

Implications of the Toxic Releases Inventory for Electric Utilities

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The Toxics Release Inventory

- Public database for community access to toxic release information
- Established by the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986
- Strengthened by Pollution Prevention Act of 1990
- Lists approximately 650 chemicals and chemical categories
- No explicit consideration of risks or effects

Application to Power Plants

- Electric utilities added to TRI as of 1998 (along with six other industry groups)
- Includes all coal-fired and oil-fired plants with more than ten employees (approximately 1000 facilities)
- First reports were due by July 1, 1999 for releases in calendar year 1998

What Gets Reported?

- “Coincidentally manufactured” chemicals, if more than 25,000 lbs/yr
- “Processed” chemicals, if more than 25,000 lbs/yr
- “Otherwise used” chemicals, if more than 10,000 lbs/yr
- *De minimus* exemption for byproducts distributed in commerce

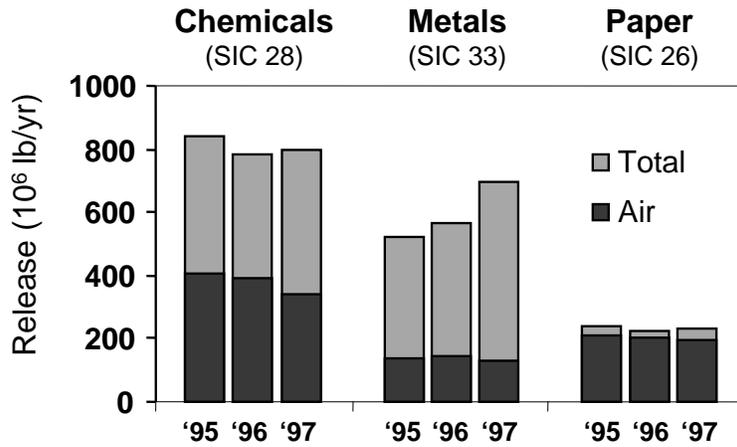
TRI Chemicals Potentially Relevant to the Electric Utility Industry

Metals	Organics	Other
Antimony	Benzene	Ammonia
Arsenic	Dichloromethane	Asbestos (friable)
Barium	Ethylbenzene	Bromine
Beryllium	Ethylene Glycol	Chlorine
Cadmium	Formaldehyde	Chlorine Dioxide
Chromium	Formic Acid	Hydrazine
Cobalt	Methanol	Hydrogen Fluoride
Copper	Naphthalene	Hydrochloric Acid
Lead	PCBs	Nitric Acid
Manganese	Polycyclic aromatics	Ozone
Mercury	Propylene	Sulfuric Acid
Molybdenum	Toluene	Thiourea
Nickel	Xylene	
Selenium		
Silver		
Thallium		
Zinc		

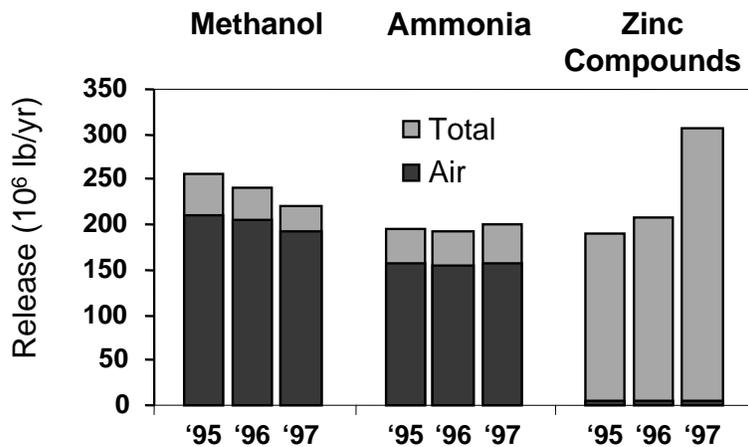
Objectives of this Study

- How do electric utility releases compare to other industries now reporting to the TRI?
- What are the implications for electric utility companies?
- How can releases be reduced?

Largest Total Releases by Industry



Largest Total Releases by Chemical



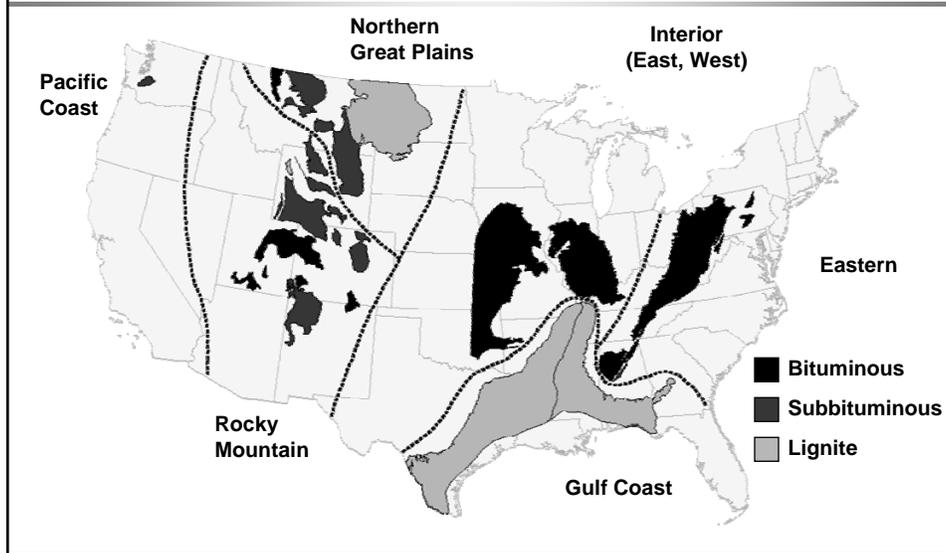
Study Approach

- Use FERC Form 423 data to quantify annual coal consumption at each U.S. power plant
- Use PISCES Model to estimate trace element composition by region, and air/land partitioning by plant type
- Apply TRI thresholds and byproduct exemptions to calculate reportable releases

Summary of Power Plant Coal Consumption (million tons/yr)

Coal Rank	<u>FERC 423 Database</u>	<u>DOE/EIA Utility Data</u>			
	1995 Totals	1995	1996	1997	1998
Bituminous	419				
Subbituminous	330				
Lignite	75				
Total Coal	823	829	875	899	911
Power Gen (BkWh)		1653	1738	1789	1807

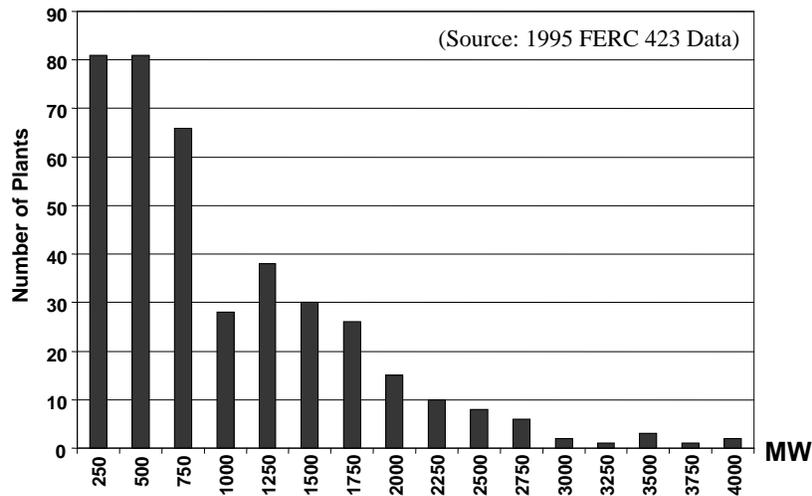
Coal Supply Regions for PISCES Model and Database



Mass Concentration of Trace Chemicals in Coal (ppmw, dry basis)

Chemical	Bit	Sub	Lig
Antimony	1.0	0.57	0.74
Arsenic	10.0	5.9	8.5
Barium	94.5	196.	220.
Beryllium	1.3	0.5	1.9
Cadmium	0.53	0.83	0.1
Chloride	750.	195.	140.
Chromium	18.6	5.0	9.3
Cobalt	6.4	2.0	3.7
Copper	21.	9.3	10.5
Fluoride	69.	44.	79.
Lead	8.1	7.8	6.2
Manganese	22.4	35.5	74.
Mercury	0.12	0.10	0.22
Molybdenum	2.1	1.7	3.0
Nickel	16.1	9.5	5.9
Selenium	3.2	0.9	1.3
Silver	0.2	0.16	0.1
Thallium	1.6	2.0	0.5
Zinc	22.0	8.7	7.8

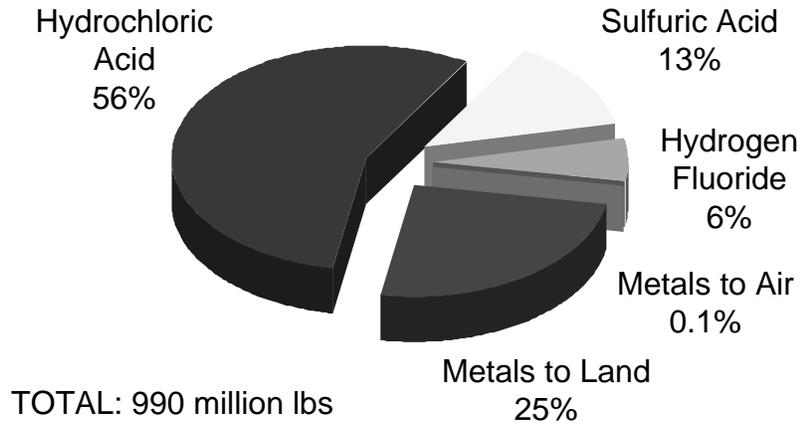
Size Distribution of Coal-Fired Power Plants Modeled in this Study



Base Case Estimates of Total Power Plant Releases for 1995 (millions of pounds)

TRI Chemical	Air	Total
Hydrochloric acid aerosol	553.5	553.5
Barium compounds	< 0.4	142.3
Sulfuric acid aerosol	129.6	129.6
Hydrogen fluoride	55.4	55.4
Manganese compounds	0.2	29.3
Zinc compounds	0.2	19.2
Copper compounds	0.1	12.2
Nickel compounds	0.1	11.7
Chromium compounds	< 0.1	9.9
Lead compounds	< 0.1	6.8
Arsenic compounds	< 0.2	6.0
Molybdenum trioxide	< 0.1	4.7
Cobalt compounds	< 0.1	3.6
Antimony compounds	< 0.1	1.5
Selenium compounds	0.3	0.7
Thallium compounds	< 0.1	0.4
Beryllium compounds	< 0.1	0.3
Total	740.	987.

Estimated 1995 Toxic Releases from Electric Power Plants (Base Case)



Uncertainty Estimates for 1995 Releases from Coal-Fired Power Plants (millions of pounds)

Substance	Air Releases		Total Releases	
	Base	Bound	Base	Bound
HCl aerosol	553	1,147	553	1,147
H ₂ SO ₄ aerosol	130	287	130	287
Hydrogen fluoride	55	135	55	135
Metal compounds	< 2	2	249	311
Total	740	1,541	987	1,880

Projections for 1998 Electric Utility Releases

Source	Million pounds	
	Coal	Oil
Carnegie Mellon (This study + 10% above 1995)	> 1100	Negligible
Edison Electric Institute (Actual utility data, extrapolated from 65% of coal-fired capacity and 40% of oil-fired capacity)	1100	

Study Implications

- Electric utility industry is likely to dominate the 1998 Toxics Release Inventory (based on total mass of releases)
- Power plant HCl aerosol releases will exceed largest current releases
- In many states, a power plant will be named as the largest source of toxic releases

Anticipated Utility Response

- Risk Communication Activities
Brochures, briefings, chemical profiles, toxicity weighting factors, screening studies, site-specific assessments
- Improved Data Acquisition
- Pollution Prevention Programs
- Emission Reduction Programs

Reducing TRI Emissions

- **Improved Estimation Methods**
 - Site-specific modeling (e.g., PISCES Model) vs. EPA emission factors
 - Additional data collection (including ICRs)

Reducing TRI Emissions

- Improved Estimation Methods
- **Decreased Plant Utilization**
 - Demand-side management
 - Environmental dispatch

Reducing TRI Emissions

- Improved Estimation Methods
- Decreased Plant Utilization
- **Fuel Switching**
 - Low S, low Cl coals (e.g., subbituminous)
 - Natural gas

Reducing TRI Emissions

- Improved Estimation Methods
- Decreased Plant Utilization
- Fuel Switching
- **Pollution Control Technology**
 - ESP upgrades
 - FGD systems

Reducing TRI Emissions

- Improved Estimation Methods
- Decreased Plant Utilization
- Fuel Switching
- Pollution Control Technology
- **Plant Operating Practices**
 - Reduce or eliminate “otherwise used” chemicals (e.g., for water treatment and plant maintenance)

Reducing TRI Emissions

- Improved Estimation Methods
- Decreased Plant Utilization
- Fuel Switching
- Pollution Control Technology
- Plant Operating Practices
- **Byproduct Utilization**
 - Bottom ash and Flyash
 - FGD solids

Future Developments

- Lower reporting thresholds for persistent, bioaccumulating toxics beginning in 2000, e.g.,
 - Mercury threshold reduced to 10 lbs/yr
 - Some organics as low as 0.1 gram/yr (vs. 25,000 lbs/yr currently)