



Federal Remediation Technologies Roundtable Virtual Meeting

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The Federal Remediation Technology Roundtable at 30 1990-2020

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FRTR: Where it started

- Initial meeting of Senior Executive-level program managers of Agencies with both cleanup programs and technology development and demonstration programs
- Relationships: “We’re from EPA and we’re here to help you”
- No basis for collaboration; enforcement history
- Started small-jointly documenting information and demonstrations
- Needed to build momentum to cooperate



The Starting Point: Innovative Technologies in 1990

- Innovative Treatment Technologies: Technologies whose routine use is inhibited by lack of data on performance and cost.
- 1990 Mandates/Drivers
 - Preference for treatment (Superfund Amendments and Reauthorization Act or SARA)
 - Move away from “dig and haul,” capping
 - Permanence
 - Land Disposal Restrictions – In Situ
 - Very limited menu of treatment options
 - Soil: Incineration, maybe solidification
 - Groundwater: pump and treat
- A new area of scientific endeavor



The Starting Point

	Containment	Treatment
Soil Remedies	75%	25%
	Pump & Treat	In-Situ Treatment
Groundwater remedies	90+ %	3%

- Soil Treatment:
 - *Ex situ*
 - Incineration
 - Solidification/stabilization
- Site characterization
 - Monitoring wells
 - Lab analyses
 - Fate and transport?



RD&D: Many Options

- U.S. EPA: Superfund Innovative Technology Evaluation (SITE) Program
- Department of Energy, EM-50
- Department of Defense
- State programs
- International
- Non-profit, private sector
 - NETAC
 - PERF
- Cost and performance information at a premium



Technology Innovation Directions: c 1990

- Treatment, soil (surface, vadose zone)
- Groundwater treatment, very limited options
- Characterization, *not so much*
- Bioremediation
 - Exxon-Valdez
 - Natural attenuation, *hmmm....*
- Ex-situ treatments
 - Soil washing
 - Solvent extraction
 - Thermal desorption
 - Bioreactors



FRTR Direction – 1990's

- Sharing cost and performance information, information resources
- Better information for decision makers
- Demonstration projects
- Information exchange
- Public-private partnerships
 - Remediation Technology Development Forum
 - Clean Sites
 - Technology testing centers
- Leveraging investment
- Biggest focus on remediation
- Subgroups
- Internet



Evolution of Technology: 1995-2015

- Treatment trains
- Platforms vs. individual technologies
- Greater focus on groundwater, broader use of alternative technologies
- RD&D money, a shrinking pie
- Emerging concepts
 - Triad-emphasis on field analytics, real time decisions
 - Optimization
 - Reuse, land revitalization
- Building library of cost and performance information, case studies



Recently Selected Source Remedies (FY 2015-2017)

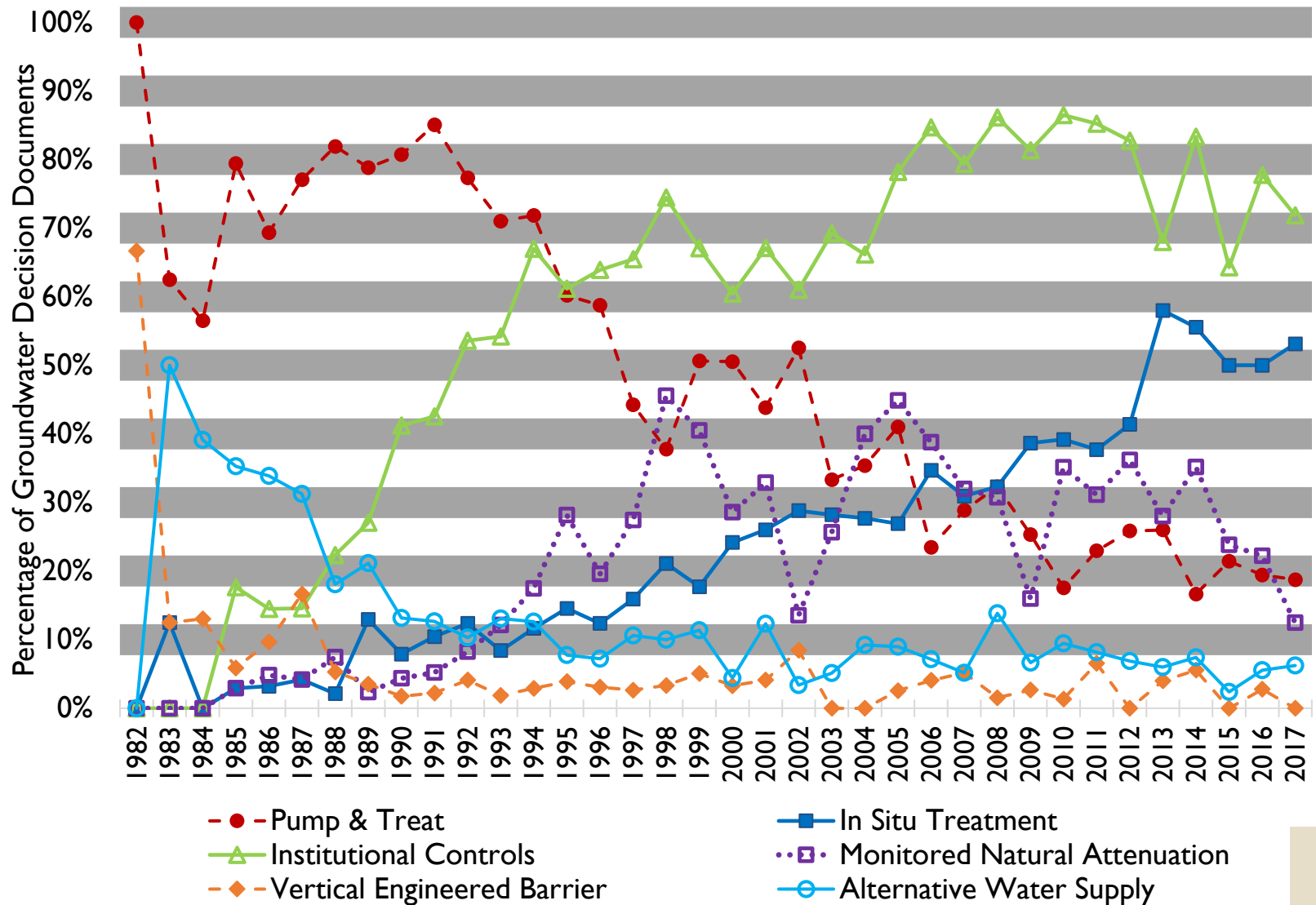
Source Decision Documents = 175

Technology	Number of Decision Documents (FY15-17)	Percent Source Decision Documents
In Situ Treatment	35	20%
Solidification/Stabilization	9	5%
Soil Vapor Extraction	9	5%
Thermal Treatment	8	5%
Bioremediation	6	3%
Chemical Treatment	5	3%
Cap (amended, in situ sediment)	2	1%
Amendments (in situ sediment)	2	1%
Multi-phase Extraction	2	1%
Electrokinetics	1	1%
Flushing	1	1%
Soil Amendments	1	1%
Ex Situ Treatment	50	29%
Containment/Disposal	117	67%
MNR/EMNR	6	3%
Institutional Controls	124	71%
Other	43	25%



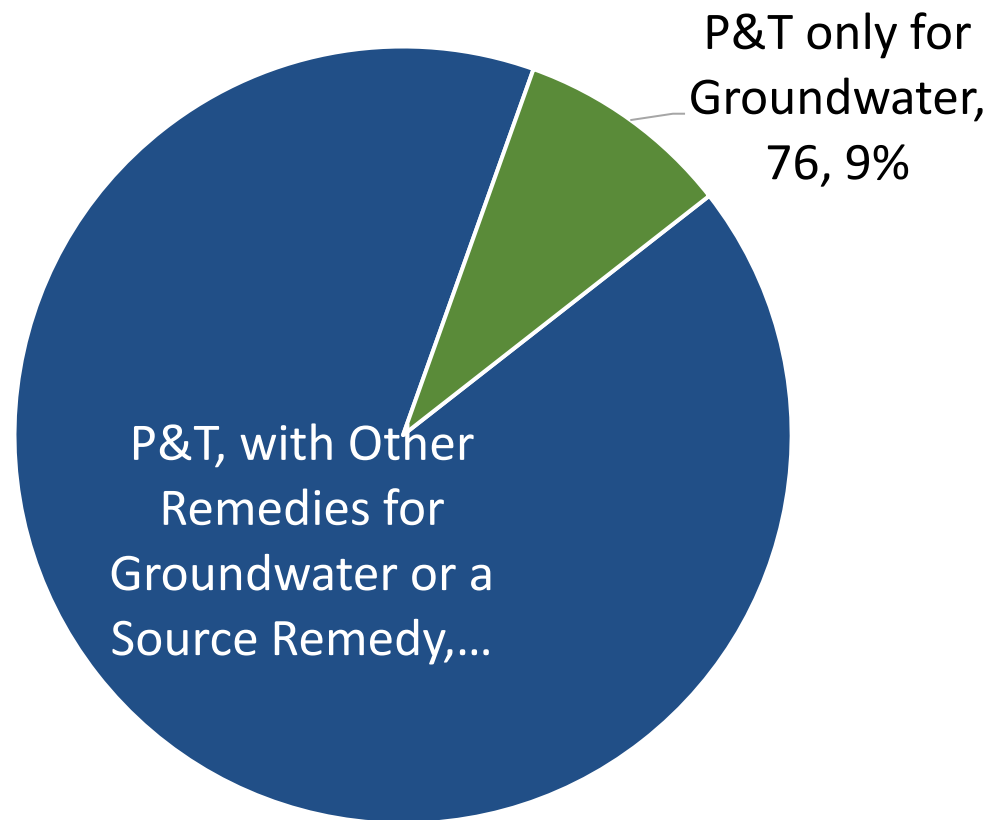
Selection Trends for Decision Documents with Groundwater Remedies (FY 1982–2017)

Groundwater Decision Documents = 2,541



Summary of Selected Groundwater P&T Remedies (FY 1981-2017)

Total P&T Sites = 845



Recently Selected Groundwater Remedies (Part I)

(FY 2015–2017)

Groundwater Decision Documents = 110

Remedy	Number of Decision Documents (FY15-17)	Percent Groundwater Decision Documents
Ex Situ Treatment (P&T)	22	20%
In Situ Treatment	56	51%
Bioremediation	30	27%
Chemical Oxidation/Reduction/ Neutralization	26	24%
Thermal Treatment	6	5%
Permeable Reactive Barrier	5	5%
Multi-phase Extraction	4	4%
Air Sparging	3	3%
Solidification/Stabilization	2	2%
Electrokinetics	1	1%
Flushing	1	1%
Phytoremediation	1	1%
Vapor Extraction	1	1%
Monitored Natural Attenuation	22	20%
Containment (Vertical Engineered Barriers)	1	1%
Institutional Controls	78	71%
Alternative Water Supply	5	5%

Continued...



The Last Five Years (2015-Present)

- Land and material reuse
- Understanding the importance of characterization, data
- Optimizing remedies
- Big sites
- Maximizing responsible use of models
- Emerging issues
 - Resiliency
 - Contaminants (e.g., PFAS)

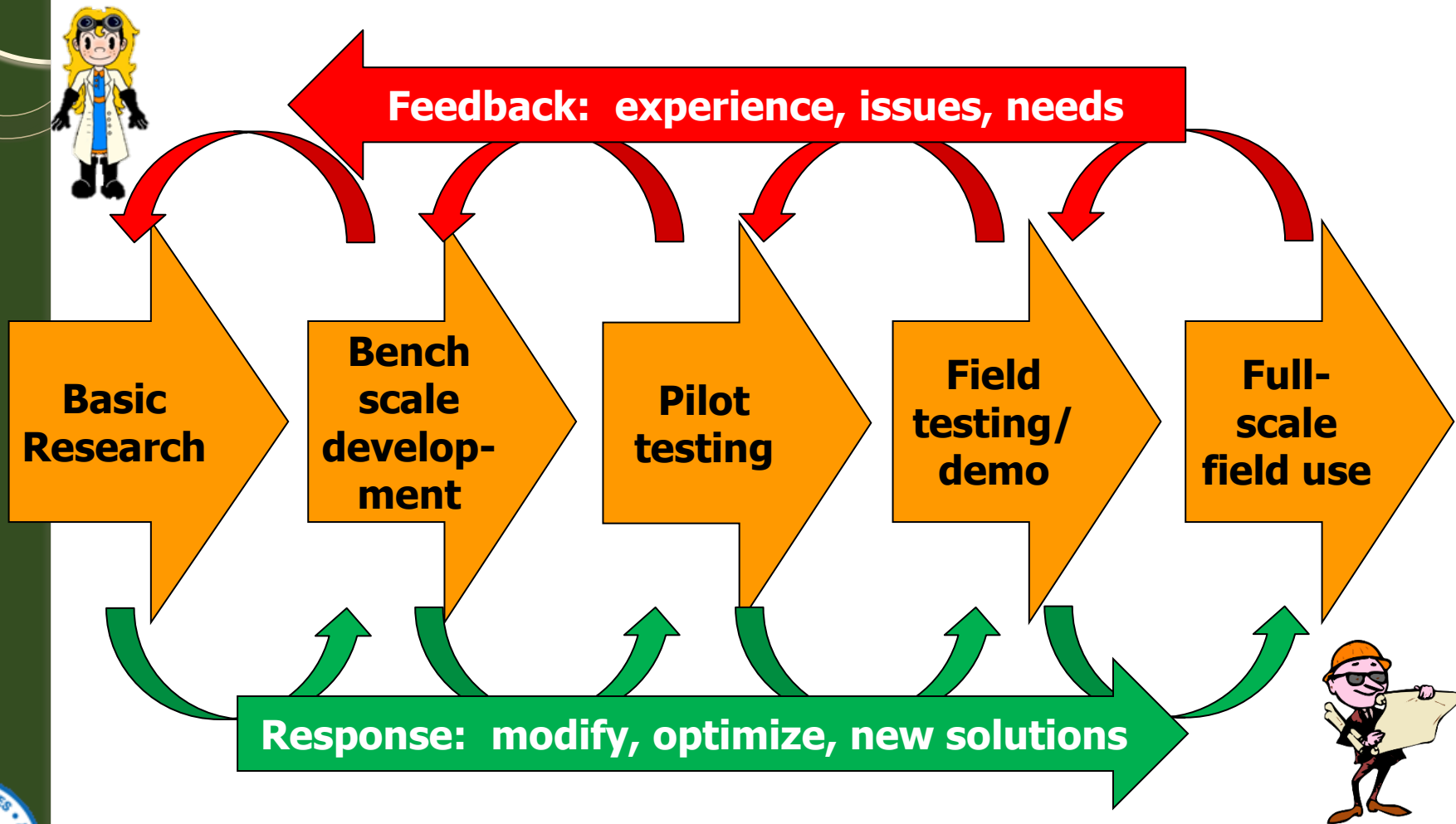


FRTR Impacts

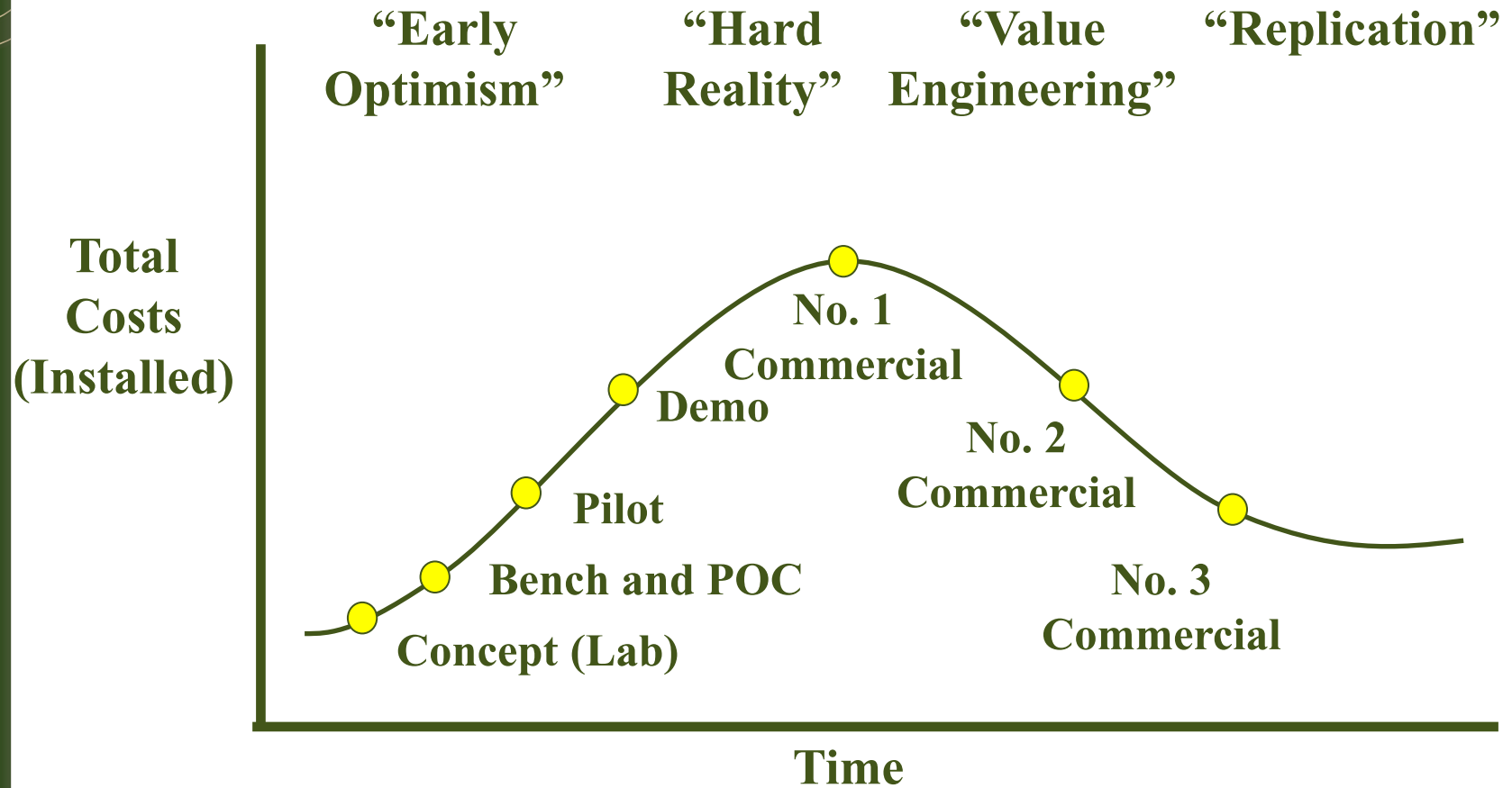
- Moved the concepts of innovation to dialogue and action among decision makers, users
- Federal technology and cleanup programs have led to significant innovation; FRTR:
 - Leveraged experience
 - Leveraged knowledge
 - E.g., direct push
 - E.g., thermal treatment
- Cooperation and collaboration
- Expanding membership (NIEHS, NRC)
- Continued education
- Federal “markets” large-will drive practice



Innovation is Not a Linear Process



Stages of Technology Commercialization



Evolution of Technology: Moving Forward

- Issues
 - High resolution site characterization approaches
 - Many data points
 - An evolving conceptual site model
 - Data management tools and visualization of data
 - Resiliency
 - Long-term remedies
 - Severe weather impacts
 - Addressing complexity of sites/"big" sites
 - Research to commercialization
 - PFAS, other emerging contaminant issues
 - Critical minerals?
- Information transfer and training – acceptance
- Advocating innovation
 - Communicating needs
 - Leveraging investments



Moving Forward

- Re-Focusing and pursuing site cleanup needs
 - Specifics are important
 - Beyond contaminant/media
 - Clearly stating need
 - Providing performance metrics in statement of need
 - Focus on decisions, decision makers
 - Need a path forward
 - If we decide we need it, what are we going to do about it?
 - Funding options
 - Map
 - Leverage
 - Path to site use
- Bottom line: with the continuing need for technology evolution and innovation, the FRTR will always have a role

