering the food chain via consumption of fish was not present in the area.

Mercury (total) in Kodai Lake Carp Samples

Fish Sample B1	Fish Sample A1	Fish Sample A2	Fish Sample A3
0.04	0.04	0.04	0.04

Source: National Listing of Fish and Wildlife Advisories (2001b). Http://www.epa.gov/ost/fish.

Summary of Mercury Concentrations in Selected Freshwater Fish from the United States, 1990 to Early 2001.

Species	**Average Mercury Concentration (mg/kg wet weight)**
Benthic Feeding Species	
Carp	0.11
White Sucker	0.11
Channel Catfish	0.09
Predatory Fish Species	
Largemouth Bass	0.46
Smallmouth Bass	0.34
Brown Trout	0.14
Walleye	0.52

Source: National Listing of Fish and Wildlife Advisories (2001b). Http://www.epa.gov/ost/fish.

Summary of Mercury or Methyl Concentrations in Fish

Jurisdiction	Health-based Guideline or Standard for Mercury in Fish	Comment
Australia and New Zealand ANZFA Food Standards Code (2001)	0.1 mg mercury/kg (wet weight)	For fish that are known to contain high levels of mercury (such as swordfish, southern bluefin tuna, barramundi, ling, orange roughy, rays and shark).
	0.5 mg mercury/kg (wet weight)	For all other species of fish, crustaceans and molluscs.
United States of America	0.1 mg mercury/kg (wet weight)	For consumers who each less than 10 grams of fish per day.
Canada	0.5 mg mercury/kg (wet weight)	Health Canada (2001), CFIA (2002)

Codex Alimentarius Commission (CAC/GL 7-1991)	0.5 mg methylmercury/kg (wet weight)	All fish except predatory fish. For fresh or processed fish and fish products moving in international trade.
	1.0 mg methylmercury/kg (wet weight)	Predatory fish (such as shark, swordfish, tuna, pike and others). For fresh or processed fish and fish products moving in international trade.
World Health Organisation	0.1 to 0.2 mg mercury/kg (wet weight)	Environmental Criteria for mercury concentrations in freshwater fish from non-polluted areas.

Source: National Listing of Fish and Wildlife Advisories (2001b). Http://www.epa.gov/ost/fish.

Exhibit X
Mercury Material Balance Calculations

The detailed mercury balance conducted by URS was based on available data and a set of assumptions which URS and HLL believed were prudent and conservative.

The total quantity of mercury brought on site was 136,486 kg. A total of 165,178,795 thermometers had been exported, containing an estimated 119,067 kg of mercury.

Based on the frequency of air changes, the period of operations and an average mercury concentration in the air of .03mg/m^3, (HLL believed a figure of .03mg/m^3 was very conservative) an estimated 64 kg of mercury had been expelled into the air. Mercury in air bore a reasonably constant relationship to mercury in the urine. A 1mg/m^3 concentration in the air implied 1.2-2.0 mg /litre in urine. An average concentration of 32 microgram/litre in urine implied 0.016-.026mg/m^3 in air.

Glass scrap came in three forms: unrecovered with approximately 5.97% mercury, partially recovered with an estimated 1.04% mercury and more completely recovered, with approximately 0.15% mercury. Glass scrap stored onsite amounted to 165,051 kg with 5.97% mercury, 9858 kg with 1.04% and 58,511kg with 0.15%. Glass scrap disposed, amounted to 43,577 kg (1.04%) and 5,327 kg (0.15%).

Based on extensive sampling, HLL estimated a mercury concentration of 3.38% in the sludge. So a total quantity of 17,542 kg of sludge from the Effluent Treatment Plant (ETP) was estimated to contain 593 kg of mercury.

Out of the 136,468 kg of mercury imported, the total quantity accounted for, included exports (119,067 kg), scrap stored on site (9746 kg), and scrap disposed (461 kg), mercury in stock (2983 kg), work-in-process (1605 kg) and mercury in sludge (593 kg). Unaccounted losses thus amounted to 2031 kg. More detailed calculations estimated the unaccounted mercury losses as 396 kg in soil and sediment, 282 kg as mercury recovered at the plant and 1353 kg as the discharge into Pambar Shola. The maximum discharge from site to the Pambar River catchment was of the order of 1,350 kg[18] of mercury over a period of 18 years or an average of about 75 kg/year.

[18] Greenpeace believed that the discharge was much higher.

HLL indicated it would revise these figures when more data would be available after recycling of glass scrap and site remediation had been completed.

Exhibit XI
Composition of the TNPCB Hazardous Waste Management Working Committee

Chairman	-	G. Rangaswamy, Former Member Secretary, TNPCB
Convener	-	R. Ramachandran, Additional Chief Environmental Engineer, TNPCB, Chennai
District Collector	-	Dindigul
Member Secretary	-	Central Pollution Control Board
District Environment Engineer	–	TNPCB (Dindigul)
Navroz Mody	–	Greenpeace representative
R Kannan	-	Palani Hills Conservation Council
M S Srinivasan	–	Vice President, EI D Parry
L Sabaratnam	-	Ex President, Madras Chambers of Commerce & Industry
Ganapathy	-	Chemical Industries Association, Chennai.

Source: HLL

Exhibit XII
Working Committee Proceedings

1st meeting (28/5/2001, 29/5/2001): This meeting, held in Kodaikanal, discussed the following issues:

- Preliminary report of URS
- Shifting of scrap from Munjikkal scrap yard to factory
- Closure of factory

2nd meeting (11/10/2002): This meeting held in Chennai, discussed the following issues:

- Final report of URS
- Export of hazardous waste to Bethlehem Apparatus Inc, USA.
- Proposal for disposal of plant & machinery
- Proposal for remediation of soil

3rd meeting (13/2/2004): This meeting held in Chennai discussed the following issues:

- Decontamination protocol form thermometer manufacturing equipment
- Soil remediation
- Disposal of non-contaminated plant and machinery.

Source: HLL

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