

**INFORMATION NOTE: SOIL REMEDIATION AT OUR FORMER THERMOMETER FACTORY IN KODAIKANAL, INDIA**

**Introduction**

The issue of ensuring that the contaminated soil at our former thermometer factory in Kodaikanal, India is remediated to an optimal standard, is a complex one. There have been many claims made concerning the standards that should be applied to the remediation work. Many of these claims have been misleading and have created confusion.

The Tamil Nadu Pollution Control Board (TNPCB) is the statutory authority responsible for deciding the soil remediation standard and we will abide by their decision. They have consulted with both the Scientific Expert Committee (SEC) which was constituted by the Supreme Court Monitoring Committee and the Central Pollution Control Board while deciding the remediation standard.

This note is intended to provide the facts on:

- 1) Difference between 'intervention', 'screening' or 'guideline' values and remediation criteria
- 2) How the remediation standard of 20 mg/kg for our site in Kodaikanal was reached
- 3) Why the 20 mg/kg remediation criteria is internationally acceptable
- 4) The implications of applying a remediation criteria below 20 mg/kg
- 5) In annexures:
  - a. Full chronological background on this issue
  - b. Standard Methodology/Codes used in the Risk Assessment
  - c. Examples of Site Screening Levels vs Site Specific Target Levels

On December 31, 2016, HUL received permission from TNPCB to commence preparatory work and trials for soil remediation at former factory site in Kodaikanal.

On August 16, 2017, HUL commenced soil remediation on a trial basis at its former factory site in Kodaikanal. The trial was conducted for a period of three months and was successfully completed in November 2017 in accordance with the Detailed Project Report and as per the approval given by TNPCB.

In February 2018, HUL submitted the final soil remediation plan for remediating the soil inside the factory premises to the TNPCB.

On June 11, 2018, Hindustan Unilever Limited (HUL) received permission from Tamil Nadu Pollution Control Board (TNPCB) to commence full scale soil remediation to the remedial standard of 20mg/kg at its former factory site in Kodaikanal.

Following this, some of the activists approached the National Green Tribunal (NGT) contesting the soil remediation standard of 20 mg/kg. The NGT has directed the Central Pollution Control Board (CPCB) to obtain an expert opinion on whether the Site-Specific Target Level of 20 mg/kg is the right remediation standard. In the interim, the NGT asked HUL to wait for its order to begin remediation of soil inside the factory premises.

On November 1, 2018, the Principal bench of the NGT, Delhi cleared the way for soil remediation at HUL's former factory in Kodaikanal. The NGT has reaffirmed the soil remediation standard of 20 mg/kg.

The decision of the NGT was challenged before the Supreme Court of India. In March 2019, the Supreme Court dismissed the petition and allowed the soil remediation to go ahead.

HUL received clearances/approvals for soil remediation from different statutory authorities including the Hill Area Conservation Authority, Forest Department, and the Department of Industrial Safety and Health. HUL also received the Consent-to-Establish from Tamil Nadu Pollution Control Board (TNPCB) and is now in the process of installing and commissioning the remediation equipment and establishing facilities to undertake soil remediation. Full scale soil remediation work will commence after receiving Consent-to-Operate from the TNPCB.

HUL is committed to cleaning up the site.

### **1) Difference between 'intervention', 'screening' or 'guideline' values and remediation criteria?**

All developed countries have established some form of preliminary screening criteria [called by various terms, depending on the country: Intervention Value (Netherlands), Guideline Value (UK) Soil Quality Guideline (Canada), Regional Screening Level (US)] to allow the regulator to determine whether a site is potentially contaminated or not and poses a risk to human and/ or ecological receptors.

Basically, when the authorities develop generic preliminary screening levels, they make certain assumptions about the contaminant in question and potential exposure pathways that may exist at a hypothetical site. Pursuant to best practice, if a contaminant is present at a site at a concentration above the established generic screening level, a remedial program needs to be developed to address that contaminant.

Remediation standards, also referred to as The Site Specific Target Levels (SSTL), are based on the globally recognized and adopted principle of conducting human health and ecological risk assessments to determine the site-specific remediation standard applicable to the site under investigation. Before arriving at the SSTL, which protects human health and the environment, site-specific conditions like soil type, exposure scenarios and the sensitivity of receptors are considered.

All risks related to contaminated sites are assessed and deemed complete only if there is a complete pathway, i.e. there is a contaminant source present, and a pathway exists for the contaminant to reach a receptor, which could be human or ecological. The best practice followed globally for setting the SSTL is based on conducting a site-specific human health and ecological risk assessment following internationally accepted protocol.

This is adopted from the recommendations of Environment protection agencies of Western Europe and USA. All aspects of risk, including residual contamination are considered in this approach. **(Annexure B)**

Many countries, including USA, Netherlands, Canada, UK and Australia, have developed country specific risk-based Tier 1 criteria. These are dependent on assumptions made about how people are likely to interact with the soil (e.g. amount ingested) and assumptions about the site in question (e.g. building dimensions, soil type, soil cover), and the adopted acceptable level of health risk. Hence, Tier 1 values can vary by orders of magnitude for the same chemical between countries.

It is important to note that these preliminary screening criteria are not mandatory remediation standard or remediation standards for a particular contaminant at any given site. In fact, all regulations/ guidelines from these various countries, specifically reference that further site-specific investigations/risk assessments should be conducted in the event that the preliminary screening criteria are exceeded. The applicable remediation standard for a specific site is therefore determined based on a scientific and approved methodology of risk assessment, which are referenced in various standards. The examples of the same are in **Annexure C**.

In this case, elemental mercury was considered to be the main mercury species of concern on the site as concentrations of other forms of mercury were not detected to any significant extent. The risk assessment that was conducted considered the most conservative and protective future residential use pattern (e.g. presence of a kitchen garden, where vegetables are grown embedded in soil for consumption).

## **2) How the remediation standard of 20 mg/kg set by the TNPCB and approved by CPCB for our site in Kodaikanal was reached**

In the case of the former factory of HUL at Kodaikanal, two levels of risk assessment were undertaken. These were Tier II - Risk Assessment followed by Tier III - Probabilistic Risk Assessment. Each subsequent tier brings in more site-specific data and analytical rigour to derive the SSTL.

The risk assessment concluded that the total mercury concentration of 25 mg/kg was health protective for a future residential use setting where the receptors were children and women.

It is important to note that the above SSTL was finalised after a protocol was developed by National Environment Engineering Research Institute (NEERI) on the advice of the Supreme Court Monitoring Committee (SCMC). This protocol was a site-specific protocol developed for the former Kodaikanal factory and was accepted by all the parties including the SCMC and TNPCB.

Based on further deliberations on the SSTL and taking into account the principle of abundant caution, the TNPCB directed HUL to remediate the site to a further conservative value set by them – that of 20 mg/kg.

On account of opposition by activists to the SSTL of 20 mg/ kg that had been finalised by TNPCB, the pre-remediation work that was commenced in May 2009 had to be stopped in October 2010. TNPCB had then decided to get additional studies done by national institutions of repute.

Subsequently, following the directives of TNPCB, IIT Delhi revalidated the Risk Assessment Study and site specific clean-up standard; National Botanical Research Institute, Lucknow, studied the impact on trees and preservation of trees; and the Centre for Soil and Water Conservation Research and Training Institute, Ooty, studied the impact on soil and soil erosion. The findings of these additional studies were submitted to TNPCB and SEC in February 2011.

Based on the above detailed consideration of these expert bodies, on May 15, 2013, the SEC reconfirmed the standard of 20 mg/kg with 100% accuracy to be the applicable Remediation Standard which had been set by TNPCB.

The salient points of the process so far are as follows:

- Applying the most conservative and protective receptor and land use assumptions and employing globally accepted methodologies and codes, a risk assessment was undertaken. It took into account the site-specific conditions and an appropriately protective remediation standard was derived for the site. The Supreme Court Monitoring Committee directed NEERI to do risk assessment study to develop soil remediation standard for the site.
- The additional studies done by the above expert bodies have also given their recommendations including IIT Delhi, which recommended a site-specific clean-up standard of 22.4 mg/ kg for soil remediation.
- TNPCB had sought the advice from the Central Pollution Control Board (CPCB). The CPCB also confirmed 20 mg/kg as the standard on April 29, 2015 after reviewing the results of all these studies and agreeing that it is based on the globally accepted best practice of site-specific remediation standard.

### **3) Why the 20 mg/kg remediation standard set by the TNPCB and approved by CPCB, is internationally acceptable**

As mentioned, there are no national standards for soil remediation. There is however an Intervention Value (Netherlands), Guideline Value (UK), Regional Screening Level (US) or Soil Quality Guideline (Canada) that allow the regulator to determine whether a site is potentially contaminated or not and whether it possess a risk to humans or the environment.

The procedure of assessing contaminated sites and deriving site specific remediation standard as per globally acceptable methodologies/codes was followed and was as per Supreme Court Monitoring Committee (SCMC) directives.

There have been many instances globally where the screening criteria/guideline value followed by a country and the site-specific remediation standard derived are different, for the simple reason that they are meant to be different. The screening criteria/guideline value once exceeded on a particular site indicates that some remediation should be considered. The remediation standard for that site is then arrived at after following the site-specific risk assessment. (Annexure B) and, that derived standard is calculated to be fully protective of human health and the environment.

A country's intervention values can also change. For example, the Dutch Intervention Value for mercury which was 10 mg/kg set in 1994 was revised in 2006 to 36 mg/kg, based on the lower eco toxicity value and the latest scientific data.

Also, all developed countries including Netherlands, US, UK, Australia do not recommend using a generic standard as remediation goal. Rather, they all require the use of site-specific risk assessments, as has been done in this case, in order to develop the appropriate remediation standard for the site under investigation. When the land inside our former factory in Kodaikanal is remediated to site specific remediation standard of 20 mg/kg as set by TNPCB and approved by CPCB, it would render the site safe for residential use. The risk assessment carried out has validated that it would be safe for children to play in or to grow vegetables there and the clean-up would be protective both for humans and the environment.

### **4) The implications of applying a remediation standard below the TNPCB set 20 mg/kg**

Arbitrarily lowering the site specific remediation standard to below TNPCB set standard of 20 mg/kg should not be considered since there may be a risk of ecological damage and, it would not be any more protective of human health and the environment.

- The TNPCB has set the 20mg/kg standard following internationally recognised best practice for determining site specific remediation standard. This has been approved by the CPCB.
- There is no science to back any reduction in the site-specific remediation standard, as it is not based on any site-specific risk assessment.
- A remediation to the Canadian Soil Quality Guideline would not be any more protective to human health and the environment than a remediation to the site-specific mercury remediation standard.
- A lower standard will lead to much greater ecological and environmental damage on account of greater soil excavation and will lead to soil erosion & ecological imbalance in the hilly terrain where soil content is not uniform.
  - It is estimated that 300 trees will be affected / removed if the standard is 20 mg/kg as set by TNPCB and approved by CPCB. If the standard is taken to 6.6 mg/kg (as currently suggested by activists based on current Canadian Soil Quality Guideline), an estimated 3 to 4 times the number of trees will be affected / removed.
  - We estimate that the area to be excavated would be approximately 10000 m<sup>2</sup> if the standard is 20 mg/kg as set by TNPCB and approved by CPCB. If the standard is taken to 6.6 mg/kg the area to be excavated would be around five times more – causing significantly greater disturbance of a fragile ecosystem, and implications for soil runoff and landslides.

## **Conclusion**

Deciding on soil remediation standards is a complex and technical process which requires the inputs of expert organizations and the considered decision of the appropriate regulatory authorities.

HUL is committed to cleaning up the site to the optimal standard deemed appropriate for the site and approved by the regulatory authorities.

TNPCB's proposed 20mg/kg clean-up standard has also been approved by the CPCB. It has been determined following international best practice, using a site-specific risk assessment which will ensure that the land will be fully protective of human health and the environment.

An arbitrarily imposed remediation standard – for example the 6.6 mg/kg standard currently proposed by some activists – would not be based on science and would also have significant detrimental impacts on the surrounding environment. Moreover, it would not be any more protective of human health and the environment than the site-specific and scientifically derived 20 mg/kg remediation standard that has been proposed and approved by the authorities.

We submitted the Detailed Project Report (DPR) for soil remediation to TNPCB in August 2015.

On December 31, 2016, HUL received permission from TNPCB to commence preparatory work and trials for soil remediation at former factory site in Kodaikanal. HUL is committed to cleaning up the site.

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## **5) ANNEXURE A**

### **The chronological background on this issue:**

- In June 2001, HUL removed 7.4 tonnes of glass scrap with residual mercury and the soil beneath the scrap from the scrap yard to its factory premises for safe storage. HUL also took action to track down any glass scrap which had left the site over the previous ten years and offered to recover any scrap from recyclers for safe storage on the Kodaikanal site.
- HUL sought permission as early as June 2002 for soil remediation.
- In 2003, Hindustan Unilever obtained permission from the Indian and US governments for permits to pack and transport the mercury-containing material to the US for recycling. The consignment consisted of 290 tonnes of materials and included glass scrap with residual mercury, semi-finished and finished thermometers, effluent treatment plant waste and elemental mercury. They were packed under the supervision of TNPCB officials and witnessed by local NGOs, including Greenpeace. The materials reached New York on May 31, 2003 and were then transported to Bethlehem Apparatus Inc. for recovery of mercury and its subsequent recycling/disposal.

- In 2004, on the advice of the Supreme Court Monitoring Committee (SCMC), TNPCB asked HUL to engage technical experts from the Government of India's National Environment Engineering Research Institute (NEERI) to associate with the remedial measures.
- In 2003 and 2004, HUL sought permission of the TNPCB for the decontamination and disposal of the plant machinery and materials. Plant, machinery, and materials used in thermometer manufacturing at the site were decontaminated and disposed as scrap to industrial recyclers in May 2006 after obtaining necessary approval.
- Supreme Court Monitoring Committee in its meeting in 2006 directed NEERI to do risk assessment studies to develop soil remediation standard for the site.
- In 2007, NEERI presented the protocol to the TNPCB and the Scientific Experts Committee (SEC) and the protocol was accepted.
- Based on the recommendation of the SEC, the TNPCB set soil remediation standard and asked NEERI to prepare a Detailed Project Report (DPR) for undertaking soil remediation.
- In November 2007, the SEC and TNPCB considered the DPR. They granted in principle approval for the remediation, asking HUL to incorporate some suggestions and submit a revised DPR.
- In May 2008, the SEC and TNPCB visited the factory site, inspected the pilot plant, reviewed, and cleared the revised DPR.
- In July 2008, the TNPCB set the remediation standard of 20 mg/kg of mercury concentration in soil and granted HUL permission for soil remediation to commence.
- HUL commenced the pre-remediation work in May 2009 according to the approved Detailed Project Report.
- In January 2010, TNPCB and the SEC during project review meeting, directed HUL to get additional studies done with eminent national institutions due to objections raised by NGOs on the remediation standard.
- Subsequently in October 2010, HUL was asked to stop this work by the regulator.
- Accordingly, Indian Institute of Technology (IIT), Delhi, revalidated the Risk Assessment Study and site specific clean-up standard; National Botanical Research Institute, Lucknow, studied the impact on trees and preservation of trees; and the Centre for Soil and Water Conservation Research and Training Institute, Ooty, studied the impact on soil and soil erosion. The findings of these additional studies were submitted to TNPCB and the SEC in February 2011.
- Subsequent to the findings of the above three studies, the Scientific Experts Committee, in May 2013, reconfirmed 20 mg/kg as the clean-up standard for soil remediation in the factory. Further to this, in February 2014, TNPCB asked the Central Pollution Control Board (CPCB) of the Central Government of India to advise on the clean-up standard.
- In April 2015, the CPCB reviewed the reports on site assessment, risk assessment and the recommendations of institutions like IIT and NEERI in the context of the views of the members of the NGOs, which were submitted through a letter.
- The CPCB observed that the remediation clean-up standard (i.e., the site-specific target levels) have been calculated using internationally acceptable methods and agreed with the site-specific target level for soil remediation.
- In May 2015, TNPCB and SEC fixed the soil remediation standard at 20 mg/kg and HUL was informed of the same on July 17, 2015 and asked to submit a revised DPR.
- On August 10, 2015, HUL submitted the DPR for soil remediation to TNPCB.

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## **ANNEXURE B**

### Standard Methodology/ Codes used in the Risk Assessment

- US EPA (1989) Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual (Part A);
- US EPA (2004) Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment);
- US EPA (2009) Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment);
- ASTM (2000) Standard Guide for Risk-Based Corrective Action. E2081-00, published November 2000;
- ASTM (2002) Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. E1739-95 (reapproved 2002).

## **ANNEXURE C**

### Examples of Site Screening Levels vs Site Specific Target Levels

It is pertinent to note that across various countries, the actual site-specific remediation standard derived is higher than the Country Guideline Value.

#	Name of Site	Location	Country Guideline Value	Remediation Standard derived based on Risk Assessment
1	Turner Valley Gas Plant	Canada	10 mg/kg	21 mg/kg
2	Amino-anthraquinone synthesis plant	Switzerland	5 mg/kg	20 mg/kg
3	Chlor Alkali Plant - Orica	Australia	15-75 mg/kg depending on various land use scenarios	90 mg/kg for areas under future buildings and 200 mg/kg for soil to be left as open space
4	Fraise paints and paper Site, Glen Falls	New York, USA	NYS Part 375 Soil Cleanup Objective: 0.81 mg/kg	Site-specific removal action level: 20 mg/kg
5	Carson River Site	New York, USA	20 mg/kg	80 mg/kg

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