ATSDR Newsletter for Health Assessors

Including APPLETREE Partners

Guidance & Clearance News

October 2024

Welcome!

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

What is in this Newsletter?

The following topics are included in this edition of the ATSDR Newsletter for Health Assessors. An index of all topics covered in previous newsletters has been added to the Public Health Assessment Site Tool (PHAST) resources page under the heading of ATSDR Health Assessor Newsletter.

Source Analysis at Vapor Intrusion Sites Using Attenuation Factor Ratios

Health assessors can use attenuation factors (AFs) as lines of evidence to support whether the source of detected indoor air contaminants is background (indoor or outdoor source) or vapor intrusion.

Comparing AFs allows a quantitative way to identify background sources. The AF for subslab soil gas is the indoor air concentration of a contaminant divided by the subslab soil gas concentration. The AF for groundwater is the indoor air concentration of a contaminant divided by the soil gas concentration that occurs just above the shallowest groundwater table (near-source soil gas). The near-source soil gas concentration is estimated by multiplying the shallow

groundwater concentration by the contaminant's Henry's law constant available in the *Contaminant Categories and Properties* list under the PHAST *CVs and Health Guidelines* tab.

The AF formulas for subslab soil gas and for groundwater are as follows:

$$SSG_{AF} = \frac{IA}{SSG} \qquad \text{Equation 1}$$

$$GW_{AF} = \frac{IA}{\left[GW * H' * 1{,}000 \frac{\text{L}}{\text{m}^3}\right]} \qquad \text{Equation 2}$$

where,

GW = shallow groundwater concentration (µg/L)
GW_{AF} = shallow groundwater AF (unitless)
IA = indoor air concentration (µg/m^3)
H' = Henry's law constant (dimensionless partition coefficient: concentration in air / concentration in water)
L/m^3 = liters of air per cubic meter of air
SSG = subslab soil gas concentration (µg/m^3)
SSG_{AF} = subslab soil gas AF (unitless)

Perform these calculations when paired subsurface and indoor air samples are available for each indoor air sampling event. Use paired subsurface and indoor air samples that are collected near the same part of the building and within a similar timeframe. Then, use the following two steps to provide lines of evidence about the source of the indoor air contamination:

Step 1: Compare each attenuation factor to the value of one

An AF greater than one indicates that a background source is present. An AF greater than one occurs when the indoor air concentration is greater than the subsurface concentration. Contaminants move from areas of higher concentration (source areas) to areas of lower concentration. Health assessors need to perform only step 2 analysis to determine the strength (strong, weak, or indiscernible) for contaminants with a background source identified in step 1.

Step 2: Compare each attenuation factor to the attenuation factor of the index contaminant

Indoor air contaminants with similar properties should attenuate at about the same rate as they move from the subsurface to indoor air. ATSDR has used the following "rule of thumb" method to identify contaminants with strong and weak background sources.

The contaminants should be separated into two groups for Step 2:

- Nonhydrocarbons, which are recalcitrant (not aerobically biodegradable)
- Hydrocarbons, which are aerobically biodegradable [NAVFAC 2011]

Determine the index contaminant for each group. The contaminant for each date and location with the lowest subsurface AF is considered the "index contaminant" for that sampling timeframe and location and is the least likely to have a background source.

Identify AF results that support a strong, a weak, or an indiscernible indoor or outdoor source that is within the range of inherent variability in measurements used to calculate AFs according to the following criteria:

- Results support the potential for a **strong** indoor source, a strong outdoor source, or both, when the contaminant's subsurface AF is **more than 10 times** the index contaminant's AF from the same medium, timeframe, and location.
- Results support the potential for a **weak** indoor source, a weak outdoor source, or both, when the contaminant's subsurface AF is **5 to 10 times** the index contaminant's AF from the same medium, timeframe, and location.
- Results **do not support** the potential for indoor or outdoor sources when the contaminant of concern's subsurface AF is **less than 5 times** the index contaminant's AF from the same medium, timeframe, and location. According to USEPA [2012], AFs with similar fate and transport properties may inherently vary by a factor of 5 to 10 when contaminants are detected near the reporting limit. The presence of a background source is indiscernible in this range.

Indoor air background sources are common. Generally, if either step 1 or step 2 indicates a background source, assume that a background source is likely present but note when the lines of evidence do not all agree.

Limitations

The following limitations may apply to source analysis using AF ratios:

- Varying biodegradation rates and diffusion rates amongst contaminants may introduce uncertainty in the AF analysis.
- AF ratios calculated for contaminants detected near the reporting limit (e.g., within a factor of ten) may have additional uncertainty versus contaminants detected at higher concentrations.

Attenuation Factor Analysis Example

Recalcitrant contaminants: In the following example (Table 1), the carbon tetrachloride has an AF of one, which indicates a potential background source is present in step 1.
In step 2, the methylene chloride AF is more than 10 times the lowest (index) AF which indicates a potential strong background source. The chloroform AF is within 5 to 10 times the index AF, indicating a potential weak background source. Trichloroethylene is within the range of inherent variability of 1 to 5 times the index AF and may or may not be from a background source.

Aerobically biodegradable contaminants: Toluene, xylenes, and benzene have potential background source contributions because the indoor air concentrations are greater than the subslab gas concentrations (the AFs are greater than one in step 1).

In step 2, the toluene AF is more than 10 times the index AF which indicates a potential strong background source. The xylene and benzene AFs are less than 5 but assume that a background source is present from step 1. Cyclohexane has the lowest AF and is the least likely to have a background source contribution to indoor air.

Table 1. Example of Summary Table for Comparing Subslab Gas Attenuation Factors

Sample ID and date	Contaminant*	Contaminant is Rapidly Naturally Biodegradable under Aerobic Conditions?	Indoor Air Concentration (µg/m³)	Subslab Soil Gas Concentration (µg/m³)	AF	Ratio of Contaminant AF to Index Contaminant AF	AF Is 5 to 10 times the Index Contaminant AF?	AF Is More Than 10 times the Index Contaminant AF?
IA29 4/10/13	Carbon tetrachloride	No	0.060	0.060	1.0	78	No	Yes
IA29 4/10/13	Methylene chloride	No	0.050	0.13	0.38	30	No	Yes
IA29 4/10/13	Chloroform	No	0.41	3.5	0.12	9	Yes	No
IA29 4/10/13	Trichloro-ethylene	No	0.040	0.9	0.044	3	No	No
IA29 4/10/13	**Tetrachloro-ethylene**	**No**	**0.040**	**3.1**	**0.013**	**N/A – Index Contaminant**	**N/A – Index Contaminant**	**N/A – Index Contaminant**
IA29 4/10/13	Toluene	Yes	5.6	0.28	20	51	No	Yes
IA29 4/10/13	Xylenes (total)	Yes	0.16	0.10	1.6	1.6	No	No
IA29 4/10/13	Benzene	Yes	0.11	0.10	1.1	1.1	No	No
IA29 4/10/13	**Cyclohexane**	**Yes**	**0.13**	**0.33**	**0.39**	**N/A – Index Contaminant**	**N/A – Index Contaminant**	**N/A – Index Contaminant**

Acronyms: ID = identifier; AF = attenuation factor; N/A = Not applicable

* The index contaminant is the bolded contaminant with the lowest AF, i.e., tetrachloroethylene for chlorinated contaminants and cyclohexane for non-chlorinated contaminants in this example.

Other Lines of Evidence

Other lines of evidence should also be consulted when identifying background sources:

- Consult building surveys that identify products present within buildings that may contain and serve as a source of detected indoor air contaminants.
- Compare indoor air concentrations at sites to indoor air concentrations in literature studies of similar uncontaminated buildings, e.g., EPA [2011], to see if contaminants are present within typical background concentrations.

The two lines of evidence above are particularly important for noting if the index contaminant is also likely attributable to a background source.

Feel free to request assistance from ATSDR's vapor intrusion subject matter experts.

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Summing Aroclor Data for Cancer Risk Assessment

Polychlorinated biphenyls, or PCBs, are a complex class of 209 different chemical species, or congeners. These congeners are routinely grouped together into specific sets called Aroclors. They are given a number, such as 1254, where the first two numbers identify the number of carbon atoms and the second two numbers the average percentage by weight of chlorine. So Aroclor 1254 would have 12 carbons, and, on average, 54% of the total mass of the molecules comes from chlorine. Aroclors were the commercially used mixtures, and regulatory information exists only for Aroclor data, not individual congeners. Because of this, it is more frequent to encounter Aroclor data in environmental health sciences.

It is not common, but in some instances multiple Aroclor mixtures can be identified in a single sample. The way the Aroclor mixtures are identified allows for the different Aroclor concentrations to be summed together to obtain total PCBs for an individual sample [EPA 2007]. Although there is significant overlap of specific congeners in the Aroclors, the analyst will look for patterns of prominent peaks, Aroclor-specific congeners, and congener ratios to determine which Aroclor mixtures are present [NOAA 2008].

The majority of toxicological information is available for Aroclor 1254, but all Aroclor mixtures that have been tested have resulted in a carcinogenic potential [ATSDR 2000]. When multiple Aroclors have been reported for a single sample, those Aroclors should be summed to get a total PCB concentration. If sample results are reported just as PCB congeners, those congeners should be summed to get a total PCB concentration for the sample. Health assessors should compare the summed PCB concentrations to ATDSR's comparison values (CVs) in PHAST, the Cancer Risk Evaluation Guide (CREG), and should use the total PCB concentration to estimate cancer risk from exposure to these contaminants.

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Public Health Assessment Training Modules 1-4: Renewed Continuing Education

The Public Health Assessment Training (PHAT) is a series of online modules that teach you about the basics of the public health assessment process. It's self-paced and interactive.

You can get continuing education (CE) credits for the first four modules of the PHAT. OCDAPS worked with CDC TRAIN to renew their accreditation.

To obtain CE for PHAT Modules 1-4:

1. Click on the following links for each module and register for the course in CDC TRAIN.
    - *Public Health Assessment Training Module 1: About ATSDR and Its Method (Course Number: WB4811)*
    - *Public Health Assessment Training Module 2: Public Health Assessment Overview (Course Number: WB4812)*
    - *Public Health Assessment Training Module 3: Site Information and Data Gathering (Course Number: WB4808)*
    - *Public Health Assessment Training Module 4: Exposure Pathway Evaluation (Course Number: WB4809)*
2. Check the box for each type of CE you wish to apply for when registering for each course. If you are not interested in CE credits, you can still obtain a Certificate of Completion. You can obtain the following CE credits:
    - Continuing Education Units (CEUs)
    - Certified Health Education Specialist (CHES)
    - Master Certified Health Education Specialist (MCHES)
    - Certified Public Health (CPH)
3. Complete the course.
4. If there is a **Mark Completed** button on the course page in TRAIN, click to move to the next step.
5. Pass the post-assessment. You will have 2 attempts to pass.
6. Complete the evaluation.

Please pass the modules' post-assessments and complete evaluations by **April 9, 2026**.
You can access your certificates and transcript by visiting **Your Learning** in TRAIN.

If you completed the PHAT Modules 1-4 to attend the "Diving Deeper into the Public Health Assessment Process" training (conducted in Atlanta on April 22-26, 2024), you can still register for these modules in CDC TRAIN, pass their post-assessments, and finish their evaluations to obtain CEs.

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508 Tips and Tricks: 10 Ways to Improve Accessibility in Documents

ATSDR documents that are posted online need to be 508-compliant. This newsletter features a series of articles about common issues in making your public health documents 508-compliant.

For this edition of 508 Tips and Tricks, we are discussing 10 things you can do to improve accessibility.

1. **Title your documents**
   Choose a title that identifies the document or describes its content. Be as specific as possible about the pathway or the contaminants. A more in-depth discussion of how to title your document can be found in the December 2023 ATSDR Newsletter article, "Judging a Document by its Cover: How to Name Your Document."

2. **Describe your images**
   Use up to 120 characters, including punctuation and spaces. What is important about the picture? What does your audience need to know? A more in-depth discussion of how to describe the images in your document can be found in the April 2023 ATSDR Newsletter article, "508 Tips and Tricks: Alternative Text for Images."

3. **Create headings using Word's styles**
   From the styles menu in Word's 'Home' tab, select the appropriate headings level. Keep the headings logical and in order: H1 followed by H2, H2 followed by H3, etc. Assistive technology, like screen readers, will convey the heading level to the user.

4. **Avoid excessive bullet levels**
   Every list level is announced by a screen reader. Be sure to use Word's built-in number or bullets. Do not manually type characters or numbers. In addition, too many bullets can make it difficult for the listener to keep track of where they are in a list. For example, the clear writing guidance recommends keeping bulleted lists to seven or fewer bullets. Try to avoid going more than two deep for lists with embedded lists.

5. **Use descriptive links**
   Use meaningful text when inserting a link in the text. Instead of using "Click here" or long URLs, use at least 2 methods to identify the links. For example, "Download the form" uses a text description, color, and underlining.

6. **Don't use images of text**
   Screen readers can't read text in an image. If you include an image with some text, repeat the text when writing the alt text for the image. If you omit the image text in the alt text description, your message is lost.

7. **Keep tables simple**
   Use a single heading row at the top of the table with no joined cells. This will make your table much more accessible without having to add table IDs or other descriptors in the PDF that you would have to use with complex tables. A more in-depth discussion of how to keep tables simple can be found in the December 2022 ATSDR Newsletter article, "508 Tips and Trick: Complex Tables."

8. **Color contrast**
   People with low vision can't see faded colors, oranges, reds, or greens. Check to ensure all the colors meet the CDC ratio of 4.5:1 and when possible, use darker colors. Here is a link to an example of a color contrast analyzer: https://www.tpgi.com/color-contrast-checker/.

9. **Avoid red and green indicators**
   As many as 1 in 8 males are red-green color blind. That means they can't see the difference between red and green text or red and green arrows. Use other distinguishing markers liked dashed and dotted lines when using these colors or avoid the colors altogether.

10. **Use simple language**
    Use plain language when possible. If you need to use scientific or technical terms, be sure to define them. These little steps will improve reading for everyone**.**

A training video will be available soon that gives practical advice to health assessors about how to create 508-compliant health consultations and public health assessments.

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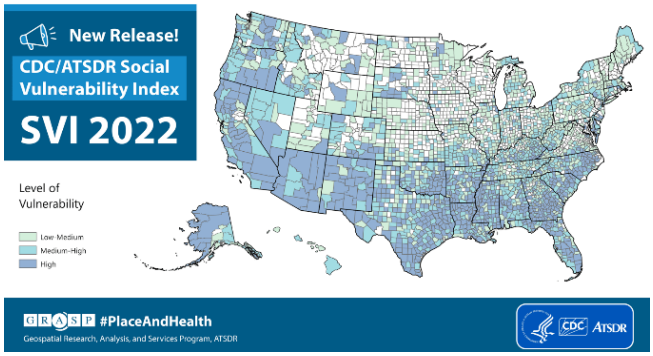
Strengthening Community Resilience with CDC/ATSDR's SVI 2022 Update



CDC/ATSDR's Social Vulnerability Index (SVI) is pleased to announce its updated SVI 2022 dataset. By incorporating the latest census data and other indicators, the 2022 dataset provides an up-to-date look at the social factors that can influence a community's ability to prepare for, respond to, and recover from public health crises.

The updated SVI 2022 dataset will enable ATSDR and state health assessors to use the CDC/ATSDR SVI insights and enhance your efforts to build resilient communities and promote health equity.

Start making a difference today! Health assessors can use this powerful place-based index, dataset, and mapping application to

- Direct resources to the areas with the greatest needs
- Identify areas in need of emergency shelters and estimate the amount of supplies needed
- Guide community-based health promotion initiatives

For more information

- To review datasets and methodology, see the CDC/ATSDR SVI Data and Documentation page.
- For questions, contact the CDC/ATSDR SVI coordinator at svi_coordinator@cdc.gov.

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CDC/ATSDR & HHS Launch the Heat and Health Index (HHI)

The Center for Disease Control and Prevention (CDC) and ATSDR are partnering with the U.S. Department of Health and Human Services' Office of Climate Change and Health Equity (OCCHE) to prepare and respond to heat events in the United States. We released the Heat and Health Index (HHI) on May 31, 2024, as the first national tool to incorporate heat-related illness data at a fine geographic scale to measure vulnerability to heat.

The HHI delivers a single ranking for each ZIP code so public health officials, city planners, policymakers, and community members can identify and map areas most at risk of negative health impacts from heat. Along with historical data on heat-related illness, the HHI incorporates data on pre-existing health conditions, sociodemographic factors, and natural and built environmental factors to assess vulnerability to heat. This tool helps policymakers prioritize interventions for communities most impacted by heat.

Using HHI to Prepare for and Respond to Heat Events

ATSDR and state health assessors can use the HHI to:

- Identify and prioritize areas that may require special attention during the heat season or additional action to reduce heat-related illness over time
- Educate and inform the public about heat risk in their community

- Analyze the unique, local factors driving heat-related illness to inform policymaking and decision-making

The HHI, a collaborative initiative led by the ATSDR Geospatial Research, Analysis, and Services Program (GRASP), is shared via CDC's Heat and Health Tracker, powered by the Environmental Public Health Tracking Program.

Access the HHI and explore its capabilities at https://ephtracking.cdc.gov/Applications/heatTracker/.

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Exposure Point Concentration Basics

Use the exposure point concentration (EPC) tool to determine the EPC to use in your dose calculations and air evaluations (see Figure 1). You can access the EPC tool from the PHAST resource page, under the EPC tool category. An EPC tool user's guide (ATSDR 2022) and training video are also available from the PHAST resource page. If you need access to PHAST, send a request to PHAST@cdc.gov.

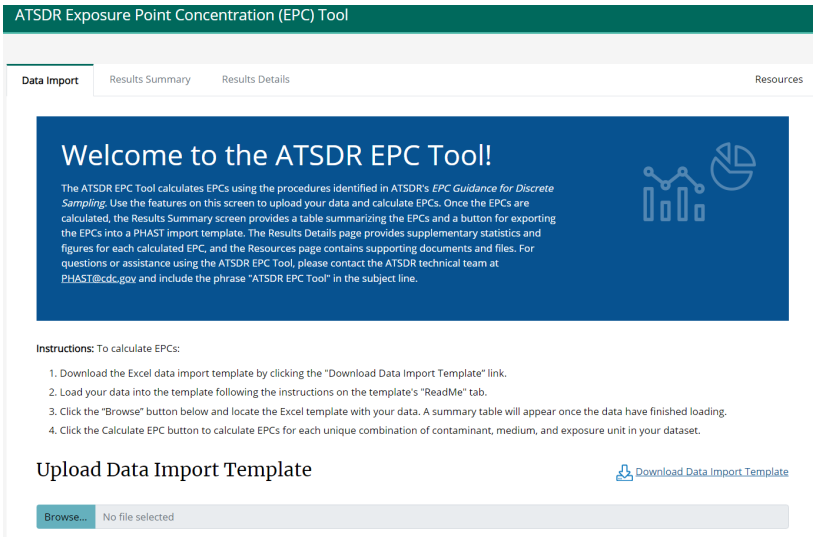

Figure 1. Home Screen for ATSDR's EPC Tool

Determining the EPC for a dataset is a complex process that requires insight into the type of distribution in the dataset, the number of samples, and the number of detects and non-detects. The EPC tool will apply the criteria described in ATSDR's EPC Guidance for Discrete Sampling to decide whether the data are sufficient to calculate a 95UCL of the mean. If data are not

sufficient, the EPC tool will select the maximum concentration from the dataset to use as the EPC for the exposure unit. Here are the criteria.

- For an exposure unit with fewer than eight samples, the tool will select the maximum value as the EPC.
- For an exposure unit with 8 to 19 samples and at least 4 detected values, the tool will use parametric methods to determine the appropriate distribution and will calculate a 95UCL as the EPC using the selected distribution. If 3 or fewer samples have detected values, the tool will select the maximum value as the EPC.
- For an exposure unit with 20 or more samples and with at least 20 percent of the samples having detected values, the tool will use non-parametric methods to calculate the EPC. If the 20% rule is not met, the tool will select the maximum value as the EPC.

An important consideration for UCL calculations is how to handle non-detect observations. Non-detects are valid measurements in which the concentration of the contaminant is too low to be measured with confidence. Sampling reports typically present non-detects as being less than a specified limit (e.g., "< 0.5 mg/kg") with that limit being, for example, the method detection limit. In these cases, health assessors can only conclude that the contaminant level is somewhere between 0 and the specified limit, but the actual value is not known. Health assessors should apply the following rules when calculating 95UCLs for datasets containing non-detects:

- Do not delete non-detect observations from datasets. Although actual environmental concentrations are not known for non-detect observations, these samples are valid measurements and must be included in 95UCL calculations. When non-detect values are deleted, this action will generally remove the lowest contamination levels from the dataset, thus introducing a positive bias to the calculated 95UCLs.

- Do not consider non-detect observations with extremely high detection limits. As the one exception to the previous rule, health assessors should delete from datasets any non-detects reported for relatively insensitive methods. For example, if the majority of garden vegetable samples from an exposure unit have detected metal concentrations between 1 and 10 µg/kg but two samples are reported as "<10,000 µg/kg," health assessors should exclude the latter samples from the EPC calculation because they offer no informational value. Other groups of chemicals that often report high non-detect values include PAHs (polycyclic aromatic hydrocarbons) and Aroclors. All non-detect results with detection limits above the highest detected concentration in an exposure unit should not be considered when calculating 95UCLs.

- Do not replace non-detect observations with a single surrogate value. In some evaluations of environmental sampling data, health assessors may notice that non-detect observations have been replaced with surrogate values (i.e., concentrations of zero, one-half the detection limit, or the detection limit). When calculating 95UCLs, health assessors should never do this. Among other problems, replacing non-detects

with the same number multiple times will generally underestimate the variability (i.e., standard deviation) of the data, which then underestimates the 95UCL. The statistical methods used in the EPC tool were developed specifically for computing 95UCLs for datasets including non-detect observations. These methods address non-detect values without the need for them to be substituted with a surrogate value.

- The EPC tool will not calculate 95UCLs for datasets containing less than three unique detected values. For example, consider a dataset with five detections at a concentration of 1 ppb and four non-detects at concentrations of <0.5 ppb. The lack of variability in the detected concentrations will lead to computational issues in some of the statistical approaches used in the EPC tool. When this happens, the EPC tool will select the unique detected value anytime the dataset includes only one unique detected value. At least three unique detected values are needed to calculate a 95UCL using the procedures outlined in this document. If there are fewer than three unique detected values, the EPC tool will select the maximum detected concentration as the EPC (ATSDR 2023).

ATSDR's EPC tool should be used over other similar tools like EPA's ProUCL because ATSDR's EPC tool incorporates the criteria previously described, and it provides the EPC that should be used in PHAST. The summary generated by the tool sometimes points out issues with the dataset and will often refer users to different sections in the EPC guidance document for further explanation of the issue and provide advice.

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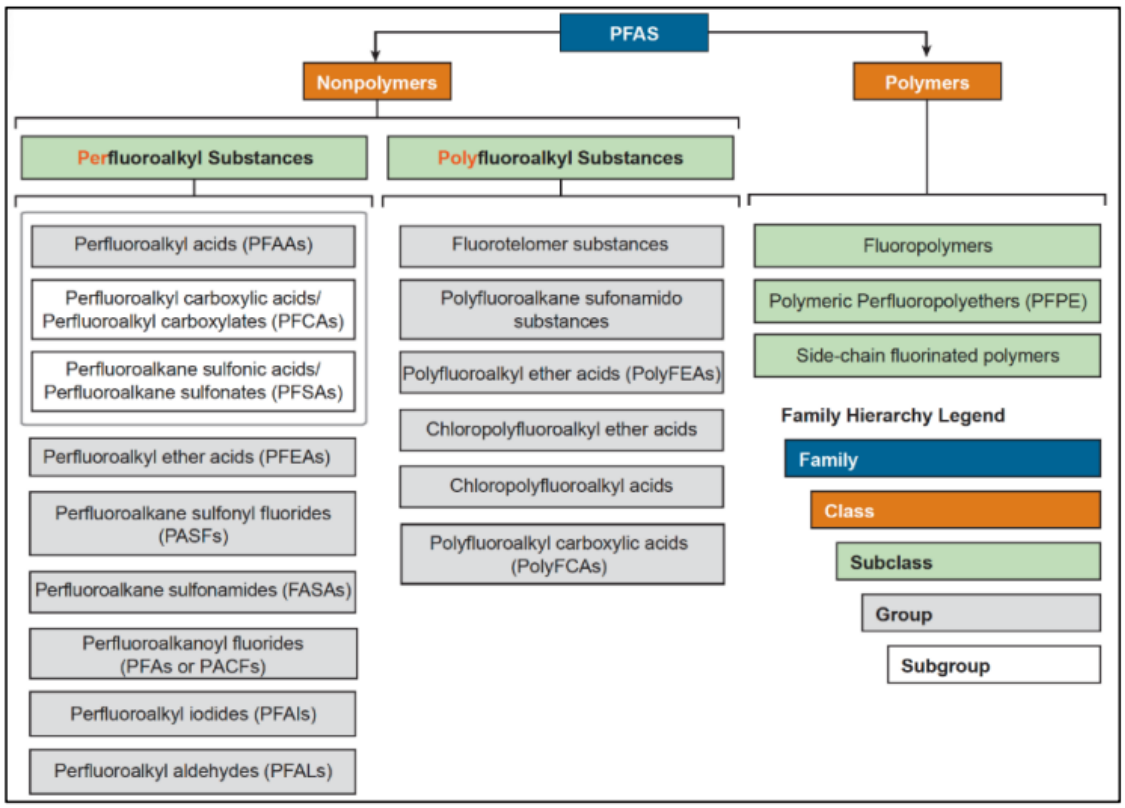
Nomenclature for Per- and Polyfluoroalkyl Substances

In September 2023, the Interstate Technology and Regulatory Council (ITRC) updated their fact sheet describing the nomenclature of per- and polyfluoroalkyl substances (PFAS) (ITRC 2023). Figure 2 shows the complex nomenclature based on family, class, and group names. The PFAS that we evaluate in our public health documents come from the nonpolymer perfluoroalkyl substances class, which can be further divided into subclass, group, and subgroup. Most of the PFAS we evaluate come from the perfluoroalkyl acid group. The PFAAs, which consists of two subgroups, are either perfluoroalkyl carboxylic acids (e.g., PFOA, [perfluorooctanoic acid]) or perfluoroalkane sulfonic acids (e.g., PFOS [perfluorooctane sulfonic acid]).

The fact sheet has brief but important explanations describing the basic names for perfluoroalkyl carboxylic acids (PFCAs) and perfluoroalkane sulfonic acids (PFSAs) as well as the difference between the anionic and acidic forms of PFAAs. There's also a table showing how PFCAs and PFSAs are divided into short-chain and long chain compounds.

Here's a hint when you're looking for PFAS in ATSDR's PHAST. If you can't find a specific PFAS when searching PHAST, use the CASRN (chemical abstract service registry number) instead of

the name or enter the word 'PFAS' in the search field. Entering 'PFAS' will bring up a list of all the PFAS in the PHAST database.



Source: ITRC 2023. Used with permission.

Figure 2. The PFAS Family

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Update Your Public Health Documents with These New MRLs

In May and July 2024, ATSDR released four toxicological profiles with minimal risk levels (MRLs) for six chemicals. The six chemicals are

- Acrolein (107-02-8)
- n-Hexane (110-54-3)
- Naphthalene (91-20-3)
- 1-Methylnaphthalene (90-12-0)
- 2-Methylnapthalene (91-57-6)
- 1,2-Dichloroethane (107-06-2)

The MRLs for acrolein, n-hexane, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene are provisional because these profiles were released for public comment. The provisional MRLs were added to ATSDR's PHAST in May and should be used in your public health documents. The final toxicological profile for 1,2-dichloroethane was released in July 2024.

It's easy to identify newly released toxicological profiles and MRLs by periodically checking ATSDR's toxicological profiles website. You can receive email updates by providing your email address to our tox profile group. Look for the 'Get Email Updates' on the bottom right of the website.

Update Your MRLs in Documents Being Developed

If you are currently working on a public health document with these chemicals, you should review your screening process to see if any duration- or route-specific EMEGs changed because the MRL changed. Some duration- and route-specific CVs are now lower (chronic acrolein, acute and intermediate naphthalene, acute 1,2-dichloroethane). Lower MRLs will result in lower duration- and route-specific EMEG used to screen your data for noncancer endpoints. All six chemicals have at least one new MRL, so your data should be screened against these new EMEGs. Sometimes, a new duration-specific MRL will be higher than the previous MRL. This is the case for 2-methylnaphthalene (chronic, oral), acrolein (intermediate, inhalation), and 1,2-dichloroethane (intermediate, oral). See Table 2 for details for which duration- or route-specific MRLs changed.
If you had previously selected these chemicals as a potential contaminant of concern (COC) and if the MRL changed, you'll also need to update your toxicological evaluation. You'll also need to use the new MRL and evaluate whether harmful effects are possible. You'll do the same for all the MRLs shown in Table 2 that changed.

Checking for MRL Updates

Another way to check for changes in MRLs is to click "Contaminant Updates" on the home page for PHAST (see Figure 3). You can then open an Excel file that will show recent updates to the PHAST database, including changes to MRLs. The file will show the old and new MRLs and provide information about other changes to PHAST.

If MRLs change while your document is being developed or during clearance, you will need to update your document to the new MRL, even if it's in eClearance. If you have questions, talk to your Associate Director for Science (ADS) office or technical project officer (TPO).

Table 2. Summary of the MRLs released in May and July 2024 compared to their previous MRL

Chemical	Route, Duration	Previous MRL	Current MRL	Current MRL Is Different or New
Acrolein	Inhalation, acute	3 ppb	3 ppb	No
Acrolein	Inhalation, intermediate	0.04 ppb	0.4 ppb	Yes
Acrolein	Inhalation, chronic	None	0.4 ppb	*New*
Acrolein	Oral, chronic	0.004 mkd	0.002 mkd	Yes
n-Hexane	Inhalation, acute	None	6 ppm	*New*
n-Hexane	Inhalation, intermediate	None	0.4 ppm	*New*
n-Hexane	Inhalation, chronic	0.6 ppm	None	Yes
n-Hexane	Oral, intermediate	None	0.1 mkd	*New*
Naphthalene	Inhalation, acute	None	0.06 ppb	*New*
Naphthalene	Inhalation, chronic	0.7 ppb	None	Yes
Naphthalene	Oral, acute	0.6 mkd	0.2 mkd	Yes
Naphthalene	Oral, intermediate	0.6 mkd	0.2 mkd	Yes
1-Methylnaphthalene	Inhalation, intermediate	None	0.09 mkd	*New*
1-Methylnaphthalene	Oral, intermediate	None	0.6 mkd	*New*
1-Methylnaphthalene	Oral, chronic	0.07 mkd	0.07 mkd	No
2-Methylnaphthalene	Inhalation, intermediate	None	0.3 ppb	*New*
2-Methylnaphthalene	Oral, chronic	0.04 mkd	0.06 mkd	Yes
1,2-dichloroethane	Oral, intermediate	0.2 mkd	0.7 mkd	Yes
1,2-dichloroethane	Inhalation, intermediate	None	100 ppb	*New*
1,2-dichloroethane	Inhalation, acute	300 ppb	100 ppb	Yes

ppm = part per million; ppb = parts per billion; mkd = mg/kg/day

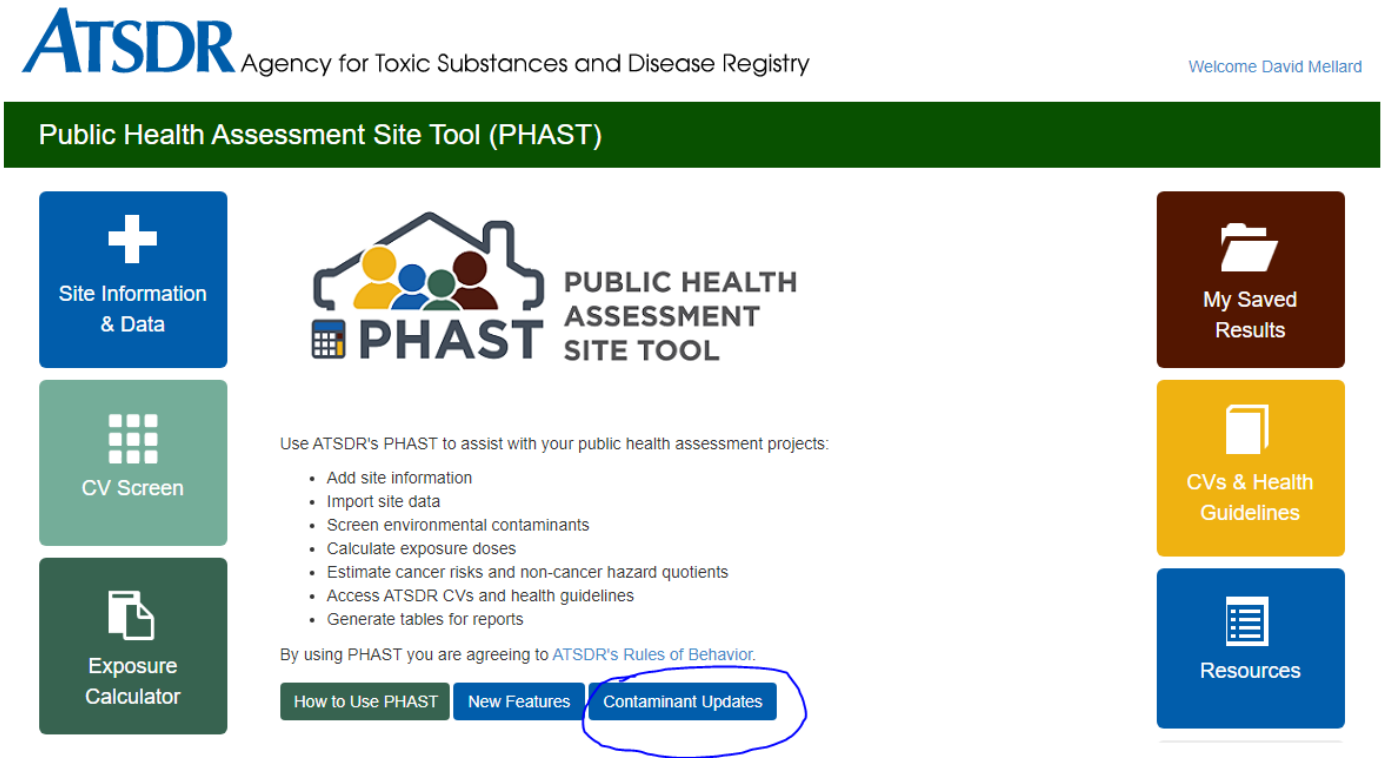

Figure 3. The PHAST home screen

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ATSDR's SHOWER Model Now Has Non-residential Scenarios

In September 2024, ATSDR released v4 of the Shower and Household Water-use Exposure (SHOWER) model. In addition to residential scenarios, this version of the model allows health assessors to simulate exposures at commercial gyms, schools, offices, and barracks. When you run a new scenario now, you'll first select whether to run a residential scenario or a communal shower/bathroom scenario (Figure 4).

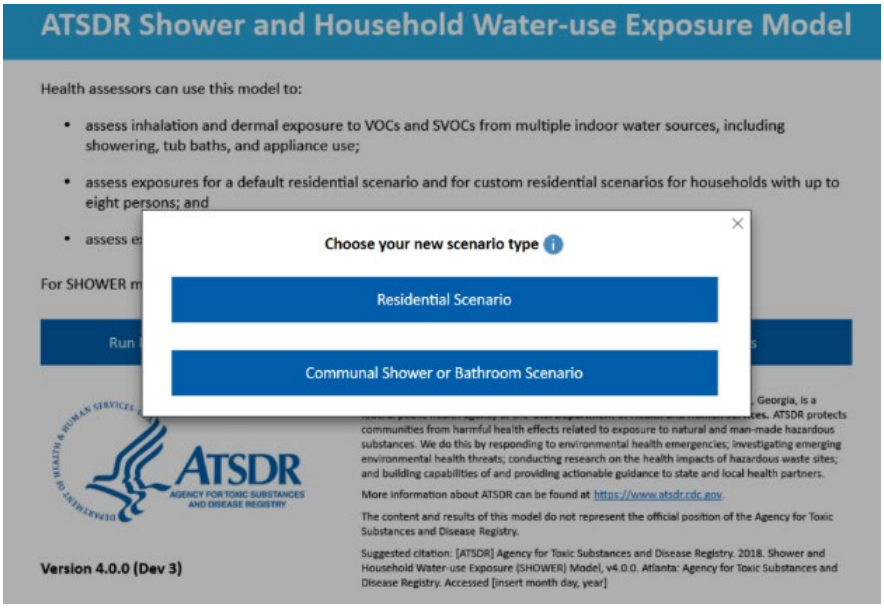

Figure 4. Options for choosing a residential scenario or the communal shower/bathroom scenarios.

If you have experience running the SHOWER model for residential scenarios, many of the screens will look similar and operate in the same way. One difference, though, will be the simulation type screen (Figure 5). On this screen, you select from several building types (gym, daycare, school, office, and barracks) and specify the type of shower and bathroom facilities in the building you want the model to simulate. The model has two options: a shower area with a locker room containing toilets and sinks or only a restroom consisting of toilets and sinks. You'll then select run default scenario or run a custom scenario. The last information that is needed is the number of people by gender using the facility. Information icons can be found throughout the model that will help you understand the type of information that is needed.

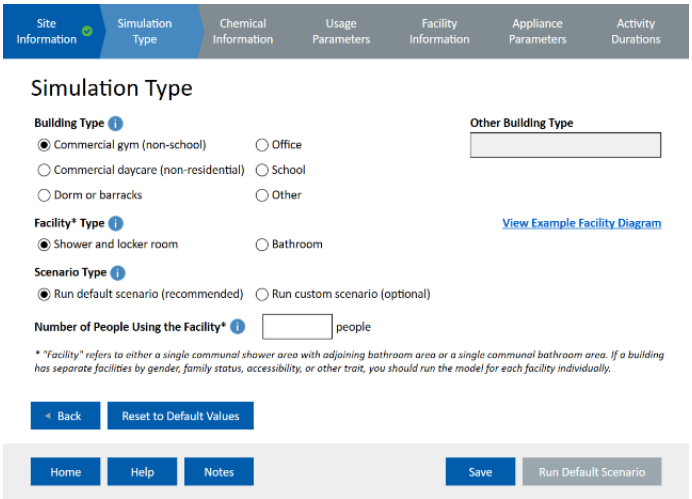

Figure 5. Simulation type screen

Using Monte Carlo methods, the model can simulate the activities of up to 1,000 persons to generate central tendency exposure (CTE) and reasonable maximum exposure (RME) estimates. CTE and RME estimates are provided as a daily, time-weighted average, exposure concentration from breathing air while in the building and as a dermal dose from skin contact with water. When showering is an option, these outputs are provided for people who shower and for people who do not shower.

Like the residential SHOWER model, v4 allows users to generate a report describing the results in detail. You also can export the results to a file that can be imported into ATSDR's PHAST. PHAST will use the inhalation and dermal results to generate hazard quotients and cancer risk estimates. Like the residential scenario, you also have the option of combining the dermal dose (for those who shower or bathe) with the oral dose for those who are drinking the water.

After reviewing the results online, you can download the information into a PHAST-generated SHOWER model report. The report provides all the results viewed onscreen and has the added advantage of giving advice and instructions on which results to use in your public health documents. These instructions can be found in the scenario description section of the PHAST-generated report.

Remember that additional information from the simulation can be found in the original SHOWER model report. This information is easily available from the data import screen by clicking 'Download Original SHOWER Model Report' (Figure 6). The SHOWER model report provides CTE and RME histograms of people who shower and who do not shower as well other statistical and parameter information from the simulation.

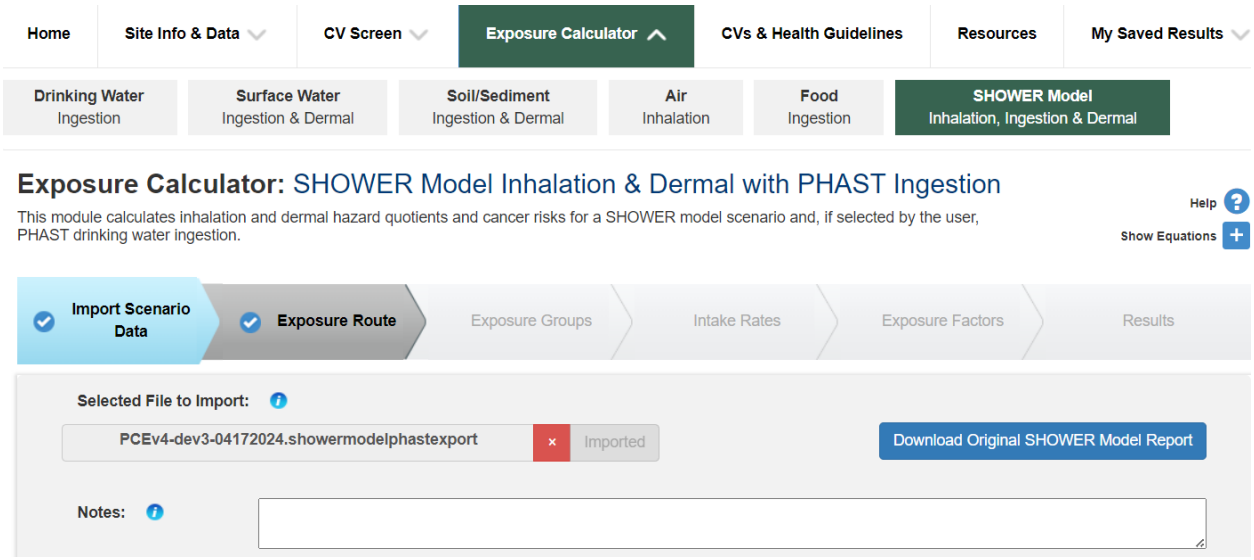

Figure 6. Where to download the original SHOWER model report.

The SHOWER model is a stand-alone application that is downloaded to your computer and is available in the toolbox for ATSDR's Public Health Assessment Guidance Manual (PHAGM) under 'Evaluating Exposure Pathways'. The resource page in PHAGM also has the user's guide for the SHOWER model. Questions or comments about the model can be directed to showermodel@cdc.gov.
The preferred citation for the SHOWER model follows:

> [ATSDR] Agency for Toxic Substances and Disease Registry. 2024. Shower and Household Water-use Exposure (SHOWER) Model, v4.0. Atlanta: Agency for Toxic Substances and Disease Registry. Available by request to showermodel@cdc.gov.

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[ITRC] Interstate Technology & Regulatory Council. 2023. PFAS Technical and Regulatory Guidance Document and Fact Sheets PFAS-1. Washington, D.C.: Interstate Technology & Regulatory Council, PFAS Team. https://pfas-1.itrcweb.org/.