2016 TRI National Training Conference
Lightning Talks: P2 Innovations

Organizing Toxic Chemicals: Internal Corporate Structures and Community Contexts

Juyoung Lee

PhD Candidate
Department of Sociology
Brown University

BHOPAL DISASTER, 1984–

On December 2, 2011 during the 27th anniversary of the Bhopal disaster

BHOPAL DISASTER, 1984–

"[Union Carbide Corporation] owned just 51 percent of the company [Union Carbide India Limited], and left oversight to local executives"

From the obituary of Warren Anderson (CEO of the Union Carbide Corporation)
New York Times, Oct 30, 2014

CORPORATE ARCHITECTURE

- Multi-Establishment Firms
  - Terminology: Establishments vs. Firms
- Firm Restructuring & Environmental Impact
  - Organizational hierarchization
    - Liability firewalls (Prechel & Zheng, 2012)
  - Geographic diversification
    - Weak attachment to replaceable host communities (Logan & Molotch, 2007)
  - Different hierarchical and geographic positions of establishments within the firms
    - Heterogeneous environmental impacts among establishments

ENVIRONMENTAL OUTCOME

- Establishment-Level Outcome
  - Whether or not establishments carry out environmentally hazardous activities
    - Empirical setting: 71 largest US-headquartered chemical manufacturing firms and their 23,321 establishments in the US

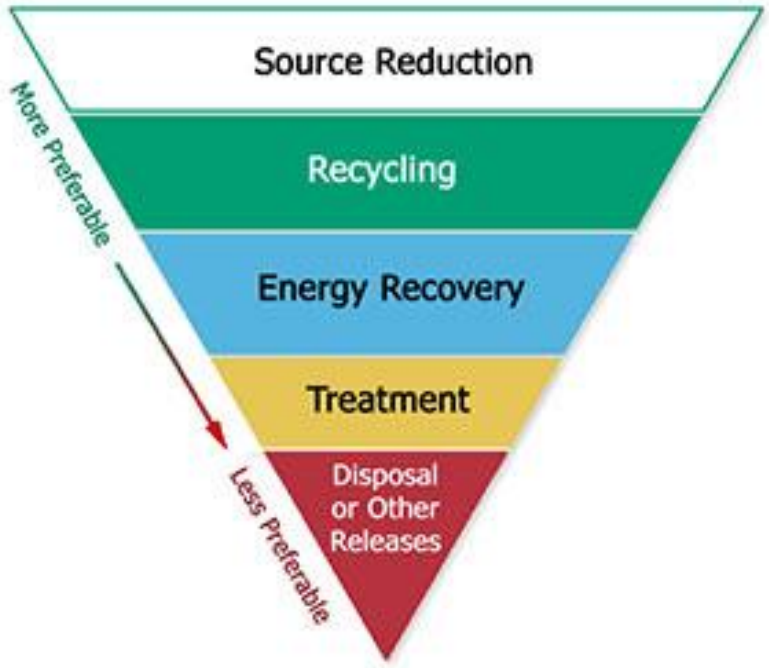
FINDINGS

Institutional Pressure	Multi-Establishment Firms' Corporate Architecture	Establishment-level Environmental Outcomes
Corporate environmentalism - Nationwide - Local-specific	Establishment position within the firm - Hierarchical - Geographic	Whether or not establishment performs environmentally hazardous activities

- **Lower-level / non-local establishments** were more likely to carry out environmentally hazardous activities than higher-level / local establishments
- When communities put greater pressure for corporate environmental practice, **lower-level / non-local establishments** were much more likely to carry out environmentally hazardous activities than higher-level and local establishments.

IMPLICATION

- Pollution Prevention (P2) Practices
  - Waste Management Hierarchy



  - Source reduction at low-level and non-local TRI facilities?

THANK YOU

Juyoung_Lee@brown.edu

Funding Acknowledgement

National Science Foundation Dissertation Improvement Grant

The Center for Engaged Scholarship

Institute at Brown for Environment & Society

Spatial Structures in the Social Sciences

SUPPLEMENTARY SLIDES

KEY VARIABLES

- Outcome Variables
  - Whether or not establishments carry out environmentally hazardous activities

- Establishment Characteristics
  - Hierarchical position
    - $\frac{\text{No. of corporate linkages between estb. and HQ}}{\text{Largest No. of corporate linkages in the firm}}$
  - Geographic position
    - 1 = *Non-local* establishments that have HQs in other states
    - 0 = *Local* establishments that have HQs in the same states

KEY VARIABLES

- Community Contexts
  - Neighborhood characteristics
    - Population density
    - Racial composition: % non-white residents
    - Socioeconomic status: (1) % families below the poverty line, (2) % unemployed labor force, and (3) % adults without high school degree

FINDING I

- Establishment
  - Lower-level > Higher-level
    - H1: Lower-level establishments are more likely to carry out environmentally hazardous activities rather than higher-level establishments.
  - Non-local > Local
    - H2: Non-local establishments are more likely to carry out environmentally hazardous activities rather than local establishments.

FINDING II

- Community
  - With less pressure > With greater pressure
    - H3: When communities put less pressure on corporate environmental practices, establishments are more likely to carry out environmentally hazardous activities.

FINDING III

- Establishment X Community
  - When communities put greater pressures on corporate environmental practice,
    - H4: *Lower-level* establishments are more likely to carry out environmentally hazardous activities than *higher-level* establishments.
    - *H5: Non-local* establishments are more likely to carry out environmentally hazardous activities than *local* establishments.

Reducing Toxics Releases in Company Supply Chains

2016 TRI National Training Conference

Washington, DC

October 20, 2016

Increasing Attention to Supply Chains

- Company supply chains growing ***more disperse and complex***
- ***Increasing interest*** by companies and stakeholders to know and disclose more about suppliers
- ***Increasing media attention*** on supply chain issues

Business Importance of Supply Chains

- ***Baxter*** - "[C]ollaborating with suppliers to improve their performance can collectively support the company's ***overall performance***"
- ***Dell*** - "Dell's supplier chain .. [is] an ***indispensable part of our business***"
- ***McDonald's*** - "[T]he actions of our business partners can be attributed to McDonald's, ***affecting our reputation and the level of trust*** we have earned from customers and others"
- ***IBM*** - "supply chain is a ***strategic asset*** that enables us to deliver consistently high-quality goods and services to our customers on a local and global level"
- ***Tesco*** - "Our strong belief is that we cannot build a ***sustainable business*** on an unsustainable supply chain"
- ***Unilever*** - [O]nly through partnering with .. our suppliers will ***sustainable and profitable growth*** be achievable"

Company Exposure to Business Risks Due to Supply Chain

- ***Physical risk*** to suppliers' assets and operations
- ***Availability*** and/or increased costs of inputs
- ***Regulations*** in sourcing or distribution markets
- ***Litigation risk*** that may follow from lawsuits or other legal actions
- ***Product risk*** if products become unpopular or unsellable
- ***Environmental disruptions*** in communities that affect supplier workforce availability and productivity
- ***Reputational risk*** can be shaped by events, media, public opinion, etc. and affect brand equity, credibility, social license to operate, public opinion
- ***Financial risk*** due to financial losses, decreased investment, revenue losses

Eliminating supply chain risks is main driver for embedding sustainability in supply chains (Ethical Corporation)

Importance of Supply Chain to Environmental Footprints

40-60% of a manufacturing company's and **80%** of a retail company's **carbon footprint** is from its supply chain (McKinsey & Company)

A company's supply chain represents **more than double** its **direct plus indirect GHG emissions** on average (CDP)

Majority – 17 of 19 - industrial sector **environmental impacts** come from their supply chains (GreenBiz and Trucost)

Examples of Company Engagement with Suppliers

- Supplier code of conduct
- Audit and monitoring
- Performance scorecard
- Technical assistance
- Incentives

Supplier Code of Conduct (and relevance to TRI)

Electronic Industry Citizenship Coalition (> 100 members, incl. Apple, Dell, Ford, HP, IBM, Intel, Microsoft, Sony, Texas Instruments, Xerox)

Environmental standards include **Hazardous Substances**:

- **Chemicals** and other **materials** posing **hazard** if released are identified and managed safely

3M

Environmental category includes **hazardous substances** and pollution prevention / resource reduction:

- **Chemicals** and other **materials** and **wastes** posing **hazard** if released, are identified and managed
- Reduce or eliminate use of **resources** where feasible

Mars Inc.

Environment guidelines include:

- Supplier properly handles and stores **hazardous materials** and **waste**, including **discharges** and **disposal**

Audit and Monitoring

- ***Conduct audits*** of suppliers to assess sustainability performance and compliance with regulations or conformance with code of conduct
- ***Implement corrective measures*** based on significance of finding
- ***Track progress*** in addressing noncompliance/nonconformance
- ***Report publicly*** on findings and progress

Performance Scorecard (and relevance to TRI)

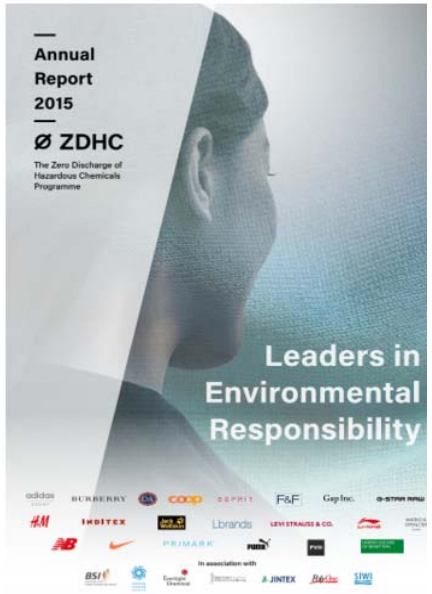
Procter & Gamble Supply Chain Environmental Sustainability Scorecard:

- **Hazardous Waste Disposal** is a core measure
- Scorecard rating of suppliers

Sustainable Apparel Coalition HIGG Index:

- Self-assessment tools to measure company environmental and social and labor impacts and identify areas for improvement.
- Coalition of **apparel**, **footwear**, and **home textile** companies (e.g., Columbia, DuPont, Esprit, Gap, Hanes, H&M, LL Bean, Levi Strauss, Patagonia, Puma, REI, Target)
- **Chemicals Management** and **Hazardous Waste** modules

Technical Assistance to Suppliers



Zero Discharge of Hazardous Chemicals (ZDHC) Programme:

- **Mission** - Advance toward zero discharge of **hazardous chemicals**, improve environment and people's well being in **textile** and **footwear** supply chain (including Adidas, Esprit, Gap, H&M, Levi-Strauss, M&S, New Balance, Nike, Puma)
- **Focus** - Manufacturing **Restricted Substances** List, Conformity Guidance, Wastewater Quality, Audit Protocol, Research, Data & Disclosure, and Training to eliminate the use of **priority chemicals** globally

Examples of Incentives

- Well designed and aligned incentives can make a supply chain more efficient and create win-win situations:
  - **Consistent demand** or **increased business** from company;
  - Consistent and fair **prices**;
  - **Longer-term contracts**;
  - **Low-interest loans** to support capital projects;
  - **Sharing costs** for improvements;
  - **Recognition** and **awards**;
  - **Reduction** in supplier **audit frequency**;
  - **Paid-for** consultation to provide training or technical assistance

Importance of TRI Data

- TRI data can provide another lens for companies to assess performance by U.S. suppliers:
  - Consider **trends** and **benchmark** suppliers;
  - Identify opportunities to **apply P2 practices**; and
  - **Compare P2 performance** at facility and parent company levels

- Search TRI P2 Data:
  - By industry sector, chemical, or parent company – **TRI P2 Search Tool**
  - By specific facility - **TRI Search Tool**

Contact Information

Richard Kashmanian

- kashmanian.richard@epa.gov
- 202-566-2875

Sandra Gaona

- gaona.sandra@epa.gov
- 202-566-0687

Manufacturing Technology Center

"Enhancing the Effectiveness of Business & Industry in Virginia"

E3, Economy Energy Environmental Activities

- **E3 Technical Assessment for Virginia Industries**

  (Pre assessment information, two days onsite, recommendation report)

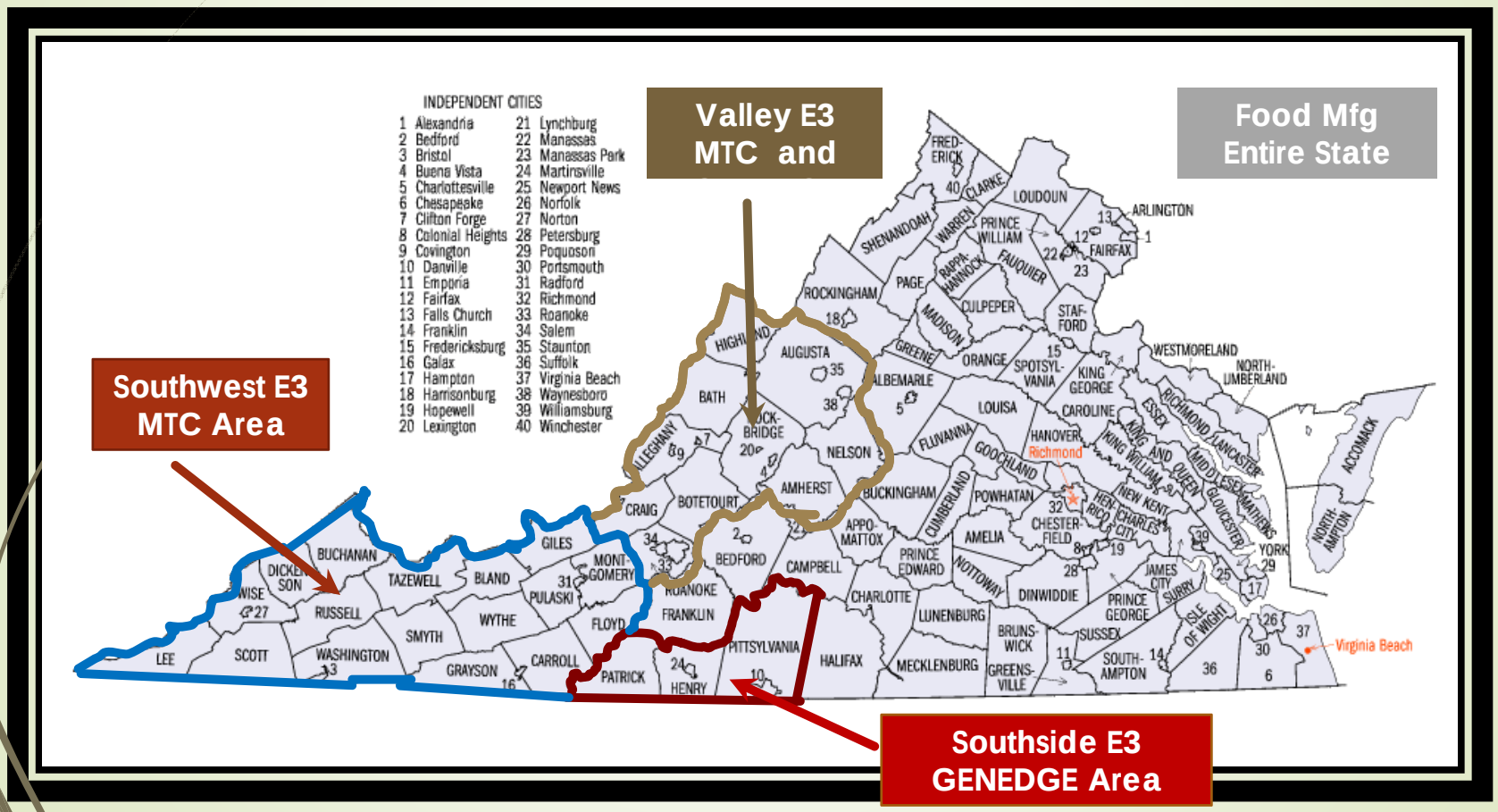
- **E3 Peer Events providing sustainability training and best practices**

- **E3 Newsletters providing practical information to manufacturers**

- **Implementation assistance to facilities on their sustainability journey**

  (Incentives, low cost loans, suggesting service providers)

E3 in Virginia as of 2016



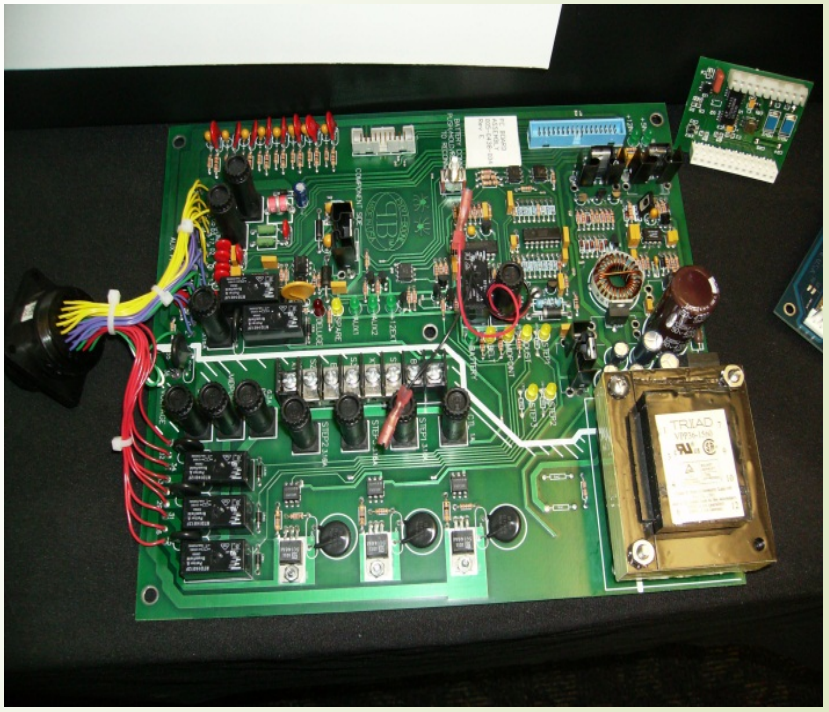
Regulatory Compliance

Each assessment includes environmental regulatory compliance

This prevents contamination of local landfills

- ✓ Mercury containing lighting
- ✓ Electronic Waste
- ✓ Batteries with heavy metals
- ✓ Aerosol cans
- ✓ Paint waste
- ✓ Air emissions from processes

Materials that were sent to the landfill



Recommendation Examples

- Settling of wastewater to reduce surcharges - $120,000
- Settling of 6.9 MM gallons of wastewater for reuse
- Reuse of 11 MM gallons of non contact cooling water

Solvent Recovery at Automotive Supplier

- Annual solvent disposal cost savings of $88,835
- $87,244 annual solvent purchase savings
- Partnered with supplier to rent distillation equipment

Types of Savings Projects Identified

- Recovering starch for sale and reusing water
- Treating wash for reuse in cooling towers
- Harvesting rainwater for plant use
- Proper air compressor operation
- Lighting upgrades to prevent energy waste
- Installing light sensors to prevent waste
- Heat recovery to capture wasted energy
- Bulk recycling to lessen landfill impact
- Single stream recycling to save money
- Identify non value added process to save money
- Standardize work to promote the “one best way”
- Add visual instructions to aid team members
- Identify excess inventory to reduce cost
- Prevent hazardous material from entering landfills

Client Regulatory Reporting Requirements Review

- SPCC
- Oil Spill Contingency Plan
- EPCRA
- Air Permitting
- Hazardous Waste collection and storage
- Universal Waste Compliance
- Stormwater requirements
- Industrial Wastewater Discharges
- Others specific to facility

Supporting Manufacturing Leadership Through Sustainability

E3: Economy, Energy, and Environment

U.S. Small Business Administration

Technical Assessment

A **Lean Review** which leads to increased productivity and reduced costs

An **Energy Audit** which provides tools and insight to reduce energy demand and costs

A **Clean Review** which results in water and energy conservation, reduced emissions, reduced hazardous wastes and additional cost savings. Includes a **Greenhouse Gas (GHG) Evaluation**.

An Ergonomic Review to identify repetitive motion risks and other health and safety issues including health risks of hazardous and toxic chemicals.

Post-Assessment Recommendations that guide each facility toward improvements in overall efficiency, reduced waste, more efficient use of resources including energy and water, and cost savings

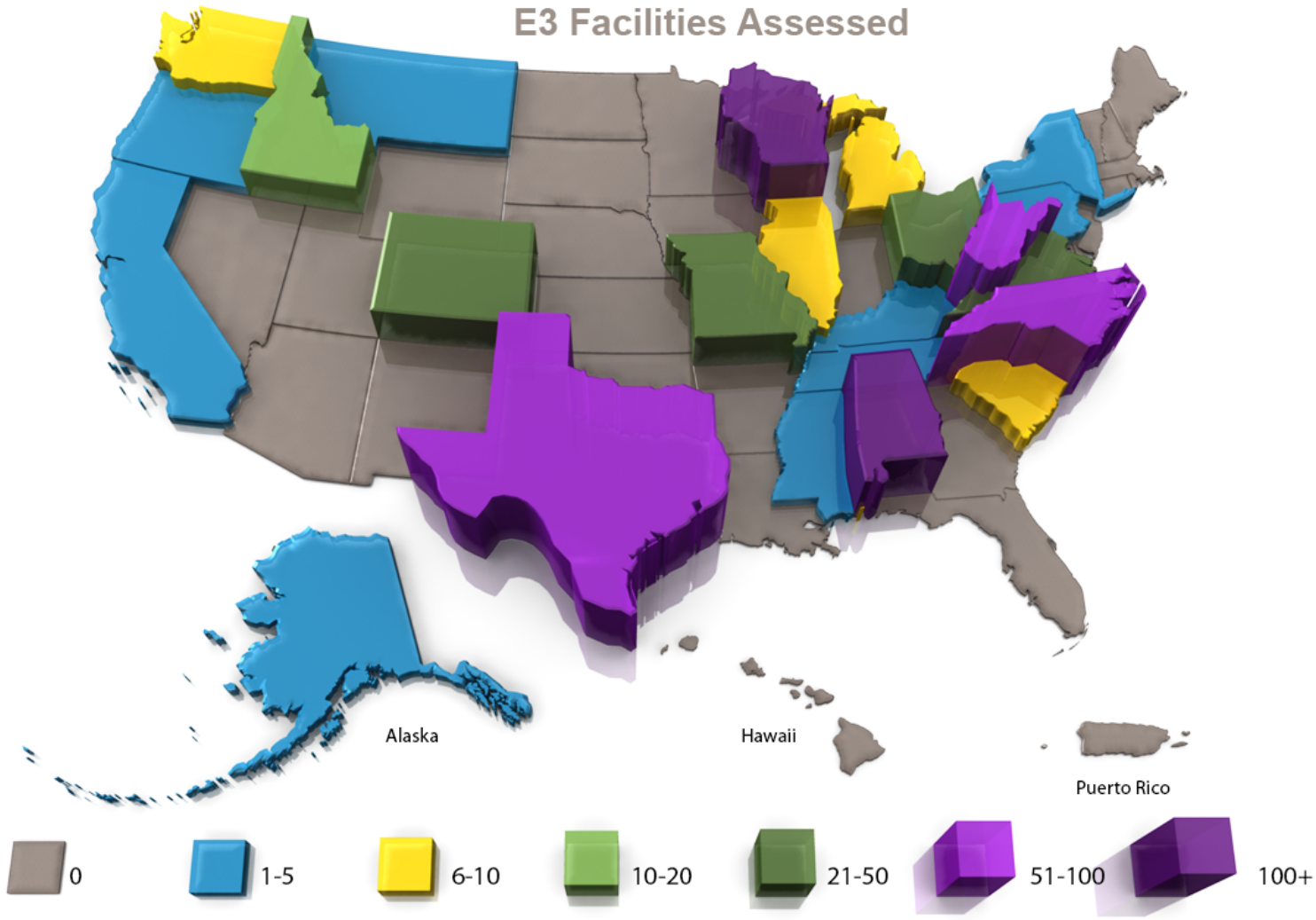
Who is involved in E3?

E3 MODEL: Federal Programs Working Together with Local Communities

ECONOMY:	ENERGY:	ENVIRONMENT:
DOC's NIST Manufacturing Extension Partnership (**MEP**), **SBA** financing, and **DOL** skills training	**DOE**'s Save Energy Now (**SEN**) program	**EPA**'s Green Suppliers Network (**GSN**) and Climate Leaders (**CL**) program

COMMUNITIES:

Large and small manufacturers, utilities, local government, and other municipal authorities


E3 Facilities Assessed
Alaska
Hawaii
Puerto Rico
0
1-5
6-10
10-20
21-50
51-100
100+
December 2014

E3 ASSESSMENT

Economy, Energy & Environment



only if you are ready for some new ideas- 817-307-0613

form your **team**

EarthView & Bills **PREASSESSMENT**



back to the floor to find where you are wasting other stuff **Day 2 AM**

learn about lean wastes and walk the floor **Day 1 PM**

team **Day 1 AM** meets to prepare process map



Day 2 PM energy wastes in your facility

quantify impacts **Day 3 AM**

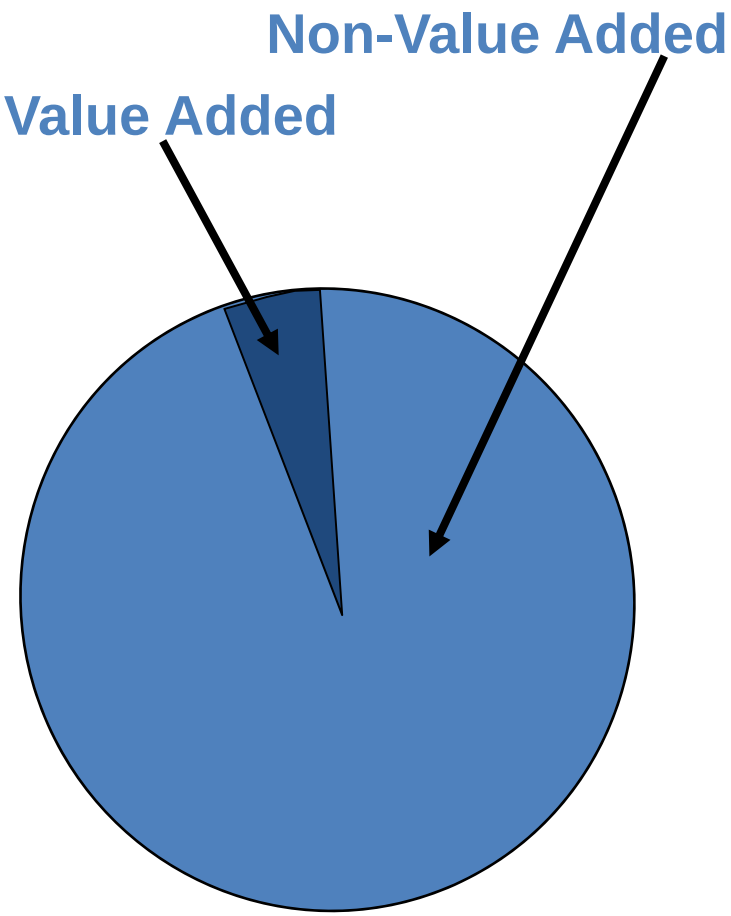
its time for the team to share their findings to the boss **share success**

brought to you by : TMAC Work Smart. Grow Smart.™


TMAC
EarthView
Review


TMAC
EarthView
Review
• LEED Best Practices
• Environmental Compliance
• Lean Wastes
• Risk Identification

Lean = Eliminating Wastes



Defects

Overproduction

Waiting

Non-Value Added Processing

Transportation

Inventory

Motion

Employees Underutilized (K, S, A)

Typically 95% of all lead time is non-value added

Value Stream Mapping

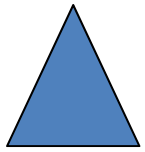
Process:

ECONOMY/LEAN

- Cycle Time (C/T)
- Change Over (C/O)
- Up time (U/T)
- Quality level

Defects
Overproduction
Waiting
Non-utilized resources
Transportation
Inventory
Motion
Extra processing

- Inventory after process



ENVIRONMENT

- Emissions
- Water
- Solid Waste
- Hazardous Waste
- Impacts on People
- Wasted Materials
- Compliance/permits
- % Recycled content
- Toxics-TRI
- Safety Data Sheets

ENERGY

- Lights
- Motors/Fans
- Compressed air
- HVAC
- Heaters
- Boilers
- Equipment
- Ovens
- Building envelope
- Turn off unneeded equipment

Impacts

	9/30/2016
Lean Savings	12,393,139
Energy Cost Savings	5,370,360
Environmental Savings	2,891,732
Energy Conserved	60,441,119
Water conserved gallons	20,301,330
Air Emissions Pounds	85,860,191
Solid Waste reduced lbs	31,807,671
Hazardous waste reduced lbs	484,381
Jobs created	87
Jobs retained	27
Individuals trained	794
Facilities scheduleed for assessments	5
Facilities assessed	91
Opportunities identified	3,913
Projects implemented	274

Kurt Middelkoop

The University of Texas at Arlington

TMAC

kurt.Middelkoop@tmac.org

817-307-0613

South Australia's Environment Protection Authority

Using National Pollutant Inventory Data for Load Based Licensing in South Australia

Lightning Talks: P2 Innovations

Naomi Struve
Environmental Engineer
South Australian Environment Protection Authority
October 2016

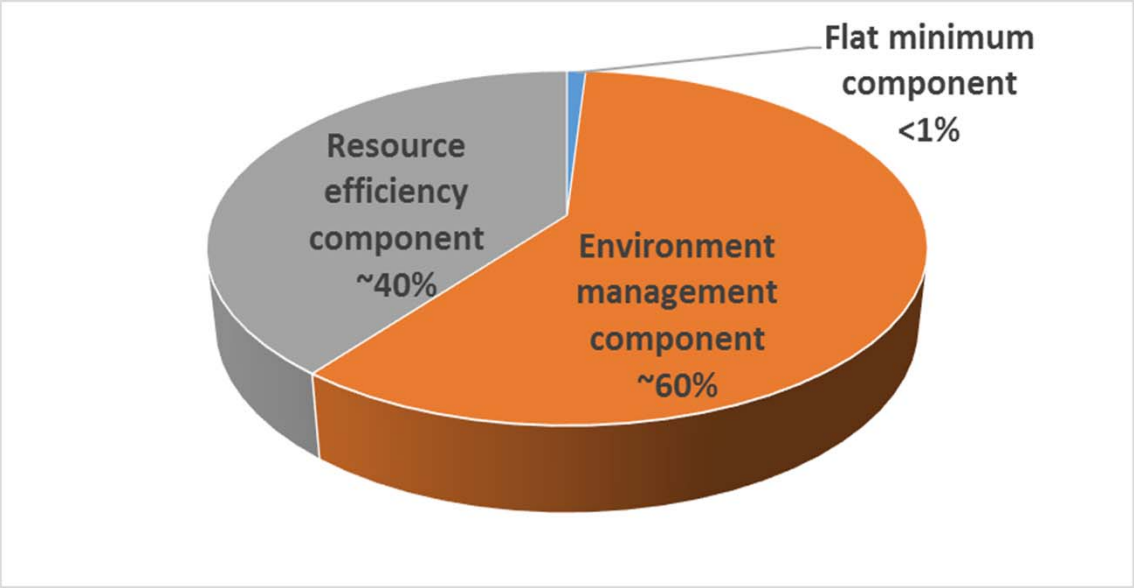
National Pollutant Inventory (NPI)

- Equivalent of TRI
- Established in 1998
- Run by Commonwealth, States and Territories
- 93 substances
- Emissions and transfers reported annually
- Many emission factors are from AP42
- www.npi.gov.au

Image from http://www.migration.sa.gov.au/

The Licensing Fee Structure (LFS) in SA

- Principles
  - User pays
  - Polluter pays
  - Financial incentive for better environmental performance
- Resource Efficiency Component (REC) uses NPI data uploaded to licensing system annually
- Fee based on amount emitted, type of pollutant and zone weighting



NPI Substances used for LFS

Chosen due to importance of local environmental issues

- Nutrients in the Gulf of St. Vincent leading to reduction in seagrass
- TVOCs and NOx have greater weighting in Adelaide airshed
- Lead in Port Pirie
- Elevated particulates in Adelaide and Mount Gambier

Benefits of using NPI for LFS

- Use of an existing data set
- Awareness of the NPI increased within the EPA and with industry
- Identification of new reporters
- Improvement in data quality
- Incentive to decrease pollution

Further Research and Information

- How has load based licensing impacted awareness and changed emission levels?
- Determination of whether the policy objectives of cost recovery and polluter pays have been successful

http://www.epa.sa.gov.au/licensees/licence_fee_system

- ➢ Discussion papers and consultation
- ➢ Information on fee units/zones/weightings

naomi.struve@epa.sa.gov.au

The U.S. Environmental Protection Agency's Toxics Release Inventory, Green Chemistry and Environmental Justice

Sheryl Mebane, Ph.D.

October 20, 2016 in the TRI Conference Panel/
Lightning Talks on P2 Innovations

The views expressed in this presentation are those of the author and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

Overview

For decades, the U.S. Environmental Protection Agency's Toxics Release Inventory has been a resource for groups and individuals seeking reliable access to information.

Flowing from a separate TRI project that linked green chemistry practices to emissions reductions for the pharmaceuticals industry, this work moves from TRI data on chemical releases and on pollution prevention activities of inorganic pigment and dye manufacturers to identify green chemistry options that may inform the efforts of environmental justice organizations in areas near the manufacturing facilities.

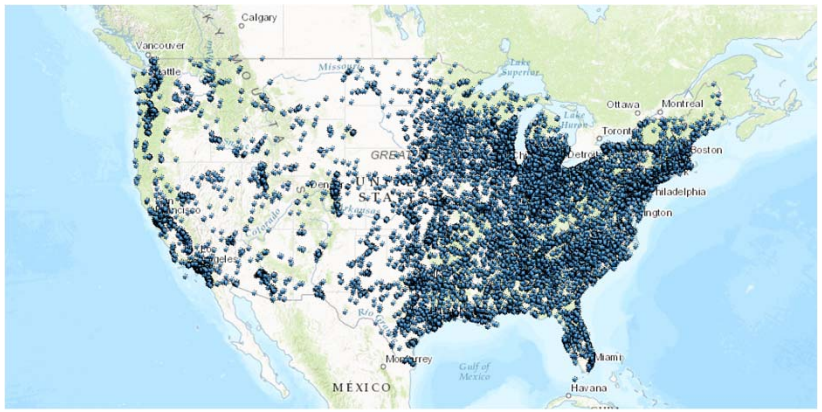
Paints, Pigments and Dyes

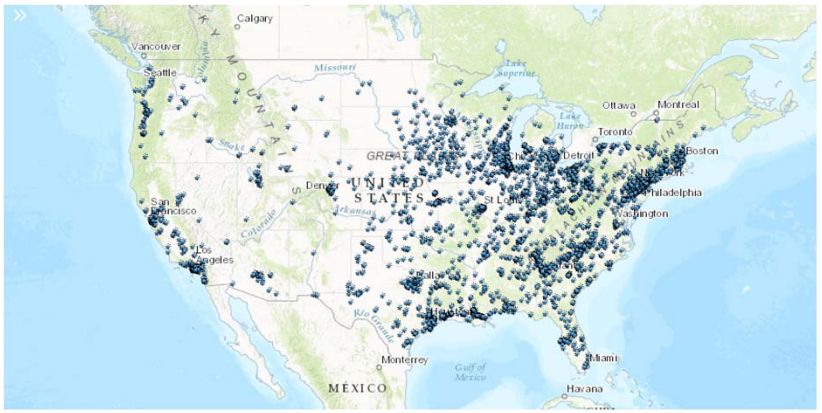
"From the earliest mentions of dyestuffs in China in 2600 B.C. to the middle of the 19th century, dyes were derived from natural products … In the United States, the first ready-mixed paint was developed in 1867. … Although lead pigments were a staple, because of **safety issues**, industry consensus standards limited their use beginning in the 1950s. … Throughout the 1960s and early 1970s, propelled by both **environmental regulations** and the increasing **cost** of petrochemicals, a variety of powder coatings were developed, including epoxy, polyester, and acrylics. … Today, … coatings and coating additives … provide an ever-expanding array of protective and **performance** enhancements."

Creative Commons image from jenniferlinnig.com: paint cans

Source: Mark S. Lesney's "Paints, Pigments, and Dyes" in *Enterprise of the Chemical Sciences - Chronicles of Chemistry 2* (2004). pubs.acs.org/supplements/chemchronicles2/pdf/029.pdf

Focusing On Inorganic Pigment Manufacturers





From the 2014 National Analysis, the five inorganic pigment facilities with the largest reported releases were located in four states. TRI reporting facilities, chemical facilities, and inorganic and organic pigment and dye facilities are also shown.

Connecting to EJ and Nearby Communities

2010 Data (Not Showing Only Significant Figures)	Population	Population in Poverty	Population within Defined Radius	Population within Defined Radius in Poverty
US	308.7 million people	46.2 million p. (15%)		
Ashtabula, Ohio	19,124 people	(33.4%)	22,134 p. (3 mi.)	10,780 p. (49%)
Hamilton, Mississippi Monroe County, Mississippi	36,989 people	(20.1%)	2,460 p. (5 mi.)	767 p. (31%)
New Johnsonville, Tennessee Humphreys County, TN	18,538 people	(17.6%)	2,053 p. (3 mi.)	597 p. (29%)
Pass Christian, Mississippi	4,613 people	(13.5%)	4,358 p. (3 mi.)	875 p. (20%)
Westlake, Louisiana Lake Charles, Louisiana	72,033 people	(23.6%)	52,087 p. (5 mi.)	14,587 p. (28%)

Sources: echo.epa.gov and census.gov

Linking to Green Chemistry

- Dow Chemical won a Presidential Green Chemistry Challenge Award for a polymer that improves one pigment's dispersion, which decreases how much pigment is needed.
- The relevant pigment was titanium dioxide (TiO_2), which is added to paint as the base white pigment that hides the color of the painted surface.
- Up to **20 percent lower** TiO_2 loading was reported.

*Sources Paraphrased: epa.gov/greenchemistry/document-presidential-green-chemistry-challenge-award-recipients-1996-2015, acs.org/content/dam/acsorg/greenchemistry/resources/the-12-principles-of-green-chemistry-pocket-guide.pdf and acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/principles/12-principles-of-green-engineering.html

Green Chemistry Principle

1. Prevent Waste

It is better to prevent waste than to treat or clean up waste after it has been created.

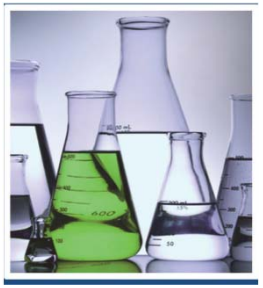


Image from front cover of document at first source on the left: flasks

Green Engineering Principles

2. Prevention Instead of Treatment

It is better to prevent waste than to treat or clean up waste after it is formed.

4. Maximize Efficiency

Products, processes, and systems should be designed to maximize mass, energy, space, and time efficiency.

Involving Others

Possibly Interested Organizations

Environmental Health Watch (ehw.org)

Deep South Center for Environmental Justice (dscej.org)

Louisiana Bucket Brigade (labucketbrigade.org)

Tulane Environmental Law Clinic (tulane.edu/~telc)

Possible Interests of the Organizations

Partnering with university researchers who may want to explore alternative options (*sparking innovation*).

Contacting local companies to see if they are aware of the alternative (*expanding the use of current advancements*).

Thank you!