EPA National Biosolids Meeting Summary 2021

November 2-4, 2021

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EPA NATIONAL BIOSOLIDS MEETING 2021

Meeting Summary

November 2-4, 2021
Virtual meeting via ZoomGov

Agenda

Day 1: Tuesday, November 2, 12:30-4:30 PM Eastern

12:30 – 12:45 PM	**Welcome and Opening Remarks** • Elizabeth (Betsy) Behl, Director, EPA Health and Ecological Criteria Division • Radhika Fox, Assistant Administrator, EPA Office of Water
12:45 – 1:45 PM	**Plenary Panel: Biosolids Management Priorities: EPA HQ, Region, and State Perspective** • Deborah Nagle, Director, EPA Office of Science and Technology (OST) • Jeffery Robichaud, Director, Water Division, EPA Region 7 • Karen Mogus, Deputy Director, Division of Water Quality, California State Water Resources Control Board
1:45 – 2:00 PM	**EPA Biosolids Current Work and Areas of Support** • Elizabeth (Betsy) Behl, Division Director, EPA Health and Ecological Criteria Division
2:00 – 2:10 PM	**Break**
2:10 – 3:10 PM	**Panel: EPA's Preliminary Biosolids Risk Assessment Approach** • Biosolids Pollutant Prioritization (Dr. Richard Judson, EPA Office of Research and Development, Center for Computational Toxicology and Exposure) • PFOA/PFOS Eco-Toxicity Value for Risk Evaluation (Amanda Jarvis, EPA Health and Ecological Criteria Division)
3:10 – 3:20 PM	**Break**
3:20 – 4:20 PM	**Panel: EPA's Preliminary Biosolids Risk Assessment Approach** • Risk Screening & Refined Risk Assessment Model (Dr. David Tobias, Biosolids Risk Assessment Lead, EPA Health and Ecological Criteria Division)
4:20 – 4:30 PM	**Wrap Up and Adjourn**

Day 2: Wednesday, November 3, 1:00-4:15 PM Eastern

1:00 – 1:05 PM	**Welcome and Overview of Day 2**
1:05 – 2:15 PM	**Interactive Exercises and Panel: Environmental Justice** • Catherine Flowers, Founder, Center for Rural Enterprise and Environmental Justice • Dennis Randolph, Civil Engineer, City of Kalamazoo Public Services Department

2:15 – 2:30 PM	**Break**
2:30 – 3:15 PM	**Biosolids PFAS Method** • Adrian Hanley, EPA Engineering and Analysis Division
3:15 – 4:00 PM	**Panel: State Biosolids Requirements Discussion** • Michael Le, Biosolids Coordinator, EPA Region 10 • Kyle Dorsey, Biosolids Coordinator, Washington Department of Ecology • Terry Alber, Biosolids Coordinator, Idaho Department of Environmental Quality
4:00 – 4:15 PM	**Wrap Up & Adjourn**

Day 3: Thursday, November 4, 12:30-4:00 PM Eastern

12:30 – 12:45 PM	**Welcome and Overview of Day 3**
12:45 – 2:15 PM	**Panel: Biosolids for Climate Change Mitigation and Adaptation** • Janine Burke-Wells, Executive Director, Northeast Biosolids and Residuals Association (NEBRA) • Ben Axt, Biosolids Forestry Project Manager, King County Wastewater Treatment Division • Karri Ving, Business Strategy and Performance Manager, San Francisco Public Utilities Commission
2:15 – 2:30 PM	**Break**
2:30 – 3:45 PM	**Panel: Key Research** • Dr. Chris Impellitteri, EPA Office of Research and Development • Ashwin Dhanasekar and Lola Olabode, Research Program Managers, Water Research Foundation • Dr. Nick Basta, Ohio State University, W4170 • Jake Adler, Environmental Analyst, Association of Clean Water Administrators
3:45 – 4:00 PM	**Wrap Up and Next Steps**
4:00 PM	**Adjourn**

Meeting Summary

Day 1: Tuesday, November 2, 12:30-4:30 PM Eastern

Welcome and Opening Remarks

Elizabeth (Betsy) Behl, Director, EPA Health and Ecological Criteria Division
Radhika Fox, Assistant Administrator, EPA Office of Water

Elizabeth (Betsy) Behl, Director, EPA Health and Ecological Criteria Division, welcomed participants to the meeting, and introduced Radhika Fox, Assistant Administrator, EPA Office of Water (OW). Radhika opened the meeting by acknowledging that biosolids are a priority for OW. She emphasized the importance of the three-day national meeting which was happening during an unbelievable moment for the water sector. She noted that never before have we seen water elevated in the national dialogue as we are right now, and that we are poised to see the single largest investment in the nation's water infrastructure, include significant investments that matter to all meeting participants. She commented that this funding and investment can help the sector make progress in biosolids processing. Radhika shared that she's been deeply engaged in work on PFAS, including her role as a co-chair of the EPA Council on PFAS, which intends to accelerate progress on analytical methods to test for PFAS. She also shared her excitement that EPA is moving forward with a biosolids risk assessment, which she expects to be completed in 2024. Lastly, Radhika noted that it is such an incredible time to be in the water sector, emphasizing the fundamental role the biosolids community plays in ensuring safe and healthy communities. A recording of Radhika's opening remarks is available here.

Plenary Panel: Biosolids Management Priorities: EPA HQ, Region, and State Perspective

Deborah Nagle, Director, EPA Office of Water, Office of Science and Technology (OST)
Jeffery Robichaud, Director, Water Division, EPA Region 7
Karen Mogus, Deputy Director, Division of Water Quality, California State Water Resources Control Board

Rob Willis, lead facilitator from Ross Strategic, introduced the three panelists and led a facilitated discussion. The questions for each panelist are included in this summary. A recording of the full discussion is available here.

Opening Questions

Deborah Nagle: We've heard that the EPA (OST) Biosolids Program "is back." What does that mean?
Deborah Nagle: You talked about building back EPA's presence. Can you elaborate on that for us?
Jeffery Robichaud: Please explain the role of the Center of Excellence in Region 7.
Jeffery Robichaud: What other roles are left to States and Regions?
Karen Mogus: How does California run their biosolids program? Does California have delegated authority for biosolids?

Questions around PFAS

Karen Mogus: Can you please describe the work being done in California regarding PFAS in biosolids?
Deborah Nagle: PFAS is on everyone's mind. What is the OST Biosolids Program doing to address PFAS in biosolids?

Questions around Biosolids Programs
Deborah Nagle: What else is the OST Biosolids Program working on?
Karen Mogus: What are some of the requirements for land application of biosolids in California?
Karen Mogus: What are some trends you see regarding land application of biosolids in California? The response to this question will include discussion of organics diversion from landfills under recent California legislation.

Wrap Up Questions
Karen Mogus: What's next for biosolids in California?
Jeffery Robichaud: What improvements would you like to see nationally?
Jeffery Robichaud: How do you think the Biosolids Program will need to change going into the future?
Deborah Nagle: Finally, where do you see the Biosolids Program in the future?

EPA Biosolids Current Work and Areas of Support
Elizabeth (Betsy) Behl, Division Director, EPA Health and Ecological Criteria Division

Ms. Behl introduced the EPA Biosolids Team in OST, which includes the following:
- Elizabeth (Liz) Resek, Biosolids Lead
- Dr. David Tobias, Risk Assessment Lead
- Tess Richman, ORISE Fellow
- Lauren Questell, ORISE Fellow

Ms. Behl briefly walked participants through the Biosolids Program Strategy: Fiscal Year 2020-2025.

Plenary: EPA's Preliminary Biosolids Risk Assessment Approach
Dr. Richard Judson, EPA ORD, Center for Computational Toxicology and Exposure
Amanda Jarvis, EPA Health and Ecological Criteria Division
Dr. David Tobias, Biosolids Risk Assessment Lead, EPA Health and Ecological Criteria Division

The Office of Science and Technology Biosolids Program has requested EPA's Science Advisory Board (SAB) to review the biosolids risk assessment approach which consists of 1) prioritization, 2) risk screening using a deterministic risk assessment model, and 3) probabilistic risk assessment. The SAB review is scheduled for early 2022. This session consisted of presentations related to biosolids risk assessment.

Dr. Richard Judson, EPA Office of Research and Development, Center for Computational Toxicology and Exposure, gave a presentation on **Biosolids Pollutant Prioritization**, specifically the Public Information Curation and Synthesis (PICS) approach developed for the EPA Toxics Substances Control Act (TSCA) to prioritize chemicals for risk assessment in the EPA Office of Pollution Prevention and Toxics existing chemical program. He discussed the application of the PICS process to the chemicals that have been found in biosolids and presented the top prioritized chemicals from the Biosolids List. Dr. Judson's presentation slides can be found here, and the recording of his presentation can be accessed here.

Amanda Jarvis, EPA Health and Ecological Criteria Division, gave a presentation on **PFOA/PFOS Eco-Toxicity Values for Risk Evaluation.** Amanda provided an overview on the draft conceptual model diagram of sources, partitioning, bioaccumulation, and effects of PFOA and PFOS in the aquatic environment. She shared data from a toxicity literature review that was obtained from EPA's Office of Research and Development's publicly available ECOTOX database and highlighted the ongoing work for all EPA aquatic life criteria for PFOA and PFOS. Amanda's work on evaluating the ecotoxicity of PFOA and PFOS will become part of the biosolids risk assessment for those chemicals. Amanda's presentation slides can be found here, and the recording of her presentation can be accessed here.

Dr. David Tobias, Biosolids Risk Assessment Lead, EPA Health and Ecological Criteria Division, presented EPA's **Risk Screening & Refined Risk Assessment Model**. Dr. Tobias introduced concepts such as risk, exposure assessment, toxicity, deterministic risk assessment, and refined probabilistic risk assessment. He presented information on the screening model which has the ability to evaluate a broad set of environmental pathways and connect those to household water, dietary, and inhalation exposure for human health and surface water and dietary exposures for aquatic and terrestrial organisms. The model is intended to be sufficiently conservative to indicate which chemicals are low risk in the screening process and therefore, do not need further assessment. If the screening tool indicates risk concerns for pathways in the model for a chemical, then a fuller evaluation of the chemical including probabilistic risk assessment may follow. Dr. Tobias' presentation slides can be found here, and the recording of his presentation can be accessed here.

Day 2: Wednesday, November 3, 1:00-4:15 PM Eastern

Interactive Exercises and Panel: Environmental Justice

Catherine Flowers, Founder, Center for Rural Enterprise and Environmental Justice
Dennis Randolph, Civil Engineer, City of Kalamazoo Public Services Department

Catherine Flowers *is an internationally recognized environmental activist, MacArthur "genius" grant recipient, and author. She has dedicated her life's work to advocating for environmental justice, primarily equal access to clean water and functional sanitation for communities across the United States. Founder of the Center for Rural Enterprise and Environmental Justice (CREEJ), Ms. Flowers has spent her career promoting equal access to clean water, air, sanitation, and soil to reduce health and economic disparities in marginalized, rural communities. In addition, Flowers serves as Rural Development Manager for Bryan Stevenson's Equal Justice Initiative (EJI), is a Senior Fellow for the Center for Earth Ethics at Union Theological Seminary and sits on the Board of Directors for the Climate Reality Project, the Natural Resources Defense Council, and the Center for Constitutional Rights. In 2021, her leadership and fervor in fighting for solutions to these issues led her to one of her most notable appointments yet — Vice Chair of the Biden Administration's inaugural White House Environmental Justice Advisory Council. As the author of Waste: One Woman's Fight Against America's Dirty Secret, Flowers shares her inspiring story of advocacy, from childhood to environmental justice champion. She discusses sanitation and its correlation with systemic class, racial, and geographic prejudice that affects people across the United States. She has been featured in The New York Times, The Washington Post, Bloomberg, The Guardian, and on PBS.*

Dennis A. Randolph, P.E. *is an experienced local government manager with over 50-years of working experience. Currently he is an engineer for the City of Kalamazoo, previously he was the Director of Public Works for the City of Grandview Missouri, and before that a County Public Works Director among other technical and managerial positions. Mr. Randolph has a unique combination of financial, management, practical engineering, and academic experience that brings a diverse view his work. For over 16-years he was the chief financial officer and chief executive of an organization that developed a wide range of environmental cleanup and solid waste disposal programs, taking part in discussions to obtain both public and private funds to finance the work.*

As part of his responsibilities, he has developed project documents to meet NEPA requirements and has managed many air, noise, and water quality studies. He led efforts to obtain local funds to clean up brownfield sites in three-communities and also has successfully obtained EPA Brownfield funds. He has a strong technical background and research interest in hazard identification related to infrastructure improvements, especially as they relate to community development. He has extensive knowledge of local, state and federal permitting processes, remediation of problems, and risk assessment issues. Mr. Randolph has over 20-years of university-level teaching experience and currently serves as an instructor in civil and construction engineering at the University of Missouri – Kansas City. He recently completed a 6-year term on the National Environmental Justice Advisory Council, and current serves on the Financial Advisory Board, both EPA advisory councils. He is a co-author of the American Society of Civil Engineer's recent publication Engineering for Sustainable Communities.

Before diving into this session, Rob Willis asked participants the following polling question to gauge attendees experience and interest in the topic of environmental justice (EJ).

1. What agencies/organizations are addressing Environmental Justice related to biosolids issues? The following responses included:

- 21% have not started exploring a connection and do not plan to start soon
- 19% have not started exploring a connection but do plan to start soon
- 36% have started exploring a connection but need more concrete ideas and actions
- 20% do understand the connection and have begun taking some actions that address EJ and biosolids
- 4% of participants shared that they already have a fully robust approach to EJ and biosolids.

Following the polling questions, Rob led a facilitated discussion. The questions for each panelist are included. The recording of the full discussion can be found here.

Discussion Questions

Catherine Flowers: Could you start by defining the problem surrounding wastewater in Lowndes County? What are the major issues, what groups are most affected, and what role does environmental justice play?

Catherine Flowers: Are these issues present across the entire U.S.? In your experience, is there a gap in communication between local/regional utilities and the communities they serve?

Dennis Randolph: Why is it important to discuss technical/engineering matters with people who probably don't have any background in biosolids or wastewater?

Dennis Randolph: How would you respond to individuals who say, “Doesn't all of this community engagement delay projects and just put-off fixing problems?” How might you engage with a community and still be successful in getting the engineering done?

Dennis Randolph: Suppose, we do engage with the community, just what should we do with the comments and complaints, and how can that information help solve a problem?

Catherine Flowers: What reflections do you have on the points Dennis made regarding community engagement?

Catherine Flowers: Are there any potential solutions (i.e., communication, policy, and/or technology) that can bridge the gap and help implement EJ practices effectively?

Dennis Randolph: What reflections do you have on the potential solutions Catherine described to help bridge the gap and help implement EJ practices effectively?

Dennis Randolph: Looking at the results from the first and second poll, what advice would you give those individuals who are just initiating or planning to initiate EJ conversations within their agency/organization?

Catherine Flowers: Same question to you. Looking at the results from the first and second poll, what advice would you give those individuals who are just initiating or planning to initiate EJ conversations within their agency/organization?

Biosolids PFAS Methods

Adrian Hanley, OST Engineering and Analysis Division

Tess Richman, ORISE Fellow with the OST Biosolids Team, led a facilitated Q&A discussion with Adrian Hanley. The questions are included in this summary. For more information on EPA PFAS methods, please refer to the following EPA webpage. The full recording of the discussion can be accessed here.

Question #1: EPA recently released Method 1633 for 40 PFAS Compounds in Biosolids. Does this mean utilities have to sample for PFAS in their biosolids?

- Tess shared that monitoring under 40 CFR Part 503 (also called “Part 503”) is only required for regulated pollutants. The PFOA and PFOS biosolids risk assessment is underway. Once the risk assessment is completed it informs whether limits for PFOA and/or PFOS will be set. If limits are set then the Clean Water Act (CWA) Method 1633 will be used for monitoring under Part 503 once the method is promulgated

Question #2: Please tell us about EPA Method 1633.

- Adrian explained that EPA Method 1633 is a draft method being recommended by EPA. EPA's draft methods have only been single lab validated, which is different from final methods that go through multi-lab validation and promulgation. He also explained the difference between single-lab and multi-lab validation and discussed the process and timeline of validation and publication of a CWA method.

Question #3: What is the difference between CWA methods and SW-846 methods?

- Adrian provided an overview and explained the difference of CWA methods and. SW-846 methods.

Question #4: Is there a modified EPA 537 method for PFAS?

- Adrian explained what "modified" means, noting that these drinking water methods are even more strict than CWA methods, with no deviation from procedure allowed unless specifically called out in the method.

Question #5: Will labs become certified for running Method 1633 for biosolids?

- Adrian noted that drinking water has a certification program, while wastewater does not. A lot of states have an accreditation program if you are doing National Pollutant Discharge Elimination System (NPDES) work for that state. He shared that as soon as 1633 is promulgated, he thinks more states will likely do some sort of accreditation for it.

Panel: State Biosolids Requirements Discussion

Michael Le, EPA Region 10 Biosolids Coordinator
Kyle Dorsey, Washington Department of Ecology
Terry Alber, Idaho Department of Environmental Quality

Rob Willis led a facilitated discussion with the three panelists. The intent of this discussion was for state co-regulators to learn how other states regulate biosolids according to Part 503 and highlight the differences in regulation between authorized and non-authorized states. Questions for the panelists are included. You can watch the full recording of the state requirements panelist session here.

Kyle Dorsey (Washington – non: authorized state) and Terry Alber (Idaho – authorized state): What are the differences between Part 503 and state regulations?

- Do you regulate more (additional pollutants or more stringent limits) than other states?
- Do you have a process for reducing the frequency of monitoring requirements for additional pollutants not regulated in Part 503? For example, if after a period of time the testing results consistently show non-detect or low levels, do any states have a mechanism for reducing frequency of monitoring from monthly to quarterly?

Kyle Dorsey and Terry Alber: How do you deal with local (e.g., county) level ordinances or regulations that differ from the state level regulations?

Kyle Dorsey, Terry Alber, and Michael Le: How do you coordinate with neighboring regulators when biosolids are transported across state lines?

- Discuss biosolids management trends including transition from Class B to Class A.
- How do you navigate reaction from the public, when it comes to the land application of biosolids, including odor?

Kyle Dorsey, Terry Alber, and Michael Le:

- How do you handle non-compliance as an authorized state vs. non-authorized state?
- How do you work with and communicate with EPA (regionally and with the national program) as an authorized state vs. non-authorized state?
- What other differences in your program do you notice as an authorized vs. non-authorized state?
- Discuss the pros and cons of being an authorized vs. non-authorized state.

Panel: Biosolids for Climate Change Mitigation and Adaptation

Janine Burke-Wells, Executive Director, Northeast Biosolids and Residuals Association (NEBRA)
Ben Axt, Biosolids Forestry Project Manager, King County Wastewater Treatment Division
Karri Ving, Business Strategy & Performance Manager, San Francisco Public Utilities Commission (SFPUC)

Rob Willis led a facilitated discussion with the three panelists on the topic of the climate change and biosolids nexus. Questions for the panelists are included in this summary. The full recording of the climate change panelist session can be found here.

Janine Burke-Wells: As we dive into this session, can you please define for us some key terms we are going to be talking about today (Mitigation, Adaptation, and Carbon Accounting)?

Karri Ving: When did SFPUC start the climate change discussion and what were the drivers behind the need to have that discussion?

Ben Axt: Same question, when did King County start discussing climate change and what were the drivers behind that discussion?

Ben Axt: In broad strokes, can you describe where and how climate change considerations are a part of your work?

Karri Ving: Same question, in broad strokes, can you describe where and how climate change considerations are a part of your work?

Ben Axt: Can you please describe your ongoing research related to biosolids and climate change? What questions are you seeking to understand and why are they important?

Karri Ving: How has SFPUC leveraged the work of King County and other researchers?

Ben Axt: What advice would you give municipalities who are just starting a conversation about climate change and biosolids?

Karri Ving: What advice would you give utilities who are just starting a conversation about climate change and biosolids?

Ben Axt: Where do you think the biosolids and climate change discussion will be in one year and five years from now?

Karri Ving: Where do you think the biosolids and climate change discussion will be in one year and five years from now?

Janine Burke-Wells: Can you please tell us about the carbon counting work NEBRA is involved in?

Key Research

Dr. Christopher Impellitteri, EPA Office of Research and Development (ORD)
Ashwin Dhanasekar, Research Program Manager, and Lola Olabode, Research Program Manager, Water Research Foundation (WRF)
Dr. Nick Basta, Ohio State University, W4170
Jake Adler, Environmental Analyst, Association of Clean Water Administrators (ACWA)

The intent of this session was for participants to gain some insight into what research is underway in the biosolids field. Participants were encouraged to ask questions. Dr. Christopher Impellitteri highlighted the biosolids research projects underway at EPA ORD. His presentation slides can be found here. Ashwin Dhanasekar and Lola Olabode gave an overview of research underway at WRF and discussed the recent EPA Grant awarded to WRF for the evaluation of pollutants in biosolids. Ashwin and Lola's presentation slides can be found here. Dr. Nick Basta gave a history of W4170 and gave an overview of past, current, and upcoming biosolids research at W4170. His presentation can be found here. Lastly, Jake Adler, highlighted research project updates for New Hampshire, Washington, and Minnesota. Jake's presentation slides can be found here.

The full recording of the key research session can be accessed here.

Conclusions

The Biosolids Team would like to thank those in the biosolids community for providing input on the meeting agenda, and the presenters and participants who made the EPA National Biosolids Meeting 2021 a success. EPA is committed to continuing co-regulator and stakeholder coordination and collaboration. Together we can address the challenges of biosolids management and protect human health and the environment.

Appendix A: Meeting Attendees

Affiliation	First Name	Last Name	Organization
Canadian Co-Regulators	Gordon	Dinwoodie	Alberta
	Cecily	Flemming	Ontario
	Morley	Foy	Prince Edwards Island
	Amandeep	Komal	Health Canada
	Ben	Lanigan	Prince Edwards Island
	Benoit	Lebeau	Ontario
	Mathew	McMahon	Ontario
	Glenn	Murray	Health Canada
	Gloria	Parker	British Columbia
	Shane	Patterson	Alberta
	Douglas	Sasaki	Health Canada
	Shirley Anne	Smyth	Health Canada
	Brett	Tendler	Health Canada
	Arasu	Thirunavukkarasu	Saskatchewan
U.S. Environmental Protection Agency	Deborah	Nagle	Office of Science and Technology
	Betsy	Behl	OST Health and Ecological Criteria Division
	Elizabeth	Resek	OST Biosolids Team
	David	Tobias	OST Biosolids Team
	Tess	Richman	OST Biosolids Team (ORISE Fellow)
	Lauren	Questell	OST Biosolids Team (ORISE Fellow)
	Janice	Alers-Garcia	OST Health and Ecological Criteria Division
	Amanda	Jarvis	OST Health and Ecological Criterial Division
	Mario	Sengco	OST Standards and Health Protection Division
	Carolyn	Acheson	Office of Research and Development
	Richard	Judson	Office of Research and Development
	Laura	Boczek	Office of Research and Development
	Ron	Herrmann	Office of Research and Development
	Christopher	Impellitteri	Office of Research and Development
	Marc	Russell	Office of Research and Development
	Tracy	Bone	OST Engineering and Analysis Division
	Sarah (Bekah)	Burket	OST Engineering and Analysis Division
	Adrian	Hanley	OST Engineering and Analysis Division
	Lemuel	Walker	OST Engineering and Analysis Division
	Smiti	Nepal	Office of Wastewater Management
	Jan	Pickrel	Office of Wastewater Management
	Alia	Roufaeal	Region 2 Biosolids Coordinator
	Joshua	Kogan	Region 2
	Kenneth	Pantuck	Region 3 Biosolids Coordinator
	Leann	Lopez	Region 4
	Carla	Dollar	Region 4
	Sam	Sampath	Region 4 Biosolids Coordinator

U.S. Environmental Protection Agency (cont.)	John	Colletti	Region 5 Biosolids Coordinator
	William	Cooper	Region 6 Biosolids Coordinator
	Kenneth	Gunter	Region 6
	Seth	Draper	Biosolids Center of Excellence, Office of Enforcement and Compliance
	Alex	Owutaka	Region 7
	Paul	Garrison	Region 8
	Lauren	Fondahl	Region 9 Biosolids Coordinator
	Janet	Parrish	Region 9
	Michael	Le	Region 10 Biosolids Coordinator
EPA National Priorities Grant Recipients for Evaluation of Pollutants in Biosolids	Nicole	Dennis	University of California Riverside
	Caroline	Alukkal	Purdue University
	Christina	Schilling Costello	Purdue University
	Mahsa	Modiri	Purdue University
	Linda	Lee	Purdue University
	Thomas	Burke	Johns Hopkins University
	Carsten	Prasse	Johns Hopkins University
	Keeve	Nachman	Johns Hopkins University
	Matthew	Newmeyer	Johns Hopkins University
	Courtney	Carignan	Michigan State University
	Hui	Li	Michigan State University
	John	Norton	Great Lakes Water Authority
	Drew	McAvoy	University of Cincinnati
	Bongkeun	Song	Virginia Institute of Marine Science
	Robert	Hale	Virginia Institute of Marine Science
	Ashley	King	Virginia Institute of Marine Science
	Mark	La Guardia	Virginia Institute of Marine Science
	Chris	Burbage	Hampton Roads Sanitation District
Association of Clean Water Administrators (ACWA)	Jake	Adler	ACWA
	Sean	Rolland	ACWA
California Association of Sanitation Agencies (CASA)	Ryan	Batjiaka	San Francisco Water
	Sarah	Deslauriers	Carollo Engineers
Mid-Atlantic Biosolids Association (MABA)	William	Toffey	MABA
National Association of Clean Water Agencies (NACWA)	Chris	Hornback	NACWA
	Emily	Remmel	NACWA
New England Interstate Water Pollution Control Commission (NEIWPCC)	Jen	Lichtensteiger	NEIWPCC

Northeast Biosolids and Residuals Association (NEBRA)	Ned	Beecher	NEBRA
	Janine	Burke-Wells	NEBRA
Northwest Biosolids	James	Dunbar	NW Biosolids
	Amy	Ohlinger	NW Biosolids
King County	Erika	Kinno	King County Wastewater Treatment Division
Virginia Biosolids Council	Robert	Crockett	Virginia Biosolids Council
W4170	Nick	Basta	Ohio State University
	Maria Lucia	Silveira	University of Florida
Water Environment Federation (WEF)	Maile	Lono-Batura	WEF
	Patrick	Dube	WEF
Water Research Foundation (WRF)	Ashwin	Dhanasekar	WRF
	Lola	Olabode	WRF
Alabama	Rick	Kelsey	Alabama Department of Environmental Management-Land Division
Alaska	Lori	Aldrich	Alaska Department of Environmental Conservation
	Doug	Buteyn	Alaska Department of Environmental Conservation
Arizona	Sondra	Francis	Arizona Department of Environmental Quality
California	Laleh	Rastegarzadeh	State Water Resources Control Board
	Brianna	St. Pierre	California State Water Board
Colorado	Tim	Larson	Colorado Department of Public Health & Environment
	Nathan	Moore	Colorado Department of Public Health & Environment
Connecticut	Craig	Motasky	Connecticut Department of Energy and Environmental Protection
Delaware	Brian	Churchill	Delaware Department of Natural Resources and Environmental Control
Florida	Maurice	Barker	Florida Department of Environmental Protection
	Kevin	Coyne	Florida Department of Environmental Protection
Hawaii	Michael	Cummings	State of Hawaii Wastewater Branch
	Sina	Pruder	State of Hawaii Wastewater Branch
Idaho	Terry	Alber	Idaho Department of Environmental Quality
	Tressa	Nicholas	Idaho Department of Environmental Quality
Indiana	Kira	Wren	Indiana Department of Environmental Management
	Brenda	Stephanoff	Indiana Department of Environmental Management
Iowa	Tom	Atkinson	Iowa Department of Natural Resources
	Emy	Liu	Iowa Department of Natural Resources
Kansas	Ryan	Eldredge	Kansas Department of Health & Environment
	Cara	Hendricks	Kansas Department of Health & Environment

Kentucky	Brian	Osterman	Kentucky Department of Environmental Protection
	Gary	Logsdon	Kentucky Department of Environmental Protection
	Louanna	Aldridge	Kentucky Department of Environmental Protection
	Robin	Green	Kentucky Department of Environmental Protection
	Tammi	Hudson	Kentucky Department of Environmental Protection
Louisiana	Ronda	Burtch	Kentucky Department of Environmental Protection
	Jeremy	Franklin	Kentucky Department of Environmental Protection
Maine	Mike	Jakubowski	Michigan Department of Environment, Great Lakes and Energy
Massachusetts	Jennifer	Wood	Massachusetts Department of Environmental Protection
Michigan	Sarah	Campbell	Michigan Department of Environment, Great Lakes and Energy
	Steve	Mahoney	Michigan Department of Agriculture and Rural Development
	Michael	Person	Michigan Department of Environment, Great Lakes and Energy
Minnesota	Sherry	Bock	Minnesota Pollution Control Agency
	Cole	Huggins	Minnesota Pollution Control Agency
Mississippi	Charlie	Bock	Mississippi Department of Environmental Quality
New Hampshire	Anthony	Drouin	New Hampshire Department of Environmental Services
	Wade	Pelham	New Hampshire Department of Environmental Services
New Jersey	Janice	Brogle	New Jersey Department of Environmental Protection
	Patrick	Brown	New Jersey Department of Environmental Protection
	Michelle	Christopher	New Jersey Department of Environmental Protection
New Mexico	Susan	LucasKamat	New Mexico Environment Department
New York	Samantha	MacBride	New York State Department of Environmental Conservation
	Jennifer	McDonnell	New York State Department of Environmental Conservation
	Sally	Rowland	New York State Department of Environmental Conservation
	Molly	Trembley	New York State Department of Environmental Conservation
North Dakota	Marty	Haroldson	North Dakota Department of Environmental Quality

Ohio	Betsy	Sheerin	Ohio Environmental Protection Agency
	John	Takas	Ohio Environmental Protection Agency
	John	Timmons	Ohio Environmental Protection Agency
	Kennedy	Van Horn	Ohio Environmental Protection Agency
Oklahoma	Toby	Harden	Oklahoma Department of Environmental Quality
	Myles	Mungle	Oklahoma Department of Environmental Quality
Oregon	Larry	Brown	Oregon Department of Environmental Quality
	Pat	Heins	Oregon Department of Environmental Quality
	Tim	Ruby	Oregon Department of Environmental Quality
Pennsylvania	Kevin	McLeary	Pennsylvania Department of Environmental Protection
Rhode Island	Alex	Pinto	Rhode Island Department of Environmental Management
South Carolina	Dustin	Leypoldt	South Carolina Department of Health and Environmental Control
	Tyra	Foulks	South Carolina Department of Health and Environmental Control
	Brenda	Green	South Carolina Department of Health and Environmental Control
Texas	Charles	Schneider	Texas Commission on Environmental Quality
	Brian	Sierant	Texas Commission on Environmental Quality
	Shelby	Williams	Texas Commission on Environmental Quality
Utah	Daniel	Griffin	Utah Division of Water Quality
	Glen	Lischeske	Utah Division of Water Quality
Vermont	Josh	Burns	Vermont Department of Environmental Conservation
	Eamon	Twohig	Vermont Department of Environmental Conservation
Virgin Islands	Austin	Callwood	Virgin Islands Department of Planning and Natural Resources
Virginia	Christina	Wood	Virginia Department of Environmental Quality
	Bryan	Cauthorn	Virginia Department of Environmental Quality
	Abi	Fayiga	Virginia Department of Environmental Quality
	Neil	Zahradka	Virginia Department of Environmental Quality
Washington	Amber	Corfman	Washington State Department of Ecology
	Terri	Costello	Washington State Department of Ecology
	Kyle	Dorsey	Washington State Department of Ecology
	Shawnte	Greenway	Washington State Department of Ecology
	Emily	Kijowski	Washington State Department of Ecology
	Peter	Severtson	Washington State Department of Ecology
Wisconsin	Frederick	Hegeman	Wisconsin Department of Natural Resources
	Wade	Strickland	Wisconsin Department of Natural Resources
Wyoming	Keenan	Hendon	Wyoming Office of State Lands and Investments

Utilities	Houssam	Eljerdi	Pima County, AZ
	Jeff	Prevatt	Pima County, AZ
	Joanne	Yee	San Frncisco Water
	Karri	Ving	San Francisco Water
	Ben	Axt	King County, WA
	Rebecca	Singer	King County, WA
	Layne	Baroldi	Synagro
	Bruce	Bartel	New Water/Green Bay, WI
	Matt	Bond	Kansas City Water, MO
	Frank	Dick	City of Vancouver, WA
	Scott	Firmin	Portland Water District, ME
	Michael	Hudkins	Orange County Utilities Dept, FL
	Drew	Iles	Knoxville Utilities Board, TN
	Jeannette	Klamm	Johnson County Wastewater District, KS
	Ben	Nydegger	City of Boise, ID
	Jeff	Spence	Milwaukee Metropolitan Sewerage District, WI
	Dan	Thompson	City of Tacoma, WA
	Marisa	Tricas	City of Roseville, CA

Appendix B: Meeting Presentations

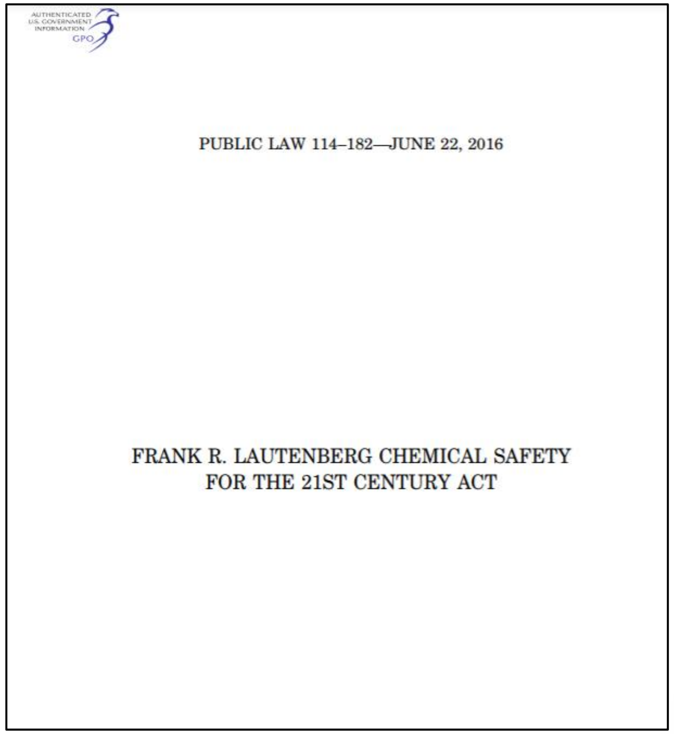
Biosolids Pollutant Prioritization

Richard Judson, PhD
US Environmental Protection Agency
National Biosolids Meeting
November 2-4, 2021

The views presented are those of the author and do not necessarily represent the views of the US EPA.

Origin of Prioritization Approach: TSCA

- The Toxic Substances Control Act (TSCA) regulates the introduction of new and existing chemicals.
- TSCA was amended by the Frank R. Lautenberg Chemical Safety for the 21st Century Act (June 22, 2016)
- EPA required to make determination if chemical substance presents an unreasonable risk of injury to human health or the environment. Determinations are risk-based.
- Periodically, sets of substances must be designated as high or low priority for risk assessments

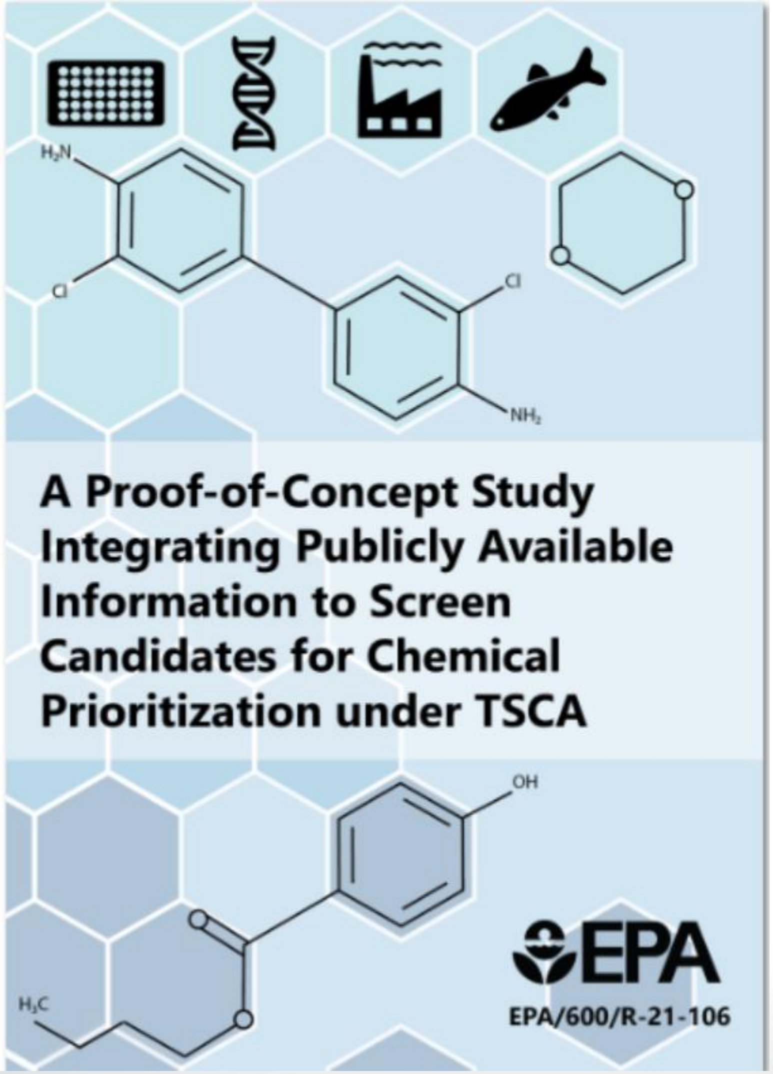


PUBLIC LAW 114–182—JUNE 22, 2016

FRANK R. LAUTENBERG CHEMICAL SAFETY
FOR THE 21ST CENTURY ACT

https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/frank-r-lautenberg-chemical-safety-21st-century-act

Defining Intended Application of PICS Approach (Public Information Curation and Synthesis)



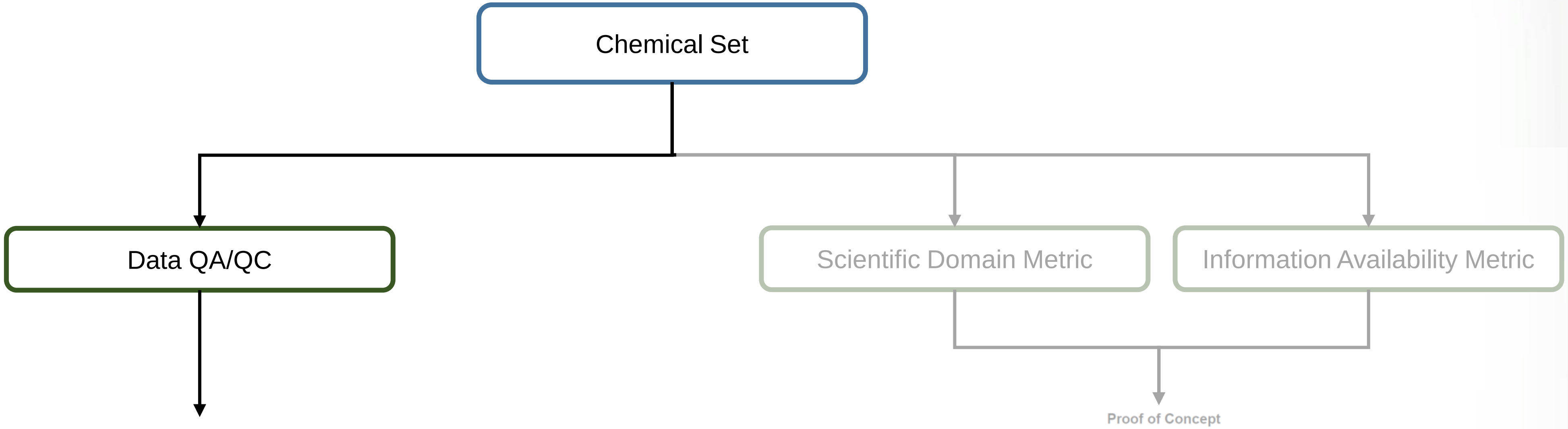
- **The PICS approach was intended to:**
  - Understand the landscape of publicly-available information on large inventories of chemicals
  - Provide a transparent and reproducible process for integrating available information and identifying potential information gaps
  - Increase efficiency and manage workload by focusing expert review on substances that may have a greater potential for selection as high- or low-priority candidates
  - Create a flexible and sustainable process that can adapt to scientific advances and continual generation of new safety-related information
  - Organize the process into modular workflows that can be readily updated or adapted to address scientific advances and prioritization needs under other mandates
- **The PICS approach was <u>not</u> intended to:**
  - Create a ranked list of substances
  - Signal that the EPA has concerns with particular substances or categories of substances
  - Supplant expert judgment and review
  - Utilize confidential business information
  - Incorporate systematic review of information to address study and data quality

https://www.epa.gov/chemical-research/translation-and-knowledge-delivery

Chemicals Selected for OW Biosolids Proof-of-Concept

- The Clean Water Act requires OW to evaluate chemicals and microbes that occur in biosolids for harm to human health and the environment
- OW's sewage sludge surveys and literature surveys have found over 500 chemicals that have been detected in biosolids
- OW has developed a screening tool and probabilistic framework to evaluate risk for these chemicals
- OW needed a prioritization process to help determine which chemicals should be evaluated for first
- ORD applied the PICS process that was developed for TSCA to prioritize the biosolids chemicals for assessment

Overall Workflow: QA/QC First

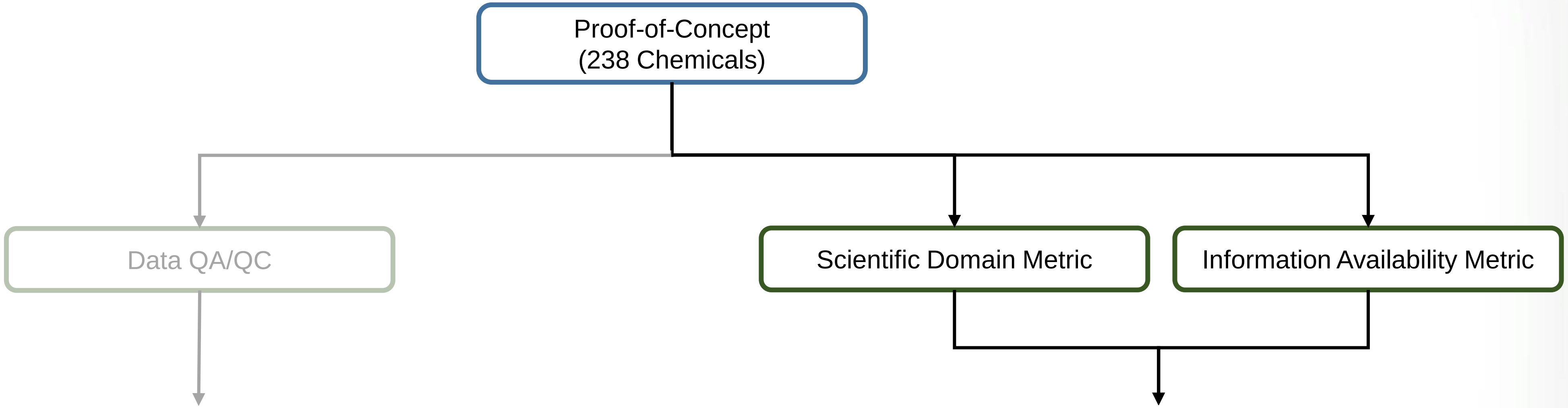


- Specific data domain and data source error rates
- Data QA plan for TSCA active inventory
- Resource estimates for data QC
- QC Tool (beta)

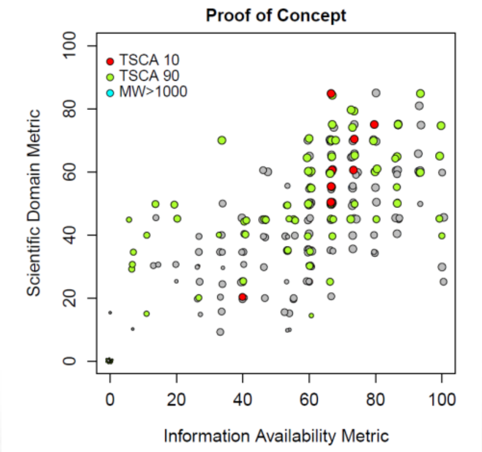
Data Extraction and Quality Control

- **Data extracted from “Type 1” data sources**
  - Type 1 data sources are publicly available and readily searchable, enabling data extraction in structured form
  - Consistent with approach outlined in the Near-term Strategy
- **Quality control (QC) was performed on the data for the proof-of-concept chemicals in order to:**
  - Estimate the accuracy of the data used in this case study
  - Inform the development of formal quality assurance (QA) plan
  - Obtain information on the scope and resources needed to perform QC for larger sets of chemicals

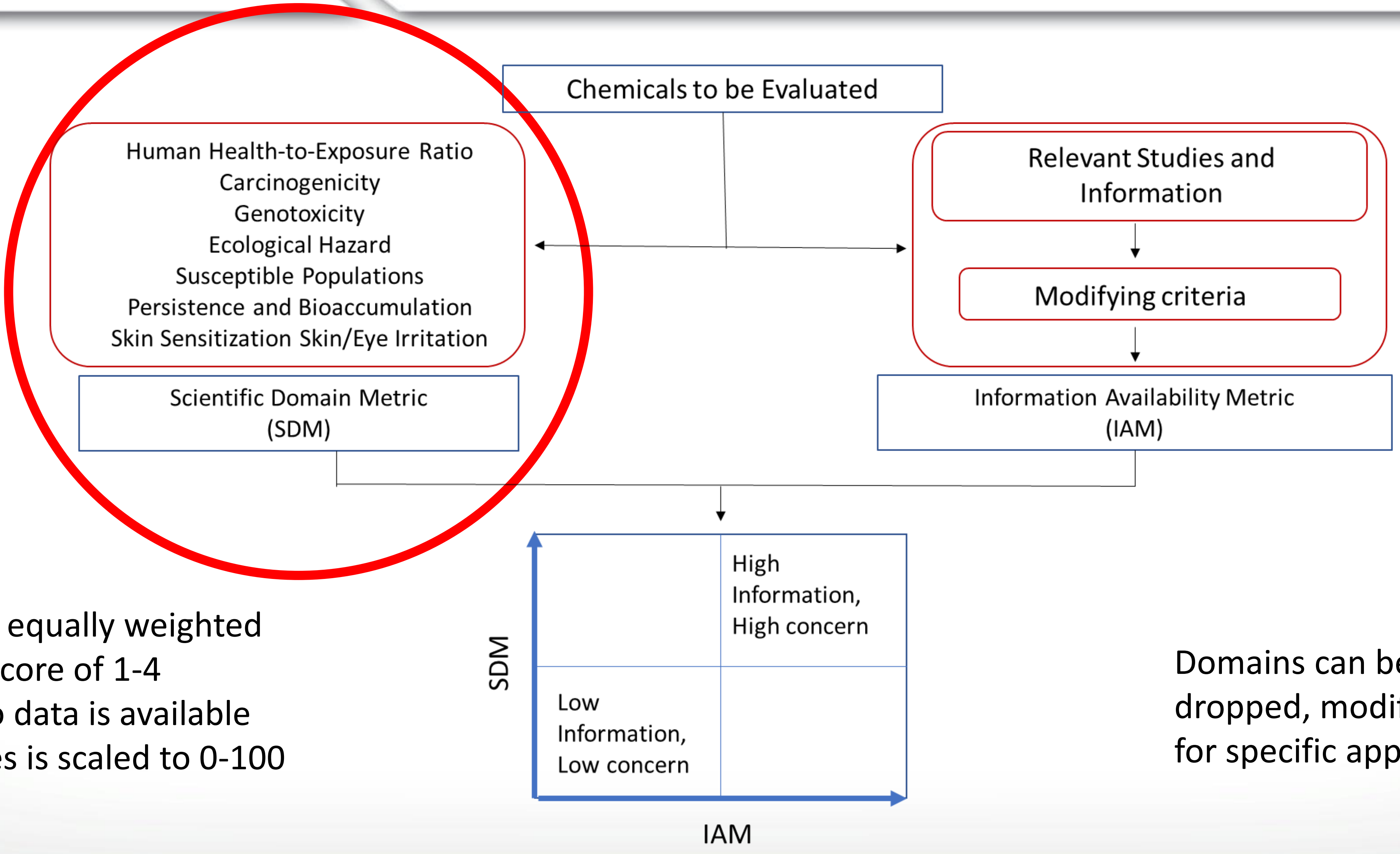
Proof-of-Concept



- Specific data domain and data source error rates
- Data QA plan for TSCA active inventory
- FTE estimates for data QC
- QC Tool (beta)



Public Information Curation and Synthesis (PICS) Approach



Domains are equally weighted
Each gets a score of 1-4
Score=0 if no data is available
Sum of scores is scaled to 0-100

Domains can be added, dropped, modified as need for specific applications

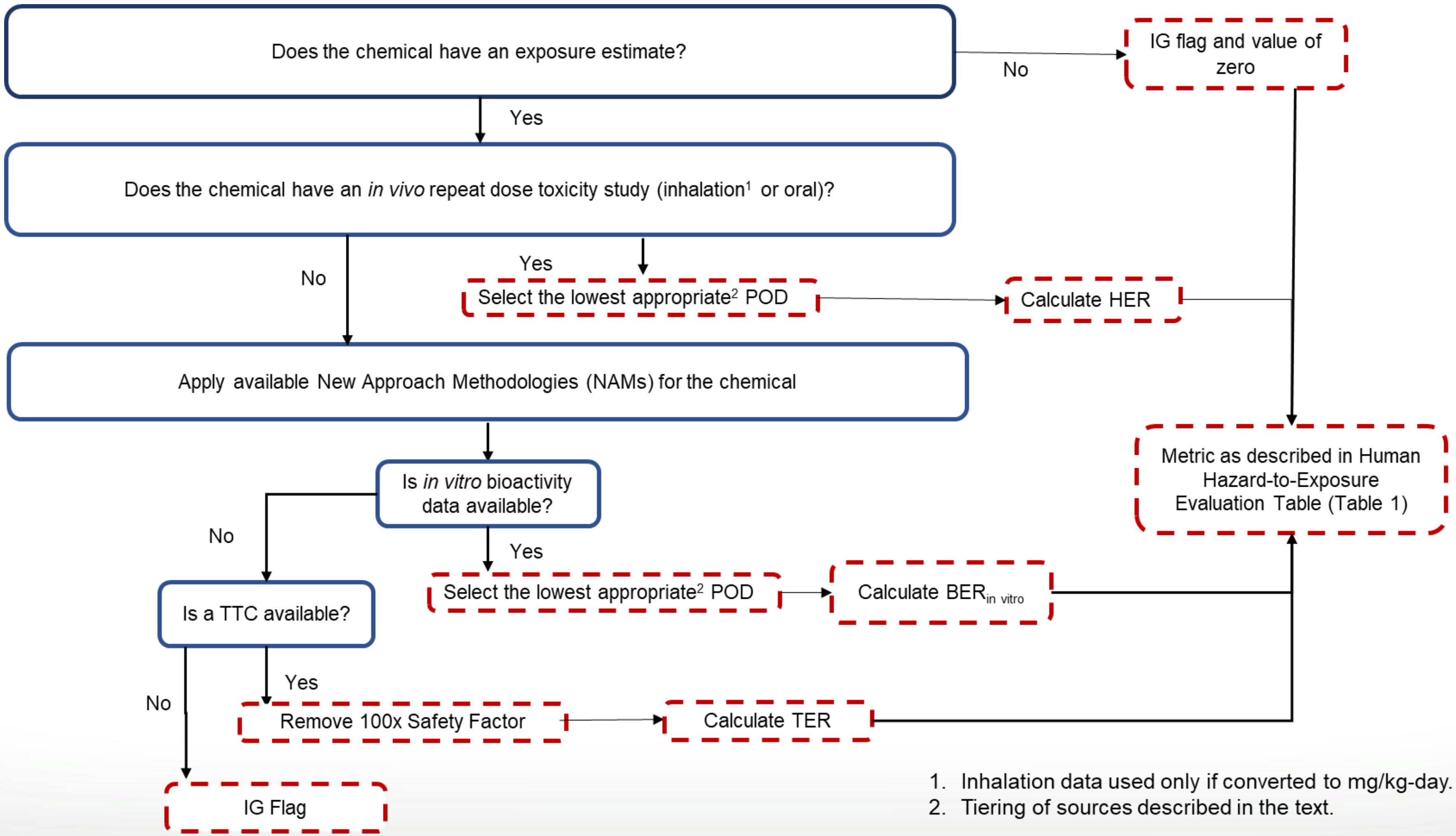
Scientific Domain Metric

- Seven scientific domains were selected based on:
  - Previous use in TSCA prioritization activities (i.e., TSCA workplan)
  - Statutory language in the amended TSCA
  - Consultation with OCSPP management and staff
- Tiered workflows for each scientific domain designed based on the current state of the science
- The overall scientific domain metric is determined by summing the results from the individual scientific domain workflows

Notes on Scientific Domains

- Human Hazard-to-Exposure Ratio
  - Oral POD / general model of exposure (SEEM3)
  - PODs from in vivo studies, in vitro to in vivo extrapolation and TTC
  - Need to replace exposure model with one that is biosolids-specific
- Carcinogenicity
- Genotoxicity
- Ecological Hazard
  - POD for vertebrates, invertebrates, plants; short and long term
  - Use in vivo studies and QSAR models
  - Potentially incorporate ecological exposure
- Susceptible Populations
  - For case study, only childrens' exposure was considered
- Persistence and Bioaccumulation
- Skin Sensitization and Skin/Eye Irritation

Example Scientific Domain Workflow: Human Hazard-to-Exposure Evaluation



1. Inhalation data used only if converted to mg/kg-day.
2. Tiering of sources described in the text.

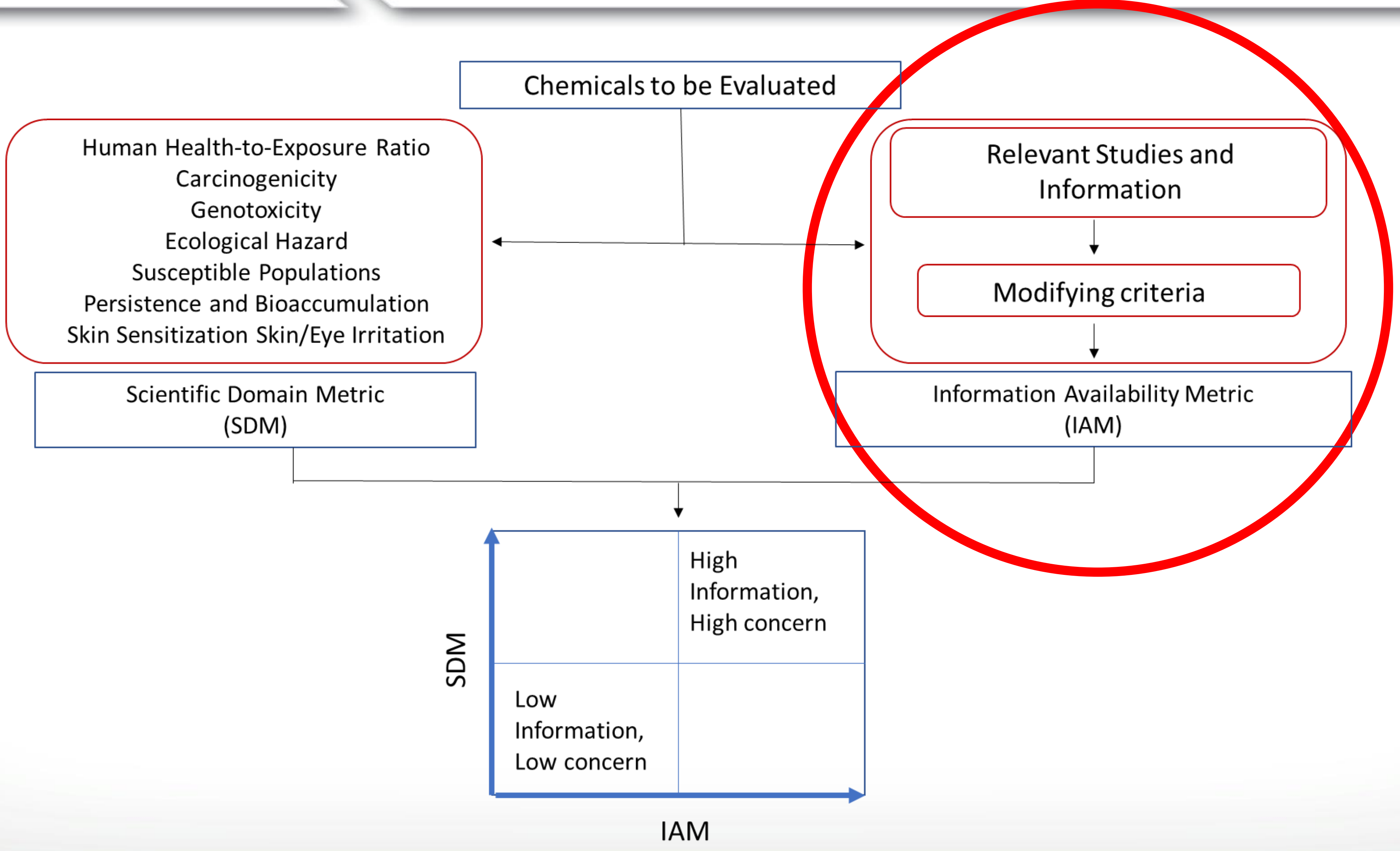
Example Scientific Domain Workflow: Human Hazard-to-Exposure Evaluation

Table 1. Criteria used to calculate the human hazard to exposure ratio domain metric	
Metric	HER, BER, or TER value[1]
0	No available data (hazard or exposure)
1	The lower the Hazard-to-Exposure Ratio, the higher the metric value Use the lowest of HER, BER, TER Mapping from HER/BER/TER to Metric uses bins / cutoffs
2	
3	
4	

Information Gathering (IG) Flags: Note concerning key study types with no in vivo data (repeat dose, reproductive, developmental); secondary source data; predicted data; lack of exposure data

[1] HER, hazard-to-exposure ratio calculated based on in vivo repeat dose toxicity studies divided by the median ExpoCast exposure estimate; BER, bioactivity-to-exposure ratio calculated based on IVIVE bioactivity estimates divided by the median ExpoCast exposure estimate; TER, TTC-to-exposure ratio calculated based on the TTC divided by the median ExpoCast exposure estimate.

Public Information Curation and Synthesis (PICS) Approach



Information Availability Metric

- Included in PICS approach to evaluate the amount of information available for use in any future chemical substance risk evaluation
- Ideally, a chemical going into risk assessment will have existing data in many domains
- Based on the potentially relevant information for exposure, human health and ecological hazard
- Modifying criteria (based on OPPT new chemicals program and consultation with OPPT technical staff) applied to make the metric context-specific
- Incorporates information gathering (IG) flags to highlight data gaps

Information Availability Metric Calculation

Available data categories

1. Mammalian Acute
2. One of (mammalian subchronic, mammalian repeat dose, mammalian chronic)
3. Mammalian reproductive
4. Mammalian developmental
5. Mammalian neurotoxicity
6. Mammalian cancer
7. Mammalian genotoxicity
8. Skin Sensitization or eye corrosivity
9. Exposure
10. Eco aquatic plant acute
11. Eco aquatic invertebrate acute
12. Eco aquatic vertebrate acute
13. Eco aquatic plant repeat dose
14. Eco aquatic invertebrate repeat dose
15. Eco aquatic vertebrate repeat dose

Modifying Criteria

None	Is there a high-quality public risk assessment (cancer or non-cancer)?	Is this a chemical intermediate AND a short environmental half-life (hours)?	Is this a chemical with low water solubility (< 0.1 mg/L)*?	Is this a chemical with MW > 1000 OR an exempt polymer?
Add 1 for categories 1-15 with available data	Add 8 for the assumption that all mammalian data is available (1-8 on list of data categories) plus 1 for categories 9-15 with available data	Add 1 for categories 1-9 with available data	Add 1 for categories 1-8 with available data	Add 1 for categories 8 and 9 with available data
Divide by the denominator (15)	Divide by the denominator (15)	Divide by the denominator (9)	Divide by the denominator (8)	Divide by the denominator (2)

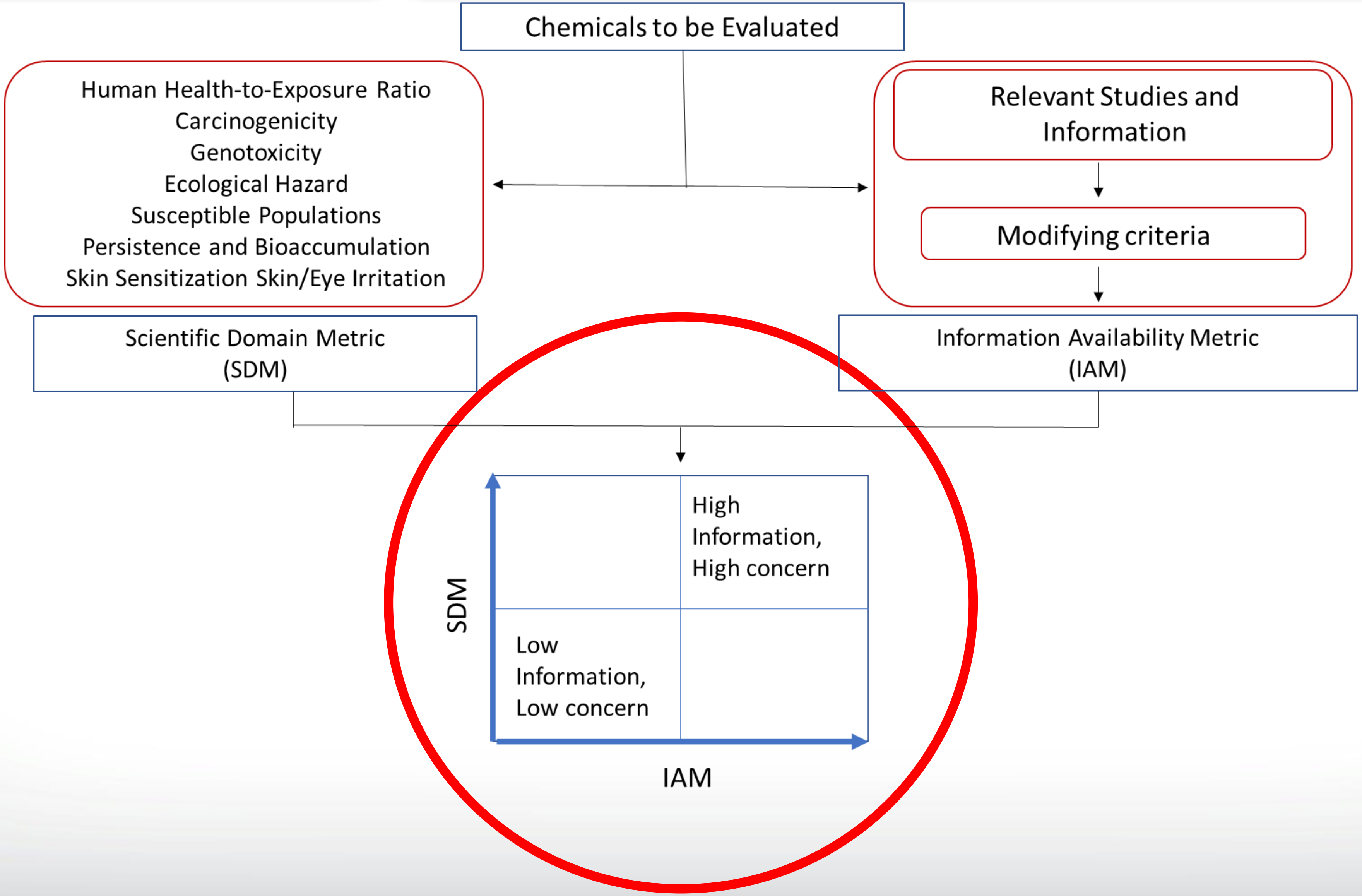
Scale to percent.

IAM

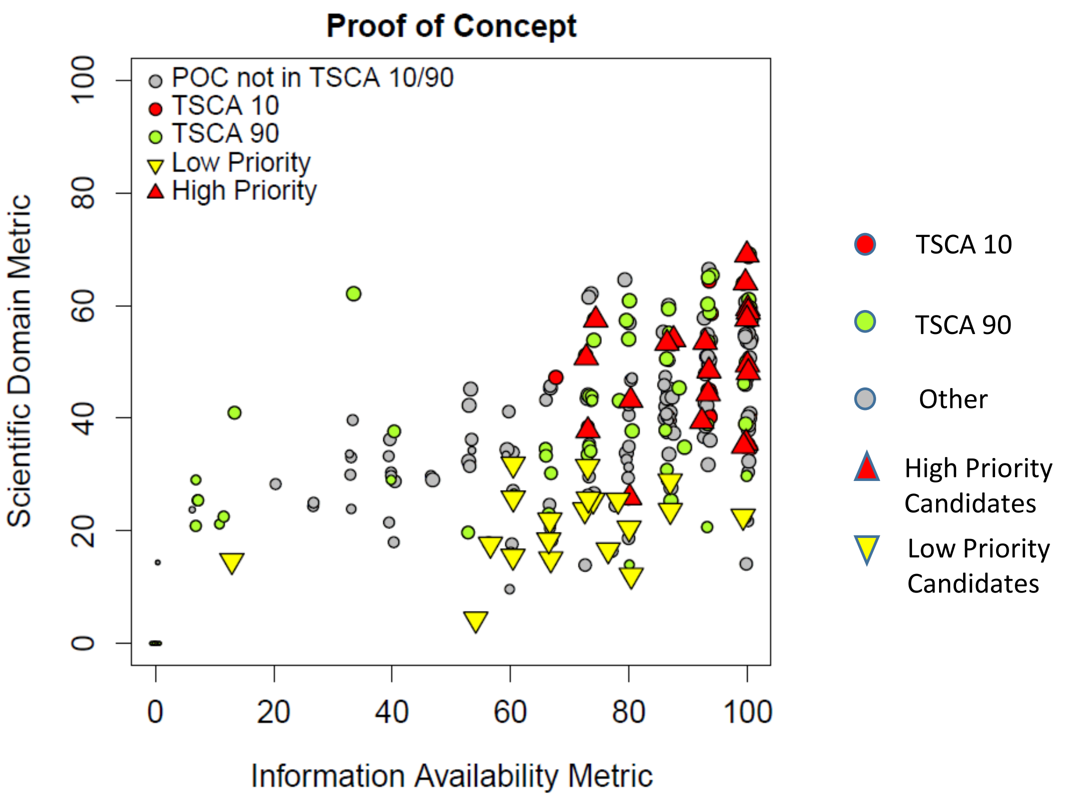
Basis: Chemicals with certain physico-chemical properties are unlikely to pose a risk to certain species classes or through certain exposure routes.

Therefore, data on those species or exposure routes is not relevant to risk assessment

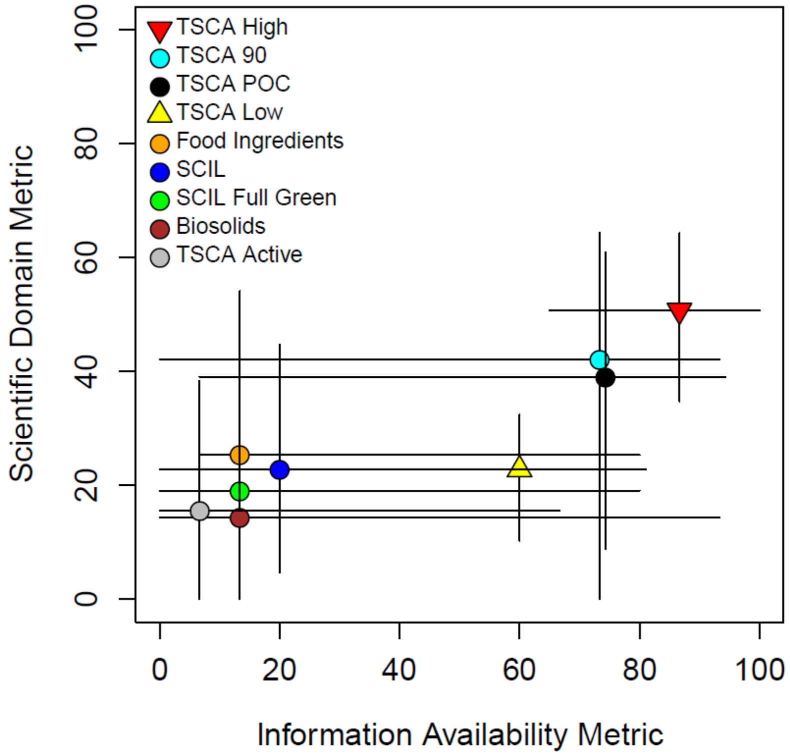
Public Information Curation and Synthesis (PICS) Approach



Proof-of-Concept Results

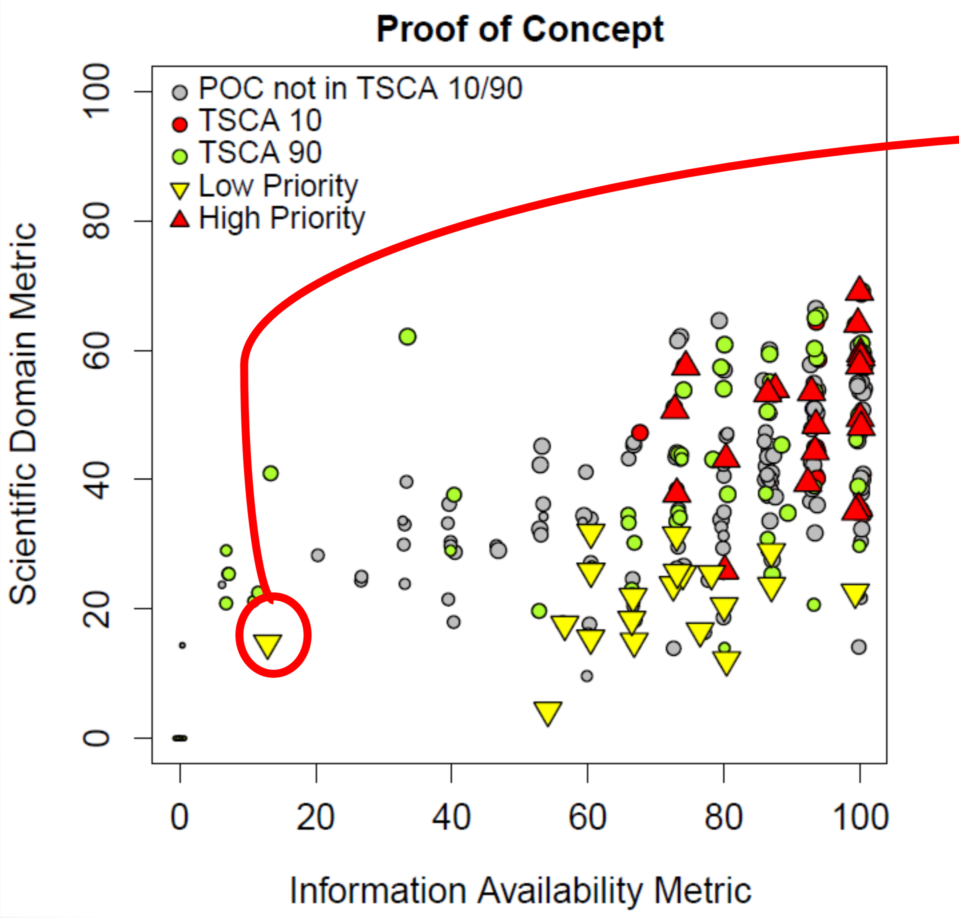


Plot of the information availability vs. scientific domain metrics for the POC238 set of chemical substances. Positions of points are staggered for ease of visualization.



Plot showing distributions of metric scores for selected chemical substance lists. For each list, the point shows the median scientific domain and information availability metrics. The whiskers span 90% of the distributions. Data here is taken from the lists across the TSCA Active Inventory.

Proof-of-Concept Results

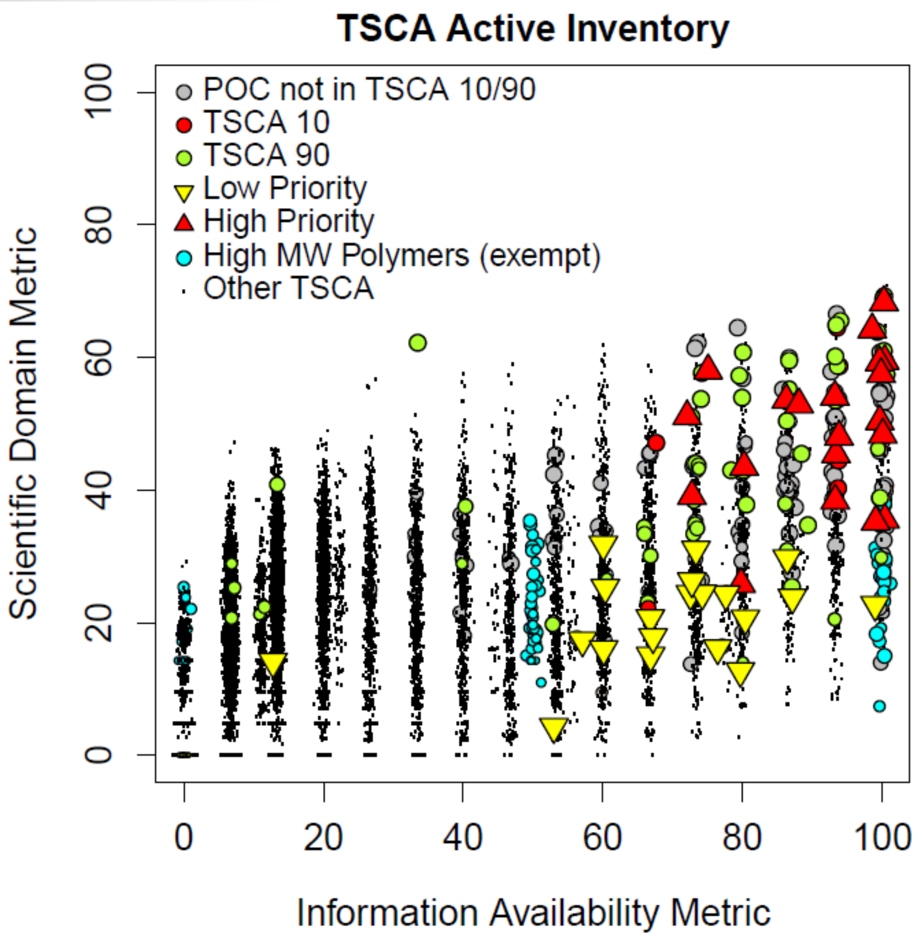


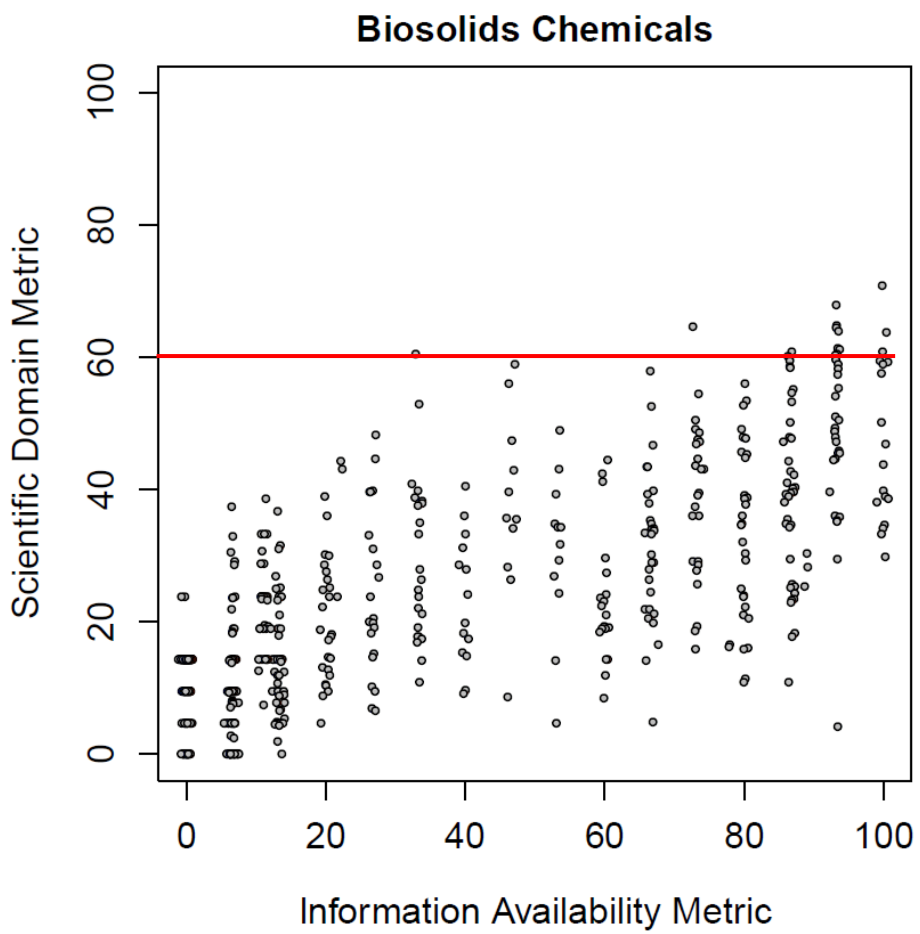
Plot of the information availability vs. scientific domain metrics for the POC238 set of chemical substances. Positions of points are staggered for ease of visualization.

Calcium D-Gluconate

- Scientific domain metric related to lack of human hazard assessment and ecological hazard data in the public domain.
- Similar to other chemicals on the low priority list.
- Read across may have been used for this determination.

Biosolids Results





Trends in biosolids chemicals closely track those for TSCA

Biosolids Details

Name	Public Hazard Assessments
Benzo(a)pyrene	noncancer / cancer
Benzene	noncancer
PFOA	noncancer
2,4-Dichlorophenoxyacetic acid (2,4-D)	noncancer
1,2-Dichloropropane	noncancer / cancer
Trichloroethylene	noncancer
1,1'-Oxybis[2,3,4,5,6-pentabromobenzene]	noncancer / cancer
p,p'-DDT	noncancer / cancer
2,4-Dichlorophenol	noncancer
4-Chloroaniline	noncancer / cancer
Bisphenol A	noncancer
Phenol	noncancer
Benzoic acid	noncancer
N-Nitrosopiperidine	
p-Cresol	
Naphthalene	noncancer / cancer

Chemicals with SDM>60%

Most chemicals with high hazard / risk values have existing public risk assessment

Key Takeaways

- The PICS approach:
  - Increases understanding of the landscape of publicly available information
  - Efficiently identifies high and low priority candidates among large chemical inventories for expert review
  - Provides a transparent and reproducible process for integrating available information and identifying potential information gaps
  - Incorporates results from domain-specific workflows that can be readily updated or adapted to address scientific advances and prioritization needs under other mandates

POC Team

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- Amar Singh
- Andrew Greenhalgh
- Anita Pascocello
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- Ashley Jackson
- Carlie LaLone
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- Michael Gonzalez
- Nagu Keshava
- Richard Judson
- Sarah Warren
- Todd Martin
- Tony Williams
- Urmila Kodavanti
- Yu-Sheng Lin

HECD OVERVIEW ON PFOA/PFOS AQUATIC LIFE AND AQUATIC–DEPENDENT WILDLIFE CRITERIA/BENCHMARK DEVELOPMENT FOR BIOSOLIDS NATIONAL MEETING

AMANDA JARVIS
JIM JUSTICE
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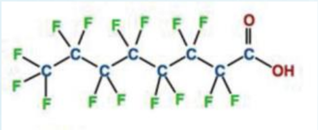
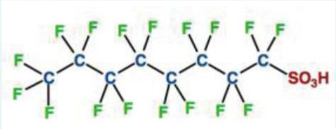
NOV. 2, 2021

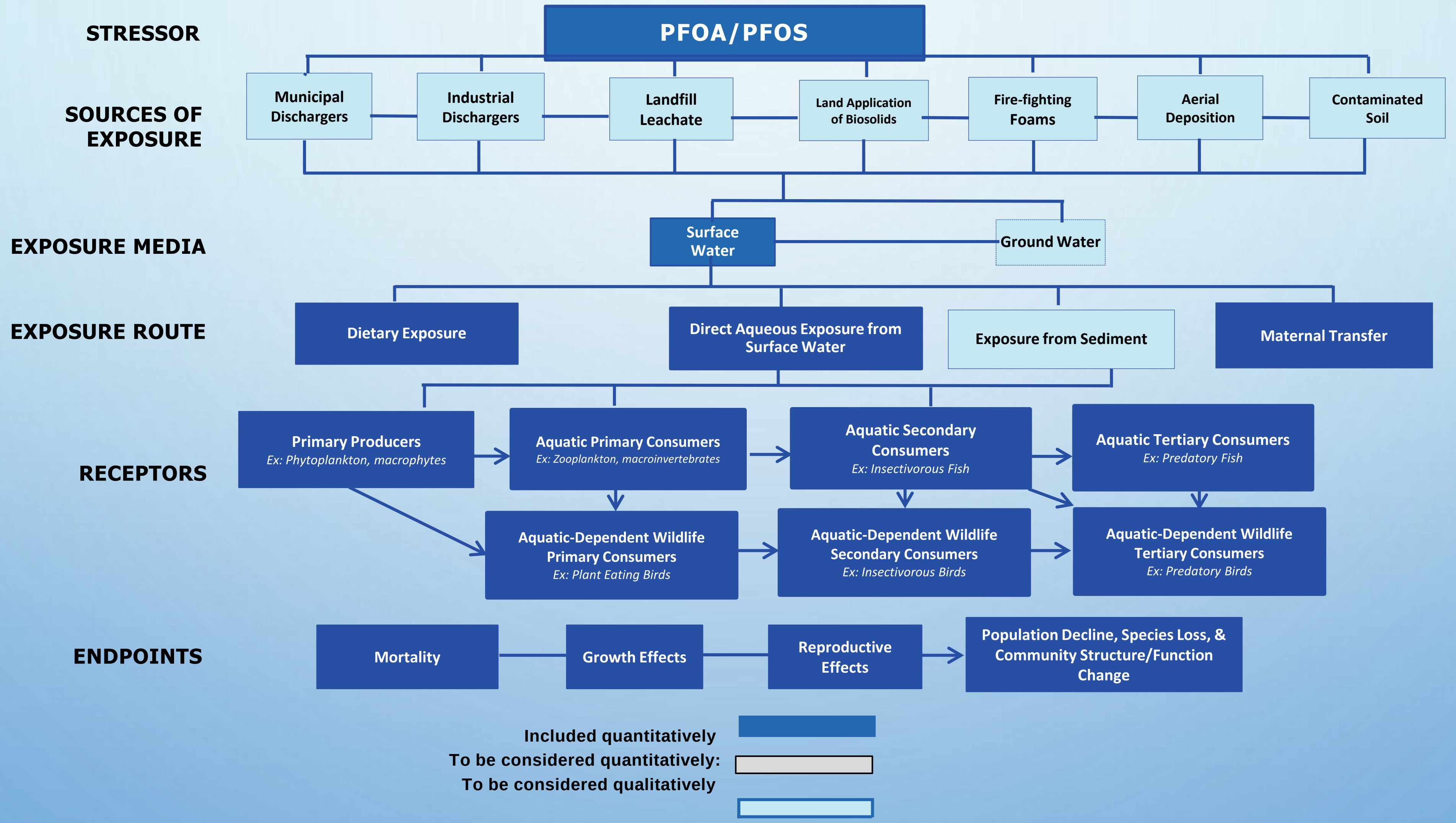
PFOA & PFOS BACKGROUND





- Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) belong to the per- and polyfluoroalkyl substances (PFAS) group of chemicals
- For decades PFOA and PFOS were incorporated into consumer and industrial products because of their unique chemical and physical properties, including thermal stability, water and oil repellency, and surfactant properties
- Sources of PFOA and PFOS include: Municipal and industrial dischargers, fire-fighting foams, landfill leachate, land application of biosolids, contaminated sediments, and aerial deposition
- PFOA and PFOS are present in some aquatic environments
- Long chain PFASs, such as PFOS, may bioaccumulate through the aquatic food web (**Figure 1**)
- Both PFOA and PFOS were subject to voluntary phase out in the early 2000s, but still occur in the aquatic environment

Figure 1. Draft conceptual model diagram of sources, partitioning, bioaccumulation, and effects of PFOA and PFOS in the aquatic environment



PFOA & PFOS ECOTOXICITY LITERATURE REVIEW

- Toxicity literature were obtained from EPA's Office of Research and Development's publicly-available ECOTOX database
- The anionic, acid, and salt forms were included for both PFOA and PFOS (**Table 1**)

Table 1. Forms of PFOA and PFOS (along with CAS Numbers) Included in PFOA and PFOS Ecotoxicity Literature Search

PFAS:	Chemical Form Name:	CAS Number:
PFOA	Perfluorooctanoic acid	335-67-1
	Perfluorooctanoate	45285-51-6
	Ammonium perfluorooctanoate	3825-26-1
PFOS	Perfluorooctane sulfonate potassium salt	2795-39-3
	Perfluorooctane sulfonate	45298-90-6
	Perfluorooctane sulfonic acid	1763-23-1
	Sodium perfluoro-1-octanesulfonate	4021-47-0
	Lithium perfluorooctane sulfonate	29457-72-5
	Perfluoro-1-octanesulfonic acid tetraethyl ammonium salt	56773-42-3

MDRS FOR DEVELOPMENT OF FRESHWATER CRITERIA

SALMONID

SECOND FISH FAMILY

CHORDATA

PLANKTONIC CRUSTACEAN

BENTHIC CRUSTACEAN

INSECT

ROTIFERA, ANNELIDA, MOLLUSCA

OTHER INSECT OR MOLLUSC

PFOA & PFOS ECOTOXICITY LITERATURE REVIEW

- Toxicity literature through the Sept. 2019 ECOTOX update were reviewed and incorporated into the PFOA and PFOS drafts

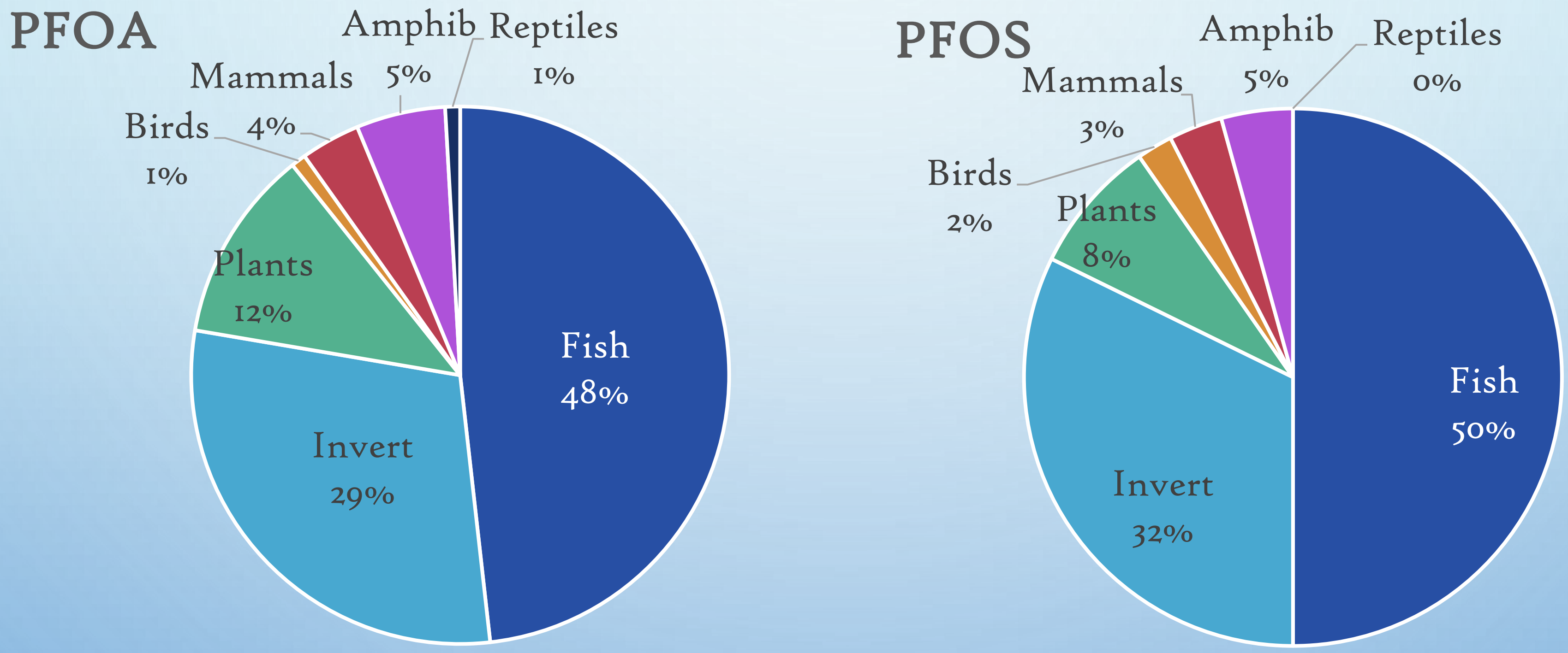


Figure 2. Taxa represented in toxicity literature search aquatic life and aquatic-dependent wildlife.

- Additional literature in ECOTOX through the June 2021 update are under review for incorporation in the drafts
  - Currently there are 216 PFOA studies and 356 PFOS studies in ECOTOX

PFOA & PFOS ECOTOXICITY LITERATURE REVIEW

- The literature review was further narrowed to apical effects on growth, mortality, and reproduction for aquatic life and aquatic-dependent wildlife to support potential, future criteria derivation
  - Focusing on these types of effects, there were:
    - 129 studies for PFOA
    - 237 studies for PFOS

PFOA & PFOS ECOTOXICITY LITERATURE REVIEW

- Of the PFOA and PFOS studies focused on apical effects:
  - All have undergone primary data quality review
  - Secondary data quality review is underway
- Curve fits are being conducted for all studies meeting EPA's test guidelines to determine toxicity values (e.g., LCs and ECs) to be used to derive the aquatic life criteria
- From the PFOA and PFOS toxicity data it was determined that sufficient data are available to derive PFOA and PFOS criteria for freshwaters

CRITERIA PROCESS OVERVIEW

- All EPA Aquatic Life Criteria for toxics undergo rigorous scientific development and review
  - Develop draft criteria document
  - Independent external peer review
  - Release to the public in draft form to obtain scientific views
  - Publication of final criteria document
- States and recognized tribes may then consider these recommended criteria in the development and legal adoption of state water quality standards

ONGOING WORK ON PFOA & PFOS

- Toxicity literature is constantly evolving
  - EPA will review and include new data as it becomes available
  - Includes reviewing newly published and identified toxicity literature through the quarterly PFAS updates in EPA's ECOTOX database
- EPA is compiling paired tissue and water data that can be used to calculate nationally representative BAFs for aquatic life and aquatic-dependent wildlife
  - EPA is coordinating with ORD scientists to make sure we consider the most recent literature with respect to PFOA and PFOS bioaccumulation in aquatic ecosystems

U.S. Environmental Protection Agency
Biosolids Program

Screening and Probabilistic Risk Assessment of Chemicals in Biosolids

David Tobias, Lead Risk Assessor

Office of Water, Office of Science and Technology (OST)

Health and Ecological Criteria Division

tobias.david@epa.gov

Background

Section 405(d) of the Clean Water Act (CWA) requires EPA to:

Establish numeric limits and management practices that protect public health and the environment from the reasonably anticipated adverse effects of chemical and microbial pollutants during the use or disposal of sewage sludge.

Review biosolids (sewage sludge) regulations every two years to identify additional toxic pollutants that occur in biosolids (i.e., biennial reviews) and set regulations for those pollutants if sufficient scientific evidence shows they may harm human health or the environment.

Chemicals in biosolids

CompTox Chemicals Dashboard

comptox.epa.gov/dashboard/chemical_lists/BIOSOLIDS

EPA United States Environmental Protection Agency | Home | Advanced Search | Batch Search | Lists | Predictions | Downloads | Share | Search all data

LIST: Chemicals in biosolids

Search BIOSOLIDS Chemicals

Identifier substring search

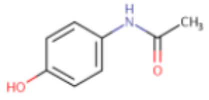
List Details

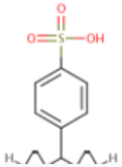
Description: Biosolids are produced from wastewater treatment processes and can be beneficially used. The Clean Water Act (CWA) Section 405(d)(2)(C) requires the EPA to review federal biosolids standards every two years to identify additional toxic pollutants that occur in biosolids and set regulations for those pollutants if sufficient scientific evidence shows they may harm human health or the environment. The biennial review process is intended to fulfil the CWA requirement to identify additional pollutants that occur in biosolids. This list of chemicals is assembled from multiple biennial review documents containing peer-reviewed literature and the results of three national sewage sludge surveys. Regulatory limits for pollutants in biosolids are defined in 40 CFR Section 503.13, which contains numerical limits, for nine metals (i.e., arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc). To view all the microbial pollutants found in biosolids see Table A-2. Microbial Pollutants Identified in Biosolids in the 2016-2017 Biennial Review.

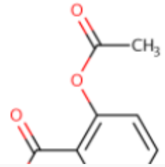
Number of Chemicals: 395

395 chemicals

Select all | Download | Send to Batch Search | Default | DTXSID | CASRN | TOXCAST | Hide chemicals that are: | Filter by Name or CASRN







Outline

- Introduction to risk
  - Deterministic risk assessments
  - Probabilistic risk assessments
- Conceptual model
  - Exposure pathways
  - Receptors
- Framework for assessing chemicals in biosolids

Introduction to Risk

- Risk is the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor
  - Chemical risk assessments use scientific information to determine the exposure and hazard from chemical stressors

- Exposure assessment describes the amount of a chemical a receptor encounters due to the chemical's presence in environmental media

- Hazard (toxicity) is a measure of the dose of a chemical stressor that results in an adverse health outcome
  - Degree of hazard may depend on exposure pathway – dermal, inhalation, ingestion

- Chemical risk assessment commonly involves two parts
  - Human health
  - Ecological
    - Aquatic and terrestrial

Land application of biosolids

- Chemicals in biosolids are released to the environment when biosolids are disposed of via land application and surface disposal
  - Incineration and landfill disposal are not part of the current biosolids risk tool

Land application of biosolids

- These chemicals are then transported through water, soil, sediment and air and cause environmental exposures to organisms
  - Exposures across pathways will be aggregated (summed) to calculate the exposure due to the transport of the chemicals in the environment
    - E.g., Ingestion of drinking water and contaminated food will be assessed
- Each of these chemicals have different levels of toxicity which will be considered for ecological and human health risks based on the aggregate exposure

Risk assessment framework

- Review publicly available information on occurrence, fate and transport in the environment, human health and ecological effects, and other relevant information for pollutants found in biosolids
- Deterministic risk assessment across chemicals detected in biosolids
  - Order of chemicals to be screened will be determined by the PICS process
- Refined probabilistic assessment for pathways and receptors of concern for those chemicals where risk was found in the deterministic assessment

Deterministic screening level assessment

- Exposure calculations are done using a single value for all necessary parameters (e.g., concentration of chemical in biosolids)
- Many parameters are set to high end values within their range, this provides a protective (i.e., conservative) estimate of exposure
- All pathways and receptors are assessed for risk if there is a toxicity value available for assessment
- If any of the calculations for ecological or human receptors show risks of concern, then the assessment moves to the next stage

Probabilistic risk assessment

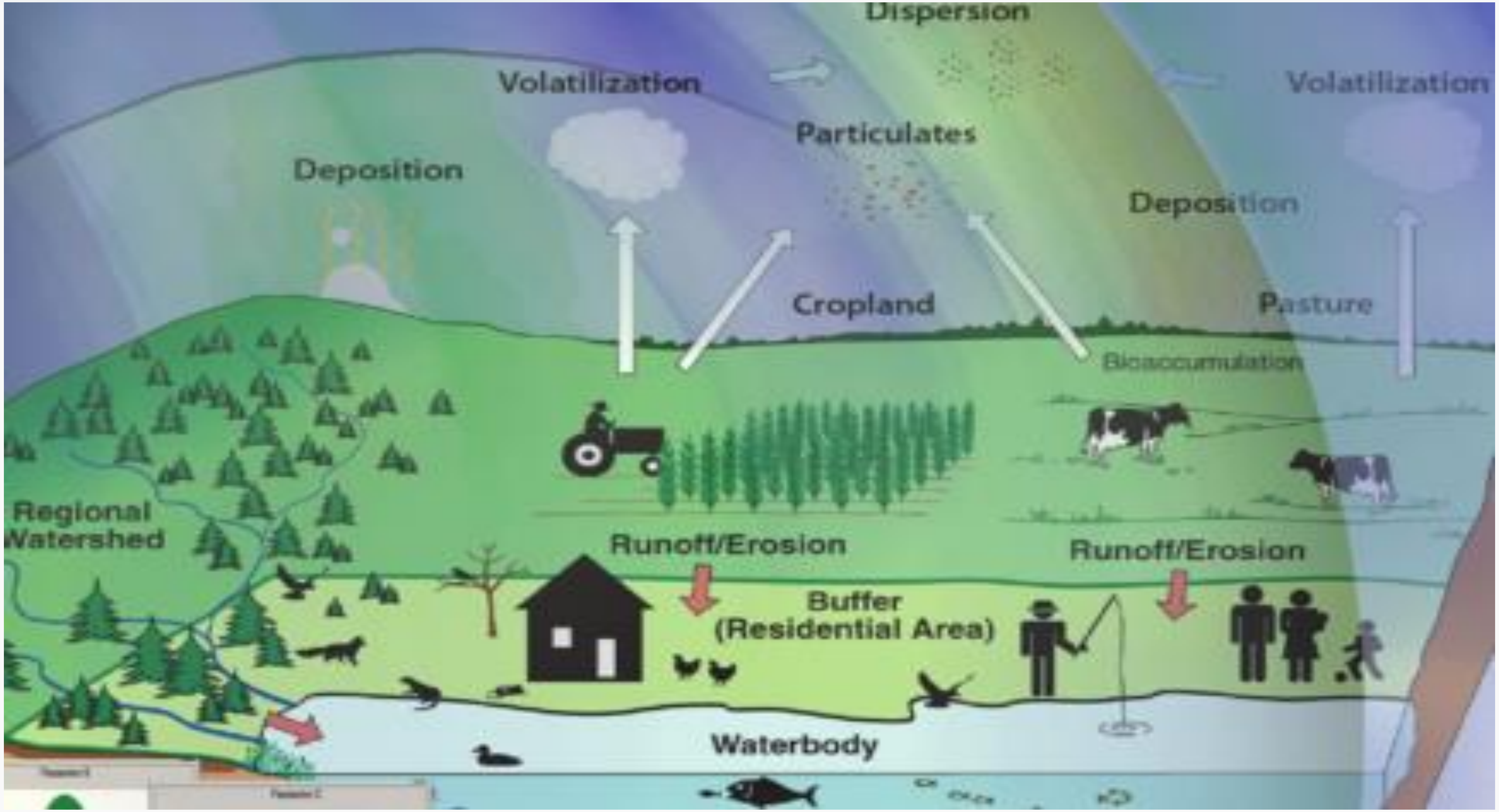
- Risk calculations are done using a range of values for the relevant parameters
- Monte Carlo assessment uses random numbers to select values within distributions for the model inputs
  - For the deterministic assessment, the concentration of the chemical in biosolids will be the 95th percentile value from the sewage sludge survey
  - For the probabilistic assessment, the entire distribution of concentrations will be used
- Pathways and receptors that were of the most concern from the deterministic assessment are refined and further refinement of chemical properties will be done if necessary

Conceptual Model

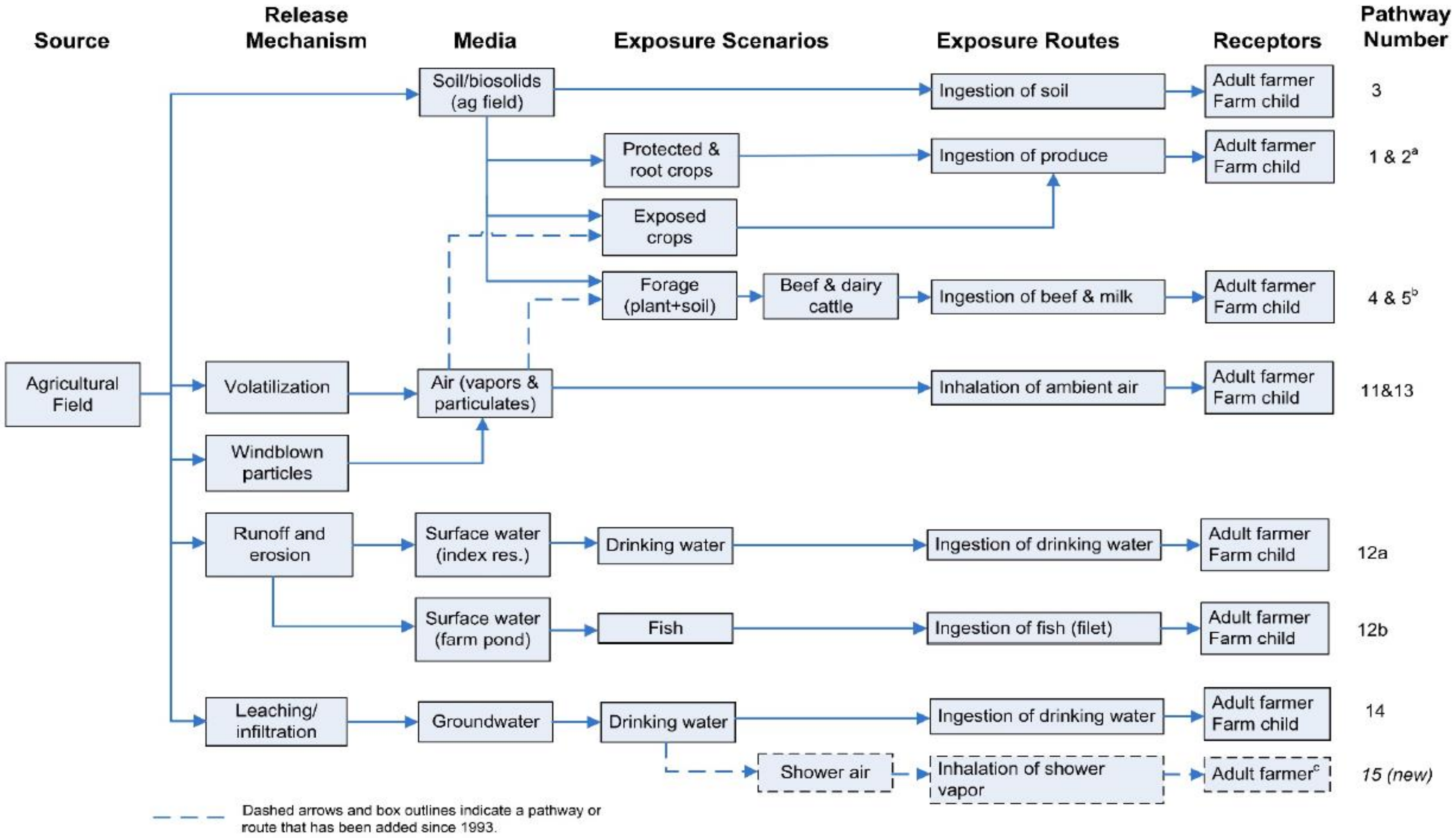
Land application of biosolids

- OST developed screening and probabilistic models to evaluate inhalation and ingestion pathways that represent high end exposures due to land application of biosolids and land disposal of biosolids
- The conceptual model is based on subsistence farmers that apply biosolids to their fields
  - Farmer’s family eats crops and fish from farm
  - Family is exposed to chemicals that enter the air (volatilize) from the biosolids
  - Run off and leachate will lead to ground and surface water concentrations and exposure from the family’s water supply
  - Aquatic organisms will be exposure via run-off into waterbodies
  - Terrestrial organisms will be exposed from their diet

Conceptual Model



Human Exposure Pathways



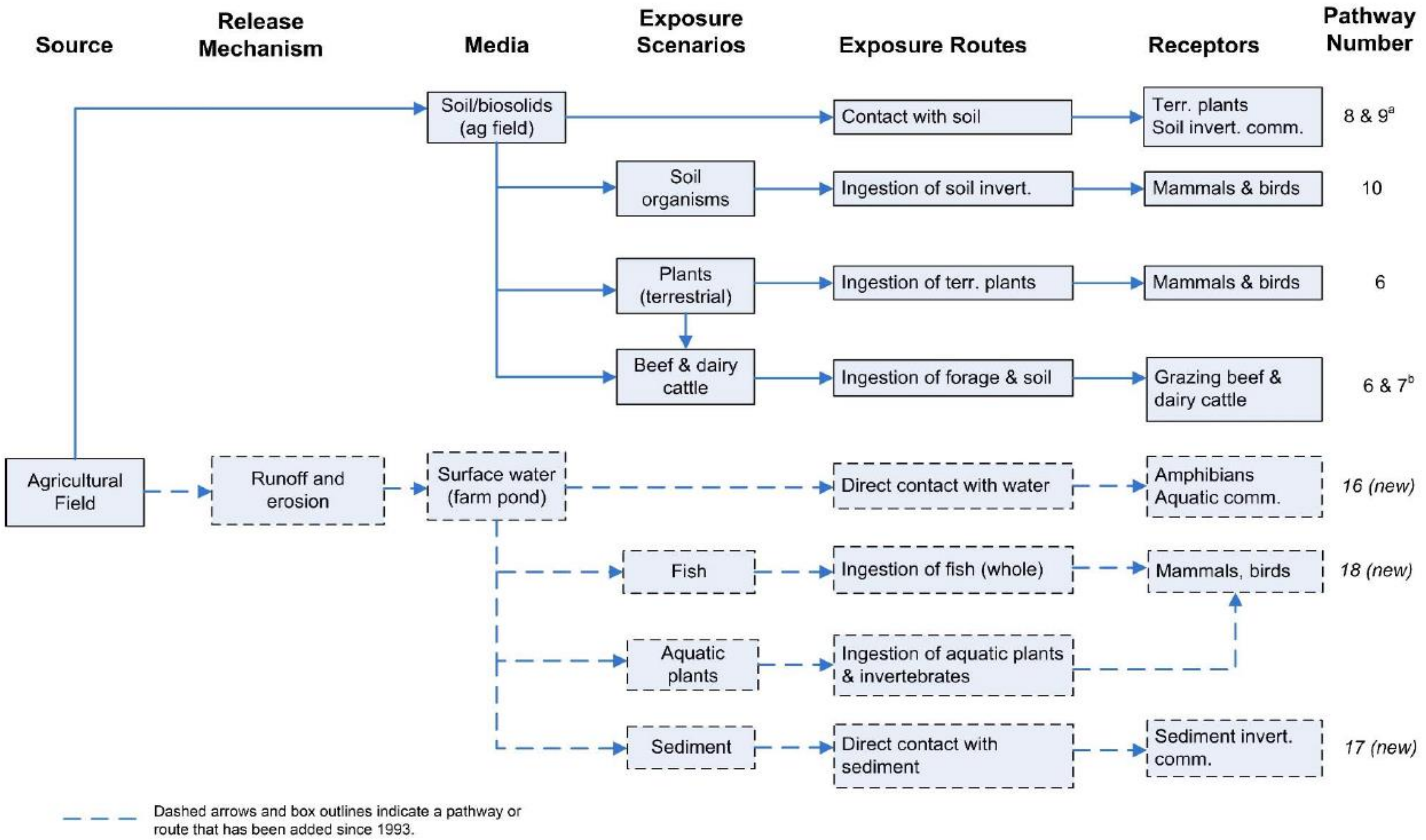
[a] Originally, Pathways 1 and 2 differed only in that they were modeled for two different scenarios (1, general population and 2, home gardener). In the Biosolids Screening Tool, this pathway is modeled for only one scenario, a farm family (adult farmer and farm child).

[b] Originally, Pathways 4 (cattle eat contaminated plants) and 5 (cattle eat contaminated soil) were modeled separately. In the Biosolids Screening Tool, these pathways are combined to reflect that when cattle eat forage, they ingest soil as well. The overall cattle diet is assumed to be 95% forage and 5% soil.

[c] The farm child is omitted because inhalation risks for children are always equal to or lower than those for adults, and young children are less likely to shower.

Figure A-1. Conceptual model for human exposures.

Ecological Exposure Pathways



[a] Pathway 8 is terrestrial plants, and Pathway 9 is soil organisms.
[b] Originally, Pathways 4 (cattle eat contaminated plants) and 5 (cattle eat contaminated soil) were modeled separately. In the Biosolids Screening Tool, these pathways are combined to reflect that when cattle eat forage, they ingest soil as well. The overall cattle diet is assumed to be 95% forage and 5% soil.

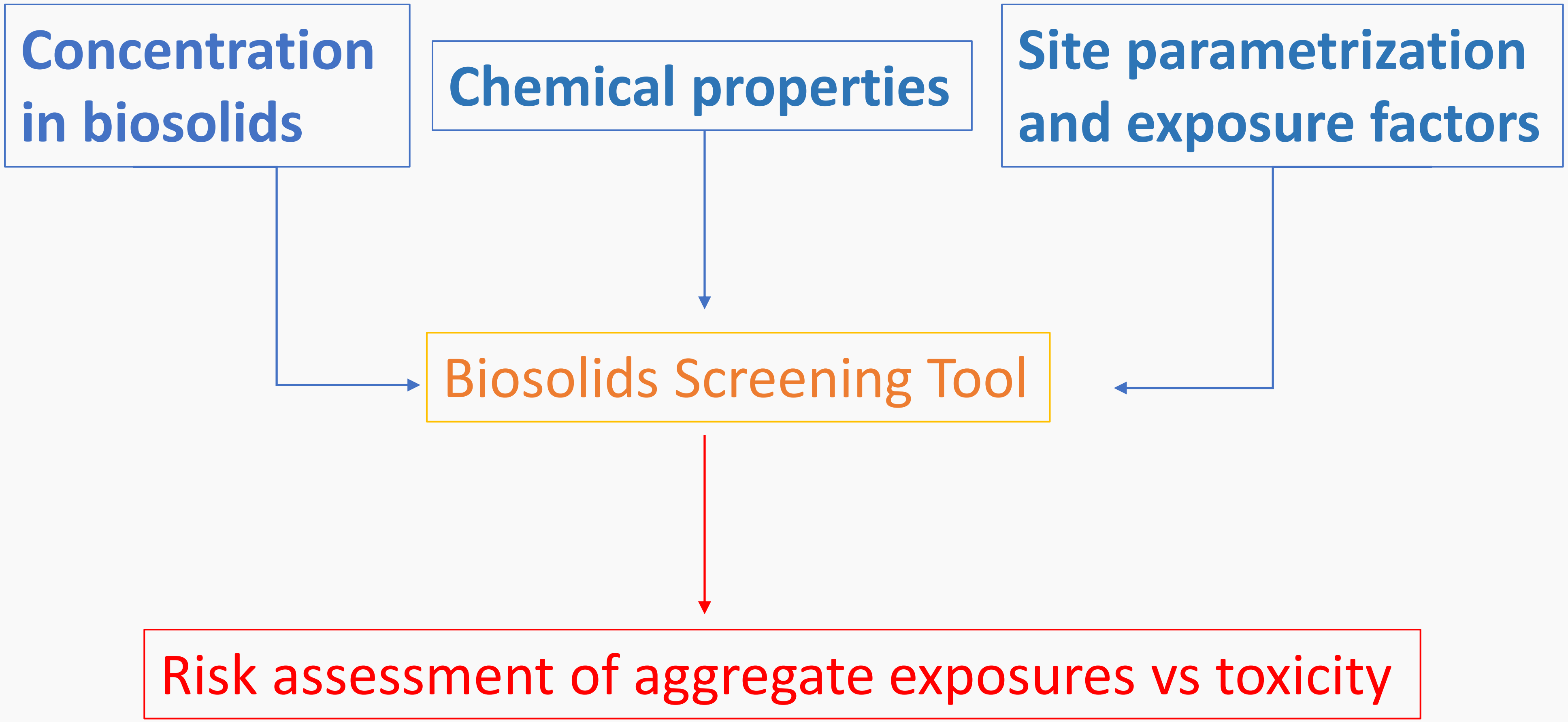
Figure A-2. Conceptual model for ecological exposures.
Includes beef and dairy cattle exposures through forage and soil ingestion while grazing on a pasture or reclamation site.

Representation of exposed communities

Land application of biosolids

- OST developed a screening tool to evaluate inhalation and ingestion pathways that represent high end exposures due to land application of biosolids
- The selected conceptual model and exposure pathways are designed to provide high end estimates for populations exposure to chemicals in biosolids
- Human health risk
  - Includes exposures to children and adults
  - Inhalation – the screening tool will evaluate high end exposures given that the farm family lives adjacent to the site of biosolids application and inhales the chemicals that volatilize from the field and while they shower with local groundwater
  - Ingestion – the model will sum over the potential exposure pathways including water (ground and surface), crops, meat, milk and fish
- Ecological
  - Aquatic assessment includes impacts from run off to a pond adjacent to the field
  - Terrestrial assessment includes impacts to organisms that eat plants and lower trophic level species
    - Birds consume fish that have bioaccumulated the chemical in the pond

Chemical risk assessment



Model inputs

Concentration in biosolids

- Over 500 chemicals found in biosolids
  - Sources for chemicals in biosolids
    - Chemicals first detected in national sewage sludge surveys
    - Chemicals first identified in the literature during biennial reviews. The concentration data for some chemicals only identified in the literature may not be sufficient for risk assessment.
- Tess Richman, Elyssa Arnold & Antony Williams will be finishing a paper shortly curating EPA’s list of chemicals found in biosolids

Model inputs

Chemical properties

- The model requires chemical properties including
  - Toxicological values for receptors of concern
  - Partitioning parameters
  - Bioaccumulation or bioconcentrations factors
- OST is developing a data hierarchy to review and select parameters by utilizing values from EPA and international assessments for screening assessments

Model inputs

Site parametrization and exposure factors

Model/Tool Component	Current Version of Biosolids Screening Tool
Conceptual site layouts	Family Farm Scenario: biosolids are applied at an agronomic rate to a tilled field used to grow crops and to an untilled field used to pasture beef and dairy cattle raised to produce beef and milk
	Surface Disposal Scenario: biosolids are placed in a lagoon simulated with three liner options: no liner, clay liner, or composite liner
	Reclamation Scenario: biosolids are applied at a higher rate suitable to a mining reclamation site, exposures are estimated for land use as a pasture for beef and dairy cattle

Model inputs

Site parametrization and exposure factors

Concentration	Deterministic model - 95th percentile TNSSS (2009) as reported in US EPA, 2021
Site-specific parameters (i.e., soil and watershed characteristics)	STATSGO median or nationally representative values. Some values were adjusted to correspond to meteorlogic or hydrologic location (noted below)
Meteorological data	Three locations: dry (Boulder, CO), moderate (Chicago, IL) and wet (Charleston, SC). Selected from analysis of TNSSS sample locations. Based on Fry et al (2016)
Ground water screening	Dilution Attenuation Factor (DAF) set to 1 based on EPACMTP analysis of site-specifc and national simulations for range of logKoc values
Air Model	AERMOD
Shower Model	Average air concentration of volatile contaminants in shower air during a shower and bathroom air immediately after a shower are estimated using a set of differential equations presented in McKone (1987) and Little (1992a,b)

Model inputs

Factors Specific to Family Farm & Reclamation - Agricultural Application Scenario

Land application model	EPA 3MRA-Land Application Unit (LAU)
Field size	Approximately 32,000 m^2 (80 acres) based on USDA, 2012 Census (USDA, 2014)
Application rates/freq. - Farm	10 MT dw/ha-application per year for 40 years
Application rates/freq. - Reclamation	A single 40 MT dw/ha-application
Surface water model	EPA's Variable Volume Water Model (VVWM), US EPA, 2020
Water body - drinking water	52,555 m^2 consistent with VVWM standard parameters, US EPA 2020
Water body - source of fish	10,000 m^2 consistent with VVWM standard parameters, US EPA 2020
Food Chain Algorithms	Based on US EPA 1998 updated in US EPA HHRAP 2005

Model inputs

Site parametrization and exposure factors – Specific to surface disposal scenario

Surface disposal model	EPA 3MRA Surface Impoundment
Unit size	Median value 6,013 m^2 (US EPA, 2001 - median)
Human Receptors	Nearby resident: Adult and Child
Human exposure pathways and routes	Inhalation of ambient air and shower air and ingestion of groundwater

Summary

- OST will assess the potential risk for chemicals detected in biosolids
  - Risk is calculated for human and ecological receptors
  - Exposures are aggregated (summed) across transport pathways for contaminants after the biosolids are land applied
  - Prioritization is based on the PICS process
- 1st step of risk assessment - Deterministic risk assessment based on
  - Conceptual model for land applied biosolids
    - Includes multiple exposure pathways for human and ecological exposure assessment
  - Exposure estimates are based on
    - Concentration values
    - Chemical properties
    - Site parametrization and exposure factors
- 2nd step of risk assessment – Probabilistic risk assessment that
  - Focuses on pathways and receptors of concern after deterministic assessment
  - Refines assessment to reflect distribution of model inputs

Thank You!

Biosolids Team

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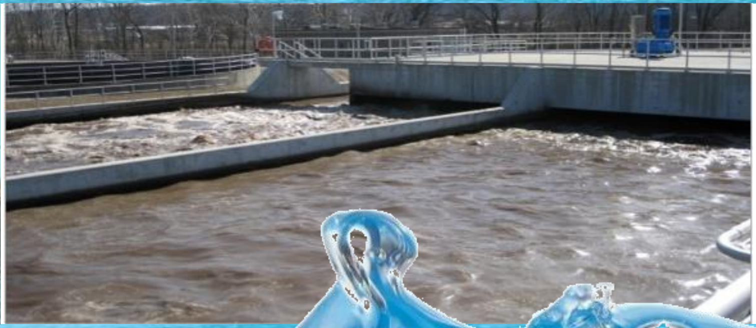
RTI contractors

Donna Womack and Ted Lillys

EPA-OST Virtual
Biosolids Workshop
November 4, 2021

EPA
Office of Research and Development

Safe and Sustainable Water Resources Research Program


EPA-ORD Biosolids Research Overview

Christopher A. Impellitteri, EPA-ORD

Biosolids Research Projects

Pathogen and Vector Attraction Reduction	**Update completed to the *"Environmental Regulations and Technology: Control of Pathogens and Vector Attraction in Sewage Sludge"* report (EPA/625/R-92/013)** • **Under internal review**
ARBs and ARGs	**Evaluate types and prevalence of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs) in biosolids to inform management strategies.**
Emerging Contaminants (CECs)	**Application of non-targeted analysis to municipal wastewater and residuals and method development and evaluation of CECs in wastewater and biosolids.**

Biosolids Research Projects

PFAS Analytical Methods	**Development and validation of a PFAS isotope dilution method for biosolids** • Draft Method 1633 (https://www.epa.gov/system/files/documents/2021-09/method_1633_draft_aug-2021.pdf) • Multi-laboratory validation ongoing • Application of non-targeted analyses
PFAS Prevalence and Pretreatment	**Research on the occurrence, fate, and transport of PFAS in WWTPs and biosolids. Identify sources and evaluate pretreatment strategies** • Pretreatment of high-strength WW: Supercritical water and electrochemical oxidation-https://www.epa.gov/chemical-research/pfas-innovative-treatment-team-pitt
Treatment Strategies	**Incineration and pyrolysis** • R7 WWTP-Sampling in August 2021. Targeted and non-targeted analyses (PICs). Data under review • San Francisco field study with BioForceTech-Analysis of biosolids (input) and biochar (output). Manuscript accepted (J. Air & Waste Mgmt.) • Co-incineration of spent DW IX media with lime sludge for F capture by Ca

Biosolids Research Projects

Risk Assessments

Provide OW-OST with information to support the development of chemical risk assessments.

- Computational toxicology
- Evaluate chemicals in biosolids for risk assessment prioritization

Contaminants and Land Application

Characterize contaminants in land applied biosolids and soils.

- Field Study 2: Application of solid and liquid biosolids and evaluation of contaminant attenuation
  - Increase (4X-33X)in stable PFAS species after 1 year.
- Field Study 3: Long-term (20 years) land application. Contaminant transport and plant uptake.
- Modeling subsurface transport. Valmont Superfund Site.
  - PFAS analyses in soil and GW
  - Adapt current modeling approaches to more accurately describe fate/transport for application to land application sites
  - Manuscript accepted by GW Monitoring and Remediation on modeling limitations

Biosolids-Related Research Grants

- **Awarded Grants:** Practical Methods to Analyze and Treat Emerging Contaminants (PFAS) in Solid Waste, Landfills, Wastewater/Leachates, Soils, and Groundwater to Protect Human Health and the Environment

- **Awarded National Priorities Grants:** Research on PFAS Impacts in Rural Communities and Agricultural Operations

- Evaluation of Pollutants in Biosolids

Research Gaps

- Based on future occurrence evaluations, assess the fate and transport of emerging contaminants (including PFAS) in land-applied biosolids.
- Examine the destruction of emerging contaminants in alternative biosolids management processes (e.g., thermal treatment).
- Develop frameworks for emerging contaminant risk management in agriculture (e.g., reducing plant uptake).
- Characterize biochar derived from the pyrolysis of biosolids and develop frameworks for beneficial use.
- Compare/contrast pyrolysis and alternative technologies (e.g., E-Beam) with existing management strategies using lifecycle assessment approaches.
- Assess microbial contamination of surface and groundwater after land application of biosolids.

Contact

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The views expressed in this presentation are those of the individual author and do not necessarily reflect the views and policies of the US EPA.

What's new with Water Research

Lola Olabode & Ashwin Dhanasekar

Research Program Managers | **Biosolids**

advancing the science of water®

ABOUT

MISSION

Advancing the science of water to improve the quality of life

VISION

To create the definitive research organization to advance the science of all things water to better meet the evolving needs of subscribers and the water sector

VALUES

Integrity • Leadership • Respect
Innovation • Collaboration

One Water

WRFs research benefits all areas of the water sector, as well as agriculture, energy, watershed management, and other commercial industries.

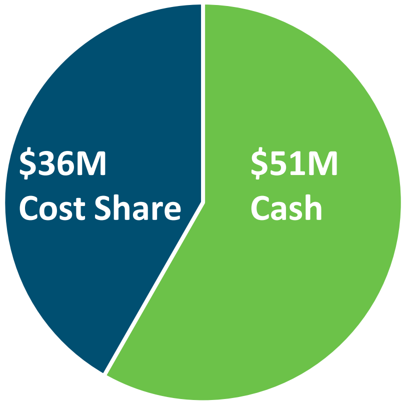
The Water Research Foundation – At a Glance

Funded Research

$87M

Contractually Funded Research

Managed by 53 Staff



Research Portfolio

1 Federal Contracts

8 Federal/State Grants

120 Co-funded Projects

333 Co-funders

287 Active Projects

Subscribers

1044 UTILITIES

90 CONSULTANTS

39 MANUFACTURERS

Research Programs

- Research Priority
- Tailored Collaboration
- Emerging Opportunities
- Unsolicited Research
- Grants/Awards
- Facilitated Research
- Paul L. Busch Award

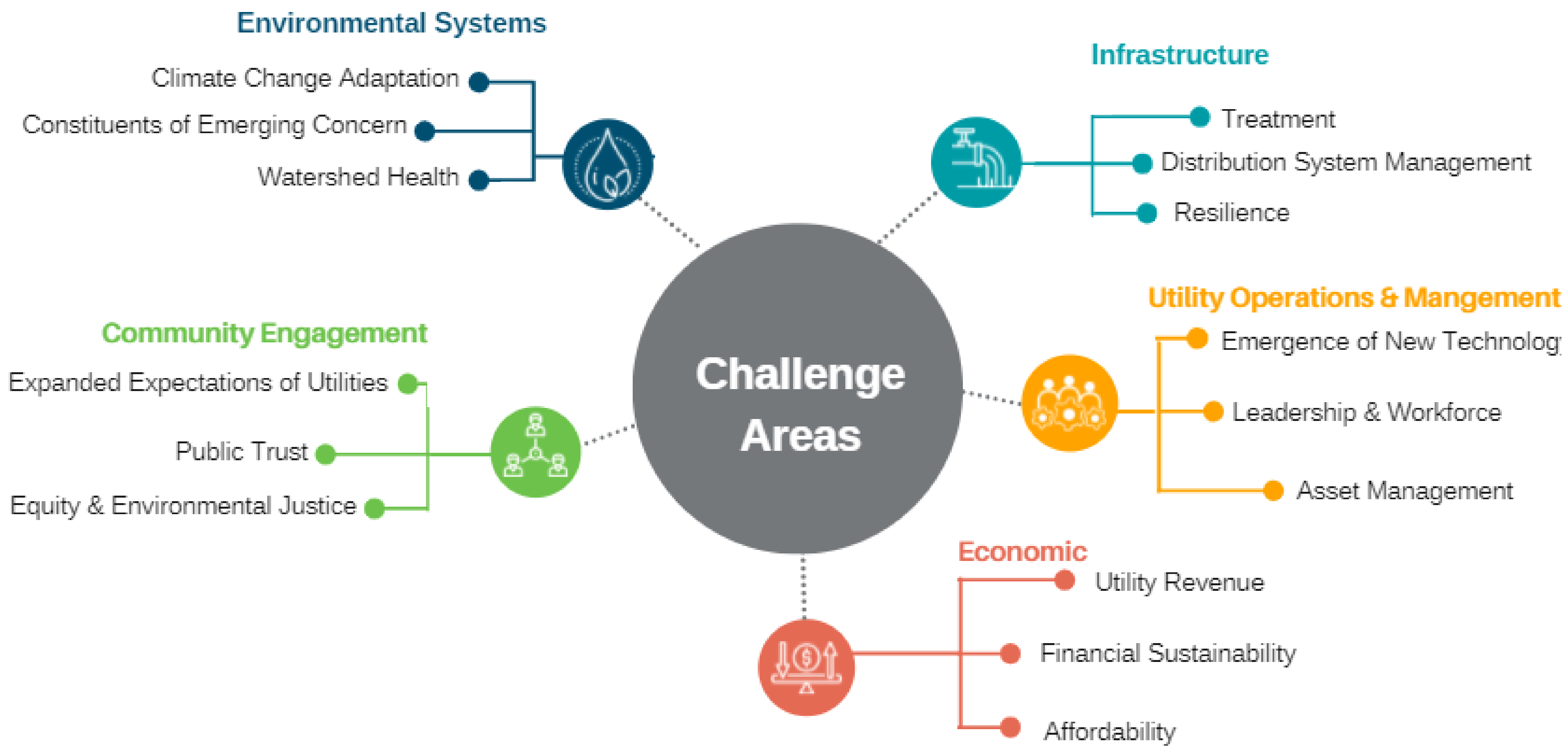
230 Average Contracts/Year

19 Ave. Contracts in Process/Month

100 Payments/Month

15* Reimbursements Per Month

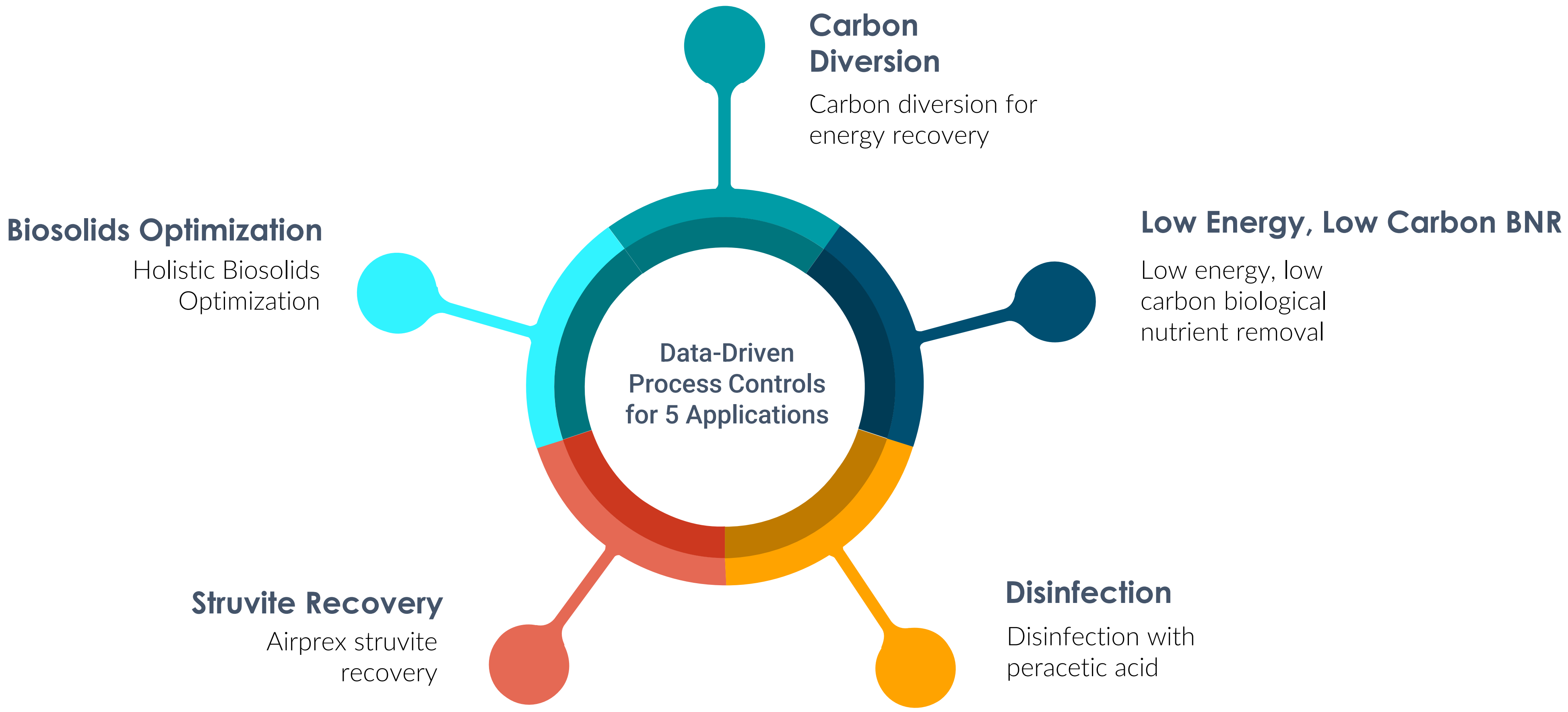
*not typical



Environmental Systems
Climate Change Adaptation
Constituents of Emerging Concern
Watershed Health
Infrastructure
Treatment
Distribution System Management
Resilience
Challenge Areas
Utility Operations & Mangement
Emergence of New Technolog
Leadership & Workforce
Asset Management
Community Engagement
Expanded Expectations of Utilities
Public Trust
Equity & Environmental Justice
Economic
Utility Revenue
Financial Sustainability
Affordability

DOE Award on Resource Recovery

Crossing the Finish Line: Integration of Data-Driven Process Control for Maximization of Energy and Resource Efficiency in Advanced Water Resource Recovery Facilities



Project Team: WRF (Lead), HRSD, DC Water, MWRD Denver, U Michigan, Northwestern, ORNL, Black & Veatch

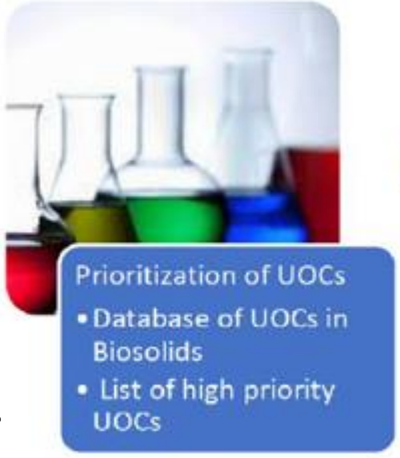
Unregulated Organic Chemicals in Biosolids: Prioritization, Fate and Risk Evaluation for Land Applications

(EPA Grant 84042501)

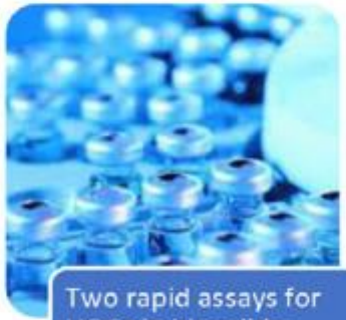
Synopsis of Project Activities

Prioritization of Biosolids-Borne UOCs

(Objective 1)



1) Develop a database that contains all measured UOCs and their frequency of detection.
2) Exclude UOCs from the list if:
    a) Risk assessments and/or regulatory standards have already been developed;
    b) UOC is a pesticide or a well-studied chemical class (e.g., PAHs);
    c) naturally produced, such as phytosterols;
    d) detected at low frequency (<10%), and
    e) low concentrations in biosolids.
3) Identify UOCs of high concern by conducting a persistent and bioaccumulative (PB) analysis using the U.S. EPA’s TSCA criteria.
4) Refine identified list of priority UOCs for further study.

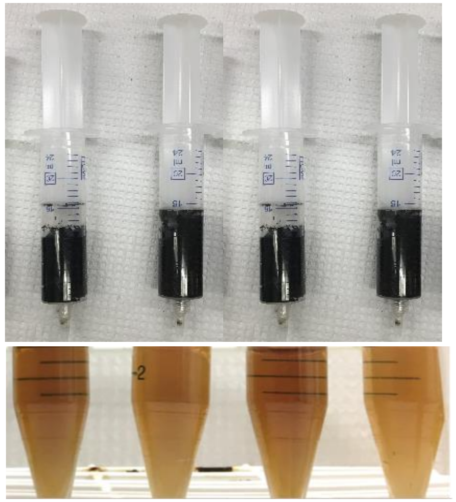


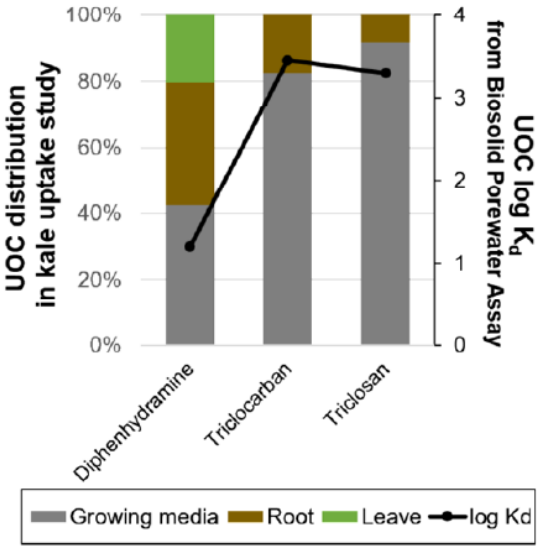
Two rapid assays for UOCs in biosolids:
1) Mobile fraction
2) Bioavailable fraction

Rapid Assays for Lability and Bioavailability
(Objective 2)

Develop or optimize, and validate with field data, simple and rigorous methods to predict the lability, bioavailability and bioaccumulation potential of the priority UOCs in biosolids and soils.

Pore-water Assays





Biomimetic Assays for Bioavailability-Bioaccumulation Assessments

Field Evaluations:
- 6 sites
- Class A in food or feed crop fields
- Class B for non-ag site
- Leaching/runoff
- Plant uptake
- Worm accumulation

Field Studies

(Objective 3)

Site/Characteristics	Planting	Biosolids	Samples
SCREC, Irvine, CA: Sandy loam; deep groundwater table	Common vegetables; fruit trees	Class A; composted biosolids; agronomic rates	Edible tissues; soil cores; edge-of-field runoff; earthworms
MWRDGC, Chicago, IL: Sandy loams; groundwater 5-14’	Corn (feedstock)	Class A; agronomic rates; Stable Class B; one-time varied non-agronomic rates	Archived stover; soil cores; lysimeters; earthworms
Progress Farm, VA: Silt loam, sandy loam; loam; groundwater ≤3’	Corn, soybeans (feedstock)	Cambi THP Class A; agronomic rates	Corn stover/grain; soybeans/leaves; deep/shallow groundwater; surface water; edge-of-field runoff; soil cores;
Howard & Cass Counties, IN:	Corn, soybeans (feedstock)	Class A; agronomic rates	Soil cores; tile drains
Central Valley, CA: Sandy loam; deep groundwater table	Alfalfa, wheat, corn (feedstock)	Class A; agronomic rates	All crops; soil cores; earthworms
Las Gallinas Valley, CA: Loam to clay loams; groundwater 3-11’	None	Class B; varied; non-agronomic rates	Soil cores; groundwater; edge-of-field runoff;

Analytical Flow

Extraction
with surrogates & QAQC

Sample clean-up

Suspect & Nontarget Screening for UOC Selection

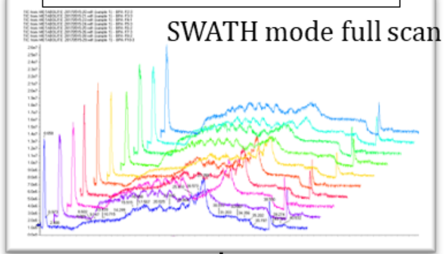
Quantification

Suspect & Nontarget Screening

Data acquisition → Data analysis (Pre-procedure → Computational procedure)

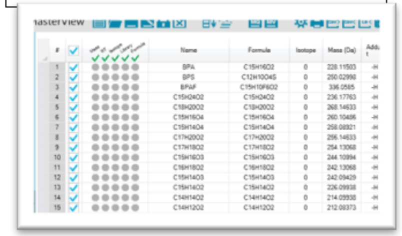
Data Acquisition on HRMS (Q-ToF)

SWATH mode full scan

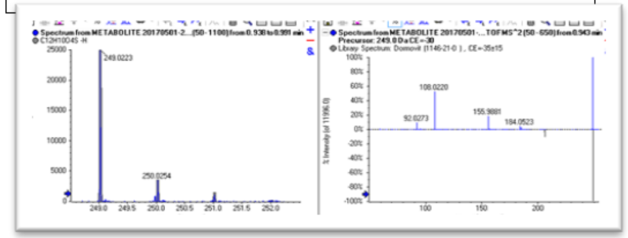


Suspect screening

Suspect List (In-house list, NORMAN, EPAcomptox, etc.)



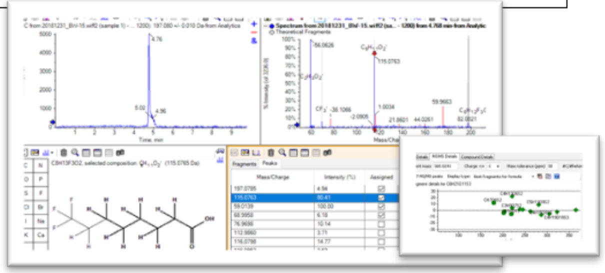
Compare detected compounds to known standard chemical data, database (libraries)



Non-target screening

Peak detection, blank subtraction, grouping (Kendrick mass defect)

Prioritization and identification by interpreting detected MS, MS accuracy, MSMS, isotope pattern, data sources



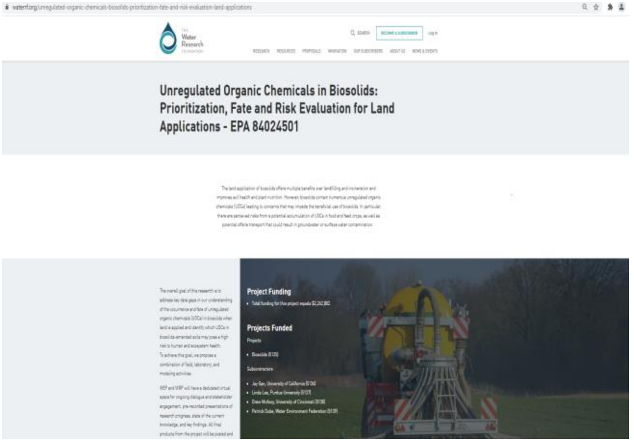
Evaluation of Fate and Transport Risk Assessment Model Formulations

(Objective 4)

- Survey model formulations for invertebrate bioaccumulation, plant uptake, bioaccumulation, leaching to groundwater, and runoff to surface waters.
- Conduct literature searches for the UOC model input parameters.
- Conduct sensitivity analysis on the model input parameters.
- Evaluate model formulations for accuracy and robustness.
- Develop a user-friendly risk calculator for assessing ecological and human health.
- *This tool will be developed in Excel with VBA as the programming language.*

Collaboration and Engagement

- Facilitate communications, education, outreach, and dissemination between the research team, project and utility advisory committees, non-traditional stakeholders, and community.
- WEF/WRF will bring together key partners to support and provide valuable guidance, engagement, and distribution/circulation of the results and impacts of this project.
- Joint network includes WEF's 30,000+ members, 45 Member Associations, utilities, trade associations, community groups, and WRF's 1200+ subscribers and online research library.
- WEF/WRF will host three professionally facilitated stakeholder engagement meetings and workshops (one virtual and two in-person), two webinars and facilitate sharing of the results at conferences (including WEF's specialty conferences and WEFTEC).
- Dedicated Virtual Space for stakeholder engagement, collaboration and communications!



https://www.waterrf.org/unregulated-organic-chemicals-biosolids-prioritization-fate-and-risk-evaluation-land-applications

Recent Highlights

THE Water Research FOUNDATION

Webcast

PFAS in Biosolids Under a Land Application Scenario: Biotic Weather, Leaching, and Transport

Thursday, October 14 | 1pm-2pm ET
(12pm CT, 11am MT, 10am PT)

Register for this Webcast

This webcast is free and open to the public.

Focus: Assessing Per- and Polyfluoroalkyl Substance Release from Finished Biosolids.

The first presentation will describe ongoing efforts to understand what factors influence PFAS partitioning between biosolids and surrounding water.

The second part of the webcast will present findings from WRF’s completed microcosm study that assessed vertical transport of PFAS through a soil column, simulating land application of biosolids.

- Presenters:

Erica McKenzie, PhD, College of Engineering, Temple University (WRF 5002)

Charles Schaefer, PhD, Director, Bellevue Research and Testing Laboratory, CDM Smith (WRF 5042)

Thank you!

Connect with us. Stay in touch with the latest on Water Research.

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USDA NIFA W4170 Research Committee
Beneficial Use of Residuals to Improve Soil Health and Protect Public, and Ecosystem Health

Groups of 50+ scientists from 30 states with extensive history on biosolids
USEPA Office of Water
USEPA ORD, Cincinnati, OH
USDA ARS
Biosolids Regional Groups (NW, NEBRA, CASA, MWRD, Mid Atlantic
Other biosolids stakeholders

W170 provided research data and risk assessment support to develop risk-based guidelines (Tables 2, 3, 4) in Part 503 1993 rule

Executive Committee of W4170

Dr. Maria Silveira, Chair, Univ. of Florida
Dr. Hui Li, co-Chair

Advisory roles
Dr. Nick Basta, Ohio State
Dr. Sally Brown, Univ. of Washington
Dr. Greg Evanylo, Virginia Tech Univ.
Dr. Ganga Hettiarachchi, Kansas State
Dr. Jim Ippolito, Colorado State
Dr. Greg Kester, CA Association of Sanitation Agencies

Wx170 Roots in Beneficial Use of Biosolids to Cropland

TASK FORCE MEMBERS

Leo M. Walsh (Chairman of the task force), Department of Soil Science, University of Wisconsin at Madison

Dale E. Baker, Department of Agronomy, Pennsylvania State University

Thomas E. Bates, Department of Land Resource Science, University of Guelph

Fred C. Boswell, Georgia Agricultural Experiment Station

Rufus L. Chaney, Agricultural Research Service, U. S. Department of Agriculture

Lee A. Christensen, Economic Research Service, U. S. Department of Agriculture

James M. Davidson, Department of Soil Science, University of Florida

Robert H. Dowdy, Agricultural Research Service, U. S. Department of Agriculture

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Roscoe Ellis, Department of Agronomy, Kansas State University

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Malcolm Sumner, Department of Soil Science, University of Wisconsin

Jack C. Taylor, Bureau of Veterinary Medicine, Food and Drug Administration

John M. Walker, Region 5, U. S. Environmental Protection Agency

EPA 430/9-76-013
CONSTRUCTION GRANTS PROGRAM
INFORMATION

APPLICATION OF SEWAGE SLUDGE TO CROPLAND:

APPRAISAL OF POTENTIAL HAZARDS OF THE HEAVY METALS TO PLANTS AND ANIMALS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NOVEMBER 1976

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER PROGRAM OPERATIONS
MUNICIPAL CONSTRUCTION DIVISION
WASHINGTON, D.C. 20460

Regional Project Time Line

- 1972 NC-118 “Utilization and Disposal of Municipal, Industrial and Agricultural Processing Waste on Land”
- 1972 W-124 "Soil as a Waste Treatment System
- 1977 W-124 "Optimum Utilization of Sewage Sludge on Land”
    - New project combined NC-118 and W124
    - Chicago sludge experiment started with annual and single applications
    - Granted a two-year extension in 1982
- 1984 W-170 “Chemistry and Bioavailability of Waste Constituents in Soils”
- 1989 W-170 “Chemistry and Bioavailability of Waste Constituents in Soils”
- 1994 W-170 “Chemistry and Bioavailability of Waste Constituents in Soils”
- 1999 W-170 “Chemistry and Bioavailability of Waste Constituents in Soils”
- 2004 W-1170 “Chemistry, Bioavailability, And Toxicity Of Constituents In Residuals And Residual-Treated Soils”
- 2009 W-2170 “Soil-Based Use of Residuals, Wastewater and Reclaimed Water”
- 2014 W-3170 “Beneficial Reuse of Residuals and Reclaimed Water: Impact on Soil Ecosystem and Human Health”
- **2019 W-4170 “Beneficial Use of Residuals to Improve Soil Health and Protect Public, and Ecosystem Health”**

Research to Support Risk-Based Beneficial Land Application of Biosolids and other Municipal / Industrial and Agricultural Byproducts

Biosolids Research leading to Part 503

- **1979** At request of EPA, reviewed "U.S. EPA Criteria of Solid Waste Disposal Facilities - Proposed Classification Criteria", Federal Register, Feb. 6, 1979. Report submitted March 31, 1979
- **1979** At request of EPA, reviewed "Interim Final Criteria", Federal Register, September 13, 1979. Report submitted January 25, 1980.
- **1985** Organized and conducted a workshop on "Land Application of Municipal Sewage Sludge". The purpose of the workshop was to bring together researchers involved in land application of sewage sludge to evaluate and summarize their most recent data. In light of this information, the workshop assessed the validity of assumptions made in the risk assessment process on fate of sludge contaminants.
- **1987** EPA Science Advisory Board. Review of Technical Documents. Supporting Proposed Revisions to EPA Regulations for the Disposal/Reuse of Sewage Sludge under Sec. 405(d) of the Clean Water Act.
- **1989** Peer Review Committee (PRC) Peer Review Standards for the Disposal of Sewage Sludge U.S. EPA Proposed Rule 40 CFR Parts-257 and 503 (February 6, 1989 Federal Register pp. 5746-5902)

Biosolids Research leading to Part 503

- **1993** Provided data summaries and technical suggestions on the comments received on Standards for the Disposal of Sewage Sludge U.S. EPA Proposed Rule 40 CFR Parts- 257 and 503 (February 6, 1989 Federal Register pp. 5746-5902) The final Standards for the Use or Disposal of Sewage Sludge (Title 40 of the Code of Federal Regulations [CFR],Part503),was published in the Federal Register (58 FR 9248 to 9404) on February 19, 1993, and became effective on March 22, 1993.

Select Biosolids Research since Part 503

- Many field studies to refine / validate Part 503 constituents (metals, PBT organic chemical contaminants
- Research on fate and risk posed by pharmaceutical and personal care products in land applied biosolids
- Risk based research of fate of antibiotics, microbial contaminants including COV19 in biosolids
- Research on PFAS and trace organic chem contaminants in biosolids and biosolids products

Recently EPA Funded Biosolids PFAS Research

- Assessing Biosolid Treatment Processes on Pollutant Environmental Fate and Plant Uptake following Land Application. This project is funded by EPA National Priorities: Evaluation of Pollutants in Biosolids (EPA-G2021-ORD-F1).

Hui Li (W4170 member, Michigan), James Ippolito (W-4170 member, Colorado), Qingguo Huang (W-4170 member, Georgia), Courtney Carignan (Michigan State University), Wei Zhang (Michigan State University), and John Norton (Great Lakes Water Authority, Detroit).
The research focuses on the occurrence, fate, transport, and plant uptake of per- and polyfluoroalkyl substances, pharmaceuticals and personal care products at the nexus of biosolids, soil, water, and crops.

- Unregulated Organic Chemicals in Biosolids: Prioritization, Fate and Risk Evaluation for Land Applications (EPA Grant 84042501)

Lola Olabode (WRF), Linda Lee (W4170 member, Indiana), Jay Gan (W4170 member, California), Drew McAvoy (Univ. of Cincinnati), Patrick Dube (WEF).

- Evaluating PFAS Occurrence and Fate in Rural Water Supplies and Agricultural Operations to Inform Management Strategies (R840082)

L.S. Lee (W4170 member, Indiana), H. Preisendanz (co-PI, PSU) & Kurt Pennell (co-PI, Brown University)
EPA National Priorities G20B113019085

Risk Based Research for other Residuals/byproducts

Risk Assessment for Beneficial use pf Foundry Sand in Topsoil Blends

U.S. EPA Office Resource Conservation and Recovery Economics and Risk Assessment Staff, USDA Agricultural Research Service and The Ohio State University. 2014. Risk assessment of spent foundry sands in soil-related applications. EPA-530-R-14-003. https://www.epa.gov/sites/production/files/2016-03/documents/risk_assessment_sfs_in_soil.pdf

Use of Drinking Water Treatment Residuals and other Byproducts to Reduce Risk from Non Point Agricultural Land

Response Document

On W4170 website: https://www.nimss.org/projects/18624
underline outline—attachment
Direct link:

nimss.org/system/ProjectAttachment/files/000/000/502/original/W4170%20Response%20to%20OIG%20Report%20July%2023%202020%20final.pdf

- **Response to chemical issues**, Dr. Nick Basta, OSU
- **PFAS**, Dr. Linda Lee, Purdue
- **Response to Antibiotic and pathogens issues**
  Dr. Ian Pepper, Univ. of Arizona
- **Overall review**, Greg Kester CASA


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PRESIDENT DECLARES A STATE OF EMERGENCY
RELIGIOUS LEADERS URGE ALL TO LOOK UP
CHICKEN LITTLE NOWHERE TO BE FOUN

Climate Change

Climate Change

Wildfires in California

Beneficial Use of Biosolids is a Solution for "The Grand Challenges"

- Food production / security
- Clean water
- Contaminant Remediation
- Climate Regulation (resilience)
- Waste Reuse

The answer is biosolids

"Carnac The Magnificent"

W4170 and OSU

Biosolids and Soil Health Research, Teaching and Extension

Judith Landing, MT

2021 National Biosolids Meeting

Background and Research Updates of Note

ACWA Eye on Biosolids

- PFAS/CEC, driven by Water Quality Standards/Permitting
- Resource Recovery
- Resilience

New Hampshire

- 3-phase study with USGS on soil/sludge leaching > Kd value > modeling > standard
- Other data: land app permittees, volunteer collection systems, phase-out lagoons

Washington

- May build a risk assessment framework to understand PFAS risks at the crop-field level
- Biosolids PFAS linked to field soil PFAS + modeling to determine PFAS risk on front end

Minnesota

- Initiating fate, transport, leaching, plant uptake study. NTA + Quant methods ~40 PFAS. Bench scale and land app growing season experiments.
- Source reduction mandated, currently evaluating appropriate strategies.

Thank you!

Contact: jadler@acwa-us.org

2021 National Biosolids Meeting

Judith Landing, MT