Report of the committee of experts appointed under the directions of the Honorable High Court of Judicature at Madras in writ petition no. 8291 of 2006

Contents **Page Numbers**

1. Preamble 2
2. Proceedings of the Committee 3
3. Details of the Factory visit in Kodaikanal 4
4. Presentation by the petitioners 8
5. Perusal of records 14
6. Evaluation of available information 21
7. Conclusions 38
8. Annexures

1. Petitioner's list of employees and their families allegedly suffering from ill-health on account of exposure to mercury – Pages 1-39
2. Presentation made by the respondents to the committee members- Pages 1-89
3. Note from the Chairman of the committee to the Honorable High Court seeking extension in submitting its final report – Pages 1-2
4. Presentation made by Dr. Rakhal Gatlonde on behalf of the petitioners to the committee members – Pages 1-25
5. Submission from the respondents on the clinical aspects and other details of the 12 ex-employees evaluated by the committee – Pages 1-7
6. Respondent's submission on exposure data and other details of the list of 279 individuals submitted by the petitioners – Pages 1-12
7. Details on methodological aspects of urine mercury analysis and the provision of personal protective equipments provided by the respondents- Pages 1-7
8. Report of Dr. S.K. Dave (committee member) on the site visit and clinical evaluation of ex-employees at Kodaikanal – Pages 1-7

1. Preamble

The Honorable High Court of Judicature at Madras had passed an order dated 29.06.2007 in the writ petition no. 8291 of 2006 in the case of Ponds Hindustan Lever Limited Ex-mercury employees' welfare association vs. Hindustan Lever Limited and others as mentioned in the said writ petition. The order laid down the composition of an expert committee to be formed under the chairmanship of an expert to be nominated by the ITRC with other members nominated from the NIOH, AIIMS, CMC Vellore and MAMC New Delhi.

In compliance with court orders, ITRC, Lucknow nominated Dr. A .K .Srivastava Dy Director and Head Of the Epidemiology Division as Chairman and sent letters requesting the Dean of CMC, Vellore, Director AIIMS, Delhi, Director, NIOH, Ahmedabad and Dean, MAMC, Delhi for nominating members to the expert committee as directed by the court. The names of all the nominees from these institutes were received by ITRC on August 3, 2007.

The committee comprised the following members:

Dr. A .K .Srivastava ITRC, Lucknow - Chairman
Dr. S. K. Dave, NIOH, Ahmedabad – Member
Dr. Jayaprakash Muliyil, CMC, Vellore – Member
Dr. K. Anand, AIIMS, Delhi – Member
Dr. Neeraj Gupta, MAMC, New Delhi – Member

The committee in its first meeting on 24.8.2007 deliberated and listed the following terms of reference to decide on the matter. These terms of reference were identified as per the court order dated 29.6.2007.

a. To decide whether the alleged health conditions/ symptoms shown by the workers and their family members are relatable to mercury exposure.
b. To peruse the materials provided by petitioner and respondents
c. To provide opportunity to either party (subject to providing proof of employment in case of petitioners) for presenting their respective cases with supporting documents.
d. To decide on other modalities in performing the above task
e. To complete and submit the report within a period of three months.

2. Proceedings of the Committee

2.1. The committee sought from the petitioners a list of employees and their relatives claiming to be affected by exposure to mercury in the erstwhile plant at Kodaikanal and the ailments suffered by them. A list of 279 subjects was made available to us by the petitioners on September 17, 2007 (Annexure -1)

2.2. The committee also sought from the respondents a detail of the proceedings in the court and the safety/ health measures etc in the erstwhile plant at Kodaikanal. This was made available to us during the meeting of the expert committee on Aug 24, 2007 in New Delhi through a power point presentation (Annexure 2)

2.3. The committee wrote to the Asst. Registrar of the Honb'le High Court at Madras to seek extension to file its response citing the complexity of the case and other important reasons as mentioned in its letter dated Sep 25, 2007 (Annexure - 3)

2.4 The expert committee visited Kodaikanal on the 10.10.2007

a) to examine the erstwhile factory so as to have a first hand idea of the health and safety systems in place as well as understand the operational aspects of the factory &

b) to provide opportunity to the petitioners for presenting their case

2.5 The committee members were in regular touch with each other and communicated on this issue through e-mails and telephone calls from Aug 2007 to Nov 2007. A number of clarifications were also sought and all the available information was thoroughly examined by each committee member for reaching to a conclusion.

2.6 The final meeting of the committee members took place in Delhi on Dec. 5, 2007 at Tivoli Garden Resorts Hotel. Prior to the meeting a draft report was circulated to the members on Nov. 22, 2007 for their perusal and consequent comments and suggestions. This draft report was discussed thread bare in the final committee meeting and comments sought from all committee members. Based on these discussions and comments a revised draft was circulated on Dec. 9, 2007 for review by the members. After feedback from the members (involving series of discussions through electronic media) the report was finalized on Dec. 18, 2007 with inputs from all members. This final report has the consensus of all the committee members.

4

3. Details of the Factory visit at Kodai

Mr. John George, Factory Manager, HUL, Kodaikanal took the committee members around the factory and explained the manufacturing process, safety systems and procedures. Mr. K.Gopalakrishnan, ex-staff of the factory and representing the petitioner Ponds Hindustan Lever Ltd. ex-mercury employees' welfare association, at the request of the committee, accompanied the committee members during the site visit to ensure that their point of view was communicated to the committee members.

The factory was without machinery since all machinery had been decontaminated and disposed off. The committee members went around the factory to examine the location of various departments and understand details of operations carried out.

The thermometer manufacturing consisted of the following sections.

(1) Utilities & Services: This department housed electrical power distribution including transformer, electrical generators, compressors, oxygen generators, LPG bullets and de-humidifiers etc. Workmen from this section took care of electrical work, plumbing and other factory maintenance activities. 8 workmen were engaged in this section. There was no mercury used in this section. Size of utilities section: 116ft x 27 ft

(2) Non- mercury area: Stem glass and bulb glass were used to produce empty thermometer shells in this section. Stem cutting, End opening, End cutting, Bulb forming and Non-mercury thermometer operations were carried using automatic and semi-automatic machines. *30 workmen* were engaged in this section. Size of the non-mercury area is 89ft x 80 ft.

(3) Mercury filling room: The empty thermometers were filled with mercury in a separate room using a filling machine. This section had 3 exhaust fans to expel the mercury vapor from the room and to keep mercury vapor level in the work area below 0.05 mg/m^3, which is the safe prescribed level. *2 workmen* were engaged in this section. At the time of unloading of thermometers from the filling machine one workman from mercury area was engaged. Size of the room is 45ft x 30 ft.

(4) Mercury area: In this section, manufacturing operations post filling of the mercury into thermometers including top chambering, contracting, air removal, grading, top sealing, scale printing, top making and quality inspection etc. were carried out using automatic and semi automatic machines. Around 20 to 25 thousand thermometers were produced in a day. There were 22 exhaust fans to expel mercury vapor from this section to keep the work area within the safe mercury vapor level. The floor of the mercury section was kept wet all the time to minimize vaporization of mercury. The broken thermometers were removed using special vacuum cleaners with water seal. The workmen were also using mandrel and hand gloves to handle broken thermometers. The broken pieces were kept in buckets containing water. *88 employees* were engaged in this section. Size of the mercury area is 209ft x 80 ft.

(5) Mercury distillation room: Commercially available mercury and mercury etrieved from recovery room were distilled in this room. There were 5 exhaust fans to expel mercury vapor from this section to keep the work area within the safe mercury vapor level. About 20 to 30 kg of mercury were distilled in a day. *1 workman* was engaged in this operation. Size of the room: 48ft x 15 ft.

(6) Mercury recovery room: Mercury contained glass scrap from the manufacturing areas was crushed in a crusher and heated in an oven to recover mercury. There were 6 exhaust fans to expel mercury vapor from this room to keep the work area within the safe mercury vapor level. *1 workman* was engaged in the recovery process. At the time of crushing the glass scrap one additional workman from mercury area was engaged in this section. Size of the room: 48ft x 15 ft.

(7) Packing section: The packing was a post manufacturing operation where the finished thermometers were packed in packing cases for retail distribution. This activity was carried out in the old building till 1992 and thereafter in a separate room annexed to the manufacturing shed. The size of the room: 55ft x 22ft.

(8) Digital thermometer: Digital thermometer manufacturing was carried out in the old building away from the mercury thermometer manufacturing shed. Around *200 workmen* were engaged in digital operation in the years 1996 to 1999. After this period, the digital operation was shifted to MEPZ, Chennai.

The manpower figures mentioned in different sections correspond to deployment pattern as on March 2001 when the factory was closed down.

During the factory visit, the committee members were informed about the safety systems and procedures. Some of the points mentioned were:

- All the regular employees were provided with uniforms, shoes, goggles, head cover, mask, gloves etc. In addition workmen in mercury filling, distillation and recovery sections were provided with NIOSH mercury respiratory cartridges.
- The uniforms were washed at the factory itself and these were never allowed to be taken home.
- Standard operating procedures and warning instructions regarding hazardous nature of mercury were displayed at prominent locations in the factory.
- All the workmen were provided safety training prior to employment.
- Exhaust fans were installed in mercury area, mercury filling, mercury distillation and recovery sections to flush out mercury vapor, provide air change, and maintain mercury vapor within the safe level of 0.05 mg/m^3
- The mercury vapor level in the work areas was monitored daily at 15 to 22 different locations in the factory using Jerome Mercury Vapor Analyzer and necessary actions were taken to maintain the mercury level below the safe limit of 0.05 mg/m^3. The committee inspected the Jerome Mercury Vapor Analyzer used.
- Workers urine analysis was carried out monthly using a cold vapor atomic absorption spectrometer and the workers exceeding the safe limit, if any, were shifted out of mercury area to non-mercury sections till the urine level came down. The committee visited the urine analysis lab.
- Annual medical examination was carried out by factory medical officer once in a year.
- Records pertaining to mercury vapor readings, urine analysis and annual medical examination were maintained in the records room. The committee members have gone through some of the records maintained.

The nature of jobs allotted to different categories of workmen.

- Permanent workmen: Engaged in manufacturing operations.
- Contract workmen: Engaged in security, gardening and canteen activities.
- Casuals / Temporary: These workmen were engaged for a shorter period of time, just to meet export orders during peak periods. Once the exports orders were completed, they were removed from the services. These casuals/ temporary workmen were engaged in material handling, packing and ancillary jobs.
- Trainees: Based on work performance and manpower requirement, some of the temporary workmen were taken as trainees and provided training. On satisfactory completion of training, they were absorbed as probationer and thereafter as permanent workmen.

Women workers were engaged only in digital, packing, office, non-mercury area, gardening and canteen. They were never engaged in mercury area.

The representative of the petitioner's Mr. Gopalakrishnan was present throughout the visit and confirmed the existence and practice of various health and safety measures as outlined above. However, there was divergence regarding type of masks provided and monitoring of mercury in urine.

The committee members also visited the Moonjikal scrap yard to see the location of the yard and the place from which the company retrieved some mercury tainted glass scrap.

The limitation of time lapse and absence of any machines were partially overcome by lucid explanations from the representatives of petitioners and respondents.

8

4. **Presentation by the petitioners**

Subsequently, a meeting was organized in the meeting room at Carlton Hotel (Kodai) with the following members of the petitioners:

1. Mr. SA Mahindran:	President,	*Ponds Hindustan Lever Ltd. ex-mercury employees' welfare association*
2. Mr. K. Gopalakrishnan:	Member,	*-do-*
3. Mr. S. Raja Mohamed:	Secretary	*-do-*
4. Dr Rakhal Gaitonde:		*Community Health Centre (NGO), Chennai*
5. Mr. Navroz Mody:		*Environmental activist & Consultant for different NGOs.*
6. Ms. Jenny Dolly:		*M.A. (Social Sciences) final year student of Madras Institute of Social Sciences - Doing her project work on Kodai issue.*

The meeting commenced with mutual introductions. The petitioners and their representatives made the following presentations/discussions.

Mr. Navroz Mody welcomed the committee members and showed them the photographs taken on March 21, 2001 depicting bags containing broken thermometers in a scrap yard and informed that in June 2001 the scrap area was cleaned up. He followed it up by a exhaustive discourse on mercury and its impact on environment and human health.

He stated that the company had produced around 165 million thermometers, out of which there was around 40% breakage. Each thermometer contains 0.6667 gm of mercury and hence there would have been a mercury spillage of around 74 tons of mercury. The maximum breakage of thermometers was in the centrifuge. He confirmed that the workers used to wear overalls and stated that the workers carried mercury to their homes via clothes and hair.

He further informed that the mercury gets attracted to asbestos and now you can find mercury on asbestos sheets. He said that 50 mg of mercury was found in a tree near the lake as per Dames and Moore report. This mercury has entered the environment because of the use of exhaust fans to blow out mercury. He also stated that the respondents had given data of urine analysis of only those workers whose mercury levels were 100 mcg and had not taken the data of those employees whose levels had exceeded over 300 mcg.

Mr. Mody opined that there were people who had enormous exposure but did not present any symptoms of poisoning. He thus concluded that that there are some people who are more susceptible to the toxicity of a chemical and there are some who are less.

Mr. Mody stated that all the earlier committees had not examined the issue properly and were not well informed about problems related to mercury exposure. He was also highly critical of NEERI and its Director.

He emphasized that his chief interest was in protecting the environment from mercury and was of the opinion that use of mercury should be stopped at national level.

Dr Rakhal Gaitonde made a power point presentation giving a general overview of the evidence of adverse effects due to occupational exposure to mercury. He quoted findings of studies by Indian Peoples Tribunal, Drs Isaac & Praveen, Dr Gita Arjun and his own study on 18 subjects.

He pointed out that the permanent workers were only tested for presence of mercury and the rest of the workers were left out. Dr Gaitonde also suggested use of DMPS challenge for assessing body burden of mercury in workers, use of psychological tests and use of biomarkers for evaluating the complaints of the workers in relation to mercury.

He gave handout of his presentation to the committee members. (Annexure 4)

Mr. S A Mahindran informed the members that it takes around 30 days from the process of filling to packing of thermometers. Spilling takes place in the filling room. He also explained in detail the process of filling and the related matters of working conditions. He informed that during lunch break the workers were not allowed to change their clothes.

He further said that the respondents only took urine samples of the workers but never took the blood samples. Initially the urine samples were taken twice a month, later it became once a month and subsequently once in three months. The respondents also did not inform the workers about their urinary mercury levels. However, when they found that the urinary mercury was above permissible levels in some workers, the same workers were shifted to another section.

Mr. Mahindran further informed the committee that a total of 900 workers were employed in the factory during its productive years. 400 of these worked for more than five years. He said that he joined the factory in 1983 along 25 other colleagues. Two of his colleagues died, one in 2004 and the other in 2005. He showed the photographs of people who had died and also the photographs of children who had suffered from brain and heart disorders.

He stated that the information about safety from mercury was not provided to workers. The petitioners also showed the committee members a number of photographs of children suffering from a plethora of diseases which they attributed to mercury exposure.

The committee gave a patient hearing to all the representatives of the petitioners. Some of the members questioned Mr. Mahindran to understand the work process and conditions therein.

The petitioners submitted the following reports/papers for the perusal by the committee.

1. Neurological Abnormalities Associated With Remote Occupational Elemental Mercury Exposure: Animals of Neurology Vol.24 No. 5 November 1988.
2. Neurotoxic Effects in workers of The Clinical Thermometer Manufacture Plant: International Journal of Occupational Medicine and Environmental Health 2006; 19 (3):198-201.
3. Mercury exposure in children: a review: Toxicology and Applied Pharmacology 198 (2004) 209-230.
4. Neurological and electrophysiological examinations on three groups of workers with different levels of exposure to mercury vapors: European Journal of Neurology 1999, 6: 571-577.

5. Neurobehavioural test results and exposure to inorganic mercury: in search of dose-response relations: Arch toxicol (2004) 78: 207-211.
6. Health Effects of Long- Term Mercury Exposure among Chloralkali Plant Workers: American Journal of Industrial Medicine 39:1-18 (2001).
7. Residual neurobehavioral effect associated with chronic exposure to mercury vapor: Occupational and Environmental Medicine 1994; 51:35-41.
8. Chronic neurobehavioral effects of mercury poisoning on a group of Zulu chemical workers: Brain injury, Vol.14. No.9, 797-814.
9. Mercury Exposure and Child Development Outcomes: Pediatrics Vol. 113 No. 4 April 2004.
10. The Toxicology of Mercury- Current Exposures and Clinical Manifestations: The New England Journal of Medicine 349; 18 oct30, 2003.
11. Study of Mercury pollution near a thermometer factory using Lichens and Mosses: Environmental Pollution 124 (2003) 357-360.
12. Studies of Mercury pollution in a lake due to a thermometer factory situated in a tourist resort: Kodaikkanal, India: Environmental Pollution 143 (2006)153-158.
13. The Indian people's Tribunal Report: On the alleged Environmental Pollution and Health Impacts caused by the Hindustan Lever Mercury Thermometer Factory at Kodaikanal: Indian people's tribunal On Environment and Human: June 2003.
14. Atmospheric dispersal of Mercury from the Hindustan Lever Limited Thermometer Factory at Kodaikanal, Tamil Nadu, India, using lichen as a Biomonitor. Greenpeace research Laboratories, Department of Biological science, University of Exeter, Prince of Wales Road, UK.
15. UNEP/EU review of Mercury.
16. Note on Health Effects of Elemental Mercury Exposure in Occupational Settings: Regarding Absorption, Distribution and Metabolism.
17. Mercury in the Mist: portrait of a corporate crime by Navroz Mody.
18. A Peer review of a Health study on workers of Hindustan Lever Thermometer Factory in Kodaikanal presented by HLL team at community Health Cell, Bangalore.
19. Points to consider in and outside the workplace.

4.1 Interaction with workers and examination of some of the affected subjects

The petitioners wanted the committee to examine the workers and their family members. The committee, therefore, requested the petitioners to bring 10 -12 subjects who they considered to be suffering from characteristic signs and symptoms attributable to mercury.

The subjects as selected by the petitioners were also examined by the committee members. These included

1	S.Sahayaraj	44	M
2	John Ignatius	46	M
3	M.J.Antony	46	M
4	A.Paulraj	49	M
5	Manikan	58	M
6	K. Muthuraj	41	M
7	Peter Sundrajan	46	M
8	S.Jayabharti	29	F
9	S.Kuruppasamy	48	M
10	F.Leo Joseph	29	M
11	S. Ramachandran	42	M
12	S.Shivangam	45	M

The committee members heard the complaints of these subjects and **examined them physically.**

Further Dr J P Muliyil and Dr K Anand also examined a number of children as insisted by the petitioners. The objective of this exercise was to ascertain if prima facie there was any evidence of mercury induced ill-health amongst them. As a prelude to the visit and the examination the petitioners were sent the following letter:

13

Dear Sirs,

The committee appointed under the directions of the Honorable High court of Madras will visit Kodai on the 9th of October to enable you to present your case before the committee. In order for a smooth conduct for the meeting we will request you to present your case in person along with supporting evidence for any claims for ill-health allegedly occurring due to exposure to mercury.

In this connection you may present to the committee a maximum of 15 - 20 individuals allegedly suffering from exposure to mercury and who you feel merit the committee's attention. For these individuals please let them come with

- *Employment history*
- *Details of their illness*
- *Records of illness during employment*
- *Period when the illness started*
- *Current health status*
- *Doctors' prescriptions for their current illness*
- *Medicines currently being taken by them , along with chemists bills*
- *Investigation reports*
- *Evidence of hospitalization (if any)*

It would also be useful for the committee to have an idea on their activities since they left employment in terms of jobs / work they have been on since they left the factory. The committee would also need proof of their employment in the erstwhile thermometer factory at Kodaikanal. The committee will decide on the future course of action based on the visit.

While the petitioners had presented to the committee a list of 279 ex-employees and their relatives allegedly suffering from health effects due to past exposure to mercury they asked the committee to evaluate the 12 cases as mentioned above who they felt were exhibiting classical symptoms and were most affected from past exposure. In the current medical evaluation of 12 ex-employees at Kodai on Oct 10, 2007, three were having tremors. There were no cases of dysdiadochokinesis *(loss of ability to do repetitive tasks e.g. ability to rotate hand so that the palms face alternatively up or down),* abnormal Rhomberg's test *(test for gait)* for knee-heel-toe tests. The details of these workers were also sought from the respondents (Annexure 5).

Evaluation of these workers showed that their 'urine levels of mercury' during their working period were well within permissible normal levels. One of the individuals with tremor had a history of cerebral infarct with cardiac ischemia, the other had a history of alcoholism and the third was a lady who worked only for 4 months and that too in a non-mercury area. In addition, for these three ex-employees a confirmatory test of handwriting to detect *micrographia* was also negative making it difficult to conclude that their illness was related to mercury.
Amongst the children evaluated – none had any condition which could be scientifically linked to exposure to elemental mercury.

5. Perusal of records

5.1 The respondents were asked to provide details of all the 279 individuals alleged to be suffering from ill effects of mercury during occupation at erstwhile factory by the petitioners. The details included following

- *Date of joining and date of leaving the factory*
- *Recorded illness with the unit during the course of their employment along with doctors' diagnosis and prescriptions*
- *Urinary mercury values*
- *Details of any individual who had higher mercury content than the recommended value at the time of leaving the factory.*
- *Cause of death, if available, for those listed in the petitioners list*
- *If any employee(s) has signed a settlement with the company stating that he/they have no health related issues and their names are in the list.*
- *Any other pertinent information*

The details were then studied by all the committee members and are summarized below. The respondent's submission in this respect is annexed (**Annexure 6**).

An initial analysis of the symptoms among subjects included in the list provided by the petitioners: N=279

Sl_No	Broad Symptom Category	Number of employees	%	Are these symptoms specific/ characteristic only to mercury exposure? "
1	Nervous problems [a]	14	5	No
2	Skin problems [b]	70	25.1	No
3	Dental Problems [c]	76	27.2	No
4	Headache	158	56.6	No
5	Tremors	2	0.7	No
6	Tiredness/Weakness	68	24.4	No
7	Eye Complaints [d]	68	24.4	No
8	Breathing Problems	42	15.1	Not applicable
9	Tuberculosis	2	0.7	Not applicable
10	GIT Disturbances [e]	87	31.2	No
11	Anorexia	2	0.7	No
12	Weight loss	8	2.9	No
13	Relatives with alleged problems [f]	105	37.6	Not applicable
14	Gynecological problems [g]	26	9.3	Not applicable
15	Giddiness	45	16.1	No
16	Others [h]	118	42.3	Not applicable
17	Psychological disturbances [i]	2	0.7	No
18	CVS Symptoms [j]	36	12.9	Not applicable
19	Oral Cavity (Mouth Ulcers)	2	0.7	No
20	Memory loss	75	26.9	No
21	Diabetes	9	3.2	Not applicable
22	Impotency	10	3.6	Not applicable
23	Urinary Problems [k]	18	6.5	No
24	Insomnia	2	0.7	No

Notes:

***Elemental mercury may cause such symptoms but there are many other conditions where such symptoms are also observed. Thus signs and symptoms may be due to common conditions other than only being attributable to mercury exposure. Sicknesses that have no bearing to mercury have been listed as not applicable. In addition, a review of past exposure data of the employees did not reveal exposures of any health related concern to elemental mercury.*

[a] Nervous problems includes those conditions for whom no descriptions are given but are just mentioned as nervous problems. This category also includes fits.

[b] Skin problems include patches, skin diseases, allergy, itching, hair whitening and falling.

[c] Dental problems include bleeding gums and fallen teeth.

[d] Eye complaints include loss of eyesight, eye irritation, pain and other eye defects.

[e] GIT disturbances include stomach pain, ulcers, digestion problems, vomiting including blood vomiting.

[f] Relatives with alleged problems include children with TB, primary complex and brain disorders. They also include wife with h/o repeated abortions, thyroid, asthma, irregular periods, unable t conceive, sinus problems, skin issues, loss of eyesight, allergy, giddiness. Some children had difficulty walking, had clubfeet or had memory loss and some relatives had backache and respiratory problems.

[g] Gynecological problems include excessive bleeding, problems with periods or a h/o uterus removal.

[h] The others category included hernia operation, ear /orthopedic surgery. Also included joint pains, body pain, limb pain, bleeding nose, laziness, cancer leg, brain tumor, spinal cord operation, inability to speak, perforated ear and swelling of the chest.

[i] Psycological symptoms include tension and perceived mental problems.

[j] CVS problems include blood pressure, chest pain, anemia and heart problems.

[k] Urinary problems include frequent urination, kidney stones, failure and other kidney problems.

5.2 Review of reports of experts already in hand

The reports given by the local practitioners, national and international institutions and other experts have also been studied and evaluated by the committee members. These comprised reports provided by the petitioners as well as the respondents.

5.2.1 Reports presented by petitioners

1. Dr. Rakhal Gaitonde from the petitioner's side has mentioned that many of the individuals screened have symptoms that "could be attributable to chronic long term mercury exposure".

   Dr. Gaitonde has mentioned issues from literature and not from any specific observations. The information in literature is given keeping specific issues in mind and cannot be generalized for all situations.

2. Dr. Gita Arjun also in Vol X, para 1 & 2 has mentioned about one of the exposed worker having child with deformity and 3 abortions. Similarly, another patient Gynanasundari Jayaprakash had two children with skeletal deformities. There is also reference to Ms. Ruthpriya who gave birth to twins with one having ulceration in mouth.

   In the well studied latest literature there is no scientific support of such occasional observation as made by Dr. Gita Arjun when cause-effect relationship is not documented. With respect to Gynanasundari "Mercury cannot cause any mutation and genotoxicity". WHO literature on this is quite clear. With respect to Ruthpriya such observations without proper history of exposures or in the absence of scientific literature cannot be accepted.

3. Similarly, Dr. Ambudorai reported that Ms.Ruby had severe psychological problems. With respect to Ruby's condition - the exposure to mercury in thermometer factory or any other factory has never been associated with psychological problems. As such in modern life because of a lot of stress from survival and existence there is a large number of people amongst the population who are prone to stress.

5.2.2 Reports presented by the respondents

1. On a specific inquiry, Dr. Balaji who was a leading medical practitioner in Kodaikanal has stated that he has not come across any case which can be attributable to mercury exposure. However, this is anecdotal.

2. Dr. Tom Van Teunenbroek an expert from Netherlands (who was specifically brought in at the request of Greenpeace and other NGOs) well conversant with occupational and environmental epidemiology has on the 1st May 2001 and again on 1st October 2001 clearly stated that (after going through and validating all data and their further evaluation department wise and looking at the mean group values in hazardous and non-hazardous areas) there is no indication of any mercury relatable morbidity amongst the employees. All individual data were also within acceptable limits with a very few (< 1%) of them showing a higher spot value which also quickly reverted back to normal on being rotated from their jobs.

3. Experts from the Indian Association of Occupational Health during their visit to Kodai clearly mentioned that < 1% of workers were having urine Hg value more than 100mcg/lit and were rotated till their levels came down below acceptable norms. Similarly, they also revealed that annual clinical evaluation of employees over the years did not reveal any clinical or biochemical abnormalities.

4. In addition, Drs. Pandav and Pandey from the country's premier medical institute the All India Institute of Medical Sciences while evaluating critically the remarks made by Dr. Mark Chernaik concluded that *the occupational health and safety measures in place in Kodaikanal factory have succeeded in keeping the exposure of factory employees to mercury to consistently acceptable low levels*. In view of the comprehensive health surveillance carried out over the working life of the factory, especially keeping in view the monthly biological monitoring of mercury in urine (as compared to a standard 6 monthly to yearly evaluations) and a detailed individual annual clinical and biochemical examination and the recently conducted (March 2001, May 2001) comprehensive clinical-epidemiological study, *there is no evidence to suggest adverse health effects that can be attributable to mercury exposure.*

5. The certifying surgeon after studying the plant structure and function evaluated the employees with specific reference to the target organs. He has opined that "the employees are healthy and sound"

6. At the specific direction of the Supreme Court Monitoring Committee, the Tamil Nadu Pollution Control Board had requested the ITRC to evaluate the health aspects. The ITRC after a detailed evaluation had concluded :

a. To determine cause effect relationship in occupational diseases a systemic analysis of published data on the basis of extensive literature survey coupled with epidemiological evidence (environmental monitoring, biological monitoring) , clinical evidence and correlation with scientific knowledge of dose response relationship is essential.

b. Based on this scientific principle we have evaluated the health records and other data as indicated on site and there is no evidence indicating any adverse health impact which can be correlated to past exposure to mercury in this unit.

7. With specific reference to the need to carry out any further study the ITRC opined

   a. The factory was closed in March 2001. A review in May 2001 of the body burden of mercury in the employees 2 months after the closure showed a mean mercury in urine of 10.1 micrograms/L which is well below acceptable limits.

   b. Mercury has a half life in the body of 60 days *[ATSDR, Toxicological profile of Mercury, US Dept. of health and human services, March 1999, page 187]*. The exit yearly mean values of employees in the HLL plant (Table 7 of the ITRC report Vol. V of the respondents with the Honorable High Court at Chennai) were within acceptable limits. After a gap of six years of closure of factory it is scientifically inconceivable that the ex-employees will have any effects arising out of past exposure.

   c. There is no scientific evidence of delayed exposure to Hg after a long latency period especially if the exposure levels during the working life of an employee have been within acceptable limits. No evidence of the ex-employees having high exposure to Hg has been found. (page 4 & 5 of the ITRC report / Vol. V)

8. In addition to the reports enumerated above it will be useful to list all other reports made by leading national and international bodies and experts which are already available with the Honorable High Court - all of which do not find

any health effects attributable to past exposure to mercury. They include the following:

a. *Dr. P. N. Viswanathan's* report - page 362 - 9 / Vol. II Dr. Viswanathan as a retired Director Grade Scientist at the ITRC, Lucknow and an authority on mercury. He was a scientific member of the WHO Environmental Health Criteria no. 86 on Mercury published by the IPCS/WHO in 1989.

b. *Dr. Tom Van Teunenbroek* reports of May 2001 and October 2001 (approached at the specific instance of the NGOs and pursuant to the direction of the TNPCB) - page 423 - 6 / Vol. II,

c. *Government of Tamil Nadu, Certifying Surgeon's* report dated 25. 08. 2001 - page 478 -480 / Vol. II

d. 4. Report of the *All India Institute of Medical Sciences* dated 9.11. 2001 - page 513 - 515 / Vol. II

e. Report of the *Indian Association of Occupational Health* dated 10.1.2002 - page 526 - 531 / Vol. II

f. Peer reviewed scientific article in the *Indian Journal of Occupational and Environmental Medicine* dated Jan- Apr 2006: pages 384 - 416 / Vol. II

g. *ITRC report* dated 11. 06. 2006 (approached at the instance of the *Supreme Court Monitoring committee* directive) - page 1 - 22 / Vol. V.

h. Report of the *National Institute of Occupational Health* dated 11.09.2006, page 23 - 25 / Vol. V.

i. *All India Institute of Medical Sciences report* dated 3.10.2006 : page 27 - 29 / Vol. V.

j. *Dr. Robert Winker's report* dated 11.09.2006: pages 45-55 / Vol. V

k. *Report of Dr. S. K. Rastogi* on behalf of ITRC dated 12.11.2006 pages 4 - 27 / Vol. VII &

l. Report from the *All India Institute of Medical Sciences* dated 23.11.2006 pages 37 -66 / Vol. VII

6. Evaluation of available Information

6.1 While evaluating the entire material in hand, the submissions made by the petitioners and the respondents as well as the findings from the factory visit and the medical evaluation of some of the ex-employees and their families including children, the committee had a number of issues to deal with in order to scientifically appraise and come to a conclusion on the issue, the committee members addressed some of the salient points that need to answered before drawing conclusions. These are

6.1.1. What adverse health effects can elemental mercury cause? [1,2,3]

Acute

Short term exposure to metallic mercury vapour in concentrations of several mg/m^3 causes

- Irritation of the bronchial mucosa
- Stomatitis with increased salivation
- Pneumonitis with fever

Chronic

- Non-specific early symptoms include anorexia, weight loss, headache
- Tremor of a mixed type with handwriting becoming shaky
- Flushing, increased perspiration
- Chronic gingivitis
- Triad of excitability , tremor and gingivitis.
- Neurotoxic symptoms include tremors, emotional lability, insomnia, polyneuropathy – these symptoms are characterized by great variability in the s usceptibility of humans to neurotoxic effects of mercury.
- Renal damage at high levels of exposure - tubular damage

6.1.2. What adverse health effects cannot be attributed to elemental mercury? [1,2,3]

- Cancer
- Mutagenesis
- Congenital malformations
- Abortions / still births
- Effects on fertility

Reference [1,2,3]

1. *Early detection of occupational diseases. Diseases caused by mercury and its toxic compounds. Pages 79-84. World Health Organization, 1986.*
2. *International Programme on Chemical Safety – Concise International Chemical Assessment Document 50. Elemental Mercury and Inorganic Mercury compounds: Human Health Effects. WHO 2003.*
3. *Biological monitoring of chemical exposure in the workplace. Guidelines. Volume 1. WHO, 1996. Inorganic Mercury. Summary of toxic effect. Page 135.*

6.1.3. Levels of mercury in human body that are responsible for specific diseases, signs and symptoms.

WHO found no evidence of the classical symptoms of mercurialism, tremor or gingivitis below a time-weighted occupational exposure to mercury in air of 0.1 mg/m^3 (which is at levels twice those allowable under the Indian Factories Act) - *WHO -1976. Environmental Health Criteria 1. Mercury. Geneva, WHO*

- Smith et al have documented the effect on humans of various mercury vapour concentration in the atmosphere and their findings are summarized below:

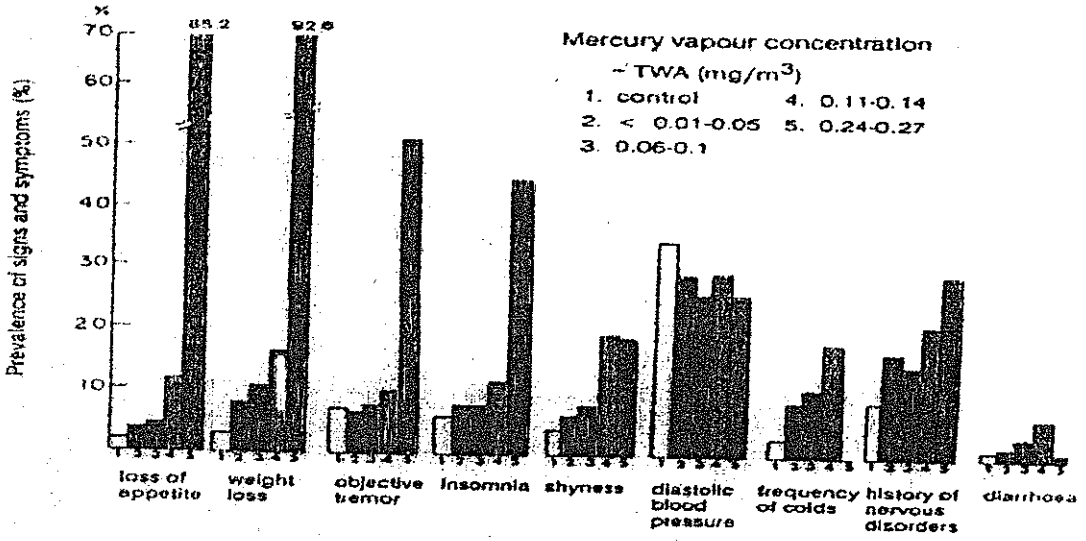

Fig. 6. Relation between mercury in work room and certain signs and symptoms (From: Smith et al., 1970).

Smith RG., Vorwald AJ., et al: Effects of exposure to mercury in the manufacture of chlorine. Am. Ind. Hyg. J 1970;31: 681-700.

Non-specific complaints like objective tremor, insomnia, shyness increase when the level of exposure reaches >0.1 mg/m^3. This would correspond to a level of 140 µg/litre HgU.

- In a study by Schuckmann 30 chloralkali workers with an average urinary mercury concentration of 100 µg/litre were compared with a control group. There was no evidence of changes in psychomotor activity - *SCHUCKMANN F. Study of preclinical changes in workers exposed to inorganic mercury in chloralkali plants. Int. Arch. Occup. Environ. Health. 44, 193 – 200.*

Relationship between levels of Hg in work environment and symptoms

Exposure level in air in µg/m^3	Corresponding HgU* levels in µg/lit.	Signs and symptoms observed
Levels above 80 µg/m^3	HgU values >112 µg/lit.	Chronic exposures can increase the probability of developing the classical neurological signs of mercury intoxication (tremor, erethism) and proteinuria.
Levels between 25 and 80 µg/m^3	HgU values of 35 – 112 µg/lit.	The exposure in this range increases the incidence of less severe toxic effects that do not lead to overt clinical impairment. These subtle effects are defects in psychomotor performance, objectively detectable tremor and evidence of impaired nerve conduction velocity which are present only in particularly sensitive individuals. Although the incidence of some signs was increased in the exposure range, most studies did not find a dose-response relationship. Improvements in most neurological dysfunctions has been observed upon removal of persons from source of exposure (IPCS CICAD 50 – WHO 2003).
Levels below 25 µg/m^3	HgU values below 35 µg/lit.	Appropriate epidemiological data covering such exposures are not available.

* **HgU** - mercury in urine levels

International Programme on Chemical Safety – Inorganic mercury EHC 118, WHO 1991. Summary of section 9 – Effects on Humans. Pages 110 – 112.

Time weighted average air concentration associated with the earliest effects in the most sensitive adults following long term exposure to elemental mercury vapour

Air concentration in mg/m^3	Earliest effects
0.05 mg/m^3	Non specific symptoms
0.1 – 0.2 mg/m^3	Tremor

Source: Casarett and Doull's Toxicology.Ed: Curtis D. Klaassen 5th International Edition, 1996. Table 23-6, page712.

Dose effect relationships on Hg exposure on nervous and renal systems

Target organ	Threshold limit for HgU (mercury in urine)
Nervous system and kidney	HgU of > 500 µg/lit. in the previous year [1]
Impaired visual memory tasks	HgU peaks of > 100 µg/lit [2]
Abnormal reflexes and decreased coordination	HgU > 600 µg/lit [3]
Postural and intention tremors	HgU mean of 63 µg/lit [4]
Impaired performance in memory tasks	Group means of HgU 56 µg/lit [5]
Kidneys – early damages	Biological permissible limit of 200 µg/lit [6]

References:

1. *Langolf GD, Chaffin DB, Henderson R. Evaluation of workers exposed to elemental mercury using quantitative tests. Am. Ind.Hyg. Assoc J 1978;39:976-84.*

2. *Forzi M, Cassitto MG, Bulgheroni C, Foa V. Psychological measures in workers occupationally exposed to mercury vapor. A validation study. Adverse effects of environmental chemicals and psychotoxic drugs. Amsterdam, Oxford, New York, Elsevier Science Publishers; 1978. p.165-72.*

3. *Albers JW, Kallenbach LR, Fine LJ. Neurological abnormalities associated with remote occupational elemental mercury exposure. Am Jr Ind Med 1988;15:517-29.*

4. *Roels H, AbdeladimM, Braun. Detection of hand tremors in workers exposed to mercury vapor. A comparative study of three methods. Environ Res 1989;49:152-65.*

5. *Piikivi L, Hamninen T, Maretelin. Psychological performance and long term exposure to mercury vapors. Scandi J Work Environ Health 1984;10:35-41.*

6. *Schaller KH, Gonzales J, Thurauf J, Schiele R. Detection of early kidney damages in workers exposed to lead mercury and cadmium.Zentralbl Bakteriol Hyg. I Abt Orig B 1980;171:320-5.*

Impact on psychomotor performance –group averages and individual values importance

Groups of workers with a mean HgU below 50 µg/lit do not show disturbances in psychomotor performances but those with HgU above 100 µg/lit may present some impairment of short term memory.

- Harry-Roels, Jean-Phillippe Gennet, Robert Lauwerys et al. Surveillance of workers exposed to mercury vapour:validation of a previously proposed biological threshold limit value for mercury concentration in urine. American Jr. Ind. Med. 1985 (7): 45-71

ATSDR data on neurological LOAEL (Lowest observed adverse effect levels) from elemental mercury exposure

Exposure duration	Less serious effects at an air concentration of of mercury in mg/m^3
1-5 years	0.076 mg/m3 (difficulty with heel-to-toe gait) [A]
1-41 years (Median of 15.3 years)	0.026 mg/m (increased frequency of mild intention tremors with weight load) [B]

A. Ehrenberg RL, Vogt RL, Smith AB. Effects of elemental mercury exposure at a thermometer plant. American Jr Ind Med 1991;19:495- 507.

B. Fawer RF, DeRibaupierre Y, Guillemin M. et al 1983. Measurement of hand tremor induced by industrial exposure to metallic mercury. Br. Jr. Ind Med 40:204-208

WHO Regional Office for Europe, Copenhagen, Denmark. 2000. Chapter 6.9. Mercury. Air quality guidelines – second edition.

Effects	Levels at which observed.
Mild proteinuria	HgU 50 – 100 µg/lit
Objective tremor and psychomotor disturbances	HgU > 300 µg/lit
Objective tremor in sensitive individuals	HgU around 100 µg/lit

Note: Most effects of mercury vapour usually disappear within a few months after cessation of exposure to mercury.

6.1.4.Half life of mercury in the human body

Tissue	Half life in days	Phase	Reference
Brain	20	Biphasic	Hursh et al 1976
Blood / Plasma	3.3	Early phase	Cherian et al 1978
Blood	2.4	Early phase	Clarkson 1978
Blood	15	Late phase	Clarkson 1978
Blood	28	Late phase	Rahola et al 1973
Whole body	60		Rahola et al 1973
Whole body	60		Hursh et al 1976
Kidney	60		Hursh et al 1976
Kidney	55		Salisten et al 1993

Experimental data obtained in human subjects with radio-labeled mercury shows that mercury has a half life of 64 days in the kidney. *Cherian et al 1978*

According to *Nakasaki* and *Barregard* the half-time of urinary excretion is around 40 – 50 days.

References:

- Cherian MG, Hursh JG, Clarkson TW, et al. 1978. Radioactive mercury distribution in biological fluids and excretion in human subjects after inhalation of mercury vapor. Arch Environ Health 33:190-214.
- Clarkson TW. 1978. The metabolism of inhaled mercury vapor in animals and man. Preprints of papers presented at the 176th National Meeting of the American Chemical Society, Division of Environmental Chemistry, September, Miami Beach, Fl. Washington, DC: American Chemical Society, 274-275.
- Hursh JB, Clarkson TW, Cherian MG, et al. 1976. Clearance of mercury (Hg-197, Hg-203) vapor inhaled by human subjects. Arch Environ Health 31:302-309.
- Rahola T, Hattula, T, Korolainen A, et al. 1973. Elimination of free and protein-bound ionic mercury 203Hg2+ in man. Ann Clin Res 5:214-219.

- Nakasaki K, Fukabori S. & Tada O. On the evaluation of mercury exposure – A proposal of the standard value for health care of workers. Journal of Science of Labour 1978:54(Part II):1-8.

- Barregard L. Occupational exposure to inorganic mercury in chloralkali workers. Studies on metabolism and health effect. Thesis. University of Gothenburg. Department of Occupational Medicine. Sweden. 1991.

6.1.5. Accumulation of mercury in the human brain

- The biological half life of most mercury is just a few days to a few weeks but can be upto years for a fraction of the previously absorbed mercury.

  - *Martin L. Rohling and George J. Demakis. A meta analysis of the Neuropsychological effects of occupational exposure to mercury. The Clinical Neuropsychologist . 20:108 -132, 2006.*

- The oxidation of metallic mercury vapour to inorganic (divalent ionic mercury) takes place very soon after absorption but some elemental mercury remains dissolved in the blood long enough (a few minutes for it to cross the blood brain barrier.

  - *World Health Organization (1976) Environmental Health Criteria 1: Mercury, 131 pp.*

- Oxidation of the mercury vapour in the brain converts this into the inorganic form which serves as a trap to hold the mercury, from where it cannot cross the blood brain barrier. Deceased miners have been shown to have mercury concentrations in the brain years after cessation of exposure. However, these studies are marred by poor quality control of the biomarker analysis and air samples, which makes these data uncertain. Also amongst a small number of deceased dentists none of whom demonstrated symptoms of mercury intoxication widely varying levels of mercury concentrations were found in the occipital lobe.

  - *World Health Organization (1991). Inorganic Mercury. Volume 118, International Programme on Chemical Safety. Geneva. Switzerland.*

- The World Health Organization has reviewed various studies and opined that the form of mercury which is responsible for the long biological half-life may be the **biochemically inactive mercury selenide.**

  - *World Health Organization (1991). Inorganic Mercury. Volume 118, International Programme on Chemical Safety. Geneva. Switzerland. Page 60.*

- The half life of mercury vapour in the human brain is 20 days.

  - *Hursh JB, Clarkson TW, Cherian MG, et al. 1976. Clearance of mercury (Hg-197, Hg-203) vapor inhaled by human subjects. Arch Environ Health 31:302-309.*

6.1.6. Can chronic occupational exposure lead to delayed effects after the cessation of exposure?

Largely there is no evidence in literature in respect of delayed effects after cessation of exposure to elemental mercury. The cessation of exposure in fact leads to recovery from symptoms rather than having any delayed effects.

- On a meta analysis study to determine the association between years since last exposure and outcome a regression analysis showed that there was a significant association such that the longer it had been since participants had been exposed to mercury the less neuropsychological impairment they suffered. When previously exposed individuals were compared to currently exposed individuals their impairment was smaller in magnitude. And, following these individuals cessation of mercury exposure there was significant recovery over time from whatever small degrees of impairment they may have suffered.

  - *Martin L. Rohling and George J. Demakis. A meta analysis of the Neuropsychological effects of occupational exposure to mercury. The Clinical Neuropsychologist . 20:108 -132, 2006.*

- Improvements in most neurological dysfunctions have been observed upon removal of persons from the source of exposure.

  - *International Programme on Chemical Safety – Concise International Chemical Assessment Document 50. Elemental Mercury and Inorganic Mercury compounds: Human Health Effects. WHO 2003.*

- Majority of scientific studies suggest that motor system disturbances are reversible upon exposure cessation

  - *Toxicological Profile for Mercury (update). U.S Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. ATSDR March 1999.P. 61.*

- Case study : A 27 year old female who worked primarily in a room with TWA mercury air concentration of 0.709mg/m3 and who had been on the job for 1.5 years showed a variety of symptoms including gum pain, poor attention, bad temper, numbness, dizziness and fatigue. She had a urine concentration

of 408 µg/lit – and her symptoms abated fully approximately 2 months following discontinuation of exposure. †

† *Yu-Jen Yang, Chin-Chang Huang, et al. Chronic elemental mercury intoxication: clinical and field studies in lampsocket manufacturers. Occupational and Environmental Medicine: 1994:51:267-270.*

Delayed effects have been documented in literature only for exposure to methylmercury and not elemental mercury. [a & b]

[a] *Rice DC. 1996a. Evidence for delayed neurotoxicity produced by methylmercury. Neurotoxicology 17(3-4):583-596.*

[b] *Nierenberg DW, Nordgren RE, Chang MB, et al. 1998. Delayed cerebellar disease and death after accidental exposure to dimethylmercury. N Engl J Med (June 4, 1998) 338(23): 1672-1676.*

Expert opinions in hand submitted to the Honb'le High Court at Madras

1. Industrial Toxicology Research Centre report – "there is no scientific evidence of delayed exposure to Hg after a long patency period especially if the exposure levels during the working life of an employee have been within acceptable limits." *ITRC report dated 11.06.2006, Respondent's volume V – page 5.*
2. Report of the Director, National Institute of Occupational Health. "No case of delayed onset of mercury poisoning has been reported in the literature. *NIOH report dated 11.09.2006 Respondent's volume V – page 25*

6.1.7. Can workers bring home the mercury thereby resulting in mercury related diseases amongst family members including pregnant women and their progeny?

- If a worker uses the same clothing in the factory and the house he may bring in mercury into the home. With respect to affecting pregnant women and their progeny, metallic mercury is not a known mutagen, nor does it cause abortions, still births or congenital malformations.

  International Programme on Chemical Safety – Concise International Chemical Assessment Document 50. Elemental Mercury and Inorganic Mercury compounds: Human Health Effects. WHO 2003.

- With respect to affecting other family members if an employee working in a factory for years and is not exposed to high levels and does not himself manifest any mercury related disease it is unlikely that his family will manifest any such condition.

6.1.8. Standard methods of monitoring mercury in the workplace

- Field instruments are useful for providing real-time surveys of the affected areas and identifying "hot spots" that require immediate attention. The JeromeTM Gold Film Mercury Vapor Analyzer (Arizona Instruments, Inc., Arizona, Model 411 or Model 431) is often used for this purpose. The instrument's detection limit for approximately 3 $\mu g/m^3$ in air, is greater than the ATSDR long-term residential exposure limit of 0.2 $\mu g/m^3$. The Jerome instrument is extremely useful for conducting an initial extent of contamination survey. Typically, three 10-second breathing zone readings are averaged to produce the reported result. Jerome instruments may be used for indoor or ambient air. The instrument operates by drawing a precise volume of air over a gold film sensor. Mercury in the sample is adsorbed by the gold film, which results in an increase in electrical resistance. The change in resistance is compared to a reference gold film and is proportional to the mercury concentration. The Jerome is factory calibrated (from 0.01 to 0.1 mg/m3) and mercury vapor results are reported in mg/m^3.

- The Lumex RA-915+ (Ohio-Lumex Co., Ohio) is a portable atomic absorption spectrometer designed to detect extremely low mercury vapor concentrations and perform fast and simple analyses both at a fixed laboratory and in the field. Two modes of operation are available for ambient air analysis: (ON STREAM) and (MONITORING). At a sample rate of 15-20 liters per minute (L/min), the Lumex can detect mercury vapor in ambient air at concentrations as low as 2 nanograms per cubic meter (ng/m^3). The low mercury detection limit and the sensitivity of the instrument are achieved through a combination of a 10-meter multi-path optical cell and Zeeman Atomic Absorption Spectrometry using high frequency modulation of polarized light. The Lumex is factory calibrated (from 1,000 to 40,000 ng/m3) and mercury vapor results are reported in ng/m^3.

- The Mercury Tracker 3000 is a portable instrument based on resonance absorption of mercury atoms at a wavelength of 253.7 nanometers (nm). The mercury sample is drawn through a 1-micron polytetrafluroethylene (PTFE) filter, at approximately 1.2 L/min, into the optical cell of the instrument by a membrane pump. Radiation from a mercury lamp passes through the cell and is measured by a solid-state ultraviolet (UV) detector. The attenuation of the UV light reaching the detector depends on the number of mercury atoms in the optical cell. The internal computer performs the quantitative evaluation of the mercury concentration in the sample in real-time. The Tracker is factory calibrated (from 60 to 300 $\mu g/m^3$) and mercury vapor concentration is reported in $\mu g/m^3$.

Suggested Action Levels for Mercury (CAS # 7439-97-6) – ATSDR / HSDR and recommended methods of analysis

Indoor Air Concentration (µg/m3)	Use of the Action Level	Rationale for Action Level	Method of Analysis	Reference
10	Isolate residents from the exposure	Based on ATSDR guidelines	Real-time air monitoring instrument (i.e., **Jerome™** or Lumex meter equivalent	ATSDR, 1999.
25	Occupational settings where mercury is handled	Based on the 1996 ACGIH TLV. Assumes hazards communications programs as required by OSHA; engineering controls as recommended by NIOSH; and medical monitoring programs as recommended by the ILO, NIOSH, and ACGIH are in place. This concentration is ½ the peer-reviewed 1973 NIOSH REL and 1/4 the regulatory1972 OSHA PEL. See HSDB at toxnet.nlm.nih.gov/sis on the Internet.	Real-time Air monitoring instrument (i.e., **Jerome™** meter or equivalent)	HSDB, 1999

- *HSDB. 1999. Hazardous Substance Data Bank. National Library of Medicine, Bethesda,Maryland.*

- *Toxicological Profile for Mercury (update). U.S Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. March 1999*

Hence the Jerome analyzer is quite suitable for monitoring Hg in the atmosphere in a factory environment.

6.1.9. Reliability of urine mercury levels as exposure marker

- Urine samples are considered to be the best determinants of body burden of mercury from long term exposure to elemental and inorganic mercury

  International Programme on Chemical Safety – Concise International Chemical Assessment Document 50. Elemental Mercury and Inorganic Mercury compounds: Human Health Effects. WHO 2003.page 15.

- Urinary mercury measurement is reliable and simple and provides rapid identification of individuals with elevated mercury levels.

  Naleway C, Chou HN, Muller T, Dabney J, Roxe D, Siddiqui F (1991) On-site screening for urinary Hg concentrations and correlation with glomerular and renal tubular function. Journal of Public Health and Dentistry, 51(1):12–17.

- Urinary mercury levels have been found to correlate better with exposure than blood inorganic mercury concentration following long term low level exposures to elemental mercury vapour.

  - *Yoshida M (1985) Relation of mercury exposure to elemental mercury levels in the urine and blood. Scandinavian Journal of Work, Environment and Health, 11:33–37.*

- It has been estimated that an airborne mercury concentration of 1mg/m3 leads to an average urinary concentration of 1.4mg/m3 (a ratio of 1:1.4).

  - *International Programme on Chemical Safety – Concise International Chemical Assessment Document 50. Elemental Mercury and Inorganic Mercury compounds: Human Health Effects. WHO 2003.page 16.*

  - *Cross HJ, Smillie MV, Chipman JK, Fletcher AC, Levy LS, Spurgeon A, Fairhurst S, Howe A, Mason H, Northage C, Wright A (1995) Mercury and its inorganic divalent compounds. Criteria document for an occupational exposure limit. Sudbury, HSE Books.*

- For the biological monitoring of mercury exposure at the workplace, mercury concentration in urine is an important parameter.

  - *Clarkson TW, Hursh JB, Sager PR, et al. 1988b. Mercury. In: Clarkson TW, Hursh JB, Sager PR, et al. eds. Biological monitoring of toxic metals. New York: Plenum Press, 199-246.*

  - *Lauwerys RR, Hoet P. Industrial Chemical exposure. Guidelines for biological monitoring. Lewis publishers.1993:174-82.*

- Mercury concentrations in the urine of workers with mercury poisoning remain elevated for 100 days at the end of exposure.

  - *Yamamura Y, Mercury concentrations in blood and urine as indicators of exposure to mercury vapour. In: Biological Monitoring of Exposure to Industrial Chemicals. Fiserova-Bergenova V, Ogata M. (Eds) ACGIH Cincinatti 1990: 113 -7.*

Other references

1. *Toxicological Profile for Mercury (update). U.S Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. March 1999. page 187.*
2. *Biological monitoring of chemical exposure in the workplace. Guidelines. Volume 1. WHO, 1996. Inorganic Mercury. pp 132 – 155.*

6.1.10. Recommended rules and regulations for measurement of mercury and its control in Indian Legislation

Permissible limits of exposure

Time weighted average concentration for Mercury (as Hg) is 0.05 mg/m^3 and short term maximum concentration is 0.15 mg/m^3.

Periodicity of medical examination (Tamil Nadu factories Rules 62-N. MEDICAL EXAMINATION &section VI of Chemical works - Medical requirements)

- Before employment to ascertain the physical fitness of the person to do the job.

- Once in 6 months to ascertain the health status of all the workers in respect of occupational health hazards to which they are exposed: and in cases where in the opinion of the factory medical officer to do so at a shorter interval in respect of any worker.

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- Decontamination facilities. Readily accessible means of water for washing by workers as well as for drenching the clothing of workers who have been contaminated with hazardous and corrosive substance.

Maintenance of Records (Tamilnadu Factories Rules Chapter IX special provisions Dangerous operations)

- Any register or record of medical examination and tests connected therewith required to be carried out under any of the schedules hereto in respect of any worker shall be kept readily available to the inspector and shall be preserved till the expiry of 1 year after the worker ceases to be in employment of the factory.

Ambient Air Sampling (Rule 102 A Tamilnadu Factories Rules)

- Sampling has to be done in work locations. Work location is defined as a location in a factory at which a worker works or may be required to work at any time during any shift on any day. There is no mention of personal sampling.

6.2 Issues of exposure data and other details:
The committee deliberated in detail on these issues including the safety practices. The respondents were also asked to respond on

1) Urinary mercury level estimation: whether it was a planned monthly or a randomly done. Was it done on Mondays or Fridays, etc. How was the report shared with the workers. How involved were the workers in the safety measures / practices.
2) The details regarding use of filter and cartridge masks. Supply of masks and type provided in different sections. Deviances, if any.

The details provided by the respondents are appended (Annexure 7)

The committee deliberated and noted that:

6.2.1. The respondent was carrying out the biological monitoring since the inception of the factory to its closure in 2001 even though this is not a statutory requirement. The committee believes that company generated the data without any bias or prejudice. It is worth reiterating here that at the specific direction of the Supreme Court Monitoring Committee the Tamil Nadu Pollution Control Board had asked the ITRC to evaluate the health aspect. ITRC as a part of this evaluation had individually examined and certified each record as being correct on the basis of an extensive audit. It must be stressed that ITRC is a premier scientific institution of this country and is a part of the Council of Scientific and Industrial Research Laboratories (CSIR). *ITRC*

opinion is highly regarded and valued in scientific circles across the world and proper scientific respect must be given to their findings.

It is difficult to attribute vague psychological and neurological symptoms expressed by the workers in 2006 to exposures that occurred before 2001. There is no evidence in respect of any of the employees visiting local medical practitioners/experts with complaints relatable to mercury exposure in this intervening period. The company's medical evaluation team posted it's advertisement in local dailies asking ex-employees to present themselves for an evaluation also did not reveal any mercury relatable ill-health. Vague symptoms such as memory loss / headache etc. can be due to a myriad of common causes and are not specific to exposure to mercury.

6.2.3 Causal relationship and epidemiological principles

The committee evaluated available evidence in order to determine if there was a causal link between a alleged health condition and attributed cause (mercury exposure) and drew upon the set of laid conditions that need to be fulfilled for making such assumption. As per standard epidemiological methods these conditions include

1) *Strength of the association:* This is particularly important if the neurotoxic disease under study is relatively common (e.g., polyneuropathy, tremors) or is multifactorial in nature (e.g. loss of memory, dementia)

2) *Consistency of the association:* It has not been observed by the committee in the cases and patient reports.

3) *Temporal relationship between cause and effect:* This criterion requires that exposure to a neurotoxic agent must precede the neurotoxic effect.

This criterion of a temporal relationship was recently used in the design of an epidemiological study aimed at elucidating the role of different exposures in unexplained illness in US Gulf War veterans (Spencer et al., 1998). Results from this study revealed that illness among veterans was not a function of the period of time they were actually present in the theatre of operations. That is, illness was distributed to the same degree in persons who served prior to, during and following the actual conflict, thus arguing against exposure to a neurotoxic agent as the cause of the illness.

4) *Biological gradient of the association:* Evidence for causality is strengthened when the risk for disease is shown to increase with increased levels of exposure.

5) *Specificity of the association:* The specificity criterion requires that the disease under study is caused only by a particular agent or that a particular agent

produces only a specific disease. Specificity of cause is common in infectious diseases, but much less so in chronic diseases with multifactorial causes (IPCS, 1999). In neurotoxicology, many examples of known neurotoxic disease exist (e.g., polyneuropathy due to *n*-hexane, acrylamide, etc.; parkinsonism due to manganese, MPTP, etc.) that are not specific to exposure to only one compound.

6) *Biological plausibility of the association:* An epidemiological inference of causality is strengthened by data from experimental studies showing consistency with biological mechanisms.

The committee could not locate animal studies that show delayed effects of elemental mercury poisoning. In addition expert opinion from the ITRC and the NIOH stating that there is no evidence in literature of delayed effects to elemental mercury exposure has already been placed before the Honorable High Court.

Further the following issues will also have an adverse impact on quality of any study envisaged at this juncture of time.

- Difficulty in finding a suitable comparison group which differs from the factory workers with respect to exposure to mercury and nothing else.
- The frequency of expected illnesses following mercury poisoning decreases over a period of time, hence initiating a study now will not tease out any useful information.
- A study of this nature will have to depend on secondary data on exposure.
- Since the exposure data (urinary mercury values) is available for roughly 200 subjects, the study size may not yield statistically significant results.
- It is important to note that at this point in time the workers have not only been exposed to certain levels of mercury at work but have also undergone the stress related to experience of losing jobs and the consequent emotional and social problems. A confounding factor difficult to control.

On an overall evaluation the committee was of the opinion that there are no valid scientific reasons for designing or pursuing any further studies in view of the following reasons:

- Exposure data show that exposures were within acceptable limits
- Group means were well within WHO guidelines
- Individual means well within recommendations in the Indian Factories' Act (on the basis of derived values for atmospheric allowable workplace concentrations).
- The fact that most effects arising out of low level exposure to mercury are indeed reversible

- Half life of Hg in the body is around 60 days and many years have elapsed since the petitioners last worked in the factory. In most cases the claims of fresh symptoms as evinced by their evaluation by the petitioner's doctor indicates that they have begun many years after leaving the factory and are hence untenable from an epidemiological perspective of cause-effect relationship.
- Mercury does not have a latency period with respect to effects beginning long after cessation of employment (ITRC, AIIMS & NIOH expert views already on record)
- Mercury is not carcinogenic
- Elemental mercury does not get converted to organic mercury in the human body.
- Any epidemiological study needs to consider relevant exposure data and in the context of the current issue can only be undertaken on the basis of existing urinary mercury data . Such a study has already been done, peer reviewed and published (*Indian Journal of Occupational and Environmental Medicine dated Jan- Apr 2006: pages 384 - 416 / Respondent's Vol. II in the High Court submissions).*

The Kodaikanal site visit report by Dr. S. K. Dave elaborates on the aspects referred above. (Annexure 8)

7.0 Conclusions

The factory was closed in March 2001. After this the company carried out systemic medical examination by a panel of eight doctors to find out whether mercury related symptoms such as tremors, dysdiadochokinesis, Rhomberg's test and knee-heel-toe tests were present or not. The respondent doctors not only examined mercury related symptoms but the morbidities if any due to other reasons.

Apart from conducting medical examination at the time of closure the company was regularly conducting periodical medical examination since its inception. All the records pertaining to these have been very well maintained and documented. The company carried out the medical examination using standard questionnaire based on US department of mines questionnaire on exposure to heavy metals. The questionnaire and the subsequent clinical evaluation were validated on site by an external epidemiologist.

Further, the certifying surgeon from the factories inspectorate of the Govt. of Tamil Nadu, had conducted medical evaluation of the workers and reported no abnormality.

The company was regularly conducting environmental and biological monitoring. The environmental monitoring details revealed that the company was keeping the levels of Hg in the workplace to < 0.05 mg/m^3 in line with the Indian Factories Act

and rules. The company was regularly conducting biological monitoring as per the WHO guidelines by CVAAS which is a well accepted method all over the world. The data of each individual has been recorded in a separate file. These data have been further analyzed as a group means and presented accordingly. Similar data have been presented year wise with number of workers studied in each year along with their values. As per WHO guidelines group means were well within the WHO recommended level of 50 µg/lit. With respect to individual values there were a few outliers. Such outliers were rotated and evaluated. Sufficient care was taken to see that before they were shifted back to their original job their levels came back to acceptable limits. As per the records only < 1% were showing such higher levels.

Similarly no specific morbidities such as dysdiadochokinesis, *(loss of ability to do repetitive tasks e.g. ability to rotate hand so that the palms face alternatively up or down),* abnormal Rhomberg's test *(test for gait)* knee-heel-toe or index finger to nose tests were found. Problems like loss of teeth and gingivitis (inflammation of gums) can be attributed to pan/tobacco chewing and poor oral hygiene.

In view of these observations and committee's deliberations including the site visit etc., the committee concludes:

- Based on the site visit, the clinical evaluation of subjects considered to be most affected by the petitioners on site at Kodaikanal and a comprehensive review of all available material on hand and keeping in view the available contemporary scientific literature the committee members after a careful consideration concluded that the committee failed to find sufficient evidence to link the current clinical condition of the factory workers to the mercury exposure in the factory in the past.

- In view of the reasons as mentioned above the committee does not recommend any further study - The ex-workers not only had an opportunity to get exposed to mercury but also had to go through a process of losing job and facing consequent socio-economic dislocations. This could have induced life style changes which could have had an effect on perceived health status. Hence, at this point in time it will be difficult to bring out the pure ill effects of mercury on them.

A K Srivastava

(On behalf of the committee appointed under the directions of the Hon"ble High Court of Madras in writ petition no. 8291 of 2006)

Annexure - 1

Petitioner's list of employees and their families allegedly suffering from ill-health on account of exposure to mercury

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
1	1	S.Arun Prasath / 45 / M S/o.D.Salethnathan 402, Vinoba Nagar, G.Kallupatti (PO), Ganguvarpatti, Periyakulam T.K	1984-1992 9 years	Screening Production Opcrator (Hg. Area)	Confirmation Letter Copy **Regular**	Dental Problem, Skin patches, Nervous Problem, Head Ache, Shivering. Medical reports enclosed Wife - 2 Times abortion, Son 1 - Primary Complex, Son 2 - Asthma.
2	2	S.Johnson / 45 S/o.Sundi Micheal, Ugarthe Magar, Kodaikanal	1987-1992 (5 years)	Certification Fixing (Hg Area)	Service Certificate **Regular**	Skin Patches, Tiredness, Head Ache, Low Eye Sight. Wife - Irregular Periods, Head ache. (No Medical Reports)
3	4	R. Vijayalakshmi (35) W/o. M. Raveendran. 11/9R. Street Mary's Road Kodaikanal.	1993-1997 (4years)	Digital Sec. Bulb washing (Non Hg. Area) Packing in Hg Area	P.F.No. TN/[illegible]/36 Contract / TCard	Head ache, giddiness, Irregular Periods, Tension Dental problems, Uterus problem.
4	5	A.Antony Dass / 42 S/o.K.Robert, 4/62, Tunerpuram, 2nd Street, Kodaikanal.	1984-1989 (5 years)	Screening Washing (Hg. Area.)	Confirmation Letter copy **Regular**	Breathing Problems, , Head Ache, Hernia Operation Problems. Wife - Irregular Period, uterus Problem (Medical Report Enclosed)
5	6	V.J.Vincent / 49 S/o.Y.V.Jacob Rifle Range Road, Kodaikanal.	1984 - 1998 (14 years)	Screening (Hg. Area.)	Company Employ Medical Card Copy **Regular**	Shivering, Dental Problem, Tiredness, (No Medical Reports).
6	7	P.Paul Raj / 37 S/o.K.Paulraj, 11/88A, Lasabth Street, St. Mary's Road, Kodaikanal.	1984-1991 (8 years)	Laser Contracting Chart out 98 Top cutting N. Opening (Hg. Area)	Confirmation Letter Copy **Regular**	T.B. Stomach Pain, Head Ache, Body Pain. Wife - 2 times abortion, Hip Ache, Head Ache. Son - Primary Complex (Medical Records Enclosed)
7	9	D.Yesiah / 43 S/o.Daniel, Pambarpuram, Kodaikanal.	1984-1986 Yogaraj Contract 1986 - 996 (12 years)	Service	Service Certificate **Regular**	Stomach Pain, Back Ache, Dental Problem, Deformed Ear Wife - Irregular Periods, Body Ache. 1 time abortion. Hip Ache Son - Deformed Ears, Body Weakness. (Medical records enclosed)

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
8	10	S.Joseph Mathew / 29 S/o.Soosai Manickam, Lloyds Road, Ambetkar Nagar, Kodaikanal.	1995-1999 (5 years)	Fine air passing Rough air passing (Hg. Area)	Pay Slip	Ulcer, Head Ache, Tiredness, Shivering, orthopedic Surgery. (Medical Report Enclosed)
9	12	A.S.Robert Kennedy / 42 S/o.K.M. Arul Dass Behind R.C. School, Kodaikanal.	1984-1987 (3 years)	Laser (Hg. Area)	Pay Slip	B.P., Stomach Pain, Chest Pain, Plain Fall. Wife - Hire Abortion, Head Ache. Son - Brain disorder (Medical records enclosed)
10	13	M.J.Antony / 46 S/o.M.Joseph Veeramuthu 15/227-C, Rackiapuram, Maidupuram, Kodaikanal	1984 - 1998 (14 years)	Rough air passing, Test for Shake,Top Chamber, fill room, fixing (Hg. Area)	Service Certificate Copy **Regular**	Bleeding in teeth, Mouth Ulcer, Memory loss, Skin Patches, Giddiness. Medical Report enclosed. Wife - 1 time abortion, Giddiness, Irregular Periods, Abdomen Problem.
11	14	A.Rathina Rajaseelan / 40 S/o.S.P.Anandraj, 15/K3, Angel Cottage, Packigpuram, Kodaikanal	1985 - 1994 (9½ years)	Filling, Topchamber Fixing Air passing (Hg. Area)	Service Certificate Copy **Regular**	Blood Sugar, Head Ache, Dental Problem, memory Loss, Impotency, Shivering, Tiredness. Wife - 2 time abortion, Thyroid. (Medical Reports enclosed)
12	15	J.Peter Sunderrajan / 46 S/o.John peter 4/40, Tumerpuram, 1st Street, Kodaikanal.	1984 - 1996 (13 years)	Fine Air passing (Hg. Area)	Service Certificate Copy **Regular**	Breathing Problem, Tiredness, shivering eye sight loss. Wife - Irregular periods, Stomach pain, Ultras problem, (Medical records enclosed)
13	16	B. Shagaya Mary (45) W/o.S.Babu M.G.R.Nagar, Govt. Play Ground Kodaikanal	1997-1998 (1 year)	Packing (Hg.Area)	Company Medical Check up letter	Nerve problem, frequent Headache giddiness
14	17	M.Marimuthu / 47 S/o.Munuyandi 4/130, 37, Indra Nagar, Kodaikanal.	1985-1989 (4 years)	Laser Operator (Hg. Area.)	Salary Slip **Regular**	Skin Patches, Tiredness, Dental Problem, Eye sight loss. (No Medical Reports)

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
15	20	G.Suresh / 47 S/o.D.George, Langcraft Compound, Kodaikanal.	1984-1992 (8 years)	Electrician (Hg Area)	Probationary Order Copy Regular	Head Ache, Body Weak, Back Ache. (Medical Reports Enclosed)
16	21	R.Ramesh / 29 S/o.Arputharaj, Moovaroor Post, Musiry Trichy.	1995 - 1999 (4 years)	Bulb cutting (Non-Hg) Fill room Top Chamber (Hg. Area.)	General Training Programme	Eye sight loss, Stomach Pain, Head ache, Wife - 5 times Abortion, Irregular Periods, Eye Sight Loss. (No Medical Records)
17	22	P.Amalorpavam /(40) W/o. V. Patric. No. 17/328-6, M.G.R. Nanga, Govt.Play ground , Kodaikanall.	1997 – 1998 (1 year)	Stores, Digital and packing in Hg. Area	Company letter	Giddiness, Head ache, B.P Knee pain (Legs & hands)
18	23	P. Jeyanthi (28) D/o. Patric, W/o.Kumar 17/368/6A, M.G.R.Nagar, Kodaikanal	1997-1998 (1 year)	Digital & Packing in Hg Area	Company letter	Ulcer, Chest pain, Head Ache excessive bleeding
19	24	R.Rajah / 43 S/o.R.Rangaraj 13/179, Anandayiri, 3rd Street, Kodaikanal	1985 - 1991 (6 years)	Rough air Passing, (Hg. Area) Office Worker	Urinary Report Copy Regular	Breathing Problem, Back ache, Urinary Problem, Head Ache, Eye Sight Loss. Wife - 3 times abortion & operation. (Medical record enclosed)
20	25	T.Kaviraj / 40 S/o.Theordre, Punitha Illam, Srinivasapuram, Kodaikanal.	1989 - 1994 Pondurangam Contract. 1994 - 1998 (10 years)	Fire air passing Top chamber Mercury filtration (Hg. Area.) Service.	Service Certificate copy Regular	Memory loss, tiredness, Shivering, Eye sight loss. (No Medical records).
21	29	V.Pappa (40) W/o.R.Vishwanathan 1/98, Haniraj Compomet, St.Mary's Roa, Kodaikanal	1994 - 1995 (1½ years)	Packing, Top cutting (Hg. Area)	Temporary Workmen order copy	Uterus problem, Irregular periods, giddiness, excessive bleeding son - irritation of eyes chest pain

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
22	33	J.Sudhakar / 28 S/o.Jeganathan, Sinivasapuram, Kodaikanal.	1990 – 1999 (9 years)	Fill Room Filtration (Hg Area)	Temporary workman Certificate	Headache, Body ache, Giddiness, Blood Vomiting, Ulcer, Eye Defect.
23	34	R.S.Jayapal Joseph / 25 S/o.R.Sebastian, C/o.Devasahayam, Veterinary Hospital Quarters, Kodaikanal.	12.08.1996 - 30.06.1999 (2¼ years)	(Hg.) Distillation Service	T.Card T.20, Token 295, General Training Order copy	Kidney Problem, memory Loss & Kidney stone, Head ache
24	35	S.Sagayaraj / 44 S/o.Saleth Nadhan, 12/20, Pambarpuram, Kodaikanal.	1986 - 1994 (9 years)	Screening (Hg. Area)	Confirmation Order copy Regular	Chest Pain, Head Ache, Sugar Complaint, Memory Loss, respiratory problems, Nerves Problem. Wife - Irregular Periods, 4 times abortion Stomach pain. (Medical Reports enclosed)
25	37	M.Kulandairaj / 41 S/o.Mariya Arockiaraj, 4/115, B-1, Anna Nagar, Kodaikanal.	1986 - 1993 (7 years)	98' Inspection, Laser (Hg. Area)	Service Certificate Copy Regular	tiredness Body Weakness. Wife - Uterus Operation, Irregular Periods, Giddiness. Daughter - White Patches (Medical reports enclosed)
26	39	R.Antony / 43 S/o.S.Raphel, A.3-5/296, Anandagiri, 7th Street, Kodaikanal	1988 - 1996 (8 years)	Canteen Rough Air passing (Hg. Area)	Confirmation order Copy Regular	Head Ache, Piles, Giddiness, Knee Pain, Dental Problem, Shivering. Wife - Irregular periods, Eyesight loss, head Ache. (No medical records)
27	40	G. Mallika (48) W/o.A.Gnanayya St. Antony Kovil Street, Kodaikanal	1993 - 1999 (7 years)	Digital & packing (Hg. Area)	T. Card A.398, Temporary workmen order copy	Knee pain, Head ache, Dental problem Back ache ulcer daughter - Urinary problem - Breathing problem
28	41	A.Baskaran, S/o.Anga Naidu,	1984 - 1991 (8 years)	Quality Assurance (Hg. Area)	Confirmation Order copy Regular	Back Ache, Head Ache, Memory Loss, Tiredness Wife - Bleeding Nose, Irregular Periods

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Palani Road, Kodaikanal.				Daughter - Skin Patches.
29	42	P.Velu / 60 S/o.Poochi 298, D1 Pudukkadu, Observotery, Kodaikanal.	1984 - 1989 (5 years)	Bulb forming (Non Hg. Area) Contracting (Hg. Area.)	Company Urine Report Copy **Regular**	Medical records enclosed. Chest Pain, Tiredness, Skin Patches, Eye Eight Loss. Dental Problem, all tooth fallen. Wife - Dental Problem Giddiness.
30	43	R.Subbaiah / 48 S/o.S.Raj Naidu 3/26, Perumal Malai Post, Kodaikanal.	1985 - 1989 (4½ years)	Contracting (Hg. Area)	T.Card T.No.160	Head ache Memory loss, Giddiness, Bleeding gums. Wife - Irregular Periods, B.P., Tiredness, head Ache 1 Son - Expired, 2 Son - Brain disorder - Dem, Unable to walk, 3 son - Mental disorder. (Medical records enclosed)
31	44	O.Poovalingam / 40 S/o.Ondi Thevar, Convant Road, Depot, Kodaikanal.	1989 - 1995 (7 years)	Rough Air passing fill room (Hg. Area)	Confirmation order Copy **Regular**	Head ache, Back ache, Stomach pain, Memory Loss, Nervous Problem. Wife - Allergy, Skin Patches. (Medical Records enclosed)
32	46	J.Nirmala / 54 W/o.Jayapal Chandran, 11/96-B, St. Mary's Road, Kodaikanal.	1992 - 1997 (7 years)	Top cutting Packing. Screening (Hg. Area) & Digital		Irregular periods, Backache, Stomach Pain, Head Ache. Husband - Asthma, Back Ache, Medical Reports Enclosed.
33	47	S.X.F.Sridhar / 49 S/o.A.Salethnathan 17/328, 63, M.G.R.Nagar, Kodaikanal	1984 - 1997 (13 years)	Fill Room Top Chamber (Hg. Area.)	Confirmation Order Copy **Regular**	Dental Problem, Eye Sight Loss, Back Ache, Headache, Weakness. Wife - Backache, Headache. (Sister - Expired - Medical records enclosed)
34	48	S.S.John Sahayanathan / 44 S/o.John Sabestian 15/41-A, Jancy Illam, Bear Shola Road, Kodaikanal	1984 - 1989 (5 years)	Contracting Top Chamber (Hg. Area.)	Probationary letter copy **Regular**	Itching, Skin patches, Headache. Wife - Sinus Problem, Daughter-Sinus Son - eye sight loss. (Medical records not available)
35	49	R.S.Rahunathan,	1985 - 1989	Fine air passing Rough air	Company letter copy	Irritation of head ache, Skin patches, Dental Problem.

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		S/o.R.Subbiah, 9/128, Bliso Villa Street, Kodaikanal.				
36	50	S.Alagar Raja / 49 S/o.Subbaiah, 15/49, A1, Vadakarai Village, Convent Road, Kodaikanal.	13.05.1986 - 1995 (10 years)	Maintenance Top cut,Laser certification (Hg. Area)	Pay Slip Time card **Regular**	Stomach pain, Piles Body Shivering Giddiness, Skin disease, Heart Problem. Diabetes left Eye Operation. Medical report's Enclosed. Wife - Shivering Menstrual Problem, 2nd son nose bleeding.
37	51	A.Johnson / 43 S/o.P.S.Augustine, Convent Road, Naidupuram, Kodaikanal.	01.01.1984 - 30.11.1986 (12 years)	Non Mercury & Fill room Top Chamber, Grading (Hg. Area.)	Service Certificate T.K.No.26. **Regular**	Giddiness, Dental Problem Piles, Hand & Leg. Shivering, Headache. Pass 10 years No child (Impotency) Wife - Several time abortion and menstrual problem. Children's Memory loss.
38	54	K.M.Giyas Mohamed / 42 S/o.K.M.Kasim, C/o.St. Peter's School, Fairy Falls Road, Pambar Puram, Kodaikanal.	18.04.1984 31.08.1989 (5 years)	Screening (Hg. area.) & Service	Confirmation Order **Regular**	Dental Problem, Back pain Memory Loss, Headache, Tiredness. Wife - 9 time abortion Mental problem.
39	56	S.A.Mahindran / 47 S/o.G.T.Sebastian, 10/2-A, Blissuilla Street, Kodaikanal.	1984 - 1989 (5 years)	Mercury Filling Contracting (Hg. Area.)	Probationary Order copy **Regular**	Frequent Head ache. Stomach problems Impotency Skin itching Diabetes Bleeding nose. Wife - Heart problem. Medical reports enclosed.
40	57	S.Raja Mohamed / 45 S/o.Syed Mohamed, 4/41, Noor Illam, Turnerpuram, 2nd Street, Kodaikanal.	26.03.1984 – 1989 (5 years)	Fire Air passing 95° inspection No clear inspection, Test for shake, Quality control (Hg. Area.)	Identity Card T.K.No.62 **Regular**	Frequent Headache. Hand & Leg Shivering. Memory Loss, Back Pain, Tiredness. Cancer in the leg operated. Medical Record's Enclosed. Wife - Uterus Problem, Menstrual Problem. One abortion. Son - Heart Beat in High Level, memory loss.
41	60	S.Balu / 43 S/o.M.Subramniayam 15/39, Pear sola falls Road, Kodaikanal.	04.04.1984 - 31.08.1989 (5 years)	Quality Assurance (Hg. Area)	Confirm order copy **Regular**	Headache sinus. Head back side, itching, Body itching Digestion problem, Eye sight problem. Wife - two abortion, Medical records enclosed

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
42	61	C.Robertson Jeyaraj / 44 S/o.s.P.chellaih, 31/235, Arandagiri, 4th Street, Kodaikanal.	06.01.1984 - 01.03.1988 (4 years)	Rough Air Passing (Hg. Area)	Company Letter about Medial Record's	(Daughter Primary complex) Body Swelling. Skin disease, Hand and leg swelling. Wife - Skin problem. Daughter - Skin patches Son - Breathing Problem.
43	62	A.Kulanthairaj (38) S/o.Antony Gruz, 17/317, M.M.Street, Kodaikanal	1990-1996 (6 years) Jeyaseelan Contract	Tailoring Work	No.	Head Ache, Wife - had one time Abortion
44	64	T.JohnManohar / 44 S/o.Thankayya, Tumerpuram, 1st Street, Kodaikanal.	08.05.1984 - 31.08.1989 (5 years)	Screening (Hg. Area)	Identity Card **Regular**	Tiredness, Shivering, Skin desires, Headache. Wife : One time abortion. Son and daughter, has skin problem.
45	65	A.Babu / 43 S/o.Abdhul Menon Rifle RangeRoad, Naidupuram, Kodaikanal.	10.10.1985 - 02.09.1989 (4 years)	Fine Grading Laser cut Packing (Hg. Area)	Service Certificate	Giddiness, Memory Loss, Tiredness, Shivering, Urinal Problem. Wife - Leg Pain
46	66	K.Radhkrishnan / 44 S/o.K.Karthiyappa Aasari, Andhagiri 3rd Street, Kodaikanal.	11.04.1985 - 01.09.1989 (5½ years)	Screening (Hg. Area) Bulb Forming (Non Hg)	Time card confirm Order **Regular**	Impotency, Back pain, Headache, memory loss, Weight loss, Dental Problem, Spinal cord operation.
47	70	A.Augustine Chelladurai / 52 S/o.A.Augustine, 16/54-C, Mudhalipuram, 1st Street, Kodaikanal	02.04.1984 - 30.09.1989 (5 years)	Fixing Rough Air passing Fine Air Passing No clear Inspection (Hg. Area.)	Service Certificate **Regular**	Giddiness Headache, Body itching, Tiredness, Hand & Leg Shivering, Memory Loss Wife - Menstrual Problem. Thyroid problem, Body Itching, Joint Pain.
48	71	L.Rengasamy / 50 S/o.Lakshmanan, 14/39-B, berifalls Road, Observatory P.O. Kodaikanal.	10.03.1986 - 07.02.1996 (11 years)	Service Cold Blub oven. (Hg. Area)	Confirm Order copy **Regular**	Respiratory problem unable to work. Wife - Dental Problem, Stomach Pain. Daughter : Stomach pain.
49	74	L.Chandrasekar / 48 S/o.S.Lakshmanan, 5/108, Annandhagiri, 2nd Street,	02.04.1984 - 1996 (12 years)	Test for shake Quality Assurance	Junior Charge-hand Order copy. P.F.No. T.N./17287/74	Headache, Dental Problem, Eye sight Problem. Wife - Two time abortion Eye defect, Headache.

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Kodaikanal.				
50	76.	P.Masimalai / 41 S/o.K.Periyannan, Moolakambi, Gel Pudhukadu, Observatory P.O. Kodaikanal.	1986-1995 (11 years)	Fine Air Passing, No clear Inspection Grading (Hg. Area.)	Company Urinal Report **Regular**	Hip ache Blood Vomiting Headache Stomach Pain. Wife - Menstrual Problem one time abortion. Son & Daughter, headache, Eye eight Problem.
51	77	K.Sivamoorthy / 42 S/o. R.Kandhaiah, Viduthalai Nagar, Gundupatti, Pudhuputhor P.O. Kodaikanal.	11.09.1986 - 06.06.1996 (10 years)	Top chamber Laser Cut, Fine air passing Screening, Oven (Hg. Area)	Probationary Order Copy **Regular**	Giddiness, Headache, Right-hand Pain, Tiredness, Memory Loss. Wife - One abortion Menstrual problem, leg pain. Son - Eye defect.
52	78	M.Jayapal Thiyagarajan / 45 S/o.S.E.Michale Pambur Puram, Kodaikanal.	06.03.1987 - 05.09.1995 (8¼ years)	98° inspection grading Laser cut (Hg. Area.)	Service Certificate **Regular**	Dental Problem
53	80	S.Peer Sherief / 45 S/o.Sahul Hameed Thadivanainar Street, 6-5.41 Devadanapatti, Theni.	30.03.1987 - 25.04.1996 (11 years)	Bulb forming (Non Hg. Area) Top chamber Shake out (Hg. Area.)	Service Certificate **Regular**	Body Itching Back pain . Wife - Menstrual Problem Two abortion, Headache Son - Skin problem, daughter - white patches.
54	84	Y.N.Abraham / 34 S/o.Yesu Nesam, 79/248, A.I, Naidupuram, Packiyapuram, Kodaikanal.	1989 - 1991 (2 years)	Air testing top cutting & Packing. (Hg. Area)	T.Card P.F.No.TN/17287 /472	Tiredness, Stomach Pain Eye Defect Continual Headache.
55	86	S.Anbudass / 40 s/o.F.Sebatian, 15/161-B6, Convent Road, Kodaikanal.	1985 - 31.08.1989 (4 years)	98° Inspection (Hg. Area)	PF No. TN/17287/227 **Regular**	Skin patches, Stomach Pain, Headache, Memory Loss. Wife L head ache, Daughter chest pain.
56	87	A.V.Murugan / 41 S/o.Veerasamy, 17/432-A Police, Line - Near, Fern hill Road, Kodaikanal.	1987 – 1995 (8 years)	Contracting (Hg. Area) Hg Waste Crushing unit.	Confirmation letter copy **Regular**	White patches in Body Head ache, Weakness Wife - many time abortions (Medial reports enclosed).
57	89	P. Jenifer Nanaj Rani (44) W/o. Y. Paulraj	1998-1990 (1½ years)	Packing	Company letter	Head ache, Memory loss, eye sight problem Uterus problem - Uterus removed

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		D/No.4/501, Thiru.V.Ka, 4th Cross Street, Vivay Ganantha Main Road, Anna Nagar, Madurai -20		(Hg. Area) & Digital Sec.		
58	90	Ruby Kanayadass (30) W/o.Edwin Poomari Illam, Pambarpuram, Kodaikanal.	1996- 1998 (2½ years)	Digital & Packing (Hg.Area)	PF No.TN/17287/937	Irregular periods, Menstrual problem, under treatment (No medical records available)
59	91	J.Jayalakshmi / 32 D/o.Jayaraman, Govt. Play Ground, M.G.R. Nagar, Kodaikanal.	1996 - 1997 (8 months)	Packing (Hg Area) & Digital Sec.	Company Medical record Letter	Headache, Eye Irritation, Irregular period, Ulcer, Stomach pain,
60	93	V.Jayapaul S/o.R.Varatharajan, 1/115, Shenbaganur, Kodaikanal.	1985 - 1989 (5 years)	Laser (Hg. Area)	Company Identity Card Regular	Skin patches, Itching Head ache, Back ache. Wife : 1 time abortion, Irregular periods, skin itching. Daughter – not well grown (8 years - 11 kg only) (Medical reports enclosed)
61	95	P.Anandan / 47, S/o.Poombarayandi, 1/5, Vellagavi, Kodaikanal.	1985 - 1992 (7 years)	Rough Grading Fine grading 98' Inspection (Hg. Area)	Confirmation Order copy Regular	Head ache, Giddiness, Skin patches, Itching, Dental Problems, Eye sight loss, bleeding in gums Wife : Irregular periods 3 time abortion 2 son - expired (Medical records enclosed).
62	96	S.Samuel Rajkumar / 28 S/o.C.Selvaraj, 5/235, Annanthagiri, 4th Street, Kodaikanal.	1996 - 1997 (2 years)	Office work Packing in Hg Area	T. Card Urine Report	Headache Eye Defect, back pain
63	97	A.Sahayam / 45 S/o.Antony Samy	1984 - 1985 (1 year)	Bulb forming	Sport Certificate	Heart Problem.

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		S.J.J.Illam, Forn Hill Road, Kodaikanal.				
64	98	W.Victor / 46 S/o.C.William, 12/144D, Pambarpuram, Kodaikanal.	1984 - 1998 (15 years)	Fill room Top cutting top chamber (Hg. Area)	Pay slip Regular	Stomach Pain, Dental Problem, Eye sight loss. Wife : 1 time abortion. Daughter - Heart Problem (No medical reports)
65	99	K.N.Muniyandi / 34 S/o.Natchimuthu, 4/115, D-3, Anna Nagar, Kodaikanal.	1992 - 1994 (3 years).	Injection molding, Hg. Waste crusher, Packing in Hg. Area	Temporary Order copy	Headache, dental problem, Eye irritation, Skin problem, Memory loss. (Medical Bills only.)
66	100	Joseph Philip / 39 S/o Thomas 15/208, A-1, Packiyapuram, Naidupuram, Kodaikanal.	1988 - 1993 (5 years)	Air Test, Top chamber, contracting (Hg. Area).	T. Card No.2, Temporary Workman Order copy.	Breathing Problem
67	102	M.Kumaraguru / 52, S/o.Muthupillai, Attuvam Patti, Kodaikanal.	1984 - 1986 (2 years)	Rough Air passing (Hg. Area.)	ToK. 139 Casual Operator	Skin patches, Dental problem Head ache, white patches, (medical records available enclosed)
68	108	S.Shagayaraj / 42, S/o.Soosai, P.K.M.Cross Street, Shenbaganur, Kodaikanal.	1984 - 1991 (7 years)	Fine Grading Screening Washing (Hg. Area.)	Employee Medical Card Regular	Skin Patches, Giddiness, Head ache, Stomach pain, tiredness, (Medical records enclosed) Wife - 1 time abortion.
69	109	K.Murugan / 37 S/o.M.Kairan 4/79, Tunnerpuram, Kodaikanal	1991 - 1993 (3 years)	Injection Molding, Packing (Hg. Area.)	Temporary Workman Order copy	Headache, Skin problem, Teeth problem, eye problem, memory loss, giddiness.
70	110	P.Saravana Kumar / 23 S/o.Pandurangan Fary Falls Road, Observatory, Kodaikanal.	1990 - 1992 (2 years)	Top cutting (Hg. Area)	Temporary workman order copy	Bleeding Nose, Cold, Head ache, vomiting (No Medical reports)
71	113	R.Sukumaran,	1984 - 1989 (5½ years)	Grading Screening	Token No.63 Regular	Itching, giddiness, Head ache Ulcer, Irritation in eyes. (No medical Records)

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		S/o.Ramakrishnan, Dobhi Kanal, Kodaikanal.		(Hg. Area)		
72	114	J. Metilda Selva kumari (29) W/o.Sathiyadass Summer Chit Dep Road, Kodaikanal	1997 - 1998 (1¼ years)	Digital & packing (Hg Area)	Company letter	Irregular periods Dental problem stomach pain, Giddiness eye sight problem, legs pain tired ness
73	118	A.Sivakumar / 36 S/o.M.Angaiah 5/43, Anandagiri, 1st Street Kodaikanal.	1988 - 1990 (2 years)	Top cutting (Hg. Area)	P.F. No.17287 / 344	Impotency, T.B.
74	122	A.Suresh / 40 S/o.T.Abel Rifle Range Road, Kodaikanal.	1985 - 1989 (3½ years)	Top cutting Rough Air Passing, T.F.S. (Hg. Area.)	Company Urine Analysis Report	Eye Irritation, head ache, Body weakness irritation, Chest (No Medical Reports)
75	123	Y.Stephen / 42 S/o.I.Yesudass, Rifle Range Road, Maidupuram, Kodaikanal.	1996 - 1997 (1 year)	Auto Laser, Air passing Top cutting, Packing (Hg. Area)	P.F.No. TN17282 /894	Heart Pain Laziness.
76	124	A.John Ignatius, S/o.M.D.Asirvatham 15/247, Packiapuram, Naidupuram, Kodaikanal.	1984 - 1986 (2 years)	Service Dept.	Casual T.N. 139	Abdomen - problem (medical Reports Enclosed) Son - Heart Problem, Daughter - nervous problem, Medical reports enclosed.
77	126	S.Sathiya Murthy / 36 S/o.Sounderrajan, Annai Theresa Nagar, Near Play Ground, Kodaikanal	1986 - 1992 (6 years)	Test for shake rough air passing, laser (Hg. Area.)	Company Identity Card **Regular**	Stomach Pain cold
78	129	R.SenthilKumar / 31 S/o.S.Rajamani, 5/185C Anandagiri, 3rd Street, Kodaikanal.	1992 - 1993 (1 year)	Top cutting (Hg. Area.)	Temporary Workman Order copy PF.No. TN/17287/536	Wife - abortion one time. Back Ache, Headache, Memory loss. (Medical reports enclosed)
79	130	F.A.Joseph / 52 S/o.M.S.Francis	1984 - 1997 (13 years)	Contracting (Hg. Area.)	P.F No. TN/17287/73	Body Weakness, Breathing Problem, and Headache - irritation. Cold. Wife – nervous weakness. Son - Cold effects

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Yogesh Spray Painting works, Opp. Chidambaram Bank, Batlagundu				
80	131	J. Gnana Soundari W/o.Jay prakash Sanlarpuram, Nillakkottai Taluk, Dindugal	1993-2000 (8 years)	Top Cutting . Packing (Hg. Area)	PF.No. TN.17287/128, Temproary workmen order copy	Irregular periods - (Medical records, available Child - Handicapped – clubbed legs.)
81	132	B.Chandrasekar / 56 S/o.K.Bala Naidu, Andagiri, 1st Street, Kodaikanal.	1984 - 1993 (11 years)	Shake out T.F.S. (Hg. Area.)	Confirmation Order copy. **Regular**	Wife Irregular periods, breathing problem Irritation of eye, Headache, Chest Pain, Buddles forming in Body impotency. (Medical reports enclosed
82	133	L.John Ebenezer / 45 S/o.Leslie Williams, 4/1, Laws Galt Road, Kodaikanal.	1984 - 1985 (1 year)	Bulb forming screening (Hg. Area.)	Casual Oper[illegible]y cover T.No.45	Dental Problem, Stomach Pain Impotency, Head ache. (Medical reports enclosed)
83	134	P.Velankani Mercy / 28 D/o. C.Peter, W/o. G.Jeevan, 6/46, Gandhi Puram, Kodaikanal.	02.01.1997 - 2000 (3 years)	Packing in Hg Area & Digital Sec.	P.F.No.TN17287 /979 T.Card 114, T51	Stomach ache, Loss of memory, skin disease, Eye pain.
84	135	A. Hellen Apollo (40) W/o. Aurther Apollo Ganga Compound, K.I.S. Kodaikanal	1994-1998 (5 years)	Packing in Hg Area	PF.No. TN/17287/735	Skin patches, Head ache, stomach pain, Dental Problem
85	136	G. Ruthpriya (29) W/o.Gunaseelan 6/111, Ananda Giri 6th Street, Kodaikanal.	1995 – 2000 (5 years)	Packing in Hg Area and Digital Sec.	Temporary Workmen order copy PF.No.TN/17287/88/ TN17287/1140	Irregular periods, Stomach pain. Head ache, nerve problem.
86	137	S.Jeyaraj / 29 S/o.Subramanian, 15/39, Bear Shola Road, Kodaikanal.	1998 - 2000 (3 years)	Bulb cutting Bulb washing (Non Hg. Area)	Company Medical Record	Head ache, skin problem, giddiness, nerves problem, stone effect in kidney.
87	142	M.Ramachandran / 38 S/o.M.K.Munusamy, 12/41, F Pambar Puram, Kodaikanal.	1987 - 1989 (3 years)	R.A.P. (Hg. Area)	T.Card - 5, Company Urine Report Enclosed.	Back pain, Dental Problem. Headache, stomach Ache.

S. No.	File No.	Name & Age / Father's Name / Address	Period of Employment	Department	Employment Evidence	Health Status
88	148	P.Rangasamy / 67, S/o.Poochi, 852, M.g.R.Nagar, Kodaikanal.	1994-1997 (4 years)	Non mercury Area	Temporary appointment order	White patches, giddiness, Knee Pain, eye irritation, Dental problem (Medical records enclosed) Wife - Stomach problem, Back ache, Daughter - Stomach problem Son - Asthma.
89	149	R. Thiruselvi (35) D/o.Rengasamy, W/o.Iyappan, M.G.R. Nagar, Kodaikanal	1997-1998 (1 year)	Packing (Hg. Area)	T.Card 1/3/ TN/17287/915	Excessive Bleeding, Head ache, ulcer, irritation of eye. Giddiness Acidity, Peptic ulcer (Medical records available)
90	150	S.Domnic Fernodo / 41 S/o.S.Thanistasus 4/141I, Anandagiri 4th Street, Kodakanal.	1988 - 1990 1992 – 1997 (7 years)	FAP, Grading (Hg. Area) & Injection Moulding	P.F.No.TN/ 17287/Group IV Account / 97 Contract and Regular	Back ache, Dental problems, Body weakness Head ache. Wife - Uterus Problem, Son : 1½ year Expired (Medical records enclosed)
91	151	C.Sundarraj / 35 S/o.M.Chitravel, new World Guest House, Fern hill Road, Kodaikanal.	1987 - 1995 (8 years)	Canteen	Company letter PF No. TM 17287/325	Head ache, giddiness, memory loss, Teeth problem
92	152	T. Sekar / 31 S.o.Y.Thangaraj, 92/247, C, Packiyapuram, Kodaikanal.	1993 - 1995 (2 years)	Fine grading Top cutting (Hg. Area)	Temporary work men order copy	Head Ache, giddiness Laziness, shivering hands and legs
93	155	R.Raman / 43 S/o.R.Raj Naidu, M.M Street, Opp. KPS. School, Kodaikanal.	1986 - 1994 (9 years)	Bulb Washing End Cutting (Non Hg. Area.)	Probation order by company Regular	Head ache, skin patches. Memory loss, Breathing problem. Wife - Breathing problem, Back ache. Daughter - Breathing problem (Medical reports enclosed)
94	156	S.Karuppasamy / 48 S/o.A.Susai 4/108,B, Turnerpuram, 1st Street, Kodaikanal.	1984 - 1994 (10½ years)	Scavenger Worker Hg & Non Hg Area	Salary Slip Regular	Head ache, Itching, Leg problem, eye irritation, heart problem stomach pain. Wife - expired 21.07.2001 (Medical records enclosed)
95	158	C.Valliammal (26) D/o.Chandra Sekar W/o.A.Ramesh, C/o.Karuppiah	1997-2000 (4 years)	Packing (Hg. Area)	Company Letter Medical	Knee pain, Heart problem, 1. Child only

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Muniyandi Kovil, Gandhipuram Kopdaikanal				
96	160	T. Rani (31) W/o.V.Arockiam, M.M.Street, Kodaikanal	1997 - 1998 (1¼ year)	Digital Sec & Packing in Hg. Area.	PF.No. TN/17287/1072	Irregular periods Back ache, stomach pain 1 time abortion (Medical records un available)
97	161	G.Bhavani (35) W/o.Giribabu Savitha Cottage, Kheel Boomi Near Sterling, Kodaikanal	1996-1997 (1 year)	Digital & Packing in Hg. Area	-	Head ache, Dental problem
98	162	J. Gracy (34) W/o.I.Joseph Good shepered House Mea to water tank Kodaikanal	1992-1998 (6 years)	Top cutting (Hg.Area)	PF.No. TN/17287/ 1381	Irregular periods, Dental problem Head ache. Body pain. Giddiness Breathing problem, Memory loss, 2 times abortion (Medical reports unavailable)
99	163	J.Jebaleela (36) W/o.L.Rajan Junue Good Shepherd House. Near Water Tank, Naidupuram, Kodaikanal	1993-2001 (7 years)	Digital Sec and packing (Hg Area)	PF.No.TN/17287 /771 TN 17287/888 TN 17287/1286	Ulcer, Dental Problem, L.B.P Irregular periods, Head ache 2 times abortion - memory loss
100	164	C. Selvarani (28) W/o.Chinnathambi Y-313, Naidupuram, Seran Nagar, Kodaikanal.	1997 - 1998 (1 year)	Digital Sec & Packing (Hg Area)	T. Card 90/91	Uterus problem, Head ache, Irregular periods Dental problem (medical records Available)
101	166	M.Nagarajan / 43 S/o.M.K.Muttusamy 12/46F, Pambarpuram, Kodaikanal.	1987 - 1994 (7 years)	Rough & Airpassing Screening (Hg. Area.)	Confirm Order Regular	Hip ache, Headache, Chest swelling (No Medical reports)
102	169	K. Vijaya (35) W/o.R.Sagayam 6/111-12 -A, Anandagiri, 6th Street, Kodaikanal	1995 - 200 (5 years)	Digital Sec. & Packing (Hg Area)	-	Head ache. B.P. Giddiness irregular problems

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
103	170	M. Margaret (32) W/o.Micheal Antonyraj Cookmicheal illam, Irudayapuram, Shenbagapuram, Kodaikanal.	1996 - 1998 (2 years)	Bulb Forming (Non Hg) Packing (Hg. Area) & Digital Section	PF. No. TN/17287/1034	Headache, Shivering, Giddiness Son- mental problem and admitted in Ralyo home (No medical regards available)
104	172	R.Vijayakumar / 42 S/o.Ramaiya Vattakanal, Kodaikanal.	27.01.1987 - 05.12.1991 (4 Years) Yogaraj / Pandu contract	F.A.P. lesser ice Machine (Hg. Area)	Contractor's Letter	Headache, Tiredness, loss of memory, Shivering.
105	173	M.Ramiah / 64 S/o.Muthaiah, Vattakanal, Kodaikanal.	16.11.1986 - 1997 (10 years) (Pandurangan Contract)	Garden Worker	P.F. No. TN17287/A/18 Contractors Letter	Headache, Chest Pain, Giddiness.
106	176	L.Pandy / 55 S/o.Lakshmanan, 117/119, Anandagiri, 2nd Street, Kodaikanal.	1988 - 2000 (12 years) S.Pandurengan Contract	Garden Work	Contractor Letter	Stomach pain, Head ache, Breathing problems.
107	177	A. Roselin (46) W/o. Oliver Billsvilla IInd Street , Kodaikanal	1993 -1997 (4 years)	Packing certification (Hg. Area)	P.F.No. TN/ 1728/732.	Knee pain legs. Head Ache, Breathing problem
108	179	S.Balasubramanian / 48 S/o.Sivalingam, S.M.G. Nagar, Alambadi Mines Post, Vedasandoor Taluk, Dindigul Dist	1984 - 1989 (4½ years)	Rough Air passing, contracting (Hg. Area)	Casual labour Salary slips	Breathing problem, Memory loss, less eye sight, No medical reports. Wife - Allergy, Nerves Problem Son - Skin patches.
109	180	F.Leo Joseph / 29 S/o.Nirmala Francis, A.Vellodu Post, Pushpapuri, Dindigul.	1992 - 1993 (2 years) Pandurangan Contract 1993 - 1997 (5 years)	Contracting, Top Chamber (Hg. Area.)	Temporary work man Order	Head ache, giddiness, piles, frequent urinal, laziness, memory loss, eye irritation, stomach pain.
110	184	S.Edward Alocius,	1986 - 1997	Airtest	Service Certificate	Piles Problem.

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		S/o.D.Salethnathan C/o.Arockia Samy, 9-K, Kondaswamy Layout, Thambu Nagar, Puliyakulam, Coimbatore - 45.	(11 year)	(Hg. Area)	Regular	
111	191	K.Muthuraj / 41 S/o.Krishnasamy, 5/297C, 7th Street, Kodaikanal.	1986 - 1993 (7 years)	Packing Screening (Hg. Area)	P.F.No. TN/17287/254	Tiredness, Giddiness, Stomach Pain, head ache, Shivering, Skin Problems. 1 son - expired - 1999 - Age 11 2 son - Brain disorder (Medical records enclosed)
112	193	A.Antony Samy / 38 S/o.B.Arockia samy, 17/99-A, Woodcot Compound Shenbaganur Kodaikanal.	1987 - 1994 (7 years) (Pandurangan Contract)	Driver & Packing in Hg Area	Identity Card P.F.TN/17287/ 466. Contractors Letter	Headache, Neck Nervous Problem, Stomachache, Eye defect Skin Problems.
113	194	A.P.Alocius Jerome / 29 S/o.S.John Peter, Thandhi Medu, Kodai Kanal.	1999 - 1999 Jan - Dec. (1 year)	Bulb forming (Non Hg.) Packing (Hg. Area.)	Urine report	Teeth affected, Skin problem, memory loss.
114	195	P.Shanthi / 44, W/o.S.Paneer Selvam, 8/136, A.J.Indira Nagar, Kodaikanal	1995 - 1999 (5 years)	Digital Sec. & Packing (Hg. Area.)	P.F.No.17287/ 1105, 17287/1317.	Tooth ache, Dental problem, Irregular periods,
115	196	A.Peter Muthu / 30 S/o.C.M.Arockiasamy, 4/27B, Turner puram, 1st, Koaikanal.	1996 - 1997 (2 years)	Laser (Hg. Area.) Stem cutting (Non Hg Area)	Company requesting letter	head ache Bleeding Nouse teeth problem. Giddiness.
116	199	R.Alagarsamy / 43 S/o.Ramasamy, M.M.Street, Kodaikanal.	1984 - 1989 (5 years)	Screening (Hg. Area)	Company confirmation order copy Regular	Mouth ulcer, giddiness shivering skin problem, tiredness. (No Medical records)
117	202	I.R.Antony / 49 S/o.M.Irudayaraj,	22.05.1984 - 26.06 1989	End Opening (Non Hg) FAP, Screening Top	Confirm Order copy (enclosed)	Eye defect, Stomach pain Memory loss weight loss

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		4/31 Tumerpuram, 1st Street, Kodaikanal.				
118	204	R.Ganesan / 32 S/o.N.Ramadass, Srinivasapuram, Kodaikanal.	18.02.1991 - 07.11.1993 (2½ years)	Packing (Hg. Area) Bulb/Stem cutting (Non Hg. Area)	Company Medical reference letter	Breathing Problem, Ulcer, Headache, Tiredness, Memory Loss.
119	205	N.Krishnan / 40 S/o.R.Narasimhalu, South Street, Ganguvarpatty, Periyakulam.	13.05.1986 - 09.04.1990 (4 years)	Fine Air passing (Hg. Area)	Service certificate **Regular**	Urinal Problem, Hair Whitening Wife has Irregular period, Two abortion,
120	206	G. Agatha Preetha (30) W/o.Gabriel Bliss Villa IInd Street, Kodaikanal	1994 - 1996 (2½ years)	Certification packing (Hg Area)	Company letter	Breathing problem, Allergy. Head Ache Irregular periods, tiredness, memory loss, stomach pain, eye pain
121	207	K.S.Manikandan / 30 S/o.Subramani, 17/15/3, Rifle Range Road, Naidupuram, Kodaikanal.	11.01.1997 - 1997 (1¼ years)	Digital Sec & Packing in Hg Area	T.Card 102 T.Card 108	Asthma, headache, Tiredness Stomachache. (Children affected)
122	210	A.Lasar / 44 S/o.Alexzander 24, Vijaya Cottage, Convent Road, Kodaikanal.	29.04.1985 - 12.10.1996 (11 years)	Laser Cut Top cutting Rough Air passing (Hg. Area.) & Generator	Service Certificate	Back pain, Eye defect. Tiredness
123	211	A.X.Ravi / 32 S/o.V.A.Xavier Vanaraj, Srinivasapuram, Kodaikanal.	1993 - 1995 1995 - 1999 (4½ years)	Top cutting RAP, FAP (Hg Area)	T.Card 127 T.Card 9	Stomach pain, Weight loss, Giddiness.
124	212	E.Ramesh Selvapandiyan / 40, I.George Eddy 11/53, Anandagiri 1st Street, Kodaikanal.	1984 - 1987 (4 years)	Rough Air Passing , Fixing (Hg. Area)	25-B; Certificate Operator T.K.No.208. **Regular**	Dental Problem Weakness Impotency wife has abortion. (Menstrual problem)
125	213	A.Xavier / 43 S/o.Arockiyasamy 22/VIII Street, C.L.C. Lane,	03 05 1984 - 22.06.1989	Laser cut, warm out inspection Airtest, packing,	25, B Time Card Identity Card Probationary Order copy enclosed	Eye Problem. Skin diseases, Memory loss, Leg swelling (medical reports enclosed) Wife has thyroid problem 3 time's apportion. Menstrual problem. Son skin diseases

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Say Boss Colony, Chennai - 44.		(Hg. Area.)	Regular.	Daughter - Head ache Eye defect.
126	214	A.Alex Bernand / 41 S/o.R.Antony, 4/108, A1, Mary I Illam, Anna Nagar, Kodaikanal.	16.01.1986 - 28.07.1992 (6 years)	Certification Top cutting (Hg. Area.)	Company Urine Report & Identity Card **Regular**	Skin Diseases, Head ache, stomachache, wife has eye pain, Headache, Son has knows bleeding sometime.
127	215	P.Jai / 34 S/o.S.palanisamy Ambrose Nadar Cottage, Blissvilla, Kodaikanal.	1990 - 1993 (3 years)	Top cutting, Packing (Hg Area)	P.F. No. TN / 17287/489 TK. No.79 **Regular**	Sugar Problem, Giddiness Chest Pain, Respiratory Problem.
128	216	E.Nepolean / 30 S/o.J.Edward D.No.12, R.C.Street, Nadar Compound, Palanganatham, Madurai - 3.	08.03.1994 - 15.05.1996	Screening Washing (Hg. Area.)	T. Card T.25, T.14, T.44, T.45, T.54, Urine Report Enclosed.	Body itching, Allergy Eye Defect, Ulcer, Shivering.
129	217	B.Ramakrishnan / 36 S/o.N.Balasubramani, 70,261, Kurinji Andavar Koil, Kodaikanal.	1989 - 1992	Non Mercury Area and Packing in Hg Area	P.F.No.17/261 70/261	Respiratory problem Giddiness
130	218	I.Pandiaraj / 38 S/o.Iyyapillai, Behind Police Line, Fern hill Road, Kodaikanal.	06.08.1995 - 22.11.1998 (3 years)	Digital Sec. & Packing in Hg Area	PF No.17287/1248 T. Card	Tiredness, Body Itching, Memory loss, Headache.
131	220	V.George Junious / 46 S/o.Vasu, 7/12, Santhi Nillayam, Muthaliyor 4th Street, Kodaikanal.	01.01.1984 - 21.06.1989 (5½ years)	Fine Air passing (Hg. Area)	Identity Card Urine Report **Regular**	Weight loss, Stomach pain, Headache, memory Loss, Itching, Dental Problem, Wife - had two time abortion Son - skin diseases Daughter Stomach, Eye, Problem
132	222	S.Johnson / 37 D.Saleth Nathan Topps Road, Kodaikanal.	1990-1991 (1 year) (Pandurangan Contract)	Packing (Hg Area)	Contractor's letter	Tiredness, No child Headache, Dental problem

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
133	223	R.Neelavanan / 32 S/o.M.A.Rathinagiri, 13/302, Keel Pudhu Kadu, Observatory Road, Kodaikanal.	1990 - 1992 1994 - 1998	Canteen work Top cutting & Laser (Hg Area)	T. Card (T.96) (T.7) (T.37) (Temporary workmen order copy)	Frequent Headache, Leg Pain, Memory loss.
134	225	A.Lingeswaran / 30 S/o.K.Adhikari, Vellakeri, Kodaikanal.	07.06.1998 - 1999 (1 year)	Packing (Hg Area)	T.Card No.167, urine Report enclosed	Tiredness, Giddiness Unable to work.
135	226	R.Pandiyarajan / 29 S/o.J.R.Ribert 292, Pudhukadu, Observatory P.O. Kodaikanal.	1997	Rough Air passing (Hg Area)	T.Card No.81	Headache, Body Irritation, Respiratory problem, Eye irritation.
136	228	C.Rathina Muthu / 47 S/o.M.Chellaiah, 21st Street, Arivoli Nagar, Narnapuram P.O. Palladam, Coimbatore.	1994-1994 (5 years)	95% inspection Top cutting (Hg. Area.)	Temporary order copy enclosed)	Eye defect, Headache, memory Loss, Tiredness, Chest Pain, Weight loss.
137	229	K.Indiran / 31 S/o.V.Karuppanan, Vellakeri, Kodaikanal.	30.06.1994 - 05.02.1996 (1¼ years)	Rough Air passing (Hg. Area.)	Temporary order copy enclosed T card.	Stomach Pain, Headache, Giddiness
138	230	M.Muthusamy / 32 S/o.K.Mari, Vellakeri Kodaikanal	1993 - 31.12.1994 (1½ years)	Fine Air passing (Hg. Area.)	T.Card PF No. TN/17287/659	Stomach pain, Chest Pain
139	231	M.Murugesan (41) S/o.K.Muniyandi, 4/115, C.B. Anna Nagar, Kodakanal.	04.09.1986 - 1998 (2 years)	Rough Air passing (Hg. Area)	Company Time Card T.K.No.236	Tiredness, Memory Loss, Body Pain, Less Eye Sight. Wife - hade stomach pain, hand & Leg swilling Less Eye sight, 1st son - Leg Pain, 2nd son - Fix
140	232	M.Govindaraj / 26 M.K.Muniyandi, Perumal Koil Street, Melapatti Perayur.	1997 - 2001 (4½ years) (Pandurangan Contract)	Canteen, Top cutting	Contractor's Letter	Headache, Urinal Problem

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department (Hg. Area)	Employment Evidence	Health Status
141	233	N.Ravichandran / 43 S/o.P.Nathan, W-14-1-12 Bharathipuram, Aalampatti, Pannaikadu, Kodaikanal.	23.01.1987 - 14.11.1990 (4 years)	Top cutting Fine Air passing (Hg. Area.)	Service Certificate copy	Fits, Memory Loss, Hand & Leg shivering. Wife - Irregular period.
142	237	D.Irudayaraj / 43 S/o.Devasahayam D/No.16, Keelboomi, Kodaikanal.	14.10.1985 - 1990 (4½ years)	Test for shake NCI Certification Laser Cut Packing Rough Air passing (Hg. Area.)	Company Identity Card **Regular**	Back Pain , Headache.
143	238	A.Yesuraj, S/o.Aruldass, 11/201-J, Keelpoomi, Lake Rod, Kodaikanal	03.05.1984 - 1987 (3½ years)	Test for shake (Hg. Area)	Casual T.K.No.101	Headache, Back pain, Dental Problem, Tiredness. Wife : Menstrual Problem.
144	240	R.Thilavathy, (29) W/o.I.Prakash 20/15, Srinivasapuram, Kodaikanal	1997 - 1998 (1 year)	Digital & Packing (Hg Area)		Stomach pain, Head Ache Dental Problem, (1 Time abortion 1999 - 3month)
145	243	R.Malsingh / 49 S/o.A.J.Raj Aanantha Illam, Ganga Compound, Kodaikanal.	01.01.1984 - 26.10.1988 (4 years)	Laser Cut (Hg Area)	Company Sports Certificate (enclosed) Regular	One side Headache, memory loss, Breathing Problem, Body shivering. Son has bleeding knows Daughter has eye defect.
146	245	A.Natarajan / 47 S/o. Alagar Samy 20/143 Pambarpuram, Kodiakanal	1984 - 1985 (2 years)	Contracting (Hg Area)	PF.No. TN. 17287/44	Respiratory problem Frequent vomiting
147	246	A.Johnson / 41 S/o. Antony Cruz 5/296 Annanalgiri 2nd Street Kodaikanal	1987 - 1990 (2½ years Pandurangan Contract	Driver	Contractors letter	Headache, Back pain, Frequent cough. Tiredness, shivering

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
148	247	V.Subramani / 36 S/o. Velu Ugarthe Nagar, Shenbaganur Kodaikanal	1.11.1991 - 9.11.2001 (10 years) Pandurangan Contraction	Driver . Packing in Hg Area	Contractors letter compensation for contract workmen detail's	Headache, Shivering Tiredness, Dental Problem memory loss.
149	249	K.Vairavan / 31 S/o.P.Kumaravel D.No.34, Vellakeri, Kodiakanal	31.3.1994 - 31.12.1994 (9 months only)	Test for shake (Hg. Area)	Temporary workman Order copy Enclosed	Eye Sight problem Frequent headache at one side stomach pain, Chest pain.
150	251	S.Andaleswari (28) D/o.Subramani, W/o.P.Vaanjinathan 133/137-B, Anandgiri, 4th Street, Kodaikanal.	1995-1997, (2 years)	Digital Sec & Packing (Hg. Area)		2 time abortion, stomach pain, Irregular periods, and memory loss head ache.
151	253	V.Thomas / 45 S/o.Vincent 1/G, Subramnipuram, 2nd Street, Madurai.	1984 - 1985 (2 years)	Grading (Hg. Area)	Casual Labour (No Evidence)	Back pain, Frequent Headache, Asthma Wife - Back Pain, Menstrual Problem.
152	254.	A.Rama Moorthi / 42 S/o.g.Alagarsamy Srinivasapuram, Kodaikanal.	20.05.1984 - 20.08.1988 (4 years)	Quality Assurance (Hg. Area)	Time Card T.K. No.115	Skin Allergy, Respiratory problem, Giddiness, Headache. Wife - Frequent headache.
153	255.	A.Thirupalanisamy / 53 S/o.Aandiya Pillai, 15/31, Shanmugapuram, Naidupuram, Kodaikanal.	17.07.1984 - 1996 (12 years)	130°Insepction Test for shake certification (Hg Area)	Company Urine Report copy	Peptic ulcer, Tiredness, Eye Defect, Dental Problem. Wife - Menstrual Problem, Dental Problem, Stomach Pain.
154	256	C.Carmel / 47 S/o. Chinappan V.K.John Cottage St.Mary Road, Kodiakanal	1984 - 2000 (16 yrs)	Painting work in and around the factory	Under contractor's	Weight loss, chest pain, joint pain, breathing problem. My son hade Heart Problem Report enclosed
155	258	S.Sahayaraj / 43 S/o.Salathan Vattakanal, Kodaikanal.	1987 - 20.08.1997 (10 years)	Rough Air Passing (Hg.Area) & Non Mercury	Service Certificate	Headache, Chest Pain Memory Loss, Giddiness Shivering. Wife - Menstrual Problem, Giddiness, Stomach pain. 1st Son - Headache

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
						2nd Son - Leg Pain
156	261	R.Ramasamy / 55 S/o. K.Ramasamy Vattakanal, Kodaikanal	1.2.1984 - 13.11.2001 (18 years) Mr.Yogaraj & 84 - 1986 Panduragan Contract 1987 - 2001	Gardener	I.D. card contractor Employee letter	Back Pain Eye sight problem, Hair falling nervous weakness
157	262	R. Annamal (65) W/o.Ponniah, Pmarkarpuram, Kodaikanal	1987-1994 (7 years)	Canteen	PF.No. TN/17287/275	Head ache, fever, tiredness, memory loss, Dental problem
158	263	V.Rajaskear / 38 S/o.V.Kamuthai, Vaigai Road, Devathanapatti.	28.07.1987 - Resigned Date nor mentioned	Laser Cut (Hg. Area.)	Compound Identity Card	Headache, Tiredness, memory loss. Wife - Head one time abortion Sun - suffered Thyroid Problem
159	269	B.Jeayaraj / 45 S/o.A.Barthalocmew (Late) 24/40, Park Town, Sangam, Combatore - 45.	01.01.198 - 31.08.1989 (5½ years)	Hg. Fill Room & Top Cutting (Hg Area)	Token No.23	Skin disease, Memory Loss. Wife - suffered by swelling in Leg's 1st son - born as a premature, skin problem also.
160	274	A.Rajendran - 55 S/o.V.Antony, Antonyar Koil Street, Kadai Parappari, Pehampur Dindigul.	1984 - 2001 (18 years)	Maintenance Mechanic	Confirm order copy enclosed	Eye irritation Breathing Problem, Respiratory problem Dental problem. Wife - Stomach Pain& Dental problem Son - Respiratory problem Medical records enclosed.
161	275	S.Sivaganam / 45 S/o.S.Shanmugam Pudukadu, Observatory P.O., Kodaikanal	01.01.1984 - 2001 (18 years)	Generator Operator & Packing in Hg Area	Company Identity Card Regular	Brain Tumor, Skin disease, Urinal problem, Medical record enclosed. Wife - Hands Menstrual Problem one time abortion. Chest pain also. Son - Giddiness & chest pain
162	276	A.Paulraj / 49 S/o.V.Antony, Ritle Range Road, Naidupuram, Kodaikanal.	15.05.1985 - 09.11.2001 (16½ years)	Hg Waste Crusher, Generator, Laser cut, Mercury- distillation	Confirm order copy enclosed Regular	Body Pain, Breathing Problem, Hand & Leg Swelling High P.B. Tiredness. One Baby child dead. Son - Headache, memory loss.
163	279	A.Arulsamy / 31 S/o.B.Arockiasamy,	28.07.1991 - 13.11.2001	Fixing	Confirm Order copy enclosed	Giddiness, Headache, Stomachache, Tiredness.

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		17/99, A1 Woodcot Compound, Shenbaganoor, Kodaikanal.				
164	280	P.Anandharaja / 45 S/o.N.Perumal, 37/161/G-29, Annai Theresa Nagar, Govt. Play Ground, Kodaikanal.	22.04.1987 - 09.11.2001 (15 years)	Test for Shake Fine Air passing, Rough Air passing Shake out (Hg. Area)	Promotion order copy enclosed **Regular**	Headache, Hand & leg shivering, memory loss tiredness, Back pain. Wife - One time abortion, Skin allergy, heart problem.
165	281	P.Natarajan / 51) (Dead) S/o.M.Poochi, 13/292, A06, Pudhukadu, Observatory P.O. Kodaikanal.	11.01.1984 - 09.11.2001 (18 years)	Non Mercury Area	Time Card & pay slip **Regular**	Kidney Problem he was no more, Medical records enclosed. Wife - stomach pain, dental problem, body pain. 1st son - Eye defect, 2nd son - Heart problem.
166	282	S.Palanisamy (55) S/o.M.Subramanian, 19/35, H, Anandh Ashram Road, Observatory Post, Kadaikanal.	05.03.1984 - 09.11.2001 (18 years)	Non mercury and quality Assurance (Hg.Area)	Confirm order Copy Enclosed **Regular**	B.P. Memory loss, Stomach irritation, Cant sleep, Dental & Eye Problem Wife : Nose bleeding Menstrual problem B.P.also
167	285	K.Kaliraj (45) S/o.N.Kamakshi Saraswathi Complex, Anandagiri 1st Street, Kodaikanal.	09.12.1985 - 09.11.2001 (16 years)	Top cutting (Hg. Area) Service All Dept.	Service Certificate pay slip T.K.No.190 **Regular**	Body Shivering skin disease Giddiness dental problem eye defect Wife: Menstrual problem body shivering respiratory problem Daughter: Eye defect, Headache Son : Premature, memory loss medical bills enclosed.
168	288	H. Sahayaraj (45) S/o.A.Hendry 11/1 - H Thanthimedu Kodaikanal	28.02.1984 - 09.11.2001 (18 years)	Shake out Top Chamber Test for shake contracting (Hg Area)	Confirm order copy enclosed **Regular**	Impotency, Back pain Head ache, Respiratory wife - uterus problem
169	289	S.Hamidass (51) S/o.Chellamuthu Pudukadu Observatory P.O.	01.01.1984 - 09.11.2001 (18 years)	Factory cleanup crusher (Hg Area)	probationary order copy enclosed **Regular**	Urinal problem dental, stomach Headache Giddiness Joint pain Wife - menstrual problem weightless eye irritation thyroid problem Children - Dental problem

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Kodaikanal.				
170	290	P. Ganesan (44) S/o.Ponnusami Anmandagiri 2nd Street Kodaikanal	12.05.1987 - 09.11.2001 (14 years)	Fine Air passing, Fixing Certification (Hg Area)	Service Certificate **Regular**	Frequent Headache Diabetes, dental problem Ulcer, Skin problem Tiredness, Shivering Wife - virtue problem ** Body swilling, menstrual problem.
171	291	S.Selvaraj (52) Samudra Pandiyan, Atturvampatty Post Kodaikanal	08.05.1984 - 09.11.2001 (17½ yers)	Laser cut Grading, Quality assurance (Hg.Area)	Pay slip, time card **Regular**	Dental problem stomach irritation less eye sight respiratory problem memory loss, back pain. wife - one time abortion.
172	292	A. Robert (43) S/o.S.M.Antonysamy 2/98, Woodker Compound Shenbaganur Post Kodaikanal	11.04.1984 - 09.11.2001 (18 years)	Top chamber fixing, rough air passing , fine air passing test for shake top cutting (Hg.Area)	Confirm order copy **Regular**	Frequent - Headache Tiredness, Hand and leg pain wife - back pain
173	293	K.Kannan (32) K. Karupasamy Rifle Range Road, Naidupuram, Kodaikanal	26.12.1992 - 09.11.2001 (11 years)	Fill room contracting Laser cut service work (Hg. Area)	Service Certificate **Regular**	Respiratory problem memory loss body pain Wife - menstrual problem headache..
174	298	S. Shajahan (39) S/o.N.Samsudeen Fairy Falls Road Pambarpuram Kodaikanal	23 01.1987 - 09.11.2001 (15 years)	Laser cut Grading Inspection (Hg Area)	Probation order copy enclosed **Regular**	Headache, Tiredness wife : Giddiness, Tiredness Hand Leg pain Ist daughter -Weight loss II nd - Daughter,
175	300	S.Ramachandran (42) S/o.L.Chinniah, 13/292, Pudhukadu, A-1, Observatory Post, Kodaikanal.	13.05.1986 - 09.11.2001 (16 years)	Hg. Filtering crusher mechanic, Hg. Distillation generator, top cutting	Confirm order copy enclosed **Regular**	Skin Disease Back pain Joint pain Wife - Menstrual time Too much pain IInd daughter Dead Due to frequent headache and vomiting Ist daughter Headache stomach pain

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
				(Hg. Area)		
176	301	R.Issac Neuton (45) S/o. D.Raj Shahana Shahas, Observatory, Kodaikonal	30.01.84 - 09.11.01	Screening Grading (Hg Area) and Non Hg.	ID card EPF **Regular**	Headache, tiredness eye right problem wife – limb pain, eye sight problem, once suffered abortion (wife medical records enclosed)
177	306	D.Pragaram (54) S/o.R.S.Daniel 12/100 Pambarpuram, Kodai Konal	01.01.84 - 09.11.01	Mechanical Sec. (Hg. Area)	Blood request enclosed **Regular**	eye problem nervous problem, tiredness teeth problem
178	307	M. Su[illegible] (47) S/o.Muthaiya Thiruvalluvar Nagar, Vattakanal, Kodaikanal.	16.04.86 - 09.11.01	Non-mercury, contracting, screening, packing and digital (Hg. Area)	Confirmation order **Regular**	Skin disease, eye problem, teeth problem loss of memory tiredness, stomach pain. wife - suffers kidney problem, headache, stomach pain & menstrual problem
179	308	A.Inico Jerold (43) S/o.A.Antonydass 42/7, Anantha Giri, 7th Street, Kodaikanal	09.12.85 - 09.11.01	Filling sec. Top chambering in mercury area	Service certificate blood Report pay slip **Regular**	Back pain, teeth affected, tiredness, eye sight problem, white hair.
180	309	P.Pandi / 43 S/o. Perumal C/o. Jayasingh Compound Naidupuram, Kodaikanal	8.5.84 - 9.11.01	Non - Mercury, Top chambering flame cutting, maintenance (Hg. Area)	Confirmation order & Private and confidential report **Regular**	Loss of memory, tiredness, tremor, skin itching, eyesight problem Knife suffer menstrual problem, eye problem, giddiness, respiration problem. (Medial records enclosed)
181	310	A.Arul Dass / 48 S/o. V.Abel 4/51A Damarpuram, I Street, Kodaikanal	14.10.85 - 9.11.01	Top cutting, Air test, laser grading, in Hg Area and Non Hg. Sec.	Confirmation order **Regular**	Stein disease, headache, loss of memory, loss of hair chest swelling. Confident report with opinion to consult surgeon for lump in left breast (Children's medical documents filed)
182	311	V.Sankar /45 S/o. P.Vetriyandi Shoba Cottage, Loits Road Kodaikanal	19.11.85 - 9.11.01 (16 years)	Packing (mercury area)	Confirmation order **Regular**	Headache, allergy, impotency, loss of memory (Medical records enclosed)

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
183	317	S.D.Krishnan / 47 S/o. S.Doraisamy 13/292, Pudukadu Observatory, Kodaikanal	2.7.90 - 9.11.01 (11 years)	Screening, Air passing (Hg Area)	Service certificate **Regular**	Body itching teeth problem, limb pain neuroses problem Wife suffers - limb pain, 3 times abortion and menstrual problem (Medical records enclosed)
184	318	P.Subbaiyan / 43 S/o. Poomparaiyandi Thiruvalluvar Nagar Vettakanal Kodaikanal	11.4.34 - 9.11.01 (Regular) 18 years)	Laser, Certification and final inspection (Hg Area)	Confirmation order **Regular**	Sons suffer - patches and teeth problem Teeth problem, headache, loss of memory, tiredness, tremors eye problem. Wife suffer uterus problem, tiredness, head ache, eye burning, limb shivering. - 1st child died on 16.6.90 at 1½ years. Blue body heart problem. 2nd Child suffers chest pain back pain, headache, and limb pain. (Medical records enclosed)
185	319	P.Balakrishnan / 41 S/o. Perumal 4/115, Anna Nagar Kodiakanal	7.10.86 - 9.1101 (15 years) (Regular)	Laser & 98 Inspection, Grading (Hg Area)	Confirmation order **Regular**	Headache, giddiness, blood pressure sleeplessness, Married on 11.9.91 wife suffered 2 abortions suffers uterus problem - One children (Company's private and confidential report says dental carries, Eczema & blood pressure)
186	321	K.Sridhar / 40 S/o. S.Kittappa 16/37, B.Muthaliyar Puram II Street, Kodaikanal	17.6.95 - 9.11.01 (16 years)	Certification and all department of Mercury area	Conforming order copy private and confidential report **Regular**	(Medical records enclosed) Headache, Nervous weakness, giddiness, loss of memory, back pain & eye right problem (Medical records enclosed)
187	325	D.Ravichandran (31) S/o.Doraisamy Kumboe vayal (Post) Kumbore Vayal , Kadaikanal (Taluk)	10.08.91 - 09.11.01 (10 years) (91-98 trainee)	F.A.P. R.A.P. Leser (Hg Area)	Trainee orders **Regular**	Headache, loss of memory, tiredness, limb problem. wife - (married on 27.05.2001) stomach pain, menstrual problem, body loan). daughter - suffer stomach pain, lean son - suffers stomach pain (Medical records enclosed)
188	326	K.V.Veerapandian (43) S/o.Vadivel, Coment Road, Kadaikanal	28.05.84 - 09.11.01 (18 years) (confirmed on 02.08.88)	Test for sale F.A.Passing Rough air passing (Hg Area)	Confirmation order (P&C report) **Regular**	Limb pain, Wife - suffers menstrual problem, stomach pain (no medical records)

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
189	329	A.Kannan (45) S/o.Adimoolam V.M.Bangalow Observetory, Kodaikanal	07.06.84 - 09.11.01 (10 years)	Screening quality assurance (Hg Area)	Regular Token No. 111	Skin disease wife - suffers stomach pain children are very lean and suffer tiredness.
190	333	D.Sorryanarayanan (42) T.N.Dharmalingam 5/194, Ananda Giri Kodaikan, III Street, Kodaikanal	19.11.85 - 09.11.01 (16 ½ years)	Quality assurance (Hg Area)	service certificate Regular	Skin problem, Dental problem, Urinal problem, body sheering, limb pain. Wife Suffers - stomach pain, respiratory problem and tiredness. children - suffer skin disease body might, faintness(medical records enclosed)
191	334	A. Andrews (43) S/o. A.Abraham Somasundaram Colony, 4th Street, Kodaikkanal	02.01.86 - 09.11.01	Non-Mercury & Laser, Air passing screening, contracting, grading. (Hg Area)	Service Certificate Regular	Dental Problem, Head Ache. Skin problems. (P (Report - enclosed) Wife suffers - Heart ailment sugar swelling legs, Abortion once Son suffers - Swelling legs, Abrasion
192	335	M. Antany doss (47) S/o.Mariasoosai 15/239, Rifle Range Road, Nayudupuram.	22.04.87 - 09.11.01	Laser, Grading screening , CBO (Hg Area)	Nil Regular	Skin problem, Giddiness Dental problems, tiredness loss of memory (private and confidential report) (Medical records enclosed) wife - suffers - skin problems.
193	336	M.Balasundaram (38) S/o.Mettaiyar Balu Tea Stall, Kalarai Medu, Kurunji Nagar, Kodaikanal	1994 - 09.11.01 brought probation in 2000	FAP, RAP, Laser, Top Chamber Grading (Hg Area)	Probationary order Regular	Skin problem, Deafness, Head Ache, Giddiness loss of memory (medical records enclosed) wife suffers - headache
194	337	V.P.Murugesan / 37 S/o. Palani 4/115 E1, Anna Nagar, Kodiakanal	1990 - 9.11.01 (11 years) (brought on babation on 30.6.97)	Machine operator (Non Hg Area)	Probationary order Regular	Limb shivering, giddiness, Dental Problem - Once abortion body lean head achieve Menstrual problem (No medical records)
195	338	G.Balakrishnan / 33 S/o. P.Gurusamy 13/186 Pudukadu, Observatory (Po)	1989 - 9.1101 (13 years) (brought on probation in 1997) (employed at 15 years	canteen & Screening in Hg Area	Probationary order training order Regular	Dental pain, stomach ache, limb pain, loss of memory ulcer, head ache, tiredness Wife: Lean, limb pain menstrual problem abortion 1999 - a child still form children suffer from white hair, deaf

... No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Kodiakanal	of age)			
196	340	V.Natarajan / 30 S/o.Veeramalai 13-5-A-6, Peripauls Road Pambar Puram	26.8.85 - 9.11.01 (16 years) (Confirmed in 1990)	Laser, Top cutting, top chambering (Hg Area)	Confirmation order Regular	Stomach ache, skin disease tiredness, headache, Urinary problem, eye problem (Medical records enclosed)
197	343	S.Kanakarathinam / 43 S/o.Shanmugam Fairy Falls Road, Observatory PO Kodiakanal	2.1.86 - 9.11.01 (16 years) (Regular)	Lesar Crusher, Screening Grading (Hg Area)	P & Confidential report Regular	Back pain, body pain, head ache, eye problem, loss of memory
198	344	A. Lourdu Yesurajan (49) S/o.M.Ariuadam 64/14C, Dharmarpuram, I Street, Kodaikanal.	14.07.84 - 09.11.01 (17½ years) (confirmed in 1989)	Laser, Grading Shake out auto-laser (Hg Area)	confirmation order Regular	Breathing problem, joint pain heart problem, headache Dental problem, eye problem, loss of memory, operation (Medical report enclosed).
199	346	V.X. Joseph (50) S/o.U.J. Zaiver 138/A/A1, Indira Nagar Kodaikanal	24.09.84 - 09.11.01 (18 years) confirmed in 1989	Rough air passing (Hg Area)	conformation order P & C report Regular	Headache, by pain, loss of memory, skin disease
200	352	J.S.Sahayaraj / 43 s/o.John Sebastrian Joncy House, Pear Sozha Road Kodiakanal	2.4.88 - 9.11.01	Test for shake, Air passing, Contracting & Grading (Hg Area)	Private and confidential report Regular	Tiredness, Chest burning nervous meekness, no appetite, Dental Problem
201	358	S. Kannan (42) K. Subramanian 4/230, F-3, Muthammal Colony, Opp. Partey Jarm, Thoothukudy.	01.05.87 - 09.11.01	Fill room (Hg Area)	T. No. 256 Regular	Breathing problem, tiredness Headache, frequent stomach ache sugar (Medical records available) Wife - suffers - tiredness married on 22.01.1995, child : still born child on 1996 on 8 months
202	364	A.Muthu Krishnan (Late) / 45 S/o. Angaiah 12/14, Mudaliyar puram 4th Street	1989-1999 11 years Pandurangan Contract	Washer man	P.F.No.TN.17287 / 460 Contactors letter	Frequent chest pain Hand leg, Face ÃUP® Heart problem

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Kodaikanal				
203	365	G.A.Kannan (24 at the time of dead) S/o.A.V.Alenandar, Sterling cottage, Obseratory Road, Kodaikanal, died on 18.09.96	1990-1996	Digital Sec & packing in Hg Area	Service certificate Token No.331 Regular	Headache, fever, (Medical records available)
204	366	Late S.Arokia Selvam / 33 at the time of death C/o. Antanysamy 57, Angnus Mary Street Salai Hall Road, Dindigul - 1	1985 - 1992 (8 years)	Laser, Certification (Hg Area)	Letter seeking medical records from the company	Died due to Kidney problem on 27.4.97 (Medical records enclosed)
205	368	M.Christropher / 34 in 1997 (Dead) S/o. Martine, Thandi Madu Kodiakanal	10.9.85 - 1991	Hg Area	Company letter recommending medical Aid	Chest Pain, blood vomiting no appetite Died in 1997 (Medical records enclosed)
206	371	E.Angela Mary / 42 W/o. Edward (Late) 5/212, Annandagiri 4th Street Kodaikanal	1993-2001 8 years Pandurangan Contract	Factory cleaning work	PE, No. TN 17287-A/12 Contactor's letter	Headache, Tiredness
207	372	R.Mahesh Kumar / 34 When died on 11.6.99 S/o. Rengaraj 71/78, Kalimuthu Pillai Lane Vasanth & Co. (near)	17.7.1984 1986		Company's and Certificate ID Card Casual	Died due to kidney problem (Medical records enclosed)
208	373	V.Poongodi / 47 W/o. Natarajan (late) 12/46 B Pambarpuram, Kodaikanal	1990-1991 1 year	Packing in Hg Area	Contractor's letter	Breathing problem, Headache Stomachache
209	374	M.Thiruthuvaraj (Late) / 64 (Dead) S/o. Mekkaiyan Vattakanel, Kodaikanal	1.4.1985 - 6.1.1996 Mr.Yogaraj & 1985-87 Pandurangan Contract 1989-96	Gardener	Contractor's letter employees' Pension fund Scheme	Kidney failure died on 21 07 2000

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
210	375	M.Sasikumar / 29 in 2001 (Dead) S/o. P.Thangaraj 3/38, Karunji Nagar Kodiakanal	1988 - 1994 (6 years)	Mercury area	EPF	Face swelling, urinal problem, kidney failure, Heart value damaged. (Medical records enclosed)
211	376	E.John Britto (Dead) / 24 Died on 7.10.2003	1997 - 1998 (1 year) Panduragan contract	Burying Broken thermometers	Contractors letter	Under dialysis several times died on 7.10.2003 due to Renal failure suffer vomiting severe. Abdominal pain Renal problem, Medical records enclosed.
212	380	K.Udyakumar (died in 2001) (Dead) S/o. Karthiyappa Achari C/o.K.Raj Achari 4/5 Ambedkar Street, M.G.R. Nagar, Theni	8.7.85 - Nov. 1990 (5 years)		Company's letter issuing show cause notice **Regular**	Tiredness, loss of memory, died due to metal disorder lined (Death certificate enclosed)
213	381	S.Ammulu / 62 W/o. Subbiah Shanmugavel Illam Laskat Road, Kodaikanal	1988-2001 (13 years) Pandurangan Contract	Uniform Washing	P.F.A/c. No. TN. 17287-A/17 Contractors letter	No Children Chest Pain Joint Pain. Clubbed leg
214	383	M.Murugaiah / 41 S/o.K.Munusamy AITUC Nagar, Srinivasapuram Kodaikanal	1994-1995 11 months only Pandurangan Contractor	Rough Air Passing (Hg Area)	Contractor letter	Asthma, Respiratory Problem
215	385	S.Irudayaraj / 30 S/o.V.Salethraj A/22, Shenbaganur P.O P.K.M.Road, Kodaikanal	1995-1996 (9 months only Pandurangan Contract	Packing Within Hg Area	Contractor letter	Headache, Tiredness
216	388	D. Vasantha (37), D/o.Divyanathan, 12/31, Pambarpuram, Kodaikanal.	1996 - 1998 (1½ years)	Garden work (Non.Hg.) Packing in Hg Area	T-Card No.104	Weight Loss, Head ache, Spinal cord ache, Breathing problem
217	392	A.Suresh Paulraj / 31 S/o. Antonysamy	1991-1992 one year only Pandurangan	Packing in Hg Area & Injection moulding	T-card No.18 contractor letter	Headache stomach pain Tiredness

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		2/98-C Woodcot compound Shenbaganur P.O., Kodaikanal	Contract			
218	393	M.Latheef / 48 Mohamed Mustafa 16/82-C-1, Naidu Puram Kodaikanal	1984 - 1985	Top cutting (Hg Area)		Giddiness, eye problem, eye operation, sugar (Medical records enclosed)
219	396	J. Gracy (38) W/o.Joseph 20/120, Carmelpuram, Shenbaganur, Kodaikanal	1992 - 1994 (2½ years)	Digital Sec & Packing in Hg. Area	T.Card	Thyroid, Breathing problem, 1 Time abortion Thyroid operation,
220	397	K.Velusamy / 46 S/o. Krishnan Vellakavi, Kodaikanal	1.1.1995 - 16.7.1996 Pandurangan Contract	Packing (Hg Area)	Contractor's letter	Body pain, stomach pain eye problem
221	398	A.Jerald Manjula / 37 S/o. A.Arokia Indra Nagar, Kodaikanal	14.3.97 - 26.9.1997 6 months only Pandurangan Contract	Test for shake T.F.S (Hg Area)	T-card	Respiratory problem Headache Eye problem
222	399	A.Markes / 27 S/o. Arockiasamy 1/115 D-15-2 Anna Nagar, Kodaikanal	1998 - 1999 6 months only Pandurangan Cotnract	Top cutting (Hg Area)	Contractor's letter	Headache, loss of memory
223	400	A.Amalorpava Mary / 46 W/o. Arockiasamy 1/115 D-15-2, Anna Nagar Kodaikanal	1993-1994 6 months only Pandurangan Contract	Packing (Hg Area)	Contractor's letter	Headache
224	403.	K.Prem Nazeer / 31 S/o. Kahar Basha 78, Ramsan House, Gandhipuram Kodaikanal.	11.4.94 - 1995 T-card	Bulb cutting bulb washing, (Non Hg) Top Chamber (Hg Area)	Temporary	Stomach pain, nervous Problem, blood clothing (Medical Records enclosed)
225	405	S.Sakaria / 43 S/o. Salethsathyanathan	1984 - 1989 (5 years)	Grading	Confirmation order copy	Frequent headache, spinal problem Irregular, period Hip ache, leg hand swelling (No

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		15/100 A Bllisvilla Kodiakanal				
226	409	S.Vijayakumar / 44 S/o.Subramani 115/116 D-A-2 Indira Nagar Kodiakanal	1988 - 1990 (2 years)	Canteen	-	Frequent Headache Stomach Pain in the Right Side
227	410	R. Magajothi (37), W/o.Rajendran, Chellapuram, Kodaikanal	1997 - 1998 (1 year)	Digital Sec & Packing in Hg Area	Company letter	Head ache, Ulcer, Memory Loss, Uterus problem
228	411	S.Jeyalakhmi (27) W/o. Sivakumar. 14/106B. Chella puram. observetony Kodeaikanal.	1997-1998(1year)	Digital Sec & packing in Hg Area	Company letter	Ulcer, Head ache, Body pain memory loss
229	413	V.Sivakumar / 36 S/o. U.Kamudai	1987-1900 (Contract)	Packing In Hg Area	Contractor's letter	Skin Problem, Headache, loss of memory, bone (Medical Records enclosed)
230	415	V.Vinoth Raja / 27 S/o.P.U.S. Johnson Anandagiri 1 Street, Kodaikanal	April 1999 - July 1999 (Contract	Top cutting (Hg Area)	Contractors letter	ULCER, Headache, Stomach Pain, blood pressure (Medical records enclosed)
231	416	P.Ganesan / 34 S/o.A.Perumalsamy Anandhagiri 6th Street Somasundram Colony, Kodiakanal	1992 6 months only Pandurangan Contract	Top cutting (Hg Area)	Contractor letter	varicose disease nervous Problem

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
232	417	S.P.Sentil Kumar / 37 S/o. S.Pandurangan 2/222 - A1 Ugarthe Nagar Senbaganur - PO , Kodiakanal	1987 - 2001 (15 years)	Top Cutting fill room, Laser (Hg Area)	Company Transfer order copy Regular	Skin Patches. Nervous problem memory loss. Wife: Three times apportion (Medical bills enclosed)
233	418	S.R.Ramesh Kumar / 36 S/o. Pandurangan 2/222-A, Ugarthe Nagar Shenbaganur, Kodaikanal	1998 - 2002 (5 years) (Contract)	Supervisor	Contractor's letter	Headache, Tension, loss of memory nervous pain at head
234	419	S.Amirthavalli / 30 W/o. Xavier 17/428 F-1, Near Paradise Inn Lossgot Road, Kodiakanal	1999 (Contract)	Final Inspection (Mercury area)	Contractor's letter	Headache, Stomach pain, menstrual problem, eye problem, Child in very ban
235	420	K.M.Akbar Shait S/o.Mugamathu Ravother C/o. Eswari Mucical, Kodiakanal	21.1.2001 - 31.12.2002 After Closer all so	Watchman	SDB CISCO Indian Ltd Appointment on Contract letter	Memory loss, leg pain spinal pain, skin problem
236	426	V.Gnana Sebastian / 38 S/o.Velankanni Ugarthe Nager Kodiakanal	3.3.92 - 3.3.93 (Contract)	Ice breaking & Air passing (Hg Area)	Contractor's letter	Skin disease, Headache, loss of memory, (medical records enclosed)
237	432	P.Chelladurai / 31 S/o. Perumal 8/72 Noise Road Kodiakanal	1997 - 1999 (Contract)	Air Passing, Screening, Ts washing (Hg Area)	Contractor's letter	Loss of memory, headache, body pain, eyesight problem, (No medical records)
238	435	M.Yesuraj (33) S/o.Michael 47, Beach Road, Mathakoil Thoothukudi	1993-1996 Rafeeq Contract	Canteen	P.F.No. TN/17287/593	Breathing Problem Done operation (Medical Report Enclosed)
239	436	A.Jayabalan / 27 S/o. M.Arulanathan	1997 - 1998 (Contract)	Top cutting, crusher, oven	Contractor's letter	Loss of masonry ulcer does not cure, loss of immunity

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Collony Street, Perumal Malai Kodiakanal		(Hg Area)		
240	437	V.Ravikumar (31) S/o.N.Velayutham 15/115, Ambedkar Nagar Kodaikanal.	01.04.1996 - 15.07.1997 (1 year) Rabika contract	Canteen	-	Headache, Stomach pain Back pain, Hand & Leg pain
241	439	S. Kamatchi (28) W/o. Parthiban, Vellakevi, Kodaikanal	1998-2000 (2 years)	Packing (Hg. Area)	-	Head ache, stomach pain, Irregular periods, tiredness
242	440	L.Amutha (42), W/o.L.Lasar, Swedish settlements Paparpuram, Kodaikanal	1998 - 1999 (1¼ years)	Digital Sec & packing (Hg.Area)	-	Irregular periods, Dental Problem Stomach pain, Head Ache.,
243	441	G.S.John Prabaharan / 28 S/o. J.Johnson St.Marys Road, Kodiakanal	15.10.99 - 9.11.01 (Contract)	Gardening, Hg Waste Crusher	Contractor's letter and company's compensation	Neck, throat pain
244	442	G.Dency Selvarani (26) W/o. George 11/100, St.Mary's Road, Opp. Pon's Factory, Kodaikanal.	1994 - 1997 (3 years)	Packing in Hg Area & Digital Section	T. card	Anemia, Dental Problem tooth plucked.
245	443	S.Susila / 52 W/o.J.G.Stephon 11/100, Charlimant Banglow St. Mary's Road,Kodiakanal	1990-2001 (11 years)	Garden work	P.F.No.TN/17287/A113	Knee Pain, Dental problem B P. Husband - Frequent head ache Dental problem (No Medical reports)
246	444	P. Malika, (46) W/o. A.Paneer Selvam, 9/12, N.L.B.Nagar, Kovailputhur Post, Coimbatore	1992-1995 (3½ years)	Packing (Hg. Area)	T-Card	Dental problem, Hip ache, Head ache, Irregular periods, stomach pain
247	446	S.Anantharaman / 32 S/o. N.Subramaian (C/o. Mari Muthu)	Jan 1990 - 15.12.90 (T card)	Fine Air passing (Hg Area)	Company's relieving order	Tiredness, continuous tears, eye sight problem, loss of hair, headache

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		420, Gandhi Puram,Kodiakanal				
248	448	S.Amir Syed Abdahis / 44 S/o. M.A. Sayub Near Poultary form Indra Nagar, Kodiakanal	1984 – 1985 6 months	Screening , fine air passing (Hg. Area)	Casual labour	Mental effect, dental problem, Wife: Irregular periods 1 time abortion (4 months) (No medical reports)
249	452	A.Durairaj (55) Aadhi Moolam 190, M.M.Street, Kodaikanal.	1984-1995 (11 years) Yogaraj/ Pandurangan Contract	Garden Work Packing in Hg Area	Contract form No.XIV Employment card Enclosed	Heart attack Medical reports enclosed.
250	454	K.Mohan Doss / 45 S/o. J.Kumar Dass Karaiyankulam Kalarara Kala House Kaapukadu, Marthendam, Kaniyakumari	1985 – 1989 4 years	Fine grading (Hg. Area)		Allergy, Itching Right hand cancer
251	463	P.Gnana Sekar / 42 S/o. Y.Peter Opp. to Pand's Company St. Marys Road,Kodiakanal	1986 - 1987 (Contract)	Electrician, Maintenance	Contractor's letter	Eye problem, face swelling (mother suffers from respiratory problem) (Mother medical reports enclosed)
252	464	B.Senthil kumari (31) D/o.Balusamy W/o.Arokia John, 29, Anandagiri 7th Street, Kodaikanal	1996-1999 (3 years)	Digital Sec & Packing in Hg. Area	Fire certificate copy enclosed	Spinal cord pain, Breathing problems, 2 times abortion Hip pain.
253	466	M.Paraman / 34 S/o. Muthu 5/328, Govt. Play Ground Kodiakanal	1991 - 1995 (T Card)	Packing, contracting section (Hg Area)	-	Headache, stomach pain (Medical records enclosed)
254	467	G.Gopikaniranjani / 27 W/o. M.Ramasamy Govt. Play Ground, M.G.R. Nagar, Kodiakanal	March 1998 - Sept. 1998 (Contract)	Digital Sec & Packing in Hg Area	HLL's letter calling far medical examination and contractor's letter	Ulcer, headache, eye problem, menstrual problem, uterus problem and early adding (medical records enclosed)

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
255	471	A.Saleth Rani / 45 W/o. Antony Doss Srinivasapuram, Kodiakanal	1995 - 1996 (Contract)	Packing (Mercury Area)	Contractor's letter	Not able to speak (loss of speech) limbs affected, headache, gaudiness menstrual problem (Medical records enclosed)
256	472	G.John Sagaya Brabu / 37 S/o. George	May 1997 - Oct. 1999 T card	Digital Sec. and packing in Mercury area	T Card	Frequent headache, after Cancer forming headache, Neurons problem teeth, gum problem, impotency one eye's nerves affected (Medical records enclosed)
257	474	A.Prabhu / 31 S/o. Arockiadass 160, 4/138 C-3, Indira Nagar Kodiakanal	1992 - 1993 1 year Pandurangan Contract	Rough Air Passing (RAP) (Hg. Area)	T-card contractor letter	Stomachache. Eye irritation level problem. Medical reports enclosed
258	475	A. Markantony / 32 S/o. D.Arockiadass 160 4/138 C-3, Indira Nagar Kodiakanal	1992 - 1993 1½ years Pandurangan Contract	Packing (Hg Area)	Contractor letter	Eye problem, Respiratory problem Back Pain, Headache
259	481	S.Antony Jerald / 29 S/o.Stanisalns 5/141 Annandagiri 4th Street Kodiakanal	1994 - 1995 8 months only	RAP, Screening & Washing (Hg Area)	T-Card 224	Respiratory Problem Headache Memory loss
260	483	S.Jerome Jaykumar / 32 S/o. S.Sinion 40/130 1E, Indira Nagar Kodiakanal	1996 - 1997 1 year Pandurangan Contract	Shake out (Hg Area)	T. Card	Chest Pain. Loss of memory
261	486	A.Arokiya Ramesh / 34 I.Aroakiadass Bliss Villa, 3rd Street, Kodiakanal	1.4.1993 - 31.12.1993 8 months only	Rough Air passing (Hg Area)	T-Card temporary workman certificate	Respiratory problem
262	487	A. Alex (65) S/o.V.E.Augustine, 2/57, Mudhliyar puram Kodaikanal	1987-1995 (8 years) Jeyaseelan contract	Tailoring work	No.	Dental problem Headache Diabetes

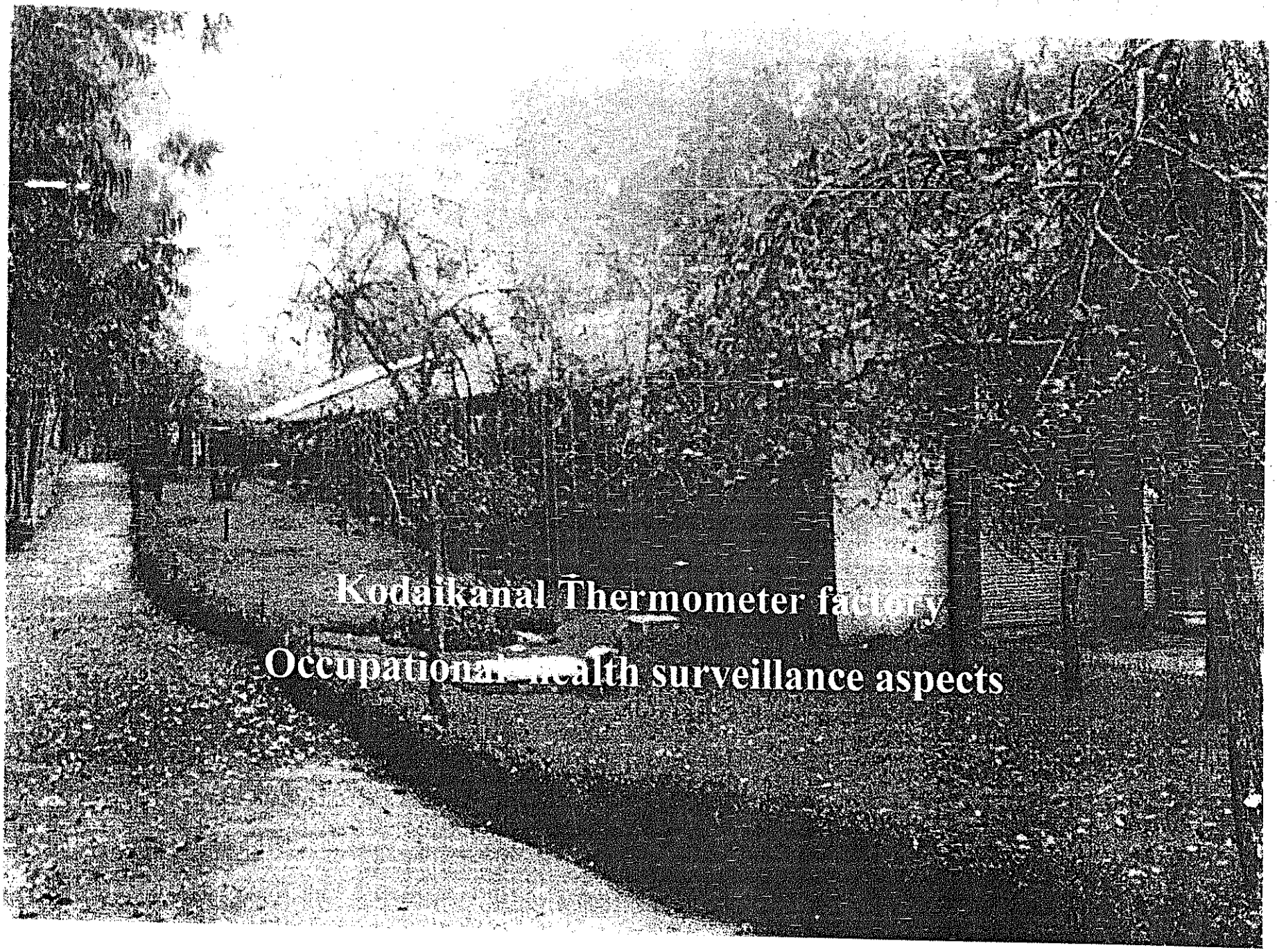
S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
263	489	A.Robert / 32 S/o. Arockiasamy 8/22, 91 Nehru Street Pulumpatti, Pandiyan Nagar Thirupoor	1990 - 5.9.1998 8 years	Top cutting injunction molding Hg. Distillation	A-Card, A01 Intensive Training programme letter	Tiredness, Memory loss Headache, weight loss Dental problem weakness
264	491	S.Justin / 33 S/o.S.Simon Chellapuram, Observatory P.O. Kodiakanal	1991-1993 2 years	Packing in Hg. Area	Temporary workman Order copy 7.10.1992 and 7.01.1993 T. Card No.17	Chest Pain, Chest swelling Dental Problem Giddiness memory loss
265	492	A.Raja / 33 S/o. C.M.Arockiasamy Tumerpuram 1st Street Kodiakanal	1992 - 1993 (1 year) Panduragan Contract	Packing (Hg Area)	Contractor letter	Joint Pain Eye sight problem piles
266	498	P.Senthil Kumar / 32 S/o N.Purusothaman 7/39, Mudhaliar Puram 2nd Street Kodiakanal	1990 - 1997 (7 years)	RAP, Contracting in Hg Area & Non Hg Area	T.Card Temporary workman order copy	Headache Tiredness, Eye pain Ear operation
267	499	T.John / 36 S/o. Thiruthuvaraj (Late) Vattakanal, Kodiakanal	1989 - 1900 2 yeas Mr.Yogaraj & Pandurangan contract	Garden work & Packing in Hg. Area	Contractor letter	Dental problem, Headache Stomach Pain
268	502	J.Shekabdullah (31) S/o.Abdhul Jaber Annai Therasa Nagar, Kodaikanal	01.10.1997 - 07.03.2000 SDB contract	Security	-	Ulcer, Headache, Skin Disease
269	517	R. Komala Valli (36) W/o.K.Radhakrishnan Farifalls Road, Pbservatory, Kodaikanal	1998 - 1999 (1 year)	Packing in Hg Area & Digital Sec.	T-card	Heart problem, Dental problem Head ache, Eye problem.
270	520	P. Jancy (27) W/o.T.John	1997 - 1997 (1 year)	Digital Sec & Packing in Hg Area	T Card 2 No 80	Skin patches Frequent eye problem 1 time abortion Dental problem Irregular periods

... .lo.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
		Vattakanal, Kodaikanal				
271	541	S.Francis (44) Harrington S/o. Selvaraj Vijaya Sri Bangalow Convent Road, Kodaikanal	1984-2001 (18 years)	Certification Bulb forming Top chamber (Hg Area)	Confirmation order copy **Regular**	Memory loss, tiredness, Dental problem Disorder - house Daughter - skin patches (Medical records enclosed)
272	542	R.Salethan / 40 s/o.Rathinam Vattakanel, Kodiakanal	10.1.1987 - 25.5.1988 1½ years Yogaraj Contract	Top cutting (Hg Area)	No	Kidney problem headache
273	543	S.Prabhakaran (40) S/o. Sebastian, Henry Illam, Moyes Road, Kodaikanal	1986 - 2001 (16 years)	Fine grading (Hg Area)	Confirmation order copy **Regular**	Weakness, tiredness wife - Nerves problem 1997 under developed baby born and expired 7th month (Medical records enclosed)
274	561	F.Selvam Samuel (32) S/o.H.Franilin Opp. Gokolam Bangalow Observations Road, Kodaikanal	1990-1995 (4½ years)	Laser & packing (Hg Area)	Temporary order copy	Ulcer, weakness wife - 1 time abortion Irregular periods
275	565	B. Selvamani, (42) W/o.R.Balasubramani, F1, Sivanandi Road, Kodaikanal	1998 - 1999 (1¼ year)	Digital Sec & Packing in Hg Area	T-card	Skin patches, stomach pain Head ache
276	569	V.Daisy (29) W/o.Vargheese Annai illam, AITUC Nagar, Srinivasapuram, Kodaikanal	1996 - 1998 (2 years)	Digital Sec & Packing in Hg Area	T. Card No.42	Skin spatchs. Stomachpain 1 time operation Son -
277	571	S.Charlie Joshep / 54 s/o. A.Sebantin 1/335 A, Pandiyen Nagar Pandiyen Nagar Dindugal	1984-2001 (18 years)	Generator Operator Maintenance Engineering works	Pay slip **Regular**	Wound in Back, Skin patches Wife Ulcer, Skin (son 2 Eye sight Spectacles records enclosed) Giddiness Patches problem wearing

S. No.	File No.	Name & Age / Father Name / Address	Period of Employment	Department	Employment Evidence	Health Status
278	572	A.Sahayam / 46 S/o. I.Aaccevatham Senbhanoor, Kodiakanal	1984 - 1986 Mr.Yogaraj Contract	Carpenter work & Packing in Hg Area	No	Tiredness skin patches weakness wife had Irregular period problem
279	574	S. Rajah (59) S/o.Y.Subbian Kurinji Nagar, Kodaikanal	1984-1988 5 years	Contracting (Hg Area)	Company pay slip **Regular**	Breathing problems, stomach pain chest pain, shoulder pain, Head ache Medical reports enclosed.

Annexure - 2

Presentation made by the respondents to the committee members


Kodaikanal Thermometer fa ry
Occupational ealth surveillance aspects

Update on the issue

- Breaches in company procedures led to mercury tainted glass finding its way to a local dump yard (March 2001)
- 8th March 2001 company suspended all operations. Internal audit team rushed to the site for investigations. The company appointed URS Dames & Moore international environmental consultants to study the issue from an environmental and occupational health perspective.
- Final report from them has concluded that the Kodai lake has not been impacted, the workmen have not suffered any health related effects and the site soil needs remediation. This report has been accepted by the Tamil Nadu Pollution Control Board working committee
- The company also engaged the services of **Prof. Vishwanathan Ecotoxicological expert from ITRC** who is a WHO expert on elemental mercury to evaluate health and environmental risks
- The company conducted a comprehensive epidemiological study in March and April 2001 covering 255 individuals (133 current, 64 contract, 55 ex-employees and 6 scrap dealers)

Update on the issue

- At the specific request of the NGOs and the TNPCB the occupational health issues were evaluated by a specialist from **TNO, Netherlands** who did not find any occupational health related issues.
- Study design, findings and results peer reviewed by **AIIMS** and subsequently evaluated by **ITRC** (based on a specific directive from the **SCMC**)
- Over the years the factory has been subject to statutory inspections and health evaluations by the factories Inspectorate of the government who have not found any mercury related ill-health amongst the employees. In August 2001 the **Certifying Surgeon** conducted a health survey and has opined *"the overall study reveals that the employees are healthy and sound"*.
- Factory shut down permanently in 2001. 130 employees opted for Voluntary separation by entering into individual settlements with the company. Acceptance of the separation package was discussed and agreed to by all in the presence of the Deputy Labour Commissioner. The employees also confirmed at this meeting that they had no occupational health related complaints, when asked to specifically list any complaints to the mediating authorities.
- Mercury contaminated glass re-exported back to USA for reprocessing at their end. – Done in May 2003 following a special treaty between Govt. of India and the US Govt.

Update on the issue

- The Supreme Court Monitoring Committee (SCMC) on Hazardous Waste management visited the State of Tamil Nadu during September 20-22, 2004
- SCMC in its meeting on 5th Nov 2004 ***modified the earlier directions*** given in the report of the sub-committee as follows : "Tamil Nadu Pollution Control Board is directed to make an assessment of the extent of contamination and to calculate the costs involved in rehabilitation / remediation of the contaminated areas in Kodaikanal, in association with a reputed organization such as NEERI. TNPCB is further responsible for ensuring that the costs of such remediation are borne by HLL, if necessary by invoking Rule 16(2) of the HW Rules"
- Regarding health of ex-employees of the thermometer factory, the SCMC recommended at it's meeting with TNPCB on 2nd Feb 2005 the following: "Regarding the health study in Kodaikanal, NEERI can coordinate with ITRC, Lucknow. NEERI Director confirmed that he would take up the matter with ITRC on priority". **TNPCB approached ITRC through the Director of NEERI. ITRC expressed the willingness to take up a health study.**

Update on the issue

- As directed by the SCMC, decontamination of machinery and materials commenced, using the decontamination protocol, on 7th July 2005 after obtaining the necessary approvals from TNPCB
- Stops and starts due to local NGO interventions
- Interim injunction given by the Hon'ble Madras High Court on the writ petition filed by Mr. Nithyanand Jayaraman, an NGO objecting to the decontamination work. The Chairman of the SCMC Dr. G. Thyagarajan explained to the Hon'ble High Court about the urgency to undertake the decontamination and complete it and also said that the process were being supervised by a Panel comprising of experts. The court vacated the stay.
- Decontamination work finally completed on 7th May 2006.
- Next action steps – soil remediation to be done with overall guidance from NEERI (as per SCMC directives). NEERI has finally recommended a level of 25 mg/kg as the goal for soil remediation.

Kodaikanal factory

Epidemiological surveillance of employees – an occupational health study

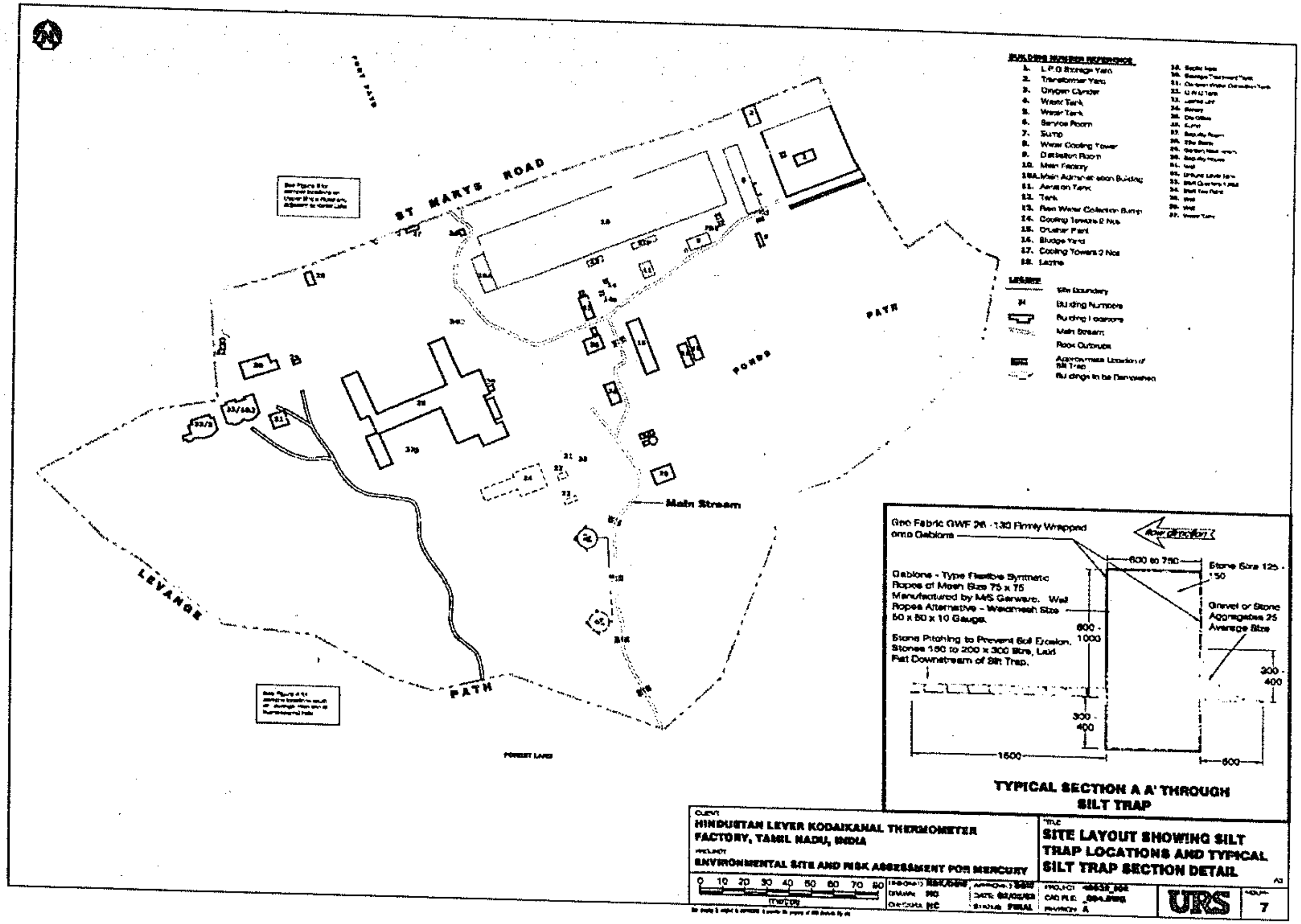
Mercury - Sources and its uses

- Natural degassing of the earth's crust 25000 to 125000 tonnes per year
- Anthropogenic sources are less than natural sources. World production through mining is around ` 15000 tonnes per year
- Chloralkali, electrical and paint industry are the biggest consumers of mercury
- Used in Industry, Agriculture, Medicine and Dentistry
- Burning of fossil fuel, production of steel, cement and phosphorous & the smelting of metals from their sulfide ores all release mercury
- Alkylmercury fungicides used as seed dressings are important sources of Hg in terrestrial food chains.

Kodaikanal factory - History

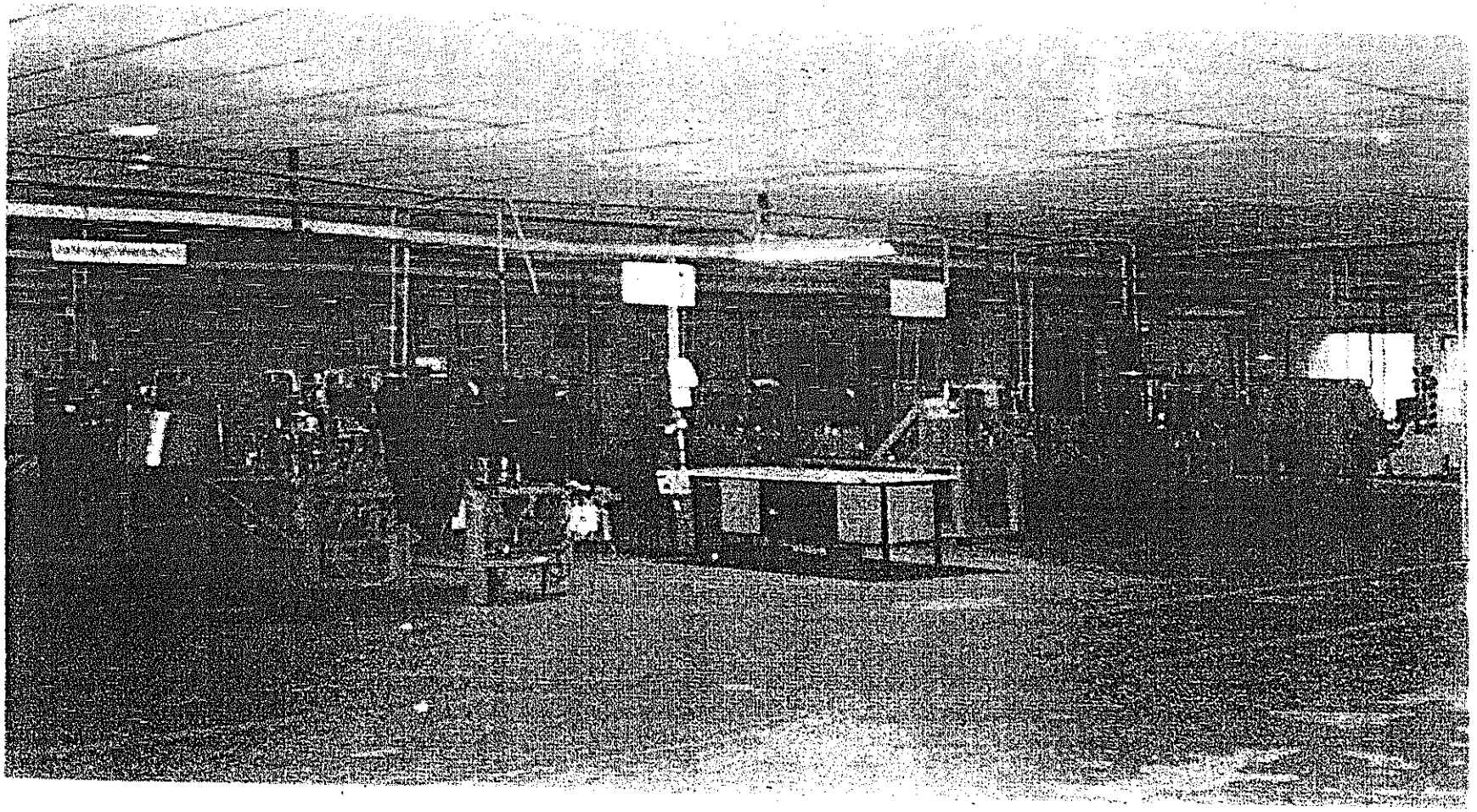
- Set up by Ponds in 1984 with equipment from US. Kodaikanal was chosen due to climatic conditions [2°C to 20°C] conducive to negligible Hg vaporisation at this temperature.
- In 1998 became part of HLL following merger. Unit is EN46002 certified. Thermometers made for export.
- Rated capacity of 20 million thermometers per annum
- Valid consent for discharge of effluents and air consent by the TNPCB as well as for hazardous waste disposal.

Site layout


ST MARYS ROAD
PATH
PONDS
Main Stream
LEVANGE
PATH
FOREST LAND
BUILDING NUMBER REFERENCE
1. L.P.G Storage Yard
2. Transformer Yard
3. Oxygen Cylinder
4. Water Tank
5. Water Tank
6. Service Room
7. Sump
8. Water Cooling Tower
9. Distillation Room
10. Main Factory
10A. Main Administration Building
11. Aeration Tank
12. Tank
13. Rain Water Collection Sump
14. Cooling Towers 2 Nos
15. Crusher Plant
16. Sludge Yard
17. Cooling Towers 2 Nos
18. Latrine
LEGEND
Site Boundary
Building Numbers
Building Locations
Main Stream
Rock Outcrops
Approximate Location of Silt Trap
Buildings to be Demolished
Geo Fabric GWF 26 - 130 Firmly Wrapped onto Gabions
flow direction
Gabions - Type Flexible Synthetic Ropes of Mesh Size 75 x 75 Manufactured by M/S Garware. Wall Ropes Alternative - Weldmesh Size 50 x 50 x 10 Gauge.
Stone Pitching to Prevent Soil Erosion. Stones 150 to 200 x 300 Size, Laid Flat Downstream of Silt Trap.
600 to 750
Stone Size 125 - 150
Gravel or Stone Aggregates 25 Average Size
600 - 1000
300 - 400
1500
600
TYPICAL SECTION A A' THROUGH SILT TRAP
HINDUSTAN LEVER KODAIKANAL THERMOMETER FACTORY, TAMIL NADU, INDIA
ENVIRONMENTAL SITE AND RISK ASSESSMENT FOR MERCURY
SITE LAYOUT SHOWING SILT TRAP LOCATIONS AND TYPICAL SILT TRAP SECTION DETAIL
0 10 20 30 40 50 60 70 80
metres
URS
7

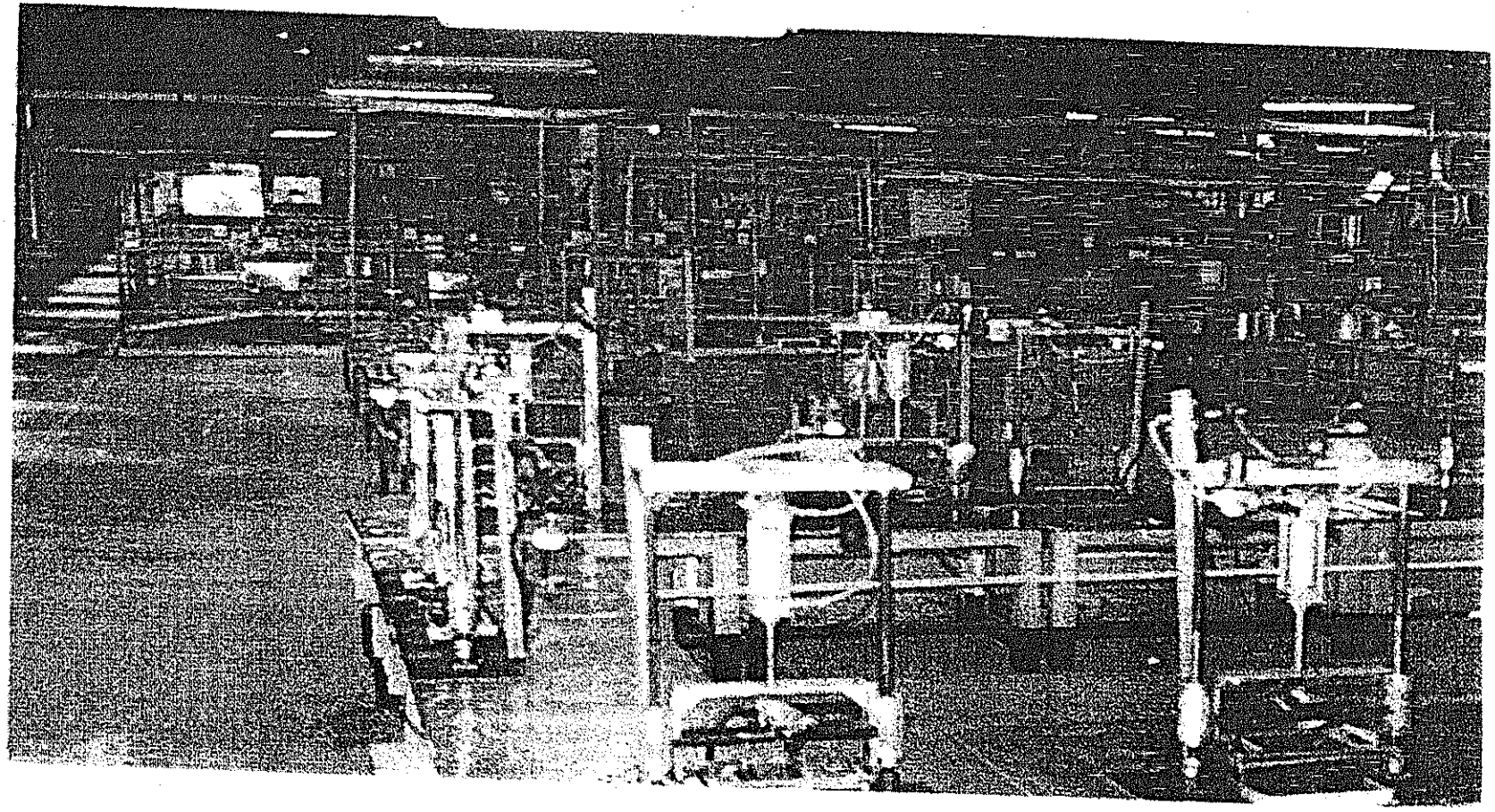
Manufacturing process

- Non- Mercury Area
  - Glass forming operations. Includes stem cutting, bulb cutting, end opening, end cutting and bulb forming



Manufacturing process

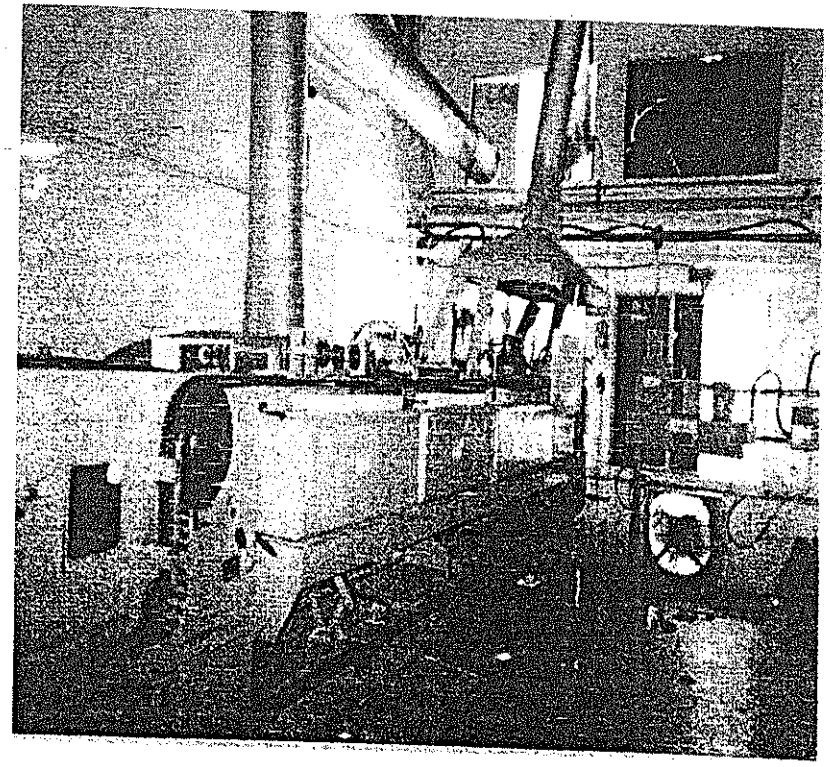
- Mercury Area
  - Includes Mercury filling, Distillation, Top chambering, Annealing, Contracting, Air passing, Scale setting, Grading, Screening, Baking, Top Making, Inspection, Quality assurance and Packing and the Recovery section.



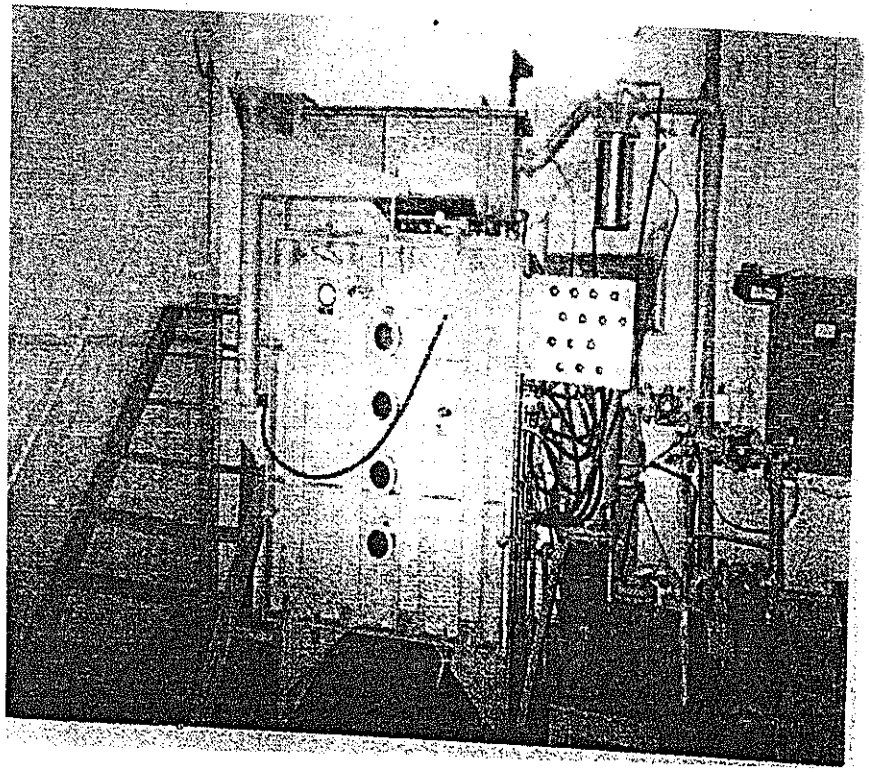
Mercury usage at Kodaikanal

- Procurement in glass/plastic/steel containers from abroad
- Storage in bonded warehouse under excise control
- Acid washed and Distilled and then handled in the filling room - filling is done under vacuum conditions with full protective gear
- Hall dimensions around 60' x 100' with a ceiling height of 12'. Exhaust fans at ground level on one side and big windows on the other side. Backup power facility present
- Spills cleaned and drained to functional ETP → sludge stored in drums for disposal.

Manufacture of a mercury thermometer

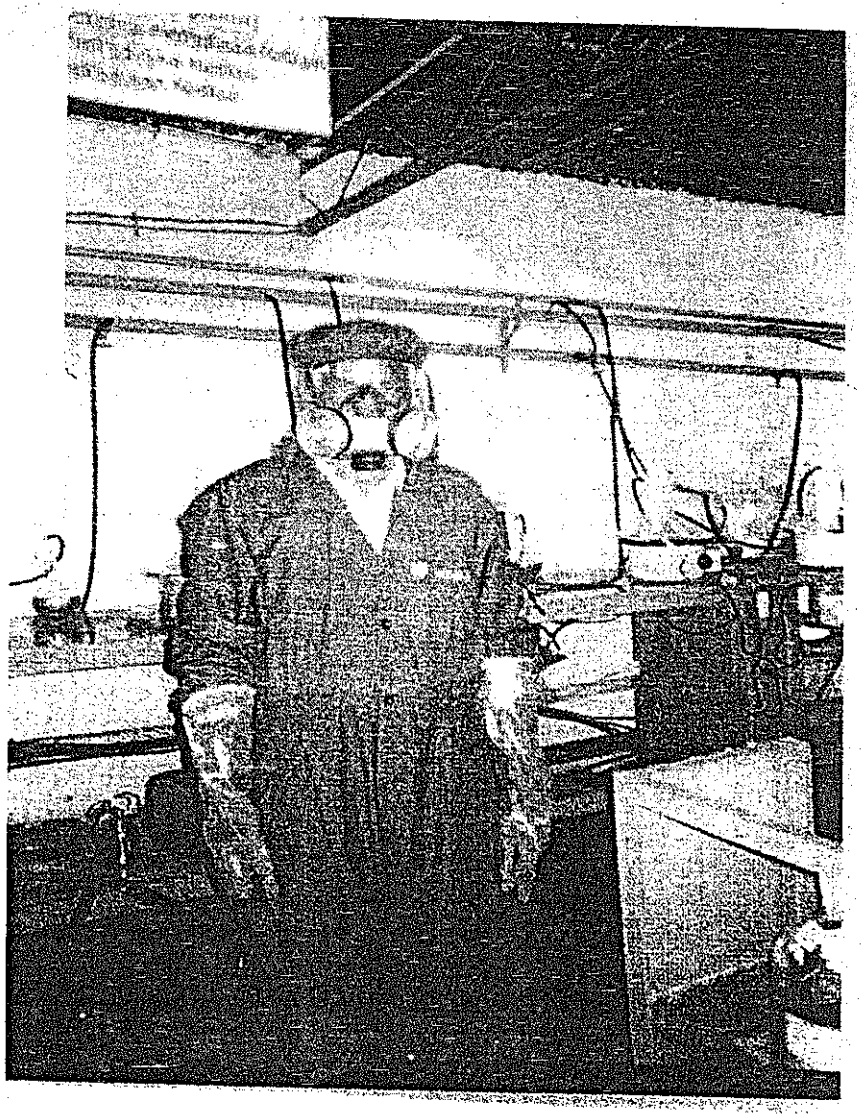


Top chambering machine



Filling machine

Manufacture of a mercury thermometer



Distillation process

Occupational health and safety measures in place

- Total of 25 exhaust fans fitted along the south-eastern wall of the mercury area to turnover the 15,145 m^3 of open area every 45 minutes for 16 hrs/day for 310 days a year.
- A total of 6 exhaust fans were provided along the northeastern wall of the mercury crusher building for an air change of 288 m^3 of area every 5 minutes for 24 hrs/day, 310 days per year.
- Total of 5 exhaust fans along the southeastern wall of the mercury distillation building for an air change of 166 m^3 of area every 4 minutes for 8 hrs/day, 310 days per year.
- Provision of vacuum cleaners equipped with water seals to collect broken thermometers when breakage occurred.
- Scrubbing and washing of the factory floor once a day with water to remove traces of mercury. This water was treated at the ETP.
- Operators in the mercury area were provided with special cartridge type safety masks to filter out mercury vapours. This was backed by an emergency procedure (opening all windows and cleaning the entire floor with water) when the mercury vapours exceeded 0.05mg/m^3.
- **Jerome sampler** with self-calibrating facility used to monitor Hg in air in 15 – 22 locations in the plant spread across mercury, non-mercury and external to the plant

Occupational health and safety measures

- All employees underwent a monthly monitoring of mercury in urine through the use of an Atomic Absorption Spectrometer to regulate Hg in urine to be within the WHO recommended individual limit of 100 µg/Lit Employees whose mercury levels exceeded 100 µg/Lit were deployed out of the mercury area and in all such cases the mercury levels came back to acceptable levels within 1-2 months. Such readings constituted < 1% of over 18,000 readings over the working life of the plant.
- This was supplemented by an annual clinical evaluation with specific emphasis on the oral cavity, lungs, cardiovascular system, the eyes, skin, kidneys and the central nervous system. The medical test also included blood tests (hemogram) and routine urine examination for albumin, red blood cells, casts, crystals and sugar.
- Group averages for mercury in urine for employees over the period 1998 to 2001 show an annual range between 13 and 32 µg/Lit., and well within the WHO recommended group limits of 50 µg/Lit.

Mercury - Occupational Health effects

- **Acute poisoning**

Irritation of bronchial mucous membrane

Stomatitis with increased salivation

Pneumonitis with fever and dysnpoea

Ingestion of mercuric chloride causes kidney failure

- **Chronic poisoning**

Non-specific early symptoms include anorexia, weightloss, headaches followed by more characteristic disorders *like...*

Mercury - Occupational Health effects

- **Irritability, sleep disorders, anxiety, depression.**
- **Mercurial tremor. Tremor along with excessive shyness, excitability, insomnia is called as Erethism. Handwriting gets affected.**
- **Other neurological signs include flushing, perspiration, deep reflexes changes. ? Sensori - neural changes**
- **Proteinuria and less commonly nephrotic syndrome [immunologically mediated]**
- **Not considered to be carcinogenic**

Approach to planning the epidemiological study

Principles

Toxicokinetics

Dose Response Relationships

Phases of Risk assessment and associated epidemiological strategies.

UNEP, WHO, USEPA HEADLAMP Technical guidelines 1997

Qualitative risk assessment [Hazard identification] ↓	Descriptive epidemiology ↓
Modelling for risk realization [Dose-response modelling] ↓	Molecular epidemiology ↓
Quantitative risk assessment [QRA] [exposure estimation, toxicological data, estimation of health effects from epidemiological studies, risk characterisation] ↓	Analytical epidemiology ↓
Evaluation of efficacy of preventive measures	Interventional epidemiology

Assessment of exposure and health effects the use of biological markers in occupational epidemiology

- Health relevant exposure is much better assessed in biological monitoring since the impact on internal exposure of personal behavior, food, interindividual differences in absorption and metabolism, disease states, anthropometry as well as biological characteristics such as age and sex are taken into account
- In recent years Biological exposure limits e.g. acceptable concentrations of agents or metabolites in exhaled air, blood or urine have been developed which takes into account epidemiological studies on the relationships between environmental exposure, biological exposure and health effects.
- Biomarkers to be used to confirm the exposure of individuals in a population to a particular substance. Quantitative measurements may facilitate the determination of dose-response relationships
- Repeated measurement of biomarkers may be cost-effective methodologies to monitor disease development.
- Biomarkers of exposure or effect may be used to evaluate compliance with advice for minimizing exposure and to supplement environmental measurements of chemicals with recognized adverse health effects.

Environmental Health Criteria 27 : *Guidelines on Studies on Environmental Epidemiology WHO 1983*

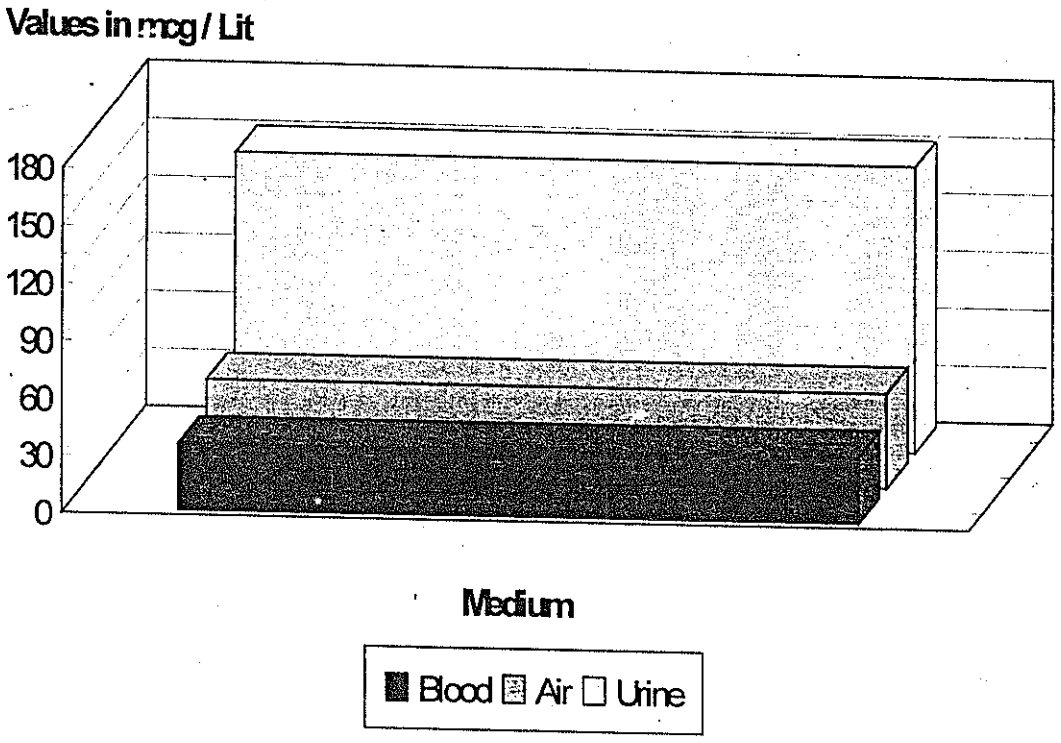
Biomarkers and risk assessment – concepts and Principles Environmental Health Criteria 155 WHO 1993

Toxicokinetics of Mercury

- Elemental mercury dissolved in the blood is rapidly oxidized in RBCs to divalent mercury Hg++ [mercuric mercury]. After removal of subjects from exposure two phases of urinary excretion has been identified. The first phase lasts for two days and accounts for 20 - 30% of the Hg excreted. The second phase has a half-time of 60 days.
- After exposure to Hg vapor, the decrease in Hg in blood follows two half-times - the 1st for 2-4 days and another for 15-30 days.

- **There is no evidence that inorganic mercury is methylated to form methylmercury in mammalian cells. [WHO EHC 118 - p.54] [EPA December 1997 Vol. V 2-6]**

Correlates between air monitoring and biological monitoring for Mercury



- 50 µg/m^3 Hg level in air corresponds to 35 µg/Lit of Hg in blood and 150 µg/Lit of Hg in urine - WHO 1976.
- WHO in 1991 indicated a ratio of 1:2 for air to urine values of Hg.
- IPCS /WHO 2003 has arrived at a 1:1.4 ratio for air vs. HgU

Biological exposure limits

- WHO 1976 proposed that a level of exposure of 0.05mg/m3 to elemental mercury vapor the group blood levels would correspond to 35 µg/Lit and 150 µg/Lit in the urine.[WHO EHC 1 - 1976]

- WHO in 1986 [Early detection of Occupational Diseases] proposed an individual threshold level of 100 µg/Lit. Hg in urine. In subjects not exposed to Hg the levels are < 20 µg/Lit. of urine.

- OSHA Standards lay a TLV of 0.05 mg/m^3 for mercury. The same limits are laid under the Indian Factories Act.

- WHO in 1980 [TRS 647] laid a long term health based group occupational exposure limit of Hg 50 µg/Lit.

- In Germany the Biological Tolerance Value for Hg in urine is 200 µG/Lit. In Germany the Biological Tolerance Value Hg in Blood 50 µg/Lit.

Mercury

Dose Response Relationships

Mercury Dose-Response Relationship

- When exposure is above 80 $\mu g/m^3$ the probability of developing the clinical neurological signs of mercury intoxication [tremor, erythism] & proteinuria is high.

- Exposure in the range of 25 - 80 $\mu g/m^3$ increases incidence of symptoms like fatigue, irritability, loss of appetite

- A specific no-observed -effect level cannot be established and if large populations are exposed to low concentrations of mercury, it cannot be excluded that mild adverse effects may occur in certain sensitive individuals.

WHO - EHC 118, page 111

Mercury Dose-Response Relationship

- WHO 1976 found no evidence of classical symptoms of mercurialism, erethysm, intentional tremor or gingivitis < TWA of 100 $\mu g/m^3$.
- Bunn etal 1986 did not find any significant differences in subjective or objective findings to Hg exposure of 50 - 100 $\mu g/m^3$
- Urine Hg peaks in excess of 100 $\mu g/m^3$ have been associated with impaired performance in memory tasks [Fozst et al 1976]
- Pikkivi et al 1984 reported decreased verbal intelligence when urine mercury level for the group was > 56 $\mu g/L$

Mercury Dose-Response Relationship

- Langolf et al 1978 showed neurological signs and symptoms in 79 workers - urine levels > 500 µg/L. Roels et al 1982 found higher incidence of proteinuria and albuminuria for workers with mean urine Hg of 71 µg/L
- Mercury vapors may lead to glomerular dysfunction in some workers due to auto-immune reaction. Stonard et al [1983] found no evidence of renal dysfunction in workers with an average urine Hg level of 67 µg/g creatinine.
- Mercury vapors at high levels may cause 'Pink disease' characterised by peeling palms and soles joint pain, high BP - known collectively as Acrodynia Karpathios 1991.

Mercury Dose-Response Relationship

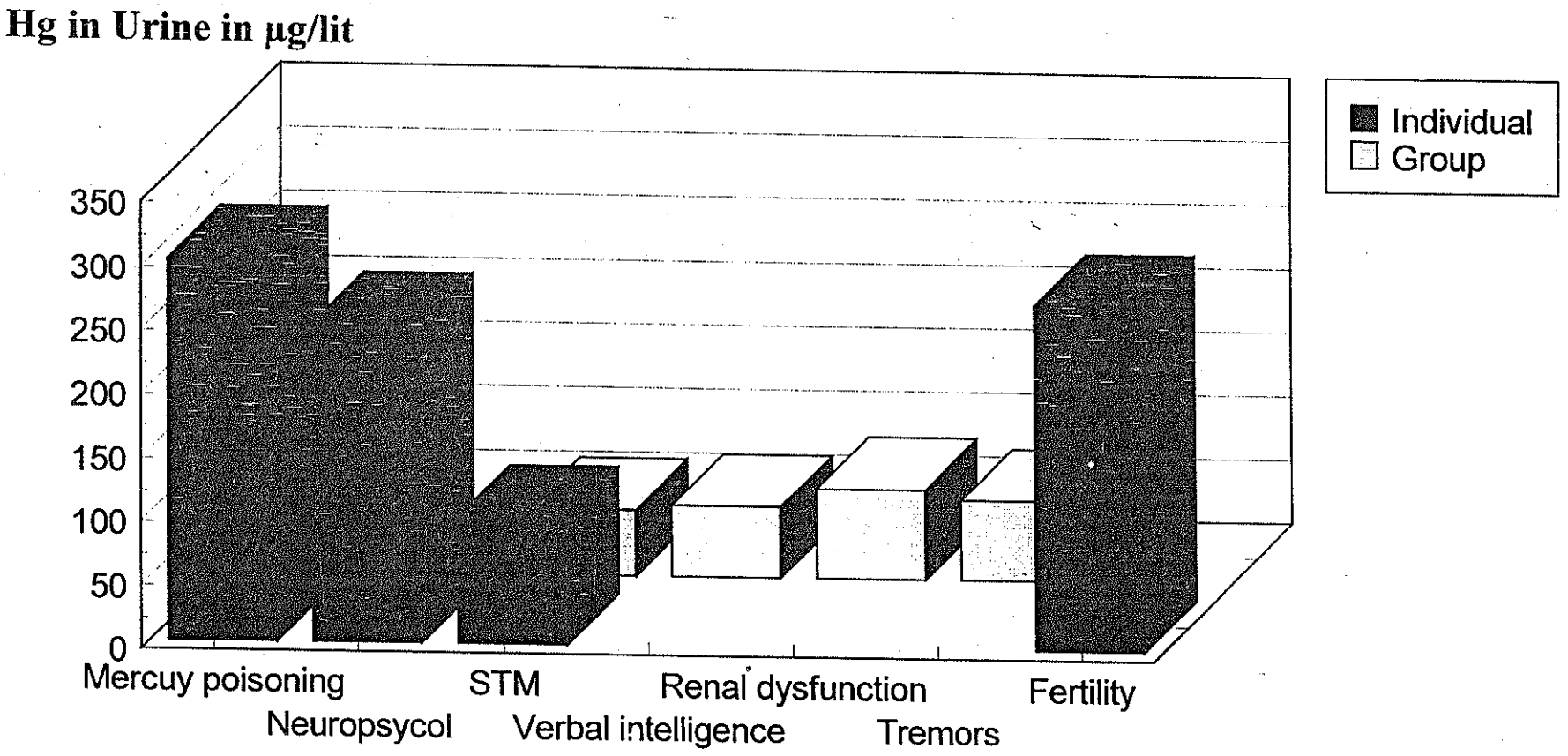
- Rosemann et al [1986] found positive correlation between mercury levels (100 µg - 250 µg / L) and neuropsychological symptoms
- Postural and intention tremor was observed in 54 exposed workers whose mean urinary Hg was 63 µg/L.[Roels et al 1989]
- Lauwreys[1985] found no effect on fertility of male workers [Hg in urine upto 272.1 µg/gm creatinine]

Literature review : Effect of Hg vapor on Psychomotor performances

Authors	Number of subjects	Group mean HgU	Observations
Smith and Langoff [1981]	26 subjects	180 µg/L	Deficit in STM
Roels et al 1985	131 subjects	52 µg/gm creatinine	No change in STM, SRT, CFF & color discrimn.

STM – short term memory; SRT – simple reaction time and
CFF – critical flicker fusion

Summary of Epidemiological studies
Dose effect relationships

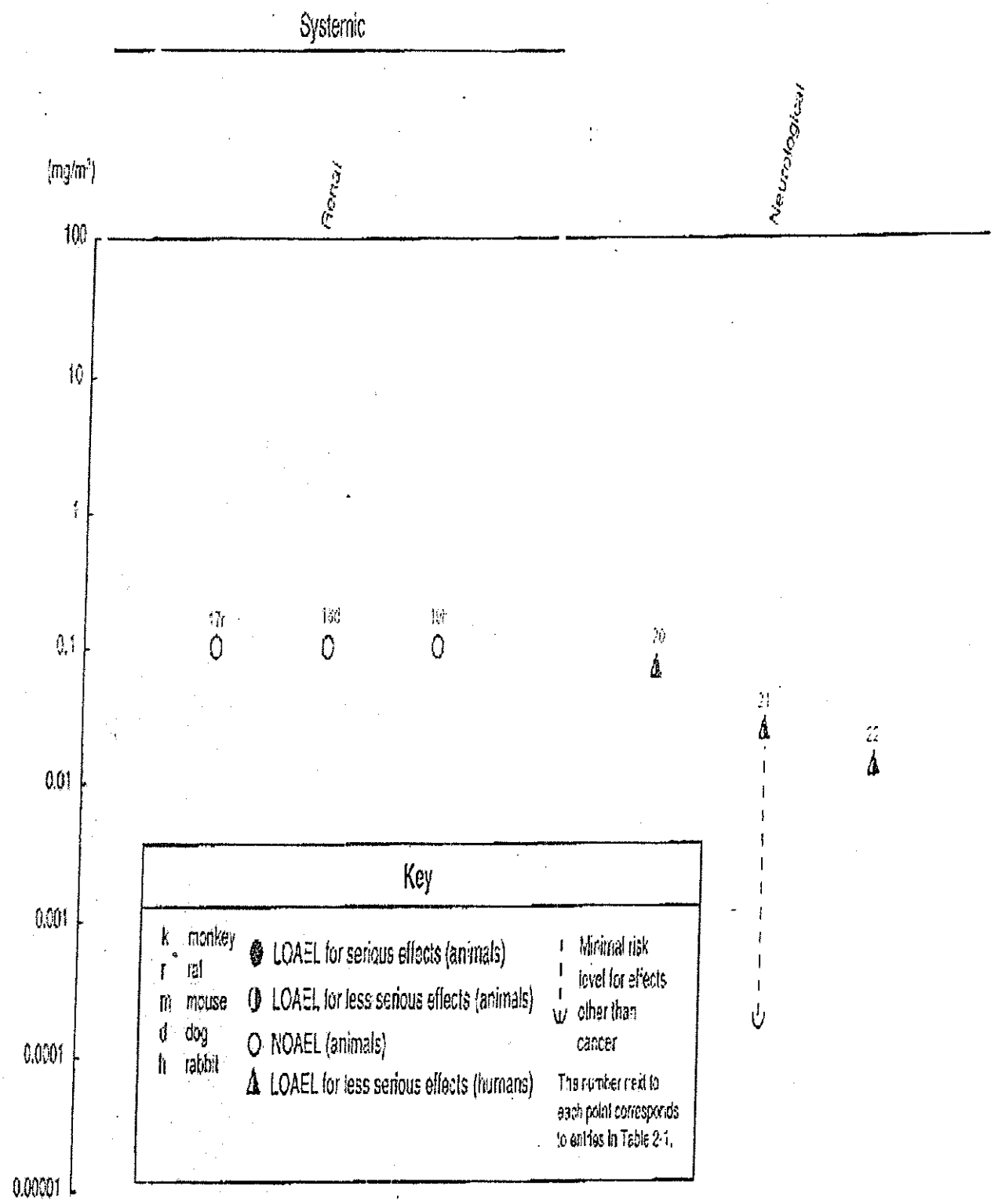


Dose effect relationships
Critical Target Organs

Target organ	Threshold limit for HgU	Reference
Nervous system and kidney	HgU of > 500 µg/l in the previous year	Langolf et al (1977,1978)
Nervous system – Impaired performance on visual memory tasks	HgU peaks > 100µg/L	Forzi et al (1976)
Nervous system- Abnormal reflexes, decreased coordination	HgU > 600 µg/l	Albers et al (1988)
Postural and intention tremors	HgU mean of 63 µg/l	Roels et al (1989)
Kidneys (Excretion of high and low molecular weight proteins)	Biological permissible limit of 200 µg/l	Schaller et al (1980)
Kidneys (Glomerular type proteinuria)	HgU >50 µg/gm creatinine	Berode etal (1980) Buchet et al(1980)
CNS and Kidneys	HgU > 50 µg/gm creatinine	Roels et al (1982)

Figure 2-1. Levels of Significant Exposure to Inorganic Mercury - Inhalation (cont.)

Chronic (≥365 days)



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- Basic Epidemiology – WHO 2006

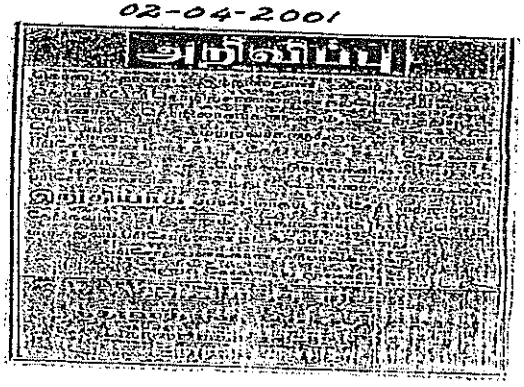
The Occupational Health and Environmental study

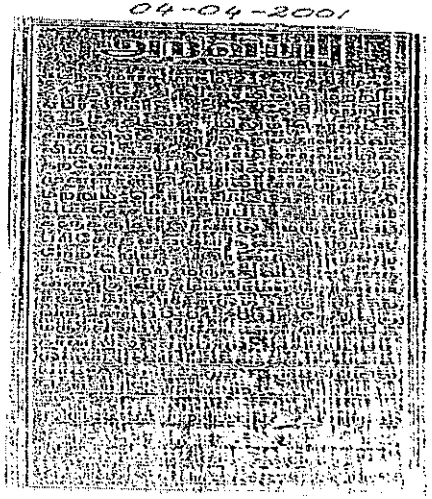
- Health Impact Assessment
  - Cross sectional epidemiological study (2001)
    - Clinical questionnaire and evaluation
    - Biological monitoring
  - Retrospective Cohort Study (1988 - 2001)
    - Historical Biological monitoring data
    - Indoor air monitoring data
    - Morbidity and Mortality profiling
    - Hospital and Physician based surveys
- Environmental Impact Assessment
  - Analysis of mercury in soil, lichen, bark (done in Australia)
  - Analysis of Hg in fish and sediments (USEPA method- done in Australia)
  - Analysis of methyl mercury (Conducted at Sydney & Netherlands)
- Peer reviews

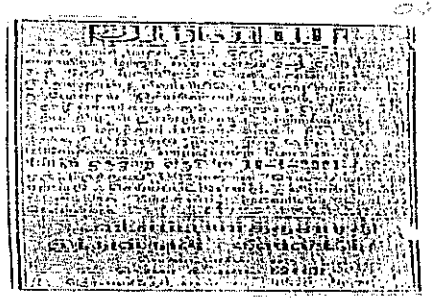
Cross sectional-Epidemiological study

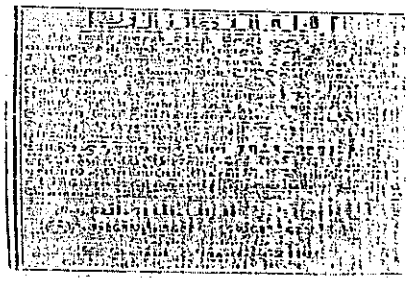
Methodology, results and discussion

Advertisements inviting ex-employees for health check ups









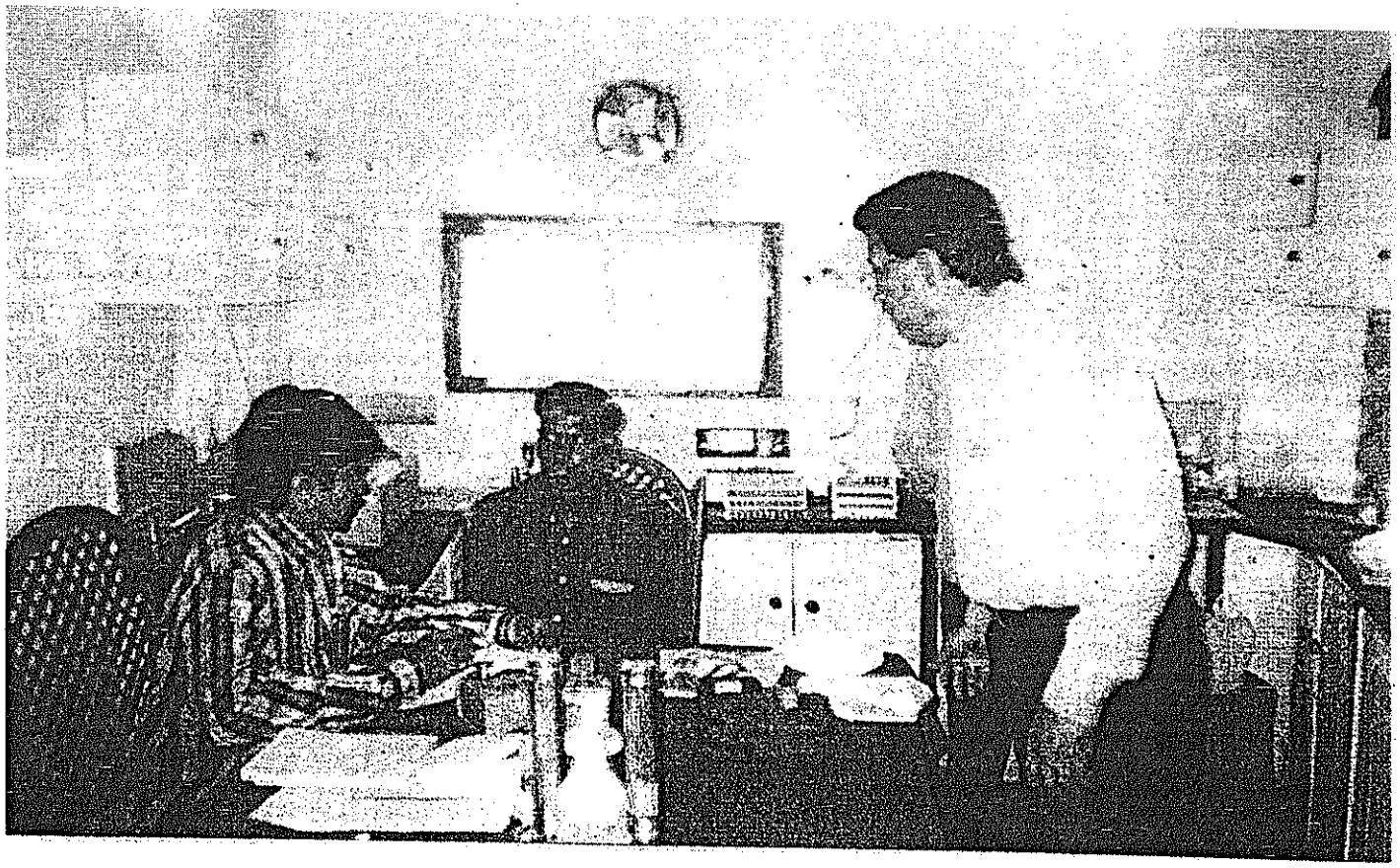
Cross sectional epidemiological study
Protocol for health surveillance

- Questionnaire based on US Dept. of Labor, Mines Safety & Health Administration [July 1999]. Original questionnaire reviewed by CDC, Rutgers Medical School and NIOSH.
- Questionnaire taken as a base and developed further & clinically validated on site by an Epidemiologist
- Standardization of interview and clinical evaluation with a coordinator to ensure uniformity in interpretation- *Inter & Intraobserver variability*
- Clinical evaluation covering Oral cavity, Lungs, CVS, Eyes, Skin, Kidneys & CNS
- Lab. Investigations: Blood Urea, Creatinine, Routine CBC & Urine (albumin, casts, RBCs)
- Biological monitoring of Hg in Urine through Inductively Coupled Plasma Spectrometry (ICP)

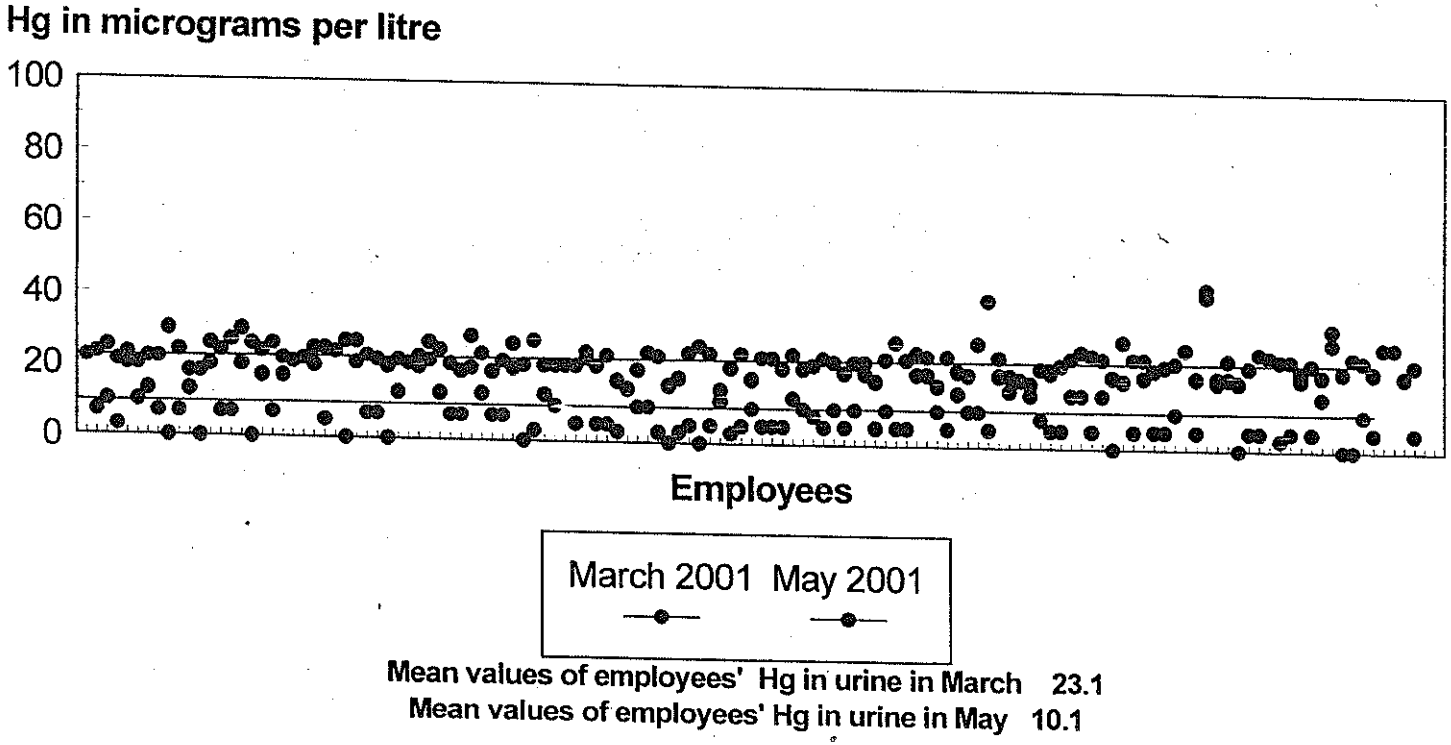
Neurobehavioral evaluation

- **Sensorimotor performance**
  - Grip strength, Reflex evaluation, Writing test
  - Vibration sense (128 Hz at index finger / great toe)
  - Hearing tests
- **Psychomotor performance**
  - Hand-eye coordination,
  - Visual fields and Color discrimination tests
  - Memory tests, Gait evaluation.

Medical surveillance



Biological monitoring results
May 2001 Vs March 2001



Mean values of employees' Hg in urine in March 23.1
Mean values of employees' Hg in urine in May 10.1

Clinical evaluation findings

Morbidity	Permanent employees N=185	Others N=70
Inflammation of gums	19 (10.2)	5 (7)
Dental Caries	62 (33.5)	25 (36)
Hypertension	13 (7)	3 (4.2)
Asthma	4 (2)	2 (2.8)
Diabetes	1 (0.5)	3 (4.2)
IHD	1 (0.5)	2 (2.8)
Tremors	3 (1.6)	1(1.4)
Hyperkeratosis skin	0	0

Figures in parenthesis represent % prevalence

Specific tests for CNS evaluation

Specific tests	Permanent employees	Others
Visual disturbances	0	0
Sensori-neural disturbances	0	0
Lack of Coordination	0	0

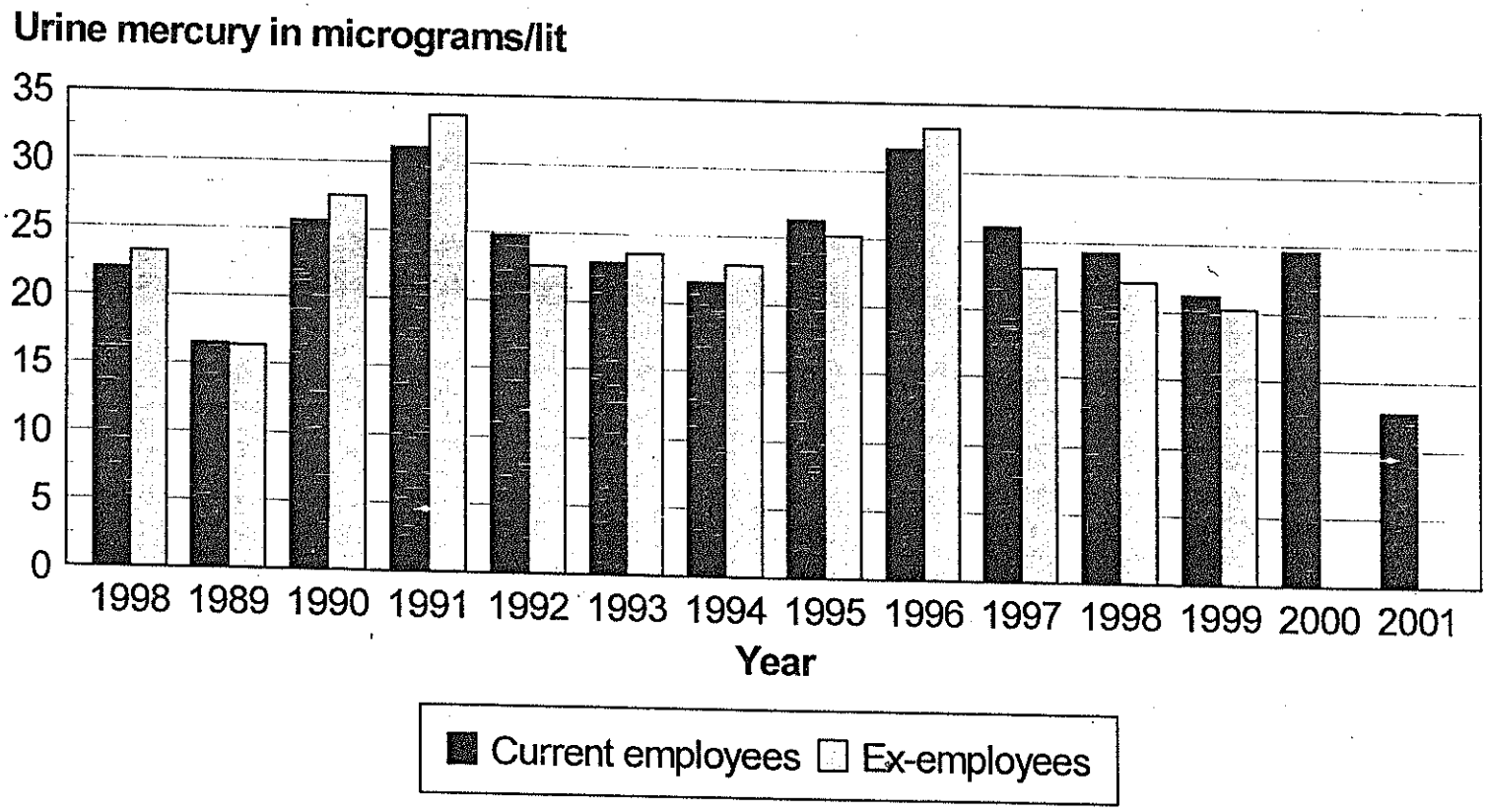
Linkage of symptoms to results of biological monitoring

Symptoms pertaining to	Biological monitoring results – HgU in µg/L					Total
	< 20	21 - 30	31 - 40	41 - 50	> 51	
Central Nervous system	34	49	1	1	3	78
Cardiovascular	11	18	0	0	0	29
Respiratory	20	44	0	1	0	65
Gastrointestinal	4	12	0	0	0	16
Genitourinary	2	4	0	1	0	7

Retrospective Cohort study

Results and Discussion

Biological monitoring of mercury in urine
Group mean values 1988 - 2001



WHO (1980) recommendation for group means 50 µg/L.

Group means HgU - all permanent employees 1988 - 2001

Year	Number of employees	Group HgU Values (µg/L) Mean ± SD
1988	208	22.7 ± 10.4
1989	182	16.4 ± 9.1
1990	147	26.4 ± 16.5
1991	143	31.9 ± 23.7
1992	151	24.2 ± 22.6
1993	161	22.6 ± 6.5
1994	161	21.9 ± 4.6
1995	149	26.1 ± 14.1
1996	136	31.8 ± 16.6
1997	131	26 ± 11.1
1998	126	24.3 ± 11.8
1999	130	21.3 ± 11.0
2000	126	24.8 ± 10.6
2001	130	12.9 ± 5.5

Biological monitoring results for three-year periods
Retrospective cohort analysis

Year	HgU in µg/l for employees in the hazardous section*		HgU in µg/l for employees in the non-hazardous section	
	N	Mean ± S.D.	N	Mean ± S.D.
1988-1990	19	26 ± 26	161	21.5 ± 23.2
1991-1993	19	30.1 ± 29.5	134	25.5 ± 25.8
1994-1996	17	25.4 ± 19.3	131	25.9 ± 19.6
1997-1999	13	27.4 ± 20.2	109	22.6 ± 16
2000-2001	13	26.8 ± 20.4	113	19.1 ± 15.7
Overall	37	27.1 ± 24.1	253	23.2 + 21.0

Hazardous sections include distillation, fill and crusher departments.

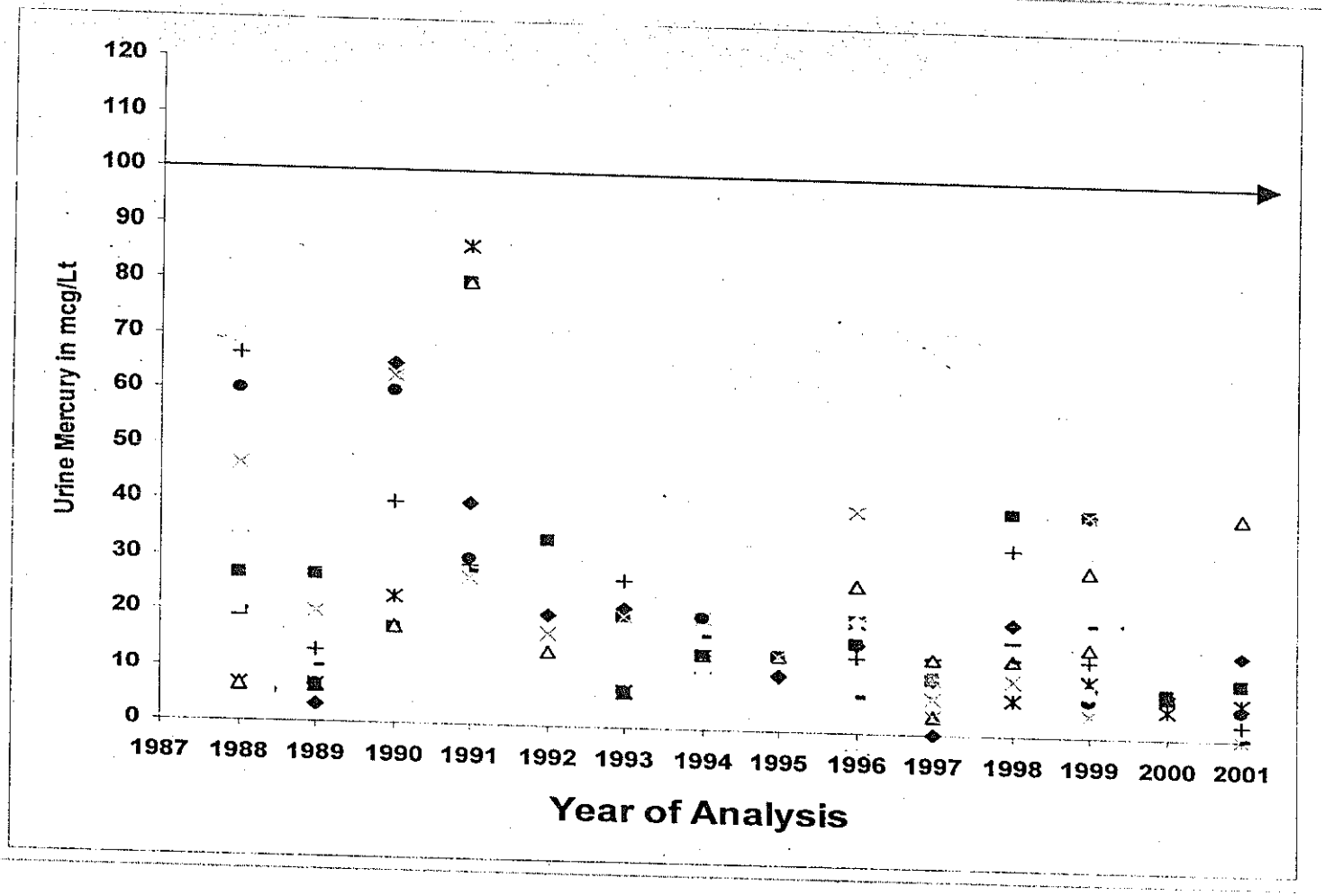
Number of employees with annual biological monitoring levels of HgU > 70 µg/lit

Year	Total Number of employees	Number of employees with urine Hg > 70 µg/l	Percentage of employees with urine Hg > 70 µg/l
1988	208	1	0.4
1889	182	0	0
1990	147	2	1.3
1991	143	6	4.1
1992	151	6	3.9
1993	161	0	0
1994	161	0	0
1995	149	3	2
1996	136	6	4.4
1997	131	1	.7
1998	126	1	.8
1999	130	1	.7
2000	126	0	0
2001	130	0	0

Indian regulations Hg in atmosphere 0.05 mg/m^3

Equivalent HgU of 70 µg/Lit [WHO 1993]

Biological monitoring over time



Environmental monitoring data
Mean values of Hg in atmosphere in mg/m^3

Section	1988	1989	1990	1991	1992	1993	1998	1999	2000	2001
Non – Mercury	0.013	0.016	0.015	0.034	0.043	0.017	0.022	0.023	0.006	0.003
Filling	0.023	0.023	0.043	0.047	0.044	0.046	0.047	0.038	0.012	0.010
Top Chamber	0.010	0.016	0.021	0.031	0.047	0.029	0.039	0.034	0.006	0.005
Contracting	0.016	0.015	0.020	0.028	0.021	0.034	0.033	0.037	0.009	0.006
Air pass	0.017	0.016	0.017	0.028	0.041	0.040	0.035	0.039	0.009	0.010
Laser and inspection	0.017	0.015	0.017	0.018	0.035	0.025	0.039	0.043	0.007	0.005
Grading	0.013	0.014	0.014	0.018	0.003	0.001	0.027	0.025	0.004	0.003
Screen printing	0.023	0.022	0.024	0.030	0.028	0.019	0.036	0.028	0.007	0.005
Head cutting	0.017	0.015	0.014	0.022	0.029	0.024	0.041	0.042	0.008	0.006
Quality assurance	0.014	0.012	0.011	0.018	0.023	0.009	0.019	0.025	0.006	0.005
Packing	-	-	-	0.007	0.029	0.040	0.035	0.023	0.007	0.003
Distillation and crushing	-	-	0.024	0.048	0.042	0.038	0.049	0.064	0.024	0.018

Mortality data analysis - Kodaikanal factory

Employee no.	Age at death	Duration of service in years	Gap between retirement and death (in years)	Cause of death
1	33	5	6	Asthma
2	34	7	Died in service	Tuberculosis with diabetes
3	40	1.5	.25 (3 months)	Complications of jaundice
4	27	.58 (7 mths)	Died in service	Tuberculosis
5	32	7	6	Not known
6	40	8	.25 (3 months)	Rheumatic heart disease
7	29	0.4 (5 mths)	10	Post cardiac surgery
8	26	Not available	? 10 years	Not known
9	35	2	Died in service	Cardiac arrest
10	35	4	.58 (7 months)	Leukemia

Conclusions

- On the basis of the results of environmental monitoring, biological monitoring, clinical evaluations and review in comparison with published data on dose-response relationships, there is no evidence to suggest that any of the employees in the thermometer plant suffered from health effects which could be attributed to mercury exposure.
- Mortality analysis did not reveal any mortality which could be attributed to working in this plant
- Community concerns have mainly been fanned by interested groups without any scientific evidence to substantiate claims of ill health amongst employees at the plant.
- Over the years the factory has been subjected to statutory inspections and health evaluations by the factory inspectorate who did not find any mercury related illness amongst the employees

Peer review and publication of the findings

- This paper was presented in the XXXIInd International Congress of Occupational and Environmental Health in the production and use of chemicals (MEDICHEM) at Paris in September 2004 in the session N 11B on Epidemiology.

- The occupational health study has been subsequently peer reviewed and published in the Indian Journal of Occupational and Environmental Medicine (IJOEM) April 2006, Volume 10 – Issue 1.

Tamil Nadu Government
Certifying Surgeon's report

August 2001

August 25, 2001

Dr.W.R.S. Thangaswamy. M.B.B.S Dip. Poll. Control.
Certifying Surgeon,
Office of the Deputy Chief Inspector of Factories,
SIVAKASI.

To

The Deputy Chief Inspector of Factories, Sivakasi.

Respected Sir,

Sub: Health Survey: Factory using Mercury:
Hindustan Lever Limited, Thermometer Division
Kodaikanal-Report - reg:

Ref : Memo No. H4 / 33659/99 dated 26.07.2001.

Vide reference cited above, a health survey was conducted in the Thermometer Division of the Hindustan Lever Limited, Kodaikanal on 25.08.2001. I am herewith submitting the consolidated report for your perusal.

Health Survey Report:

Venue: Hindustan Lever Limited, Thermometer Divison Kodaikanal.
Total Number of employees examined: 75 (Present)
Special examination : 06 (who were directly handling mercury)

The Hindustan Lever Limited Thermometer Division, Kodaikanal 624101, is located at St. Mary's Road Kodaikanal , employing 130 permanent employees. 09 Staff Members and 35 contract employees.

Present condition of the Factory:

The Factory had been manufacturing clinical Thermometers (Mercury in Glass) by importing stem glass from abroad. Filling mercury in stem glass is done by immersing The stem tube in the tank which is kept in vaccum state. The mercury is led in the tank and sucked in. The top of the tube is sealed by glass fusion technique. 06 employees were directly working in the mercury filling department, 25 in Air Testing and 15 in grade testing. The employees had been provided with full covered uniforms, shoes, caps masks, safety glasses and goggles which were essential for the health and safety of the employees. The working shed is adequately ventilated and the drainage system was in a complete concealed pattern.

TREATMENT PLANT:

The trade effluant had been re-cycled and used for cleaning floors and this had been controlled by the Pollution Control Board , Dindugal.

On instructions from the Chief Inspector Of Factories Chennai , and the Deputy Chief Inspector of factories , Sivakasi , a health survey was conducted in the unit on 25-8-2001. The unit is at a stand still and workers present were examined On giving prior intimation all the workers were made to be present at the factory premises and general examination was done giving importance to the Central nervous system,respiratory system ,skin , oral cavity , and cardio vascular system which are said to be affected by acute and chronic mercury poisoning .The list of clinical examinations with reports is attached.

The necessary haematological reports of investigations like haemoglobin percentage and total white blood cells count , blood urea serum cretinine , urine , routine examination for albumenuria were colleted from the done with the assistence of local clinical laboratory reports for study.

RESPIRATORY SYSTEM:

None of the employees seem to be affected by pnemonitis or any major pulmonary ailment except for one or two having common cold with dry cough .Not even a single employee is found to have a wheezing showing airway obstruction and nobody was found to have been affected by acute or chronic mercury poisoning .On auscultation both lungs fields were clear .

The Central Nervous System of all employees was examined . None of them was found to have intentional or non-intentional tremors , incresed excitibility , anorexia , lastitude or weight loss.On history it was found that no one had major gastrointestinal disturbanses , no memory loss , insomnia or derilium.

ORAL CAVITY:

Salaivation was normal there is no abrupt sudden loss of teeth no evidence of gingivitus and somatitis . All the teeth were found to be healthy.

Cardiovascular System:

There was no specific case of murmur or extra sounds.Pulse and blood pressure has been uniformly normal.No employee gave a history of chest pain, breathlessness or sweating.

Skin:

All employees had normal skin without any evidence of dermatitis or leukoplakia but for a few having dry skin sue to dry weather.The factory premises si kept clean though not functioning.

The health survey commenced from 9am to 5pm.

Impression:

The overall study reveals that the employees are healthy and sound.No employee is found to have a deficient haemoglobin percentage or leucopenia which are additional findings in chronic and acute mercury poisoning as said in Davidson's Clinical Practice of medicine Laboratory investigations show normal blood urea,serum creatinine level which denote no possibility of renal involvement.Apart from the employees subjected for the examination,the rest were on leave.

Dr. W.R.S. THNAGASAMY
Certifiying Surgeon
O/o. Deputy Chief Inspector
of Factories,
Sivakasi.

Professional reviews

- Professor Viswanathan ITRC
- TNO
- All India Institute of Medical Sciences
- Indian Association of Occupational Health

Review & Report by Dr. Viswanathan, [Member WHO Task group on Environmental Health Criteria for Mercury-1989]

- In Kodaikanal unit and its vicinity any Hg attributable health problem is unlikely. He has made this observation on the basis of a site visit and a review of systems and health surveillance results. Dr. Viswanathan made this comment based on his experience of a comprehensive epidemiological study of Environmental Hg and health effects as an expert toxicologist with the ITC Lucknow as well as his background as a technical expert with the WHO Task force on Environmental aspects of Mercury.
- In support of his observations he has also opined that the WHO ceiling limit of 139 $\mu g/m^3$ for manifestation of renal and neurological effects and average air levels of 80 $\mu g/m^3$ and urinary levels of 100 $\mu g/lit$ for CNS effects are also not observable in the unit.

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Doorkiesnummer
055 549 34 87

Datum
28 May 2001

Nummer
01/05/201

Uw brief

Onderwerp
A Review of the Occupational Health Surveillance of employees of the Kodaikanal Thermometer plant of Hindustan Lever Limited.

Geachte

Dear Sirs,

A comprehensive Occupational Health Surveillance of 255 employees [194 current and contract employees, 55 ex-employees and 6 scrap dealer employees] was conducted by Hindustan Lever Limited in March 2001. The health surveillance was based on a clinical protocol devised by the US Dept. of Mines to monitor health of workers exposed to mercury. This protocol was supplemented by biological monitoring to assess the levels of mercury in blood and urine as well as relevant blood tests to assess renal functions. The clinical examination laid special emphasis on evaluation of psychomotor, central nervous system and eyes and was conducted by a team of doctors, which included three independent doctors from Kodaikanal. The results of the clinical evaluation as well as biological monitoring do not reveal any abnormality in the health of the employees.

To validate the sampling techniques and analysis I had asked for certain additional sampling and analysis to be carried out. I have now seen the results of this validation exercise and am satisfied with the procedures in place for biological monitoring of mercury.

A repeat examination of current employees [130] has indicated that the levels of mercury in urine have further dropped down to a mean level of around 10 mcg/Lit [since the operation at the factory have been discontinued since the first week of March], as compared with the accepted upper limit of 100 mcg/lit as laid down by the WHO.

My conclusion on a thorough review of the clinical protocol, the clinical evaluation as well as the methodology and results of the biological monitoring is that there is no mercury related health risk to the employees. I have however recommended a follow up study of those employees who have shown 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 mcg/L.

Sincerely

drs. Tom van Teunenbroek

A Review of the Occupational Health Surveillance of employees at the Kodaikanal Thermometer plant of Hindustan Lever Limited – Final report.

Dear Sirs,

This report is in continuation of my earlier report dated 28th May 2001. Subsequent to the issuance of that report I had asked for additional analysis of the occupational health surveillance data pertaining to ex-employees at the Kodaikanal thermometer factory. These analysis pertain to segregation of data according to the departments / locations where the employees worked [viz. Hazardous vs Non-hazardous; the spreads in terms of group means and standard deviations [of biological monitoring results], individual spreads and study on outliers to determine if any of the employee (s) had any health risk arising out of exposure to mercury [chronic or acute].

I have now studied the additional statistical data and they do not show any abnormalities to indicate any health risk. The data have been compared with the WHO standards for group means as well as individual variations. I have also studied the distribution of the outliers [only 3 outliers in the entire working period of the ex-employees] and find no cause for health related concern. To summarize my observations are:

1.. Individuals with urine level of over 100 µg/lit. over a lifetime of their working in this unit were rare. They were dealt with in conformity to the WHO recommendations pertaining to dealing with individuals with urinary mercury values of > 100 µg/lit.

2. Group mean urinary levels for employees from both the hazardous and the non-hazardous areas in the plant were well below the WHO recommendation of 50 µg/lit., throughout their working period at the plant. The spread and range as measured by standard deviations also reveal no cause for further inquiries.

3. My professional expertise coupled with an extensive literature survey on epidemiological aspects and dose effect relationships vis-à-vis exposure to elementary mercury, substantiates my scientific opinion that there are no data which support the claim that the employees, who were exposed to mercury, have acquired ill-health on account of such exposures.

4. I have examined on site the methodology of biological monitoring. I have validated and therefore satisfied with the scientific manner in which urine samples have been collected and analyzed for mercury and the interpretation of results thereof.

5. In view of the comprehensive occupational health surveillance measures followed by Hindustan Lever Limited, and, no scientific epidemiological link between current symptoms and past exposures, any concern which the employees may have vis-à-vis their current health status /symptoms should be addressed by looking for other common causes of such symptoms.

My overall conclusion based on a thorough review of the occupational health surveillance measures *[biological monitoring, workplace environmental monitoring, shop floor health and safety practices and clinical evaluations]* as well as the analysis of group and individual loading over the years, based on a wealth of data due to monitoring at a frequency well above WHO standards, is that there has been no harmful exposure to mercury amongst the employees of the Kodaikanal factory leading to chronic or acute mercury poisoning.

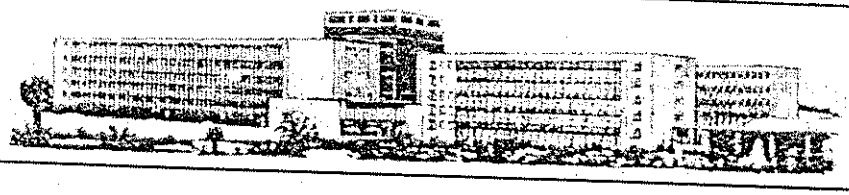
Tom van Teunenbroek

1 - october - 2003

ROTTERDAM.

समुदाय आयुर्विज्ञान केन्द्र
अखिल भारतीय आयुर्विज्ञान संस्थान
अंसारी नगर, नई दिल्ली – 110029, भारत

Centre for Community Medicine
All India Institute of Medical Sciences
ANSARI NAGAR, NEW DELHI - 110029, India



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Note for the Record

Comments on the Presentation by Dr. Rajgopal, Corporate Medical Advisor, Hindustan Lever Limited on the "Effectiveness of Occupational Health and safety measures in the Thermometer factory at Kodaikanal", Tamil Nadu for prevention of adverse health effects due to exposure to mercury .

Presentation made at Centre for Community Medicine and Clinical Epidemiology Unit at the All India Institute of Medical Sciences, New Delhi on Friday the 9th November 2001 at 4 p.m.

A| Members Present:

Dr. M G Karmarkar, Retd. Professor & Head, Department of Laboratory Medicine.
Dr. Anurag Shrivastav, Professor, Dept. of Surgery & Member Clinical Epidemiology Unit
Dr. C.S. Pandav, Additional Professor, Dept. of Centre for Community Medicine & Member Clinical Epidemiology Unit
Dr. R.M. Pandey, Associate Professor, Dept. of Biostatistics and Member Clinical Epidemiology Unit
Dr. K. Anand, Assistant Professor, CRHSP, Ballabgarh and Member Clinical Epidemiology Unit

B| Summary of The study:

Dr. Rajgopal presented the background information related to the environmental and health effects of mercury before proceeding to the details of the Kodaikanal study. He explained the procedures in place for assessment of both the exposure and the effect of mercury on the employees of the unit.

Monitoring air levels of Hg on frequent basis
2 Monitoring urinary levels of Hg on a monthly basis
3 Health Checkups on an annual basis including clinical and biochemical tests

He also elaborated the utility of biological monitoring as an important tool in environmental epidemiology to monitor occupational health of employees.

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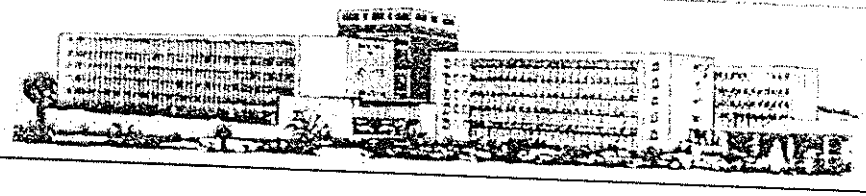

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The results of the biological monitoring were presented. These in brief are as follows:

1. Individuals with urine level over 100µg/L over a lifetime of their working in this unit were rare. In accordance with the existing practice they were given a rotation posting to a mercury free environment, whenever found. This was in conformity with WHO recommendations of dealing with individuals with urinary mercury values of > 100 µg/L.
2. Group Mean urine mercury levels were below 27 µg/L for all the years from 1988 except for the years 1991(31.9 µg/L) and 1996 (31.8 µg/L) [as compared with a WHO recommendation of group mean of 50 µg/L].
3. Data on annual clinical examinations of all employees carried regularly over a period of more than 12 years did not reveal anybody having clinical or biochemical manifestations attributable to mercury exposure .
4. Records of all individual biological and clinical monitoring are available at the unit for all these years.

C] Comments/ Suggestions:

1. To explore the possibility of neutralizing the mercury before it was released into the environment from the room.

2. To explore the possibility of exposure to mercury from other sources:
   - Thermal power plant emissions
   - Dental fillings
   - Sindoor/ vermillion among females

3. To carry out analysis of individual level data looking at their accumulated exposure over the years and correlating them with biochemical markers like Blood urea/ creatinine.

4. To carry out an exploratory analysis, to determine the effects of some individual characteristics e.g. Age, Gender, food habits on the urinary mercury levels given a similar amount of environmental exposure.

5. To compare the mercury levels in nearby population which is not exposed to mercury.

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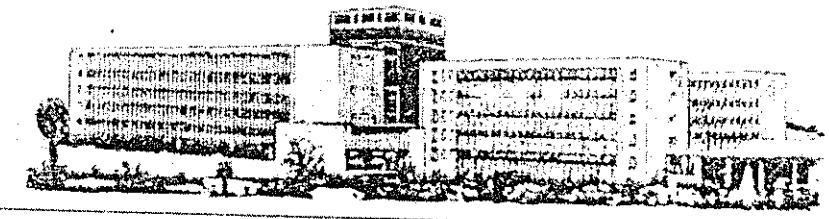

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6. In view of the systematic and scientific approach followed to address the occupational health issue of the employees, the group requested Dr. Rajgopal to prepare a report and explore the possibility of submitting the same for publication in international peer reviewed journals.

D| Conclusions:

The Occupational Health and Safety measures in place at the Kodaikanal Factory have succeeded in keeping the exposure of the factory employees to Hg to consistently acceptable low levels. In view of the comprehensive occupational health surveillance carried out over a period of more than 12 years, specially keeping in view the monthly biological monitoring of Hg in urine (as compared with the WHO recommended 6mthly to yearly evaluations) and detailed individual annual clinical and biochemical records of the employees and the recently (March 2001 and May 2001) carried out comprehensive Clinical-epidemiological and environmental study , there is no evidence to suggest any adverse health effects that can be attributed to mercury exposure.

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Expert committee's report on the occupational health surveillance and site visit.

The expert committee was presented the details of Risk Assessment' undertaken by HLL to evaluate the degree of environmental and occupational health effects resulting form mercury exposure on employees in the unit and also had a physical tour of the factory.. The committee was also explained on site the biological monitoring for mercury in urine. The committee then reviewed the comprehensive occupational health surveillance procedures in place and the results thereof. The key features of the occupational health surveillance and its results are

1. All employees with a urine level of more than 100 µg/l were rotated to a mercury free environment, and monitored closely to ensure that their levels came back to permissible limits. This was in conformity with a WHO [1986] recommendation of dealing with even asymptomatic individuals with Hg in urine levels > 100 µg/l. There were only a few Individuals having Hg urine level of >100 µg/l during their working life time.
2. Group mean levels for the years 1988 to 2001 were well below a WHO expert committee [1980] recommended level of 50 µg/l. For most years from 1988 they were below 27 µg/l except for the years 1991 (31.9 µg/l) and 1996 (31.8 µg/l).
3. The annual clinical evaluation of all employees from the year 1988 onwards also did not reveal any clinical or biochemical abnormalities which could be attributed to mercury exposure.
4. The unit maintains appropriate records for biological and clinical evaluations for individual employees as well as the entire group for the years 1988 onwards.

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IAOH Expert committee conclusions

The expert committee would like to compliment Hindustan Lever Limited for its comprehensive occupational health surveillance measures in place at Kodaikanal factory as well as its initiatives in significantly minimizing occupational exposure to mercury through its site occupational health and safety measures.

In India the permissible limit for mercury in the atmosphere is 0.05 mg/m^3. The unit has been doing regular environmental assessment of air borne concentrations of mercury in work environment in the plant to comply with these limits and has systems in place to ensure adequate safeguards in the event of deviation. Coupled with the periodical biological monitoring and annual clinical evaluations, the occupational health and safety measures instituted by Hindustan Lever Limited have succeeded in keeping the exposure of the factory employees to Hg to well within acceptable limits.

The committee has specifically reviewed on site, the methodology for biological monitoring of Hg in urine using a cold wave AAS and is satisfied with the calibration and quality control measures in place to ensure appropriate biological monitoring on a consistent basis. These results have also been recently validated by a comparison between results obtained through in house biological monitoring vis-à-vis running the samples externally on an Inductively Coupled Plasma Spectrometry [ICP].

Keeping in context the comprehensive occupational health surveillance conducted over the past 12 years viz

- The periodic biological monitoring at a frequency exceeding industry standards
- The detailed individual annual clinical evaluations including biochemical tests &
- The recently conducted comprehensive clinicoepidemiological study

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The IAOH expert group is of opinion that with the measures taken by HLL for protecting workers health and adequate safety measures in place, any adverse consequences of mercury exposure on workers' health are highly unlikely at the thermometer factory in Kodiakanal.

The expert group has been briefed on apprehensions of some of the ex-employees who feel that some of their current problems like gum trouble or skin related conditions have been due to past exposures to mercury. 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 evaluations, the expert group believes that the health complaints like gum and skin involvement attributed to mercury 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 & gum morbidity.

Signed this report on 10th January 2002.

Dr G K. Kulkarni

Dr S M. Shanbhag

Dr G G Davay

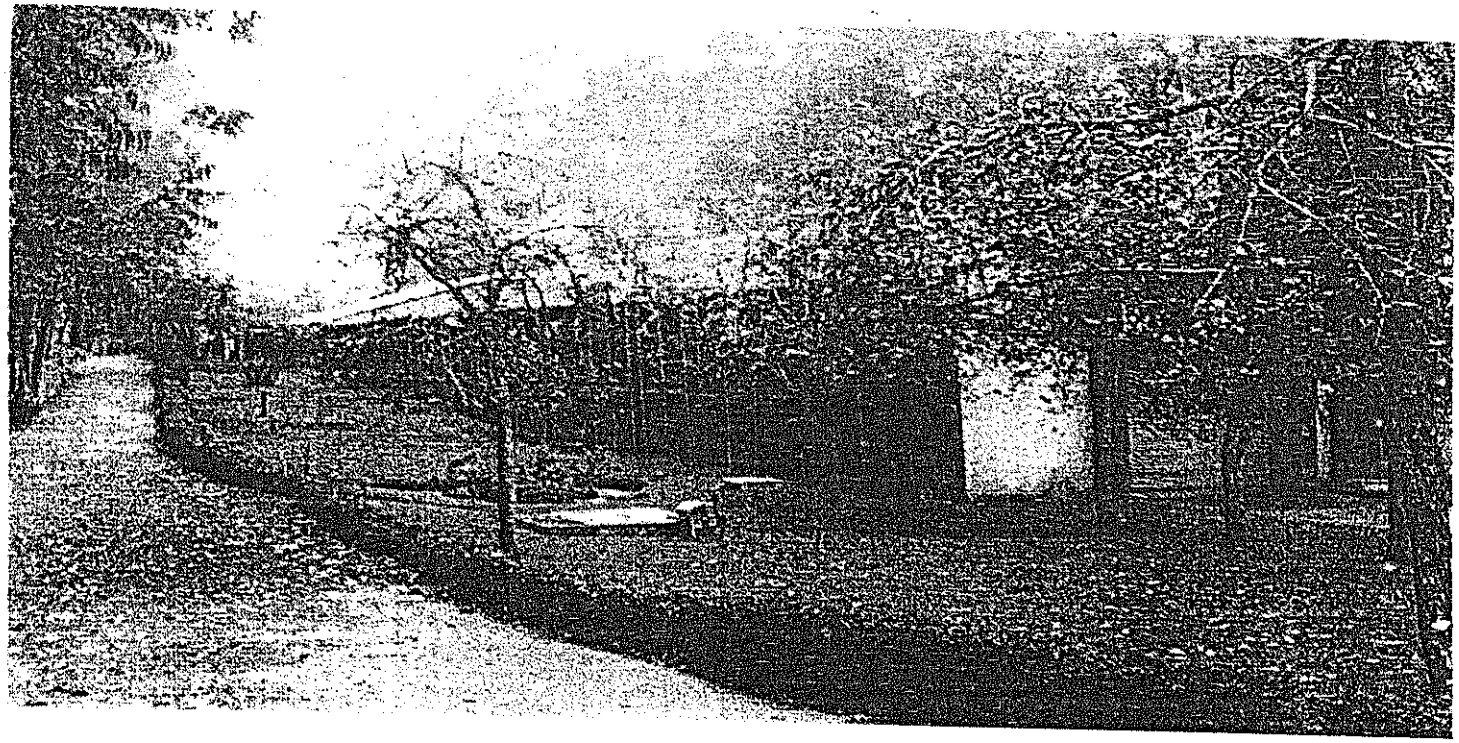
Dr T. K Joshi

Dr. S. R Keshavamurthy

148

ITRC review of occupational health at the Kodaikanal factory

Key findings



The Supreme Court Monitoring committee specifically directed the TPPCB to request ITRC for evaluating the health aspects in the erstwhile Kodaikanal plant.

The ITRC conducted the evaluation in two stages.

In the first stage the Director of the ITRC visited Kodiakanal, reviewed all records and recommended:

- *"While prima facie the occupational health and safety measures in place do seem to have provided adequate protection against health problem, I would recommend that an epidemiologist from ITRC make a visit to Kodai to review the health records/exposure data on site since they would be useful to making an inference with respect to cause-effect relationship between past exposures and health problems. The details of any further studies (if needed) can be assessed after the evaluation by the ITRC scientists."*

ITRC findings

- Workplace occupational health and safety measures to prevent adverse health effects arising due to exposure to Hg at the workplace were adequate
- From an epidemiological perspective the group means of HgU are within internationally accepted norms of WHO (1980)
- The individual exposure levels also do not suggest any Hg induced health effects (mercury toxicity)
- The health issues as encountered by the employees are non-specific in nature and bear no correlation with their exposure to Hg at the workplace
- No scientific evidence linking mortality and past exposure to Hg at this plant.
- Record of environmental exposure levels in this unit has been consistently within acceptable limits

ITRC conclusions on the occupational health aspects

To determine cause effect relationship in occupational diseases a systematic analysis of published data on the basis of extensive literature survey coupled with epidemiological evidence (environmental monitoring, biological monitoring data), clinical evidence and a correlation of such data in conjunction with scientific knowledge or dose response relationship is essential. Based on this scientific principle we have evaluated the health records and other data as indicated on site ***and no evidence indicating any adverse health impact which can be correlated to past exposure to mercury in this unit."*** (I*TRC report* dated 11. 06. 2006 (approached at the instance of the Supreme Court Monitoring committee directive) – page 4 of the report pages 1- 22 / Vol. V)"

Commenting on the need for any fresh health study the ITRC specifically mentions that any fresh health study may not be fruitful for the following reasons:

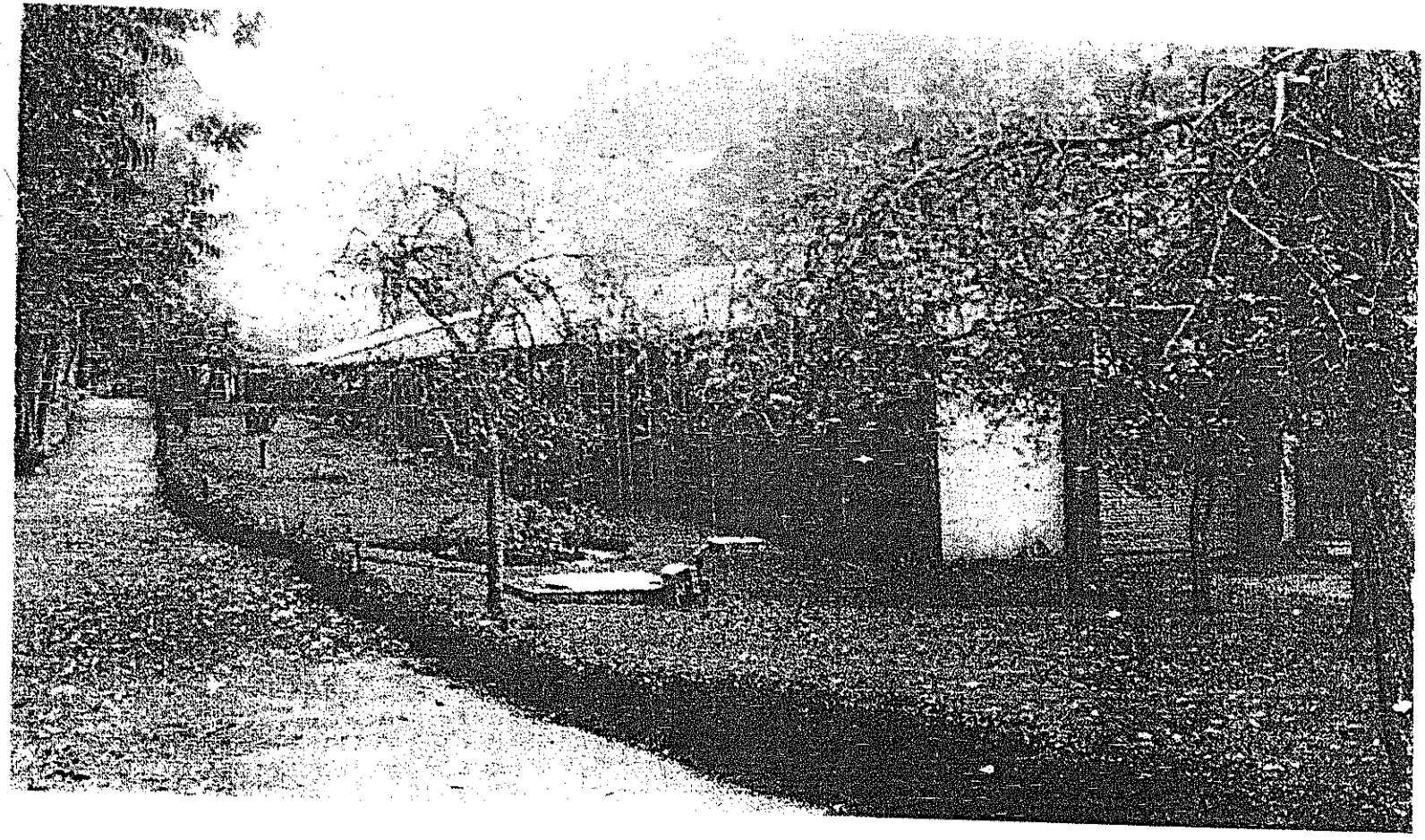
- The factory was closed in March 2001. A review in May 2001 of the body burden of mercury in the employees 2 months after the closure showed a mean mercury in urine of 10.1 micrograms/L which is well below acceptable limits.

- Mercury has a half life in the body of 60 days [ATSDR, Toxicological profile of Mercury, US Dept. of health and human services, March 199, page 187]. The exit yearly mean values of employees in the HLL plant (Table 7) were within acceptable limits. After a gap of five years of closure of factory it is scientifically inconceivable that the ex-employees will have any effects arising out of past exposure.

- There is no scientific evidence of delayed exposure to Hg after a long latency period especially if the exposure levels during the working life of an employee have been within acceptable limits. No evidence of the ex-employees having high exposure to Hg has been found. (page 4 & 5 of the report / Vol. V)

125

AIIMS scientific opinion on other allegations of ill-health



Other allegations –women with children with malformations - and scientific response

Lakshmi Murugesan Still born child 3 miscarriages followed by normal male child	Worked in factory only between Jan to August 1997. Worked in digital – non mercury area. Still born child born in April 1996 – before joining factory.
Gyanasundari Jayaprakash Two children with club foot	Temporary worker in packing department – 14 months. Got married after leaving the factory
Ruthpriya Dayalan Twins – one of them has ulceration on tongue	Worked in digital department for 20 months and gave birth to twins after leaving the job. Married her mother's cousin – consanguineous marriage.

AIIMS view on the above: Metallic mercury is not a mutagen and has not been reported to cause still births – IPCS CICAD 50, WHO 2003

On the issue of a report on another female worker with psychiatric problems Ms. Ruby – she worked only for two months and got admitted for her psychiatric complaints 7 years after leaving the job. **AIIMS holds the complaint scientifically untenable.**

Dr. Gaitonde's evaluation and AIIMS expert comments

Dr. Gatonde's comments	AIIMS opinion
•Blood and urine levels of mercury are useful only to measure acute effects	➢This is scientifically inaccurate – urine levels are gold standard for evaluating chronic exposures (section 7.5 – CICAD 50 – WHO 2003)
•Mercury is stored for long periods in the brain and kidneys	➢Scientifically misleading – Half life of Hg in brain is 20 days and kidneys is 60 days. ATSDR Table 2.4 page 187.
•Neurological symptoms have an onset only 3 to 5 years after leaving the factory	➢Mercury has a half life of 60 days.and any symptoms arising after 3-5 years of leaving the job cannot be attributed to Hg. Exposure**
•Minimum risk level table provided	➢The levels provided are misleading – Dr. Gaitonde provides levels for 24hrs exposure / 7 days a week – whereas we are concerned with occupational health exposures

NIOH opinion – No case of delayed onset of mercury poisoning reported in literature.

National and International professional reviews

1. Dr. P. N. Viswanathan's report – page 362 -9 / Vol.II
2. Dr. Tom Van Teunenbroek's reports of May 2001 and October 2001 (approached at the specific instance of NGOs and pursuant to TNPCB directive): page 423-426/ Vol. II
3. Govt. of Tamil Nadu Certifying Surgeon's report dated 25.08.2001: pages 478-480 / Vol. II
4. Report of the All India Institute of Medical Sciences dated 9.11.2001:pages 513-515/Vol.II
5. Report of the Indian Association of Occupational Health dated 10.1.2002: pages 526-531/Vol.II
6. Peer reviewed scientific article in the Indian Journal of Occupational and Environmental Medicine: Jan-Apr 2006 – pages 384 – 416 / Vol. II
7. ITRC report dated 11th May 2006 (approached by TNPCB at the specific instance of the SCMC directive): pages 1-22 Vol. V.

National and International reviews and endorsements Additional reports

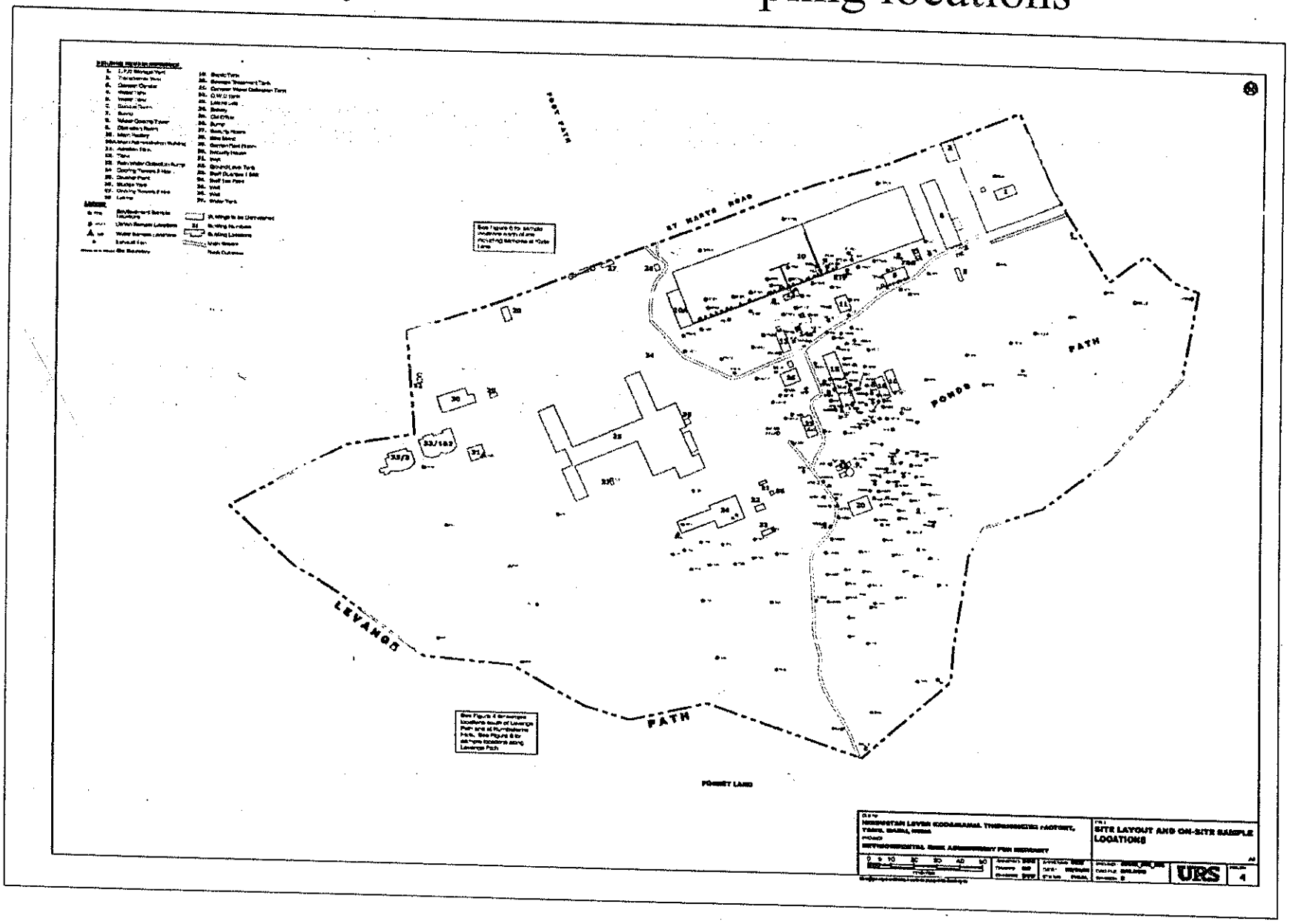
1. Report of the National Institute of Occupational Health dated 11.9.2006 pages 23 – 25 / Vol V
2. All India Institute of Medical Sciences report dated 3.10.2006 pages 27-29 / Vol. V
3. Dr. Robert Winker's report dated 11.9. 2006 pages 45 – 55/ Vol. V
4. Report of Dr. S.K. Rastogi on behalf of ITRC dated 12.11.2006 pages 4-27/ Vol VII
5. Report from the All India Institute of Medical Sciences dated 23.11.2006: pages 37 – 66 / Vol> VI

In addition ex-employees have signed a bipartite agreement at time of closure of factory clearly mentioning that they had no specific health issues. Pages 516-525 / Vol. II

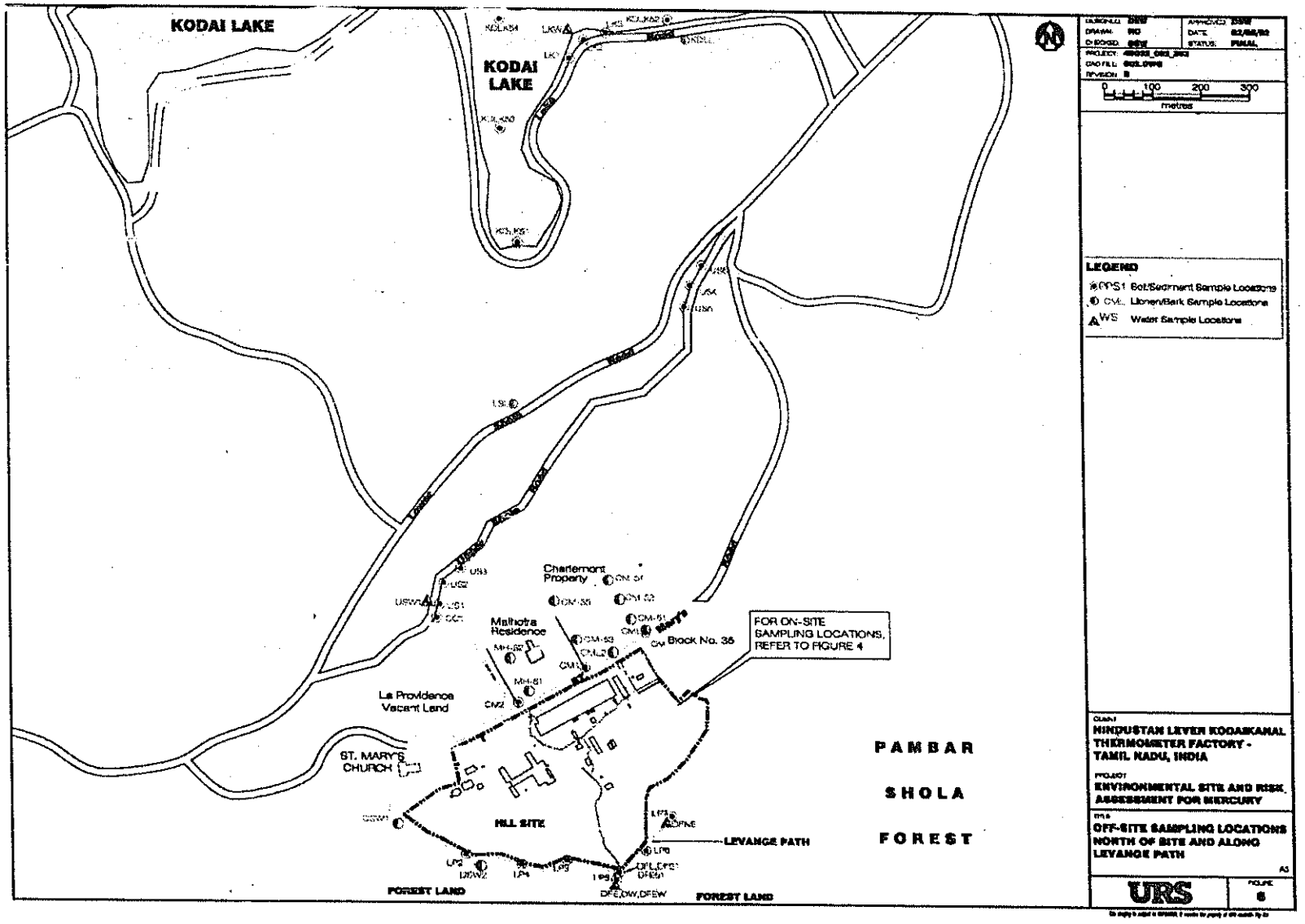
Environmental Impact Assessment

- Analysis of mercury in soil, lichen, bark (done in Australia)
- Analysis of Hg in fish and sediments (USEPA method- done in Australia)
- Analysis of methyl mercury (Conducted at Sydney & Netherlands)

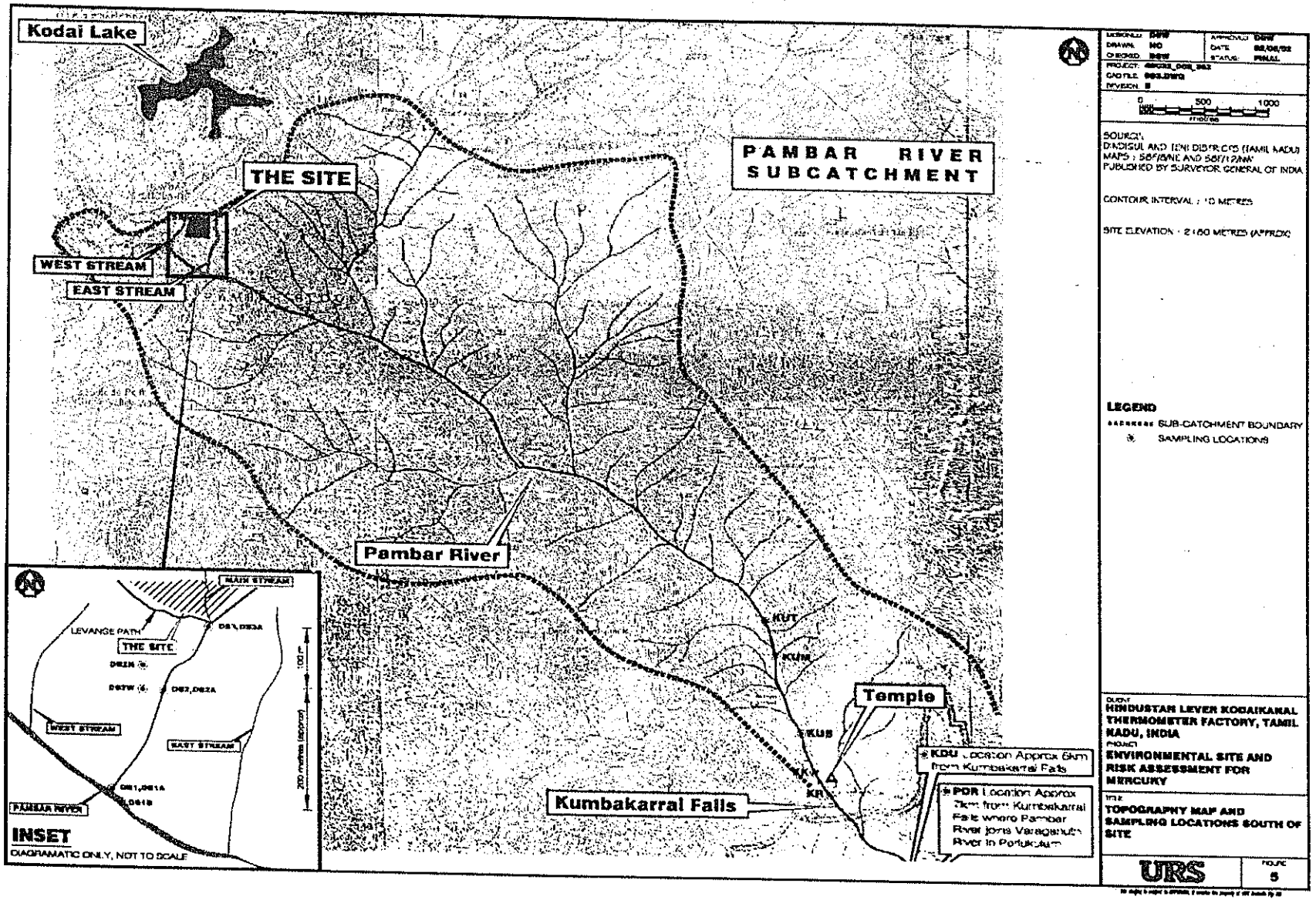
Site layout and onsite sampling locations



Off-site sampling locations north of site



Topography and sampling locations south of site



Assessing environmental impact

Sample taken from	On-site	Off-site
Lichen	7	21
Bark	7	25
Soil	346	18
Sediment	2	22
Water	5	16
Fish	-	4

Results of Environmental impact assessment

- Elevated Hg levels in Lichen and bark to the north and south of the site. Levels between 2.2 - 9 mg /Kg. Reduces to < 0.2 mg/kg on the banks of the lake
- Methyl mercury levels well below levels of concern (USEPA Guideline levels)
- Fish samples 0.04 mg/Kg and sediment samples 0.07 - 0.2 mg/kg. [WHO standards for freshwater fish: Hg 0.1 - 0.2 mg/kg.] (ref:Narvez 2002). Sediment levels also of no concern and methylmercury undetectable.

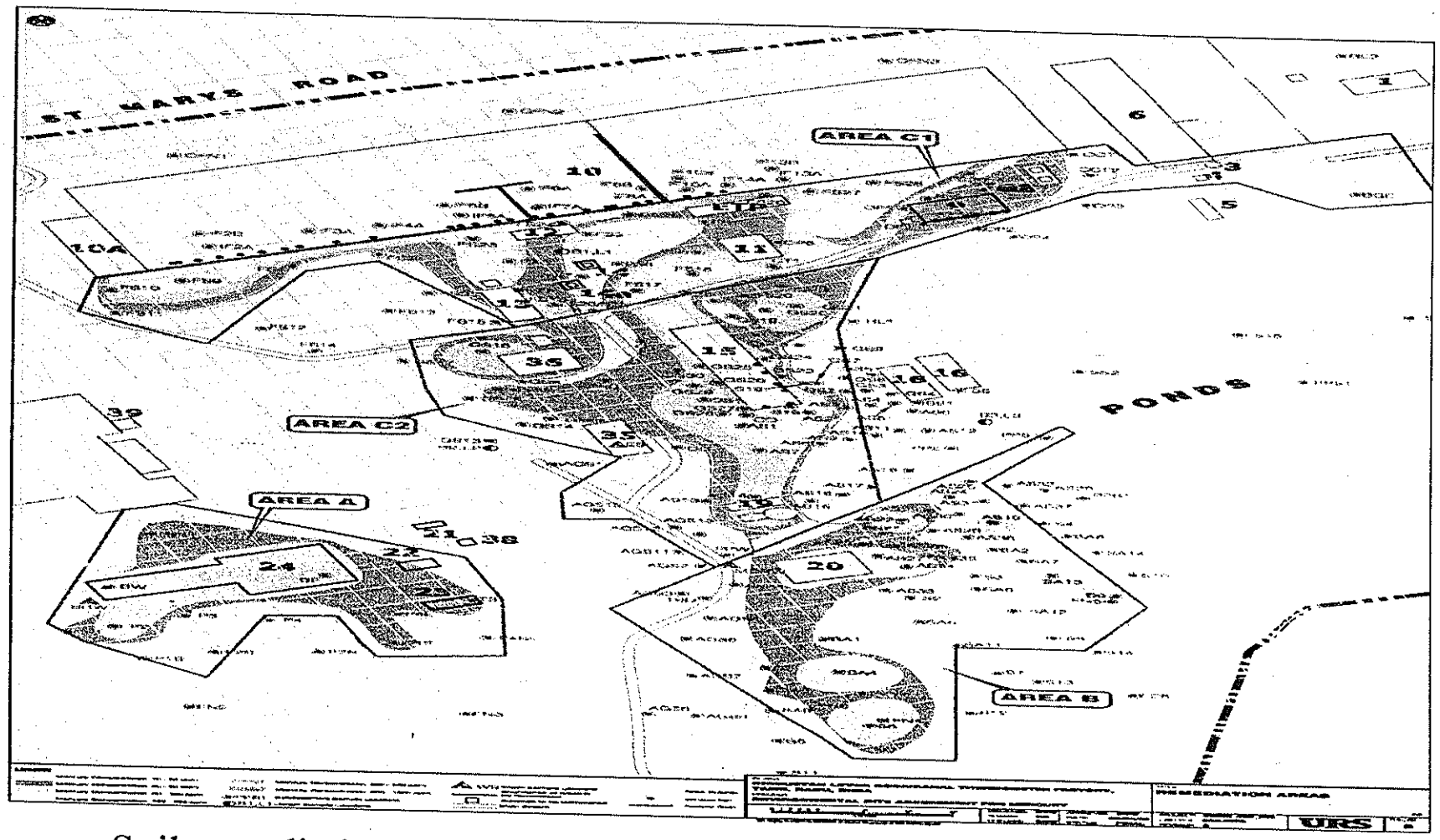
Analysis of fish and sediment samples

(values in mg/kg)

Fish samples				Sediment samples			
Sample 1	Sample 2	Sample 3	Sample 4	A	B	C	D
0.04	0.04	0.04	0.04	0.07 - 0.08	0.05 – 0.10	0.13	0.18 – 0.20

[WHO standards for freshwater fish: Hg 0.1 - 0.2 mg/kg.]

On-site remediation areas



•Soil remediation to be done within the factory premises. NEERI providing overall guidance for remediation Environmental sampling reveal no contamination of significance off-site

Table 2.1. Major features of various study designs in environmental epidemiology

Study design	Population	Exposure	Health effect	Confounders are:	Problems	Advantages
Descriptive study	Various sub-populations	Records of past measurements	Mortality and morbidity statistics, case registries, etc.	Difficult to sort out	Hard to establish cause-result and exposure-effect relationships	Cheap, useful to formulate hypothesis
Cross-sectional study	Community or special groups; exposed vs. non-exposed groups	Current	Current	Usually easy to measure	Hard to establish cause-relationship; current exposure may be irrelevant to current disease	Can be done quickly; can use large populations; can estimate extent of problem (prevalence)
Prospective study	Community or special groups; exposed vs. non-exposed groups	Defined at outset of study (can change during course of study)	To be determined during course of study	Usually easy to measure	Expensive and time consuming; exposure categories can change; high dropout rate	Can estimate incidence and relative risk; can study many diseases; can infer cause-result relationship
Retrospective cohort study	Special groups such as occupational groups, patients, and insured persons	Occurred in past - need records of past measurements	Occurred in past - need records of past diagnosis and measurements	Often difficult to measure because of retrospective nature (e.g., past smoking habits)	Changes in exposure/effect over time of study; need to rely on records that may not be accurate enough	Less expensive and quicker than cohort prospective study giving similar response, if sufficient past records are available

Table 2.1. (contd).

Study design	Population	Exposure	Health effect	Confounders are:	Problems	Advantages
Time-series study	Large community with several million people; susceptible groups such as asthmatics	Current, e.g., daily changes in exposure	Current, e.g., daily variations in mortality	Often difficult to sort out, e.g., effects of influenza	Many confounding factors, often difficult to measure	Useful for studies on acute effects
Case-control study	Usually small groups; diseased (cases) vs. non-diseased (controls)	Occurred in past and determined by records or interview	Known at start of study	Possible to eliminate by matching for them	Difficult to generalize due to small study group; some incorporated biases	Relatively cheap and quick; useful for studying rare diseases
Experimental (intervention) study	Community or special groups	Controlled/known	To be measured during course of study	Can be measured; can be controlled by randomization of subjects	Expensive; ethical consideration; study subjects' compliance required; drop-outs	Well accepted results; strong evidence for causality
Monitoring and surveillance	Community or special groups	Current	Current	Difficult to sort out	Difficult to relate exposure data with effects	Cheap when using existing monitoring and surveillance data

Annexure - 3

Note from the Chairman of the committee to the Honorable High Court seeking extension in submitting its final report

(150)

To,
The Honourable Mr. A. P. Shah, Chief Justice and
The Honourable Justice Mr .K. Chandru.

Your Honours,

This has reference to your order dated 29.06.2007 in the writ petition no. 8291 of 2006.

1. In compliance with your orders, an expert committee has been constituted with the following members

Dr. A .K .Srivastava ITRC, Lucknow - Chairman
Dr. S. K. Dave, NIOH, Anmedabad - Member
Dr. K. Anand, AIIMS, Delhi - Member
Dr. Neeraj Gupta, MAMC, New Delhi - Member
Dr. Jayaprakash Muliyil, CMC, Vellore - Member

The names of all the nominees from these institutes were received by us on August 3, 2007.

2. The committee had sought from the petitioners a list of employees and their relatives claiming to be affected by exposure in the erstwhile plant at Kodaikanal and the ailments suffered by them. A list of 279 subjects was made available to us by the petitioners on September 17, 2007.

2. The committee had also sought from the respondents a detail of the proceedings in the court and the safety/ health measures etc in the erstwhile plant at Kodaikanal. This was made available to us during the meeting of the expert committee on Aug 24, 2007 in New Delhi through a power point presentation.

4. The list of 279 subjects claiming to be suffering from exposure in the said plant is being examined by the committee members. Additional details may have to be provided by the petitioners.

5. The committee expects to visit Kodaikanal in the first week of October and review all material, provide opportunity to either party to present their respective cases as well as decide on the future course of action for the purpose of submitting its report to the Hon'ble high court.

6. The matter is complex and additional inputs are required for reaching at a valid conclusion for finalizing the report. Further, the logistics of the committee meetings and consultations because of the fact that members are located in far away cities, is also time consuming.

~~170~~
171

In view of the above facts, I on behalf of the committee seek your Lordship's permission to grant this committee an extension for a period of eight (8) weeks. We hope to be able to submit our report by November end.

Yours sincerely,

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Annexure - 4

Presentation made by Dr. Rakhal Gaitonde on behalf of the petitioners to the committee members

173

A review of the evidence of adverse effects due to occupational exposure to mercury

Dr. Rakhal Gaitonde, M D (Community Medicine)
Community Health Cell
Chennai Project Team

STRUCTURE OF THE PRESENTATION

- *Pointers to the presence of adverse effects due to occupational exposure to mercury in the context of the HLL thermometer factory.*
- *Toxicokinetics and metabolism – evidence for long term persistence.*
- *Measuring body burden of Mercury.*
- *Examinations of workers.*
- *What does the literature say?*
- *Damage not limited to the individuals working in the factory.*
- *Challenges before the committee.*

178

POINTERS TO THE PRESENCE OF ADVERSE IMPACT

- Mercury is a known hazardous metal.
- The process of production of thermometers known to be hazardous to workers.
- Anecdotal evidence of neglect of safety protocols in the factory.
- Incomplete / inadequate bio-monitoring.
- Extensive presence of mercury in the environment.
- Improper disposal of mercury.

Mercury

- Hg occurs naturally, and the absolute amount on the planet does not change. Its chemical form and location do, however, change quite readily.
- Of all the metals that have been studied, Hg is the only one that bio-magnifies through the food web.
- No known use in the human body.
- Converted to different forms in the environment by soil bacteria.
- Well documented to cause extensive acute and chronic symptoms.

Environmental Toxicology. Cambridge Environmental Series. 2002

Thermometer factories n the literature

- Static tremor, abnormal Romberg test, dysdiadochokinesia, and difficulty with heel-to-toe gait were more prevalent among thermometer workers than control workers.
- Neurasthenic symptoms were found in 51.75% of the subjects, emotional changes in 27.27%, tremors in 11.19%, and inflammations in 21.68%.
- Headache, irritability-hair loss, and wrist and ankle pain were the most frequently occurring symptoms

- Am Ind Med. 1991;19(4):493-507.
- International Journal of Occupational Medicine and Environmental Health 2005;18(3):193 – 201
- Scand J Work Environ Health. 1982;8 Suppl 1:161-6.

Incomplete / Inadequate Bio-monitoring

- Only permanent workers were tested.
- Numerous trainees, contract workers, women not monitored.
- 24 hr urine sample ideal.
- Early morning specimen (first specimen) acceptable.
- Not to use glass bottles.
- To be reported as mg/gm of Creatinine (to control for concentration of urine).

- BRAIN INJURY, 2000, VOL. 14, NO. 9, 797- 814
- German Federal Environmental Agency. Gesundheitsschutz 42 (5), (1999), 522-532

Presence of mercury in the environment in Kodaikanal

- Greenpeace study.
- DAE study 1.
- DAE study 2.
- Dames and Moore.

Improper disposal of waste

- 7.4 tonnes to scrap dealer in Moonjikal, a densely populated area of Kodaikanal.
- Ordered by the TNPCB to clean up and ship mercury waste back to the USA.
- Shipped in April – May 2001.
- Factory closed down by TNPCB in 2001.

- http://findarticles.com/p/articles/mi_qa4158/is_200103114/ai_n14377879
- http://www.mindfully.org/Industry/Unilever-Mercury-India.htm
- http://www.indiaresource.org/news/2001/4025.html
- http://www.ens-newswire.com/ens/mar2003/2003-03-31-02.asp
- http://www.thehindujobs.com/thehindu/2003/06/13/stories/2003061302621300.htm
- http://www.senoe.info/reports/tamilnadu/senoetamilnadu.htm
- Proceeding no.HWM/27566/D1/DGL/Mercury(Vol.18)-2/Dt. 14.12.04

TOXICOKINETICS / METABOLISM

- *Some Hg crosses the blood-brain and blood nerve barriers and is oxidised to Hg2+ in nervous tissue. Ionic mercury is much less likely to traverse the blood brain barrier as it binds to -SH containing ligands, and becomes trapped in the nervous tissue. This results in accumulation of mercury in the brain.*
- *The whole body elimination half-time is found to be about 60 days, whereas the brain elimination half-time is thought to be much longer at several years.*

- *European Journal of Neurology. 1999;6(571 – 577).*
- *Toxicological Profile of Mercury: Agency for Toxic Substances and Diseases Registry; 1999*
- *Clin Neuropath 15: 139-144 (1996)*
- *Zonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi. 2006; 24(7): 403-5*

TOXICOKINETICS / METABOLISM Contd.

- *Studies in Japan and Germany demonstrated mercury in the brains of former workers 10 and 17 years after exposure stopped.*
- *In a study CSF-Hg persisted at high levels despite Blood and Urine Hg levels dropping to normal in cases of toxicity suggesting that Hg forms a complex in the CNS that is trapped.*

- *European Journal of Neurology. 1999;6(571 – 577).*
- *Toxicological Profile of Mercury: Agency for Toxic Substances and Diseases Registry; 1999*
- *Clin Neuropath 15: 139-144 (1996)*
- *Zonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi. 2006; 24(7): 403-5*

MEASURING THE BODY BURDEN OF MERCURY

- Group mean levels have no meaning when assessing individual risk.
- ATSDR report notes that
  - *prolonged motor and sensory nerve latency was also associated with urine mercury levels ranging from 20 to 450 µg/L. increased tremor frequency, increased reaction time, and reduced eye-hand coordination were observed as urinary mercury levels increased from 5 to 1,100 µg/L in 77 exposed individuals.*
  - *tremors have also been reported in 567 workers from chloralkali production facilities whose blood mercury levels ranged from <1 to >10 µg/100 ml and whose urine mercury levels ranged from <10 to >1,000 µg/L.*

- *U.S. Department of Health and Human Services. Toxicological Profile of Mercury: Agency for Toxic Substances and Diseases Registry; 1999*

MEASURING THE BODY BURDEN OF MERCURY

- *U-Hg excreted spontaneously and U-Hg excreted after DMPS, are relatively independent pieces of information.*
- *U-Hg excreted spontaneously represents a recent exposure to mercury, whereas U-Hg excreted after mobilization reflects mercury deposited in the body at a previous date.*
- *The U-Hg excreted after administration of a chelating agent might better reflect the amount of Hg deposited behind the blood-brain barrier, and might correlate more closely with electrophysiological changes.*
- *The excretion of porphyrins is another marker described in the literature – however this defect may be reversible over years.*

- *European Journal of Neurology. 1999;6(571 – 577)*
- *American Journal of Industrial Medicine. 2001;39:1-18*

EXAMINATIONS OF WORKERS

- Study by Company – ITRC report.
- Indian Peoples Tribunal
- Dr. Mohan Isaac & Dr. Praveen (Prof. Of Psychiatry, NIMHANS; Researcher, Community Health Cell)
- Dr. Gita Arjun (Obstetrician, EVKalyani Medical Center, Chennai)
- Dr. Rakhal Gaitonde (Research and Training Associate, Community Health Cell, Chennai Project Team)

COMPANY STUDY

- 134 current permanent employees and 64 contract workers – in response to a news paper advertisement.
- Retrospective analysis of 290 permanent workers in the factory – all records available to factory analysed.
- 52 / 185 permanent employees vs. 4 / 70 'others' complained of neurasthenic symptoms / memory loss etc.
- No coordination / sensori neural.
- No relation to urinary level – 83 individuals with CNS symptoms in the <20 & 21-30 µg/L, and 2 in the 31 – 50 µg/L and 3 in the >50µg/L.

Indian Journal of Occupational and Environmental Medicine. 2006 Vol 10;1: 11-18

~~176~~
180

The Indian People's Tribunal on Environment and Human Rights

- September 2, June 2003
- **Chair Person:** Justice S.N. Bhargava
  (Retired Chief Justice, Sikkim high Court and Current Chairperson, State Human Rights Commission, Manipur).
- A total of 160 ex-workers of the former thermometer factory.

- Oral Testimonies given by workers on common symptoms:
- Dental/ gum problems = 100
- Head aches = 100
- Memory loss = 83
- Vision = 78
- Spinal Problems = 111
- Stomatitis/ ulcers = 76
- Nasal bleeding = 13
- Skin diseases = 45

Dr. Mohan Isaac and Dr. Praveen

- 22nd July 2001
- Total subjects examined 30 (M=25; F=5)

- Gum & teeth problems (such as bleeding gums, inflammation of gums shaking and falling of teeth) = 9
- Skin problems (especially in the lower and upper extremities) = 5
- Non-specific functional (? Psychiatric) symptoms = 9
- Infertility problems = 2
- Renal problems = 2
- Gastrointestinal tract disorders = 3
- Recurrent depression = 1
- White discharge p/v (non-organic) = 1

- *Of the 30 subjects examined 12 persons had resigned from their job after varying periods of work in the Ponds factory and all of them attributed their resignations to health factors*

Dr. Gita Arjun

- Examined three women with multiple abortions and children with congenital abnormalities.
- *"Having gone through the histories of these three women, it seemed significant that all the three have had children with limb deformities. Since there is evidence in the medical literature that exposure to mercury has been implicated in recurrent pregnancy loss and birth defect, it seems prudent to thoroughly investigate workers who have been exposed. Paternal exposure has also been implicated in miscarriages and birth defects".*

Dr. Rakhal Gaitonde

- 18 former workers evaluated.
  - 8/18 workers complained of past history of worsening ability to work, increasing tiredness, forgetfulness, episodes of acute unconsciousness during their terms in the factory.
  - 11/18 had dysdiadochokinesis and tremor on evaluation.
  - 10/18 complained about anger / memory loss / emotional lability (higher functions abnormalities)
  - 10/18 complained of problems with their teeth and gums.

WHAT DOES THE LITERATURE SAY?

- *The health effects of mercury depend on the chemical form of mercury, the duration, the magnitude of exposure, the individual characteristics etc.*
- *The major target organs of metallic mercury induced toxicity are the kidneys and the central nervous system. At high exposure levels, respiratory, cardiovascular, and gastrointestinal effects also occur.*

- *U. S. Department of Health and Human Services. Toxicological Profile of Mercury: Agency for Toxic Substances and Diseases Registry; 1999.*

NEUROLOGICAL EFFECTS

- *The central nervous system is probably the most sensitive target for elemental mercury vapour exposure. Similar effects are seen after all durations of exposure; however, the symptoms may intensify and / or become irreversible as exposure duration and / or concentration increase. A wide variety of cognitive, personality, sensory, and motor disturbances have been reported.*

- *International Program on Chemical Safety. Elemental Mercury and Inorganic Mercury Compounds: Human health aspects. Geneva: World Health Organization; 2003.*
- *European Journal of Neurology; 1999;6(571 – 577).*

NEUROLOGICAL EFFECTS contd.

- *At present, occupational exposure to mercury mostly is of low-level, long-term character and results in a so-called 'micromercurialism'. This manifests with non-specific neurasthenic symptoms, dominated by irritability, anxiety, insomnia and lack of self-control. Results of objective neurological examinations are mostly unremarkable or negative. Only highly sensitive methods such as neurobehavioral and elecrophysiogical examinations, are capable of giving an objective correlate to non-specific subjective complaints.*

- *European Journal of Neurology. 1999;6(571 - 57')*

NEUROLOGICAL EFFECTS contd.

- *In a meta-analysis that analysed the results of 1,106 exposed and 1,105 control subjects (from 18 studies) the authors concluded that the influence of mercury on psychological functions was different and that results on motor performance compared with memory and attention revealed the greatest impairment in mercury-exposed workers.*
- *The neuropsychological performances of the former workers suggest that occupational exposure to elemental mercury has long-term effects on information processing and psychomotor function, with increased depression and anxiety also possibly reflecting the psychosocial context.*

- *Archives of Toxicology. 2004;78:207 - 11.*
- *Braz J Med Biol Res, March 2007, Volume 40(3) 425-433*

NEUROLOGICAL EFFECTS contd.

The neuropsychological and neurobehavioral battery included
- tests of attention, short term memory, and mental control (WMS Digit Span subtest),
- inhibitory control (Stroop Interference Test),
- Verbal memory (Buschke Selective Reminding Test, SRT),
- Visual memory (WMS Visual Reproduction subtest),
- Manual dexterity (Grooved Pegboard; Lafayette Instrument),
- Verbal fluency (FAS),
- Visuomotor ability (WAIS-R Block Design subtest),
- Executive function (Wisconsin Card Sorting Test), and
- Verbal knowledge (WAIS-R Vocabulary subtest).

Other tests that showed significant results in chronically and remotely exposed individuals
- Beck Depression Inventory (BDI) and the
- State-Trait Anxiety Inventory

RENAL EFFECTS

- *All mercury compounds may ultimately be oxidised to divalent (or mercuric) mercury, which preferentially deposits in the kidneys, and all mercury compounds may cause some degree of renal toxicity.*
- *Studies have indicated that occupational exposure to elemental mercury causes increased urinary excretion of several proteins, such as β-galactosidase, N-acetyl-β-glucosaminidase (NAG), transferrin, β2-microglobulin, or even albumin.*
- *The main renal changes associated with exposure to mercury were indicative of tubular cytotoxicity and biochemical alterations.*

U. S. Department of Health and Human Services. Toxicological Profile of Mercury: Agency for Toxic Substances and Diseases Registry; 1999.

International Program on Chemical Safety. Elemental Mercury and Inorganic Mercury Compounds: Human health aspects. Geneva: World Health Organization; 2003.

EFFECTS THAT ARE EMERGING

- Neurobehavioral effects on children – especially Autism and Autism Spectrum Disorders.
- Triggering of plaque formation in endothelium and thus a link with cardiovascular disease.

CIRCULATION OF MERCURY IN THE ENVIRONMENT

- Carried home by worker.
- Run of from the factory.
- Mercury in the air.
- Mercury waste.

REVERSIBILITY / PERSISTENCE

- Most problems related to gums / gingivitis, some renal effects appear to be reversible.
- While there is evidence that neurological effects persist there is some disagreement on which. Most studies reviewed clearly documented residual neurological effects up to 30 years after cessation of exposure.
- Evidence for persistence of neuro-psychological, neuro-cognitive tests and motor functions.

- *Archives of Toxicology. 2004;78:207 – 11.*
- *Braz J Med Biol Res, March 2007, Volume 40(3) 425-433*
- *American Journal of Industrial Medicine. 2001;39:1-18.*
- *Annals of Neurology. 1988;24:651 – 9.*
- *Brain Injury. 2000;14(9):797 - 814.*

LATENCY / TIME COURSE

- Onset of symptoms delayed as much as 30 years.
- ***Neurological symptoms may continue to intensify even months after cessation of exposure.***
- ***Age may unmask subtle mercury-induced neurotoxicity.***
- ***Years since first exposure helped predict some neurotoxic outcomes, such as visual evoked response, consistent with age-related "unmasking" of mercury toxicity.***
- ***Neurologic effects were associated more with cumulative exposure that with current exposure, suggesting that some aspects of mercury neurotoxicity only emerge with age.***

- *U. S. Department of Health and Human Services. Toxicological Profile of Mercury: Agency for Toxic Substances and Diseases Registry; 1999.*
- *American Journal of Industrial Medicine. 2001;39:1-18.*
- *Annals of Neurology. 1988;24:651 - 9.*

CONVERSION / PERSISTENCE

- Mercury is easily converted into other forms – most commonly methylmercury by bacteria in the soil and water.
- Mercury is lodged for long on porous surfaces (example walls and uneven floors) and is quite resistant to routine cleaning measures.

CHALLENGES BEFORE THE COMMITTEE

- Knowing that these symptoms can be caused by mercury, and that these individuals (and citizens of Kodaikanal) have been exposed can we *rule out mercury as a cause!*
- Choosing appropriate tests for Neurobehavioral, Neurocognitive and Neuropsychological effects in addition to the standard motor and sensory tests.

CHALLENGES BEFORE THE COMMITTEE

- Assess complexity introduced by conversion of elemental mercury to inorganic mercury in the body as well as conversion of elemental mercury into methylmercury in the soil and the probable effects.
- Defining the exposed population – workers, family, households near the factory, residents of Kodaikanal

Thank you

Presentation to the High Court appointed Committee to look into Health problems of HLL ex-workers

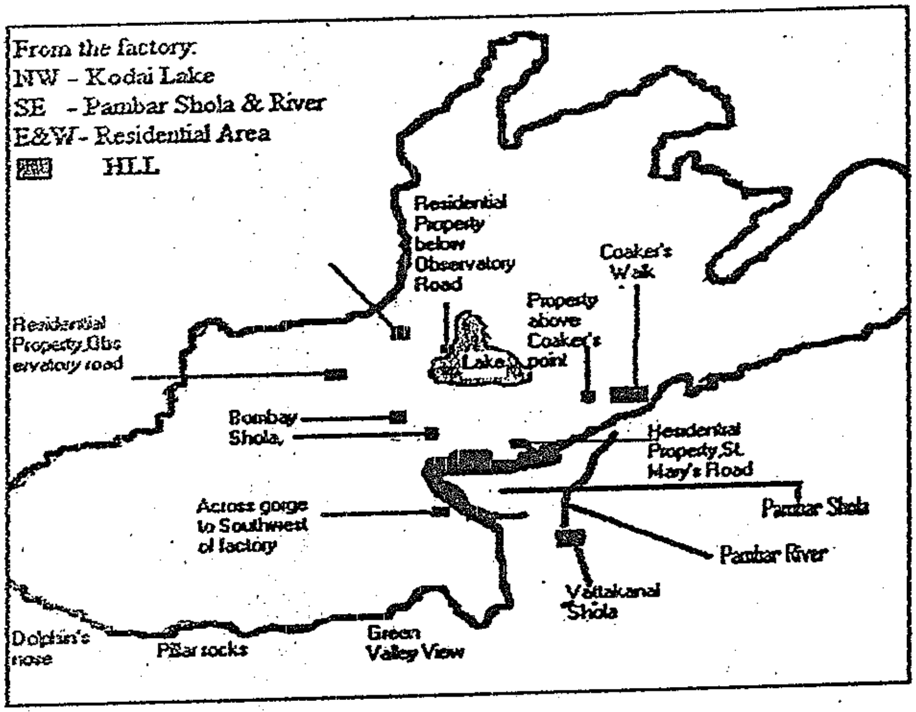
Done By:

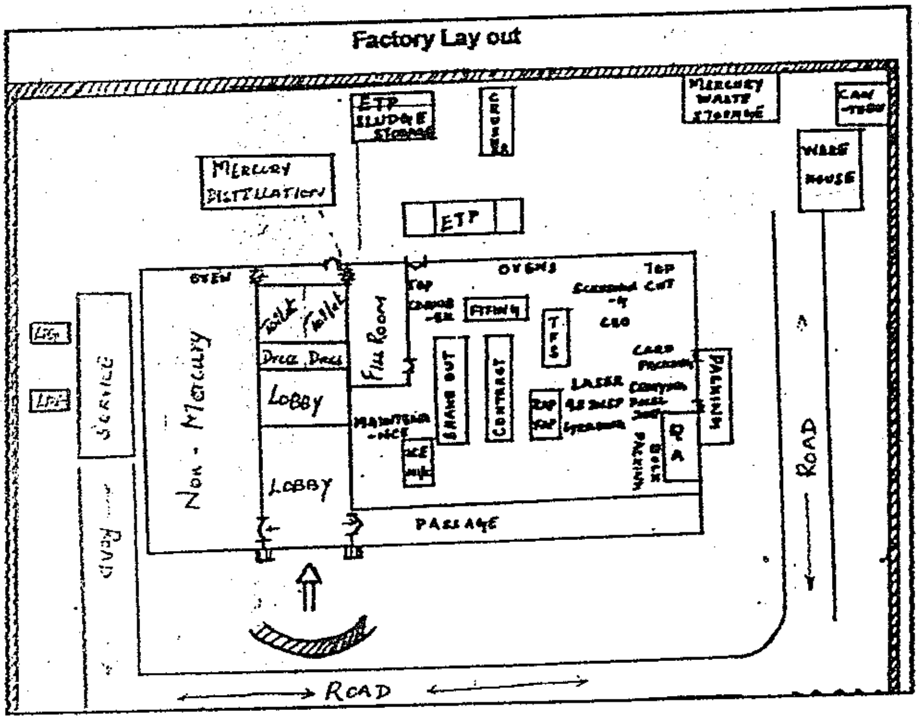
The Ponds HLL Ex- mercury Employees Welfare Association

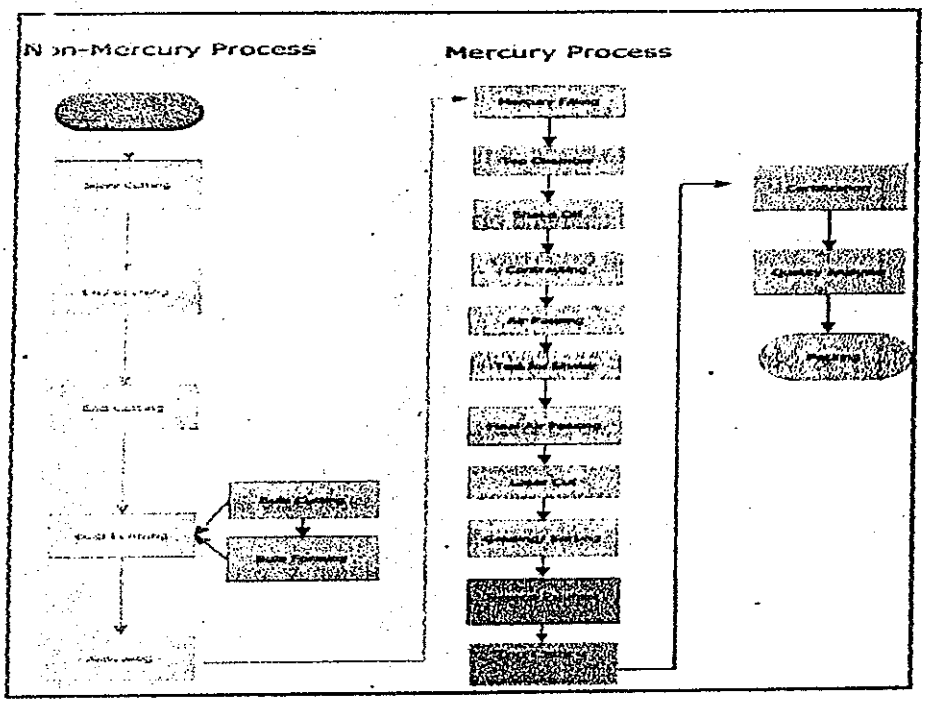
Kodaikanal

Factory Background

- 1983- Chesebrough Pond's Inc. exports its decades old mercury thermometer factory to India from the US- amidst tightening environmental regulation-due to mercury's toxic effects.
- 100% export oriented unit- mercury was imported from the U.S- finished thermometers exported to Europe and U.S
- In 18 years 163 million thermometers were produced.
- 1986 - Hindustan Lever Limited, a 51% subsidiary Unilever acquires Ponds India.


From the factory:
NW - Kodai Lake
SE - Pambar Shola & River
E&W- Residential Area
HLL
Residential Property below Observatory Road
Coaker's Walk
Property above Coaker's point
Lake
Residential Property Obs ervatory road
Bombay Shola
Residential Property St. Mary's Road
Pambar Shola
Across gorge to Southwest of factory
Pambar River
Vattakanal Shola
Dolphin's nose
Pillar rocks
Green Valley View


Factory Lay out
ETP SLUDGE STORAGE
MERCURY WASTE STORAGE
MERCURY DISTILLATION
ETP
WARE HOUSE
OVEN
OVENS
Fill Room
FITTING
Non - Mercury
LOBBY
LOBBY
SERVICE
MAINTENANCE
PASSAGE
LASER
PACKING
Q A
ROAD
ROAD
ROAD



Workers Safety

Safety measures that were supposed to be at HLL factory:

- Full Coveralls
- Gloves
- Caps
- Face masks with Cartridges in production area.

- Keeping floor and work area free from mercury droplets
- Factory should be well ventilated
- Breakages found on floor, spillages of mercury to be cleaned up immediately
- Mercury wastes should be in water in buckets/ tubs etc:
- Workers to be trained to handle mercury and awareness on the hazards of mercury

Compromise on...

Safety in regular Work

- 1988- Facility to bathe, within the factory after work, was stopped due to water shoratge
- Uniforms were changed once in 3 or 4 days
- Used caps given everyday
- No special safety gears while working in Distillation and Oven room
- Mercury sludge handled with bare hands by contract workers
- Worker's requests to change departments unheeded

Safety management Systems

- Uniforms of workers were washed with bare hands.
- Safety warnings not provided
- Safety committees discussed production & absenteeism not safety

Medical records/ tests

- Medical check-ups only for permanent workers.
- Women, probationers, temporary workers - never put through health screening
- Permanent workers reports- not maintained properly.
- In the reports from the factory- levels as high as 300 microgram/litre of mercury in urine documented.

Workers' repor s were not available when asked for after the closing of the factory.

Details of Workers until closure

- About 1138 workers worked in the factory over 18 years.
- About 400 permanent workers- between 1984 to 2001 for varied periods from 3 to 18 years.
- In 2001at the time of closure- 129 permanent workers.
- Trainees continued to be trainees for 5 to 8 years at a stretch.
- In canteen for washing, cleaning, gardening adolescents(15-18 years) were employed by canteen contractors - there were at any time 1 or 2 adolescents.

Women Employees

- About 120/130 women employed from 1995 to 2001- for different periods of time say 6 months to 2 or 3 years.
- Women were temporarily employed for 6 months with temporary workmen order
- End of six months- fresh order taking back the old order , for another six months.
- Employed for 2 or 3 years at a stretch like this.

Contd...

Women:

- Employed mostly at the digital thermometer section a few meters away from the mercury thermometer facility.
- For over half a day- employed in the packing section of mercury thermometer factory.
- About 3 or 4 women were employed in the garden.
- Two women were employed for supplying water to both digital and mercury thermometer factory
- Testimonies of 2 women who worked in the factory while pregnant talk about the damage caused.

Environmental contamination

Scrap yard at Moonjikal:

- 1999- 7.4 tons mercury waste sold to scrap merchant.
- HLL's Claim- wastes contained below 1% of mercury.
- Wastes also sold in Tamil Nadu and Karnataka
- March 2001- exposed massive dump of mercury wastes in the scrapyard by residents and ex- workers.

Pambar Shola:

- Mercury waste found dumped in places uphill from Pambar Shola
- Drums with empty mercury bottles discovered behind the factory
- Mercury sludge from the factory could have leached into the Shola

195

Atmospheric dispersal of Mercury from the Hindustan Lever Limited Thermometer Factory, Kodaikanal, Tamil Nadu, India, using lichen as a biomonitor
Bridgen,K.& stringer.R Greenpeace Research Laboratories
University of Exter UK
2002

- The concentrations of total mercury in the samples of lichen collected for this study ranged from 0.08 to 1.99 mg/kg dry weight
- The four samples with the highest concentrations of mercury were those collected closest to HLL site.
- Two further samples from the ancient forests around the factory contained significantly elevated concentrations of mercury.
- Sample collected at a residential property 300m from the factory had 0.32 mg/kg total mercury

Recommendation:

- Removal is the only long term solution for the mercury recovered from the site. HLL being the generator of this Hazardous waste must bear full legal and financial responsibility for this stewardship

Study of Mercury Pollution near a Thermometer Factory using Lichens and Mosses
Department of Atomic Energy
2003

- Mercury contamination due to a mercury thermometer factory situated in Kodaikanal was investigated using lichen and moss samples.
- Lowest concentration of mercury was found in samples collected about 20 km away from the factory near a pristine lake area
- Mercury concentration in air near the thermometer factory was around 1.3 mg m^{-3} very much higher than the nominal Hg concentration range (0.5- 10 ng m^{-3}) for a non contaminated area
- Elemental mercury though the principle form of mercury contamination in this case, is possibly converted into inorganic form on lichens and mosses.

Recommendation:

Likely conversion of one form of the contaminant into the other chemical forms on bio monitors should be further studied.

Studies of mercury pollution in a lake due to a thermometer factory situated in a tourist resort: Kodaikanal, India
Department of Atomic Energy,
Jawaharlal Nehru Technological University
2005

- Three major lakes Kodaikanal, Berijam(20kms) and Kookkal (40kms) are already showing signs of contamination, with mercury.
- Mercury levels in water is between 10 and 80 times the levels expected to be found in uncontaminated water bodies
- A value of about 50 ng/ litre mercury in methyl mercury form is found in Kodai lake.
- Half the mercury in the fish collected from Kodai lake is present as methyl mercury
- Air- and water-borne mercury emissions from the factory have contaminated large areas of Kodaikanal and the surrounding forests
- Source of the pollution is the thermometer factory.

Recommendation:
Only remediation of the factory site could prevent any further mercury inputs through vapour and drainage

Contamination through workers

- Without safety gears workers took mercury back home.
- Mercury spread through their dress, sweaters and socks
- Children play with mercury falling from workers body
- House was contaminated- living there created health problems
- Affected the children (just born and the to be born)
- Spouses & others in the family are reported to have died & been suffering due to mercury related ailments.

Current problems of workers and Families

- Workers suffer from headache, heart problems, kidney problems, bleeding gums, falling teeth, skin patches, tiredness, tremor, loss of memory, irritability and inability to work.
- Women have had frequent miscarriages, irregular periods, babies with deformities and infertile also.
- Out of 206 workers 106 have CNS related problems, 77 of them have skin related problems like patches in the skin
- Worker's families also suffer from health problems.
- Till date 19 ex- workers have died
- Many children of ex- workers have died and children suffer from low IQ and other health related problems

BS

Contd...

- Expense on medicines absolutely not affordable.
- Families have lost earning members- find it difficult even to sustain themselves.
- Traveling to places to meet Doctors is not feasible.
- Some ex- workers- no position to work anymore due to health problems.
- Many ex- workers are in debt - borrowing money for treatment.
- Women workers faced family problems due to miscarriages, etc.,

END

Annexure - 5

Submission from the respondents on the clinical aspects and other details of the 12 ex-employees evaluated by the committee

Details of the 12 ex-employees evaluated by the Committee

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings (YMUR) in mcg/lt
(Figures in italic are the group mean value of the emplyoees in that year)

Sl No	S.No as per the Doc. given the experts committee	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	YMUR 1988	YMUR 1989	YMUR 1990	YMUR 1991	YMUR 1992	YMUR 1993	YMUR 1994	YMUR 1995	YMUR 1996	YMUR 1997	YMUR 1998	YMUR 1999	YMUR 2000	YMUR 2001	Sickness reported during employment	HUL's comments : Occupation after leaving the factory & Personal habits if any.
Ex-employees who left in the year 2001 (at the time of closure of factory)																							
1	161	S.Sivaganam T.No 16	Permanent	01.01.1984	09.11.2001	17.8	Service , Packing, Maintenance.	44.5	11.7	23.9	16.1	25.0	26.7	21.4	23.3	49.9	27.8	23.9	25.0	25.0	11.3	Prolactinoma.	Manual Labourer.
2	162	A.Paulraj T.No 157	Permanent	15.05.1985	09.11.2001	16.4	Maintenance, Laser cutting	22.2	12.8	47.8	62.5	13.3	31.1	23.3	20.3	16.7	22.7	17.0	23.2	25.5	16.4	Allergy.	Petty shop owner.
3	175	S.Ramachandran T.No 226	Permanent	01.01.1985	09.11.2001	16.8	Service	7.8	17.8	47.9	60.8		21.9	20.9	26.7	34.2	25.0	30.0	16.2	23.9	18.3	Peptic ulcer, Liver disorder, Fever.	Plumbing work. Kalyanamandapam care taker.Personal habits : Drinking and chewing putkka.
4	Not in the list	V.Monickam T.No. 30	Permanent	01.01.1984	09.11.2001	17.8	Non-mercury, Laser cutting.	15.0	9.0	30.0	12.0	16.0	20.0	24.0	11.0	35.0	17.0	23.0	15.0	24.0	9.0	Chest pain.	Agricultural labour.
Ex-employees who left earlier to the year 2001																							
5	10	J.Antony T.No 126	Permanent	10.09.1984	10.03.1997	12.5	Rap, Fap, Fixing , Tfs, Top Chambring	14.0	8.0	13.0	16.0	10.0	22.0	24.0	24.0	86.0						Viral Fever.	Presently working as painter and plumbing.
6	12	J.Peter Sundarrajan T.No 32	Permanent	02.01.1984	12.08.1996	12.6	Fine air Passing.	9.4	8.9	16.6	13.3	5.8	19.6	24.7	31.7	36.0						NIL	Street vendor.Personal habits : Smoking
7	24	S.Sahayaraj T.No 198	Permanent	11.01.1986	06.12.1994	8.9	Screening	28.5	20.8	26.1	14.2	15.4	20.0	20.3								Had sugar, Had heart attack.	Had stroke/cerebral infarct subsequent to heart attack. Refer: Submission in the court by the petioner- Vol II(page 35) & Vol X (page 6 & 7). He is diabetic. Presently working as gardener in Kodai International School.
8	94	S.Karuppusamy T.No 311	Permanent	02.01.1989	11.07.1994	5.6	Scavenging, Factory cleaning.		18.0	31.6	48.1	28.0	26.7	16.7								NIL	Municipal scavenger / hotel scavenger. Alcoholic and smoking.
9	111	K.Muthuraj T.No 242	Permanent	22.09.1986	25.08.1992	5.9	Packing, Certification, Screening	21.9	13.3	21.5	31.4	17.5										NIL	Car driver. Alcoholic and smoking.
Ex-casual workman																							
10	76	A. John Ignatious T.No. 139	Casual	01.02.1985	03.05.1986	1.3	Materials Handling - FAP.															NIL	Manual Labourer.
Ex-trainee workman																							
11	109	F.Leo Joseph T.No : T 02, A 11, A 18	Trainee (Men)	02.01.1996	01.05.1997	1.4	Contracting.									17.3	80.0					NIL	Working in a shop.
Ex-temporary workman																							
12	Not in the list	S. Jaya Bharathi. T.No. T 147	Temporary (women)	28.05.1998	19.09.1998	4M	Digital											24.3					NIL	House-wife. Not worked in mercury area.

Submission for consideration by the committee

1. Any conclusion on a cause-effect relationship must consider exposure related data. If exposures during the working period of an individual were within national and international standards, any signs and symptoms which may be manifested in most cases many years after cessation of employment cannot be scientifically linked to past exposures. The exposure data in the context of the current case comprises of environmental monitoring as well as biological monitoring data. The crucial one from the aspect of impact on human health is the data pertaining to biological monitoring. In this context it is worth reiterating that at the behest of the Supreme Court Monitoring Committee the Tamil Nadu Pollution Control Board had requested the ITRC to evaluate the health angle. The ITRC had after a detailed perusal of each and every record submitted a verified data table incorporating biological monitoring details as a part of their report to the TNPCB. This report has been submitted to the honorable high court at Chennai and forms part of the testimony in the high court. [See Vol V respondents submission in writ petition no. 8291 of 2006 - full report on pages 1- 22 and Table 7 depicting audited biological monitoring data (pages 13-20)]

2. The examined employees had left the factory many years back – the factory itself was shut in 2001. So at the very minimum there is a gap of 6 years between their employment and the current findings (history given by employees and any findings arising out of that in the form of signs/symptoms). In most cases they would have ceased their employment more than 10 years back. It brings us to the important question of what were these employees doing after they ceased their employment at the erstwhile thermometer plant We have tried to put together details of their occupation after leaving the factory as also any personal habits wherever we have an idea of the same. These apparently will have a significant impact on any current signs/symptoms which they may exhibit. For instance

- Mr. S. Sahayaraj has a history of stroke and cerebral infarct (This is mentioned by the petitioners themselves in their submission to the high court (Vol II - page 35 & Vol X - page 6 & 7)
- Mr. J. Antony has worked in painting and plumbing jobs after leaving the factory – 10 years back.
- A lady who is featured in the list Ms. Jaya Bharati worked only for 4 months and left 9 years back and
- There are others who have worked in agriculture or have a history of alcoholism etc as per the attached list.

All of the above can be significant confounders in the evaluation of current health issues – thereby making it unscientific to link current complaints, signs and symptoms to past exposures – more so in the context of past exposures being validated by leading national institutions and national and international experts as being well within permissible limits vis-à-vis any potential health impact.

3. Some of the employees featuring in the list have been apparently evaluated previously by Dr. Rakhal Gaitonde and they include the following:

- S. Sahayaraj (report states that he had stroke with cerebral infarct)
- J. Antony
- Paulraj
- Peter Sunderrajan
- S. Karupusamy &
- F Leo Joseph

In his report Dr. Gaitonde mentions that neurological symptoms started 3 – 5 years after they left the factory. Elemental mercury has a half-life in the body of only 60 days and has no latency with respect to effects, i.e. it does not cause any delayed effects. This scientific aspect has been reiterated both by the All India Institute of Medical Sciences (pages 26 -37: Vol V of the respondents submission in writ petition no. 8291 in the high court at Madras), and by the National Institute of Occupational Health (pages 23-25 : Vol V of the respondents submission in writ petition no. 8291 in the high court at Madras).

4. It may be worthwhile mentioning here that around 130 employees who left the factory at the time of closure have signed an agreement with the company in the presence of a government authority that they have no health issues or any apprehension with respect to their health. They include the following from the list of employees evaluated by the committee:

S. Sivagnanam
A. Paulraj
S. Ramachandran &
V. Moonicakm

5. There is another interesting aspect which will be useful to bring to the notice of this committee. When the factory was closed and we evaluated 255 individuals in March 2001 as a part of our epidemiological study we tried to link subjective symptoms (elicited by a questionnaire) to levels of exposure. Since the overall exposure levels were low we divided these already low levels of exposures into five subsets. To our surprise we found the maximum symptoms in those who had the lowest of exposures (from amongst all the exposures which in any case were quite low and within permissible national/international standards). The extract from the peer reviewed published article detailing this finding is enclosed herewith. The article mentions that such similar findings have been found by other investigators as well and that reporting of such symptoms is influenced by knowledge of exposure to mercury.

This is indeed an important aspect which the committee may like to bear in mind while evaluating complaints(if any).

IJOEM
Indian Journal of Occupational & Environmental Medicine

Table 4: Symptoms in relation to HgU levels

Symptoms pertaining to	Biological monitoring results – HgU (µg/L)					T
	<20	21-30	31-40	41-50	>51	
Central Nervous system	34	49	1	1	3	
Cardiovascular	11	18	0	0	0	
Respiratory	20	44	0	1	0	
Gastrointestinal	4	12	0	0	0	
Genitourinary	2	4	0	1	0	

A study by Roels *et al*[1] used a questionnaire mainly to elicit symptoms related to the central nervous system disturbances. Several symptoms, mainly related to the central nervous system (memory disturbances, depressive feelings, fatigue and irritability), were more prevalent in the exposed subjects rather than the controls. The symptoms were however not related to exposure parameters. The authors therefore considered it possible that the reporting of these symptoms were influenced by the knowledge of mercury vapor exposure.

1. Roels H, Gennart J-P, Lauwerys, R. Buchet, J-P. Surveillance of workers exposed to mercury vapour. Validation of a previously proposed biological threshold limit value for mercury concentration in urine. Am J Ind Med 1985;7:45-71.

In our study [Table - 4] also, the symptomatology did not have any significant correlation with the body burden of mercury (as HgU). Neither could we correlate any morbidity with exposure to Hg in view of very low levels of exposure, as evidenced by the results of the biological monitoring in these groups

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Source: Rajgopal T. et al. Epidemiological surveillance of employees in a mercury thermometer plant : An occupational health study. Indian Journal of Occupational and Environmental medicine – April 2006 – Volume 10, Issue 1. page 14.

6. There is enough evidence in literature that symptom exaggeration is related to litigation. This has been substantiated in many areas of neuropsycology particularly where financial incentives or secondary gain exist for demonstrating impairment. [a, b, c & d.]

References for point 6

a & b

Robbins, M. L., Allen, L. M., & Green, P. (2002). Who is exaggerating cognitive impairment and who is not? *CNS Spectrum, 7*, 387–395.

Rohling, M. L., Green, P., Allen, L. M., & Iverson, G. L. (2002). Depressive symptoms and neurocognitive test scores in patients passing symptom validity tests. *Archives of Clinical Neuropsychology, 17*, 205–222.

c.

Haut, M. W., Morrow, L. A., Pool, D., Callahan, T. S., Haut, J. S., & Franzen, M. D. (1999). Neurobehavioral effects of acute exposure to inorganic mercury vapor. *Applied Neuropsychology, 6*, 193–200.

d.

Powell, T. J. (2000). Chronic neurobehavioral effects of mercury poisoning on a group of Zulu chemical workers. *Brain Injury, 14*, 797–814.

7. This entire aspect of unsubstantiated allegations vis-à-vis health of ex-employees has been examined by both national and international experts and institutions and their report is available with the committee. For ease of your reference I am chronicling their availability in the submissions made to the honorable high court at Madras::

1. *Dr. P. N. Viswanathan's* report - page 362 - 9 / Vol. II Dr. Viswanathan as a retired Director Grade Scientist at the ITRC, Lucknow and an authority on mercury. He was a scientific member of the WHO Environmental Health Criteria no. 86 on Mercury published by the IPCS/WHO in 1989.

2. *Dr. Tom Van Teunenbroek* reports of May 2001 and October 2001 (approached at the specific instance of the NGOs and pursuant to the direction of the TNPCB) - page 423 - 6 / Vol. II

3. *Government of Tamil Nadu, Certifying Surgeon's* report dated 25. 08. 2001 - page 478 -480 / Vol. II

4. Report of the *All India Institute of Medical Sciences* dated 9.11. 2001 - page 513 - 515 / Vol. II

5. Report of the *Indian Association of Occupational Health* dated 10.1.2002 - page 526 - 531 / Vol. II

6. Peer reviewed scientific article in the *Indian Journal of Occupational and Environmental Medicine* dated Jan- Apr 2006: pages 384 - 416 / Vol. II

7. *ITRC report* dated 11. 06. 2006 (approached at the instance of the *Supreme Court Monitoring committee* directive) - page 1 - 22 / Vol. V.

8. Report of the *National Institute of Occupational Health* dated 11.09.2006, page 23 - 25 / Vol. V.

9. *All India Institute of Medical Sciences report* dated 3.10.2006 : page 27 - 29 / Vol. V.

10. *Dr Robert Winker's report* dated 11.09.2006: pages 45-55 / Vol. V

11. *Report of Dr. S. K. Rastogi* on behalf of ITRC dated 12.11.2006 pages 4 - 27 / Vol. VII

12. Report from the *All India Institute of Medical Sciences* dated 23.11.2006 pages 37 -66 / Vol. VII

8. There has been some concern expressed regarding our monitoring of contract and temporary workers. It must be clarified here that contract workers worked only in designated non-mercury areas like security, canteen, drivers and gardening. The temporary workers were taken in for short periods of time to meet increased export orders. They worked in material handling, packing and other ancillary areas. For those who worked for any extended period we have their records as well. From an epidemiological perspective their exposure levels would have been no different from other permanent workers working in thee areas. (This principle is similar to the concept of 'herd immunity' in community medicine).

9. Finally we have shared with the committee members the raison–de-etre for not suggesting any further studies – all of which have been elaborated in details in earlier reports submitted by leading national institutions like the ITRC, AIIMS and the NIOH. To summarize these reasons:

1. The factory was closed in March 2001. A review in May 2001 of the body burden of mercury in the employees 2 months after the closure showed a mean mercury in urine of 10.1 micrograms/L which is well below acceptable limits.

2. Mercury has a half life in the body of 60 days [ATSDR, Toxicological profile of Mercury, US Dept. of health and human services, March 199, page 187]. The exit yearly mean values of employees in the HLL plant (Table 7 of the ITRC report Vol. V) were within acceptable limits. After a gap of six years of closure of factory it is scientifically inconceivable that the ex-employees will have any effects arising out of past exposure.

3. There is no scientific evidence of delayed exposure to Hg after a long latency period especially if the exposure levels during the working life of an employee have been within

acceptable limits. No evidence of the ex-employees having high exposure to Hg has been found. (page 4 & 5 of the ITRC report / Vol. V)

4. Signs and symptoms exhibited now may have myriad common causes which can not be ruled out. Since historically the exposure levels were well within permissible limits any linkage of current signs and symptoms to past exposure will not pass the test of scientific validity. In addition there will be many confounders queering the pitch since in many cases employees have left the factory more than 10 years back and that elemental mercury does not exhibit delayed effects.

I trust that my submission will have the careful scientific consideration of the committee and that they will find this useful in reaching a conclusion on the way forward.

Dr. T. Rajgopal
29th October 2007.

Annexure - 6

Respondent's submission on exposure data and other details of the list of 279 individuals submitted by the petitioners

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	S.Arun Prasath T.No 61	Permanent (Left earlier to 2001)	26.03.1984	10.06.1992	8.3	Screening	31.1	26.7	17.9	28.7	22.7									
2	S.Johnson T.No 260	Permanent (Left earlier to 2001)	23.01.1987	27.07.1992	5.5	Final Inspection	14.7	7.8	7.5											
3	R.Vijayalakshmy T.No T 36 & T 72	Temporary (Woman) Packing	03.10.1995 07.10.1996	31.12.1995 28.10.1996	0.3	Packing								26.1	31.8					
4	A.Antony Doss T.No 88	Permanent (Left earlier to 2001)	08.05.1984	31.08.1989	5.3	Screening	19.7	14.6												
5	V.J.Vincent T.No 80	Permanent (Left earlier to	18.04.1984	20.09.1996	12.4	Screening	15.0	14.4	33.7	11.0	15.6	25.2	24.6	33.3	26.7					
6	P.Paulraj T.No 174	Permanent (Left earlier to 2001)	14.10.1985	22.06.1990	4.7	Laser Operator.	21.5	45.0	37.0											
7	D.Yesaiyah T.No 224	Permanent (Left earlier to 2001)	02.05.1986	01.04.1996	9.9	Service	21.8	20.5	25.2	23.4	8.3	21.3	21.8	39.6						
8	S.Joseph Mathews T.No : T 14, T 11, T 46, A 16, 381	Trainee (Men)	02.01.1996 01.10.1996	30.06.1996 23.06.1999	3.3	Air passing .												18.6		
9	A.Sahaya Robert Kennedy T.No 106	Casual (Men)	04.06.1984	02.11.1987	3.4	Rough Air Passing									20.8	32.3	23.3			
10	J.Antony T.No 126	Permanent (Left earlier to 2001)	10.09.1984	10.03.1997	12.5	Rap, Fap, Fixing , Tfs, Top Chambring (Flat)	18.1	11.2	16.7	65.8	35.6	20.7	25.7							
11	A.Rathina Raja Seelam T.No 164	Permanent (Left earlier to 2001)	01.07.1985	01.03.1994	8.6	Bulb Forming, Rap, Fill & Top Chamber.	25.6	15.2	19.1	46.1	72.5	14.6	20.0							
12	J.Peter Sundarrajan T.No 32	Permanent (Left earlier to 2001)	02.01.1984	12.08.1996	12.6	Fine air Passing.	9.4	8.9	16.6	13.3	5.6	19.6	24.7	31.7	36.0					
13	B.Sahayamary T.No : T 06	Temporary (Woman)	06.01.1997	10.03.1997	0.2	Digital										26.0				
14	M.Marimuthu T.No 176	Casual (Men)	14.10.1985	24.08.1989	3.8	Bulb Forming Non Mercury area.	18.5	16.3												
15	G.Suresh T.No 34	Permanent (Left earlier to 2001)	10.01.1984	19.09.1992	8.7	Electrical Maintenance.	44.2	7.2	44.3	21.8	53.9									
16	A.Ramesh T.No : T 12, T 03,	Trainee (Men)	01.07.1996	23.06.1999	2.9	Packing.									128.1	44.2	47.7	36.7		
17	P.Amalorpavam T.No : T 107	Temporary (Woman) Digital	06.01.1997	10.03.1997	0.2	Digital										26.0				
18	P.Jayanthi T.No : T 70	Temporary (Woman) Digital	02.03.1998	13.05.1998	0.2	Digital											24.3			
19	R.Rajah T.No 162	Permanent (Left earlier to 2001)	17.06.1985	16.11.1991	6.4	Office,Service	38.1	20.3	14.7	28.2										
20	T.Kaviraj T.No 334	Permanent (Left earlier to 2001)	27.05.1991	31.08.1998	7.3	End open, Bulb Forming, Fine Air Passing.					16.7		17.4	11.1	10.7	15.9	20.8			

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt
(Figures in Italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
21	V.P... T.No : T 34	Temporary (Woman) Packing	01.10.1995	31.12.1995	0.3	Packing														
22	J.Sudhakar T.No : T 42, T 03, T 10, A 18, 380	Trainee (Men)	02.01.1996 01.10.1996	30.06.1996 23.06.1999	3.2	Non Mercury (Bulb Cutting, Bulb Washing)								26.1						
23	R.S.Jayapal Joseph T.No : T 59, T 20, T 04, A 30, 395	Trainee (Men)	01.10.1996	23.06.1999	2.8	Service									11.2	14.7	3.3	7.5		
24	S.Sahayaraj T No 198	Permanent (Left earlier to 2001)	11.01.1986	06.12.1994	8.9	Screening	28.5	20.8	26.1	14.2	15.4	20.0	20.3		33.3	54.1	31.7	35.6		
25	M.Kulandairaj T No 234	Permanent (Left earlier to 2001)	25.08.1986	25.02.1993	6.5	Laser Inspection.	29.0	21.5	28.4	19.8	15.6									
26	R.Antony T No 298	Permanent (Left earlier to 2001)	02.01.1988	04.05.1996	8.3	Rough Air Passing, Fine Air Passing.	16.7	10.6	21.1	15.8	18.3	14.5	25.0	20.0						
27	G.Maliga T.No : T 37, T 85, 398	Trainee (Women)	03.10.1995 07.10.1996 01.03.1998	31.12.1995 31.12.1996 23.06.1999	1.6	Digital & Packing														
28	A.Bhaskaran T No 135	Permanent (Left earlier to 2001)	13.12.1984	14.10.1991	6.8	Quality assurance Auditor.	19.7	9.7	5.0					26.1	31.8		24.3	21.3		
29	P.Velu T No 28	Permanent (Left earlier to 2001)	02.01.1984	01.09.1989	5.7	Screening	15.2	7.2												
30	R.Subbaiyah T No 160	Permanent (Left earlier to 2001)	15.05.1985	24.08.1989	4.3	Screening, Contracting	40.9	22.2												
31	O.Poovalingam T No 320	Permanent (Left earlier to 2001)	19.06.1990	16.08.1994	4.2	Non Mercury						21.5	12.2							
32	J.Nirmata T.No : T 33, T 71, A 25, 390	Trainee (Women)	03.10.1995 07.10.1996 01.03.1998	31.12.1995 31.12.1996 23.06.1999	1.6	Packing								26.1	31.8		24.3	21.3		
33	S.Xavier Fernando Sridher T No 36	Permanent (Left earlier to 2001)	11.01.1984	02.06.1997	13.4	Fill & Top Chamber, End Cutting, Bulb Forming.	38.7	26.0	31.7	29.3	46.1	34.7	20.0	36.7	39.2	28.0				
34	JS.John Sahayanathan T No 44	Permanent (Left earlier to 2001)	06.02.1984	01.01.1989	5.0	Test For Shake, Contracting	18.3													
35	RS.Raghunathan T No 119	Permanent (Left earlier to 2001)	16.07.1984	22.08.1989	5.1	No Clear Inspection	20.3													
36	S.Alagarraja T No 229	Permanent (Left earlier to 2001)	13.05.1986	11.01.1995	8.7	Maintenance, Top Cutting & Grading	8.1	9.6	15.3	16.7	11.7	24.2	23.3							
37	A.Johnson T No 26	Permanent (Left earlier to 2001)	02.01.1984	30.11.1996	13.8	End Cutting, End opening, Bulb Forming.	38.9	20.8	25.5	34.2	20.0	24.0	23.7	11.0	20.0					
38	K.M.Gias Mohamed Gori T No 81	Permanent (Left earlier to 2001)	18.04.1984	01.09.1989	5.3	Maintenance, Grading	23.7	31.4												

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt
(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
39	S.A.Mahendran T No 25	Permanent (Left earlier to 2001)	01.01.1984	01.01.1989	5.0	Contracting	*18.0*													
40	S.Raja Mohamed T No 62	Permanent (Left earlier to 2001)	26.03.1984	31.07.1989	5.3	Test For Shake, Rough Air Passing. QA. Auditor.	30.0	*16.2*												
41	S.Balu T No 73	Permanent (Left earlier to 2001)	03.04.1984	01.09.1989	5.4	QA. Auditor.	24.3	*32.2*												
42	C.Robertson Jayaraj T.No	Casual (Men)	11.04.1984	31.08.1984	0.4	Ancillary Jobs & Materials handling.														
43	A.Kulandai Raj	Not our employee			0.0															
44	T.John Manohar T No 91	Permanent (Left earlier to 2001)	08.05.1984	31.08.1989	5.3	Screen Making (Dark Room).	20.0	*26.7*												
45	A.Babu T.No 173	Casual (Men)	14.10.1985	02.09.1989	3.9	Bulb forming.	23.7	*15.0*												
46	K.Radhakrishnan T No 147	Permanent (Left earlier to 2001)	15.04.1985	03.05.1990	5.1	Bulb Forming, Screening.	13.3	17.9	*15.7*											
47	A.Augustin Chelladurai T No 68	Permanent (Left earlier to 2001)	02.04.1984	30.09.1989	5.5	Rough Air Passing, Fine Air Passing.	17.3	*11.0*												
48	L.Rangasamy T No 213	Permanent (Left earlier to 2001)	10.03.1986	07.02.1996	9.9	Rough Air Passing,Electrical Maint.,	20.9	10.0	36.2	32.8	20.6	18.7	17.1	*23.3*						
49	L.Chandrasekar T No 67	Permanent (Left earlier to 2001)	02.04.1984	01.11.1996	12.7	Test For Shake, Quality Auditor,	24.7	11.7	17.1	23.2	11.8	30.0	20.3	18.7	*20.9*					
50	P.Masimalai T No 291	Permanent (Left earlier to 2001)	15.07.1987	14.02.1995	7.6	Air Passing, No Clear Inspection.	37.9	35.4	34.6	22.3	53.3	16.0	*20.0*							
51	K.Sivamoorthy T No 241	Permanent (Left earlier to 2001)	11.09.1986	06.06.1996	9.8	Rough Grading, Screening.	17.8	27.2	28.4	23.0	13.9	21.1	22.4	*21.1*						
52	M.Jayapal Thiyagarajan T No 270	Permanent (Left earlier to 2001)	06.03.1987	05.09.1995	8.5	Printed Laser, Certification	17.3	16.5	19.6	22.5	20.0	22.7	26.2	*21.7*						
53	S.Peer Sherif T No 273	Permanent (Left earlier to 2001)	30.03.1987	25.04.1996	9.1	Bulb Forming, Injection Moulding, Shake out.	6.7	15.2	28.7	37.3	15.0	18.3	24.4	*18.3*						
54	Y.N.Abraham T.No T 48	Temporary (Men)	01.07.1991	31.12.1991	0.4	Packing				*12.7*										
55	S.Anbudoss T.No 199	Casual (Men)	11.01.1986	31.01.1989	3.0	Grading	35.6	*3.3*												
56	A.V.Murugesan T.No 295	Permanent (Left earlier to 2001)	09.10.1987	15.12.1995	8.2	Bulb Forming.		11.3	30.0	29.7	26.2	15.0	17.8	*13.8*						
57	P.Janifer Nancy Rani T.No : T 52	Temporary (Woman) Digital	03.01.1997	27.05.1997	0.4	Digital										*26.0*				
58	Ruby Kannayah doss Contract	Contract (Women)	02.01.1997	10.03.1997	0.2	Office Attendant										*26.0*				
59	J.Jayalakshmy	Not our employee			0.0															

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
60	S.Jayapal T.No 144	Permanent (Left earlier to 2001)	15.04.1985	31.08.1989	4.3	Grading. and Testing.	12.9	11.1												
61	P.Anandhan T.No 181	Permanent (Left earlier to 2001)	14.10.1985	10.09.1992	6.9	Rough Grading.	17.0	9.6	17.3	30.0	17.6									
62	S.Samuvel Rajkumar T.No T 61, T 22	Temporary (Men)	01.10.1996	28.06.1997	0.8	Store Asst.									11.7	8.3				
63	S.A. Sahayam T.No 65	Casual (Men)	02.04.1984	29.06.1985	1.3	Non Hg Area														
64	W.Victor T.No 29	Permanent (Left earlier to 2001)	02.01.1984	30.09.1996	12.7	End Openig M/C Adjuster	36.3	22.3	28.2	15.4	19.3	19.4	22.1	13.3	10.2					
65	K.N.Muniyandi Mohan T No T 47, T 23 T 32	Temporary (Men)	07.10.1992	31.12.1993	1.1	Inj. Moulding,														
66	T.Joseph Philip T.No T 02 , T 98	Temporary (Men)	19.07.1990	02.12.1991	1.3	Ancillary Jobs & Materials handling.			20.0	40.0										
67	M.KumaraGuru T.No 140	Casual (Men)	01.02.1985	31.01.1986	1.0	Grading														
68	S.Sahayaraj T.No 108	Permanent (Left earlier to 2001)	07.06.1984	12.08.1991	7.2	Grading, Screening,	19.3	16.1	41.8	11.5										
69	K.Murugan T.No : T 38, T 15 T 33	Temporary (Men)	24.08.1992	30.10.1993	1.2	Packing.					16.7	27.8								
70	P.Saravana Kumar T.No : T 28, T 10, T 04	Temporary (Men)	21.07.1992 07.01.1993 08.07.1993	31.12.1992 30.06.1993 23.08.1993	1.1	Ancillary Jobs & Materials handling.					6.7	14.2								
71	R.Sugumaran T.No 63	Permanent (Left earlier to 2001)	26.03.1984	06.07.1989	5.3	Grading, Screening.	18.9	7.1												
72	J.Methilda Selva Kumari T.No : T 74	Temporary (Woman) Digital	02.03.1998	23.11.1998	0.8	Digital											24.3			
73	A.Sivakumar T.No : T 113	Temporary (Men)	10.09.1990	31.12.1990	0.3	Top Cutting.			30.0											
74	A.Suresh T.No : 303	Casual (Men)	24.02.1988	31.08.1989	1.5	Top Making	17.5	12.7												
75	I.Stephen T.No : T 92, T 06	Temporary (Men)	04.11.1996	13.05.1997	0.5	Top Cutting									33.3	26.7				
76	A.John Ignocious T.No 139	Casual (Men)	01.02.1985	03.05.1986	1.3	FAP & NCI														
77	S.Sathiyamoorthy T.No : T 66	Temporary (Men)	19.07.1990 01.08.1991	30.12.1990 31.12.1991	0.4	98 Inspection			35.0	14.0										
78	R.Senthikumar T.No : T 27,T 03, T 09	Temporary (Men)	21.07.1992 08.07.1993	31.12.1992 01.09.1993	0.6	Top Cutting				55.0		42.9								
79	F.Antony Joseph T.No 66	Permanent (Left earlier to 2001)	02.04.1984	18.03.1997	12.9	Contracting	25.0	20.0	29.0	24.0	21.3	22.7	22.0	27.2	53.3	25.6				
80	J.Ganasoundary T.No : T 80, T 125, T 207	Temporary (Woman) Packing	07.10.1996 02.01.1997 17.09.1997 17.08.1998	31.12.1996 10.03.1997 26.09.1997 30.04.1999	1.2	Packing (post manufacturing)									31.8	26.0	24.3	21.3		

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
81	B.Chandrasekar T.No 71	Permanent (Left earlier to 2001)	04.04.1984	[illegible]	9.5	Shake-out, Test for Shake, 130 Inspection.	45.2	26.2	36.6	21.2	13.3	16.7								
82	L.John Ebinesar T.No 45	Casual (Men)	30.01.1984	26.11.1984	0.8	Ancillary Jobs & Materials handling.														
83	P.Vellankanni Mercy T.No : T 51,T 15	Temporary (Woman) Digital	27.01.1997	29.09.1998	1.7	Digital										26.0	24.3			
84	A.Hellen appolow T .No : T 35	Temporary (Woman) Packing	03.10.1995	31.12.1995	0.3	Packing								26.1						
85	G.Ruthe Priya T .No : T 04, T 150, T 52	Temporary (Woman) Digital	07.10.1996 02.01.1997 29.12.1997	31.12.1996 31.05.1997 04.01.1999	1.7	Digital									31.8	26.0	24.3	21.3		
86	S.Jayaraj T.No : T 39, T 52, T 160	Temporary (Men)	05.02.1996 01.10.1996 08.06.1998	30.06.1996 31.12.1996 09.03.1999	1.3	Digital & Bulb Washing									19.5					
87	M.Ramachandran T.No : T 05	Temporary (Men)	19.07.1990	30.12.1990	0.4	Ancillary Jobs & Materials handling.			22.5											
88	P.Rangasamy T.No : T 06,T 36	Temporary (Men)	04.01.1994 01.08.1994	30.06.1994 17.12.1994	0.8	Ancillary Jobs & Materials handling.							16.3							
89	R.Thiruselvi	Not our employee			0.0															
90	S.Dominic Fernando T.No : T 31, T 13, A 11, A 04, 347	Trainee (Men)	02.01.1993 08.07.1993 01.01.1995	30.06.1993 31.12.1993 13.02.1997	2.9	Grading,								25.7	40.6					
91	C.Sundararajan Contract	Comtract (Men)	16.03.1988 02.01.1993	06.03.1991 31.03.1995	5.3	Cantreen	22.7	16.4	26.4	31.9										
92	T.Sekar T.No : T 49,T 29	Temporary (Men)	04.04.1994 01.08.1994	30.06.1994 31.12.1994	0.6	Ancillary Jobs & Materials handling.							12.7							
93	R.Raman T.No 218	Casual (Men)	24.03.1986	01.01.1989	2.8	Non Mercury	39.0													
94	S.Karuppusamy T.No 311	Permanent (Left earlier to 2001)	02.01.1989	11.07.1994	5.6	Scavenging		18.0	31.6	48.1	28.0	26.7	16.7							
95	C.Valliyammal T .No : T 21	Temporary (Woman) Digital	23.06.1997	01.12.1998	1.4	Digital										26.0	24.3			
96	T.Rani T .No : T 73	Temporary (Woman) Digital	21.07.1997	04.01.1999	1.4	Digital										26.0	24.3	21.3		
97	G.Bhavani T .No : T 78 T 18	Temporary (Woman) Digital	06.06.1997	04.04.1998	0.8	Digital										26.0	24.3			
98	J.Gracy T .No : T 213	Temporary (Woman) Packing	19.08.1998	14.12.1998	0.3	Packing											24.3			
99	J.Jabha Leela T .No : T 30, T 91 T 212	Temporary (Woman) Digital	02.01.1996 10.10.1996 09.08.1998	30.06.1996 31.12.1996 01.04.1999	1.4	Packing & Digital									31.8		24.3	21.3		
100	C.Selvarani T .No : T 22	Temporary (Woman) Digital	23.06.1997	24.03.1998	0.8	Digital										26.0	24.3			
101	M.Nagarajan T.No 289	Permanent (Left earlier to 2001)	10.07.1987	02.06.1994	6.9	Rough air Passing, Fine air Passing, Screening	19.4	10.7	17.7	15.2	23.3	12.9	25.0							

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt
(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
102	S.Vijaya T .No : T 149,T 51	Temporary (Woman) Digital	18.12.1997	04.01.1999	1.0	Digital										26.0	24.3	21.3		
103	M.Margreat T .No : T 102,T 66	Temporary (Woman) Digital	04.11.1996 02.01.1997 02.03.1998	31.12.1996 10.03.1997 04.04.1998	0.4	Digital									31.8	26.0	24.3			
104	R.Vijiyakumar	Not our employee			0.0															
105	M.Ramaiyah Contract	Comtract (Men)	01.06.1988	31.03.1999	10.7	Garden			26.4	31.9	24.2	22.6	22.2	26.1	31.8	26.0	24.3	21.3		
106	L.Pandy Contract	Comtract (Men)	01.08.1987	31.03.1999	11.7	Garden			26.4	31.9	24.2	22.6	22.2	26.1	31.8	26.0	24.3	21.3		
107	I.Roosily T .No : T 31,T 70	Temporary (Woman) Digital	03.10.1995 07.10.1996	31.12.1995 17.03.1997	0.7	Digital								26.1	31.8	26.0				
108	S.Balasubramanlayan T.No 129	Permanent (Left earlier to 2001)	10.09.1984	31.01.1989	4.3	Air Passing, Contracting	40.8													
109	F.Leo Joseph T.No : T 02, A 11, A 18	Trainee (Men)	02.01.1996	01.05.1997	1.4	Contracting,									17.3	60.0				
110	S.Edward Allocious T.No 249	Permanent (Left earlier to 2001)	14.10.1986	13.05.1997	10.6	Air Test	27.9	23.5	22.8	37.2	18.8	32.7	28.1	62.2	40.6	29.4				
111	K.Muthuraj T.No 242	Permanent (Left earlier to 2001)	22.09.1986	25.08.1992	5.9	Packing, Certification, Screening	21.9	13.3	21.5	31.4	17.5									
112	A.Antony samy Contract - Driver	Comtract (Men)	02.01.1988 01.02.1991	14.10.1990 04.03.1995	6.9	Contract Driver			26.4	31.9	24.2	22.6	22.2	26.1						
113	A.P.Allocious Jerome T.No : T 228	Temporary (Men)	14.09.1998	21.01.1999	0.3	Packing	17.5	13.3	14.1	20.4	12.2	15.2	21.7							
114	P.Shanthi T .No ; T 118	Temporary (Woman) Digital	16.09.1997	24.03.1998	0.5	Digital										26.0	24.3			
115	A.Peter Mathews T No : T 104	Temporary (Men)	22.04.1998	30.04.1998	0.0	Digital .											24.3			
116	R.Alagarsamy T.No 97 / 115	Permanent (Left earlier to 2001)	26.05.1984	31.07.1989	5.2	Screening, Non Mercury	22.7	16.4												
117	I.R.Antony T.No 94	Permanent (Left earlier to 2001)	22.05.1984	23.06.1989	5.1	End Opening, Bulb Forming.	13.3	6.7												
118	R.Ganesan T.No : T 92	Temporary (Men)	01.12.1991	31.12.1991	0.1	Packing Materials supply				31.9										
119	N.Krishnan T.No : 227	Casual (Men)	13.05.1986	09.04.1990	3.9	Ancillary Jobs & Materials handling.	27.9	16.5												
120	G.Agartha pretha T .No : T 77	Temporary (Woman) Digital	07.10.1996	30.11.1996	0.2	Packing									31.8					
121	K.S.Manikandan T.No : T 102, T 26	Temporary (Men)	29.08.1997	23.06.1998	0.8	Digital										26.0	24.3			
122	A.Laser T.No 150	Permanent (Left earlier to 2001)	02.05.1985	12.08.1996	11.3	Bulb Forming, Bulb Washing, 98 Inspection	16.3	8.5	15.3	28.7	33.3	23.3	31.2	12.8	13.3					
123	A.X.ArikiyaRavi	Not our employee			0.0															
124	E.Ramesh Selva Pandiyan T .No : 208	Casual (Men)	07.02.1986	18.08.1986	0.5	Test For Shake.														

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

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S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
125	A.Xavier T .No : 83	Permanent (Left earlier to 2001)	03.05.1984	30.11.1989	5.6	Certification.	8.3	11.3												
126	A.Alex Bernand T .No : 201	Permanent (Left earlier to 2001)	16.01.1986	27.07.1992	7.5	Certification.	13.9	7.2	10.5											
127	P.Jai T .No : T 79	Temporary (Men)	09.09.1991	07.11.1991	0.2	Packing Materials supply				18.3										
128	E.Neppolien T .No : T 24 T 47	Temporary (Men)	04.04.1994 01.08.1994	30.06.1994 31.12.1994	0.7	Packing							20.0							
129	B.Ramakrisnan T .No : T 22	Temporary (Men)	23.07.1990	30.11.1990	0.3	Packing			26.4											
130	I.Pandiyaraj T .No : T 115 T 176	Temporary (Men)	15.09.1997 15.05.1998	24.03.1998 14.12.1998	1.0	Digital										26.0	24.3			
131	V.George Junious T .No : 33	Permanent (Left earlier to 2001)	16.01.1986	01.01.1989	3.0	Rough Air Passing, Fine Air Passing.	26.0													
132	S.Johnson	Not our employee			0.0															
133	R.Ncelavanan T .No : T 07, T 96	Temporary (Men)	04.01.1994 01.08.1994 20.04.1998	30.06.1994 31.12.1994 14.08.1998	1.2	Canteen &Top Cutting							16.0				24.3			
134	A.Lingeswam T .No : T 167,	Temporary (Men)	10.06.1998	22.03.1999	0.8	Packing											8.3	23.3		
135	R.Pandiyarajan T .No : T 61,	Temporary (Men)			0.0	Air passing											33.3	20.0		
136	C.Rathinamuthu T .No : T 13,t 35, T 265	Temporary (Men)	01.07.1994 01.10.1996 23.11.1998	31.12 1994 31.03.1997 07.12.1998	1.2	Inspection							20.9		23.3					
137	K.Indren T .No : T 15 T166	Temporary (Men)	01.07.1994 10.06.1998	31.12.1994 19.06.1998	0.5	Air passing							19.0							
138	K.Muthusamy T .No : T 10,	Temporary (Men)	01.07.1994	31.12.1994	0.5	Air passing							21.6							
139	M.Murugesan T .No : 236,	Casual (Men)	04.09.1986	26.08.1987	0.9	Air passing														
140	M.Govindaraj Canteen	Contract (Men)	01.07.1996 01.11.1997	07.07.1997 04.05.2000	3.5	Canteen														
141	N.Ravichandran T .No : 261	Casual (Men)	23.01.1987	14.11.1990	3.9	Fine air Passing.	13.7	12.0	8.7						31.8	26.0			24.8	
142	T.Irudayaraj T .No : 177	Casual (Men)	14.10.1985	18.07.1989	3.8	Test for Shake	54.4	52.4												
143	A.Yesuraj T .No : 85	Casual (Men)	03.05.1984	19.06.1986	2.1	Test for Shake														
144	R.Thilakavathi T .No : T 96,T 23	Temporary (Woman) Digital	23.07.1997	13.05.1998	0.8	Digital														
145	R.Malsingh T .No : 39	Casual (Men)	01.02.1984	30.05.1986	2.3	Rough Air Passing										26.0	24.3			
146	A.Natarajan T .No :	Casual (Men)	06.02.1984	02.05.1984	0.3	Ancillary Jobs & Materials handling.														
147	A.Johnson	Not our employee			0.0															
148	V.Subramani Contract Driver	Contract (Men)	01.11.1996	30.09.2001	4.9	Driver														
149	K.Valravan T .No : T 28,	Temporary (Men)	04.01.1994	24.06.1994	0.5	Air passing							13.3		31.8	26.0	24.3	21.3	24.8	12.9

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt
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S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
150	S.Andal Easwary T .No : T 50	Temporary (Woman) Digital	27.01.1997	11.06.1997	0.4	Digital										26.0				
151	V.Thomas T .No : 86	Casual (Men)	04.05.1984	06.01.1986	1.6	Test For Shake														
152	A.Ramamoorthy T .No : 115	Casual (Men)	09.07.1984	30.12.1986	2.5	Test For Shake														
153	A.Thirupalani Chamy T.No 121	Permanent (Left earlier to 2001)	17.07.1984	01.02.1997	12.5	Certification, TFS.	8.9	9.4	23.8	29.7	12.8	18.3	19.0	30.0						
154	C.Carmel	Not our employee			0.0															
155	S.Sahayaraj T.No 277	Permanent (Left earlier to 2001)	20.04.1987	20.08.1997	10.3	Rough Air Passing End Opening	24.5	7.6	30.1	17.1	16.1	15.2	25.0	18.7	23.0	16.3				
156	R.Ramasamy Contract Garden	Comtract (Men)	24.03.1986	30.09.2001	15.6	Gardner			*26.4*	*31.9*	*24.2*	*22.6*	*22.2*	*26.1*	*31.8*	*26.0*	*24.3*	*21.3*	*24.8*	*12.9*
157	R.Annammal Contract Canteen	Comtract (Women)	02.01.1987	31.07.1993	6.6	Canteen	*22.7*	*16.4*	*26.4*	*31.9*	*24.2*	*22.6*								
158	V.Rajasekar T .No : 292	Casual (Men)	20.07.1987	01.07.1991	4.0	Laser	32.7	16.6	29.2											
159	B.Jeyaraj T .No : 23	Permanent (Left earlier to 2001)	02.01.1984	21.08.1989	5.7	Fill & Top Chamber, Bulb Forming, Grading.	21.0	14.3												
160	A.Rajendren T.No 56	Permanent (Left in 2001)	14.03.1984	09.11.2001	17.6	Maintenance	15.6	7.9	22.2	29.4	22.7	26.2	30.3	22.8	22.1	29.1	17.5	19.3	9.3	13.7
161	S.Sivaganam T.No 16	Permanent (Left in 2001)	01.01.1984	09.11.2001	17.8	Service , Packing, Maintenance.	44.5	11.7	23.9	16.1	25.0	26.7	21.4	23.3	49.9	27.8	23.9	25.0	25.0	11.9
162	A.Paulraj T.No 157	Permanent (Left in 2001)	15.05.1985	09.11.2001	16.4	Maintenance, Laser	22.2	12.6	47.8	62.5	13.3	31.1	23.3	20.3	16.7	22.7	17.0	23.2	25.5	18.4
163	A.Arul samy T.No T 39,T 18 , A 13 , 345	Permanent (Left in 2001)	01.01.1993 08.07.1993 01.01.1995	30.06.1993 12.01.1994 09.11.2001	8.8	Packing, Fixing, Passing, Grading						19.6		33.3	54.3	29.2	27.6	19.0	31.5	13.3
164	P.Anandaraja T.No 280	Permanent (Left in 2001)	22.04.1987	09.11.2001	14.5	RAP, Contracting, Test for shake.	32.5	28.8	21.9	21.4	24.2	17.6	21.1	29.4	31.9	20.3	24.8	17.7	20.9	7.6
165	Late P.Natarajan T.No 20	Permanent (Left in 2001)	01.01.1984	09.11.2001	17.8	End Cutting, Stem Cutting	27.1	10.2	21.6	14.0	10.0	26.7	17.7	11.3	17.0	14.2	8.3	26.2	45.8	11.9
166	S.Palanichamy T.No 50	Permanent (Left in 2001)	05.03.1984	09.11.2001	17.6	Bulb Forming, Quality Assurance	9.1	6.7	13.3	17.0	16.2	13.3	17.0	33.3	11.6	9.3	10.4	15.7	17.9	8.3
167	K.Kaliraj T.No 190	Permanent (Left in 2001)	09.12.1985	09.11.2001	15.9	Stem Cutting, Top Making Contracting.	26.7	15.3	31.3	14.4	12.8	22.8	21.3	21.7	36.6	36.7	26.7	18.2	22.6	7.1
168	H.Sahayaraj T.No 49	Permanent (Left in 2001)	28.02.1984	09.11.2001	17.7	Shake out,TFS Contracting. Cold bulb oven , Grading.	6.7	18.5	20.8	33.9	20.4	23.7	22.7	34.3	22.9	30.0	28.9	26.1	22.4	8.3
169	S.Haridoss T.No 323	Permanent (Left in 2001)	30.07.1990	09.11.2001	11.3	Service			62.5	35.3	24.4	27.2	31.9	26.7	23.3	22.4	15.7	13.8	16.7	9.8
170	P.Ganesan T.No 284	Permanent (Left in 2001)	12.05.1987	09.11.2001	14.5	Fine Air Passing, Certification	14.5	8.9	11.0		15.3	16.2	22.1	19.3	68.6	58.5	50.4	22.8	30.1	8.5
171	S.Selvaraj T.No 89	Permanent (Left in 2001)	08.05.1984	09.11.2001	17.5	Certification, Quality assurance	21.3	14.3	14.8	25.7	17.1	21.3	25.3	34.2	25.9	28.3	22.2	24.3	32.8	20.5
172	A.Robert T.No 76	Permanent (Left in 2001)	11.04.1984	09.11.2001	17.6	Fixing, Top Cutting, RAP	25.0	11.0	17.0	23.0	15.0	23.0	33.0	25.0	45.0	30.0	29.0	24.0	39.0	16.0
173	K.Kannan T.No 348	Permanent (Left in 2001)	02.01.1993 01.01.1995	31.12.1993 09.11.2001	8.8	Grading, Laser, Fill & Top Chamber						20.0	16.7	19.6	34.3	29.7	24.2	51.2	40.9	24.6
174	S.Shajahan T.No 259	Permanent (Left in 2001)	23.01.1987	09.11.2001	14.8	Laser, Grading, Inspection	6.7	10.3	16.2	42.6	18.9	14.2	21.9	23.3	23.3	23.8	22.3	21.2	25.4	9.8
175	S.Ramachandran T.No 226	Permanent (Left in 2001)	01.01.1985	09.11.2001	16.8	Service	7.8	17.8	47.9	60.8		21.9	20.9	26.7	34.2	25.0	30.0	16.2	23.9	16.3
176	R.Isac Newton T.No 43	Permanent (Left in 2001)	01.02.1984	09.11.2001	17.8	End Cutting, Screening	14.8	11.7	27.3	39.7	15.2	12.3	18.3	31.1	29.0	21.4	22.8	29.4	20.9	11.1

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in Italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
177	D.Pragasam T.No. 31	Permanent (Left in 2001)	02.01.1984	09.11.2001	17.8	Maintenance, Top Making M/adj.	43.7	15.9	19.7	41.0	186.7	26.1	18.3	29.4	51.7	48.3	68.9	23.6	22.5	15.7
178	M.Subramaniyam TNo 222	Permanent (Left in 2001)	16.04.1986	09.11.2001	15.6	Bulb Forming, Screening, Digital, NMT	17.0	23.0		19.5	10.0	15.4	17.6	25.2	46.8	21.7		11.2	7.6	6.6
179	A.Inico Jerold T.No. 188	Permanent (Left in 2001)	09.12.1985	09.11.2001	15.9	Non Mercury, Fill Room	53.3	26.2	48.6	59.7	26.7	38.0	32.2	38.7	84.0	48.1	48.5	47.6	16.6	11.7
180	P.Pandy T.No. 090	Permanent (Left in 2001)	08.05.1984	09.11.2001	17.5	Bulb Forming M/adj., Top Sealing	14.1	21.1	27.3	26.9	18.7	20.5	16.4	13.3	12.9	21.3	12.9	16.6	31.5	11.1
181	A.Arul doss T.No. 175	Permanent (Left in 2001)	14.10.1985	09.11.2001	16.1	Air Test, End open, Laser.	12.3	20.7	24.3	35.6	15.7	27.1	13.7	17.8	23.3	11.1	14.4	19.2	18.8	9.3
182	V.Shankar T.No. 166	Permanent (Left in 2001)	19.11.1985	09.11.2001	15.9	Grading,Packing & Digital.	16.3	15.6	16.9	17.9	12.1	18.3	20.6	19.7	15.0		11.1	22.7	44.8	23.7
183	S.D.Krishnan T.No. 328	Permanent (Left in 2001)	06.08.1990 01.06.1991	31.12.1990 09.11.2001	10.8	Screening, FAP				54.8	33.7	18.6	25.7	23.7	29.0	29.3	22.2	18.7	26.8	12.9
184	P.Subbaiyan T.No. 078	Permanent (Left in 2001)	11.04.1984	09.11.2001	17.6	Laser, Certification	13.1	12.9	11.3	17.3	15.2	31.1	21.5	22.6	28.2	31.4	33.6	22.2	25.0	9.6
185	P.Balakrishnan T.No. 248	Permanent (Left in 2001)	07.10.1986	09.11.2001	15.1	Laser, Inspection, Grading.	21.3	9.8	18.7	19.2	13.9	17.0	19.5	30.0	20.1	24.6	16.3	16.5	25.3	9.5
186	K.Sridher T.No. 163	Permanent (Left in 2001)	17.06.1985	09.11.2001	16.4	Certification, Quality Assurance	36.9	17.1	32.9	46.9	67.3	15.6	20.7	18.3	25.8	26.4	22.0	18.4	25.0	8.4
187	D.Ravichandran T.No. 354	Permanent (Left in 2001)	10.08.1992 01.04.1994	09.10.1993 09.11.2001	7.8	Packing, Air Passing					6.7	21.7	17.1	19.7	47.4	72.5	34.2	19.5	21.6	22.1
188	K.V.Veera pandiyan T.No. 101	Permanent (Left in 2001)	28.05.1984	09.11.2001	17.4	TFS, NCI,	23.7	14.3	29.7	16.2	15.0	23.7	20.9	22.9	37.7	25.8	22.5	30.2	19.2	11.4
189	A.Kannan T.No. 111	Permanent (Left in 2001)	07.06.1984	09.11.2001	17.3	Screening, QA.	23.7	13.1	16.0	72.5	16.1	26.7	17.8	32.2	25.2	30.4	22.5	29.0	29.5	15.7
190	D.Sooriya Narayanan T.No. 185	Permanent (Left in 2001)	19.11.1985	09.11.2001	15.9	Top Making, Quality Assurance	29.1	12.5	24.2	47.6	17.1	17.3	20.0	19.0	28.9	29.2	29.0	24.5	25.6	14.6
191	A.Andrews T.No. 195	Permanent (Left in 2001)	02.01.1986	09.11.2001	15.8	Bulb Formoing, Screening	23.0	20.6	15.5	12.7	22.5	16.7	20.3	25.5	37.7	23.3	10.0	12.1	10.2	7.3
192	M.Antony Doss T.No. 281	Permanent (Left in 2001)	22.04.1987	09.11.2001	14.5	Screening (Dark room)	28.0	15.6	19.6	46.4	20.0	18.5	22.7	31.4	30.1	33.9	25.9	19.4	29.7	17.9
193	M.Balasundaram T.No. 401	Permanent (Left in 2001)	01.01.1999	09.11.2001	3.8	Scavenging, Flame Scale Setting.											30.0	18.4	28.3	9.6
194	V.P.Murugesan T.No. 359	Permanent (Left in 2001)	01.10.1995	09.11.2001	6.1	Packing, Top Making, Distilation.											47.7	44.0	66.3	19.8
195	G.Balakrishnan T.No. 355	Permanent (Left in 2001)	03.04.1994 01.08.1994	30.06.1994 31.12.1994	6.9	Packing, Screening (cold bulb oven)							23.3	20.0	44.7	64.4	25.6	24.5	26.6	17.6
196	V.Natarajan T.No. 169	Permanent (Left in 2001)	26.08.1985	09.11.2001	16.2	Certification, Top Cutting, Laser, Shake out.	19.4	13.2	18.9	15.0	28.7	20.4	15.4	23.7	19.4	23.3	19.3	25.8	31.3	17
197	S.Kanakarathinam T.No. 193	Permanent (Left in 2001)	02.01.1986	09.11.2001	15.9	Laser, Inspection, Screening.	19.6	12.6	12.3	16.2	9.5	16.1	19.7	18.7	28.9	29.6	20.8	23.9	27.9	13.1
198	A.Lourdu Yesu Rajan T.No. 118	Permanent (Left in 2001)	14.07.1984	09.11.2001	17.3	Grading,Laser, Shake out (Screening)	25.8	21.0	44.3	33.1	36.0	23.7	21.0	27.6	26.7	30.8	21.0	25.6	23.7	12.1
199	V.X.Joseph T.No. 131	Permanent (Left in 2001)	17.09.1984	09.11.2001	17.2	Rough Air Passing	8.2	12.0	17.2	27.8	11.7	22.0	22.0	27.1	25.5	33.1	26.3	26.8	25.9	82.6
200	J.S.Sahayaraj T.No. 301	Permanent (Left in 2001)	24.02.1986	09.11.2001	13.7	TFS, Grading.	6.7	7.6	14.1	13.0	18.9	14.8	21.8	23.3	28.3	20.6	19.3	12.6	21.2	13.0
201	S.Kannan T.No. 256	Permanent (Left in 2001)	05.01.1987	09.11.2001	14.8	Fill Room.Bulb Washing.	9.5	14.1	85.5	42.8	13.9	13.3	20.0			55.2	47.6	58.3	52.5	11.9
202	Late A.Muthukrishnan	Comtract (Men)	02.01.1991	25.03.1999	8.2	Dhobi				31.9	24.2	22.6	22.2	26.1	31.8	26.0	24.3	21.3		

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
203	Late G.A.Kannan T .No : 331	Permanent (Left earlier to 2001)	21.10.[illegible]	.2.02.1996	4.3	Packing, Certification, Digital														
204	Late S.Arokiyaselvem T .No : 103	Permanent (Left earlier to 2001)	02.06.1984	28.07.1992	8.0	Certification, Laser, Sort out.							23.8	17.8						
205	Late M.Chistopher T .No : 170	Permanent (Left earlier to 2001)	10.09.1985	27.11.1990	5.3	Contracting.	15.6	14.4	15.6											
206	E.Anjala Mary Contract Garden	Comtract (Women)	01.02.1993	30.09.2001	8.7	Garden	24.0	16.9	15.0											
207	Late R.Mahesh Kumar T .No : 120	Casual (Men)	17.07.1984	18.12.1985	1.4	Operator	*26.0*	*17.3*	*11.3*	*24.8*	*27.9*									
208	V.Poonkodi	Not our employee			0.0															
209	Late M.Thiruti[illegible]	Contract (Men)	01.01.1985	06.01.1996	11.0	Gardening														
210	Late M.Sasikumam T .No : T 35.	Temporary (Men)	23.07.1990	11.12.1990	0.4	NA	*22.7*	*16.4*	*26.4*	*31.9*	*24.2*	*22.6*	*22.2*	*26.1*	*31.8*					
211	Late E.John Britto	Not our employee			0.0				15.0											
212	Late K.Udayakumar T .No : 167	Permanent (Left earlier to 2001)	03.07.1985	28.07.1992	7.0	End Opening														
213	S.Amulu Contract Garden	Comtract (Women)	02.01.1989 01.02.1993	28.10.1990 30.09.2001	10.5	Dhobi	15.2	14.4	22.5											
214	M.Murugalah	Not our employee			0.0				*26.4*			*22.6*	*22.2*	*26.1*	*31.8*	*26.0*	*24.3*	*21.3*	*24.8*	*12.9*
215	S.Irudayaraj	Not our employee			0.0															
216	D.Vasantha T .No : T 104	Temporary (Woman) Digital	04.11.1996	19.08.1997	0.8	Digital														
217	A.Suresh Paulraj	Not our employee			0.0															
218	M.Latheef T .No :	Casual (Men)	18.04.1984	02.05.1984	0.0	Ancillary Jobs & Materials handling.									*31.8*	*26.0*	*24.3*			
219	J.Gracy T .No : T 31	Temporary (Woman) Packing	02.01.1996	26.02.1996	0.2	Packing														
220	K.Velsamy	Not our employee			0.0															
221	A.Gerald Majela	Not our employee			0.0										*31.8*					
222	A.Marks T .No : T 310	Temporary (Men)	26.03.1999	08.05.1999	0.2	Packing														
223	A.Amolorbhavamar y	Not our employee			0.0															
224	A.K.Prem Nasir T .No : T 60, T 01	Temporary (Men)	01.08.1994 02.01.1996	01.08.1994 30.05.1996	0.5	Packing & Bulb Washing												*21.3*		
225	S.Sakarios T .No : 051	Permanent (Left earlier to 2001)	05.03.1984	07.07.1989	6.3	Grading	23.0	8.0					22.2		*31.8*					
226	S.Vijiyakumar	Not our employee			0.0															
227	R.Mahajothi	Not our employee			0.0															
228	S.Jayalakshmy T .No : T 146	Temporary (Woman) Digital	27.05.1998	08.02.1999	0.7	Digital														
229	V.Sivakumar	Not our employee			0.0															
230	J.Vinoth Raja T .No : T 336	Temporary (Men)	03.05.1999	08.05.1999	0.0	Packing											*24.3*	*21.3*		
																		21.3		

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
231	P.Ganesan Contract	Comtract (Men)	02.01.1991	07.04.1991	0.3	Garden				*31.9*										
232	S.P.Senthil Kumar T .No : 361	Permanent (Left earlier to 2001)	03.10.1995 01.07.1996	31.12.1995 01.06.1999	3.0	Digital														
233	S.P.Ramesh Kumar	Not our employee			0.0									*26.1*	*31.8*	*26.0*	*24.3*	*21.3*		
234	S.Amirthavalli T .No : T 325	Temporary (Woman) Digital	05.04.1999	08.05.1999	0.1	Digital												*21.3*		
235	K.M.Akbar sait	Comtract (Men)	22.01.2001	08.01.2003	2.0	SDB Security														*12.9*
236	V.GanaSabastian	Not our employee			0.0															
237	P.Chelladurai T .No : T 04, T 33, T 41	Temporary (Men)	01.07.1994 05.02.1996 01.10.1996	31.12.1994 30.06.1996 31.12.1996	1.2	Packing														
238	M.Yesuraj Contract	Comtract (Men)	01.08.1993	01.04.1996	2.7	Canteen							25.0		40.5					
239	A.Jayabalan	Not our employee			0.0							*22.6*	*22.2*	*26.1*	*31.8*					
240	V.Ravikumar	Not our employee			0.0															
241	S.Kamachi T No T 317	Temporary (Woman) Dipital	01.04.1999	05.05.1999	0.1	Digital												*21.3*		
242	L.Amutha T No T-316	Temporary (Woman) Digital	01.04.1999	02.04.1999	0.0	Digital												*21.3*		
243	G.S.John Prabhakaran	Comtract (Men)	01.11.2000	30.09.2001	0.9	Garden													*24.8*	*12.9*
244	G.Dency Selvarani T No T 122	Temporary (Woman) Digital	03.05.1998	19.06.1998	0.1	Digital											*24.3*			
245	S.Suseela	Comtract (Women)	02.01.1993	31.12.1999	7.0	Garden						*22.6*	*22.2*	*26.1*	*31.8*	*26.0*	*24.3*	*21.3*		
246	P.Maliga	Not our employee			0.0															
247	S.Anantharaman T .No : T 89	Temporary (Men)	06.08.1990	17.12.1990	0.3	Air Passing				*10.0*										
248	S.Amir Syed Abdahis,	Not our employee			0.0															
249	S.Durai raj Contract - Garden	Comtract (Men)	01.01.1985	30.09.1993	8.8	Garden			*26.4*	*31.9*	*24.2*	*22.6*								
250	K.Mohan doss T No : 154	Casual (Men)	10.05.1985	09.02.1988	2.8	Certificatin	*26.0*													
251	P.Ganasekaran	Not our employee			0.0															
252	B.Senthil Kumary,	Not our employee			0.0															
253	M.Paraman T .No : T 26, T 14	Temporary (Men)	05.06.1992	16.10.1992	0.3	Packing					*18.3*									
254	G.Gopika rajini T No T 97	Temporary (Woman) Digital	17.04.1998	17.07.1998	0.3	Digital											*24.3*			
255	B.Salathe rani,	Not our employee			0.0															
256	G.John Sahaya Prabhu T .No : T 137	Temporary (Men)	12.05.1998	06.02.1999	0.7	Digital											*24.3*	*21.3*		
257	A.Prabhu T .No : T 61	Temporary (Men)	01.08.1994	31.12.1994	0.3	Packing							*16.2*							
258	A.Mark Antony	Not our employee			0.0															
259	S.Antony Gerald T .No : T 24	Temporary (Men)	01.07.1996	10.08.1996	0.1	Screen Washing									*10.0*					
260	S.Jerome	Temporary (Men)	03.07.1996	05.08.1996	0.1	Shake out									31.8					

Ex-employees Data : Category, Service period , Section of work and Yearly mean urine readings in mcg/lt

(Figures in italic are group mean value)

S.No as per the Doc.	Name T.No	Category of ex-employee	Service Period From	To	Service in years	Section of work	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
261	A.Arokiyaramesh T .No : T 53	Temporary (Men)	01.04.1993	19.04.1993	0.0	Packing, Air Passing.														
262	A.Alex,	Not our employee			0.0							22.6								
263	A.Robert T.No : T 12, A 17, A 10, A 04, A 01	Trainee (Men)	02.01.1995 03.10.1995 01.07.1996	28.02.1995 31.12.1995 05.09.1998	2.5	Non Mercury														
264	S.Justin T .No : T 40, T 17 T 34	Temporary (Men)	07.10.1992	23.08.1993	0.8	Packing								26.1	31.8	26.0	24.3			
265	A.Raja,	Not our employee			0.0							32.0								
266	P.Senthil Kumar T .No : T 59, T 03, T 15, T 09, T 03, T 34	Temporary (Men)	01.07.1991 18.05.1992 04.01.1994 01.08.1994	17.02.1992 04.08.1992 30.06.1994 31.12.1994	1.8	*Air Passing*														
267	T John,	Not our employee			0.0					*13.3*			*20.0*							
268	J.Shekaabdulha	Contract (Men)	06.10.1997	10.03.1998	0.5	SDB Security														
269	R.Komalavali T No T 217	Temporary (Woman) Digital	24.08.1998	31.03.1999	0.6	Digital										*26.0*	*24.3*	*21.3*	*24.8*	
270	P.Jancy T No T 80	Temporary (Woman)	11.06.1997	31.12.1997	0.5	Digital											*24.3*	*21.3*		
271	S.Francies Hrrington T.No. 74	Permanent (Left in 2001)	04.04.1984	09.11.2001	17.5	Certification, Bulb Forming										*26.0*				
272	R.Salathen	Not our employee			0.0		25.5	10.3	15.1	14.0	10.0	22.9	23.3	13.3	12.5	18.2	8.3	9.2	18.4	10.9
273	S.Prabhakaran T.No. 194	Permanent (Left in 2001)	02.01.1986	09.11.2001	15.8	Grading,														
274	F.SelvamSamuvel T .No : T 05, T 17, T 44,	Temporary (Men)	06.07.1992 04.01.1994	07.10.1992 05.12.1994	1.2	Air Passing & Packing	20.0	13.8	47.1	16.9	11.3	18.6	20.7	25.8	21.2	25.4	23.7	24.8	24.8	17.3
275	B.SelvaRani T No T 200	Temporary (Woman) Digital	10.08.1998	21.01.1999	0.4	Digital				26.1	35.8		27.8							
276	V.Daisy T No T 226	Temporary (Woman) Digital	09.09.1998	05.06.1999	0.8	Digital											*24.3*	*21.3*		
277	S.Charlie Joseph T.No. 37	Permanent (Left in 2001)	19.01.1984	09.11.2001	17.8	Machine Adjuster - Contracting, Top making -Service NMT											24.3	21.3		
278	A.Sahayam,	Not our employee			0.0		14.3	33.9	24.8	63.8	55.0	26.0	19.5	104.7	97.1	58.7	21.5	18.9	9.7	6.3
279	S.Rajah T .No : 107	Casual (Men)	07.06.1984	07.01.1986	1.6	Non Mercury														

Annexure -7

Details on methodological aspects of urine mercury analysis and the provision of personal protective equipments provided by the respondents

220

Response to queries on filter masks and mercury estimations

Query: The details regarding use of filter and cartridge masks. Supply of masks and type provided in different sections. Deviances, if any.

Mercury cartridges were used by employees in the Fill room, Distillation section and Crusher (recovery room) areas. Such employees were very few in number. Others in the manufacturing area were using ordinary masks (which were either cloth masks or a 3M mask). The use of cartridge based protective wear was only justified in the filling, distillation and recovery rooms where mercury vapor levels could be higher than in the general manufacturing areas.

Supply of PPE was never an issue. Use of PPE by workmen was monitored and enforced by the section supervisors.

From an occupational health perspective the use of personal protective equipments (PPEs) assumes importance at exposure levels which could get higher than those prescribed under the relevant statutes – because the PPEs would then act as final line of defense. PPEs are never meant to be the first line of defense.

However if exposures levels are generally low (as has been the case in the erstwhile thermometer factory) then these PPEs are an additional safeguard and not the last line of defense. Having stated this we would reiterate that at no instance were employees working without PPEs – **an irrefutable fact corroborated on site by the petitioner's representative.**

In addition may I draw the attention of the committee members to the affidavit filed in the honorable high court at Chennai by Mr. Mahindran the President of the Ponds & Hindustan Lever Limited Ex-Mercury Employees' Welfare Association , where, in his sworn affidavit dated 19th April 2006 he substantiates the fact that employees were indeed provided cloth masks or cartridge based masks (crusher area) - Please see Item 26 of his affidavit on page 11.

I have in the earlier paragraphs alluded to the utility of PPEs as a final line of defense. The fact is that occupational health and safety measures in place were thorough enough to prevent deviations from accepted health and safety norms. While these measures have been shared with the committee members it will be worthwhile to reiterate the same since they have a bearing on the issues raised by the committee :

Occupational safety and environmental monitoring measures in place

When the plant was in operation, the mercury concentration in the area was monitored using a gold film mercury vapour analyzer [Jerome Sampler] with a self-calibrating facility. Fifteen to twenty two air-monitoring locations were spread across the mercury area, non-mercury area, distillation room, crushing room and external to the workplace.

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221

The intention was for the mercury in the atmosphere to be controlled to less than 0.05 mg/m^3 of air by adopting the following measures:

- Total of 25 exhaust fans fitted along the southeastern wall of the *mercury area* to turnover the 15,145 m^3 of open area every 45 minutes for 16 hrs/ day for 310 days a year.
- A total of 6 exhaust fans were provided along the northeastern wall of the *mercury crusher building* for an air change of 288 m^3 of area every 5 minutes for 24 hrs/day, 310 days per year.
- Total of 5 exhaust fans along the southeastern wall of the *mercury distillation building* for an air change of 166 m^3 of area every 4 minutes for 8 hrs/day, 310 days per year.
- Provision of vacuum cleaners equipped with water seals to collect broken thermometers when breakage occurred.
- Scrubbing and washing of the factory floor once a day with water to remove traces of mercury. This water was treated at the ETP.
- Employees were provided with cartridge type respirators in the filling, crushing and distillation areas and ordinary masks in the other areas

The factory layout was designed keeping in mind the principles of good manufacturing practice (GMP).

Occupational health surveillance measures in place

- All employees underwent a monthly monitoring of mercury in urine through the use of an Atomic Absorption Spectrometer to regulate Hg in urine to be within the WHO recommended individual limit of 100 µg/Lit · Employees whose mercury levels exceeded 100 µg/Lit were deployed out of the mercury area and in all such cases the mercury levels came back to acceptable levels within 1-2 months.
- This was supplemented by an annual clinical evaluation with specific emphasis on the oral cavity, lungs, cardiovascular system, the eyes, skin, kidneys and the central nervous system. The medical tests also included blood tests (hemogram) and routine urine examination for albumin, red blood cells, casts, crystals and sugar. Records of 130 employees are available from 1988. Medical records of 184 employees/ casual/contract workers who left the company and of others whose services were terminated in the recent past are also available.
- Group averages for mercury in urine for employees over the period 1998 to 2001 show an annual range between 13 and 32 µg/Lit., and are well within the WHO recommended group limits of 50 µg/Lit.

If the masks especially in the filling, crushing or distillation rooms were not used properly it would have shown up immediately in the biological monitoring data and alerted the trigger point for job rotation.

In essence it meant that for whatever reason if an employee had more than acceptable limits he would be immediately redeployed. Such cases of redeployment throughout the working life of the plant were < 1%, where spot readings of mercury in urine were more than 100 micrograms / litre.

A biological monitoring measure at an interval clearly superior to any such measure recommended by national or international agencies ensured that employees never had any mercury related exposure of health related significance.

Hence from a scientific perspective the issue is to do with the impact, if any, on the health of individuals and not on hearsay that we were or were not providing masks to some individuals though all available evidence clearly indicates that these safety measures were indeed adhered to.

Let's now assume for the sake of assumption that either we did not provide masks to the employees or they did not use them. How would this be known? Is there a way of finding out if personal protective measures were indeed given 15 years back or were given but not used ?

The only sure way of coming to a conclusion on the efficacy of any health and safety measures in place is to look at personal chronic exposure levels as evidenced by the results of biological monitoring. I would like to share with the committee the triennial urine mercury levels in both the hazardous (filling, distillation and crusher areas) and the non-hazardous (manufacturing) areas.

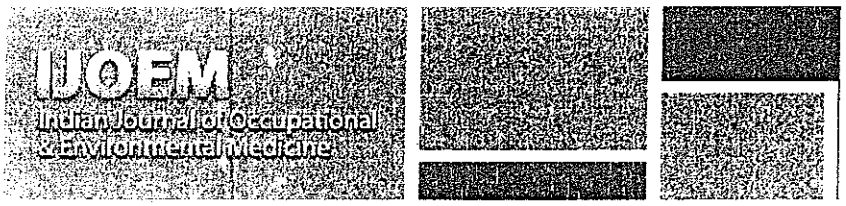

Table 6: Triennial urinary mercury levels (mean±SD) in permanent employees

Triennial period	Hazardous section* HgU (µg/L)		Non-hazardous section HgU (µg/L)		
	N	Mean±S.D.	N	Mean±S.D.	t va
1988-1990	19	26±26	161	21.5±23.2	0
1991-1993	19	30.1±29.5	134	25.5±25.8	0
1994-1996	17	25.4±19.?	131	25.9±19.6	-(
1997-1999	13	27.4±20.2	109	22.6±16	0
2000-2001	13	26.8±20.4	113	19.1±15.7	1
Overall	37	27.1±24.1	253	23.2+21.0	0

*Hazardous section depicts the distillation, mercury filling and crusher sections. **t values are statistically insignificant indicating no difference between the two

Source: Rajgopal T. et al : Epidemiological surveillance of employees in a mercury thermometer plant: An occupational health study. IJOEM April 2006 – Volume 10 – Issue 1. page 14.

As can be seen from this table only a maximum of 19 employees worked in the hazardous sections of the plant – and biological monitoring of employees in the entire plant reveals very low levels of exposures in both the hazardous and the non-hazardous areas. .

Query: Urinary mercury level estimation: whether it was a planned monthly or a randomly done. Was it done on Mondays or Fridays, etc. How was the report shared with the workers. How involved were the workers in the safety measures / practices.

Urine analysis was done regularly in all working days of the week. A fixed number of employees (5 to 10) were examined in a day.

- In the beginning years when the employees' strength was high, ten employees were analyzed in a day. In the later part of the years when the employees' strength was low, five employees were analyzed in a day. If any employee forgot to give urine sample or absent on the scheduled day for analysis, then he was covered in the next scheduled day.
- Urine examination was done for all the permanent employees. Also urine examination was done for trainee and temporary employees who were engaged in mercury area continuously. Such reports are also available with the unit.
- Women (permanent & temporary) employees were engaged in digital, non-mercury, packing (post manufacturing) and as office assistant. They were never engaged in mercury area. Hence, no urine analysis was done.
- Contract employees (men & women) were engaged in gardening, canteen, security, driver and occasionally for loading of packed cases. They were never engaged in mercury area. Hence, no urine analysis was done.

If the urine analysis result was higher than 100 mcg/lit, then the plant manager and the section supervisor was informed immediately by the lab personnel. The supervisor informed the worker concerned about the high urine value and moved him out of mercury area to non-mercury area. The worker was brought back to the mercury area only after his urine value came down.

All the workers were members of Employees Union. It was possible to move workers from one workplace to another only after assigning reason for that. All the employees and Union were aware of the fact that they were moved out of mercury area only if the mercury value in urine was more than 100 mcg/lit.. Such instances of spot readings exceeding 100 mcg/ lit were very rare < 1% throughout the working life of the plant.

The standard practice at the plant was to do a pre-shift CVAAS of the employee's urine sample. It could be done on any day depending on when his turn came on the roster of monthly evaluations. From a scientific perspective it does not make a difference if done on the Monday or the Friday since what we measure is the body burden as reflected by accumulated mercury usually over a period of 60 days. Once you have a series of such measures it accurately captures the overall chronic exposure data. That's the reason why WHO only advocates collection of sample at the pre shift level but does not recommend any specific day i.e. end of the weekly shift. There is adequate reference in literature for this approach.[1]

[1] Biological monitoring of chemical exposure in the workplace – Volume 1 World Health Organization 1996 (International Programme on Chemical Safety). Section on mercury. Pages 132 – 155.

Chronic exposure details are best exemplified by urine analysis which reflects cumulative exposure over the previous 2 – 4 months. [2,3,4,5].

[2]. Foa V, Bertelli G. Mercury. In : Biological Indicators for the assessment of human exposure to industrial chemicals. Vol. 3 Alessio L, Berlin L, Boni m, Roi R (Eds). Commission of European Communities, Ispra, Italy 1986: 29 – 46.
[3]. Clarkson TW, Hursh JB et al.Mercury in : Biological monitoring of Toxic Metals. Clarkson TZ, Friberg L et al)Eds). New York,Plenum Press, 1988: 199 – 246.
[4]. Anon, Mercury – Elemental and Inorganic. Applied Occupational and Environmental Hygiene, 1990::5: 545-52.
[5]. Lauwerys RR, Hoet P. Industrial Chemical Exposure. Guidelines for Biological Monitoring. Lewis Publishers: 1993; 174-82.

Also diurnal variation in mercury concentration does not get affected by shift work[6]

[6]. Bell ZG, Lovejoy HB, Vizena TR. Mercury exposure evaluation and their correlations with urine mercury excretions. 3. Time weighted averages (TWA) mercury exposure and urine mercury levels. Journal of Occupational Medicine 1973: 15:501-8.

I would also like to address an important aspect of what is the prescribed periodicity under relevant statutes in India ?

In India neither the Indian Factories' act nor the Tamil Nadu Factories' rules specify that a unit handling mercury should do any biological monitoring.

Hence we would appreciate if the committee takes cognizance of the fact that as a responsible employer we were clearly doing all , to protect the heath and safety of our employees - in this case doing the biological monitoring which is the gold standard to look at exposures, at a periodicity clearly in excess of any national or international recommendations.

Biological monitoring measures the cumulative body burden due to any route of exposure in an industrial setting. Such exposures in a factory setting are usually due to inhalation and in less than 3% of the cases due to dermal absorption. Absorption through food is not considered a route of exposure to workplace mercury since elemental mercury does not get digested / absorbed through the gut and passes out of the body in the faeces.

How reliable are these readings and the methodology used ?

I have in my earlier note to your committee elucidated the fact that various national and international experts and institutions have gone into this aspect and have unequivocally upheld both the methodology and the records. Please refer to my submissions under the heading "Integrity of exposure data on hand including biological monitoring details" and the section on "Expert opinion on hand from leading national and international experts and institutions".

Query: Employee's knowledge about safety systems

- Employees were provided training on safe mercury handling procedures prior to engaging them on the job.
- Safety instructions, toxic nature of mercury, Use of PPEs, safe operating procedures etc. were displayed at work area and prominent locations at the factory. These instructions were in English and Tamil.
- Employees were using PPEs including mask and mercury cartridges. Also they were changing into work uniforms while at work and leaving the uniform at factory for washing. They were never allowed to take uniforms to home.
- Factory had a safety committee which was functioning effectively.
- Workers were informed about the purpose of giving urine samples and urine analysis for mercury.
- Workers were aware about the purpose of mercury vapour monitoring, which was carried out in the work area during working hours.
- Factory had an appraisal system which considered workers knowledge about safety systems and procedures.
- Workers were aware of safety systems and following the procedures including : (i) exhaust fans running at mercury area , fill room, distillation room , recovery room to expel mercury vapours out from work area (ii) Keeping the mercury area wet by sprinkling water on the floor in order to minimize vapourisation of mercury (iii) handling procedures for broken thermometers
- Maintenance of register in form 26 (register of accidents) and 26A (register of dangerous occurrences). These were maintained by the factory even though it was not required to be maintained under law – but was done as a part of the overall administrative decision for the overall safety of the workers.

All these have been documented in our submission to the honorable high court including providing specific examples of all these aspects (For your ready reference I am including a few relevant examples)

- Vol. 1 Page 173 – New employee indoctrination proforma - please see section 3 dealing with systems , procedures, safeguards including emergency procedures and routine physicals which would train employees on relevant health and safety aspects.
- Vol 1 page 287 –289 Affidavit on biological monitoring
- Vol. 1 page 290- 291 Sample of a urine analysis record register
- Vol.1 page 293 – A sample urine biological monitoring report of an employee.
- Vol 1 266 – 286 Display of safety instructions and standard operating procedures - These were displayed prominently and a copy of these along with relevant photographs are annexed in the Vol. 1 submitted to the honorable high court.
- Safety committee meetings – a sample of such meetings drawn from across the various years has also been appended on pages 325 – 332. of the said Volume

1. The representatives to the safety committee were drawn from across various departments in the factory.

- Also refer to the affidavit by an employee who worked from the inception of the factory till 2001 and, he details various health and safety measures including the existence and functioning of safety committee.

- Vol VI of the respondent's submission - pages 1 & 2. The annual training of the employees tested their knowledge on safety and a copy of such an Annual Training Certificate countersigned by the department supervisor and the personnel supervisor has been submitted to the honorable high court as evidence of the same.

- Standing orders emphasizing the compliance with safety provisions Vol. 1 pages 192-216. : In addition to the measures listed above the standing orders of the company clearly listed the "Failure to observe safety instructions as amounting to Misconduct – refer item number 25 under serial number 22 dealing with what constituted Misconduct under the standing orders. This has been submitted to the honorable high court as further evidence to the fact that every single employee knew about safety procedures in place. Under the same section on Misconduct see item number 51 which deals with the issue of failure to wear uniform or shoes. These violations could be punishable by suspension or even dismissal. As a commitment to safety standards the factory agreement entered between the management and workers of the factory clearly provided that *"thermometers produced violating any of the safety rules and regulations will not be considered for incentive calculation"*. That reflected our commitment to safety which we would not compromise even at the risk of losing production.

I trust that our response would answer the queries raised by the committee. Please do let me know if your committee needs any additional inputs.

Dr. T. Rajgopal
8th November 2007.

Annexure - 8

Report of Dr. S.K. Dave (committee member) on the site visit and clinical evaluation of ex-employees at Kodaikanal

228

A petition was filed in the high court of Madras (Special Original Jurisdiction) petition no. 8291 of 2006. The petitioners were Ponds Hindustan Lever Litd. Ex mercury welfare association and the respondents were Hindustan Lever Limited represented by its managing director and others.

On behalf of the petitioners petition was filed by (1) S.A.Mahindran (2) Affidavit by K. Gopalakrishnan for petitioners on 18.8.2006 (3) Affidavit by Dr. K. Mathiharan (4) another affidavit by S.A.Mahindran with annexure (comments by Mark Chernaik).

On behalf of the respondents counter affidavit filed by 1st respondent by (1) Vice Chairman of HLL on 12.4.2000 (2) Dr. T. Rajgopal VP of HLL (3) By John George and (4) Affidavit of Dr. Premala Mascarenhas on 6.11.2006.

There was another reply filed by S.A. Mahindran in response to the respondents reply on 19.4.2006.

It is to be noted that the petitioners made the affidavit in the court on 19.2.2006 and by that time the respondents had already taken several actions. The factory was shut in March 2001. After this the company carried out systemic medical examination by a panel of eight doctors to find out whether mercury related symptoms such as tremors, dysdiadochokinesis, Rhomberg's test and knee-heel-toe tests were present or not. The respondent doctors not only examined mercury related symptoms but the morbidities if any due to other reasons.

It is further to be noted that apart from conducting medical examination at the time of closure the company was regularly conducting periodical medical examination since its inception. All the records pertaining to these have been very well maintained and documented. The company carried out the medical examination by the standard questionnaire based on US department of mines questionnaire on exposure to heavy metals. The questionnaire and the subsequent clinical evaluation were validated on site by an external epidemiologist.

Even the certifying surgeon from the factories inspectorate of the Govt. of Tamil Nadu had conducted medical evaluation of the workers and reported no abnormality.

The company was regularly conducting environmental and biological monitoring. The environmental monitoring details revealed that the company was keeping the levels of Hg in the workplace to < 0.05 mg/m^3 in line with the Indian Factories Act and rules. The company was regularly conducting biological monitoring as per the WHO guidelines by CVAAS which is a well accepted method all over the world. The data of each individual has been recorded in a separate file. These data have been further analyzed as a group means and presented accordingly. Similar data have been presented year wise with number of workers studied in each year along with their values. As per WHO guidelines group means were well within the WHO recommended level of 50 mcg/lit. With respect to individual values there were 3 outliers. Such outliers were rotated and evaluated.

Sufficient care was taken to see that before they were shifted back to their original job their levels came back to acceptable limits. According to the company only < 1% were showing such higher levels.

Similarly no specific morbidities such as tremor, dysdiadochokinesis, abnormal Romberg's' test knee-heel-toe or index finger to nose tests were found. Some of the problems like loss of teeth, gum related problems can be attributed to pan/tobacco chewing and poor oral hygiene.

In a nut shell the above was the presentation of the respondents.

Now let us consider the petitioner's observation that:

1. Environmental and biological monitoring was not carried out by well described methods all over the world.
2. Dr. Rakhal Gaitonde from the petitioner's side has mentioned that many of the individuals screened have symptoms that "could be attributable to chronic long term mercury exposure".
3. Dr. Gita Arjun also in Vol X, para 1 & 2 has mentioned about one of the exposed worker having child with deformity and 3 abortions. Similarly another patient Gynanasundari Jjayaprakash had two children with skeletal deformities. Similarly Ruthpriya gave birth to twins with one having ulceration in mouth.
4. Similarly Dr. Ambudorai reported that Ms.Ruby had severe psychological problems.

My response to the petitioner's views are

1. Dr. Gaitonde has mentioned issues from literature and not from any observations. The information in literature is given keeping specific issues in mind and cannot be generalized for all situations.
2. In the well studied latest literature there is no scientific support of such occasional observation as made by Dr. Gita Arjun when cause effect relationship is not documented . With respect to Gynanasundari " Mercury cannot cause any mutation and genotoxicity". WHO literature on this is quire clear. With respect to Ruth Priya such observations without proper history of exposures or in the absence of scientific literature can not be accepted.
3. With respect to Ruby's condition - the exposure to mercury in thermometer factory or any other factory, has never been associated with psychological problems. As such in modern life because of a lot of stress from survival and existence there is a huge number of populations which is prone to stress.

Now coming to the main issue of exposure data and other details:

1. It is incorrect on the part of the petitioners to state that the company has not carried out environmental or biological monitoring properly. As such the company was carrying out the biological monitoring since the inception of the factory to its closure in 2001 even though this is not a statutory requirement. The company was not collecting data "keeping in mind" that it has to close the factory in 2001 . The company did not collect the data with any bias or prejudice. At this point in time in 2006 it is unethical to doubt the integrity of the data on biological monitoring without any subjective or objective evidence. Because the data are within normal range it cannot be discarded. One should not go with the notion as " everything is Ok – so it is wrong"!

2. It is worth reiterating here that at the specific direction of the Supreme Court Monitoring Committee the Tamil Nadu Pollution Control Board had asked the ITRC to evaluate the health aspect. The ITRC as a part of this evaluation had individually examined and certified each record as being correct on the basis of an extensive audit. The ITRC is a premier scientific institution of this country and is a part of the Council of Scientific and Industrial Research Laboratories (CSIR). ITRC opinion is highly regarded and valued in scientific circles across the world and proper scientific respect must be given to their findings.

3. The vague psychological and neurological symptoms suddenly expressed by the workers in 2006 cannot be attributed to exposures in 2001 and before. If it was indeed true the workers would have gone to local medical practitioners and experts. When the company made an examination after an advertisement in newspapers and also on checking with leading private practitioners, it did not reveal any health issues attributable to mercury exposure. Thus without having any objective proof one cannot say that the company was not sincere in carrying out its job from the inception of the factory. Vague presentation about loss of memory or headache/backache can be because of many other reasons.

About the recent medical examination.

1. In the current medical evaluation of 13 ex-employees, three wren having tremors. There were no cases of dysdiadochokinesis, abnormal Rhomberg's test for knee-heel-toe tests. On scrutiny of these workers it was observed that their 'urine levels of mercury' during their working period were well within permissible normal levels. One of the individuals with tremor had a history of cerebral infarct with cardiac ischemia, the other had a history of alcoholism and the third was a lady who worked only for 4 months and that too in a non-mercury area. The

~~230~~
231

background morbidity may well be the cause of any symptom which they exhibited and cannot be attributed to past exposure to mercury.

2. The visit to the Kodaikanal plant has also helped in the understanding of health and safety provisions in place including the provision of PPEs, the use of atomic absorption spectrometry for biological monitoring, the use of Jerome sampler for environmental monitoring and the prevalence of other hygiene practices on site including the use of exhaust fans etc. - *all of which were corroborated by the petitioner's representative* on site. The spaciousness of the operating area coupled with adequate health and safety systems in place have helped in keeping exposure levels to below permissible limits.

3. In many of the employees the allegations of ill-health and the attendant signs and symptoms have apparently begun well after they have left the factory. Elemental mercury has a half-life in the body of 60 days and there is no scientific evidence that it can cause delayed effects. Any signs and symptoms (objective or subjective) at this stage must be viewed in this context. Such signs and symptoms may have a myriad of other common causes. Trying to link them with an employment in the factory (in many cases more than a decade or so back in time) would be scientifically untenable.

Review of expert reports already on hand

Now I would like to dwell upon the reports given by the local practitioner, national and international institutions and experts:

1. On a specific inquiry Dr. Balaji who was a leading medical practitioner has stated that he has not come across any case which can be attributable to mercury exposure.

2. Dr. Tom Van Teunenbroek an expert from Nethrerland (who was specifically brought in at the request of Greenpeace and other NGOs) who is well conversant with occupational and environmental epidemiology has on the 1st May 2001 and again on 1st October 2001 clearly stated that after going through and validating all data and their further evaluation department wise and looking at the mean group values in hazardous and non-hazardous areas there is no indication of any mercury relatable morbidity. All individual data were also within acceptable limits with a very few (< 1%) of them showing a higher value which also quickly reverted back to normal on being rotated from their jobs.

3. Experts from the Indian Association of Occupational Health during their visit to Kodai clearly mentioned that < 1% of workers were having urine Hg value more than 100mcg/lit and were rotated till their levels came down below acceptable norms. Similarly they also revealed that annual clinical evaluation of employees over the years did not reveal any clinical or biochemical abnormalities. The members were satisfied about preventive and promotive measures taken by the factory.

4. In addition, Drs. Pandav and Pandey from the country's premier medical institute the All India Institute of Medical Sciences while evaluating critically the remarks made by Dr. Mark Chernaik concluded that the occupational health and safety measures in place in Kodiakanal factory have succeeded in keeping the exposure of factory employees to mercury to consistently acceptable low levels. In view of the comprehensive health surveillance carried out over the working life of the factory, especially keeping in view the monthly biological monitoring of mercury in urine (as compared to a 6 monthly to yearly evaluations) and a detailed individual annual clinical and biochemical examination and the recently conducted (March 2001, May 2001) comprehensive clinical-epidemiological study, there is no evidence to suggest adverse health effects that can be attributable to mercury exposure.

5. The certifying surgeon after studying the plant structure and function evaluated the employees with specific reference to the target organs. He has opined that "the employees are healthy and sound"

6. At the specific direction of the Supreme Court Monitoring Committee, the Tamil Nadu Pollution Control Board had requested the ITRC to evaluate the health aspects. The ITRC after a detailed evaluation had concluded :

   a. To determine cause effect relationship in occupational diseases a systemic analysis of published data on the basis of extensive literature survey coupled with epidemiological evidence (environmental monitoring, biological monitoring) , clinical evidence and correlation with scientific knowledge of dose response relationship is essential.
   b. Based on this scientific principle we have evaluated the health records and other data as indicated on site and <u>there is no evidence indicating any adverse health impact which can be correlated to past exposure to mercury in this unit.</u>

7. With specific reference to the need to carry out any further study the ITRC opined

   a. The factory was closed in March 2001. A review in May 2001 of the body burden of mercury in the employees 2 months after the closure showed a mean mercury in urine of 10.1 micrograms/L which is well below acceptable limits.

   b. Mercury has a half life in the body of 60 days [ATSDR, Toxicological profile of Mercury, US Dept. of health and human services, March 199, page 187]. The exit yearly mean values of employees in the HLL plant (Table 7 of the ITRC report Vol. V) were within acceptable limits. After a gap of six years of closure of factory it is scientifically inconceivable that the ex-employees will have any effects arising out of past exposure.

   c. There is no scientific evidence of delayed exposure to Hg after a long latency period especially if the exposure levels during the working life of an employee have been within acceptable limits. No evidence of the ex-employees having high exposure to Hg has been found. (page 4 & 5 of the ITRC report / Vol. V)

8. In addition to the reports enumerated above it will be useful to list all other reports made by leading national and international bodies and experts which are already available with the honorable high court - all of which do not find any health effects attributable to past exposure to mercury. They include the following:

   a. *Dr. P. N. Viswanathan's* report - page 362 - 9 / Vol. II Dr. Viswanathan as a retired Director Grade Scientist at the ITRC, Lucknow and an authority on mercury. He was a scientific member of the WHO Environmental Health Criteria no. 86 on Mercury published by the IPCS/WHO in 1989.
   b. *Dr. Tom Van Teunenbroek* reports of May 2001 and October 2001 (approached at the specific instance of the NGOs and pursuant to the direction of the TNPCB) - page 423 - 6 / Vol. II
   c. *Government of Tamil Nadu, Certifying Surgeon's* report dated 25. 08. 2001 - page 478 -480 / Vol. II
   d. 4. Report of the *All India Institute of Medical Sciences* dated 9.11. 2001 - page 513 - 515 / Vol. II
   e. Report of the *Indian Association of Occupational Health* dated 10.1.2002 - page 526 - 531 / Vol. II
   f. Peer reviewed scientific article in the *Indian Journal of Occupational and Environmental Medicine* dated Jan- Apr 2006: pages 384 - 416 / Vol. II
   g. *ITRC report* dated 11. 06. 2006 (approached at the instance of the *Supreme Court Monitoring committee* directive) - page 1 - 22 / Vol. V.

h. Report of the *National Institute of Occupational Health* dated 11.09.2006, page 23 - 25 / Vol. V.
i. *All India Institute of Medical Sciences report* dated 3.10.2006 : page 27 - 29 / Vol. V.
j. *Dr. Robert Winker's report* dated 11.09.2006: pages 45-55 / Vol. V
k. *Report of Dr. S. K. Rastogi* on behalf of ITRC dated 12.11.2006 pages 4 - 27 / Vol. VII &
l. Report from the *All India Institute of Medical Sciences* dated 23.11.2006 pages 37 -66 / Vol. VII

Conclusions and recommendations

- Based on the site visit, the clinical evaluation of a representative sample on site at Kodaikanal and a comprehensive review of all available material on hand while also referencing contemporary scientific literature my conclusion is that on a careful consideration I see no evidence of any signs and symptoms amongst the examined individuals which can be attributed to past exposure to mercury.

- In addition in view of the reasons as mentioned above I do not recommend any further study - any attempt to study individuals at this stage would only throw up common signs and symptoms which may be either age related, related to other existing conditions or may be even purely subjective when all available evidence does not suggest any correlation to past working in the erstwhile factory.

- On a scientific basis I endorse the earlier findings, conclusions and recommendations as outlined by the leading institutions in the country i.e. the Industrial Toxicology Research Centre and the All India Institute of Medical Sciences.

Dr. S. K. Dave
Ahmedabad