



# Review and Application of Existing Tools and Needs to Assess Real-World Cumulative Exposures and Risks

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Contributing Organizations: ORD: NERL, NCER; EPA CARE Program (Program and Regional Offices)



B · O · S · C HUMAN HEALTH PROGRAM REVIEW

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RESEARCH & DEVELOPMENT

## LTG 2 Poster 10

### Science Questions

The overall science question is: "How to estimate cumulative exposures to chemical and non-chemical stressors under real-world exposure scenarios?"

Related specific science questions are:

- What are the applications for cumulative exposure/risk assessments?
- What is the state of the science for estimating exposures to chemical and non-chemical stressors?
- How effective are existing tools?
- What new tools (models, data, and methods) are needed for future assessments and risk reduction programs?

### Research Goals

The overall goal is to evaluate cumulative risk from exposures to multiple chemical and nonchemical stressors.

- Moves beyond strict regulatory mandates to public health protection

Recommended by

- National Academy of Public Administration (NAPA)
- National Research Council
- EPA's Risk Assessment Forum,
- EPA's 2005 Human Health BOSC,
- State and regional partners

Focused on communities

- Domain for convergence of multiple stressors
- Faced with challenges of identifying and mitigating environmental risks

Specific Objectives

- Determine what science-based tools are available
- Understand how to use those tools to make more informed science-based decisions

Anticipated broad range of applications will require the multiple tools, ranging from simple screening models to very sophisticated models, that can be used to predict cumulative exposures for targeted populations both spatially and temporally.

Compiled available guidance documents, exposure models, methods for community measurement collection, databases, and GIS tools.

Initial assessment of tools through EPA's Community Action for a Renewed Environment (CARE) grants program, ORD's Regional Applied Research Efforts program, and through LTG 4 pilot studies.

### Findings and Conclusions

Developed and distributed cumulative exposure tools for tribes -- Tribal Seafood Consumption Survey, Tribal Lifeline Dietary Assessment Tool.

Susceptibility and vulnerability factors (e.g., non-chemical stressors) related to community risk (e.g., NCER RFA Inner City Toxicants and Neurodevelopment in Urban Children) are being explored.

ORD scientists have designed and developed a prototype Community-Focused Exposure and Risk Screening Tool (C-FERST) that will serve as the research framework for planning and implementing cumulative exposure science and research (see Poster LTG 2-11).

### Impact and Outcomes

The products of this research will strengthen the science of cumulative risk assessment, empower communities to make more informed decisions about their risk reduction actions, and ultimately improve public health. Accomplishments to date include:

- Compendium of available tools based on a comprehensive review was disseminated for use by community programs, and existing tools were applied to assist several community projects (e.g., Detroit, MI and Holyoke, MA);
- The compilation of available tools is being used by communities under the CARE program to perform assessments and help develop minimum requirements for CARE grantees, and will be useful to other community risk prioritization efforts;
- The review of measurement tools is being used by CARE communities when supplementing existing data, and will be useful to other community measurement efforts;
- A prototype version of C-FERST was developed in close collaboration with the CARE program and presented with positive reviews at national and international meetings and conferences;
- Several journal articles were submitted for publication to provide the scientific community with information about this research program and available tools.

Outputs from this research program as it evolves will assist communities, ORD, Regions, Program Offices, other Agencies, academia, and industry in identifying high risk environmental stressors, reducing exposure to multiple stressors via multiple pathways, reducing exposure of populations at risk, and improving effectiveness and evaluation of risk management decisions. This collective research is expected to improve significantly the science and practice of community-based cumulative risk assessments, and improve public health in communities.

### Future Directions

- Refine and develop new models and related tools
- Apply the tools to identify, prioritize, and characterize cumulative exposures over time in support of the NCS Centers
- Apply the tools and characterize cumulative exposures in collaborative studies (CARE; EPA/NIEHS children centers; ORD exposure, epidemiology and accountability studies; and EPA Program Office problem driven scenarios)
- Incorporate new research on non-chemical stressors into cumulative exposure and risk tools and estimates
- Effectively transfer and communicate ORD's enhanced science and updated tools (see poster LTG 2-11).

### ORD Researchers Involved

B. Schultz, T. Barzyk, D. Hammond, M. Medina-Vera, J. Van Emon, L. Melnyk, K. Bradham, S. Harper, J. Morgan, H. Özkaynak, J. Quackenboss, L. Sheldon (NERL); D. Segal (NCER); D. Lobdell (NHEERL)

### Methods/Approach

The overall approach includes:

- Identifying partners, stakeholders, and research needs;
- Reviewing available tools and critical needs that ORD and its partners can address;
- Collaborating with partners focusing on other components of the human health source-to-outcomes paradigm: source->concentration->exposure->dose->risk->outcomes;
- Developing/enhancing exposure tools to assist with identifying/prioritizing issues, to quantify impact of risk reduction actions, and to assess risk for epidemiologic studies;
- Identifying initial case studies for collaboration;
- Developing, evaluating, applying, and demonstrating tools through case studies; and
- Communicating the research and providing the improved tools to stakeholders.

Key science issues (e.g., how to translate a national assessment into an assessment at the community level), research needs, and data gaps were identified through an extensive literature review and dialogue with partners and stakeholders at scientific meetings and conferences (e.g., 2007 ISEA symposium and NCER workshop). Research activities were then planned and/or initiated in four key areas: 1) refining/generating state-of-the-science models, databases, methods, GIS maps, and approaches for characterizing cumulative exposures and risks; 2) applying and evaluating these tools in small scale exposure studies; 3) developing/applying tools for planning and assessing exposures in large scale exposure and epidemiologic studies (e.g., NCS; ORD studies); and 4) applying tools to inform the development of risk reduction strategies and demonstrate the strategies resulted in reduced exposures.

### Development of New Tools to Address Key Needs

#### Community-Focused Exposure and Risk Screening Tool (C-FERST)

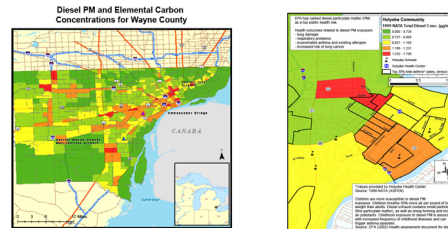
- Need for C-FERST
  - Communities want to understand environmental issues in context of risk
  - Difficulties accessing, integrating and interpreting data; rely on risk perception
  - Technical assistance across regions & communities varies greatly
  - User-friendly, state-of-science tools that rely on best available information are needed to empower communities to make their own decisions
- Prototype version of C-FERST designed as a user-friendly internet tool, based on sophisticated science, for identifying and prioritizing community environmental issues
  - "One-stop shop" to 1) view available EPA info at national or local scale, 2) add local information, 3) view community exposure/risk report for selected issues, 4) link to other tools and information
  - Intended to assist CARE and other community program partners



### Assessment of Existing Tools via Community Case Studies

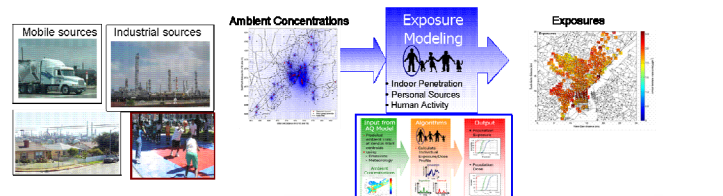
#### Detroit, MI and Holyoke, MA CARE Projects

- Community Concerns
  - Air pollution from traffic sources & local industrial sources, water quality in local river; drinking water contamination from distribution system; asthma
- ORD Contributions
  - Queried EPA national databases and conducted GIS mapping
  - Summarized results in a report for Region V and maps for Region I
  - Provided information to support interpretation of local monitoring results
  - Requested feedback to inform future tool development



#### New Haven, CT Accountability Project (see LTG4, poster 4)

- Supporting cross-ORD/ Region 1 collaboration developing methods to link and apply air quality and human exposure models with available local health data in New Haven
- Providing information needs and methods for future projects in other U.S. areas to assess impact of voluntary and regulatory air programs



## Cumulative Risk

Example Environmental Community Concern	Media			Directory of CARE Projects <sup>1</sup>	Pacoima CARE Project <sup>2</sup>	1999 NATA <sup>3</sup>	CARE PO Survey <sup>4</sup>	CARE Program Workbook <sup>5</sup>
	Air	Indoor	Water					
Agriculture	x	x	x	x				x
Airport	x				High			x
Air Quality - Mobile Source Pollution (Highways)	x			x	High		x	x
Air Quality - Point Source Emissions	x			x	High		x	x
Ambient Air Pollutants	x						x	x
Arsenic in Soil		x	x	x				x
Asthma	x	x	x	x			x	x
Autobody Shops / Recyclers	x	x	x	x			x	x
Brownfields		x	x				x	x
Criteria Air pollutants	x					High	x	x
Diesel Exhaust	x	x	x	x			x	x
Dredging/PCBs		x	x					x
Drinking Water			x					x
Environmental Tobacco Smoke	x	x			Medium-High		x	x
Fish Consumption			x	x				x
Ground-water contamination			x					x
Hazardous Waste / Pharmaceuticals		x	x	x	Medium-Low		x	x
Healthy Homes (Cleaning Products, allergens)	x	x		x	Medium		x	x
Indoor Pollution		x					x	x
Indoor Vapor Intrusion		x			Medium-Low		x	x
Industrial Waste-Water Discharges to Surface Waters			x				x	x
Integrated Pest Management/Pesticides		x		x			x	x
Land Use / Redevelopment/ Smart Growth		x	x	x			x	x
Lead		x	x	x	Medium-High		x	x
Mercury	x	x	x	x	Medium		x	x
Mold							x	x
Particulate Matter (Fine)	x	x					x	x
Pesticide Residue on Foods							x	x
Point - major other than landfills					Low		x	x
Radon		x			Low		x	x
Schools/Hazardous Waste	x	x		x	Medium-Low			x
Soil - unlined sumps			x		Low		x	x
Solid Waste Disposal (bulky items, landfills) Recycling		x	x	x	Medium		x	x
Super-emitting cars	x				Medium-High			x
Water Quality - Wastewater / Sewage			x	x			x	x
Water Quality - Stormwater Runoff			x	x	Medium		x	x

<sup>1</sup>List of Environmental Health Issues for all 2005-2007 CARE Projects. Draft dated October 2007.

<sup>2</sup>List for 18 Environmental Concerns developed in 2007 by the Pacoima CARE Project Team disseminated by Matthew Lakin. Ranked from high (most concern) to low (least concern).

<sup>3</sup>1999 National-scale Air Toxics Assessment

<sup>4</sup>CARE Project Officer Survey completed in 2007 by Katie Conlon and Tim Barzyk (U.S.EPA/ORD/NERL).

<sup>5</sup>CARE Workbook (Internal EPA Draft)