CUMULATIVE RISK ASSESSMENT:
BRIDGING THE GAP BETWEEN WELL-BEING
AND OCCUPATIONAL SAFETY AND HEALTH

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The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health (NIOSH) and should not be construed to represent any agency determination or policy.
National Academies of Science
Definition

“The combination of risks posed by aggregate exposure to multiple agents or stressors in which aggregate exposure is exposure by all routes and pathways and from all sources of each given agent or stressor.”
Environmental Protection Agency (EPA)

Definition

“An analysis, characterization, and possible quantification of the combined risks to human health or the environment from multiple agents or stressors.”
CONCEPTUAL MODEL OF CUMULATIVE RISK

Personal Risk Factors (PRF)

Cumulative Risk

Environmental Risk Factors (ERF)
ENVIRONMENTAL RISK FACTORS (ERF)

- Setting
  - Residential
  - Community
  - Environment

- Agents
  - Chemical
  - Biological
  - Radiologic
  - Physical
  - Psychological

- Pathway
  - Air
  - Soil
  - Water
  - Food

- Route
  - Inhalation
  - Ingestion
  - Dermal

Cumulative Risk

PRF
Personal Risk Factors (PRF)

**Biology**
- Genetics
- Age
- Sex
- Race
- Previous disease state

**Lifestyle choices**
- Exercise
- Diet
- Smoking
- Drinking
- Hobbies

**Other**
- Psychological
- Socioeconomic status
- Geographic region
- Cultural components

**Cumulative Risk**

**ERF**
WHAT ABOUT OCCUPATIONAL RISK FACTORS (ORF)?

Current CRA approaches focus primarily on:
- Aggregate exposures to chemical classes with common toxic mechanisms
  - Pesticides - Neurotoxicity
- Environmental, community and residential issues
  - Environmental justice
- EPA and academics

What about the workplace and occupational risk factors (ORF)?
<table>
<thead>
<tr>
<th>Reference</th>
<th>Health Endpoint</th>
<th>Stressors</th>
<th>Interaction Type</th>
<th>Risk Factor Type</th>
</tr>
</thead>
</table>
MODIFIED CRA MODEL

Cumulative Risk

ORF

- Agents
  - Chemical
  - Biological
  - Radiologic
  - Physical
  - Psychological

- Pathway
  - Air
  - Surfaces

- Route
  - Inhalation
  - Dermal
  - Ocular

PRF

ERF
INTEGRATING CRA & OCCUPATIONAL RISK ASSESSMENT

- ORF impact health & well-being
- Non-ORF influence workers
- Knowledge of the interaction of risk factors may foster enhanced management of occupational illness and injury

CHANGING WORKPLACE AND CULTURE

- Workplace changes
  - Economic
  - Demographics
  - Chronic diseases
  - Technology
    - Exposome

- Cultural changes
  - Well-being
  - Total Worker Health

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The Exposome: Exposure to Disease

- Our Exposures
- Our Unique Characteristics
- Disease

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TOTAL WORKER HEALTH™

Proposed National Total Worker Health Agenda
Comment by December 22 on priorities for research and practice!

What is Total Worker Health™?
Total Worker Health™ is a strategy integrating occupational safety and health protection with health promotion to prevent worker injury and illness and to advance health and well-being.

Today, emerging evidence recognizes that both work-related factors and health...
CASE STUDY – ADVERSE CARDIAC EFFECTS

10 leading causes of death

- Heart disease
- Cancer
- Suicide
- Stroke
- Chronic lower respiratory diseases
- Alzheimer's
- Diabetes
- Influenza/pneumonia
- Kidney disease
- Unintentional injuries

SOURCE: Centers for Disease Control and Prevention (2012)
# Factors Associated with Adverse Cardiac Effects: Epidemiological Evidence

**Chemicals**

- Particulate Matter
- Ozone
- Sulphur dioxide
- Black carbon
- PAHs
- VOCs
- Methyl mercury

**Non-Chemical Stressors**

- Temperature
- Noise

**Immutable Factors**

- Gender
- Age
- Race
- Genetics
- Smoking
- Physical Activity
- Alcohol
- Diet

**Lifestyle Choices**

- Education
- Income
- ORF under Well Being Model

**Socio-Economic**

- Traditional ORF
CUMULATIVE RISK ASSESSMENT PROJECT

- **Purpose**
  - Integrate ORF into CRA
  - Integrate CRA into occupational risk analysis

- **Funded via National Occupational Research Agenda (NORA)**
  - Sponsor: Total Worker Health (TWH) Program

- **Funding period:** FY15-FY18

- **Three primary phases**
Phase 1 - Research Vision

Phase 2 – Case Studies

Phase 3 - Framework
PHASE 1 – FY15 ACTIVITIES

- **Large Team Recruitment**
  - Subject matter experts (SMEs) in the fields of toxicology, epidemiology, risk assessment/management, exposure science, behavioral science/psychology, statistics, and health policy
  - SMEs from US federal agencies (NIOSH, ATSDR, EPA), academia and private industry

- **Small group to focus on specific topics**
  - Based on National Academies of Science Risk Assessment paradigm
    - Hazard characterization/Dose-response assessment
    - Exposure assessment
    - Risk characterization
    - Risk management
1. What are the issues that need to be addressed to advance the practice of CRA?

2. What are the issues that need to be addressed to integrate CRA into the practice of occupational risk analysis?

3. What are the data gaps and limitations that must be overcome to integrate ORF-based models in CRA?
PHASE 1 – FY15 OUTPUTS

- **Manuscript 1**
  - Evidence-based paper that illustrates the role of ORF on the cumulative risk of various health endpoints

- **Manuscript 2**
  - State of the science review
  - Outline research needs and vision
  - Establish the focus of next phases of the project

![Diagram]

Model 1: ORF → CRA

Model 2: CRA → OSH
ORF should be included in cumulative risk

Workplace an overwhelming source of many unique hazards that may cause or contribute to impairment of health & well-being

Total Worker Health
QUESTIONS?

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