United States Environmental Protection Agency

EPA Tools and Resources Webinar *PFAS Strategic Roadmap: Research Tools and Resources*

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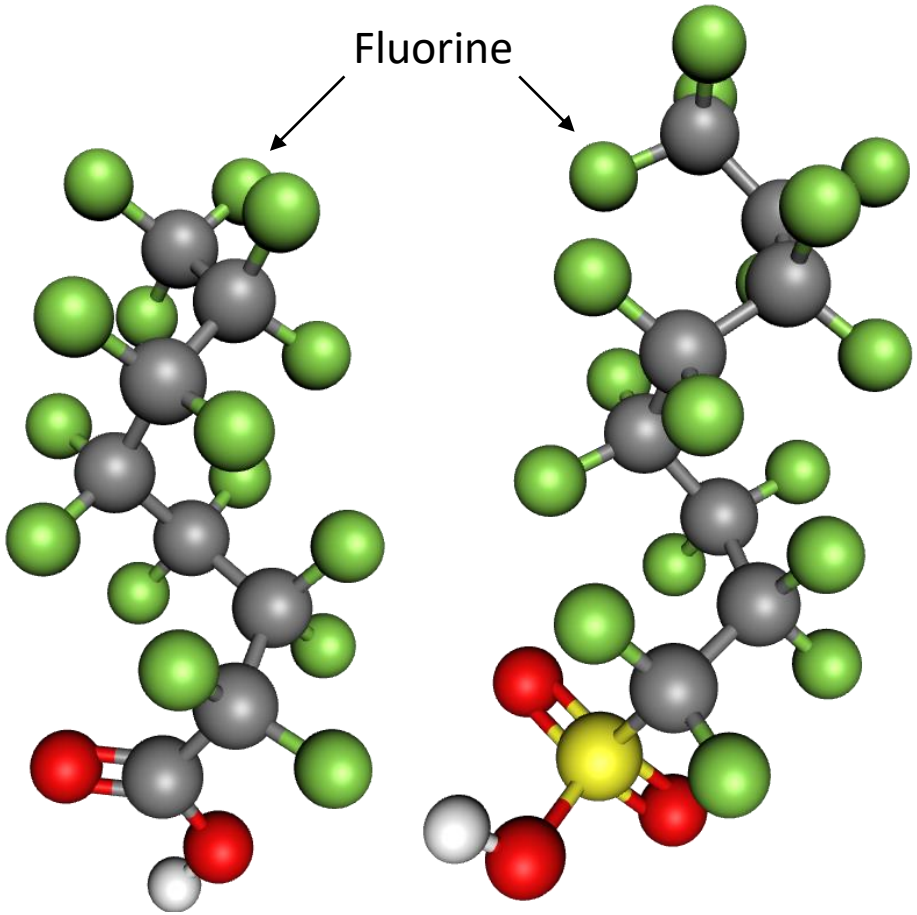
August 17, 2022

Agenda

- Introduction to PFAS
- Systematic Evidence Maps for PFAS – Laura Carlson, Avanti Shirke
- PFAS Thermal Treatment Database – Phillip Potter
- Additional PFAS Tools and Resources

Per- and Polyfluoroalkyl Substances (PFAS)



Perfluorooctanoic acid (PFOA)

Perfluorooctanesulfonic acid (PFOS)

A large class of synthetic chemicals

- Features chains of carbon atoms surrounded by fluorine atoms
- Wide variety of chemical structures, from single molecules to polymers

Used in homes, businesses and industry for decades

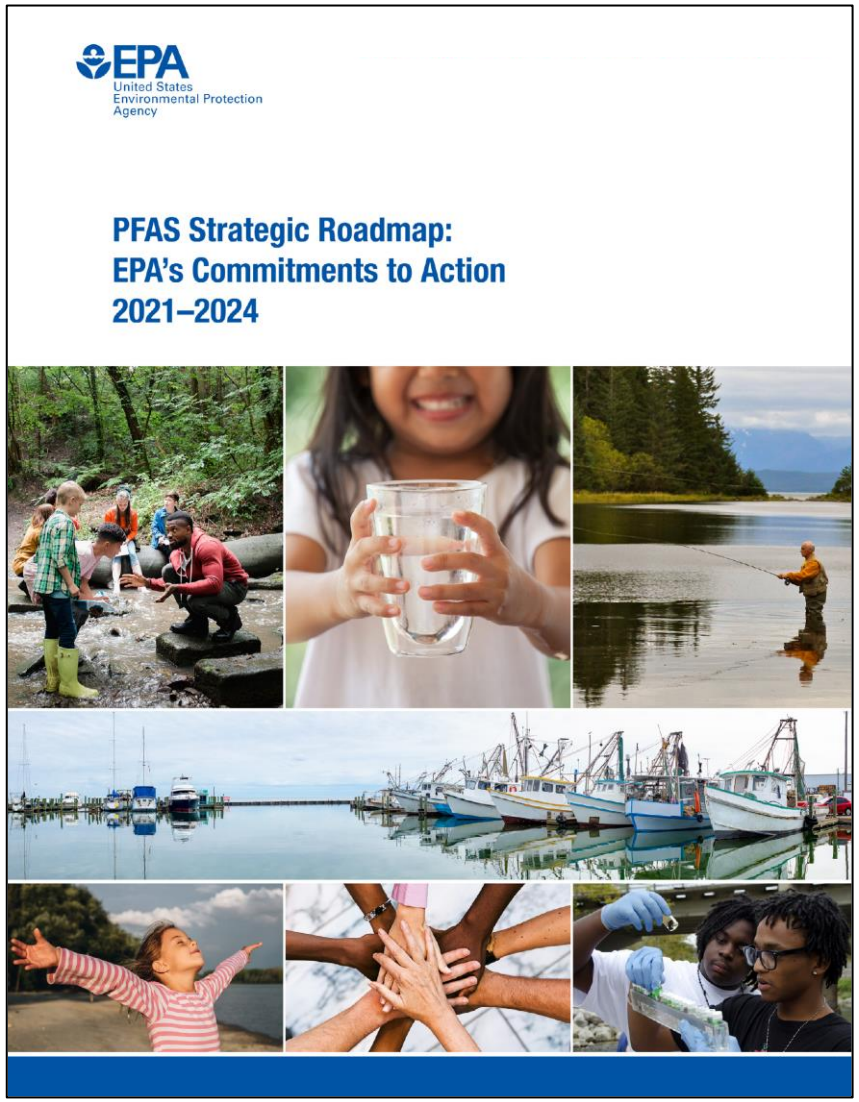
- Have been detected in soil, water and air samples
- Most people have been exposed to PFAS

Some PFAS are known to be PBT

- P = Persistent in the environment
- B = Bioaccumulative in organisms
- T = Toxic at relatively low levels (ppt)

PFAS Strategic Roadmap

- Released October 2021
- Presents EPA's whole-of-agency approach to protect public health and the environment from the impacts of PFAS
- Focused on three goals:
  - Research
  - Restrict
  - Remediate
- Available here



PFAS Research and Development

EPA is rapidly expanding the scientific foundation for understanding and addressing risk from PFAS

- EPA's Office of Research and Development (ORD) provides the best available environmental science and technology to inform and support human health and environmental decision making
- ORD is conducting scientific research to:
  - Develop methods and approaches for measuring PFAS in the environment
  - Advance the science to assess human health and environmental risks from PFAS
  - Evaluate and develop technologies for reducing PFAS in the environment

ORD collaborates with other federal agencies, states, tribes, utilities and academic institutions on PFAS research and technical assistance activities

Human Health Toxicity Research

Most PFAS have limited or no toxicity data to inform hazard assessment

CURATE EXISTING DATA

- Hazard
- Dose-response
- Chemical and physical properties

- CompTox Chemistry Dashboard – >10,000 PFAS
- HERO Database – >200,000 PFAS references
- Systematic evidence maps for ~150 PFAS

GENERATE NEW DATA

- ✓ Created chemical library of 480 PFAS samples
- ✓ Selected 150 PFAS to represent structural diversity of PFAS
- Testing PFAS using a battery of toxicological and toxicokinetic New Approach Methods (NAMs)
- Testing using traditional *in vivo* approaches

- Group PFAS into a smaller number of categories based on structural, toxicological and toxicokinetic similarity
- Prioritize PFAS for further toxicity testing and assessment

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PFAS Systematic Evidence Maps

Systematic Evidence Maps (SEMs)

What are Systematic Evidence Maps?

- Pre-decisional analyses that use systematic review methods to compile and summarize the available evidence
- Front end compilation of evidence does not include hazard ID or toxicity values
- Publishable in journals

How are they used?

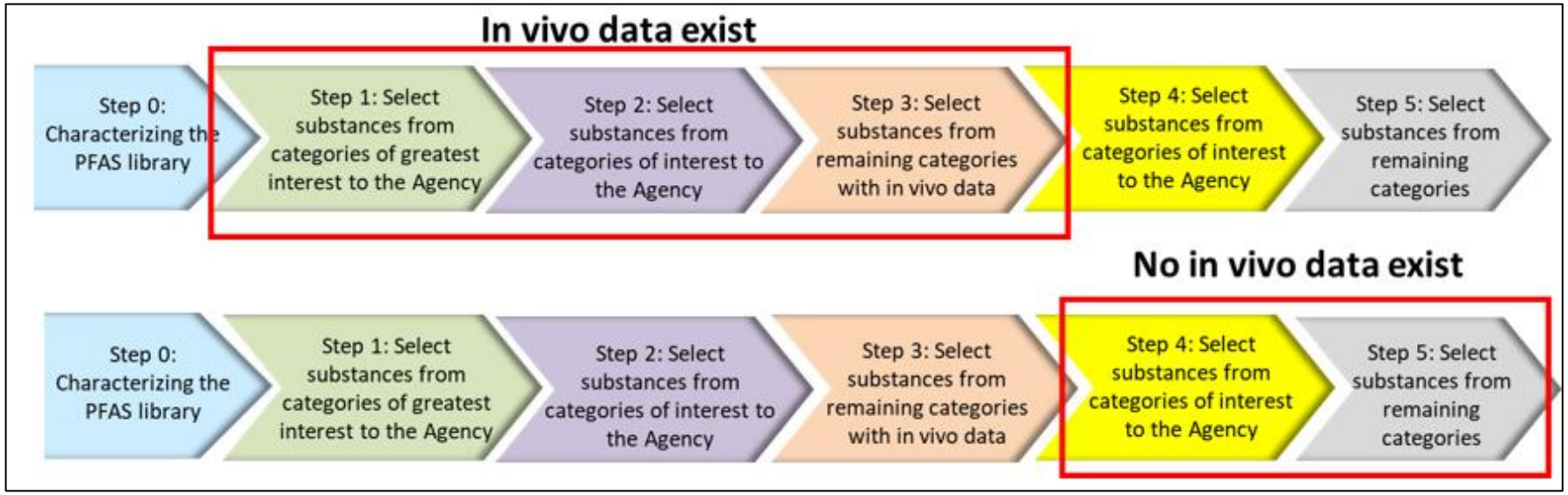
- *Prioritization and Scoping*: determine the extent to which the evidence supports an assessment, and of what type
- *Problem Formulation*: characterize the extent and nature of the evidence and reveal knowledge gaps/research needs
- *Updating*: rapidly characterize new evidence to update an assessment or decide whether an update is warranted

How are they developed?

- Use of standardized template format reduces time to prepare and review
- Tailorable (may include aspects of study evaluation or identify studies with characteristics for dose-response)
- Generally, ≤1 year to develop depending on the evidence base and available resources

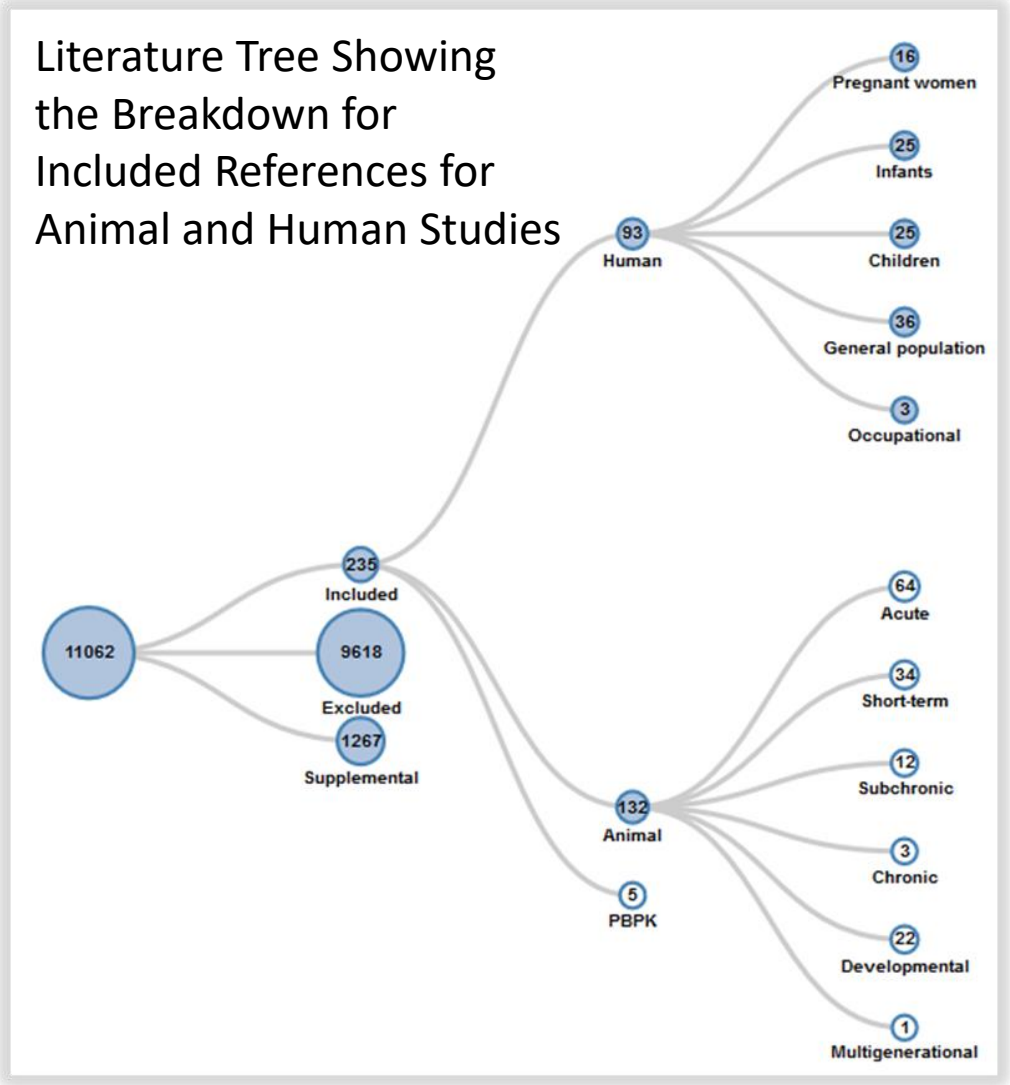
PFAS Evidence Maps

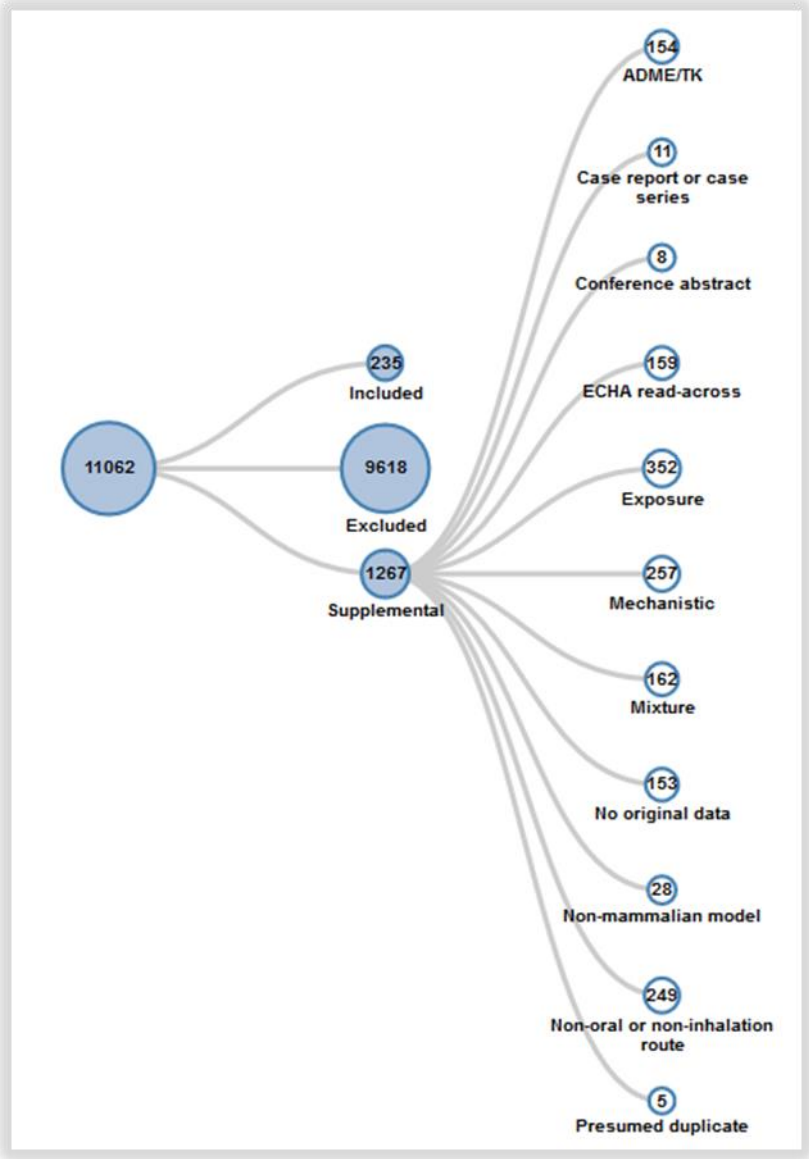
- EPA is conducting tiered toxicity testing of a structurally diverse landscape of PFAS
  - Initial effort from ORD (in 2019) identified 150 PFAS chemicals for in vitro toxicity and toxicokinetic assay evaluation, testing a range of PFAS structures, chemistries, and with environmental relevance (first 75 chemicals described in publication by Patlewicz et al. 2019)
- Existing *in vivo* toxicity data can be used to inform the toxicity of groups of PFAS using approaches like read-across
- PFAS "150" SEM conducted to help identify in vivo data and to identify data gaps



PFAS 150 SEM Screening Results

Literature Tree Showing the Breakdown for Included References for Animal and Human Studies

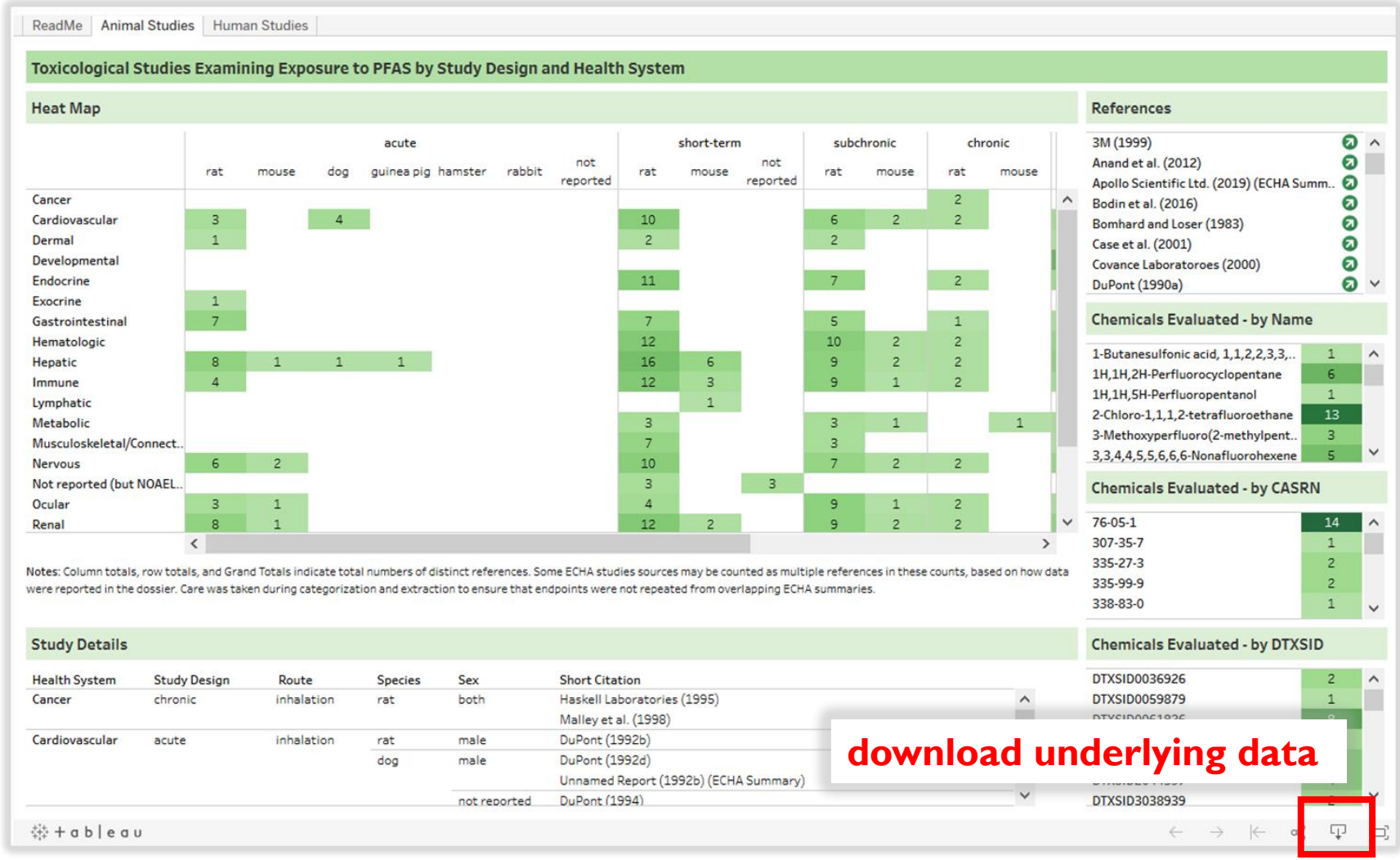




https://hawc.epa.gov/summary/assessment/100500085/visuals/

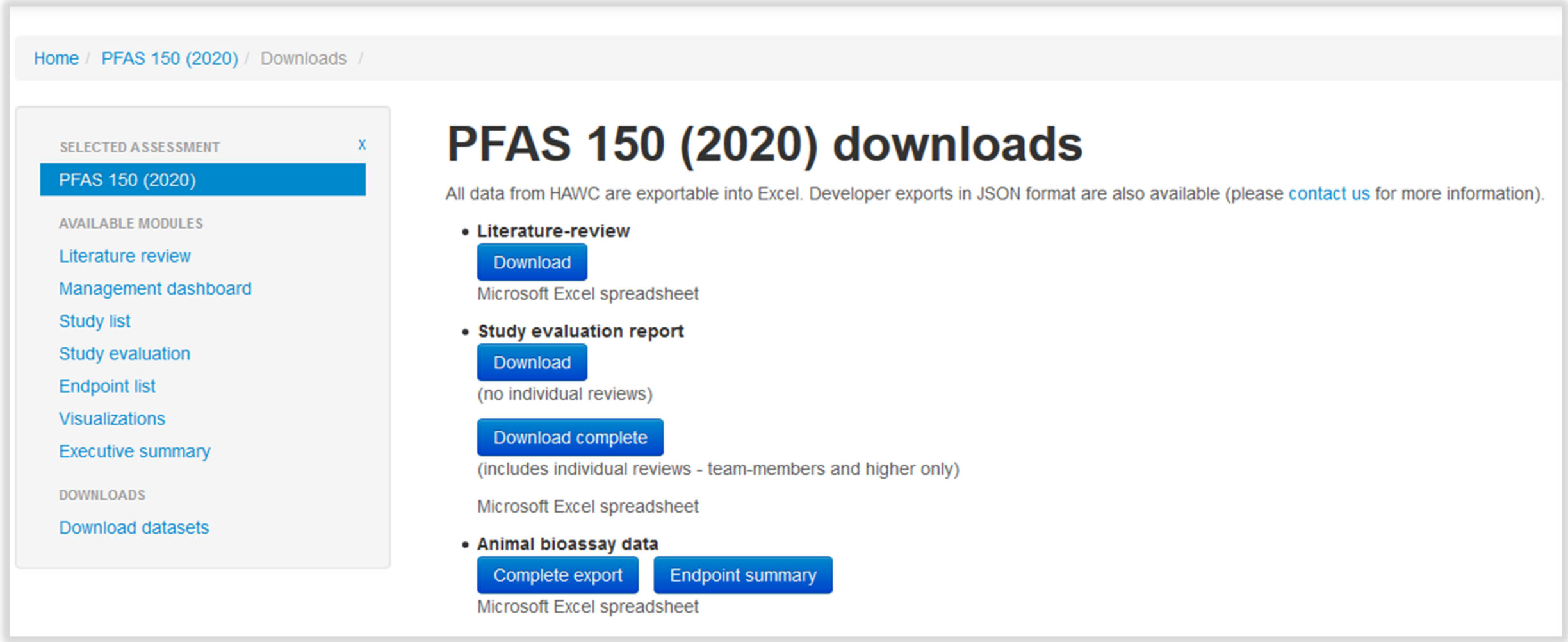
Example PFAS 150 SEM Literature Inventory: Animal Studies

- ~35 PFAS
- ~130 studies
- Sort by chemical (name, DTXID, CASRN), study design, health system



https://hawc.epa.gov/summary/visual/assessment/100500085/Figure-6-Survey-of-animal-studies/

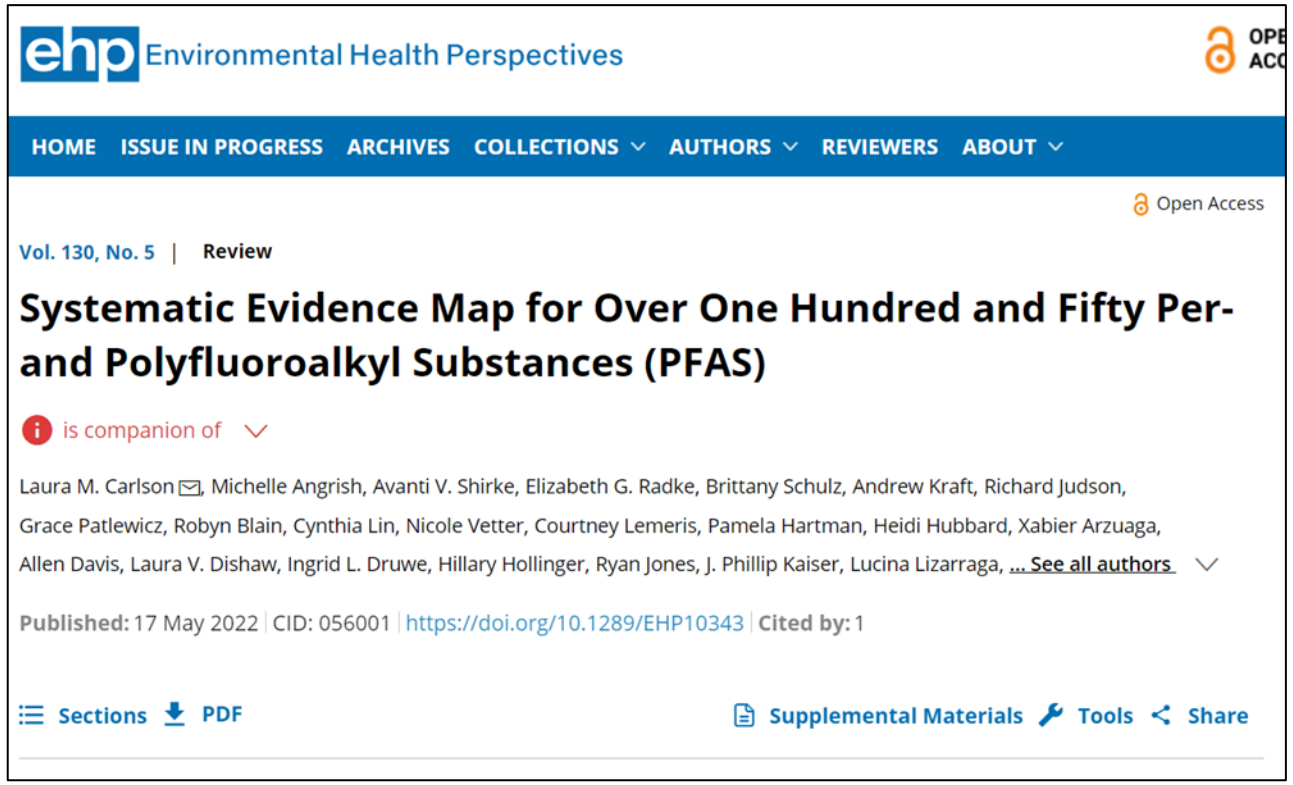
Download Data Sets



Findings to Date

- Many PFAS are data poor
  - **PFAS 150:** 136 animal studies for 35 PFAS, 166 human studies for 11 PFAS
  - **PFAS 430:** 341 unique chemicals searched that were not included in prior search; 142 had at least one human or animal study
  - **PFAS Universe:** 9,266 PFAS chemicals were searched; 416 have records
- Data extraction has been extended to shorter-term studies (<1 month)
- When a specific PFAS is identified as of interest, additional higher level of effort steps are taken to identify evidence (i.e., availability of CBI studies)
- Very few inhalation toxicity studies available
  - ORD is exploring approaches for extrapolating from oral administration studies

More Information Available



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Vol. 130, No. 5 | Review

Systematic Evidence Map for Over One Hundred and Fifty Per- and Polyfluoroalkyl Substances (PFAS)

is companion of

Laura M. Carlson, Michelle Angrish, Avanti V. Shirke, Elizabeth G. Radke, Brittany Schulz, Andrew Kraft, Richard Judson, Grace Patlewicz, Robyn Blain, Cynthia Lin, Nicole Vetter, Courtney Lemeris, Pamela Hartman, Heidi Hubbard, Xabier Arzuaga, Allen Davis, Laura V. Dishaw, Ingrid L. Druwe, Hillary Hollinger, Ryan Jones, J. Phillip Kaiser, Lucina Lizarraga, ... See all authors

Published: 17 May 2022 | CID: 056001 | https://doi.org/10.1289/EHP10343 | Cited by: 1

Sections PDF Supplemental Materials Tools Share

- For more information, see our first PFAS evidence map publication Carlson et al. (2022) *Environmental Health Perspectives* 130:5 https://doi.org/10.1289/EHP10343
- Download datasets in HAWC: https://hawcprd.epa.gov/assessment/100500085/downloads/
- Additional PFAS evidence maps for expanded groups of chemicals are under development

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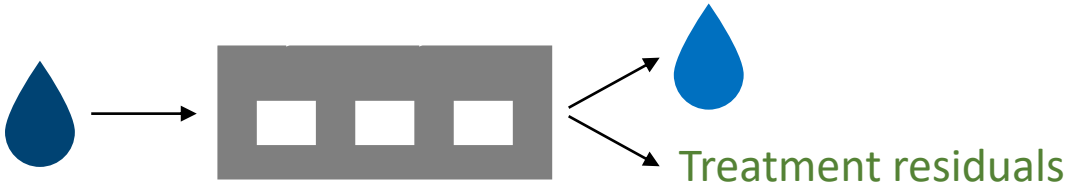
SEM Demonstration

Risk Management Research

Water Treatment

Goal: Remove or reduce PFAS in drinking water and wastewater

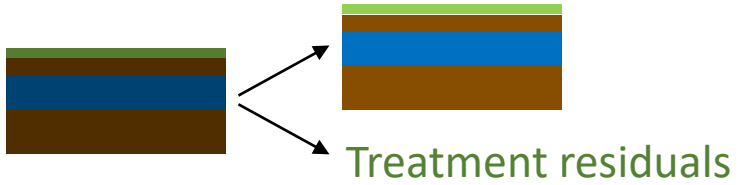


Recent Accomplishments

- Annual update to EPA's Drinking Water Treatability Database
- Modeling PFAS removal using GAC for full-scale system design (2022)

Site Remediation

Goal: Remove or reduce PFAS at contaminated sites (e.g., in soil, sediment, groundwater)

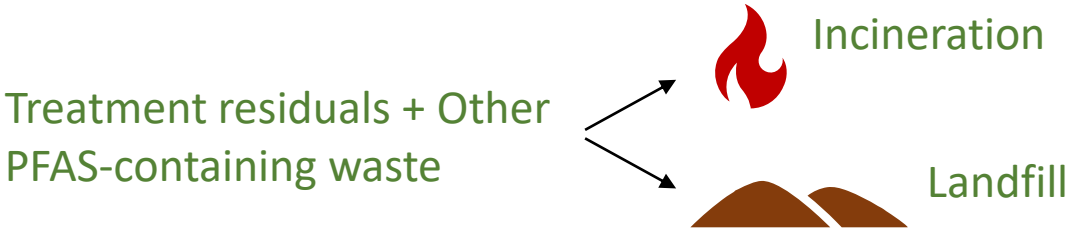


Recent Accomplishments

- Remediation and mineralization processes for PFAS in water: A review (2021)
- Investigation of an immobilization process for PFAS-contaminated soils (2021)

Destruction and Disposal

Goal: Prevent re-introduction of PFAS into the environment through destruction or containment



Recent Accomplishments

- PFAS Thermal Treatment Database (2022)
- Developing innovative treatment technologies for PFAS-containing wastes (2022)

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PFAS Thermal Treatment (PFASTT) Database

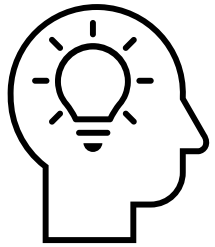
Introduction

- PFAS
  - No agency-wide definition
    - Can’t be too broad (will include fluorinated pharmaceuticals and agrichemicals)
    - Can’t be too restrictive (will exclude emerging classes of polyfluorinated species)
- Thermal treatment
  - Any transformative technique in which elevated temperature is the primary reaction driver
    - Examples include incineration, pyrolysis

Drinking Water Treatability Database

- https://tdb.epa.gov/tdb/home (or Google “epa tdb”)
- Data from thousands of references on 35 treatment processes and 123 contaminants (including 37 PFAS)
- Searchable by contaminant or treatment type

- Success! Let’s make one for thermal treatment of PFAS!



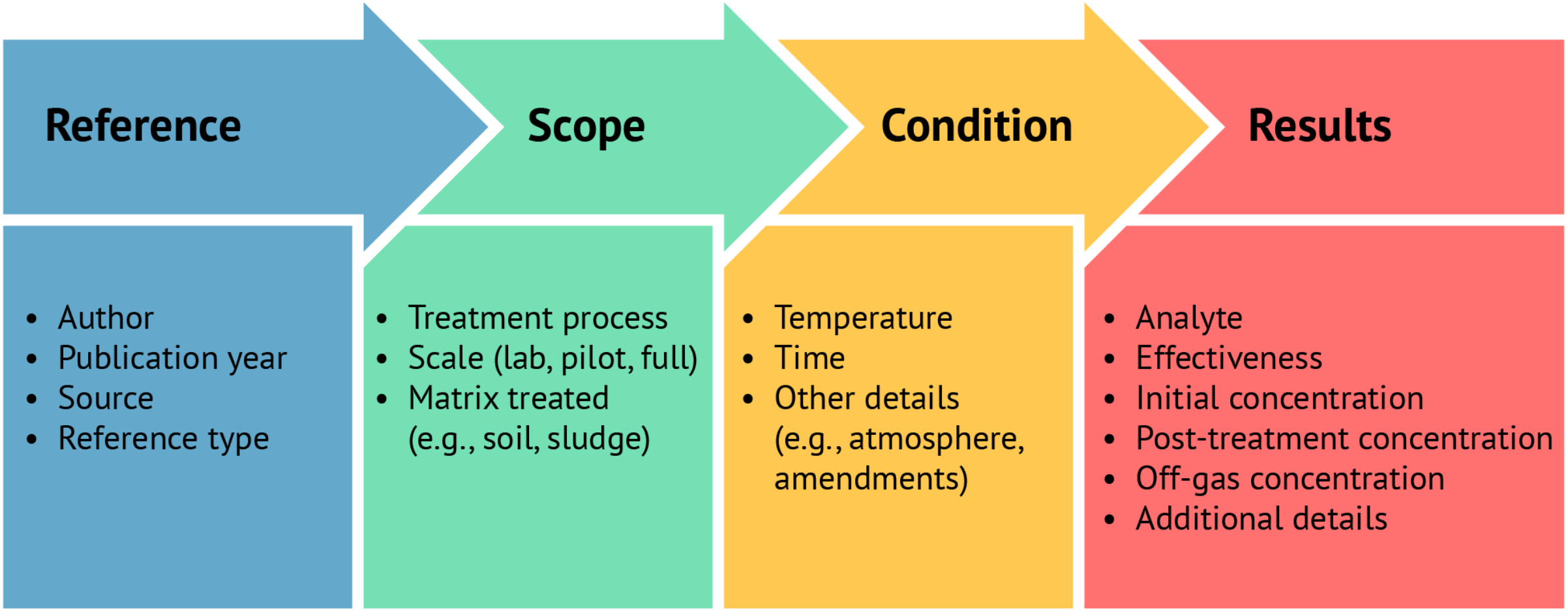
Thermal Treatment Literature Review

- Conducted Winter 2020 – Spring 2021
- Identified 49 data sources:
  - 17 review papers
  - 32 primary data sources
  - Majority are peer-reviewed journal articles
- Other EPA literature surveys added up to 52 additional sources
- Currently >2,000 ‘datapoints’

Scope of Review

- Thermal processes including, but not limited to:
  - Incineration, calcining, gasification, hydrothermal, indirect thermal desorption, pyrolysis, smoldering, GAC reactivation
- Excludes non-thermal/low temperature processes:
  - Persulfate, plasma, electrochemical, photolysis

Data Structure



Potential Uses

- Partners inside and outside the agency will find use for PFASTT
  - Searchable resource to view state of the science
  - Reveals data gaps
  - Inform best practices for full-scale thermal treatment
  - State decision-making on regulation

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PFASTT Demonstration

https://pfastt.epa.gov/

Other PFAS Tools and Resources

- Drinking Water Treatability Database – 183 references covering 54 PFAS and 20 treatment processes
- ECOTOX Knowledgebase – 1,303 references covering 173 PFAS and 704 aquatic and terrestrial species
- CompTox Chemicals Dashboard – chemical and physical properties, toxicity and exposure information for PFAS
- PFAS Analytical Method Development – EPA methods for measuring PFAS in the environment
- EPA's PFAS Website – Information about PFAS and EPA's actions to address PFAS (includes links to other resources)

Contacts

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