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## Chemical and Material Emerging Risk Alert

# Lead: Changes in EPA IEUBK Model May Reduce Soil Screening and Allowable Drinking Water Levels

*In June 2012, the Centers for Disease Control and Prevention (CDC) lowered the childhood blood lead level (BLL) reference value from 10 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) to 5  $\mu\text{g}/\text{dL}$ . Subsequently, in December 2016, the United States Environmental Protection Agency (EPA) recommended that Regions use their discretion and current science in determining an appropriate BLL cutoff. In December 2017, EPA recommended changing the default age range in the Integrated Exposure Uptake Biokinetic (IEUBK) model from 0–84 months to 12–72 months based on new evidence supporting the updated age range as the most exposed population. These changes may impact soil screening concentrations. EPA is also currently investigating the relationship between lead in drinking water and BLLs in children using the IEUBK model. This could inform the derivation of a non-regulatory, health-based benchmark for lead in drinking water at the household level.*

### What DoD applications utilize lead?

Lead is used in lead-acid batteries, bullets and shot, and it is part of solder, pewter, fusible alloys, and aviation gas. Lead compounds are used as pigments, stabilizing agents, and corrosion inhibitors. Lead also is a critical part of Department of Defense (DoD) munitions (e.g., double-base rocket propellants, percussion primers and gun propellants) and explosives (e.g., lead azide), night vision equipment, radiation shielding, and radar and sonar systems.<sup>i,ii</sup>

### What is the lower threshold for BLL based upon?

Unlike most chemicals for which the daily intake (dose) is used to establish the exposure that will not result in adverse health effects in humans, the concentration of lead in blood (BLL) is the parameter used to determine whether there is a potential for adverse human health effects as a result of exposure to lead. Until recently, the CDC's BLL reference value for children, who are more susceptible than adults to the neurological effects of lead, was 10  $\mu\text{g}/\text{dL}$ . Based on a growing body of studies concluding that BLLs <10  $\mu\text{g}/\text{dL}$  are associated with adverse health effects in children, the CDC has lowered the reference value for children to 5  $\mu\text{g}/\text{dL}$ .<sup>iii,iv</sup> The CDC has determined that no safe BLL in children has been identified.<sup>v</sup> The CDC recommends that the BLL

reference value of 5  $\mu\text{g}/\text{dL}$  be used to determine when public health actions should be initiated to assess and mitigate as necessary a child's exposure to lead.

The IEUBK model for lead estimates the BLL associated with exposure to lead by several exposure pathways.<sup>vi</sup> This model was used by the EPA in 1994 to establish a residential soil screening concentration for lead of 400 parts per million (ppm)<sup>vii</sup> based on the then current CDC analysis, which indicated that BLLs <10  $\mu\text{g}/\text{dL}$  were associated with health effects in children.<sup>viii</sup>

In 2016, EPA issued a Directive<sup>ix</sup> detailing current science and risk tools that Regions may consider when implementing Soil Lead Guidance for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites and Resource Conservation and Recovery Act (RCRA) Corrective Action Facilities.<sup>x</sup> In this memorandum, EPA urges Regions to "consider current scientific conclusions in conjunction with the IEUBK model to determine soil screening levels for residential cleanups," which would include the science related to a lower not-to-exceed BLL for use in the IEUBK model.

### What is the recommended change of the default age range in the IEUBK model based upon?

The default age range in the IEUBK model is currently 0–84 months, set forth in 1994 when EPA established



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the residential soil screening concentration for lead. However, in 2017, EPA recommended modifying the default age range to 12–72 months based on the most recent science by the National Toxicology Program (NTP) and the CDC recommendation.<sup>xi</sup> The NTP reported children ages 1–5 years consistently have higher BLLs than older children, which is hypothesized to be caused by increased hand-to-mouth activity in young children.<sup>xii</sup> Neurological deficits have been associated with increased BLLs among children in this age range. Lastly, CDC reported several studies showing a peak in children’s BLLs at approximately 24 months old.<sup>xiii</sup>

### What are the potential impacts to the DoD’s cleanup program?

If the EPA revises its soil screening concentration for lead based on the revised BLL reference value for children (5 µg/dL) and the updated default age range, the revised soil screening concentration may be less than one-half the current screening concentration of 400 ppm, and likely less than 150 ppm depending on site-specific considerations. Screening levels are not cleanup goals; however, they may be used to determine which sites or portions of sites require more comprehensive site characterization and a risk assessment that should be used to establish site-specific cleanup goals. The changes may affect the five-year cleanup review process for sites. There may be impacts to sites where lead concentrations >150 ppm remain.

### What are the impacts to drinking water regulations?

Based on most recent science, EPA is currently investigating the relationship between lead levels in drinking water and BLLs.<sup>xiv,xv</sup> Multiple tools are being used to model the relationship, including the IEUBK model and the EPA’s Stochastic Human Exposure and Dose Simulation. The results of this model would update the Lead and Copper Rule, which was promulgated in 1991. Currently, EPA has a treatment technique (TT) requirement for lead, set at 15 parts per billion (ppb). The updated Lead and Copper Rule would maintain the TT, but also implement a health-based benchmark for lead in drinking water. This is not a standard or action level, but rather a guide that would be useful in communicating and mitigating risk at the household

level. If implemented, the rule would require water systems to notify the consumer and local public health agency if the health-based benchmark level were exceeded. Individuals and local health officials would then use the information to take prompt actions, including additional lead exposure assessment at the residence. EPA may also use this health-based benchmark to inform when to provide the public with education materials related to lead, to prioritize lead service line replacement, or inform other risk mitigation actions and potential requirements related to schools and other priority locations.<sup>xvi</sup>

### Key Outcomes

- The most recent EPA memorandum concerning lead guidance for CERCLA and RCRA sites recommends a default age range of 12–72 months and the use of best-available science when choosing a not-to-exceed BLL in the IEUBK model. The impact of these changes is presented in the table below.
- EPA is currently using the IEUBK model and Stochastic Human Exposure and Dose Simulation to investigate the relationship between lead levels in drinking water and BLLs. The results of this model could result in a health-based benchmark for lead in drinking water at the residential level.

| EPA Documentation  | Age (months) | Concentration (µg/dL) | Resulting PRG (mg/kg) |
|--|--------------|-----------------------|-----------------------|
| Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (1994) | 0–84         | 10                    | 400                   |
| Updated Scientific Considerations for Lead in Soil Cleanups (2016)                               | 0–84         | 5                     | 153                   |
| Recommendations for Default Age Range in the IEUBK Model (2017)                                  | 12–72        | 5                     | ~145                  |

kg – kilogram; mg – milligram(s); PRG – Preliminary Remediation Goal



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<sup>i</sup> Emerging Contaminants Information Portal (EC Info Portal). <https://www.ecportalinfo.org/>, accessed 27 September 2018.

<sup>ii</sup> Concurrent Technologies Corporation (CTC). 2010. Final Phase II Impact Assessment for Lead (Pb), Part A – Verification and Validation of Risks for Lead (Pb) and Compounds. October 8. Submitted to the CMRMD ODUSD(I&E), Arlington, VA, USA.

<sup>iii</sup> CDC. 2012. CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in “Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention.” [http://www.cdc.gov/nceh/lead/ACCLPP/CDC\\_Response\\_Lead\\_Exposure\\_Recs.pdf](http://www.cdc.gov/nceh/lead/ACCLPP/CDC_Response_Lead_Exposure_Recs.pdf), accessed 27 September 2018.

<sup>iv</sup> CDC. 2012. Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, report of the Advisory Committee on Childhood Lead Poisoning Prevention of the CDC. January. [http://www.cdc.gov/nceh/lead/ACCLPP/Final\\_Document\\_010412.pdf](http://www.cdc.gov/nceh/lead/ACCLPP/Final_Document_010412.pdf), accessed 27 September 2018.

<sup>v</sup> <https://www.cdc.gov/nceh/lead/default.htm>.

<sup>vi</sup> EPA. 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. EPA 9285.7-15-1. February.

<sup>vii</sup> EPA. 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive #9355.4-12. August.

<sup>viii</sup> CDC. 1991. Preventing Lead Poisoning in Young Children. October. [http://wonder.cdc.gov/wonder/prevguid/p000\\_0029/p0000029.asp](http://wonder.cdc.gov/wonder/prevguid/p000_0029/p0000029.asp), accessed 27 September 2018.

<sup>ix</sup> EPA. 2016 Updated Scientific Considerations for Lead in Soil Cleanups. <https://semspub.epa.gov/work/08/1884204.pdf>, accessed 27 September 2018.

<sup>x</sup> EPA. 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. <https://semspub.epa.gov/work/05/168988.pdf>, accessed 27 September 2018.

<sup>xi</sup> EPA. 2017. Recommendations for Default Age Range in the IEUBK Model. <https://semspub.epa.gov/work/HQ/100000689.pdf>, accessed 27 September 2018.

<sup>xii</sup> National Toxicology Program. 2012. NTP Monograph: Health Effects of Low-Level Lead in Children. June 2012. [https://ntp.niehs.nih.gov/ntp/ohat/lead/final/monographhealtheffectslowlevellead\\_newissn\\_508.pdf](https://ntp.niehs.nih.gov/ntp/ohat/lead/final/monographhealtheffectslowlevellead_newissn_508.pdf), accessed 27 September 2018.

<sup>xiii</sup> CDC. 2012. Low Level Exposure Harms Children: A Renewed Call for Primary Prevention. Report of the Advisory Committee on Childhood Lead Poisoning Prevention. January. [https://www.cdc.gov/nceh/lead/acclpp/final\\_document\\_010412.pdf](https://www.cdc.gov/nceh/lead/acclpp/final_document_010412.pdf), accessed 27 September 2018.

<sup>xiv</sup> EPA Office of Water. 2016. Lead and Copper Rule Revisions White Paper. October. [https://www.epa.gov/sites/production/files/2016-10/documents/508\\_lcr\\_revisions\\_white\\_paper\\_final\\_10.26.16.pdf](https://www.epa.gov/sites/production/files/2016-10/documents/508_lcr_revisions_white_paper_final_10.26.16.pdf), accessed 27 September 2018.

<sup>xv</sup> EPA. 2017. Request for Public Comments to be sent to EPA on the Peer Review Materials to Inform the derivation of a Water Concentration Value for Lead in Drinking Water. <https://www.regulations.gov/docketBrowser?rpp=25&so=DESC&sb=commentDueDate&po=0&D=EPA-HQ-OW-2016-0686>, accessed 27 September 2018.

<sup>xvi</sup> EPA Office of Water. 2016. Lead and Copper Rule Revisions White Paper. October. [https://www.epa.gov/sites/production/files/2016-10/documents/508\\_lcr\\_revisions\\_white\\_paper\\_final\\_10.26.16.pdf](https://www.epa.gov/sites/production/files/2016-10/documents/508_lcr_revisions_white_paper_final_10.26.16.pdf), accessed 27 September 2018.



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