Stormwater Runoff Water Quality Newsletter
Devoted to Urban/Rural Stormwater Runoff
Water Quality Management Issues

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This issue of the Newsletter presents updated information on the California Department of Toxic Substances Control (DTSC) approach to **regulating soil lead** with respect to protecting children's health. This Newsletter is a followup to Newsletter 8-7 (http://www.members.aol.com/annejlee/swnews87.pdf), which presented information on a DTSC workshop on lead. That Newsletter discussed issues that are pertinent to lead as a stormwater pollutant. It also introduced the DTSC August 2005 "Draft Lead Report." On September 18, 2006, DTSC held a workshop devoted to presenting a discussion of the Department's proposed approach for revising the Lead Total Threshold Limit Concentration (TTLC) proposal for lead. The TTLC is used by the state of California to regulate lead in soils and some other media as a hazardous waste, where exceedence of the TTLC means that a soil that becomes a waste must be managed in a hazardous waste landfill. At the September 18, 2006, workshop, mention was made that the August 2005 DTSC "Draft Lead Report" was being updated and is expected to be finalized in a month or so. The current version of this report is available at http://dtsc.ca.gov/HazardousWaste/upload/HWMP_REP_dLead-Rep.pdf.

Information on the September 18, 2006, workshop is available at http://dtsc.ca.gov/LawsRegsPolicies/Regs/Lead_Threshold.cfm.
The PowerPoint slides used by DTSC staff at the workshop are available at this URL.

As part of the information for the workshop, DTSC provided the following discussion on the approach that DTSC is following in revising the TTLC:

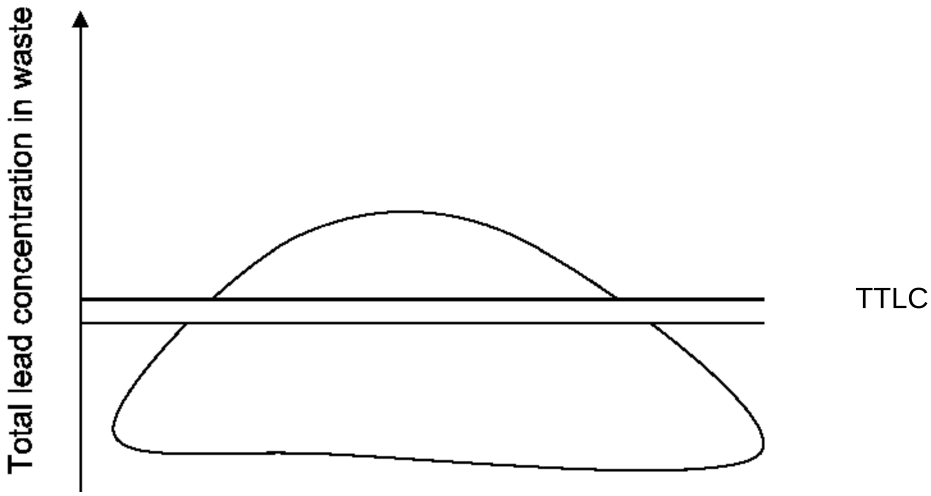
Total Threshold Limit Concentration – Lead
Summary of Approach

Introduction and Background:

The goal of this project is to update the total threshold limit concentration (TTLC) for lead to better reflect more recent findings regarding the health impacts associated with lead. The TTLC is one of the characteristics used to determine if a waste is considered hazardous and it is intended to protect receptors from direct exposure to the waste.

The objective of this project is to revise the TTLC for lead to improve protection of the general population, including children, from direct exposure to lead-containing waste, including contaminated soil. A waste whose total lead concentration exceeds the TTLC is considered hazardous and must be managed in accordance with requirements that protect the population and environment from adverse effects associated with the waste - from the time it is generated to the time it is disposed. Among other provisions, state statutes require DTSC to adopt regulations establishing criteria and guidelines to identify hazardous waste that may pose a hazard to human health or the environment when the waste is improperly managed (Health and Safety Code (HSC) section 25141).

Wastes that are identified as hazardous according to the state's laws and regulations are subject to a variety of handling, management and disposal requirements intended to protect the public health and safety and environment from adverse effects associated with the waste. At times these requirements may be violated, sometimes intentionally, sometimes not, and as a result the public and environment may come in contact with the waste. It is for this type of exposure the TTLC is intended to provide protection.



Just as the TTLC represents the lower limit of total lead measured in a hazardous waste, it also represents the upper limit of total lead allowable in a waste that has been determined to be non-hazardous using this threshold. A waste whose total lead concentration does not exceed the TTLC may be considered non-hazardous, if the waste exhibits no other characteristics, or fulfills no other conditions of a hazardous waste. The management of non-hazardous wastes is not as closely controlled as hazardous waste and direct contact of the general population with such a waste can and often does occur. This potential for exposure helps to drive the need for a TTLC value for lead that better reflects the risk of lead exposure and accurately identifies those wastes that should be properly managed as hazardous wastes.

In general the existing TTLCs in the state's regulations are based on general measures of toxicity. As described in DTSC's Lead Report, the original TTLC for lead was developed in the late 1970s/early 1980s. It was initially based on the STLC value for lead, but the calculated lead TTLC of 500 mg/kg was adjusted to 1,000 mg/kg on the basis of findings regarding mean soil lead levels and acceptable child exposure to contaminated soil. In this instance, the traditional basis for the calculation of the TTLC for lead was modified at that time by consideration of data regarding health effects. These findings, particularly those associated with child exposure to lead-contaminated soil, are now outdated and form the focus for DTSC's effort to update the TTLC. The current approach DTSC proposes to use to update the TTLC also considers health effects to modify the TTLC for lead.

DTSC's Approach

DTSC considered several options for updating the TTLC for lead and examined the extent to which each could achieve the goal of this project. The alternatives considered included:

- Recalculating the toxicity-based TTLC, but correcting the original assumptions
- Recalculating the TTLC using a health-based model to account for consideration of health effects associated with lead exposure.

The first option omits the adjustment of the calculated TTLC, and thereby eliminates the use of obsolete assumptions regarding direct contact with soil contaminated with lead. While this approach better reflects our current understanding of the health impacts associated with direct exposure to lead-containing waste by disregarding the outdated information, it does not directly update those assumptions. This approach, as initially conceived, only partially meets our goal for this project.

The second option achieves the goal of this project because it updates the TTLC for lead using a model that calculates blood lead concentration resulting from exposure to lead-containing media. Blood lead concentrations can be correlated to various health effects associated with direct exposure to lead and can be used to account for the health impact associated with direct exposure to lead-containing wastes.

DTSC considered two models for the second option, U.S. EPA's Integrated Exposure, Uptake and Biokinetic Model (IEUBK) and DTSC's Leadspread 7. The IEUBK models blood lead concentration in children from an absorbed dose of lead. This model accounts for changes in diet and water consumption with age, and makes pharmacokinetic corrections to account for changes in factors such as gastrointestinal absorption of lead and storage in bone and soft tissue as children age. Leadspread predicts lead concentration in children and adults from an applied lead dose determined from inputs from soil and dust, water, air and food. Like the IEUBK, Leadspread uses slope factors to estimate blood concentration resulting from an environmental input. A slope factor is the change in blood lead concentration resulting from each µg/day of lead intake.

Leadspread is not as detailed as the IEUBK, but it is commonly used to calculate target soil concentrations for exposure by a 2-3 year old child or an adult based on specified values for the inputs for lead in air, water and food. DTSC selected Leadspread 7 to calculate the TTLC for lead for this project due to this ability to back-calculate general, state-wide soil concentrations for children and adults using specified parameter values and a target blood lead concentration.

Assumptions and Calculations

To select the parameter values for calculating the lead concentration using Leadspread, DTSC developed an exposure scenario based on the type of potential exposure for which the TTLC is intended to provide protection, namely, direct exposure to the waste. If hazardous wastes are managed properly, in compliance with DTSC's requirements for the generation, management and disposal of such wastes, direct exposure to the general public is minimized. At times, however, hazardous wastes are improperly managed or disposed. If this happens, direct exposure of the general public to hazardous waste could occur and the TTLC should be established at a level to ensure that appropriate enforcement can be implemented to prevent adverse effects resulting from such exposure.

DTSC's exposure scenario assumes direct exposure of the general population to waste containing total lead at concentrations at or above the TTLC for lead, resulting from mismanagement or inappropriate disposal of hazardous waste outside of permitted facilities. The waste matrix is assumed to be primarily soil, ash or sludge-like material and lead-paint containing debris. The exposed population is assumed to be adults or children, and the exposure locations are assumed to be locations where the general public might encounter improperly disposed wastes, such as vacant lots, parks or roadsides in residential, industrial, rural or mixed use neighborhoods, or locations where child-occupied buildings are inadvertently constructed adjacent to or on top of sites where mismanagement or improper disposal of hazardous waste occurred in the past, throughout the state. The potential routes of exposure are assumed to be ingestion and inhalation. In using Leadspread to calculate the TTLC, DTSC also assumes lead-contaminated soil serves as a surrogate for waste containing lead.

To calculate a TTLC value that could be applicable statewide DTSC used default values for most of the input parameters in Leadspread. DTSC used a value of 5 µg/L for lead in drinking water rather than the conservative default level of 15 µg/L since the statewide average for lead in drinking water is likely to be less than 5 µg/L. DTSC also did not include backyard gardening in the exposure setting, since DTSC did not envision exposure to improperly disposed wastes from produce grown in backyard gardens was likely to occur commonly in the exposure scenario statewide.

In calculating its range of TTLC values, DTSC used a target blood lead concentration of 10 µg/dL. Using these input values, DTSC calculated the lead concentrations for child exposure at the 99th and 95th percentile confidence intervals. The results of these calculations are tabulated below.

Leadspread 7 soil concentration calculations (µg/g)

	BLL = 10 µg/dL	
	99%	95%
Child	344	525

As discussed in the Lead Report, recent research suggests adverse health effects, primarily cognitive deficits, may occur at blood lead levels below the level of 10 µg/dL, which is the level of concern for certain interventions specified by the federal Centers for Disease Control and Prevention (CDC). Rather than lowering the blood lead level of concern further in response to this research, the CDC recommends strategies that prevent childhood exposure to lead. Although DTSC recognizes that the level of concern of 10 µg/dL is currently considered high, Leadspread 7 has been designed to be used with 10 µg/dL as the parameter value for target blood lead concentration. In the absence of a national consensus regarding what the alternative target blood lead concentration should be, DTSC is proposing that a TTLC based on the value of 10 µg/dL for blood lead level serves the objective of updating the TTLC, especially when considering that the CDC blood lead level of concern was 30 µg/dL at the time the original TTLC for lead was developed.

Conclusion

DTSC considers the proposal outlined in this document to be a starting point for discussion at the workshop. DTSC is interested in public input and suggestions regarding its goals, approach, assumptions and calculations. In particular, DTSC is interested in the following questions:

- Are there other exposure scenarios DTSC should consider?
- Is there justification for input values other than the default values used in Leadspread?
- Is there another approach to updating the TTLC for lead that DTSC did not consider?

DTSC is inviting comments on the approach that DTSC is following in revising the TTLC. Comments need to be submitted by October 31, 2006, to Ms. Nancy Ostrom at (916) 322-3385 or NOstrom@dtsc.ca.gov.

Discussion at the workshop indicated that if the blood lead levels of 5 µg/dL were used instead of 10 (which would be more protective of children's health), the TTLC would be lowered to about 100 mg/kg. Adoption of this value would cause many soils near highways and streets, and some other areas (like where lead-based paint has been used) to be classified as hazardous waste if the soil becomes a waste.

At the workshop, it was pointed out that there is a significant difference in assessing the critical levels of lead in soils at Superfund sites. According to Steve Ross of DTSC,

> *"For state response* [Superfund] *sites, DTSC uses the leadspread version 7 for establishing Pb cleanup value for soil. 150 mg/kg is near* [135 mg/kg] *the result for this evaluation but ranges a smidget from site to site. The 400 mg/kg value is a PRG for* [US EPA] *region IX under residential use. Neither result would be a default cleanup value to select from without going through the FS alternative analysis & ROD & LUCs for UC."*

DTSC has announced the development of a listserv, where information on lead is available. If you would like to subscribe to this listserv, please go to http://www.calepa.ca.gov/Listservs/dtsc/.

It was announced at the workshop that DTSC's efforts at updating the TTLC for lead will be followed by efforts to update TTLC information for other constituents, such as antimony, arsenic, cadmium, chromium, copper, molybdenum, nickel, selenium, zinc, etc. The current TTLCs for these and other regulated constituents are available at http://www.dtsc.ca.gov/LawsRegsPolicies/Title22/upload/OEARA_REG_Title22_Ch11_Art3_66261-24_TableII.pdf#search=%22chapter%2011%20article%203%2C%2066261.24-1%22. This table also lists the Soluble Threshold Limit Concentration (STLC) values.

Lead Tire Weights

The following is derived from the September 11, 2006, Caltrans Water Quality Newsflash developed by Fred Krieger, (510) 843-7889, fkrieger@msn.com. The Newsflash is available at http://www.dot.ca.gov/hq/env/stormwater/publicat/newsflash/index.htm. This Newsflash is derived from an American Chemical Society Environmental Science & Technology publication which can be found at http://pubs.acs.org/subscribe/journals/esthag/40/i15/html/080106news4.html.

Lead – USGS estimates loading from tire weights – NewsFlash 05-36 reported on EPA's denial of a petition to control (and maybe ban) lead weights used to balance car tires. The petition was brought under Section 2605 of the Toxic Substances Control Act (TSCA) by the Ecology Center of Ann Arbor and supported by the states of Maine and Minnesota. Lead is one of the pollutants in roadway runoff that often exceeds water quality standards at the point of discharge and is also targeted by some TMDLs in California.

A recent U.S. Geological Survey (USGS) study estimates that roughly 2,000 tons of lead are lost from vehicles annually via tire weights that come loose. At least some of these weights are abraded by traffic or may also be pushed or swept into drainage systems. The European Union is implementing a ban on lead tire weights and reportedly some U.S. car manufacturers are moving toward other materials such as zinc and steel. Unfortunately, zinc is also a significant pollutant of concern in urban runoff. Other sources of lead near roadways include residual lead from the years when leaded gasoline was in use.

Lead in Landfills

Newsletter NL-8-7 presented information on lead in municipal solid waste (MSW) landfills as a potential source of groundwater pollution when the landfill plastic sheeting liner eventually fails. This discussion presented information on the unreliable information in the Solid Waste Association of North America (SWANA) report that claimed that heavy metals including lead in MSW landfills do not represent a threat to cause groundwater pollution. On the contrary, Lee (2004, 2006) and Lee and Jones-Lee (2005, 2006) pointed out that the concentration of lead and several other heavy metals in today's MSW leachate is sufficient to pollute groundwaters for those landfills sited where there is little or no natural protection of groundwater quality. Subsequently, O'Brien, the primary author the SWANA report, responded to the Lee and Jones-Lee comments, in which he provided information on the basis for SWANA's concluding that heavy metals in MSW leachate were not a threat to cause groundwater pollution. Lee (2006) has discussed the O'Brien responses.

O'Brien indicated that the SWANA report used the average concentration of heavy metals in leachate rather than an upper level confidence interval concentration. Lee (2006) pointed out that drinking water is not regulated based on average concentrations but on maximum concentrations of potentially toxic pollutants. O'Brien acknowledged that landfills sited in non-protective hydrogeological settings would allow transport of heavy metals in groundwaters, but assumed that regulatory agencies would not allow a landfill to be developed in such areas. This response indicates that O'Brien was not familiar with the permitting of landfills. Lee and Jones-Lee have been involved in the permitting of landfills throughout the US and have yet to encounter a regulatory agency that would prevent the siting of a landfill based on the hydrogeology of the area being non-protective, which would allow pollutants in the leachate to be transported offsite.

Overall, soils and other wastes placed in a minimum design US EPA Subtitle D landfill (with a single composite liner and monitoring wells spaced hundreds or more feet apart at the point of compliance for groundwater monitoring) have a significant potential to pollute offsite groundwaters with heavy metals in those hydrogeological settings which would allow heavy metal transport in the aquifer system.

References

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