ATSDR Newsletter for Health Assessors Including APPLETREE Partners

June 2021

Guidance & Clearance

The purpose of this newsletter is to keep you informed about the guidance and resources that are available for use in your health evaluations.

Welcome to the 2021 Spring issue of the ATSDR Newsletter for Health Assessors!

With ATSDR's re-organization completed, we would like to commend the important work that health assessors and other public health professionals at ATSDR and state partners are carrying out. This is a special era, with growing challenges related to environmental pollutants, emerging contaminants, environmental justice, climate change, and COVID-19. It also brings out opportunities for us to work as a community, share experiences, learn lessons, and tackle issues. We hope this newsletter continues to serve as a platform to provide guidance, share tips and knowledge, and promote communication and collaboration. Please feel free to send us your feedback and suggestions on the newsletter. We look forward to joining efforts to advance our mission of investigating harmful exposure in communities and promoting community health!

Gregory Ulirsch, PhD; Tonia Burk, PhD; Carole Hossom; Zheng (Jane) Li, PhD
Office of Community Health and Hazard Assessment (OCHHA), ATSDR

David Mellard, PhD
Office of Capacity Development & Applied Prevention Science (OCDAPS), ATSDR

What is in this Newsletter?

The following topics are included in this edition of the OCHHA/OCDAPS Associate Director for Science (ADS) Newsletter. An index of all topics covered in all previous newsletters has been added to the Public Health Assessment Site Tool (PHAST) Resources page under the heading of ADS Newsletter.

Evaluating Soil-Pica in Health Assessments

Source: Adobe Images

Soil ingestion can occur by incidentally consuming soil on hands, food, or objects; by intentionally eating unusually high amounts of soil (i.e., soil-pica); or by intentionally ingesting earth as part of certain cultural practices (i.e., geophagy). Health assessors should investigate geophagy only if they learn of this practice during the site visit or from talking with other agencies who might know about this practice locally. In contrast, health assessors should **assume soil-pica is occurring** in any scenario where children could be exposed to contaminated soils. Young children and developmentally delayed children have a higher prevalence of soil-pica than do older children and adults, for whom soil-pica is rare. Soil-pica behavior is most likely to occur in preschool children as part of their normal exploratory behavior, with 4% to 20% of preschool children exhibiting soil-pica [ATSDR 2001]. Among preschoolers, children between the ages of 1 and 2 years have the greatest tendency for soil-pica behavior.

The following is ATSDR's approach to evaluating soil-pica in our health assessment documents:

Step 1: Screening

Environmental media evaluation guides (EMEGs) represent estimated contaminant concentrations below which humans exposed during a specific timeframe (acute, intermediate, or chronic) are not expected to experience noncarcinogenic health effects. Soil EMEGs are derived from the corresponding oral minimal risk levels (MRLs) using conservative assumptions of intake rate and body weight. Soil-pica comparison values (CV) are derived from the corresponding oral MRLs for acute and intermediate pica scenarios using conservative assumptions of intake rate, exposure frequency, and body weight appropriate for the young age groups who exhibit soil-pica behavior.

So, why is the soil-pica CV <u>not</u> the recommended CV when conducting your screening in PHAST?

- The reason is because when you compare your maximum concentration of a contaminant to the recommended CV in PHAST, it is protective for soil-pica exposures for most chemicals.
- One exception to this rule is if copper is a contaminant of concern at your site. ATSDR has determined that the recommended CV for copper, which is the child intermediate EMEG of 520 ppm, is not protective for soil-pica exposures. Therefore, health assessor should use the soil-pica CV for copper (53 ppm) in the screening step. A note has been added to PHAST indicating this exception and discussions are taking place to modify copper's recommended CV in PHAST.

Step 2: Calculating soil-pica exposures

After a contaminant of concern is determined to be above its recommended CV (or soil-pica CV for copper) in PHAST, health assessors can compare the maximum levels of the contaminant to its soil-pica CV to get a general sense of how far above the maximum concentration the soil-pica CV is. However, after a contaminant of concern is selected, PHAST will, by default, calculate soil-pica exposure doses, which allows users to quickly determine if the doses are above the acute minimal risk level (i.e., HQ > 1). Use the following steps for calculating exposure point concentrations (EPCs) and for soil-pica exposures:

1. Run a default soil-pica scenario in PHAST. You will use an EPC that represents the maximum concentration of surface soil that a child could access. The default scenario in PHAST assumes an exposure of 3 days a week (Exposure Factor or EF = 3/7) and an intake rate of 5,000 milligrams per day.

   *If PHAST indicates the default scenario using the maximum concentration is a potential health concern (i.e., HQ >1), go to step 2.

2. Enter site-specific parameters, if available, into PHAST to determine whether a **single soil-pica event** is a health concern. Note that site-specific data are often not available and are not required to evaluate this one-time dose. Typically, this one-time dose uses an exposure of 1 day and the default intake rate of 5,000 mg/kg.

Step 3: In-depth toxicological evaluation

If an acute HQ exceeds 1 from Step 2 above, health assessors should conduct an in-depth toxicological evaluation according to guidance in the Public Health Assessment Guidance Manual and elsewhere.

In the case of copper, the current recommended CV is 520 ppm. However, if children with soil-pica behavior ingest soil at 500 ppm, for example, they will have doses that exceed gastrointestinal effects levels. The most common effect is nausea, but vomiting, abdominal pain, and diarrhea have also been reported in humans.

If health assessors have any question about evaluating soil-pica exposures at their site, please contact either the OCDAPS or OCHHA ADS Office.

How to Present Doses, Hazard Quotients, and Cancer Risk in Health Assessments

Recently, the ADS group received a question about how to show hazard quotients (HQ) less than 1 in health assessment documents, and in particular, the tables. When doses, HQs, and cancer risk estimates are shown in the PHAST-generated results table, PHAST rounds those values to two significant figures. The results are shown with two significant figures because that might be important as you make decisions about harmful effects. However, when you discuss these results in your document, the significant digit may be reduced. For example, an HQ of 0.67 in the PHAST-generated results table can simply be presented as an HQ of 0.7 in your public health document.

Here are a few general rules to follow when presenting doses, HQs, and cancer risk estimates in a health assessment document:

- Show doses to two significant figures
- When HQs < 1
    - Show the HQ to one significant figure or
    - Show as < 1
    - Avoid using both methods in the same table
- When HQs > 1
    - Show HQs as two significant figures (e.g., 1.2; 12; 120; 1,200).
- Show cancer risk estimates as one significant figure (e.g., show 7.1E-3 as 7E-3 or 7 x 10^{-3})
    - Remember, you'll need to explain the cancer risk estimate in plain language.

Evaluating Cancer for Per- and Polyfluoroalkyl Substances (PFAS) in Health Assessments

Knowledge about per- and polyfluoroalkyl substances (PFAS) carcinogenicity is evolving. This article gives some background and revised recommendations for evaluating PFAS, particularly perfluorooctanoic acid (PFOA), in ATSDR health assessment documents.

The U.S. Environmental Protection Agency (EPA) [2016a] considers the evidence that PFOA is potentially carcinogenic in humans to be suggestive. The International Agency for Research on Cancer [2017] has determined that PFOA is possibly carcinogenic to humans. A recent review of PFOA carcinogenicity by Steenland et al. [2020] found the **human** (epidemiological) evidence remains supportive but not definitive for kidney and testicular cancers. Findings from the National Cancer Institute [Shearer et al. 2021] added to the evidence that PFOA might cause kidney cancer (renal cell carcinoma) in humans. Steenland et al. [2020] also found that human studies were inconsistent but suggestive of an association between PFOA and prostate cancer. In summary, some evidence is available from human studies that PFOA is associated with kidney, testicular, and prostate cancers.

Animals given PFOA orally have shown high rates of various cancers. We do not know if the cancers in animals result from a mode of action that is relevant to humans [ATSDR 2021]. A rat study from 2012 showed that

PFOA exposure was associated with testicular cancers [Butenhoff et al. 2012]. More recent data from rats and mice suggest that lower PFOA doses than previously observed might be associated with liver and pancreatic cancers in male rats and liver, kidney, forestomach, and thyroid gland cancers in female rats [NTP 2018, 2020]. In summary, some evidence is available from animal studies that PFOA might cause several cancers, including liver, testicular, kidney, forestomach, thyroid, and pancreatic cancers. Of note, kidney and testicular cancer have been shown in human and animal studies.

Until recently, ATSDR health assessors have evaluated the potential for cancer from PFOA exposure using a 2016 oral cancer slope factor (CSF) derived by EPA' s Office of Water [EPA 2016a]. This PFOA CSF, 0.07 $(mg/kg/day)^{-1}$, was based on the 2012 rat testicular cancer data [Butenhoff et al. 2012]. EPA calculated this CSF for PFOA to assess the safety of their non-cancer reference dose against carcinogenic effects. This CSF was never added to the Integrated Risk Information System (IRIS) [EPA 2016b].

Based on the recent human studies and the National Toxicology Program (NTP) animal studies discussed above, EPA and some state agencies are reassessing their PFOA CSFs. CSFs based on the more recent NTP studies might be different from the CSF previously derived by EPA for testicular cancer. For these reasons, **ATSDR no longer recommends the use of the 0.07 $(mg/kg/day)^{-1}$ CSF to evaluate PFOA cancer risk**, and ATSDR has withdrawn the EPA CSF from the PHAST.

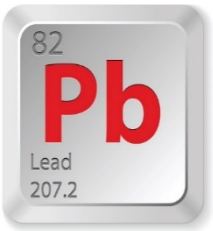
EPA cites suggestive evidence that perfluorooctane sulfonate (PFOS) causes cancer, based on limited evidence of liver cancer in rats. However, the evidence was too limited to support a quantitative cancer assessment for PFOS [EPA 2016b]. EPA has not classified any other PFAS as potentially carcinogenic and has not derived oral CSFs for PFOS or other PFAS, mostly because animal and human data are insufficient. Therefore, similar to PFOA, ATSDR cannot calculate the estimated cancer risk from PFOS or other PFAS.

Until more definitive data are available, health assessors need to evaluate the cancer risk posed by PFOA, PFOS, and other PFAS exposures qualitatively. The actual cancer risk from PFOA, PFOS, other PFAS, or PFAS mixture exposures is uncertain.

New PFAS Toxicological Summaries in PHAST

Within the PHAST CV/Health Guideline Module, ATSDR provides information on the derivation of the minimal risk level (MRL), EPA's reference dose or concentration, and cancer classification, if applicable. ATSDR has also been providing supplemental information on the derivation of the health guidelines with additional toxicological data to assist health assessors decide possible health effects. ATSDR has recently developed this information for the four PFAS where MRLs have been established (i.e., PFOA, PFOS, perfluorohexanesulfonic acid [PFHxS], and perfluorononanoic acid [PFNA]). When you access the CV/Health Guidelines Module for these four PFAS, you will find a link to the full toxicological summaries in the PHAST Resources page under the title of Chemical-Specific Guidelines and Resources.

Tips for Evaluating Lead Exposures at Sites



Overview of Important Factors to Consider

In this issue, we begin our series on tips for evaluating lead exposures. Subsequent newsletters will take a closer look at each component mentioned below.

Lead exposure evaluations are unique in that several site- and community-specific components must be considered:

- **Know your community.** Find out the social vulnerability index (SVI)[1] or socioeconomic and demographic factors that might increase risks for elevated blood lead levels.
- **Know your samples.** Find out site-specific exposure and sampling conditions:
  - Exposure point vs indicator sampling
  - Soil — ground cover, discrete or incremental sampling methodology, arithmetic mean level
  - Air — rolling 3-month arithmetic mean
  - Water — flushed vs first draw sample
- **Know your data.** Find out environmental lead levels (soil, water, air, dust, biota)

In addition to the critical information above, the following components provide information needed to determine the urgency we need to take action:

- Biological indicator of exposure or blood lead level[2] (measured or modeled)
- State and local blood lead surveillance data
- Public health actions taken or planned by public health partners

ATSDR works promptly to identify sites or community exposures to lead that pose the greatest health risk and takes responsive health actions. These actions are needed because

- Exposure to lead, even at low levels, can cause health effects in children such as slower growth and development; decreased hearing, attention, and learning; and behavioral problems [NTP 2012].
- There is no safe blood lead level in children [CDC 2012, 2021].
- CDC's current blood lead reference value of 5 micrograms per deciliter is under review by an advisory committee[3] to CDC to lower the level.
- Lead evaluation presents a unique evaluation challenge because lead is ubiquitous in the environment and there are many sources [ATSDR 2017].

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[1] Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

[2] CDC currently uses a blood lead reference value of 5 micrograms per deciliter to identify children with blood lead levels that are higher than most children's levels. The blood lead reference level is based on the U.S. population of children ages 1–5 years who were in the highest 2.5% of children when tested for lead in their blood from 2007 to 2010.

[3] The Lead Exposure and Prevention Advisory Committee (LEPAC) is reviewing CDC's current reference level. Find out more about LEPAC at https://www.cdc.gov/nceh/lead/advisory/lepac.htm.

Health assessors should remember that for sites where lead contamination is a concern

- Our primary goal is preventing or reducing exposure.
- Our recommended steps to avoid lead exposure will generally be the same for each site.
- What will differ is the urgency for taking action.

Interpreting Long-Term Indoor Air Sampling Data: Passive Sorbent vs Passive Canister Capillary-flow Controller Sampling Methods

Passive canister air samplers typically have used diaphragm controllers that allow collection for 8-hour or 24-hour samples. However, some health effect levels are based on longer exposures, such as the critical 3-week window where the developing fetus is sensitive to cardiac malformations from exposure to trichloroethylene (TCE) levels that approach or exceed 20 $\mu g/m^3$. Indoor air contaminants also vary from day to day, so a 1-day sample is limited in representing this 3-week critical exposure period. Therefore, methods that collect samples over longer periods might be more appropriate than air samples over shorter (24 hours or less) periods for some contaminants of concern.

Passive sorbent samplers are increasingly being used to collect time-weighted average indoor air samples over days or weeks. Relying on just passive sorbent sampler data might lead to biased exposure assessments. However, the new passive canister capillary-flow controller sampling method can be used solely to provide high-quality samples or to complement passive sorbent sampling to lend more confidence to health assessments.

Passive sorbent samplers are cheap and only require the opening of a cap or seal to begin sample collection. Passive sorbent samplers are more susceptible to environmental conditions (temperature, pressure, humidity, and air flow) than are canister samplers and have to be selected based on the range of concentrations being sampled. Operation outside the calibrated conditions can cause bias in the results. Confirmation sampling using at least one inter-duplicate method sample for indoor air characterization at a site is generally recommended. Passive samplers tend to have good reproducibility for a calibrated batch under similar conditions, so larger sampling events could use one confirmation sample per 10 passive samples (10%).

A recent study tested long-term sampling of indoor air by using a capillary flow-controller with a canister [Rossner et al. 2019, 2020]. The capillary controller (Figure 1) is approved by the National Institute for Occupational Safety and Health (NIOSH) and is commercially available. The controller slows intake to extend the passive collection time into canisters from about 24 hours to 3 weeks. The capillary-canister method performed well in the study, whereas the passive sorbent samplers underpredicted air levels. The underprediction/low bias of the passive sorbent samplers might have resulted from overloading, humidity, or temperature. The poor performance of passive sorbent samplers in this study emphasizes the importance of confirmation sampling using an inter-duplicate method.

Figure 1. Capillary flow controller coupled with a standard air sampling canister [Rossner 2020]

Passive sample results may still be used for some risk management purposes, even if they do not have confirmation. If passive sorbent samplers are used as a rapid screen, they might quickly identify contaminants at levels of concern and support prompt action. However, in the absence of confirmation results, low bias can result in underestimating exposure and health risk, while high bias might overestimate exposure and risk concerns. Some conditions that could bias results include the following:

- High humidity (moisture competes with contaminants for the sorbent; low bias)
- Other contaminants competing for the sorbent (low bias)
- Poor choice of sorbent (low bias)
- Sampler device (low or high bias)
- Long duration of sampling (low bias)
- Ambient factors (more easily controlled)
    - High air flow (by windows or vents) that force turbulent air into the sampler (high bias)
    - Temperature and pressure outside the calibrated range (low or high bias)

If passive sampling indicates concentrations of concern, health protective recommendations are likely needed because of the greater potential for low bias.

Some chemicals that might be missed by passive sorbent sampling include

- chlorinated ethylene degradation products, such as vinyl chloride,
- solvent stabilizers, such as 1,4-dioxane,
- fuel stabilizers, such as ethanol, methyl tert butyl ethylene or methyl ethyl ketone, and
- fixed gasses, such as methane (fire/explosion hazard).

Consider the strengths and weaknesses of the different sample collection methods discussed above to aid in your analysis and interpretation of air data. Although the capillary-canister method of field verification is relatively new, this article is meant to increase awareness of its applicability and to encourage your consideration of its potential usefulness in the future.

New ATSDR Guidance Documents and Where to Find Them

Do you know where to find all the latest ATSDR guidance documents? The table below shows recently completed guidance and new guidance coming soon!

All of the latest guidance documents are posted in the Resources Section in PHAST. In addition, all ADS Newsletters, and a list of current subject matter experts (SMEs), have been added to the Resources Section of PHAST. When the online Public Health Assessment Guidance Manual is launched, all guidance (including these newsletters) will be housed there. Only specific PHAST-related guidance and supporting materials will remain within the Resources Section in PHAST. Look for updates from the ADS Office in 2021 about the launch of the updated guidance manual. We are also updating several outdated guidance documents and hope to have those released later in 2021. If you do not see guidance on a specific topic in the Resources Section in PHAST, contact the OCHHA or OCDAPS ADS Office about that topic.

Guidance Topics	Status	Point(s) of Contact
Particulate matter	Completed	Michelle Colledge; Greg Ulirsch
Exposure points for non-discrete sampling	Summer 2021	Greg Ulirsch; James Durant
Exposure point concentrations for PAHs	Summer 2021	Greg Ulirsch; James Durant
Exposure units	Completed	Greg Ulirsch; James Durant
Inhalation exposures	Completed	Michelle Colledge

Section References

Evaluating Soil-Pica in Public Health Assessment (PHA) Documents

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Evaluating Cancer for Per- and Polyfluoroalkyl Substances (PFAS) in Our PHA Documents

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Tips for Evaluating Lead Exposures at Sites--*Overview of Important Factors to Consider*

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A New Confirmation Method for Use with Passive Sorbent Indoor Air Samplers: *Canisters with Capillary-flow Controllers*

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Further Reading

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