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EPA Office of Environmental Information (OEI) Toxic Release Inventory
EPA Office of Solid Waste and Emergency Response (OSWER)
November 24, 2009

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Schedule for November 24, 2009
SAB Science Integration for Decision Making Fact Finding Meetings

9:00 a.m. - 10:00 a.m.	Meeting with Associate Director, OEI Office of Information Analysis and Access and Directors of the Environmental Analysis Division and Toxic Release Inventory Program
10:15 a.m. - 11:15 p.m.	Meeting with Scientific and Technical Staff, Office of Information Analysis and Access, Environmental Analysis Division and Toxic Release Inventory Program
11:15 p.m. - 1:00 p.m.	Lunch and travel to Potomac Yards
1:00 p.m. - 2:00 p.m.	Meeting with Deputy Director, Office of Superfund Remediation and Technology Innovation
2:00 p.m. - 3:00 p.m.	Meeting with Chief, Science Policy Branch, Office of Superfund Remediation and Technology Innovation
3:00 p.m. - 4:00 p.m.	Meeting with Chief, Economics and Risk Analysis Staff, Office of Resource Conservation and Recovery
4:00 p.m. - 5:00 p.m.	Meeting with Director, Office of Resource Conservation and Recovery

Logistics for Visit

SAB Members meet at 8:00 at the entrance to Ariel Rios North (1200 Pennsylvania Avenue, entrance near the metro station) and then proceed to EPA West (1301 Constitution Avenue) to go through security screening. We will have a brief meeting in Conference Room 5144 to prepare for the fact-finding meetings. Telephone participants should call in at 8:30 to coordinate last details.

After the morning meetings, we suggest the in-person interviewers have lunch at the Federal Triangle Complex and then take a cab to Potomac Yards, where the afternoon meetings will be held.

SAB Science Integration for Decision Making Fact-Finding Meeting
Meeting with Associate Director, Office of Environmental Information, Office of Information Analysis and Access and Directors of the Environmental Analysis Division and Toxic Release Inventory Program
Conference Room 5144
EPA West, 1301 Constitution Avenue, NW, Washington, DC 20064
Call-in Number for SAB subgroup: 866-299-3188, access code 343-9981 and press the # sign.
November 24, 2009, 9:00-10:00 a.m.

Draft Agenda

Purpose of Interview: to help SAB Committee members learn about the Environmental Analysis Division and Toxic Release Inventory Program 's current and recent experience with science integration supporting EPA decision making so that the SAB can develop advice to support and/or strengthen Agency science integration efforts.

1. Introductions facilitated by the SAB Staff Office

2. Discussion facilitated by SAB Members
   - Practices for integrating science to support decision making
   - Consideration of public, stakeholder, external scientific, and other input in science assessment
   - Drivers and impediments to implementing past recommendations for science integration
   - Ways program receives feedback on how science is used in decision-making
   - Workforce to support science integration for decision making

3. Identification of any follow-up actions

<u>Planned participants</u>

EPA Office of Environmental Information, Office of Information Analysis and Access
Ms. Michele Anders, Assistant Office Director, Office of Information Analysis and Access
Mr. Michael Petrushka, Director, Toxic Release Inventory Program Division
Ms. Nancy Wentworth, Director, Information Analysis and Access Division

SAB Committee on Science Integration Committee Members
Dr. James Bus, Dow Chemical
Dr. James Johnson, Howard University
Dr. Catherine Kling, Iowa State University (by telephone)
Dr. Jill Lipoti, New Jersey Department of Environmental Protection (by telephone)
Dr. Thomas Theis, University of Illinois at Chicago (by telephone)

SAB Staff Office
Dr. Anthony Maciorowski, Deputy Director
Dr. Angela Nugent, Designated Federal Officer

SAB Science Integration for Decision Making Fact-Finding Meeting
Meeting with Scientific and Technical Staff, Office of Environmental Information, Office of Information Analysis and Access and Directors of the Environmental Analysis Division and Toxic Release Inventory Program
Conference Room 6524
EPA West, 1301 Constitution Avenue, NW, Washington DC 20064
Call-in Number for SAB subgroup: 866-299-3188, access code 343-9981 and press the # sign.
November 24, 2009, 10:15 a.m. - 11:15 a.m.

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<u>Planned participants</u>

EPA Office of Environmental Information, Office of Information Analysis and Access
Dr. Daniel Bushman, TRI Petitions Coordinator and Chemical List Manager, Environmental Analysis Division
Dr Stephen DeVito, Chairperson of EPA's Office of Information Access and Analysis' TRI Data Analysis Team
Dr. Nicole Paquette, Chief, Analytical Support Branch, Environmental Analysis Division
Ms. Ingrid Rosencrantz, Chief, TRI Regulatory Development Branch

SAB Committee on Science Integration Committee Members
Dr. James Bus, Dow Chemical
Dr. James Johnson, Howard University
Dr. Catherine Kling, Iowa State University (by telephone)
Dr. Jill Lipoti, New Jersey Department of Environmental Protection (by telephone)
Dr. Thomas Theis, University of Illinois at Chicago (by telephone)

SAB Staff Office
Dr. Anthony Maciorowski, Deputy Director
Dr. Angela Nugent, Designated Federal Officer

OFFICE OF
ENVIRONMENTAL
INFORMATION

TRI 101 (and 201)

A Primer on the Toxics Release Inventory

1

TRI 101 – The Basics

- Statutory background
- What information is covered
- The TRI business (collection) process
- How the information is provided to the public

TRI Mandated by Statute

- Emergency Planning and Community Right-to-Know Act (EPCRA,1986) requires covered industry sectors to report to EPA and states using a "*toxic chemical release form*"
  - EPA must maintain a "*computer data base*" and make the data (the inventory) available to the public
  - EPCRA provides civil enforcement penalties for noncompliance
- Pollution Prevention Act (PPA,1990), expanded TRI obligation to include a *"source reduction and recycling report"* as part of the required submissions
- Reports are due to EPA by July 1st of each year

3

TRI Has Data on ..

4

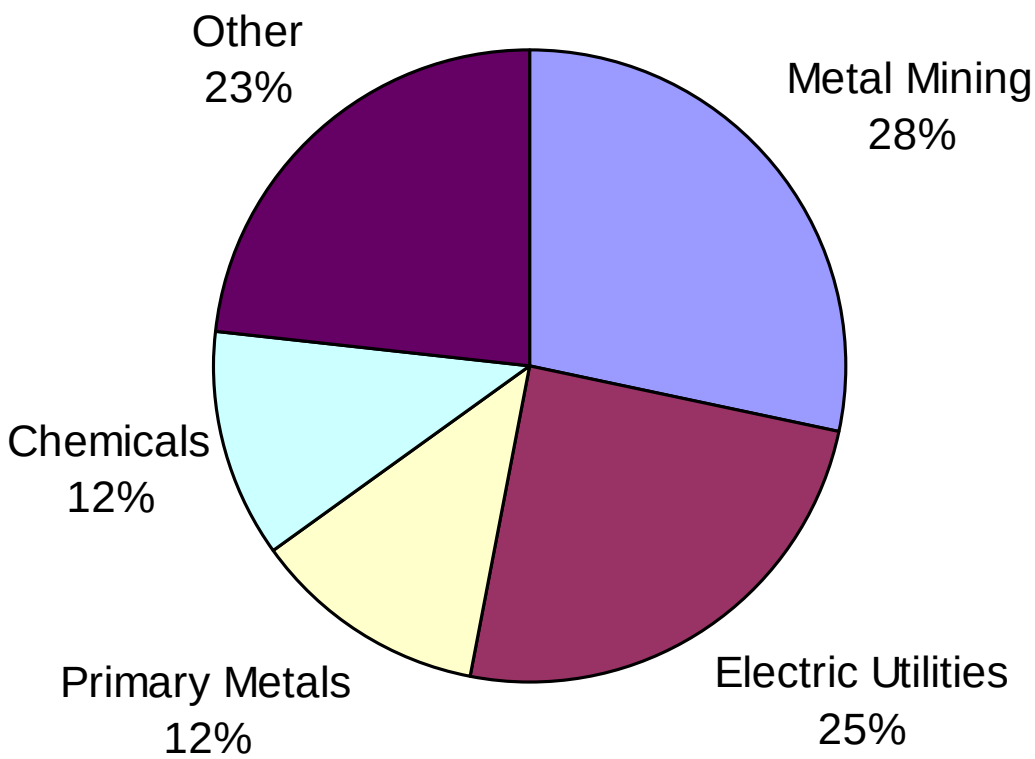
Who's Covered ? Facility reports if ..

- It is in a covered industry NAICS code
  - Many listed in EPCRA, EPA added others
  - Federal facilities must also report regardless of NAICS, by Executive Order
- It has 10 or more full-time equivalent employees
- It "manufactures," or "processes" more than 25,000 lbs of the listed chemical, or "otherwise uses" more than 10,000 lbs in the reporting year of a listed chemical
  - EPA reduced the thresholds for "persistent, bioaccumulative, and toxic ("PBT") chemicals to very low levels (e.g., mercury is reported if releases exceed 10 lbs per year)

TRI Reporting Universe

- Over 650 chemicals and chemical groups in TRI are reported by facilities in eleven two-digit NAICS sectors
  - About 23,000 facilities report, with an average of four chemicals each, for a total of over 90,000 individual submissions
- Some chemicals were in EPCRA, EPA can add others via rule
  - The public can petition EPA to add or remove a chemical
  - Some of the major chemicals of interest are lead, mercury, dioxin, PCBs, and arsenic

National data: Key industries and Their Share of Total Releases (4 B lbs total)



*Data from total disposal and other releases from 2007 TRI data

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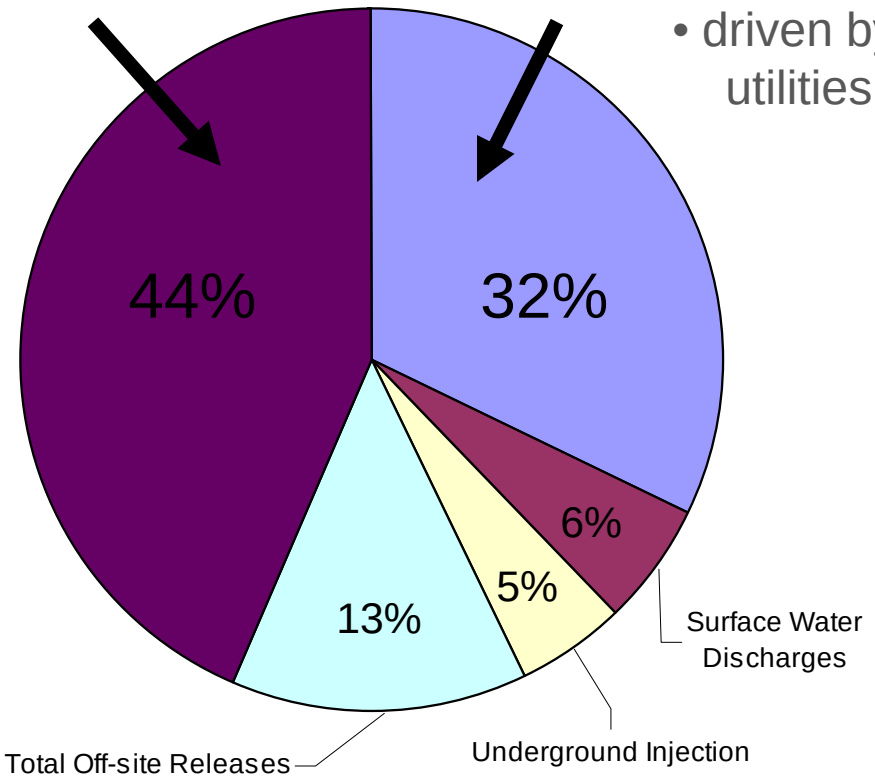
Releases to Environmental Media (4 B lbs total)

Land releases (on-site)

- driven by metal mining and electric utilities

Air releases

- driven by electric utilities

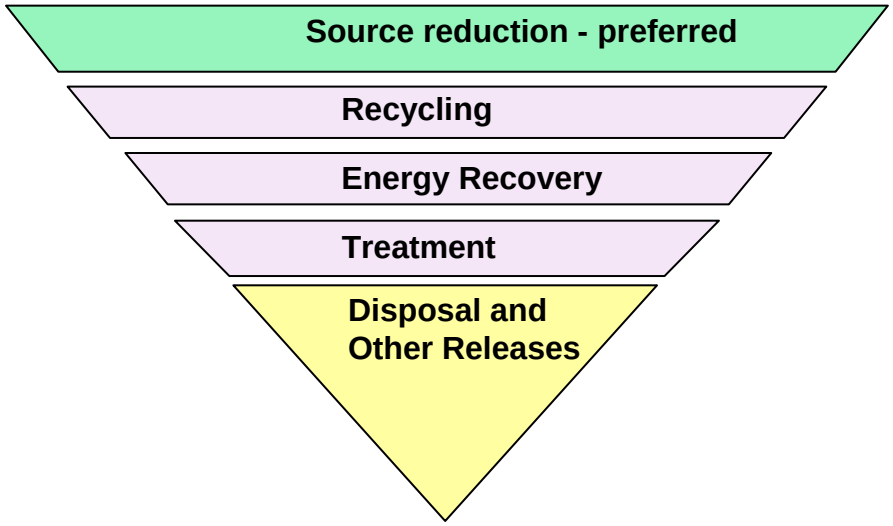


*Data from total disposal and other releases from 2007 TRI data

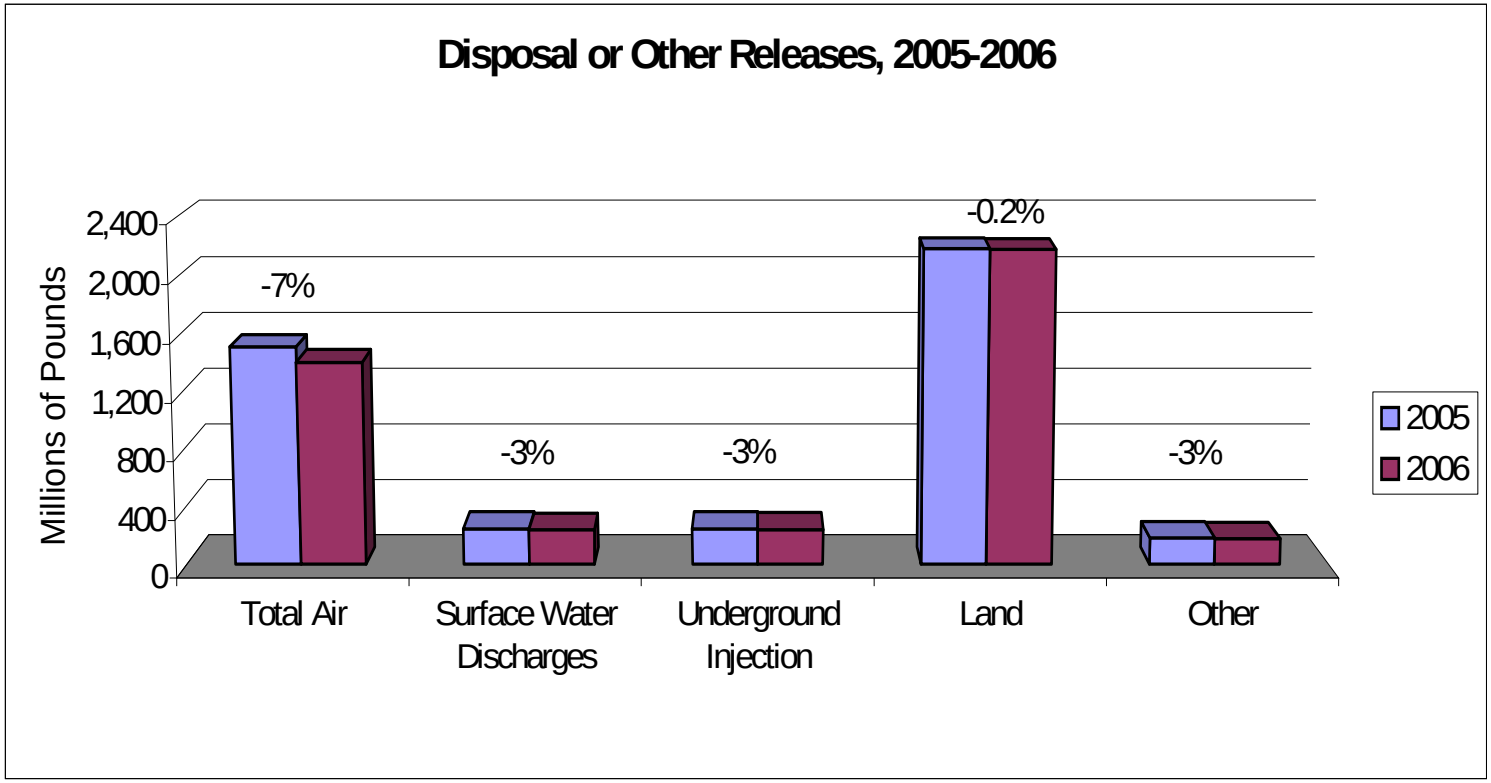
8

Waste Management Data Collected in Subgroups (25 B lbs total)

- The subgroups reflect EPA's waste management hierarchy
  - Source reduction information collected is descriptive (no quantities)
  - Recycling + Energy Recovery + Treatment + Disposal and Other Releases = Total Waste Managed



Typical Year to Year Changes are Single Digit Percents



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TRI Information Continued

- TRI also has information on pollution prevention (P2) practices and success stories
  - Unstructured data posted on line for first time in 2007 PDR
  - Exploring ways to improve access and use of the P2 data
- TRI has information on corporate identity to allow corporate "linking"
  - Exploring ways to improve accuracy
  - May add additional identifier (stock symbol)

Overview: TRI Reporting Forms

- All facilities subject to TRI must submit either Form R or A:
  - Form R (long)
  - Form A – (short)) form
- Most facilities (90% +) use TRI software, called *"TRIMEweb"*
- Facilities may use *"TRIMEweb",* which is linked with the Central Data Exchange (CDX) to submit their data securely over the internet.

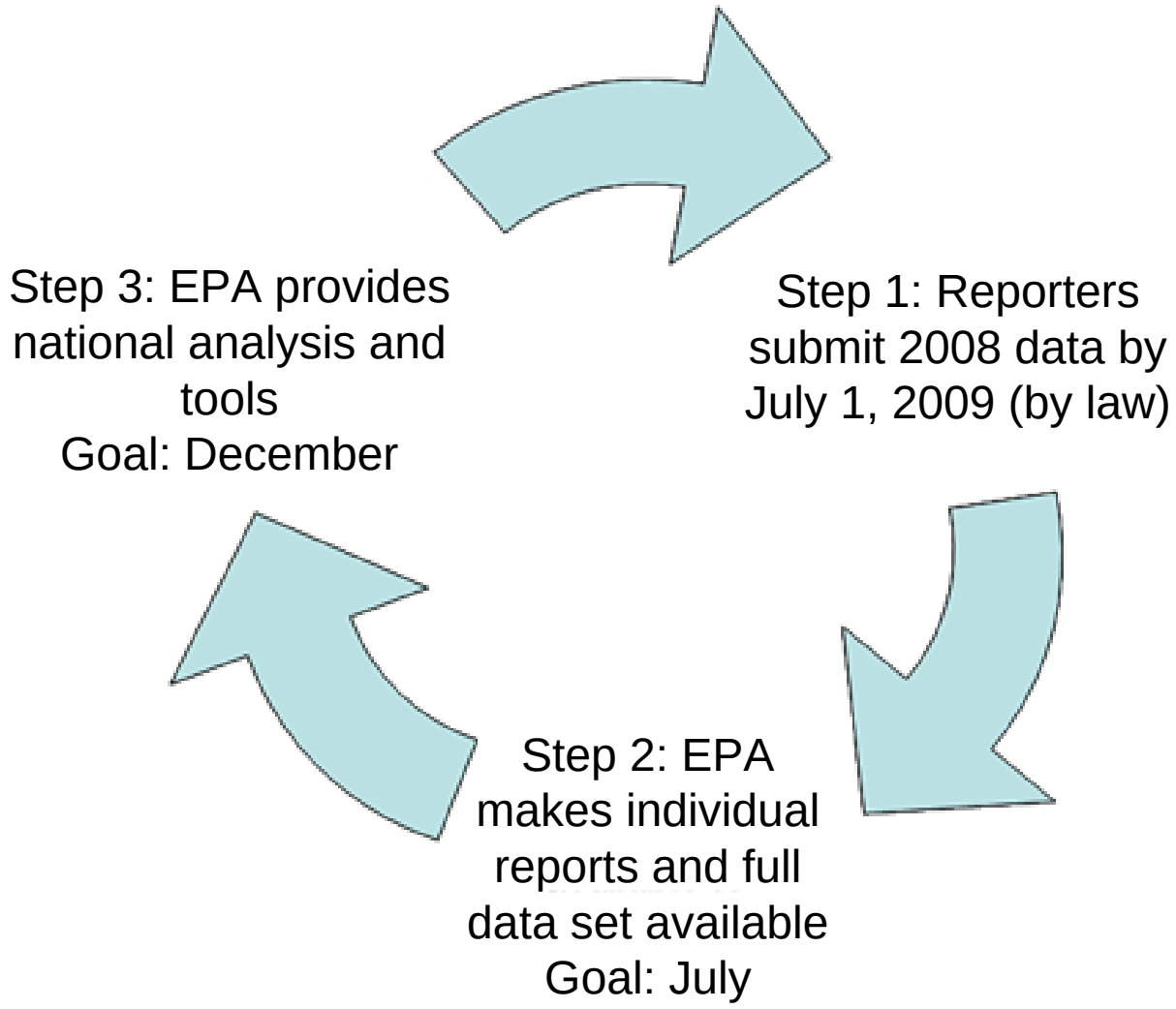
Cost of TRI Reporting

- EPA receives over $ 15 M annually to run TRI
  - Some funds to Regions, but most in OEI HQ
  - The largest cost components are salaries, and data processing (a contractor activity)
- The cost to industry for compliance is estimated to be 3.8 million burden hours ($ 205 M monetized)
  - This reflects costs to industry of 24-46 hours per Form R and less than 20 hours (per chemical) per Form A
  - Looking at ways to streamline costing methodology

TRI Annual "Business" Cycle

- EPA collects the data (mostly online):
  - Facilities must report by July 1st for the *previous calendar year*
  - The data is simultaneously transmitted to States via the Central Data Exchange when a "state data exchange" MOU is in place
- EPA processes, checks, and then releases the data to the public
  - EPA posts facility-specific data via on line tools and files in summer
  - EPA later releases a TRI National Analysis (formerly "Public Data Release")
    - Many States also publish a state level TRI report

TRI Business Cycle and Goals



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Recent Progress in e-Reporting

Greater use of electronic reporting has

- Enhanced data quality due to automated data quality checks
- Lessened the reporting burden on facility reporters (e.g., through pre-population of some data fields in TRI-MEweb)
- Allowed EPA to process and publish the data more quickly

CDX
CENTRAL DATA EXCHANGE

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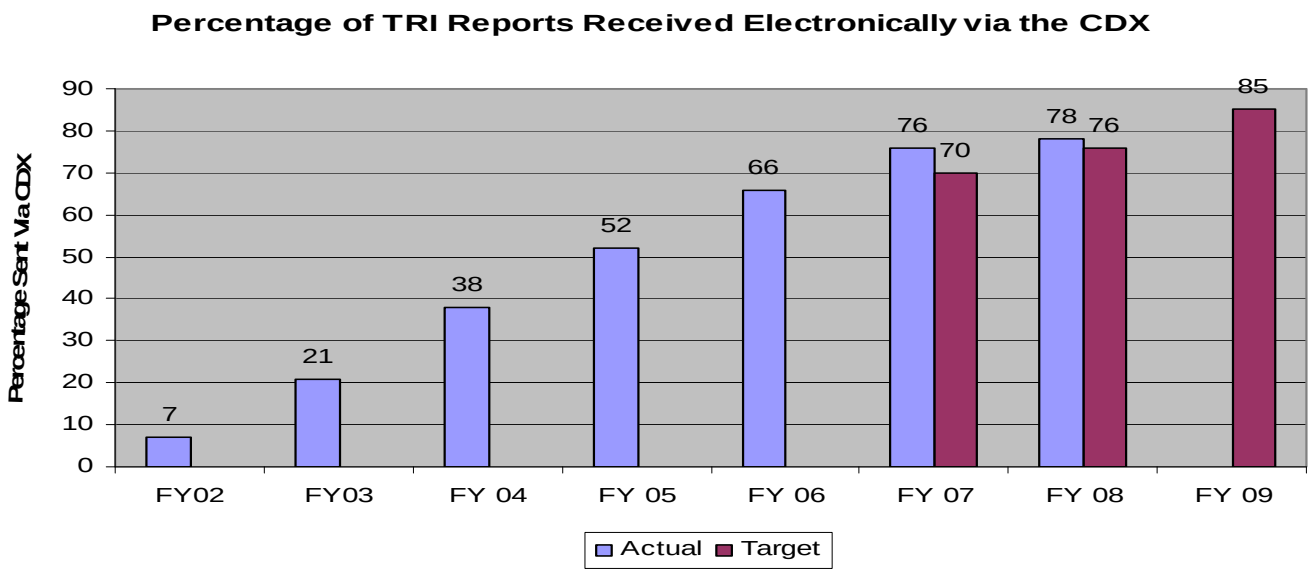
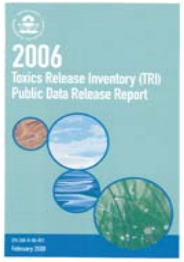
Recent Progress in e-Reporting

- **Electronic Reporting Advances – OEI leading by example**
  - Developed TRI-Made Easy (TRI-ME) web reporting software
  - Steady increase in electronic reporting through EPA's Central Data Exchange (CDX) – Paper reporting almost eliminated



Recent Progress: Faster Delivery to Public

- **Earlier Release of the Public Data Release (PDR)**
  - **TRI National Analysis (formerly PDR) dates are getting earlier:**
    - **2004 released April 2006**
    - **2005 in March 2007,**
    - **2006 in Feb 2008**
    - **2007 in March 2009**



- **Big change for 2008 Data and Report**
  - **Raw data was released in stages Aug-Sep 2009**
  - **Target December 2009 for National Analysis**

TRI Data is Widely Disseminated and Heavily Used

- Designed for release to and use by the public
  - Routinely cited by news organizations, NGO's, academics, government agencies, and industries
  - TRI information is at http://www.epa.gov/tri
- TRI data are publicly available through:
  - **Envirofacts:** http://www.epa.gov/enviro/
  - **TRI Explorer:** http://www.epa.gov/triexplorer/
  - **TRI.net:** http://www.epa.gov/tri/tridotnet/
  - **Data.gov**: http://www.data.gov

TRI 201 – Digging a little deeper

- What is TRI to the public ?
- How is the information used ?
- Current issues in the TRI program

TRI Mission and Vision

- Mission – Provide toxic chemical information to communities and others

- Vision – Communities and others have what they need to understand and manage risk

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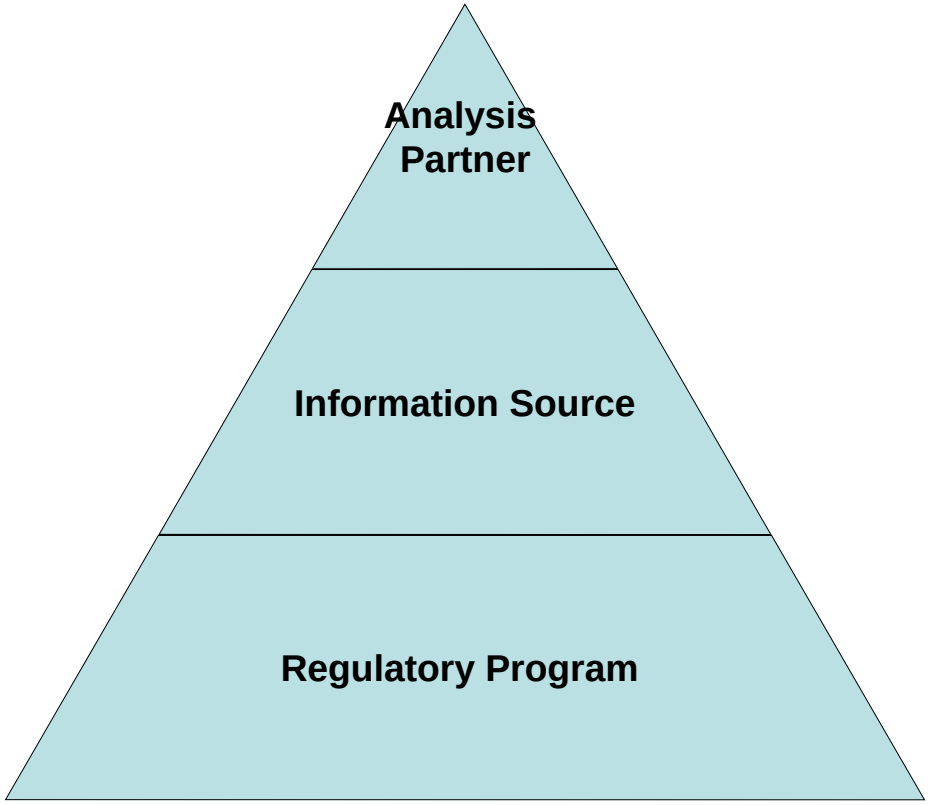
What is the TRI Program to the Public ?



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The Foundation: TRI Regulatory Program

- Regulations, guidance, and TRIME
  - Mature program (20 years of history)
  - “Reporting forms and instructions” (RFI) updated annually (along with TRIME)
- How to evaluate ?
  - Completeness of scope (do we have the right chemicals and industries)
  - Are we fair to reporting industries ?
  - Do we have credible enforcement ?

The Heart of the Mission: An Information Source

- Data is there, come and get it
  - TRI website, TRI Explorer, TRI.NET, and Envirofacts all allow access to TRI data
  - Exploring data publishing, RSS feeds
- How to evaluate ?
  - Timeliness of data
  - Quality of data
  - Ease of use (can you find what you want ?)

Additional Value Added: TRI as an Analysis Partner

- National conference, ECOS cooperative agreement, tool development, and ad hoc assistance with TRI data
  - Fostering a data using community
  - Routinely work with EPA partners and others
- How to evaluate ? Very difficult .. Still working on this
  - Attendance at TRI National Conference ?
  - Requests for data ?
  - Frequency of data and tool use (e.g., google alerts) ?

TRI Customer and Stakeholder Assessments

- 2005 Survey of internal (EPA) customers
  - Respondents from each AA-ship (22 in total)
  - 86 % said TRI data “important” or “very important” in fulfilling their program mission (most use with other data)
  - Broad range of chemicals and industries most important

Additional Feedback on TRI Data from Internal and External Stakeholders

- TRI data is objective, and levels the playing field between parties with disparate resources
  - TRI is often used in EJ analyses
- TRI data is updated annually and can document changes over time to chart progress (or lack of)
  - TRI can help examine corporate performance
  - Communities and others can use TRI data to help understand risks from toxic chemicals, and better manage those risks

Stakeholder Feedback Continued

- TRI external Stakeholders include:
  - OMB Watch and other NGOs, trade associations, small business community, State agencies
- Major issues under discussion
  - Scope of coverage (and level of detail)
  - Enforcement
  - Ability to examine corporate relationships
  - Data presentation (providing “context”)

TRI Issues: Scope of Coverage

- Perception that TRI is not fully implementing the statute (and is missing important information)
  - Previous Administration “rolled back” coverage, undone by Congress in April 2009
  - No chemicals or sectors added in over 10 years
- OEI has begun major effort to evaluate TRI coverage and enhance as appropriate
  - Chemicals, sectors, and facilities may be added

Process for Chemical Addition

- Chemicals (or categories) can be added to TRI
  - Agency initiated action
  - Petitions from outside the Agency
- Agency conducts formal rulemaking based on statutory criteria
  - Hazard assessment
  - Economic analysis
  - External peer review

Chemical Addition (EPCRA 313(d)(2))

(d) Revisions by Administrator

(1) In general The Administrator may by rule add or delete a chemical from the list described in subsection (c) of this section at any time.

(2) Additions A chemical may be added if the Administrator determines, in his judgment, that there is sufficient evidence to establish any one of the following:

(A) The chemical is known to cause or can reasonably be anticipated to cause significant adverse acute human health effects at concentration levels that are reasonably likely to exist beyond facility site boundaries as a result of continuous, or frequently recurring, releases.

(B) The chemical is known to cause or can reasonably be anticipated to cause in humans—

(i) cancer or teratogenic effects, or

(ii) serious or irreversible—

(I) reproductive dysfunctions,

(II) neurological disorders,

(III) heritable genetic mutations, or

(IV) other chronic health effects.

(C) The chemical is known to cause or can reasonably be anticipated to cause, because of—

(i) its toxicity,

(ii) its toxicity and persistence in the environment, or

(iii) its toxicity and tendency to bioaccumulate in the environment,

a significant adverse effect on the environment of sufficient seriousness, in the judgment of the Administrator, to warrant reporting under this section. The number of chemicals included on the list described in subsection (c) of this section on the basis of the preceding sentence may constitute in the aggregate no more than 25 percent of the total number of chemicals on the list.

A determination under this paragraph shall be based on generally accepted scientific principles or laboratory tests, or appropriately designed and conducted epidemiological or other population studies, available to the Administrator.

Adding Sectors and Facilities Under EPCRA Sec 313(b)

- Section 313(b)(1) says the TRI requirements apply to owners or operators of facilities that have 10 or more full time employees and that are in SIC 20-39 (now converted to NAICS)
  - The Administrator may add or delete NAICS codes but "…only to the extent necessary to provide that each SIC code to which this section applies is relevant to the purposes of this section."

- Section 313(b)(2) says the Administrator may apply TRI requirements to "… any particular facility that manufactures, processes, or otherwise uses a toxic chemical listed ..if the Administrator determines that such action is warranted on the basis of toxicity of the toxic chemical, proximity to other facilities that release the chemical or to population centers, the history of such releases at the facility, and such other factors as the Administrator deems appropriate."

TRI Issues: Enforcement

- Perception that enforcement has become lax
  - Number of facilities reporting TRI has declined over time
  - May be due to multiple reasons, including non-compliance
- OEI and OECA have begun effort to examine and identify ways to improve enforcement

Issues in Using TRI Data – Corporate Relationships

- TRI provides data on parent companies, collects Dunn and Bradstreet information
  - Financial community and NGOs critical of data completeness and quality
  - Interest in connecting corporate TRI, greenhouse gas, and compliance data
- OEI and OPEI exploring ways of improving TRI corporate identifier information

Issues in Using TRI Data - Risk

- TRI presents annual quantity and media data, but understanding risk requires additional information.
- The Risk Screening Environmental Indicator (RSEI) is a model developed by OPPTS that uses TRI data and risk surrogate information to provide relative risk screens
- Current OEI projects that address the risk context issue include:
  - TRI-CHIP (TRI Chemical Hazard Information Profiles) database provides easy access to hazard information
  - Developing a Risk context Web page that would provide easy access to EPA's existing risk assessment discussions and tools
  - Developing possible mobile applications for TRI data

SAB Science Integration for Decision Making Fact-Finding Meeting
Meeting with Meeting with Deputy Director,
Office of Superfund Remediation and Technology Innovation
Conference Room N 6661
Potomac Yard, 2733 Crystal Drive, Arlington, Virginia
Call-in Number for SAB subgroup: 866-299-3188, access code 343-9981 and press the # sign.
November 24, 2009, 1:00 p.m. - 2:00 p.m.

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EPA Office of Superfund Remediation and Technology Innovation
Mr. Barnes Johnson, Deputy Director

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EPA Office of Superfund Remediation and Technology Innovation
Dr. Helen Dawson, Chief, Science Policy Branch
Members of the Science Policy Branch

SAB Committee on Science Integration Committee Members
Dr. James Bus, Dow Chemical
Dr. James Johnson, Howard University
Dr. Catherine Kling, Iowa State University (by telephone)
Dr. Thomas Theis, University of Illinois at Chicago (by telephone)

SAB Staff Office
Dr. Anthony Maciorowski, Deputy Director
Dr. Angela Nugent, Designated Federal Officer

Biosketches of Office of Superfund Remediation and Technology Innovation Interviewees

Barnes Johnson

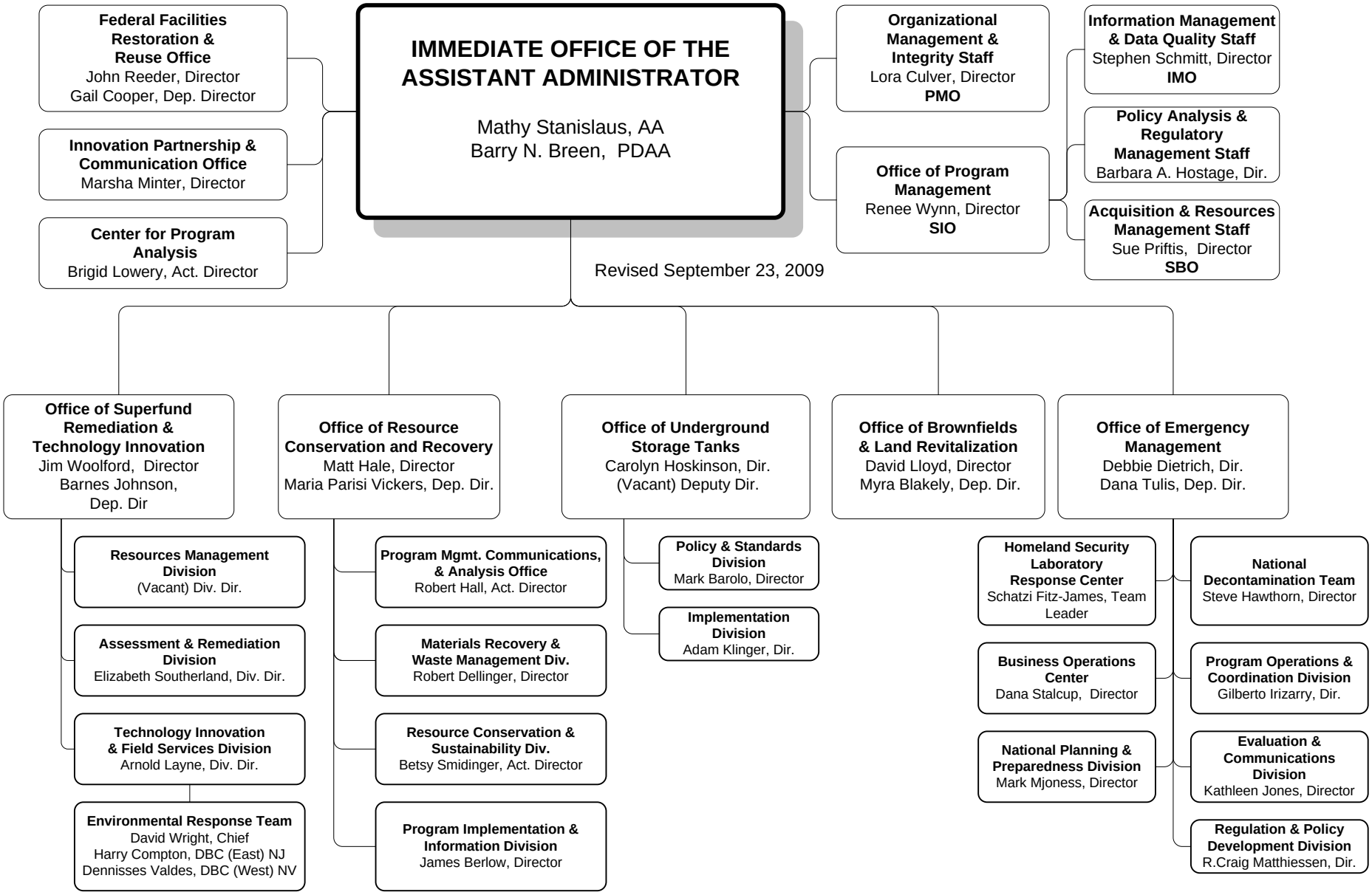
Barnes Johnson has been with EPA for over 20 years and has worked in a variety of positions. Barnes is currently Acting Director of the Office of Superfund Remediation and Technology Innovation. He joined this office in August 2006 as the Deputy Director. The Office is responsible for long term cleanup of sites under the Superfund program and promotes new technology and approaches to managing sites. It also includes EPA's Environmental Response Teams, which provide technical assistance in responding to environmental emergencies (such as chemical or oil spills) and expertise and support for response to terrorist events (including threat assessment, site evaluation, removal action, environmental monitoring, decontamination and long term restoration).

From July 2003 until joining Superfund, he was Deputy Director of the Office of Radiation and Indoor Air (ORIA) where, among other responsibilities he coordinated Homeland Security issues across the Office of Air and Radiation. Before joining ORIA, Barnes had been with the Office of Solid Waste for 14 years, most recently as the Director of the Economics, Methods and Risk Analysis Division. In addition, he has held positions in EPA's policy, enforcement and water offices. Barnes began his career as a researcher at Louisiana State University's, Center for Wetland Resources. He holds a master's degrees in Wildlife and Fisheries Management and Applied Statistics.

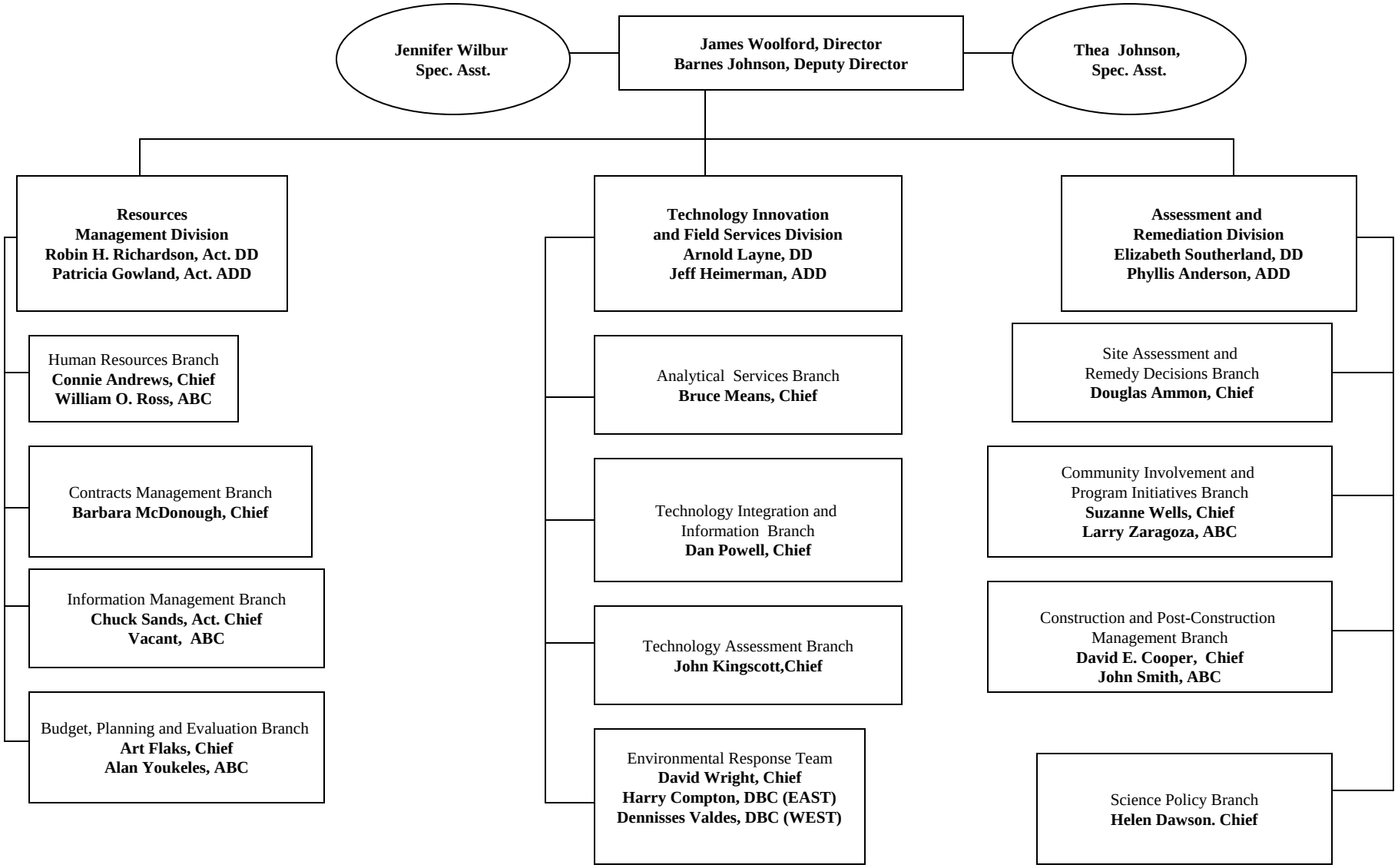
Helen Dawson, Ph.D.

Helen Dawson currently serves as Chief of the Science Policy Branch in the Superfund Program (OSWER/OSRTI/ARD). Previously she served as the Technical Assistance Unit Chief in the Technical Support Program in Region 8, US EPA. For the previous eight years, she served as the Regional Hydrogeologist for the Superfund Program in Region 8, ensuring that EPA’s groundwater policies were implemented at Superfund Sites in the Rocky Mountain Region. She also has been a key member of EPA’s vapor intrusion workgroup developing guidance for the agency since 1999. Prior to joining the US EPA Helen worked for eight years as a professor of Environmental Science and Engineering at the Colorado School of Mines, seven years as a consultant and expert witness to private industry, and five years as a geochemist. Helen has a B.S. in Geology from Stanford University, an M.S. in Geochemistry from the Colorado School of Mines, and a Ph.D. in Environmental Engineering from Stanford University.

Office of Solid Waste and Emergency Response (OSWER)



Office of Superfund Remediation and Technology Innovation



9/8/2009

Superfund Basic Information

(taken from: http://www.epa.gov/superfund/)

What is Superfund?

Superfund is the name given to the environmental program established to address abandoned hazardous waste sites. It is also the name of the fund established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA statute, CERCLA overview). This law was enacted in the wake of the discovery of toxic waste dumps such as Love Canal and Times Beach in the 1970s. It allows the EPA to clean up such sites and to compel responsible parties to perform cleanups or reimburse the government for EPA-lead cleanups.

How Superfund Works

The Superfund cleanup process is complex. It involves the steps taken to assess sites, place them on the National Priorities List, and establish and implement appropriate cleanup plans. This is the long-term cleanup process. In addition, the Agency has the authority

to conduct removal actions where immediate action needs to be taken;
to enforce against potentially responsible parties;
to ensure community involvement;
involve states;
and ensure long-term protectiveness.

The blueprint for these activities is the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a regulation applicable to all federal agencies involved in responding to hazardous substance releases.

Over the past 20+ years, we've located and analyzed tens of thousands of hazardous waste sites, protected people and the environment from contamination at the worst sites, and involved others in cleanup.

Who Implements Superfund

EPA's Office of Solid Waste and Emergency Response (OSWER) in Washington, D.C. oversees the Superfund program. The Office of Emergency Management within OSWER is responsible for short term responses conducted under the authority of Superfund. The Office of Superfund Remediation and Technology Innovation, and the Federal Facilities Response and Reuse Office, also within OSWER, have the lead for managing the long-term Superfund response program, the latter for responses involving Federal Facilities. In addition, OSWER manages the federal Brownfields program.

Regions

EPA's 10 Regional offices around the nation are responsible for implementing many of EPA's programs, including Superfund. For Superfund, EPA regions are the front line in responding to releases of hazardous substances and other emergencies.

U.S. EPA Contaminated Site Remediation Programs and Treatment Technologies

Office of Superfund Remediation and Technology Innovation
U.S. Environmental Protection Agency (EPA)

October 2009

Presentation Outline

- US EPA Overview
- US EPA's Contaminated Site Cleanup Programs
- US EPA Superfund Program
- Risk-based Asbestos Soil Cleanup
- US EPA Asbestos Site Cleanup
- Libby Montana Superfund Site
- Additional Information Sources

Overview of the U.S. EPA

- The U.S. Environmental Protection Agency (EPA) leads the nation's environmental science, research, education and assessment efforts

- Established in 1970, the mission of the EPA is to protect human health and the environment

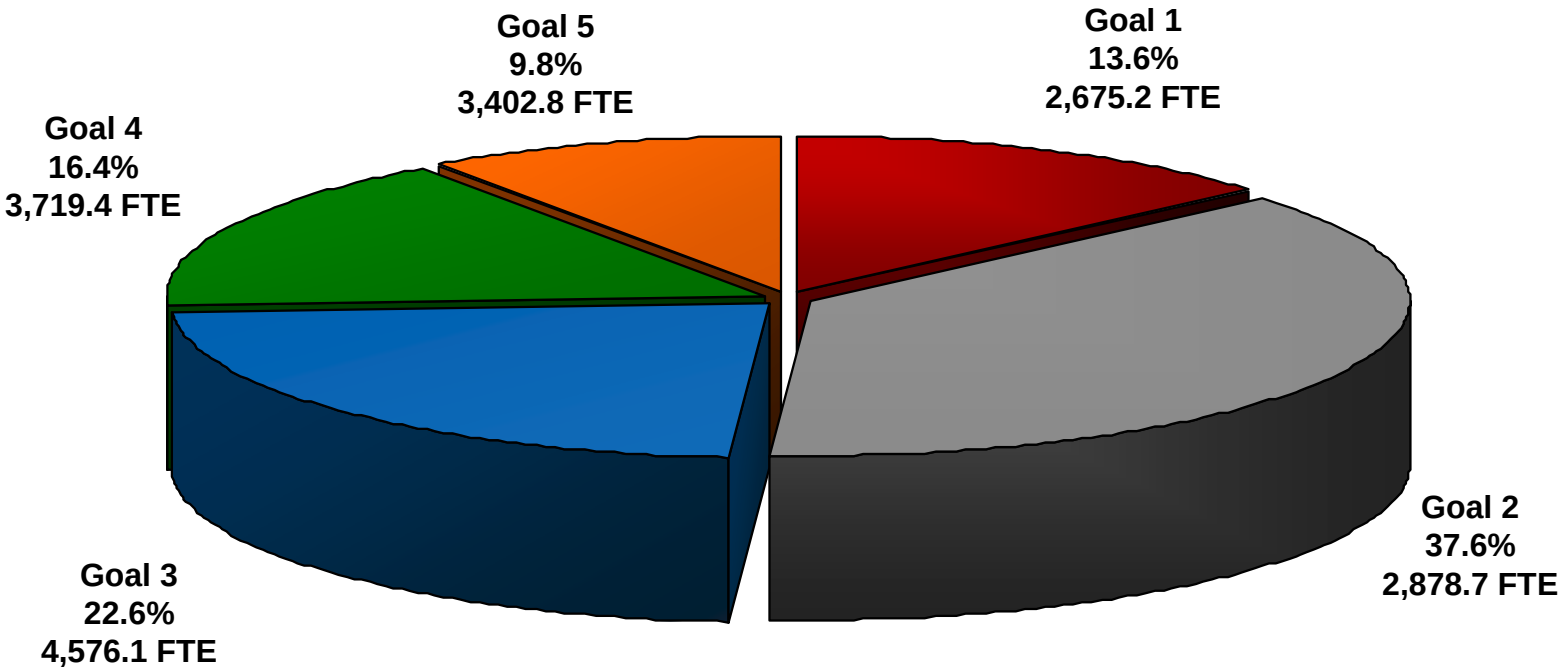
- EPA employs 17,000 people across the country, including our headquarters offices in Washington, DC, 10 regional offices, and more than a dozen labs

- **Five strategic goals:**

  - Clean Air and Global Climate Change
  - Clean and Safe Water
  - **Land Preservation and Restoration**
  - Healthy Communities and Ecosystems
  - Compliance and Environmental Stewardship

EPA 2009 Budget by Goal

Total Agency*: $7.654 Billion USD



- Goal 1: Clean Air and Global Climate Change
- Goal 2: Clean and Safe Water
- Goal 3: Land Preservation and Restoration
- Goal 4: Healthy Communities and Ecosystems
- Goal 5: Compliance and Environmental Stewardship

*Note: Does not include a $10M rescission or Recovery Act funding

Major Environmental Laws Administered by EPA

- Clean Air Act
- Clean Water Act
- CERCLA or Superfund (Comprehensive Environmental Response, Compensation and Liability Act)
- Energy Policy Act
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- National Environmental Policy Act (NEPA)
- Oil Pollution Act (OPA)
- Pollution Prevention Act
- Resource Conservation and Recovery Act (RCRA)
- Safe Drinking Water Act (SDWA)
- Toxic Substances Control Act (TSCA)

- CERCLA (Superfund) and RCRA provide the legal authority for most of EPA's work to preserve and restore the land:
  - Superfund provides the authority to clean up uncontrolled or abandoned hazardous waste sites and return land to productive use; also provides authority to fund Brownfields projects
  - RCRA provides the authority to address risks associated with leaking underground storage tanks and the generation and management of hazardous and non-hazardous wastes

EPA Contaminated Site Programs

- Accidents, spills, leaks, and past improper disposal and handling of hazardous materials and wastes have resulted in tens of thousands of sites across the U.S. that have contaminated our land, water (groundwater and surface water), and air (indoor and outdoor)

- Common categories of contaminants include: industrial solvents, petroleum products, metals, pesticides, bacteria, and radiological materials

- Strategies for addressing contaminated sites include: reducing waste at its source, recycling, managing waste to prevent spills and releases, and cleaning up contaminated property

- **EPA's Contaminated Site Programs**
  - RCRA Corrective Action
  - Underground Storage Tanks
  - Brownfields
  - **Superfund**
  - Federal Facilities

The Superfund Program

- **Superfund's Statutory Framework:**
  - The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) responding to Love Canal, Times Beach, and other discoveries of hazardous waste
  - Amended in 1986 by Superfund Amendments and Reauthorization Act (SARA) and in 2002 by Brownfields Legislation
- **Elements of CERCLA**
  - Provides two types of response: Removals (short term actions, emergencies); and Remedial Actions (long term)
  - Established a Trust Fund from taxes on corporations, petroleum products, certain chemicals, and from general revenues (tax authority expired in 1995)
  - Established strict (without fault) joint and several (each responsible for all) liability for responsible parties
- Annual federal Superfund appropriated budget: approximately $1.2B
- States, local governments, tribes, and potentially responsibly parties also play important financial and oversight roles at Superfund sites

Estimated Number of Contaminated Sites in the U.S.

Program to date (as of end-of-year 2008)

Program	Sites/Properties
Brownfields	450,000 properties
Leaking Underground Storage Tanks	479,000 sites
Superfund Removal/Emergency Response	10,134 actions/ 7,331 sites
RCRA Corrective Action	3,746 facilities
Superfund Remedial **(long-term cleanup)**	1,596 sites

Superfund Remedial Program

- **Program activities include:**
  - Evaluating sites for inclusion on the National Priorities List (NPL)
  - Assessing human health and ecological risks
  - Conducting or overseeing investigations and studies to select remedies
  - Designing and constructing or overseeing construction of remedies and post-construction activities
  - Ensuring sites are ready for anticipated use
  - Facilitating participation of other Federal agencies, state, local, and Tribal governments and communities
  - Providing sound science and continually integrate smarter technical solutions into protection strategies

- Annual Superfund remedial program appropriated budget: approximately $600M

- There are a total of 1,596 final and deleted sites on the NPL

- Nationally, estimated more than 4 million acres are affected

Superfund Site Characteristics

- The selection of remedies at contaminated sites depends largely on the types of media and contaminants present.

- Groundwater and soil are the most prevalent contaminated media. In addition, large quantities of other contaminated material such as sediments, landfill waste and sludge are present at many sites.

- VOCs, SVOCs, and metals are the most common contaminant groups remediated at NPL sites. Most sites are complex, requiring remediation for more than one of these contaminant groups.

Media Groups to be Remediated at NPL Sites

Groundwater	Soil	Sediment
79%	76%	32%

***Total: 1,596 Final and Deleted NPL Sites** **Data as of May 7, 2009**

Remediation Technologies

- Although remedial options may include a variety of possible remedies, the Superfund Amendments and Reauthorization Act of 1986 (SARA) expressed a preference for permanent remedies (that is, treatment) over containment or removal and disposal in remediation of Superfund sites

- EPA currently tracks the status of projects where treatment technologies are applied at NPL sites to collect and analyze information about the progress and contributions of technologies that have been implemented (http://www.clu-in.org/asr/)

- At nearly two-thirds of NPL sites, source control treatment, groundwater treatment, or both, have been implemented or are planned as a remedy for some portion of the site

- The most frequently used established technologies are on- and off-site incineration, solidification/stabilization (S/S), soil vapor extraction (SVE), and thermal desorption for source control, and P&T technologies for groundwater

- Treatment of groundwater after it has been pumped to the surface usually involves traditional water treatment; as such, groundwater P&T remedies are considered established technologies

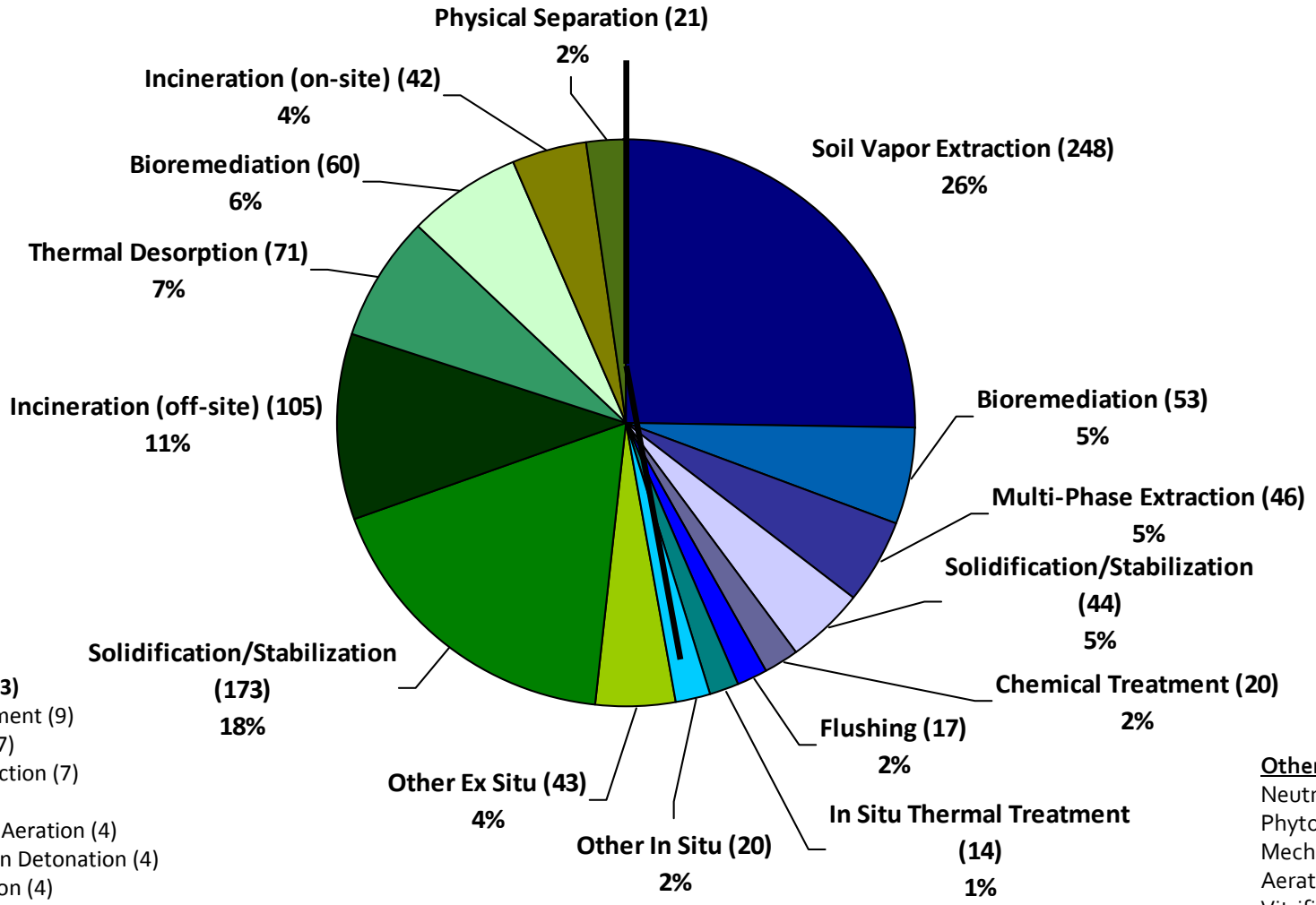
Superfund Soil Treatment Technologies

1982 – 2005

(977 total sites)

Ex Situ Technologies (515) 53%

In Situ Technologies (462) 47%



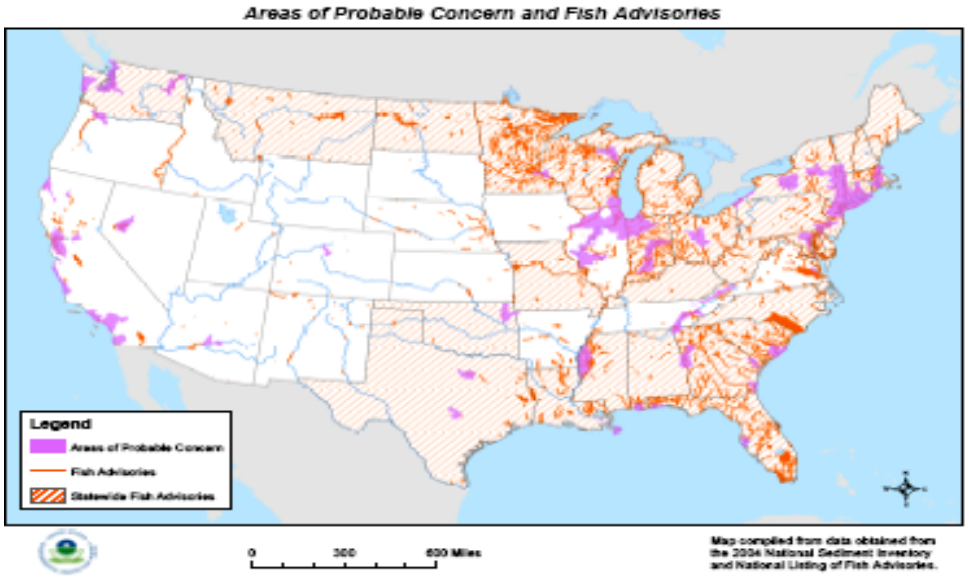
Other Ex Situ (43)
Chemical Treatment (9)
Neutralization (7)
Soil Vapor Extraction (7)
Soil Washing (6)
Mechanical Soil Aeration (4)
Open Burn/Open Detonation (4)
Solvent Extraction (4)
Phytoremediation (1)
Vitrification (1)

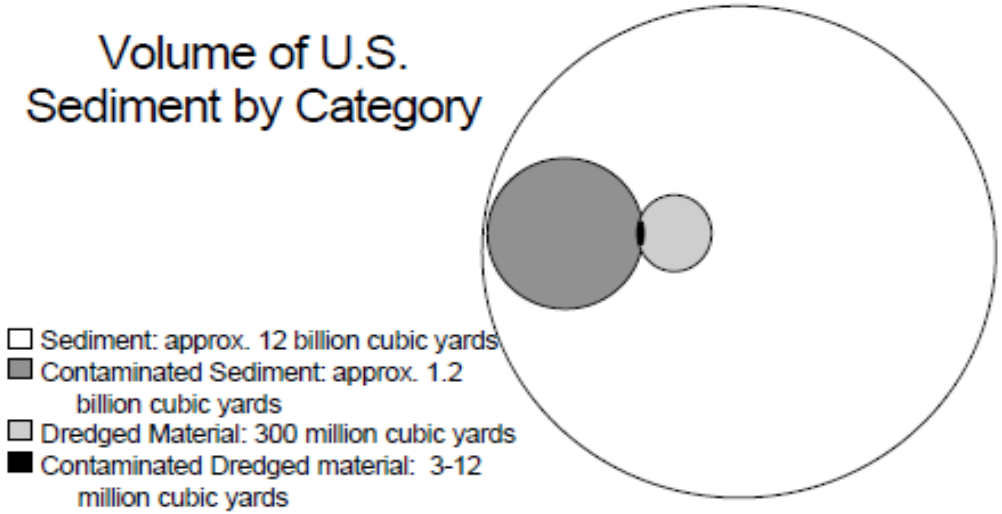
Other In Situ (20)
Neutralization (8)
Phytoremediation (6)
Mechanical Soil Aeration (3)
Vitrification (2)
Electrical Separation (1)

Data source: Annual Status Report, Twelfth Edition, EPA 2007

Sediment Contamination in the U.S.

- 3,200+ fish and shellfish consumption advisories
- Significantly impaired navigational and recreational uses of rivers and harbors
- 35 % of lake acreage (excl. Great Lakes)
- 100 % of the Great Lakes
- 24 % of river miles
- 10% of sediments contaminated enough to pose potential risks to consumers of fish

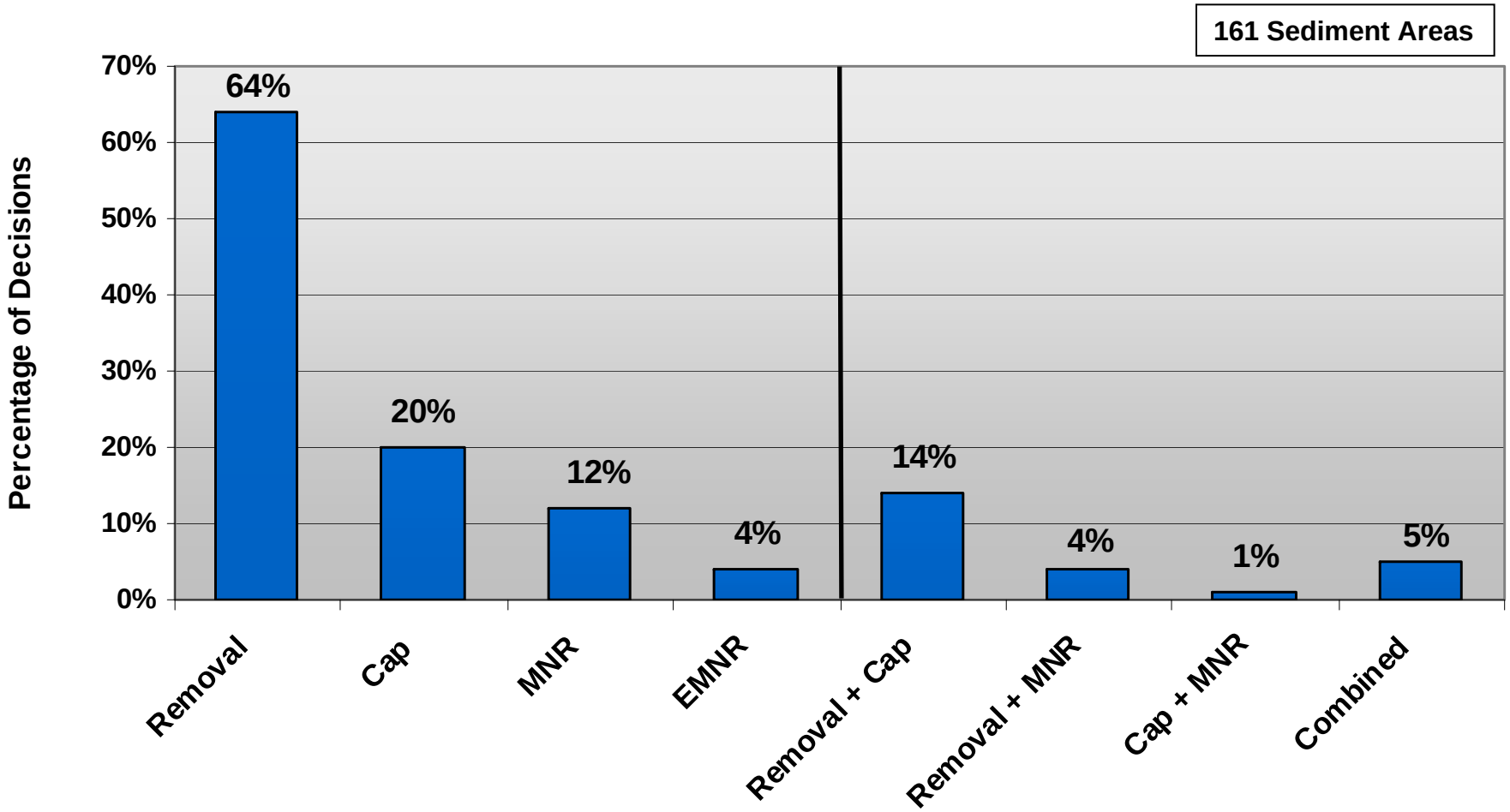




Note: Dredged material shown here is from harbors and shipping channels to maintain commerce. (EPA 1998)

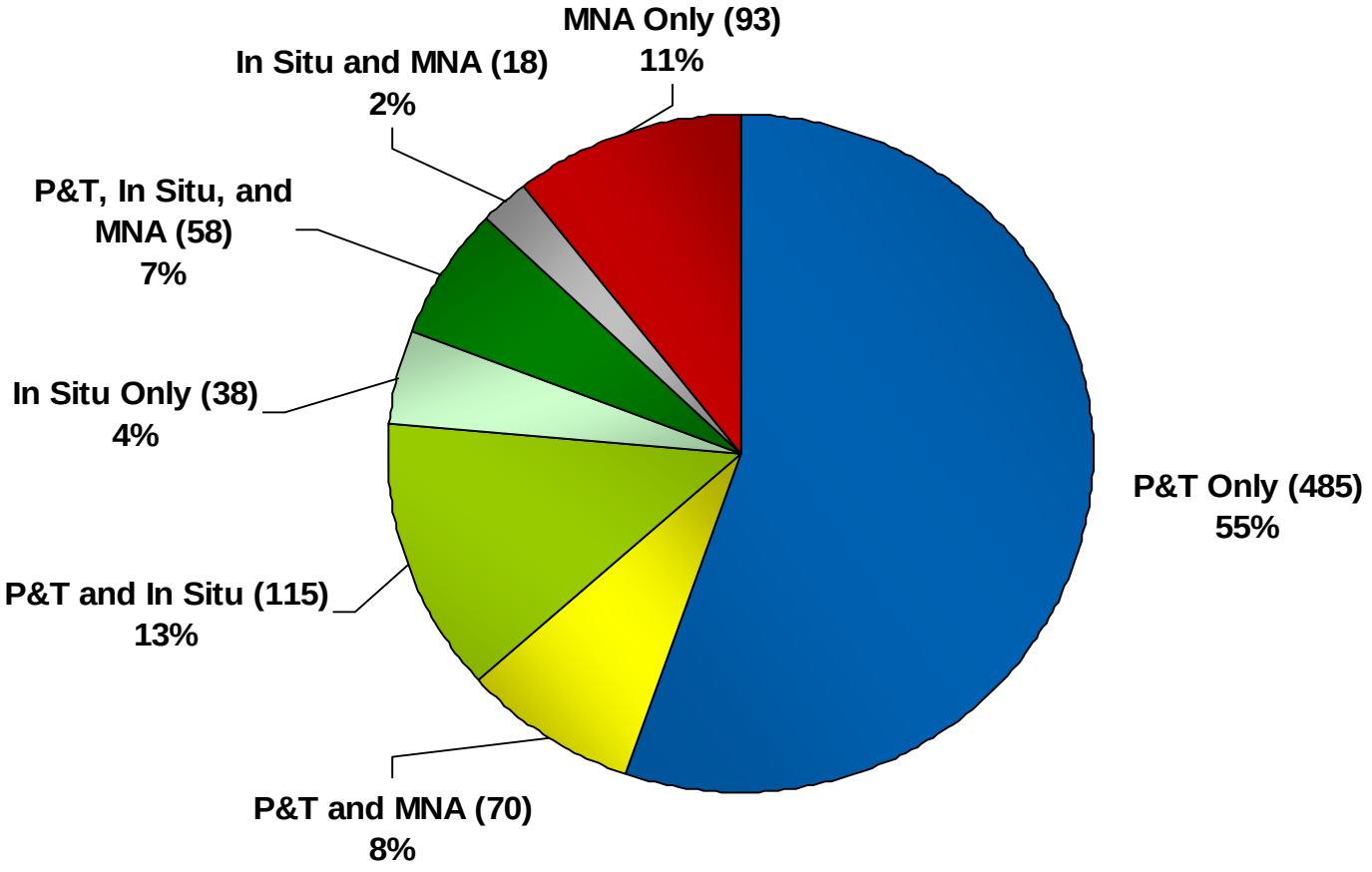
Remedies Selected

1985 - 2008



Superfund Groundwater Remedies

FY 1982 - 2005



Total Number Sites: 877

Data source: Annual Status Report, Twelfth Edition, EPA 2007

Green Remediation

- EPA is actively pursuing options to reduce the environmental footprint of assessing and cleaning up contaminated sites

- An ambitious green remediation strategy has been developed to identify and implement best practices at sites across the country using the authorities and resources currently available

- EPA can protect human health and the environment by cleaning up contaminated sites while at the same time:
  - reducing energy and carbon footprints;
  - minimizing secondary impacts on air and water quality;
  - maximizing recycling of construction and demolition debris and other waste streams; and
  - retaining and restoring ecosystem functions and integrating the cleanup with long term sustainable reuse

- EPA is working across its cleanup programs and with external parties to foster the adoption of green cleanup best practices, such as developing a voluntary green cleanup standards program

Sustainable Use on Contaminated Sites

- Long term stewardship of sites entails a strategy for putting a site into productive use. One significant area we began working on last year was siting renewable energy on Superfund, RCRA, Brownfield, mining sites and other blighted properties. This type of activity:
  - Provides economic value for property that might otherwise lack significant value
  - Furthers environmental sustainability by maximizing land use and optimizing renewable energy opportunities
  - May have lower overall transaction costs compared to greenfields
  - Reduces the stress on greenfields land for construction of new energy facilities
  - Provides clean energy

- EPA has partnered with the Department of Energy to create Google earth interactive maps showing solar, wind, and biomass potential on EPA tracked sites
- EPA has also produced financial incentive sheets describing renewable energy development and contaminated lands redevelopment incentives in each state

Risk-based Asbestos Soil Cleanup

- **Soil Cleanup**
  - Historically 1% asbestos content
  - Now recommend site-specific approach based on personal air monitoring (activity-based sampling)
  - Chuck Nace will describe EPA's Framework for Investigating Asbestos-Contaminated sites

Photo courtesy of Brian Brass, NIST

Photo courtesy of Dan Stralka, US EPA

US EPA Soil Cleanup Sites with Asbestos Contamination

- **The sites with asbestos contamination of soil may be divided into 3 categories**
  - **Removal sites**
  - **Remedial sites**
  - **Naturally Occurring Asbestos**

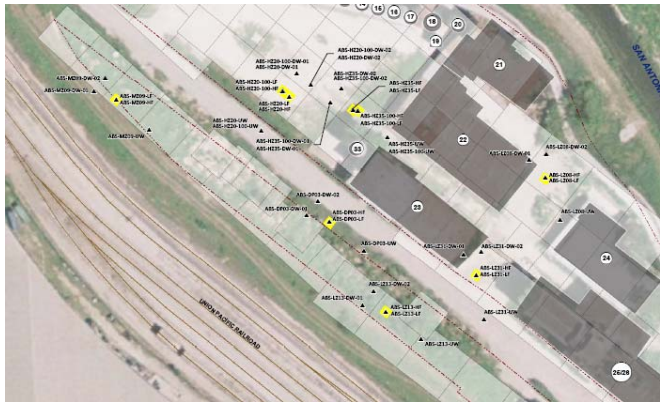


Photo courtesy of Brian Brass, NIST

Photo courtesy of Gerry Hiatt, US EPA

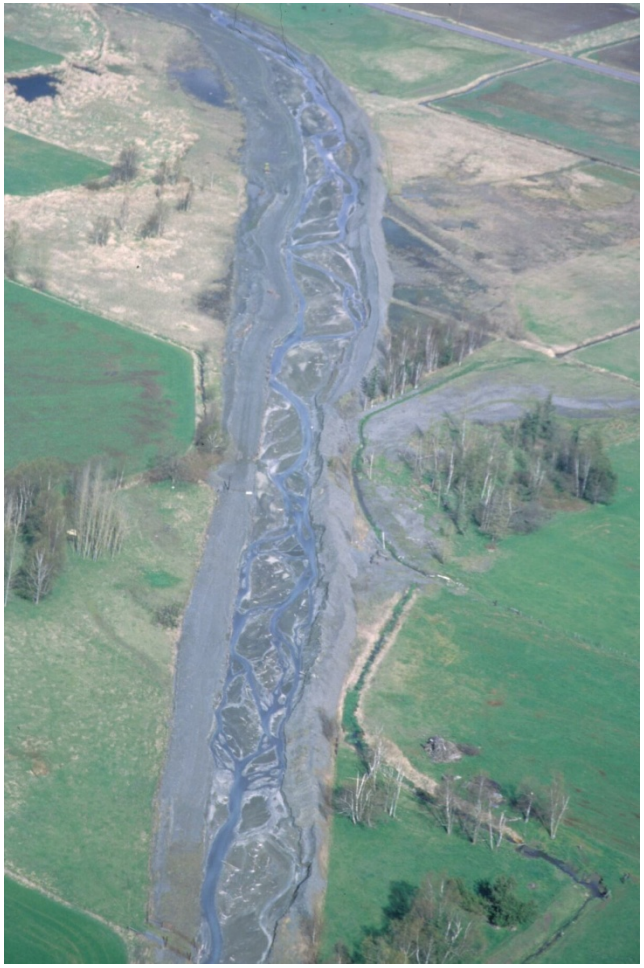


Photo courtesy of Julie Wroble, US EPA

Removal Sites with Asbestos Contamination

- **Removal sites across US**
  - 270 Sites with potential contamination from shipments of contaminated ore from Libby, Montana
  - El Dorado, California (Jere Johnson will discuss)
  - Big Tex, San Antonio, Texas—received ore from Libby, Montana, currently being redeveloped
  - Others?

Photo courtesy of Brian Brass, NIST

Photo courtesy of Brian Brass, NIST

Remedial Sites with Asbestos Contamination

- **30+ Remedial sites across US**
  - Libby, Montana (former mining operation with amphibole asbestos)
  - Coalinga, California (transportation facility for chrysotile mining operations)
  - Others?

Photo courtesy of Chad Conway, Weston

Photo courtesy of Chad Conway, Weston

Additional Information

EPA Superfund

http://www.epa/gov/superfund

Addressing Asbestos at Superfund Sites:

http://www.epa.gov/superfund/health/contaminants/asbestos/index.htm

EPA Environmental Response Team

http://www.ertsupport.org/products.htm

Remedial and Site Characterization Technologies

http://cluin.org

Superfund Risk Assessment

(from http://www.epa.gov/oswer/riskassessment/risk_superfund.htm)

Superfund Ecological Risk Topics:

Planning and Scoping

Problem Formulation

Stressor Response and

Exposure Analysis

Risk Characterization

Superfund Human Health Risk Topics:

Planning and Scoping

Exposure Assessment

Acute Hazards

Toxicity (Hazard Identification and Dose Response)

Risk Characterization

Superfund Additional Risk Assessment Topics:

Risk Management

Risk Communication

Miscellaneous

This website is intended primarily to be a resource for EPA, State, other federal agency and contractor risk assessors and toxicologists. It provides guidance, tools and databases that might be useful in preparing human health and ecological risk assesments on the types of hazardous waste sites addressed by OSWER programs. To some extent, it may also be of interest to some citizens and risk managers who wish to understand the risk assessment process in greater detail. Superfund risk assessments determine how threatening a hazardous waste site is to human health and the environment. Risk Assessors seek to determine a safe level for each potentially dangerous contaminant present. For humans, this is a level at which ill health effects are unlikely and the probability of cancer is very small. For ecological receptors, determining the level of risk is more complicated and is a function of the receptors of concern, the nature of the adverse effects caused by the contaminants, and the desired condition of the ecological resources. There is Ecological Risk Assessment Guidance which should be followed when assessing risks at Superfund sites.

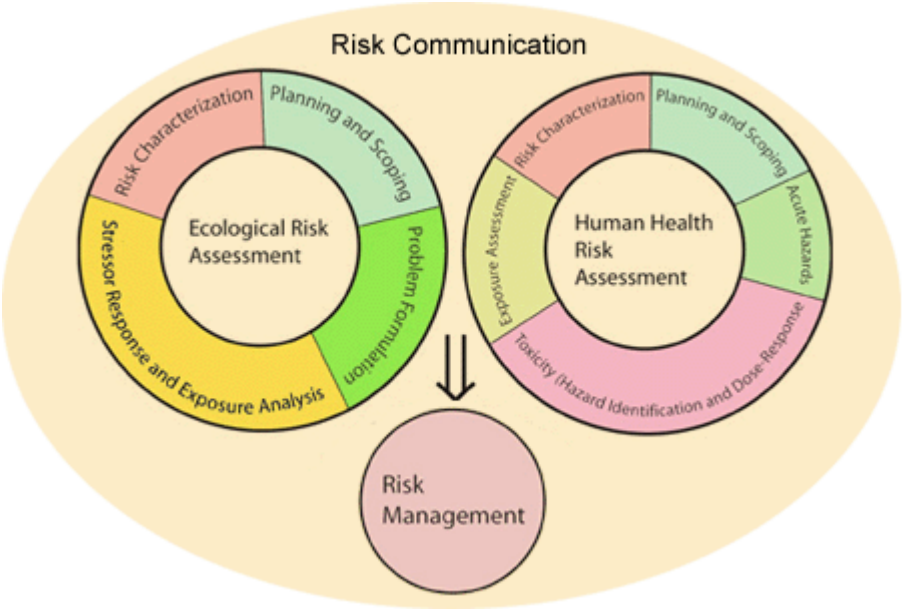
Each Superfund site is unique in terms of the contaminants present and their potential health effects. Therefore, EPA conducts risk assessments on a site-by- site basis. The risk assessment estimates the current and possible future risks, if no action were taken to clean up the site. Superfund's goal is to

manage risks to acceptable levels, and risk managers incorporate risk assessment information with a variety of site factors to select the best cleanup strategies.

Choose a topic at the top of the page to view Superfund-related Risk Assessment information.

Superfund Risk Assessment Paradigm

This diagram represents the components of ecological and human health risk assessments in the CERCLA (Superfund) and RCRA programs. Risk Assessments may proceed in a straightforward, linear fashion, but often repeat stages depending on sampling and analytical results and on decisions made by risk assessors and risk managers. Hence, the components of a risk assessment are shown in a circular fashion, rather than strictly linear (click on the map for more information on the various topics).



Although Ecological Risk Assessments in Superfund are often done in an eight-step process, those steps can be combined into the four categories in the "Ecological Risk Assessment" circle. For more information on the eight-step process please visit either of the following links:

Ecological Risk Assessment in Superfund (an overview of the eight-step process)
Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final

EPA's Ecological Risk Assessment Support Center (ERASC)

The ERASC provides technical information and addresses scientific questions of concern or interest on topics relevant to ecological risk assessment at hazardous waste sites for EPA's Office of Solid Waste and Emergency Response (OSWER) personnel and Regional Superfund/Resource Conservation and

Recovery Act (RCRA) staff. Requests must be channeled to ERASC through the Ecological Risk Assessment Forum (ERAF). To assess emerging and complex scientific issues that require expert judgment, the ERASC relies on the expertise of scientists and engineers located throughout EPA Office of Research and Development (ORD) labs and centers. ERASC develops responses that reflect the "state of the science" for ecological risk assessment and also provides a communication point for the distribution of the responses to other interested parties.

For further information, contact Erasc.Ecology@epa.gov or call 513-569-7940 or visit ERASC's website at www.epa.gov/erasc

For additional information on the Human Health process in Superfund, see Risk Assessment Guidance for Superfund (RAGS) Part A

Risk Assessment Guidance for Superfund (RAGS) Part A

(from http://www.epa.gov/oswer/riskassessment/ragsa/index.htm)

Risk Assessment Guidance for Superfund

RAGS Part A
RAGS Part Vol. III Part A
RAGS Part B
RAGS Part C
RAGS Part D
RAGS Part E
RAGS Part F

RAGS Part A provides guidance on the human health evaluation activities that are conducted during the baseline risk assessment--the first step of the RI/FS. The baseline risk assessment is an analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases (i.e., under an assumption of no action). The baseline risk assessment contributes to the site characterization and subsequent development, evaluation, and selection of appropriate response alternatives. The results of the baseline risk assessment are used to help determine whether additional response action is necessary at the site, modify preliminary remediation goals, help support selection of the "no- action" remedial alternative, where appropriate, and document the magnitude of risk at a site, and the primary causes of that risk.

Baseline risk assessments are site-specific and therefore may vary in both detail and the extent to which qualitative and quantitative analyses are used, depending on the complexity and particular circumstances of the site, as well as the availability of applicable or relevant and appropriate requirements (ARARs) and other criteria, advisories, and guidance. After an initial planning stage, there are four steps in the baseline risk assessment process: data collection and analysis; exposure assessment; toxicity assessment; and risk characterization.

Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) (PDF)
(287 pp, 7.45 MB)

The link above is a large pdf for the entire guidance document.

The below links are for viewing/downloading one section at a time.

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

Section

Table of Contents/Preface (PDF) (16 pp, 93K)

Chapter 1: Introduction (PDF) (12 pages 384K)

Chapter 2: Statutes, Regulations, Guidance, and Studies Relevant to the Human Health Evaluation (PDF) (12 pp, 371K)

Chapter 3: Getting Started: Planning for the Human Health Evaluation in the RI/FS (PDF) (4 pp, 23K)

Chapter 4: Data Collection (PDF) (25 pp, 1MB)

Chapter 5: Data Evaluation (PDF) (29 pp, 1MB)

Chapter 6: Exposure Assessment
Sections 6.1 -- 6.3.3, Text Only (PDF) (8 pp, 55K)

Chapter 6: Exposure Assessment
Sections 6.1 -- 6.3.3, Exhibits (PDF) (9 pp, 659K)

Chapter 6: Exposure Assessment
Sections 6.3.4 -- 6.6.1, Text Only (PDF) (14 pp, 74K)

Chapter 6: Exposure Assessment
Sections 6.3.4 -- 6.6.1, Exhibits (PDF) (4 pp, 293K)

Chapter 6: Exposure Assessment
Sections 6.6.2 -- References, Text Only (PDF) (6 pp, 35K)

Chapter 6: Exposure Assessment
Sections 6.6.2 -- References, Exhibits (PDF) (14 pp, 1.5MB)

Chapter 7: Toxicity Assessment (PDF) (23 pp, 772K)

Chapter 8: Risk Characterization, Text Only (PDF) (22 pp, 913K)

Risk Characterization, Exhibits (PDF) (9 pp, 1.5MB)

Chapter 9: Documentation, Review, and Management Tools for the Assessor, Reviewer, and Manager (PDF) (18 pp, 77K)

Chapter 10: Radiation Risk Assessment Guidance (PDF) (37 pp, 1MB)

Appendix A: Adjustments for Absorption Efficiency (PDF) (4 pp, 18K)

Appendix B: Index (PDF) (12 pp, 38K)

Superfund Ecological Risk Assessment 8-Step Process

(from http://www.epa.gov/region5superfund/ecology/html/8stepera.html)

U.S. EPA Risk Assessment Homepages

- Region 5 Ecological Technical Center and Ecological Risk Assessment
- Region 8 Risk Assessment
- Waste and Cleanup Risk Assessment (OSWER)
- U.S. EPA Risk Assessment Portal

Ecological Risk Assessment Information

- Basic Information
- Guide to ERA 8-steps
- ERA Guidance and Information
- Screening Benchmarks
- ERA Tools
- Case Studies
- Glossary of Terms
- Toxicity Profiles
- Literature References
- Natural Resource Trustees
- Ecological Technical Center Staff
- Region 5 Risk Assessors
- Threatened & Endangered Species Photo Gallery
- Site Map

In the Superfund program, Ecological Risk Assessments are done according the Ecological Risk Assessment Guidance for Superfund (ERAGS). The following diagram and table below are links to each of the eight-steps that are part of this guidance (U.S. EPA, 1997, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final, EPA 540-R-97-006. For more details on any of these steps beyond what is presented on this website, click above to download guidance document).

Steps 1 & 2 are considered to be part of the Screening Level Ecological Risk Assessment

1. Screening-level problem formulation and toxicity evaluation

Problem formulation - information is gathered about the site
Site visit - investigators visit the site
Ecological effects evaluation - review of scientific literature to determine at what levels the chemicals present will have adverse effects

2. Screening-level exposure estimate and risk calculation *

Estimating exposures - calculating how much plants and animals are exposed to chemicals at the site;

Risk calculation - calculation of Hazard Quotients--the comparison of the levels of chemical contamination at the the site to levels that are known to cause harm

Steps 3 to 7 are considered to be part of the Baseline Ecological Risk Assessment

3. Problem formulation *

Refining Contaminants of Potential Ecological Concern (COPECs) - deciding whether or not chemicals found at the site should be considered further in determining potential ecological risk

Contaminant fate and transport - what happens to the chemicals, biologically, chemically, physically and how they move among plants and animals

Mechanisms of toxicity - what are the harmful effects on plants and animals

Ecosystems potentially at risk - habitats and plants and animals present; sensitivity by plants and animals to chemicals; water bodies present

Exposure pathways - how the chemicals pass through the food web from the source of contamination

Assessment endpoints - the characteristic(s) of a plant or animal that can be measured in terms of harmful effects

Conceptual site model - collection of exposure pathways

Risk questions - using various lines of evidence, answer the question "does chemical X cause harmful effects in plant or animal Y?"

4. Study design and data quality objectives process *

Work plan and sampling plan - a written description of how the investigation will proceed at the site

Measurement endpoints - what is measured (i.e., reproduction, mortality, growth, etc.) in relationship to the assessment endpoints

Study design - what type of testing will be done to evaluate the potential ecological risk at the site

Data quality objectives and statistical considerations - a series of planning steps to insure the quality, type, and quantity of data will be adequate and defendable

5. Field sampling plan verification *

Determining if the site conditions still allow the investigation to proceed as described in Step 4 or if new conditions require modifications of the work plan.

6. Site investigation and data analysis *

Site investigation - the work as described in the work plan is carried out

Data analysis - the information gathered is analyzed according to the work plan and statistical design

7. Risk characterization

Risk estimation and characterization - combining the results of the studies performed to produce an estimate of the ecological risk and describe that risk in terms of extent, future potential for risk, how long might contamination remain, and what are the prospects of natural recovery if no action is taken

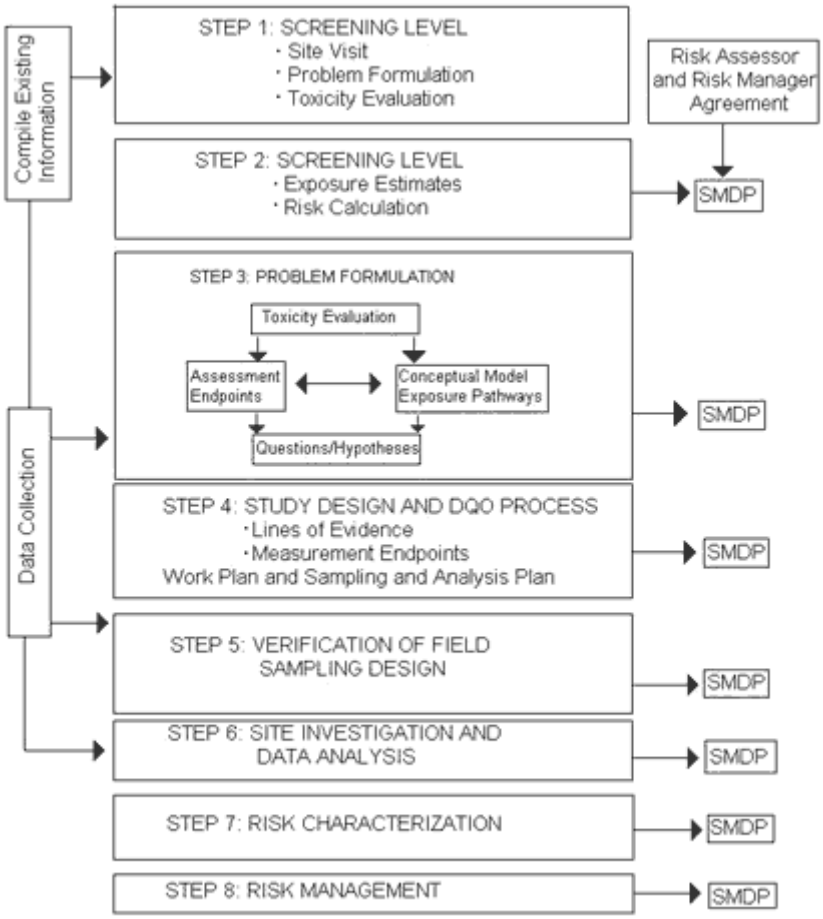
8. Risk management *

Decisions are made concerning what future actions, if any, are to be undertaken.

* These steps are followed by a Scientific Management Decision Point (SMDP), during which it is decided upon appropriate future courses of action, if any.

Figure 1. Schematic Diagram of the Superfund Eight-Step Ecological Risk Assessment (ERA) Process

Note: the diagram is an image map. Click on different parts to go to separate pages on each step. (If the image map does not load, click the 'reload' button on your browser.)



Note: SMDP is the abbreviation for "Scientific Management Decision Point"; these are points in the Ecological Risk Assessment process when the site project manager and scientific advisors decide upon what additional steps, if any, are necessary to take.

Superfund Community Involvement

(From http://www.epa.gov/superfund/community/index.htm)

Community involvement is the process of engaging in dialogue and collaboration with community members.

The goal of Superfund community involvement is to advocate and strengthen early and meaningful community participation during Superfund cleanups. Superfund community involvement staffs at Headquarters and in the Regions strive to:

Encourage and enable community members to get involved.
Listen carefully to what the community is saying.
Take the time needed to deal with community concerns.
Change planned actions where community comments or concerns have merit.
Keep the community well informed of ongoing and planned activities.
Explain to the community what EPA has done and why.

The Superfund Process

There are several steps involved in cleaning up a Superfund site. This section contains an interactive graphic of the Superfund cleanup process. You can click on each step in the graphic to learn more about that phase of the process.

Community Resources

This section provides information about a variety of technical assistance and training resources provided by EPA. These resources help communities fully participate in decisions at local Superfund sites. In addition, links to related are provided to EPA and other programs that also can be useful to communities with Superfund sites.

Community Involvement Policies and Guidance

This section provides access to EPA policy directives and other documents that guide EPA's community involvement efforts.

Superfund Community Involvement Publications

This section contains EPA publications for community members at Superfund sites. These publications include information about how EPA determines the risk at a site, how to get detailed reports about the site in your area, and how EPA supports reuse of sites after they have been cleaned up.

Community Resources

(from http://www.epa.gov/superfund/community/resources.htm)

EPA provides assistance to communities through a variety of technical assistance and training resources. These resources help communities participate in Superfund decisions at sites in their community. This page provides information about community involvement resources provided by EPA as well as links to other programs that may be useful to communities with Superfund sites.

Technical Assistance

Technical Assistance Grants (TAGs)
Provides money for activities that help your community participate in decision making at eligible Superfund sites.

Technical Assistance Services for Communities (TASC)
Provides experts who can explain hazardous waste problems in the community and U.S. EPA's plans for cleaning up these waste sites.

Community Advisory Group (CAG)

Community Advisory Group (CAG)
Provides a public forum for community members to present and discuss their needs and concerns related to the Superfund decision-making process.

Top of Page

Community Training

Community 101: An Overview of the Superfund Program (PDF) (1 pg, 2.3MB, About PDF)
Outlines the Superfund program, Emergency Response, Community Involvement, and the Environmental Justice Initiative.

Contaminated Sediments in Our Waterways: Impacts and Solutions (DVD)
Discusses what sediments are, how they become contaminated, the impact of the pollution, and various solutions for treatment and recovery of the waterways.

HAZ-ED - Classroom Activities for Understanding Hazardous Waste
Provides materials that can be used as part of a larger curriculum, as special stand-alone activities, or on an occasional basis to teach students in grades 7-12 about hazardous waste issues. Additional classroom activities for grades K-6 also are available.

Superfund for Kids
Contains activities and stories, including The Secret of Bog Creek Farm, to introduce children ages three and older to the basic concepts of the Superfund program. A Spanish version of the Bog Creek story, El Secreto de la Granja de Bog Creek, also is available.

Superfund Job Training Initiative (SuperJTI)
Supports job training programs in communities affected by nearby Superfund sites and encourages the employment of trainees at local site cleanups.

"Superfund Risk Assessment and How You Can Help" (Video)
Explains in plain terms the Superfund human health risk assessment process and how communities can be involved. Check with your Regional Community Involvement Coordinator to arrange a presentation of this 40-minute video.

This Is Superfund: A Citizen's Guide to the Superfund Program (PDF) (8 pp, 524K, About PDF)
Provides citizens with a basic understanding of the Superfund process and how they can become involved if there is a Superfund site in their neighborhoods. A Spanish version of this brochure, Guía del ciudadano para el Programa de Superfund (PDF) (19 pp, 475K, About PDF) Disponible en PDF, also is available.

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Conflict Resolution

EPA Conflict Prevention and Resolution Center
Provides resources for consensus building, conflict prevention, and alternative dispute resolution (ADR).

Regional Public Liaison Program (under development)
The ten Regional Public Liaisons (RPL), formerly known as the Superfund Regional Ombudsmen, provide information and assistance to the public in resolving issues and concerns raised about the Superfund and other programs administered by the Office of Solid Waste and Emergency Response

(OSWER). The RPL may: 1) provide information to the public; 2) facilitate informal public contact with EPA staff; 3) help resolve problems; and 4) make recommendations to Agency senior management to resolve issues.

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Useful Links

Community Involvement University (PDF) (18 pp, 349K, About PDF) EXIT Disclaimer
Provides opportunities for U.S. EPA headquarters and regional program personnel to build skills needed for successful community involvement.

Environmental Justice Geographic Assessment Tool (EnviroMapper)
Provides information for preliminary analysis of environmental justice areas of concern, including demographics, such as persons per square mile, per capita income, and percent below the poverty line.

EPA Emergency Planning and Community Right-to-Know
Describes requirements for emergency planning and chemical reporting under the Emergency Planning and Community Right-to-Know Act.

EPA Office of Environmental Justice
Coordinates the Agency's efforts to integrate the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies into all policies, programs, and activities.

EPA's Public Involvement Policy
Provides guidance to EPA staff on effective and reasonable ways to involve the public in EPA's regulatory and program implementation decisions. The Agency defines the term "the public" to include any individual or organization that may have an interest in an Agency decision.

International Association for Public Participation EXIT Disclaimer
Helps organizations and communities around the world improve their decisions by involving those people who are affected by those decisions.

Schools and Mercury
Provides information for school administrators, faculty, staff, local health jurisdictions, and parent groups on how to reduce the hazards of mercury on children's health, avoid chemical liabilities, develop planning tools, and establish collection programs for mercury.

State, Tribal, and Local Government Assistance

Describes programs and funding mechanisms available to assist state, tribal, and local government organizations in responding to cleanup and redevelop contaminated sites and respond to local emergencies.

Superfund Information Center

Provides public access to up-to-date information on U.S. EPA programs, including Emergency Planning and Community Right-to-Know Act and the Toxics Release Inventory, risk management regulations under the Clean Air Act, Superfund, and the Spill Prevention, Control & Countermeasures Plans and the oil pollution prevention regulations under the Clean Water Act and the Oil Pollution Act.

Superfund Relocation Information

Provides background information that was used in developing the Interim Policy on the Use of Permanent Relocations as Part of Superfund Remedial Actions.

SAB Science Integration for Decision Making Fact-Finding Meeting
with Chief, Economics and Risk Analysis Staff, Office of Resource Conservation and Recovery
Conference Room N 6661
Potomac Yard, 2733 Crystal Drive, Arlington, Virginia
Call-in Number for SAB subgroup: 866-299-3188, access code 343-9981 and press the # sign.
November 24, 2009, 3:00 p.m. - 4:00 p.m.

Draft Agenda

Purpose of Interview: to help SAB Committee members learn about the Office of Resource Conservation and Recovery 's current and recent experience with science integration supporting EPA decision making so that the SAB can develop advice to support and/or strengthen Agency science integration efforts.

1. Introductions facilitated by the SAB Staff Office

2. Discussion facilitated by SAB Members
   - Practices for integrating science to support decision making
   - Consideration of public, stakeholder, external scientific, and other input in science assessment
   - Drivers and impediments to implementing past recommendations for science integration
   - Ways program receives feedback on how science is used in decision-making
   - Workforce to support science integration for decision making

3. Identification of any follow-up actions

<u>Planned participants</u>

EPA Office of Resource Conservation and Recovery
Dr. Lee Hoffman, Chief, Economics and Risk Analysis Staff
Mr. Lynn Luben, Chief Economist, Economics and Risk Analysis Staff
Ms. Becky Cutherson, Risk Assessor, Economics and Risk Analysis Staff

SAB Committee on Science Integration Committee Members
Dr. James Bus, Dow Chemical
Dr. James Johnson, Howard University
Dr. Catherine Kling, Iowa State University (by telephone)
Dr. Thomas Theis, University of Illinois at Chicago (by telephone)

SAB Staff Office
Dr. Anthony Maciorowski, Deputy Director
Dr. Angela Nugent, Designated Federal Officer

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EPA Office of Resource Conservation and Recovery
Dr. Matthew Hale, Director

SAB Committee on Science Integration Committee Members
Dr. James Bus, Dow Chemical
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Dr. Catherine Kling, Iowa State University (by telephone)
Dr. Thomas Theis, University of Illinois at Chicago (by telephone)

SAB Staff Office
Dr. Anthony Maciorowski, Deputy Director
Dr. Angela Nugent, Designated Federal Officer

Biosketches of Office of Resource Conservation and Recovery Interviewees

Matthew (Matt) Hale
Director, Office of Resource Conservation and Recovery (ORCR)
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency

Mr. Hale is responsible for managing EPA's programs governing hazardous and solid waste under the Resource Conservation and Recovery Act (RCRA). Before becoming Office Director, Mr. Hale served as Deputy Office Director. Prior to being elevated to the front office, Mr. Hale served as the Director of the Permits and State Programs Division (PSPD). There, he was responsible for implementing the RCRA program throughout the country. Before joining ORCR (formerly named OSW), Mr. Hale was with EPA's Office of Toxic Substances, assigned to the new chemicals program. Mr. Hale holds an undergraduate degree from Harvard College and PhD in history from the University of Maryland.

Elizabeth Hoffman

Dr. Elizabeth Lee Hofmann is Chief of the Economic and Risk Analysis Staff in the EPA's Office of Resource Conservation and Recovery. She joined this Office in October, 2008, acting as Director of the Economics, Methods, and Risk Analysis Division. Prior to that, she was the Deputy Director of the Office of the Science Advisor and the Executive Director of the Risk Assessment Forum. Dr. Hofmann also served as the Senior Science Advisor to the Assistant Administrator for the Office of Solid Waste and Emergency Management. She has been very involved in Agency science policy issues. She is a board-certified toxicologist and an agency expert on risk assessment issues. She received her undergraduate education at Wellesley College and her doctorate at the University of Toronto.

Office of Resource Conservation and Recovery

Matt Hale, Director
Maria Parisi Vickers, Deputy Director

Date: May 7, 2009

Program Management, Communications, and Analysis Office

Robert Hall, Acting Director
Barbara Roth, Assoc. Director

Special Assistants
Lana Suarez
Sara Hartwell

Communications Services Staff
Beth Zelenksi, Acting Chief

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Roy Prince, Chief

Economics and Risk Analysis Staff
Lee Hofmann, Chief; Science Advisor

Materials Recovery and Waste Management Division

Bob Dellinger, Director
Betsy Devlin, Assoc. Director

- **Recycling and Generator Branch** — Charlotte Mooney, Chief
- **Waste Characterization Branch** — James Michael, Chief
- **International and Transportation Branch** — Frank McAlister, Chief
- **Energy Recovery and Waste Disposal Branch** — Rick Brandes, Chief

Resource Conservation and Sustainability Division

Betsy Smidinger Acting Director
Thea McManus, Assoc. Director
Janette Peterson, Assoc. Director

- **Chemicals Management Branch** — Linda Barr, Chief
- **Municipal Source Reduction Branch** — John Cross, Chief
- **Materials Conservation and Recycling Branch** — Deborah Hanlon, Chief
- **Industrial Materials Reuse Branch** — Richard Kinch, Chief

Program Implementation and Information Division

Jim Berlow, Director
Sonya Sasseville, Assoc. Director
Ben Lesser, Sr. Advisor

- **Cleanup Programs Branch** — David Hockey, Chief
- **Permits Branch** — Jeff Gaines, Acting, Chief
- **Federal, State and Tribal Programs Branch** — Michaelle Wilson, Chief
- **Information Collection and Analysis Branch** — Dwane Young, Chief

Office of Resource Conservation and Recovery - Basic Information

(from: http://www.epa.gov/epawaste/basicinfo.htm)

Nearly everything we do leaves behind some kind of waste. Households create ordinary garbage while industrial and manufacturing processes create solid and hazardous waste. EPA regulates all this waste under the Resource Conservation and Recovery Act (RCRA). RCRA's goals are to:

Protect us from the hazards of waste disposal;
Conserve energy and natural resources by recycling and recovery;
Reduce or eliminate waste; and
Clean up waste, which may have spilled, leaked, or been improperly disposed.

Wastes: Hazardous and Non-Hazardous

Hazardous waste is a waste with properties that make it dangerous or potentially harmful to human health or the environment. In regulatory terms, a RCRA hazardous waste is a waste that appears on one of the four hazardous wastes lists (F-list, K-list, P-list, or U-list), or exhibits at least one of four characteristics - ignitability, corrosivity, reactivity, or toxicity.

EPA also is responsible for overseeing the effective disposal of non-hazardous wastes, from common household garbage to large-scale industrial wastes and materials. These wastes and materials are not specifically hazardous, and have opportunities for reduction, reuse, and recycling.

EPA Waste Mission and Goals

Our mission is to protect human health and the environment by ensuring responsible national management of hazardous and nonhazardous waste. Our goals are to:

Conserve resources by reducing waste;
Prevent future waste disposal problems by enforcing regulations; and
Clean up areas where waste may have spilled, leaked, or been improperly disposed.

We work closely with individual states, industry, environmental groups, tribes, and the public to promote safe waste management. These shared responsibilities help us to:

Set national environmental goals, policies, and priorities;
Assume leadership roles in environmental education; and
Write flexible, health-based regulations that reflect ecological risks and environmental justice.

RCRA Program Overview

November 2009

Outline

- Background –Statutory Basis/Breadth of Program
- Implementation Responsibilities – EPA/States/Tribes
- Hazardous Waste
- Municipal Solid Waste
- Resource Conservation Challenge

Overview

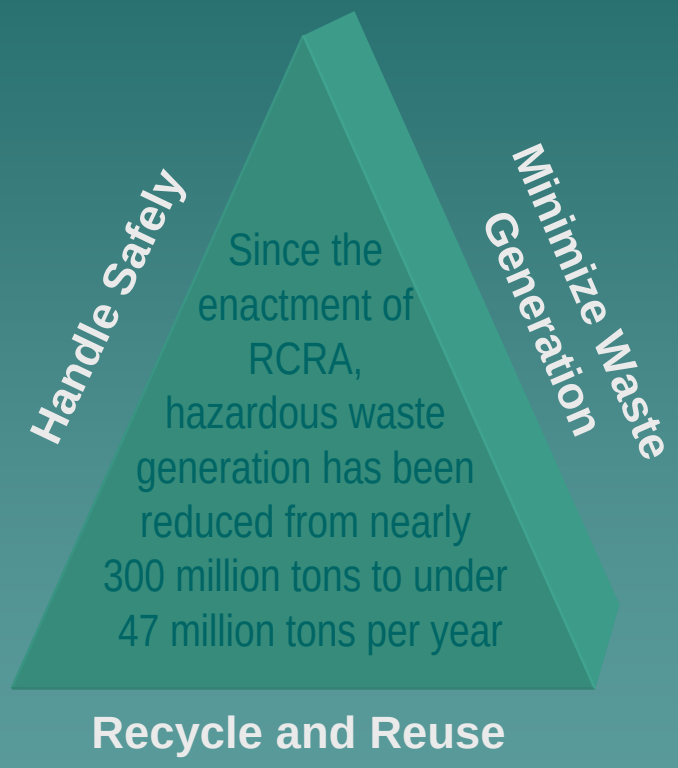
- Our goal is to protect human health and the environment and conserve natural resources
- Today's briefing will focus on two key areas, both of which are statutorily driven
  - Waste management and disposal
  - Resource conservation/energy recovery/climate change

The Resource Conservation and Recovery Act

- *A Law*—Congress outlined in RCRA the framework by which EPA would regulate waste
- *A Set of Federal Regulations*—based on Congress's mandate in RCRA, EPA established the comprehensive set of standards
- *A Regulatory Program*—EPA and states implemented the statute and regulations through guidance and policy statements

Primary Goals of RCRA

- Promote protection of human health and environment through effective waste management
- Conserve materials and energy resources through waste recycling and recovery
- Reduce or eliminate waste generation as expeditiously as possible



Congress envisioned that RCRA would be implemented primarily by the states

- A strong partnership ensures consistency of the program
- EPA sets goals with input from states and other stakeholders
- Authorized states implement and enforce the programs
  - 48 states (excepting Iowa and Alaska) plus DC and Guam have base authorization
- EPA, through grants, provides a portion of state program funding

RCRA requires EPA oversight on Tribal Lands

- Tribes are sovereign nations--EPA is responsible for RCRA implementation on Tribal Lands by:
  - Reporting/Notification for hazardous waste handlers
  - Permitting of RCRA facilities
  - Facility inspections
  - Providing compliance assistance
  - Issuing enforcement orders
  - Corrective Action for TSDFs
- Regions also provide solid waste management grants
  - Priorities set each year, often focus on waste reduction, recycling, or innovative management strategies
  - Authorized by §8001 of the Solid Waste Disposal Act
  - Funding is limited and awards are usually small (i.e., less than $50,000)

A solid waste is considered hazardous if it meets a listing description or exhibits a characteristic

- Hazardous waste listings:
  - Tied to specific industries or descriptions
  - Commonly referred to as F, K, P, and U lists
  - Waste either meets the listing description or it does not
- Hazardous waste characteristics:
  - Based on the property of wastestream
  - Not tied to specific industry or process
  - Ignitability, corrosivity, reactivity, toxicity
  - Commonly referred to as D codes (D001-D043)

F, K, P, and U codes from the listed wastes do not define broader regulatory terms

Management of Hazardous Waste

- A generator is a person whose act first creates or produces a hazardous waste
  - Hazardous waste is produced as a result of business practices
- Transporters are persons engaged in the off-site transportation of hazardous waste
  - Are regulated both by EPA and DOT
  - Transporters must obtain EPA ID numbers and use manifests (currently paper-based—EPA is working on e-manifest system)
- TSDFs are facilities engaged in the treatment, storage, or disposal of hazardous waste
  - Must comply with a more extensive set of regulations
  - Permitting is necessary for operation

RCRA Corrective Action Program

- Cleanup of past and present releases from RCRA facilities
- Few regulations—program is implemented primarily through guidance
- Process is very site-specific
- EPA continues to reform the program
  - Expanded 2020 universe in FY 2009

How facilities become subject to Corrective Action

- EPA can incorporate corrective action into a facility's **permit** using HSWA authorities (RCRA §§3004(u), 3004(v) and 3005(c)(3))
- EPA also issues corrective action **orders** (RCRA §§3008(h) and 7003)
- Facility owners or operators may **volunteer** to perform corrective action

PCB Cleanup & Disposal

- EPA's PCB *Cleanup & Disposal* program was transferred from Office of Prevention, Pesticides, and Toxic Substances in Oct. 2007
  - Authorized under Toxic Substances Control Act (TSCA)
  - The PCB *Use* program remains with OPPTS
- ORCR is now responsible for:
  - Permits for Disposal & Cleanup
  - Remediation
  - Notification of PCB Activities
  - Decontamination
  - Storage for Disposal
  - Trans-Boundary Shipments for Disposal
  - Spill Cleanup Policy

Municipal solid waste (MSW) consists of a variety of components

- Household wastes
- Non-hazardous waste from small businesses
- Containers and packaging
- Food wastes
- Yard trimmings
- Miscellaneous inorganic wastes
- Construction & Demolition (C & D)

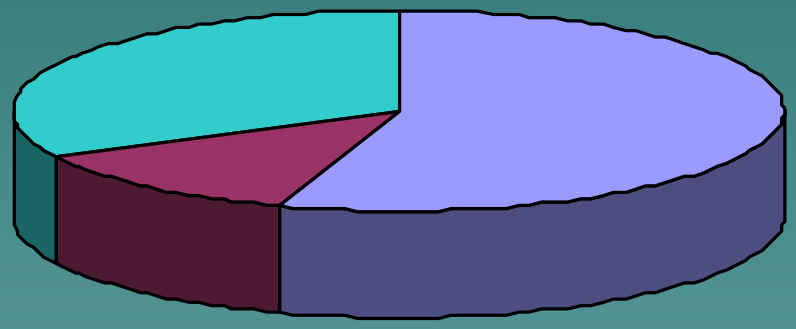
Industrial/Special Wastes under RCRA

- We’re addressing multiple issues associated with regulating coal combustion wastes (CCW) and cement kiln dust (CKD)
- We’re working with the Office of Surface Mining, which is taking the lead on environment issues and regulating minefilling

Municipal solid waste is managed by three main methods

Recovery
33.2%
83 million tons

Land Disposal
54.0%
135 million tons

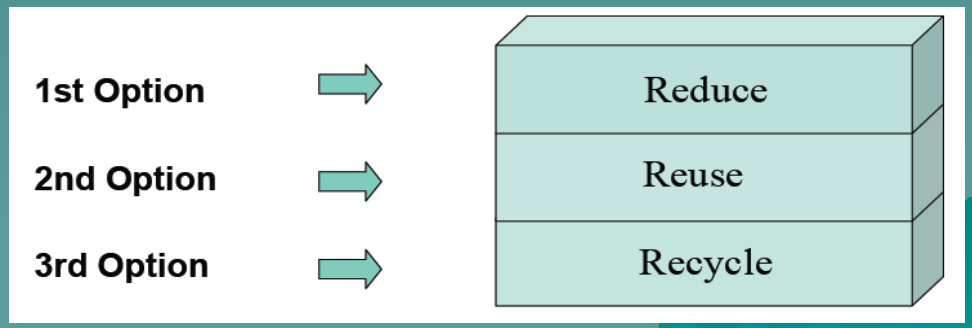


Combustion
12.8%
32 million tons

Management of MSW in the United States, 2008
Total weight = 250 million tons

EPA has developed an integrated hierarchy for managing solid waste

- EPA encourages everyone to produce less waste by practicing the 3 Rs
  - Reduce the amount and toxicity of trash discarded
  - Reuse containers and products--repair what is broken or give it to someone who can repair it
  - Recycle as much as possible, which includes buying products with recycled content
- As a last resort, solid waste should be combusted for energy recovery or landfilled



There are several challenges in managing municipal solid waste

- Recycling and disposal patterns have changed substantially in the last few decades
  - Waste generation and waste recycling rate have both increased since 1980
  - Landfill disposal rates have fallen to only 54% of amount generated in 2008, down from 89% in 1980
- Economic issues such as competing budget demands and increasing management costs
- Continued public concerns, Not In My Backyard (NIMBY)
- Need to reduce waste generation, conserve resources, and ensure safe management and disposal

The Resource Conservation Challenge Strategic Plan aligns internal EPA and state projects, goals, and strategies

- Short term: focuses primarily on solid waste and pollution prevention
- Long term: transform the nation's current waste-handling system to a materials management system
  - Challenges everyone to put "resource conservation and recovery" into design, manufacturing, and purchasing decisions
- EPA has identified four key areas for national focus
  - Priority and toxic chemical reductions
  - Municipal solid waste recycling
  - Reusing and recycling industrial materials
  - Green initiatives
    - Electronics and Green Building

EPA is using innovative waste reduction projects to help promote resource conservation

- Recycling Initiatives
- Composting
- Pay-As-You-Throw Programs
- Reuse and Exchange Programs
- Outreach Programs
- WasteWise
- National Partnership for Environmental Priorities

- Plug-In to eCycling
- Recycling on the Go
- GreenScapes

EPA is relying on partnerships and projects to meet the Resource Conservation Challenge

- EPA is establishing and expanding many partnerships with industries, states, tribes, and other entities to reduce waste
- These partnerships are designed to
  - Improve environmental performance by challenging stakeholders to identify and implement innovative approaches that go beyond compliance and current regulations
  - Increase public recognition and awareness of partners' waste reduction activities
  - Provide smarter, faster solutions that safeguard human health and the environment and provide measurable results
  - Help EPA meet the goals of the RCC
- Additional information on each of the partnership programs is available at www.epa.gov/rcc/partners.htm

Some of the Unfinished Business of RCRA

- Municipal Waste
  - Increase energy savings and reduce greenhouse gas emissions through recycling and source reduction
- Hazardous Waste Minimization
  - Reduce priority toxic chemicals used in manufacturing that end up in the nation's waste stream
- Non-hazardous Industrial Waste
  - Characterize management techniques and promote reuse and recycling
- Tribal
  - Address open dumps, help tribal communities put integrated solid waste management plans in place

Some of the Unfinished Business of RCRA (continued)

- Generation, Transportation and Storage
  - Continue to work on e-manifest system to take advantage of technology changes and reduce burden to regulated community
- Permitting
  - Develop e-permitting approach
  - Reduce permitting burden and increase efficiencies
- Corrective Action/Revitalization
  - Meet aggressive 2020 goals for cleanups
  - Increase the revitalization of RCRA facility sites and affected communities

RCRA Guidance, Policy and Resources

(taken from http://www.epa.gov/epawaste/laws-regs/rcraguidance.htm)

EPA develops and issues guidance documents to provide instructions for implementing and complying with regulations. Guidance documents also elaborate on the Agency's interpretation of the requirements of the Act. Policy statements outline a position on a topic or specify procedures that should generally be followed. In many cases, policy statements are addressed to EPA staff, but some are addressed to the regulated community.

RCRA Online is an electronic database that indexes thousands of letters, memoranda, publications, and questions and answers issued by EPA's Office of Resource Conservation and Recovery (ORCR). These documents include EPA interpretations of the RCRA regulations governing the management of solid, hazardous, and medical waste. RCRA Online allows users to locate documents through topical, full text, and advanced search functions. RCRA Online also allows users to view the actual text of the documents identified in a search.

RCRA Orientation Manual provides introductory information on the solid and hazardous waste management programs under the Resource Conservation and Recovery Act (RCRA). Designed for EPA and state staff, members of the regulated community, and the general public who wish to better understand RCRA, this document constitutes a review of the RCRA program and is not a substitute for RCRA or its implementing regulations.

RCRA Training Modules provide overviews of specific RCRA regulatory topics, for example, corrective action, exclusions, financial assurance, and permits. Two modules in particular provide a statutory overview of RCRA (PDF) (34 pp, 83K, about PDF) and an overview of other laws that interface with RCRA (PDF) (27 pp, 114K, about PDF).

RCRA in Focus (RIF) is a series of publications providing overviews of the RCRA regulations affecting specific industry sectors. Intended as a guide for small businesses, RIF presents the life cycle of a typical waste for each industry and focuses on recycling and pollution prevention options. Each issue contains a hazardous waste table of RCRA requirements for small businesses and answers frequently asked questions.

RCRA: Reducing Risk from Waste provides an overview of the RCRA solid and hazardous waste regulations. The document describes the history of RCRA, the role of EPA and the states, and hazardous waste definitions and management requirements (including the roles of generators, transporters, and treatment, storage, and disposal facilities). Information on hazardous waste minimization is also provided.

25 Years of RCRA: Building on Our Past to Protect Our Future (PDF) (21 pp, 838K) provides an historical overview of the evolution of RCRA and it major accomplishments.

Beyond RCRA: Prospects for Waste & Materials Management in the Year 2020 is a discussion paper developed jointly by EPA and state environmental agencies to open and inspire discussion on the future for the RCRA program during the next 20 years. It identifies a number of trends that could affect the future of waste and materials management, resource conservation, and human and environmental health, and suggests general strategies and tools that might be used to build a new vision for the future of the RCRA program.

RCRA Public Participation Manual

(From http://www.epa.gov/osw/hazard/tsd/permit/pubpart/manual.htm)

Background | Anticipated Utility | Documents

The RCRA Public Participation Manual is intended as a "user's manual." It explains how public participation works in the RCRA permitting process (including corrective action), and how citizens, regulators, and industry can cooperate to make it work better. It also describes a wide assortment of activities to enhance public participation, and includes several appendices that provide lists of contacts, sources of information, and examples of public participation tools and activities.

Background

The 1996 RCRA Public Participation Manual supersedes the 1993 RCRA Public Involvement Manual. It was revised, among other reasons, (1) to provide additional guidance on the new RCRA public participation requirements, as promised in the final RCRA Expanded Public Participation rule (60 FR 63417, December 11, 1995), and (2) to broaden its scope so that it will be useful to members of the public and regulated industry, as well as to permit writers.

The broader scope reflects EPA's belief that all stakeholders in RCRA permitting actions have a role in providing for meaningful public participation. Each stakeholder group -- regulators, public interest organizations, community members, and regulated facilities -- can take steps to increase participation and improve communication. Of course, the Federal and State agencies still administer RCRA and its public participation activities, but EPA acknowledges that members of communities and owners/operators of hazardous waste management facilities also play an integral role in the permitting process. The manual describes activities that EPA hopes empower all groups to maximize their role.

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Anticipated Utility

In general -- The manual provides detailed descriptions for dozens of public participation techniques -- required and optional, formal and informal. It also contains a wide variety of resources such as EPA policy memoranda, lists of contacts, fact sheets, and examples of public notices and press releases.

To regulators - The manual provides specific details about public participation requirements and outlines EPA's current policies. The manual also explains activities to help you provide better information to the public and to invite more public input into your RCRA permitting work. The manual provides tips for opening up dialogue with other stakeholders, for assessing communities and being sensitive to their concerns, and for planning public participation strategies.

To the public - The manual clearly describes the many public participation activities required by federal RCRA permitting regulations. It also points out steps that agencies, company owners and public interest groups may take to provide more public input into the permitting process. It includes useful tips on interacting with other stakeholders and conducting community involvement activities. It also includes several lists of people and organizations that you can tap into to learn more about the permitting process and community organizing.

To the regulated community - The manual describes when and how to conduct public participation events required by RCRA. It describes opportunities companies can provide that go beyond the requirements, and provides insights into how to cooperate and communicate with other stakeholders. The manual will be helpful to many companies that have or are setting up public participation programs.

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Documents

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Table of Contents (PDF) (3 pp, 10K) || TEXT
What This Manual Can Do For You (PDF) (3 pp, 16K) || TEXT
Chapter 1: Introduction (PDF) (6 pp, 21K) || TEXT
Chapter 2: Guidelines for a Successful Public Participation Program (PDF) (26 pp, 75K) || TEXT
Chapter 3: Public Participation During the RCRA Permitting Process (PDF) (34 pp, 91K) || TEXT
Chapter 4: Public Participation in RCRA Corrective Action Under Permits and Section 3008(h) Orders (PDF) (18 pp, 51K) || TEXT
Chapter 5: Public Participation Activities: How To Do Them (PDF) (143 pp, 265K) || TEXT
Appendix C: League of Women Voters Directory (PDF) (5 pp, 13K) || TEXT
Appendix D: Environmental Justice Public Participation Checklist (PDF) (8 pp, 17K) || TEXT
Appendix H: Examples of RCRA Notices (PDF) (17 pp, 54K) || TEXT
Appendix I: Examples of Additional RCRA Public Participation Tools (PDF) (44 pp, 814K) || TEXT
Appendix L: Permit Modifications Fact Sheet (PDF) (5 pp, 26K) || TEXT
Appendix M: Public Participation Resources Available to the Permitting Agency (PDF) (2 pp, 13K) || TEXT
Appendix N: Memorandum on Implementation of RCRA Public Participation Rule (PDF) (3 pp, 11K) || TEXT
Appendix O: Overview of Public Participation in RCRA Program (PDF) (10 pp, 125K) || TEXT
Appendix P: Public Participation in Enforcement and Compliance (PDF) (14 pp, 164K) || TEXT
Appendix T: Glossary of Acronyms (PDF) (1 pp, 7K) || TEXT

The hardcopy version of the 1996 RCRA Public Involvement Manual also includes the following appendices:

Appendix A: List of EPA Contacts - For current contact information, please refer to the Wastes Web site state and regional pages.

Appendix B: List of State RCRA Contacts - For current contact information, please refer to the Wastes Web site state and regional pages.
Appendix E - Guidance for Community Advisory Groups at Superfund Sites
Appendix F - Public Participation Regulations in 40 CFR Part 25
Appendix G - Public Participation Regulations in 40 CFR Part 124 Subpart A
Appendix J - Hazardous Waste Facility Permitting Process Fact Sheet (1996)

Appendix K - RCRA Expanded Public Participation Final Rule and Brochure (December 11, 1995)

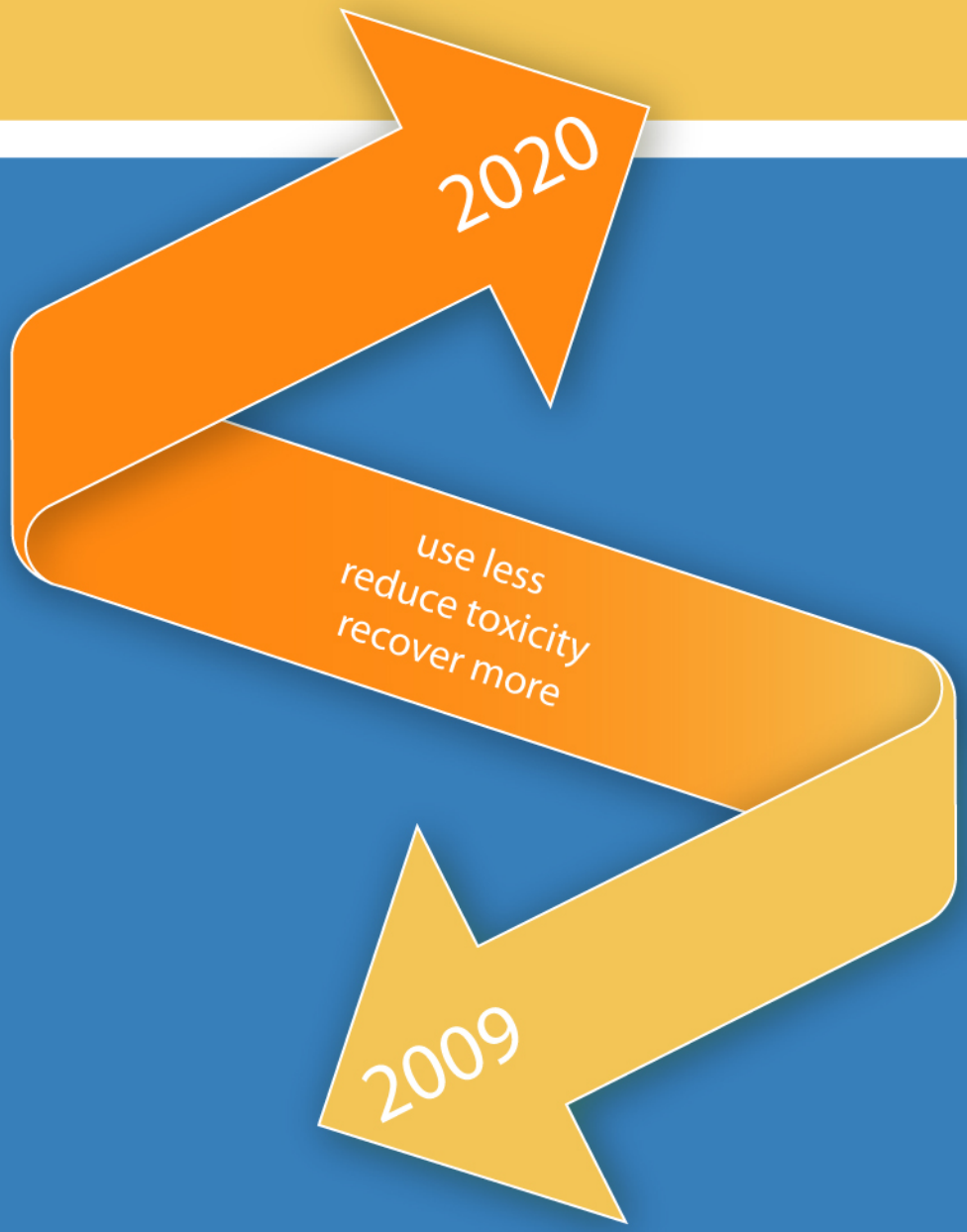
Appendix Q: Task Group Participants - For current contact information, please refer to the Wastes Web site state and regional pages.

Appendix S: State Pollution Prevention Programs - For current contact information, please refer to the Wastes Web site state and regional pages

Appendix R - Accessing EPA Information (which includes two documents):
How to Access the RCRA Information Center; and Environmental Fact Sheet

Sustainable Materials Management:

THE ROAD AHEAD



EPA United States Environmental Protection Agency

June 2009

Acknowledgements

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Executive Summary

We live in a material world. How our society uses materials is fundamental to many aspects of our economic and environmental future. If we want the U.S. to be competitive in the world economy, the sustainable use of materials must be our goal.

Our key message is simple.

- *Our use of materials is very large and increasing with population and economic growth. Energy and water use accompany materials use.*
- *Our use of materials now challenges the capacity of the Earth – air, water and land – to withstand the many resulting environmental problems. This situation fundamentally affects many other aspects of our future, such as the economy, energy and climate. We need to fulfill our human needs and prosper while using less material, reducing toxics and recovering more. Business as usual cannot continue.*
- *The public and private sectors have many of the tools that we need to manage materials much more carefully than we typically do today. However, these tools are seldom used to address the full life cycle of materials. This report describes specific measures that EPA and state environmental agencies can take to: (1) promote efforts to manage materials and products on a life-cycle basis, using present authorities, (2) build our capacity to manage materials in the future, and (3) accelerate the public dialogue necessary to start a generation-long shift in how we manage materials and create a green, resilient and competitive economy. We should begin aggressively.*

Our Material World

The foundation that underlies the world economy, prosperity and a healthy environment rests largely on how people extract and use the full range of materials that come from and return to the Earth such as wood, minerals, fuels, chemicals, agricultural plants and animals, soil, and rock.

The world at large and the United States in particular use vast amounts of materials and those amounts are rapidly increasing.

- In the past 50 years, humans have consumed more resources than in all previous history.
- The U.S. consumed 57% more materials in the year 2000 than in 1975; the global increase was even higher.
- With less than 5% of the world's population, the U.S. was responsible for about one-third of the world's total material consumption in 1970-1995.
- In 1900, 41% of the materials used in the U.S. were renewable (e.g., agricultural, fishery, and forestry products); by 1995, only 6% of materials consumed were renewable. The majority of materials now consumed in the U.S. are nonrenewable, including metals, minerals, and fossil-fuel derived products.
- Our reliance on minerals as fundamental ingredients in the manufactured products used in the U.S.—including cell phones, flat-screen monitors, paint, and toothpaste—requires the extraction of more than 25,000 pounds of new nonfuel minerals *per capita* each year.
- This rapid rise in material use has led to serious environmental effects such as habitat destruction, biodiversity loss, overly stressed fisheries, and desertification.

Projections are that between **2000 and 2050, world population will grow 50%, global economic activity will grow 500%, and global energy and materials use will grow 300%**. Commenting on the effects of material resource use on the environment, the heads of major research institutes in the United States, Germany, Japan, Austria, and the Netherlands have noted that "**unless economic growth can be dramatically decoupled from resource use and waste generation, environmental pressures will increase rapidly**.[1]"

The strategic importance of materials is causing many people to look very carefully at all aspects of the material life cycle that comprise our industrial practices and consumer habits. The material lifecycle begins with the extraction or harvesting of raw materials. Materials are then transported and processed to create the products and services that drive our society. They are distributed, consumed, reused or recycled, and ultimately disposed.

Each stage of this cycle requires energy and water as inputs and creates impacts on the environment. Because the stages are interrelated, it is important that sound approaches to materials use consider the entire life cycle. The price system, regulatory framework, technical information and human mindsets must all work together to enable and encourage **life-cycle materials management – an approach to serving human needs by using/reusing resources most productively and sustainably throughout their life cycles, generally minimizing the amount of materials involved and all the associated environmental impacts.**

By considering system-wide impacts, life-cycle materials management casts a far broader net than traditional waste and chemicals management approaches and represents a change

in how we think about environmental protection. There are many means by which life-cycle materials management can be accomplished. For instance, careful industrial and product design that reduces virgin material use and reuses materials can reduce impacts throughout the system.

While there are a number of existing EPA and state programs that are helping to move the U.S. toward a more material-efficient society, there is no comprehensive materials management strategy at the Federal level. Regulations and economic instruments seek to prevent or mitigate certain impacts, but rarely take meaningful account of upstream or downstream effects.

To accomplish the shift to life-cycle materials management, governments at all levels need to make systematic efforts to enable, encourage, and collaborate with all parts of society, including business and consumers, to ensure that materials are used more efficiently and effectively. There is much work to be done, but there also is reason for modest optimism. An increasing number of industries and individual companies are taking a life-cycle view of their materials and processes and becoming more sustainable and competitive.

Origin of This Report

In 2002, EPA published "Beyond RCRA: Waste and Materials Management in the Year 2020"—commonly referred to as the 2020 Vision. The 2020 Vision was the product of a state/EPA workgroup and was endorsed by EPA and state environmental and waste program officials. One of the key findings was the need for society to shift focus away from waste management toward materials management. Even before the Vision's release, states and EPA had been moving in this direction and in the years that followed they have continued to make progress.

In January 2007 the directors of EPA's waste and chemical programs convened the present 2020 Vision Workgroup to develop a roadmap to accelerate the move toward sustainable materials management.

Building an Analytic Framework

The U.S. economy is a highly complex and intertwined system that transforms a few hundred raw materials into thousands of products. It would be unrealistic to focus on and transform all the materials and products consumed in an entire economy simultaneously. Instead, the Workgroup recommends a strategy that includes a few well-chosen demonstration projects to provide insights into applying integrated materials management approaches (including the need for better coordination of resources, product and waste programs). To help identify candidates for these demonstration projects, the Workgroup developed a framework to relatively rank the materials, products and services consumed in the U.S. from a life-cycle perspective, accounting for the environmental impacts, resource

use (material, energy, water), and waste. This framework reflects the Workgroup's belief that these are the types of information that must be accounted for from a lifecycle perspective when applying materials management. Thirty-eight (38) materials, products and services were identified as possible candidates for demonstration projects. These can be roughly grouped into construction and development, food products and services, forestry, metals, nonrenewable organics, textiles, and other products and services.

Recommendations

The Workgroup makes three major recommendations to EPA and state environmental agencies. Some of these recommendations reflect points in international agreements under the Organization for Economic Cooperation and Development (OECD) and the Group of 8 (G8) endorsed by the United States in 2008.

1. **Promote efforts to manage materials and products on a life-cycle basis**. EPA and state environmental agencies should initiate demonstration projects on a few well-chosen materials and products to show the value of integrated materials management strategies. Further, these agencies should incorporate materials management as an important strategic approach for addressing climate change and other environmental challenges. The focus of existing chemical and waste programs should be expanded to encompass life-cycle materials management more fully.

2. **Build capacity and integrate materials management approaches in existing government programs**. EPA and state environmental agencies must ensure the availability of data and decision tools needed to support life-cycle materials management, including necessary research. Materials management strategies should be integrated into regulatory development, permitting and partnership programs. EPA and states should recognize and support champions who make this happen.

3. **Accelerate the broad, ongoing public dialogue on life-cycle materials management**. Governments alone cannot bring about the shift to life-cycle materials management. EPA and state environmental agencies should convene multi-stakeholder national dialogues on materials management to create public awareness of the environmental consequences of material and product choices and accelerate the momentum toward change at all levels. It also will be critical for the Agency to participate in international efforts related to sustainable material management.

These recommendations represent parallel paths that should be taken at the same time. Specific actions described under each recommendation are a mix of near term and long term efforts to develop the data, information, programs, policies, and partnerships that will begin to change the ways we think about and use materials.

These changes will not be easy. This report is a roadmap to the year 2020 – eleven years away. While this is not enough time to complete the changes recommended, it is enough time to make substantial progress. Starting now is critical because many of the issues we are facing require long-term solutions that cannot be put into place quickly when a problem becomes obvious or acute. The recommendations can be an important element of our national strategy to address current economic, energy, environment and climate issues and set us on a course to be more prosperous, competitive and resilient for years to come.

RECOMMENDATIONS

RECOMMENDATION 1: Promote efforts to manage materials and products on a life-cycle basis.

1.1 Select a few materials/products for an integrated life-cycle approach, and launch demonstration projects.
1.2 Expand the focus of existing environmental programs to encompass life-cycle materials management more fully.
1.3 Promote specific materials management approaches that can help address climate change.
1.4 Promote greener products, product stewardship, and product-to-service transformations.
1.5 Strengthen market signals to reduce waste and other adverse environmental impacts throughout the life cycle of materials.

RECOMMENDATION 2: Build capacity and integrate materials management approaches in existing government programs.

2.1 Establish and improve databases to promote materials management.
2.2 Improve decision tools to support life-cycle materials management.
2.3 Expand research and innovations support programs to promote materials management.
2.4 Emphasize materials management in EPA and state processes and procedures.
2.5 Support and reward federal, state, tribal, and local champions for materials management and encourage collaboration.

RECOMMENDATION 3: Accelerate the broad, ongoing public dialogue on life-cycle materials management.

3.1 Stimulate a national conversation about materials management, engaging multiple networks.
3.2 Open a dialogue on economic instruments to encourage better materials management.
3.3 Create ways to share knowledge on materials management.