

SW-846 Methods Program Status Update

NEMC 2022

Troy Strock – Organic Methods

Sandip Chattopadhyay, Ph.D. – Inorganic Methods

Kim Kirkland, Branch Chief



Presentation topics

- Overview, context
 - Resource Conservation and Recovery Act (RCRA)
 - SW-846 methods program
- SW-846 organic methods projects/updates
- SW-846 Leaching Environmental Assessment Framework
- SW-846 inorganic methods projects/updates
- Collaborations with other EPA offices, federal agencies, external organizations



Background: Resource Conservation and Recovery Act

- Regulatory framework for management of solid waste, hazardous waste in the US
- Relies on testing data for a variety of regulatory purposes, including:
 - Hazardous wastes characteristics: § 261.20 - .24
 - Cleanup of releases from hazardous waste management units: § 264, 265
 - Controlling emissions from hazardous waste incinerators: § 266
 - Meeting treatment standards to comply with land disposal restrictions for hazardous waste § 268
- Delegation: 48 of 50 US States are authorized to implement RCRA

The screenshot shows the EPA website page titled "Defining Hazardous Waste: Listed, Characteristic and Mixed Radiological Wastes". The page includes the EPA logo, a search bar, and a "MENU" button. Below the header, there is a "Hazardous Waste" section with a "CONTACT US" link. The main content area features the title "Defining Hazardous Waste: Listed, Characteristic and Mixed Radiological Wastes" and a paragraph explaining that a solid waste is hazardous if it is specifically listed or meets certain characteristics. A flowchart titled "The Hazardous Waste Identification Process" is displayed, with four steps: 1. Is the material a solid waste? (Yes/No), 2. Is the waste excluded from the definition of solid waste or hazardous waste? (Yes/No), 3. Is the waste a listed or characteristic hazardous waste? (Yes/No), and 4. Is the waste delisted? (Yes/No). The flowchart leads to two outcomes: "The material is not subject to RCRA Subtitle C regulation" and "The waste is subject to RCRA Subtitle C regulation".

<https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes>



Background: SW-846

- Collection of 200+ methods, associated guidance
- Published by EPA's Office of Resource Conservation and Recovery (ORCR) to support RCRA
- Used by a variety of other EPA stakeholders:
 - other EPA program offices, other federal agencies
 - Some methods are incorporated by reference in regulations by other EPA programs, e.g., TSCA PCBs § 761
 - regulated community
 - state and local environmental agencies
 - foreign governments

epa.gov/hw-sw846

United States Environmental Protection Agency

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CONTACT US

Hazardous Waste Test Methods / SW-846

What's New with SW-846

- [Update VII to SW-846](#)
- [Update VI to SW-846](#)
- [Validated Methods](#)
- [SW-846 FAQs](#)

<https://www.epa.gov/hw-sw846>



Background: SW-846

- Methods are organized in series
- Many are modular, may be used in different combinations.
 - Example: Aqueous samples can be prepared by **5021A** (Static Headspace) or **5030C** (Purge-and-Trap) and analyzed by **8260D** (VOCs by GC/MS)
- Chapters provide guidance on how to use the methods
 - **Chapter 1:** Quality Control
 - **Chapter 7:** Characteristics—Introduction and Regulatory Definitions
 - **Chapter 9:** Sampling Plans

epa.gov/hw-sw846/sw-846-compendium#3500series
frequency.

On this page:

- [Methods](#)
 - [0010-0100: Air Sampling and Stack Emissions](#)
 - [1000 Series: Waste Characteristics and Leaching/Extraction Methods](#)
 - [3000 Series: Inorganic Sample Preparation](#)
 - [3500 Series: Organic Sample Extraction](#)
 - [3600 Series: Organic Extract Cleanup](#)
 - [4000 Series: Immunoassay Methods](#)
 - [5000 Series: Sample Preparation and Introduction for Volatile Organic Compounds](#)
 - [6000 Series: Inorganic Determinative Methods - Inductively Coupled Plasma \(ICP\) and Other Methods](#)
 - [7000 Series: Inorganic Determinative Methods - Atomic Absorption \(AA\) and Other Methods](#)
 - [8000 Series: Chromatographic Separation Methods](#)
 - [9000 Series: Miscellaneous Test Methods](#)
- [Chapters](#)
- [Supporting Documents](#)

<https://www.epa.gov/hw-sw846/sw-846-compendium>



Background: Methods Innovation Rule

- (2005) Removed most required uses of SW-846 from RCRA
 - Intended to provide flexibility to the regulated community, encourage innovation
- Identified some SW-846 methods, ASTM standards as Method Defined Parameters (MDPs)
 - Must be followed as written
 - Incorporated by reference at 40 CFR Part 260.11
- Identified most SW-846 methods as performance-based; tools *generally* appropriate for RCRA testing
 - Appropriate modifications are allowed
 - Other published, reliable methods may be used
 - Focus: Meet project-specific data quality objectives

epa.gov/hw-sw846/final

An official website of the United States government
[Here's how you know](#)

EPA United States Environmental Protection Agency MENU

Search EPA.gov

Related Topics: [Hazardous Waste Test Methods / SW-846](#)

CONTACT US

Final Rule: Methods Innovation Rule (MIR)

Basic Information

Legal Authority [EXIT](#)

42 U.S.C. §7412 and 7414
42 U.S.C. §6905, 6921(a), 6921-6927, 6930, 6934-6939, and 6974

Federal Register Citation

[67 FR 66252-66301 \(PDF\)](#) [EXIT](#) (50 pp, 380 K)
[70 FR 34538-34592 \(PDF\)](#) [EXIT](#) (55 pp, 411 K)

<https://www.epa.gov/hw-sw846/final-rule-methods-innovation-rule-mir>



SW-846 Organic Methods Updates: PFAS

- DoD collaboration with EPA on analytical methods validation study
 - OW/OST published [draft Method 1633](#) based on single lab data
 - Includes aqueous and solid sample matrices
 - Status: Multi-laboratory validation study underway
 - Data acquisition anticipated to be complete by end of 2022 or early 2023
- ASTM collaboration with EPA on interlaboratory study for D8421-22
 - Aqueous matrices
 - Developed by EPA Region 5 laboratory
 - Similar to ASTM D7979-20, SW-846 Methods 3512/8327
 - Includes more target analytes, tested in a wider array of wastewaters
 - Status: ASTM in planning stage for interlaboratory study
- EPA evaluation of calibration models for methods 3512 and 8327
 - See Troy's presentation on Thursday



SW-846 Organic Methods Updates: PFAS

- Planned new SW-846 PFAS analytical methods:
 - **3536**: Solid Phase Extraction using Weak Anion Exchange (Aqueous)
 - **3551**: Equilibrium basic solvent extraction (Solids)
 - **3670**: Non-porous graphitized carbon cleanup
- Planned revisions of SW-846 PFAS analytical methods:
 - **3512A**: Solvent dilution of non-potable waters
 - **8327A**: Per- and Polyfluoroalkyl Substances by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)
 - Add target analytes, performance data, chromatography conditions, isotope dilution calibration



SW-846 Organic Methods Updates: Publish Validated Methods

- Validated methods are available and recommended for use, where appropriate
- Have not been through public comment, not formally incorporated in SW-846
- 16 validated methods, including:
 - **5030C** – Purge and Trap for Aqueous Samples
 - **5035A** – Closed System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples
 - **8330B** – Nitroaromatics, Nitramines, and Nitrate Esters by High Performance Liquid Chromatography (HPLC)
 - **8015D** – Nonhalogenated Organics Using Gas Chromatography/Flame Ionization Detection (GC/FID)

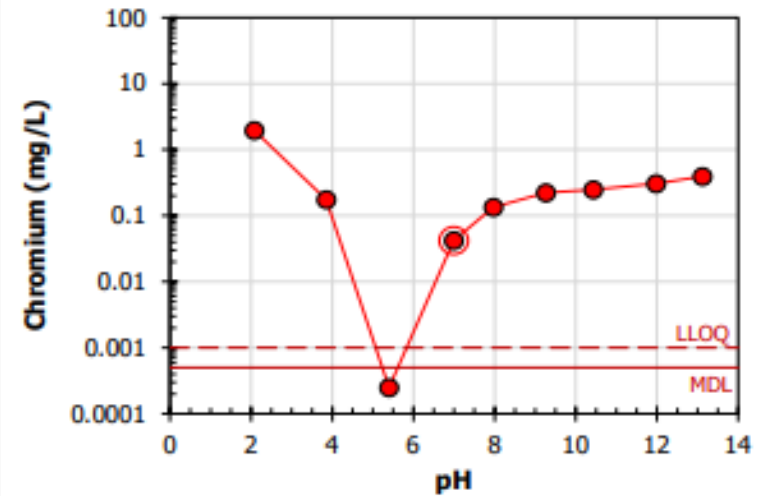
A screenshot of the EPA website page titled "Validated Test Methods Recommended for Waste Testing". The page includes the EPA logo, a search bar, and a "Menu" button. Below the search bar, there is a "Related Topics" section with a link to "Hazardous Waste Test Methods / SW-846". A "CONTACT US" link is also present. The main heading is "Validated Test Methods Recommended for Waste Testing". Below this, a paragraph states: "EPA and independent laboratories validated the following methods, which are recommended for use as the most up-to-date methods available." At the bottom, there is a blue hyperlink: <https://www.epa.gov/hw-sw846/validated-test-methods-recommended-waste-testing>



SW-846 Methods Updates: LEAF

LEAF: Leaching Environmental Assessment Framework

- Aqueous leaching methods, data management/visualization software, “How to” guide, case studies
- LEAF provides inputs for fate and transport modeling
 - Identify key variable(s) affecting leaching behavior
 - Estimate “source term” i.e., aqueous concentration, release rate
 - Evaluate immobilization strategies prior to field deployment

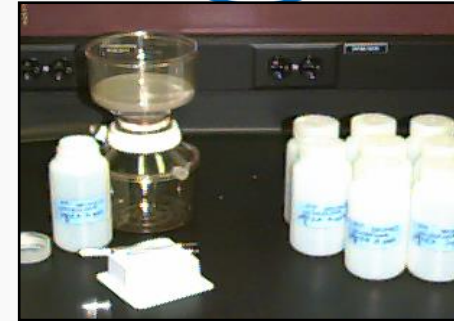


https://www.epa.gov/sites/default/files/2019-05/documents/final_leaching_environmental_assessment_framework_leaf_how-to_guide.pdf



SW-846 Methods Updates: LEAF

- **Equilibrium-based Tests (Method 1313, 1316)**
 - Batch tests on size-reduced material
 - *Contaminant concentration and release as function of:*
 - *Eluate pH* – Method 1313
 - *Liquid-solid ratio (L/S)* – Method 1316
- **Percolation Column Test (Method 1314)**
 - Up-flow column – saturated to minimize preferential flow
 - *Contaminant concentration and flux as a function of water percolated*
- **Mass Transport Rate Test (Method 1315)**
 - Tank-based leaching test, monolithic or compacted granular
 - *Rates of contaminant release*





SW-846 Methods Updates: LEAF

- Initially developed and validated for inorganics
 - Final versions of Methods 1313-1316 and LEAF “How To” User’s Guide published in 2019
- Methods have already been applied to organics
 - Need to standardize to ensure comparability!
 - Evaluate materials compatibility, process changes to accommodate different classes of chemicals
- Interested stakeholders:
 - EPA Superfund and RCRA programs
 - Department of Energy, Department of Defense
 - National Academy of Sciences, Engineering and Medicine
 - Australian, European, Israeli governments

The screenshot shows the EPA website page for LEAF methods and guidance. The browser address bar displays "epa.gov/hw-sw846/leacl". The EPA logo and "United States Environmental Protection Agency" are visible at the top. A search bar contains "Search EPA.gov". Below the search bar, there is a "Related Topics" section with a link to "Hazardous Waste Test Methods / SW-846". A "CONTACT US" link is also present. The main heading reads "Leaching Environmental Assessment Framework (LEAF) Methods and Guidance". The introductory text states: "The Leaching Environmental Assessment Framework (LEAF) is a leaching evaluation system, which consists of four leaching methods, data management tools, and scenario assessment approaches designed to work individually or to be integrated to provide a description of the release of". A blue hyperlink is provided at the bottom: <https://www.epa.gov/hw-sw846/leaching-environmental-assessment-framework-leaf-methods-and-guidance>.



SW-846 Methods Updates: LEAF

Current status of LEAF Methods for both organics and inorganics

- LEAF development and single laboratory demonstration work nearly complete for SVOCs, progressing for PFAS
 - Completing experiments to address:
 - Materials of construction
 - Volatile loss for light end
 - Aqueous subsampling
- Planning multi-laboratory validation study with EPA ORD, Jacobs and Vanderbilt University
- PFAS LEAF method development funded by DoD through SERDP grant – joint effort by Texas Tech and Vanderbilt
- VOCs still needs development work

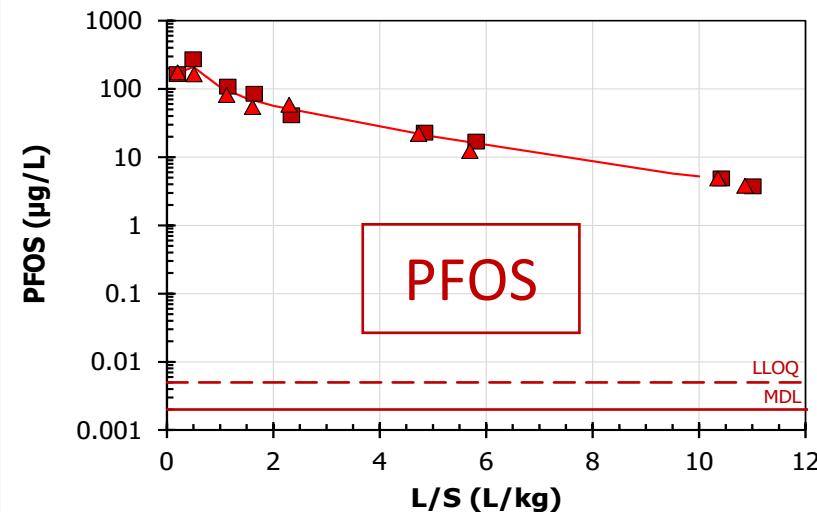
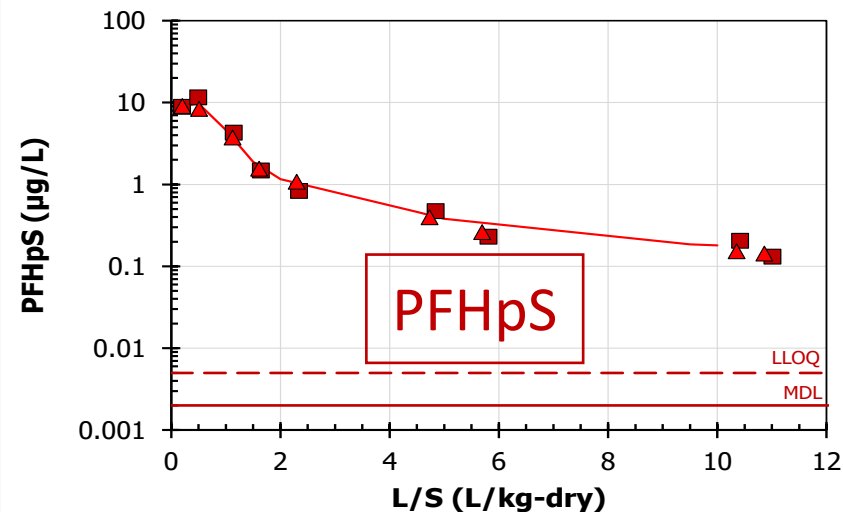
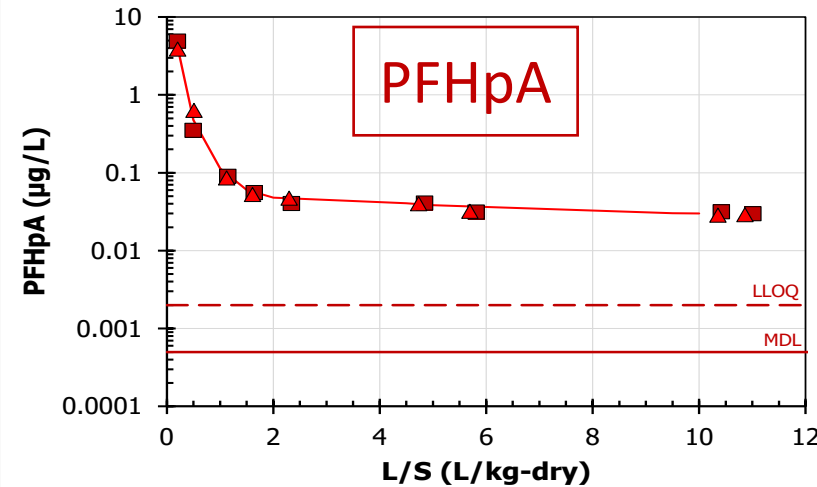
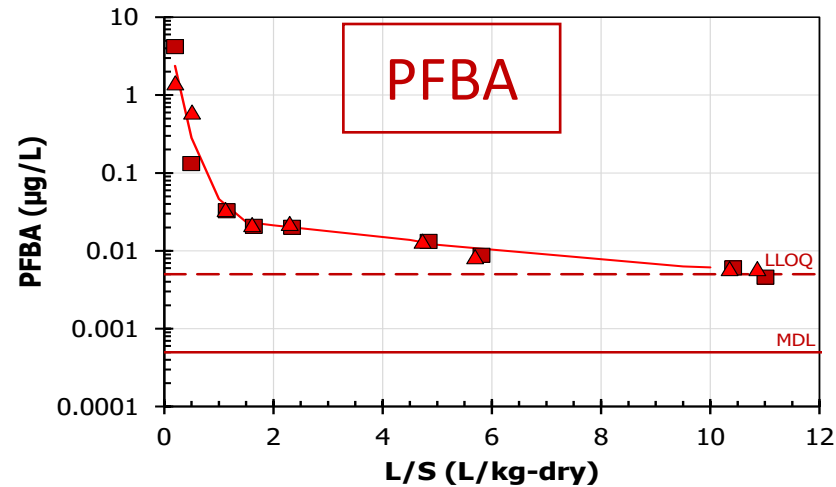


SW-846 Methods Updates: LEAF 1314A example for PFAS

Credit for figure:

- Dr. Jenn Guelfo at Texas Tech U
- Dr. David Kosson, Dr. Andy Garrabrants and Fangfei Liu at Vanderbilt U

<https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER20-1126/ER20-1126/>





SW-846 Inorganic Methods Updates: Method 3050C

- Strong acid digestion to solubilize metals that could become “environmentally available”
- 3050B has separate digestion steps for ICP-OES (6010D)/AA and ICP-MS (6020B)
- ICP-MS collision/reaction cell technology reduces Cl-related interferences

3050C changes:

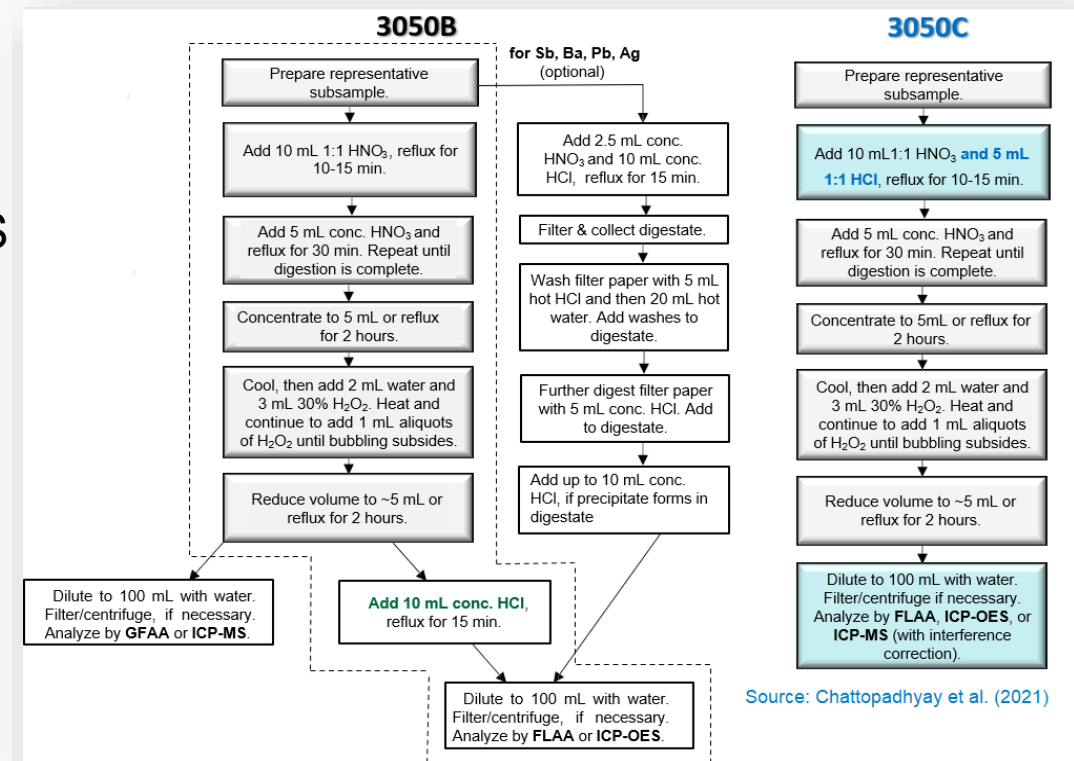
- Add HCl earlier
- One solids digestion for both ICP and ICP-MS

Validation study complete

- 10 participating laboratories
- Five solid certified reference materials

Next steps:

- EPA management review
- Propose for public comment
- See Sandip’s presentation on Thursday





Projects proposed by external organizations:

- Acrolein and acrylonitrile pH 2 preservation stability study in water
 - Supporting data submitted by the Environmental Monitoring Coalition
 - Considered for update to sample preservation and holding times in SW-846 Chapter 4
- Light hydrocarbons in groundwater by static headspace/GC-FID
 - Supporting data submitted by Environmental Standards, Inc./Marcellus Shale Coalition
 - EPA Region 9 laboratory, Pennsylvania DEP participated
 - Considered for update to SW-846 methods 5021A and 8015D
- Insensitive Munitions target analytes
 - Supporting data to be provided by DoD
 - Process changes to 8330B for extraction and analysis in aqueous, solid matrices
 - Propose adding liquid chromatography/tandem mass spectrometry for determination



Opportunities for Involvement:

- Sign up for mailing list or send an inquiry to:
<https://www.epa.gov/hw-sw846/forms/contact-us-about-hazardous-waste-test-methods>
- Participate in upcoming validation study
- Contact us at:

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SW-846 Publication Process

Two paths:

- For Method Defined Parameters (MDPs): Rulemaking
 - Public notification/involvement through Federal Register notice-and-comment process

For more info about rulemaking: <https://www.epa.gov/laws-regulations/basics-regulatory-process>

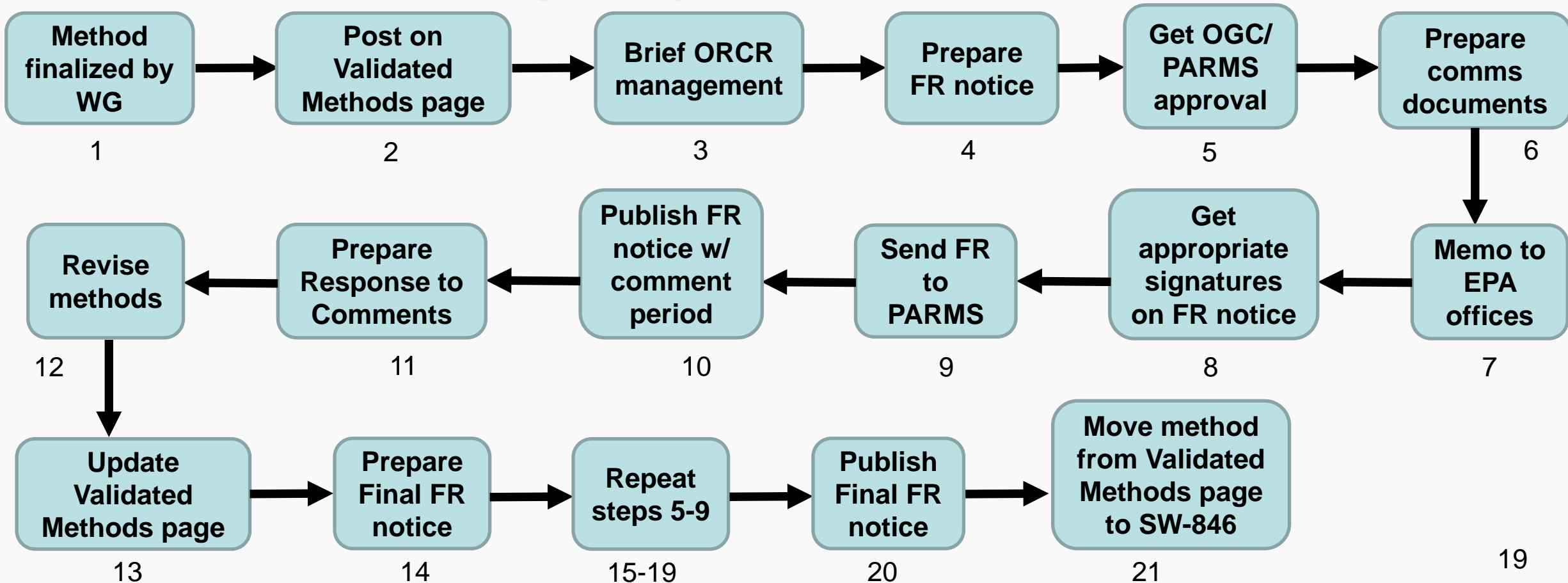
- For Non-Regulatory Methods: Streamlined process (2016)
 - Public notification/involvement through SW-846 mailing list

For more info about SW-846 streamlined publication process: <https://www.epa.gov/hw-sw846/streamlined-procedure-publishing-non-regulatory-sw-846-methods>



SW-846 Publication Process

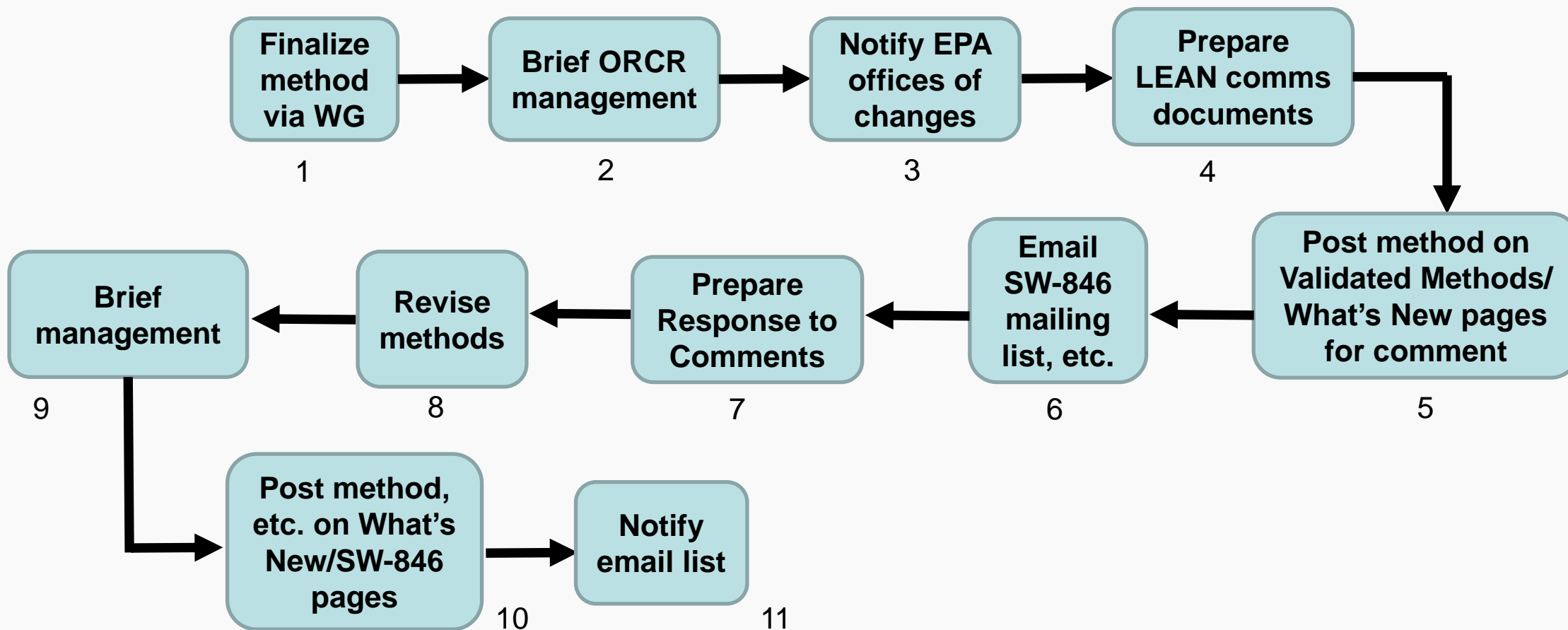
Prior to 2016 for “Non-Regulatory” Methods - Similar for MDPs





SW-846 Publication Process

Streamlined process for “Non-Regulatory” Methods





The SW-846 Compendium

Method-Defined Parameters:

Method-defined parameters are physical or chemical properties of materials determined with specific methods used to evaluate whether the materials comply with certain RCRA Subtitle C regulations. ***Method-defined parameters can only be determined by the methods prescribed in RCRA regulations because the methods are part of the regulations.*** These methods (listed below) must be followed exactly as written, or the resulting data cannot be used to ensure regulatory compliance. In addition to the table below, a list of method-defined parameters may be found at [40 CFR Section 260.11](https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-260/subpart-11/section-260.11).

For more information: <https://www.epa.gov/hw-sw846/final-rule-methods-innovation-rule-mir>

A screenshot of the EPA website page for Hazardous Waste Test Methods / SW-846. The page features the EPA logo, a search bar, and a list of links under the heading "What's New with SW-846".

epa.gov/hw-sw846

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Hazardous Waste Test Methods / SW-846

What's New with SW-846

A row of colorful test tubes in various colors (red, orange, yellow, green, blue).

- [Update VII to SW-846](#)
- [Update VI to SW-846](#)
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- [SW-846 FAQs](#)

<https://www.epa.gov/hw-sw846>



SW-846 Methods Workgroup

- Review SW-846 methods, chapters prior to posting for public comment and/or finalizing
- Annual (regular) and project-focused (episodic) meetings
- Separate organic and inorganic workgroups
- WG members:
 - From EPA program offices, Regional and ORD labs, other federal/state government agencies, academia, and commercial labs
 - Scientists with appropriate background, experience, and interest to actively participate
- EPA retains discretion to make final decisions, limit participation from individual sectors outside EPA