

# **Alf Nachemson Memorial Lecture**

## **Assessing the Impact of NIOSH Research on Worker Health Protection**

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

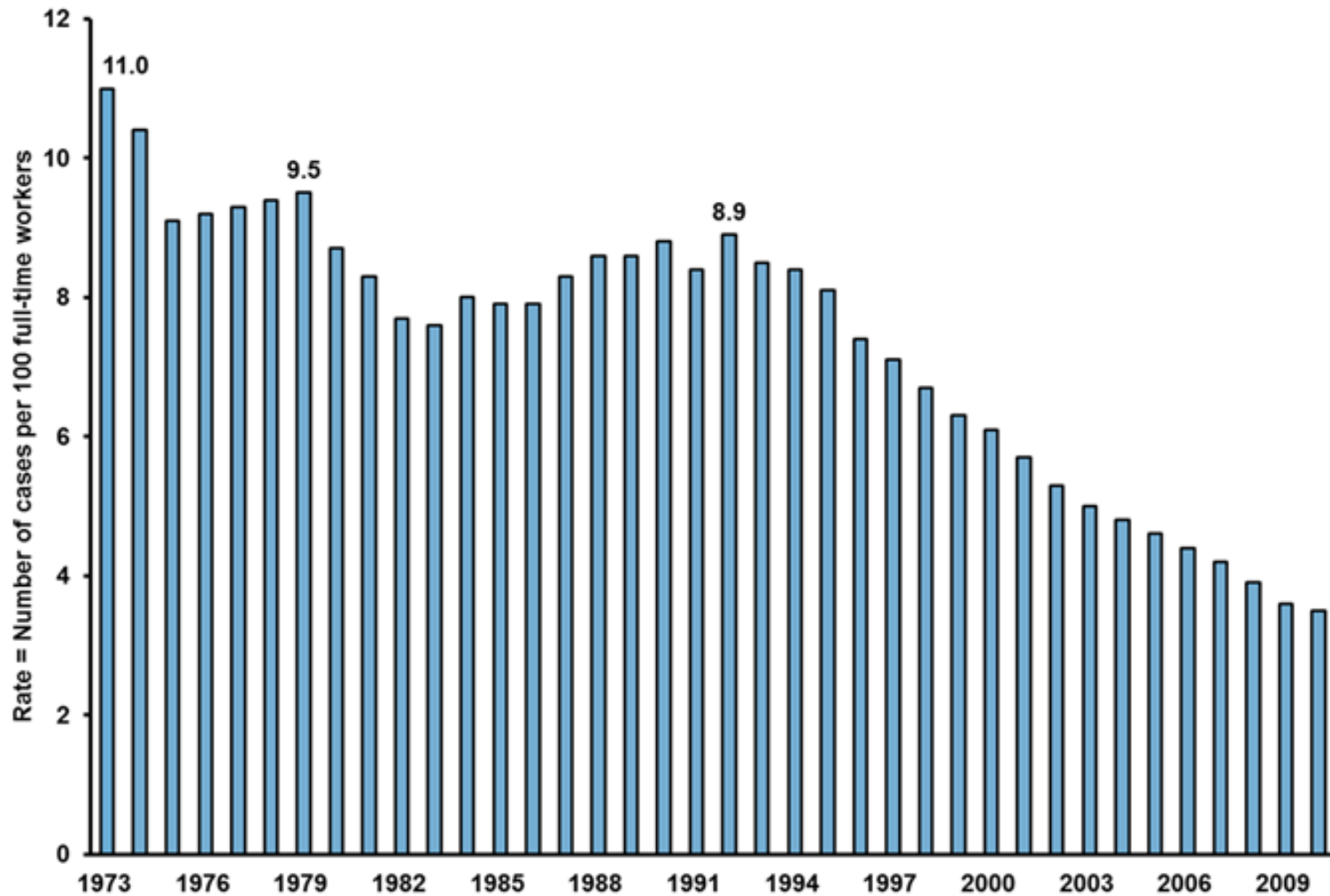


# **Acknowledgement**

This presentation reflects the work of numerous NIOSH colleagues.

- ❑ Historically in occupational safety and health (OSH) assessing impact of programs
  - Not a priority
  - Utility of intervention was generally apparent
  - The value of reducing exposure to hazard was intuitive
- ❑ Consequently, many of the serious causes of OSH morbidity and mortality were addressed

**Rate of total recordable nonfatal occupational injury and illness cases  
in Private industry, 1973–2010**

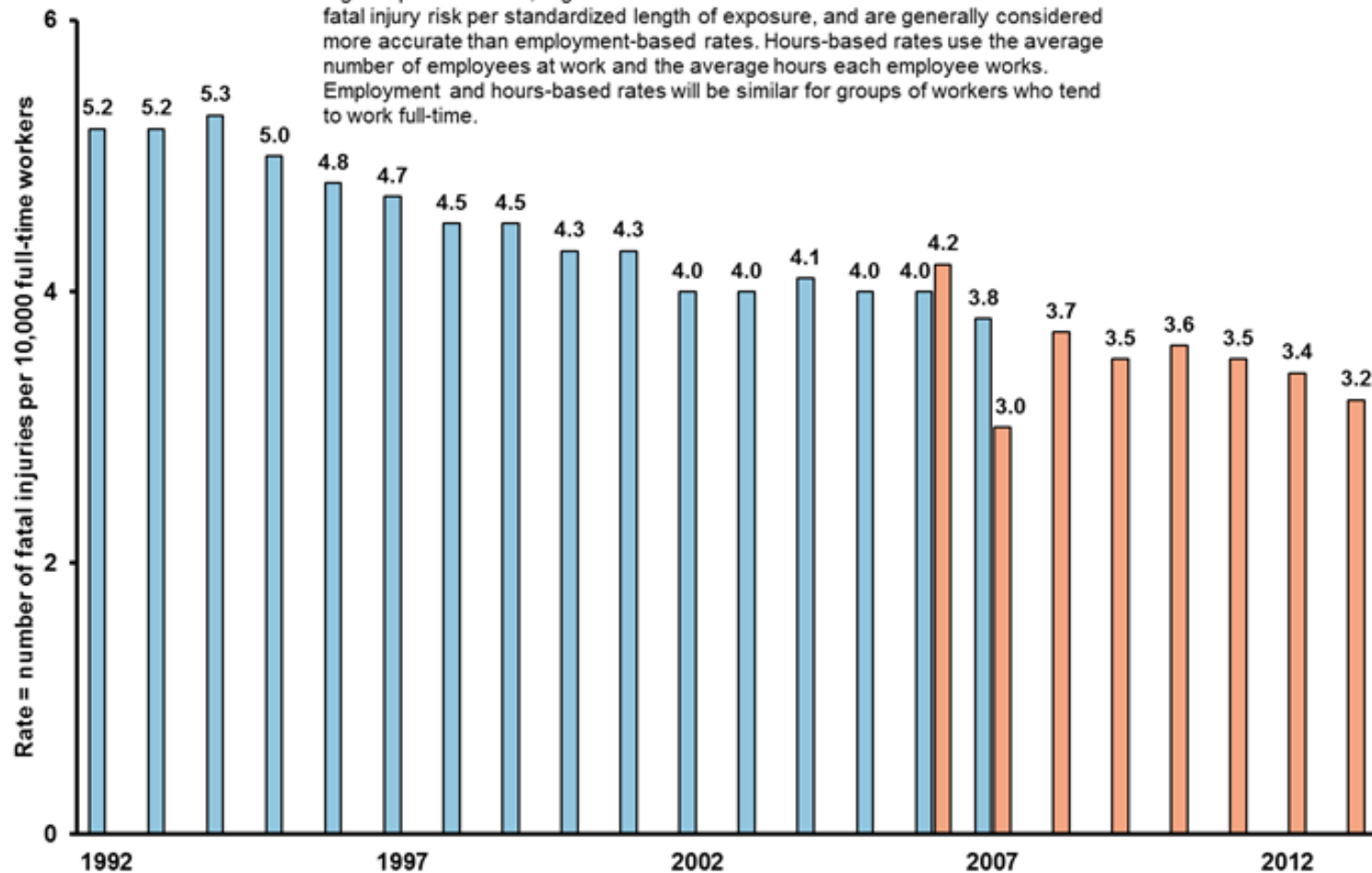


[BLS 2010]

## Rates of fatal occupational injuries, United States, 1992–2012

■ Employment-based ■ Hours-based

Fatal injury rates published by BLS for the years 1992 through 2007 were employment-based, and measured the risk of fatal injury for those employed during a given period of time, regardless of hours worked. Hours-based rates measure fatal injury risk per standardized length of exposure, and are generally considered more accurate than employment-based rates. Hours-based rates use the average number of employees at work and the average hours each employee works. Employment and hours-based rates will be similar for groups of workers who tend to work full-time.



[BLS 2013]

- ❑ Unfortunately, the decrease in rates has not been to tolerable levels—more work needs to be done
- ❑ What remains are core and not easy-to-solve problems

...and the US burden is still large

# US Burden

## Daily

- ❑ 12 workers are killed on the job

## Annually

- ❑ 4,409 deaths from injury [BLS 2013]
- ❑ 3.7 million serious injuries [BLS 2010]
- ❑ 181,000 work-related illnesses [BLS 2010]
  - 47,000 deaths from illness
- ❑ \$250 billion in direct and indirect costs [Leigh 2011]\*
- ❑ Untold pain, suffering, and impact on families

\*Based on 2007 illness and injury rates

Internationally, there is growing interest by governments to understand the impact of publicly funded research.

## In US

- ❑ Pressures to reduce deficit
- ❑ Reassess value of programs across the federal government
- ❑ Update nation's spending priorities (GAO, 1996)
- ❑ Shift from focus on staffing and activity levels to "outcomes"
- ❑ Outcomes: the difference federal programs make in people's lives



## **In the US**

- 1993** Government Performance and Results Act (GPRA)
- 2003** Program Assessment Rating Tool (PART)
- 2010** GPRA Modernization Act (GPRAMA)

# PART Ratings

Ratings	Rating
85-100	Effective
70-84	Moderately effective
50-69	Adequate
0-49	Ineffective

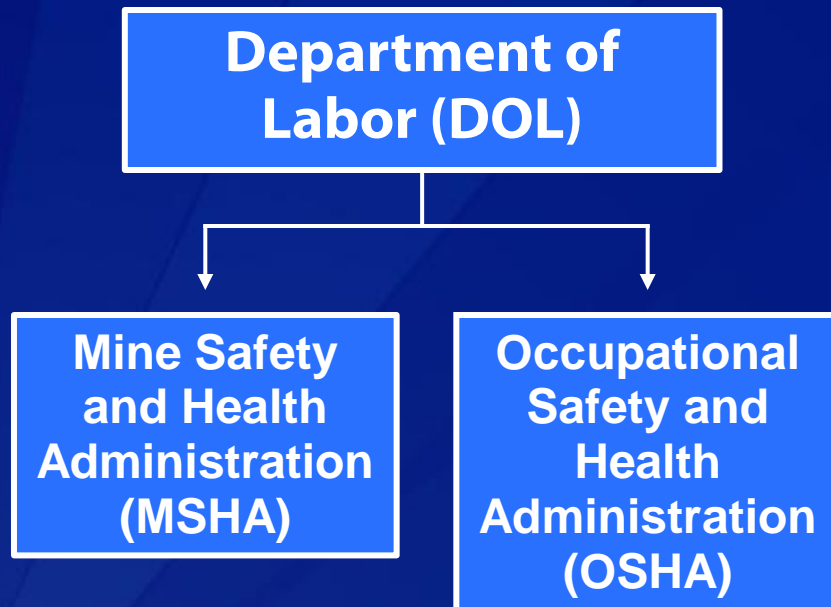
# **Assessing impact of occupational research and guidance is difficult**

- ❑ Outputs of a research agency are separate from control of workplace
- ❑ Intervening temporal, jurisdictional, social, economic, and political factors

# **Impact Assessment at the National Institute for Occupational Safety and Health (NIOSH)**

# Occupational Safety and Health (OSH) Act of 1970

## Regulation/Enforcement

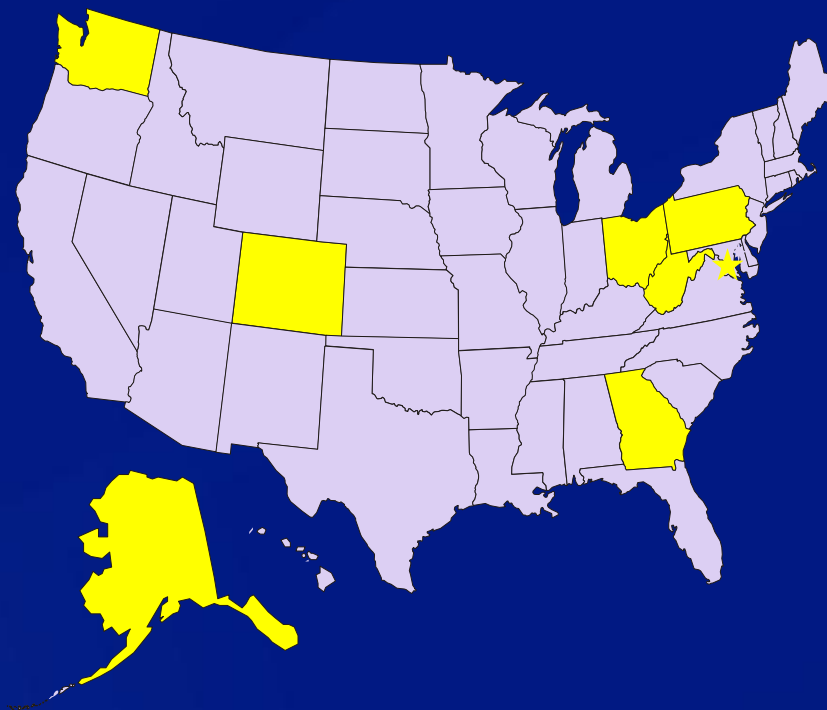


## Research and Prevention Recommendations



# NIOSH Locations

- ❑ Washington, DC
- ❑ Atlanta, GA
- ❑ Cincinnati, OH
- ❑ Morgantown, WV
- ❑ Pittsburgh, PA
- ❑ Spokane, WA
- ❑ Anchorage, AK
- ❑ Denver, CO



# NIOSH Responsibilities

- ❑ Researching hazards present in the workplace through laboratory and field studies
- ❑ Training safety and health professionals
- ❑ Recommending occupational safety and health standards and guidance



# NIOSH

- ❑ Approximately 1731 employees
- ❑ Eight locations
- ❑ Budget \$332 million Occupational Safety and Health  
\$268 million World Trade Center  
+ \$ 49 million Energy Workers' Compensation  
\$649 million



# Background to NIOSH Impact Evaluations

## External 1990s

- ❑ Relationship of science to society was changing
  - “Mode 2” science
  - “Science could no longer be considered as an autonomous space clearly demarcated from ‘others’ of society, culture, and economy” [Nowotny et al. 2009]
- ❑ Knowledge management: emerging concept
  - Knowledge as an asset
- ❑ Growing criticism of “big government”

# Background to NIOSH Impact Evaluations

## Internal

**1980s** Total Quality Management (TQM)

**1996** Move to a goal-driven organization  
National Occupational Research Agenda  
(NORA)

**1996** Intervention Effectiveness Research

**2004** Research to Practice (r2p)

**2006** Second decade of NORA

## **Background: Internal**

### **Total Quality Management (TQM)**

- ❑ Based on work of Deming [1982]
- ❑ Popular in business community in 1980s
- ❑ Calls for respect for people, empowerment
- ❑ Calls for continuous improvement

# **Background to NIOSH Impact Evaluations**

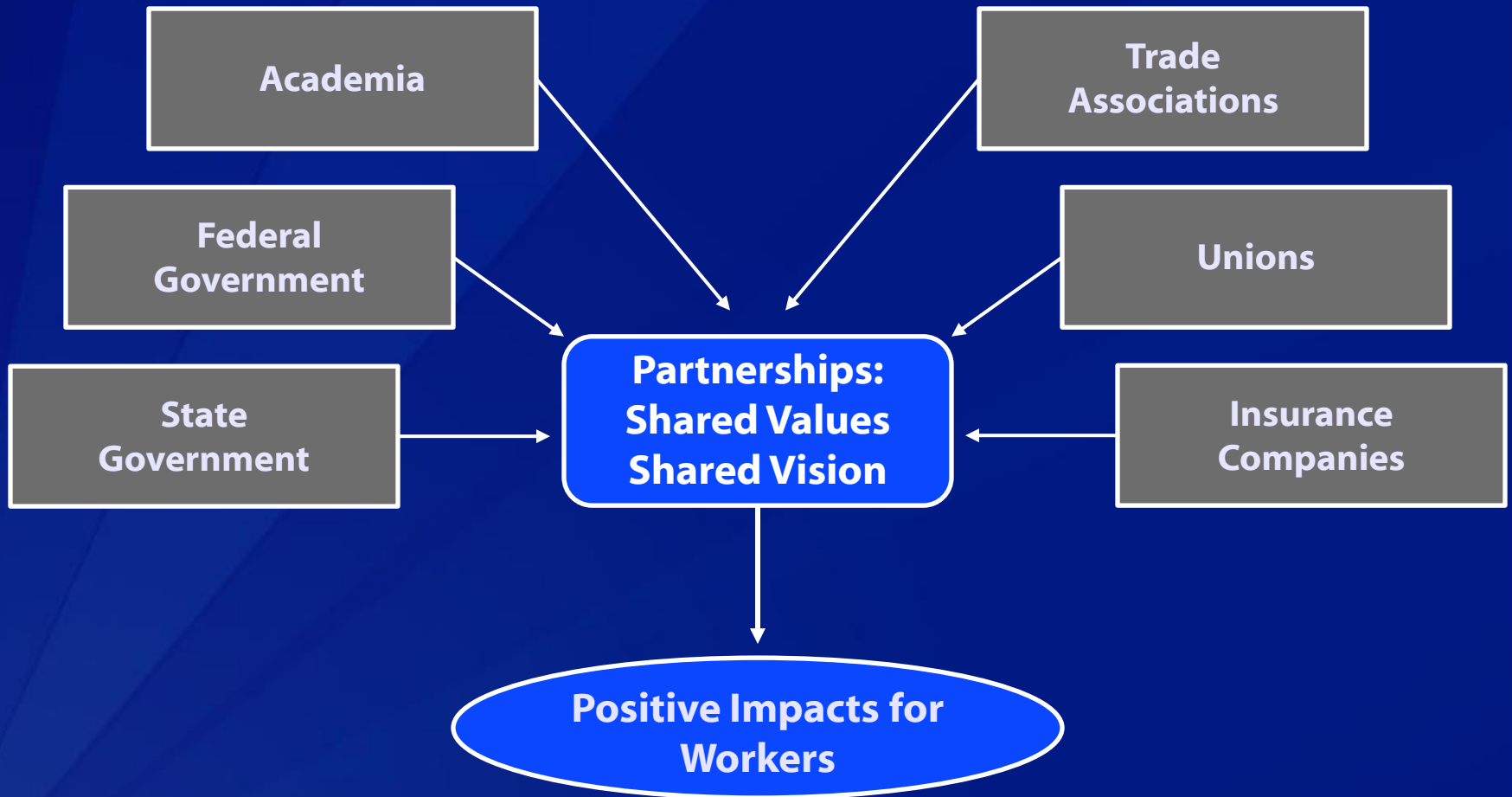
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**National Occupational Research Agenda (NORA)**
- 1996** Intervention Effectiveness Research
- 2004** Research to Practice (r2p)
- 2006** Second decade of NORA

# **Drive to Become a Goal-Driven Organization**

- ❑ Established the National Occupational Research Agenda (NORA) [1996]
- ❑ Agenda for the Nation
- ❑ No single organization has the resources
- ❑ 21 research categories

# NORA Implementation



# **Background to NIOSH Impact Evaluations**

## **Internal**

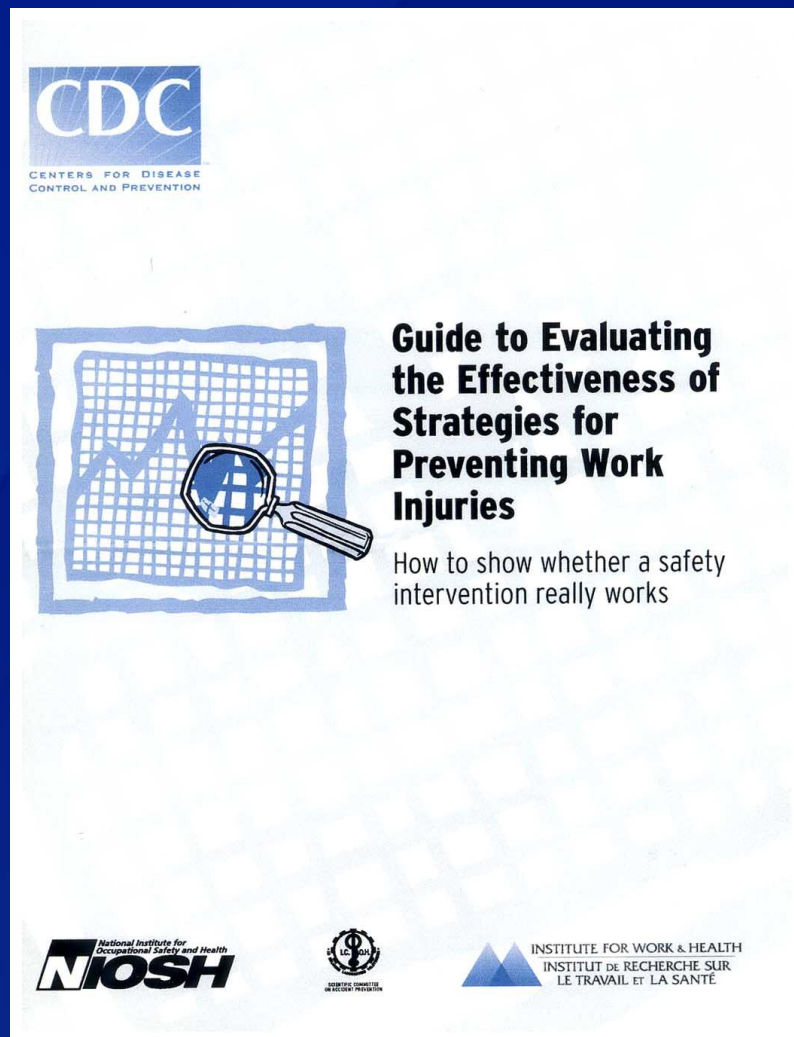
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# **Intervention Effectiveness Research**

- ❑ Pertinent to impact assessment
- ❑ Intervention can range from tools, process change, program, or agency
- ❑ Rich history
  - Clinical trials
  - Health services research
  - CDC Framework for assessing prevention program
  - Evaluation research
- ❑ NIOSH conference (1994)



# Seminal Publication (2001)



# **Background to NIOSH Impact Evaluations**

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# NIOSH Research to Practice (r2p) Program



Initiative focused on transfer and translation  
of knowledge, intervention, and technologies

*into*

effective practices and products which are  
adopted in the workplace.

## **Goal:**

Reduce injury and illness by increasing use of  
NIOSH outputs.

**r2p drives impact**

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- 2006** **Second decade of NORA**

## Second Decade of NORA (2006–2016)



Move research to practice in workplaces  
through sector-based partnerships



# **Second Decade of NORA**

## **NIOSH Program Portfolio: Sector Programs**

- ❑ Agriculture, Forestry, and Fishing
- ❑ Construction
- ❑ Healthcare and Social Assistance
- ❑ Manufacturing
- ❑ Mining
- ❑ Oil and Gas Extraction
- ❑ Public Safety
- ❑ Services
- ❑ Transportation, Warehousing, and Utilities
- ❑ Wholesale and Retail Trade

## **Restructure NORA Around Industrial Sectors (NAICS)**

### **Solicit Stakeholder Comments**

**Submission form on internet**

**NORA Town Hall meetings**

**13 locations**

**Transcript to capture comments**

**850 submissions from individuals  
and organizations**

**1600 categorized comments in  
internet database on NORA website**

**Considered by NORA Sector Councils**

### **Form Sector Councils**

**1/3 NIOSH, 2/3 Partners**

**Co-Leaders: one NIOSH, one Partner**

**Meet twice per year**

**Workgroups**

**Corresponding Members**

# NORA Sector Councils



**Mission:** Sector-specific strategic plan for the nation;  
Widespread adoption of improved workplace practices

**Characteristics:** Broad participation; Participants represent the  
sector; Transparency



# Initial NORA Sector Council Work



# **“Ideal” Strategic Plan**

<b>Strategic Goals</b>	<b>Reductions in Worker Illnesses, Injuries, Deaths or Exposures (End Outcome)</b>
<b>Intermediate Goals</b>	<b>Activities/Outputs of Intermediate Customers (Partners) that will be necessary</b>
<b>Activity/Output Goals or Action Steps</b>	<b>Activities/Outputs of Researchers or Partners that will be necessary</b>
<b>Performance Measures</b>	<b>Desired change in measurable activities/outputs/outcomes</b>
<b>Organizational Commitments to Advance Specific Goals</b>	<b>NIOSH will commit to advancing many of the goals; Partners will be asked to make commitments.</b>

# **Case Study**

**NIOSH Efforts at Impact Evaluation 1994–2014**

## **Five Examples**

- 1. Protocol-based studies**
2. National Academies Review
3. Review of second decade of NORA
4. Nanotechnology review
5. Development of new impact metrics

# 1

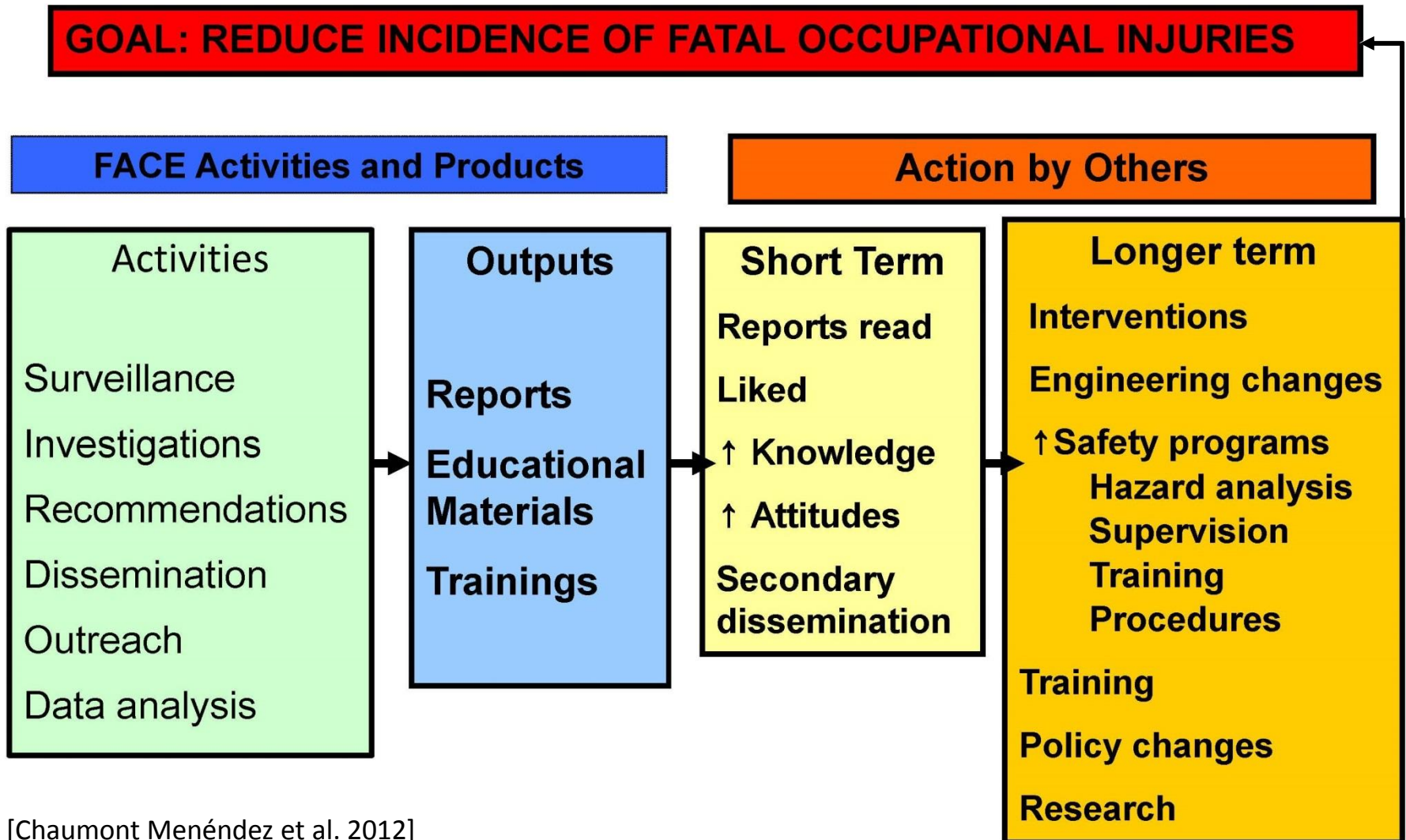
## Protocol-based Studies

- ❑ Latex Alert [Mayfield et al. 1999]
- ❑ Assessment of adoption of NIOSH recommendation for firefighters [Peterson et al. 2008]
- ❑ Impact of FACE program recommendations at the state level [Chaumont Menéndez et al. 2012]

# Fatality Assessment and Control Evaluation (FACE) Program

- ❑ Targets selected fatalities to investigate
- ❑ Identifies contributing factors
- ❑ Examines:
  - Level of supervision
  - Extent of safety training
  - Equipment designs and malfunctions
  - Presence of employer safety programs
- ❑ Makes recommendations for preventing similar events

# Framework for Effect



# Evaluation of a Nationally Funded State-based Program to Reduce Fatal Occupational Injuries

**Purpose:** Evaluate impact of The Fatality Assessment and Control Evaluation (FACE) Program on two focus areas

- ❑ Fall fatality rates
- ❑ Electrocution fatality rates

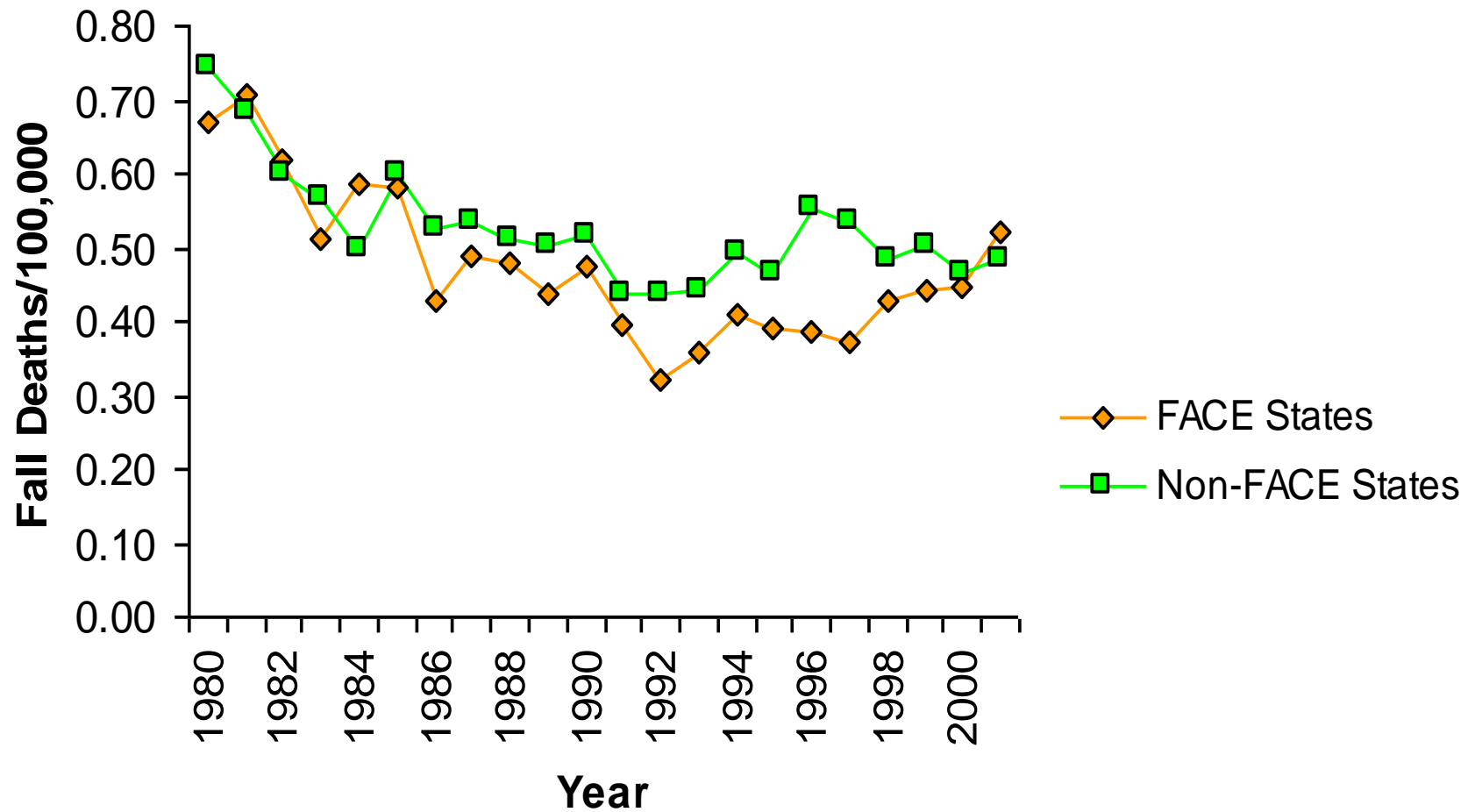


# Study Design

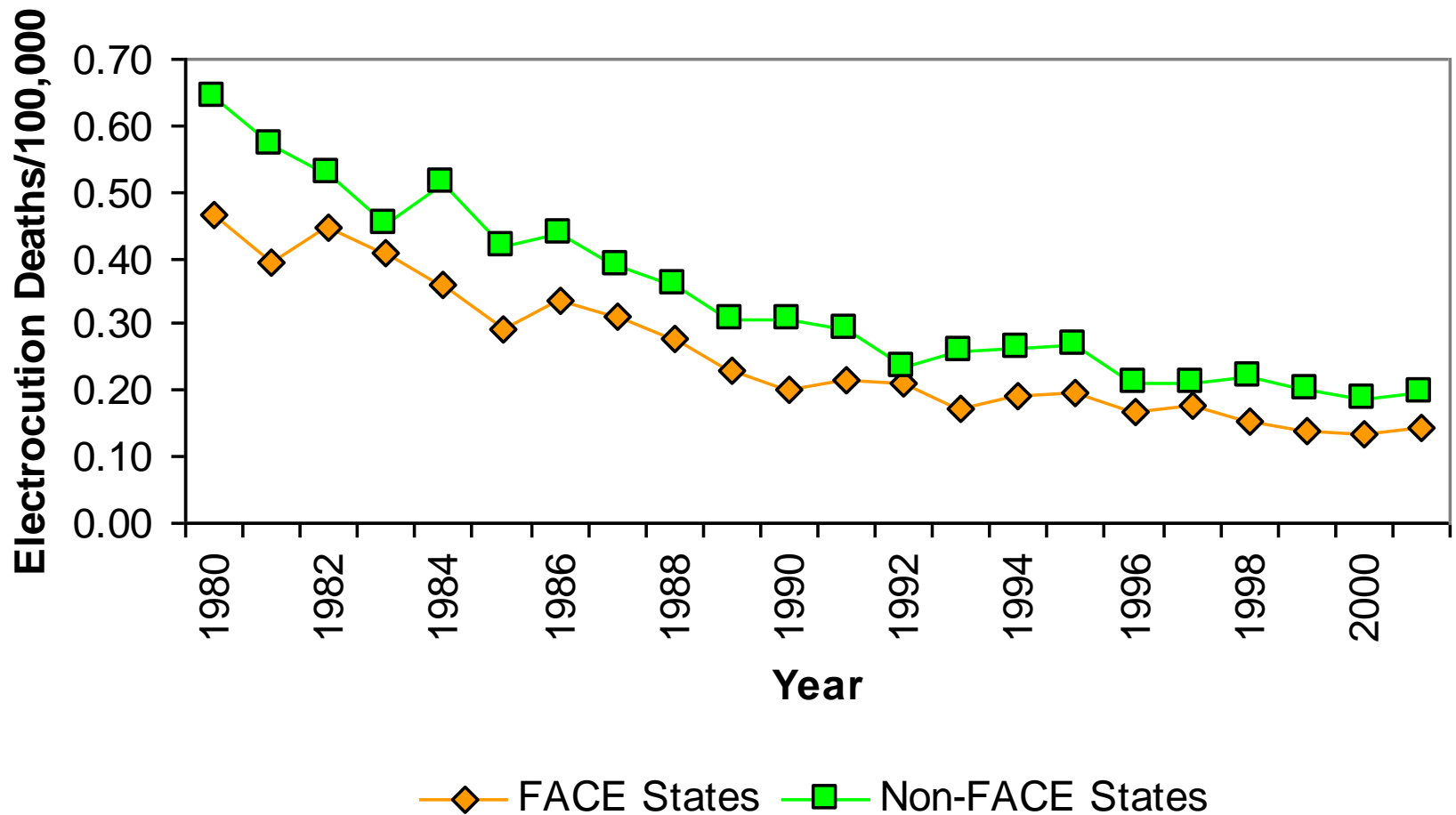
- ❑ Retrospective longitudinal time series analysis
- ❑ Outcomes fatality rates
- ❑ Used National Traumatic Occupational Fatalities (NTOF) Surveillance System
- ❑ Main effect participation in FACE Program
- ❑ Covariates
  - Proportion of workforce older than 65
  - Proportion of men in the workforce
  - Proportion of workers belonging to a minority group
  - Proportion of workers in construction industry
  - Various macroeconomic factors

# Results

- ❑ Reduction of fall fatality rates
  - Borderline significance
  - 1-year lag
  - Adjusted RR = 0.92 (0.84 to 1.00)
- ❑ Reduction of electrocution rates
  - 3-year lag
  - Adjusted RR = 0.92 (0.82 to 1.03)



Fall fatality rates by Fatality Assessment and Control Evaluation Program funding status from 1980 through 2001. Chaumont Menéndez et al. [2012]



Electrocution fatality rates by Fatality Assessment and Control Evaluation Program funding status from 1980 through 2001. Chaumont Menéndez et al. [2012]

## Discussion

- ❑ There are few studies comprehensively validating fall or electrocution prevention programs
- ❑ Only a small proportion of fatalities were investigated and reported on
- ❑ Non-FACE states also received reports minimizing the difference

## Five Examples

1. Protocol-based studies
2. **National Academies Review**
3. Review of second decade of NORA
4. Nanotechnology review
5. Development of new impact metrics

# 2

## **National Academies (NAS) Review of Eight NIOSH Programs**

- ❑ Hearing Loss Research Program
- ❑ Mining Research Program
- ❑ Respiratory Disease Research Program
- ❑ Agriculture, Forestry, and Fishing Research Program
- ❑ Traumatic Injuries Research Program
- ❑ Personal Protective Technology Research Program
- ❑ Construction Research Program
- ❑ Health Hazard Evaluation Program

# DEMONSTRATING AND COMMUNICATING RESEARCH IMPACT

Preparing NIOSH Programs for External Review



Valerie L. Williams | Elisa Eiseman | Eric Landree | David M. Adamson



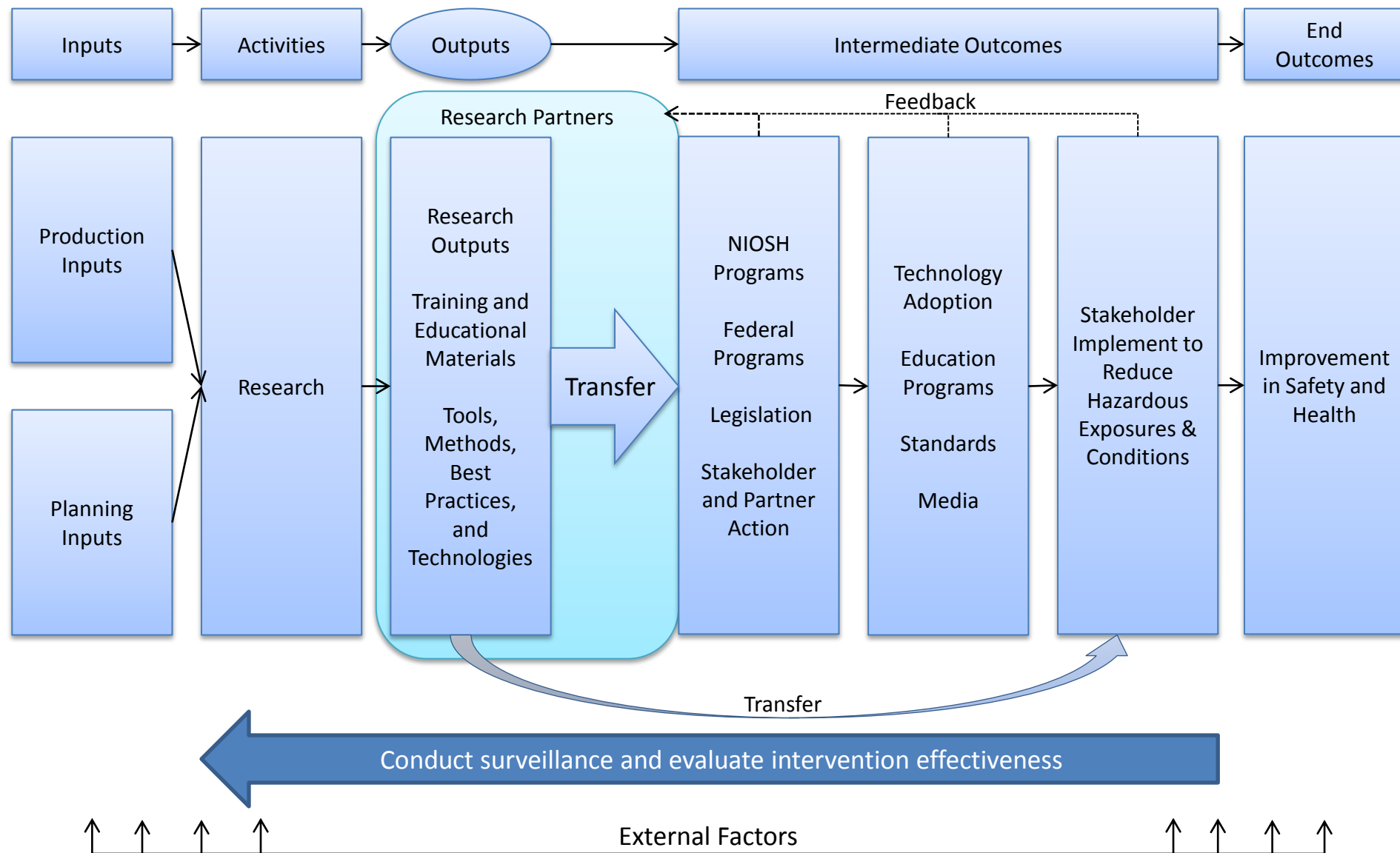
Safety and Justice

a RAND CORPORATION, GAO, and NIOSH research program



# National Academies NIOSH Logic Model

Mission: To provide national and world leadership to prevent work-related illness and injuries



Adapted from: Committee on the Review of NIOSH Research Programs. "Evaluating Occupational Health and Safety Research Programs." The National Academy of Sciences 2009.

REVIEWS OF  
RESEARCH PROGRAMS OF  
THE NATIONAL INSTITUTE  
FOR OCCUPATIONAL  
SAFETY AND HEALTH



# Evaluating Occupational Health and Safety Research Programs

FRAMEWORK AND NEXT STEPS

INSTITUTE OF MEDICINE AND  
NATIONAL RESEARCH COUNCIL  
ON OCCUPATIONAL SAFETY AND HEALTH

## **Evidence Package**

- ❑ Communicate how research activities contributed to positive societal outcomes

## Review of Evidence Package

- ❑ Numerically score programs – score of 1-5 for relevance and impact
  - Score of 5 for relevance

Research is in high-priority subject areas and the NIOSH program is significantly engaged in appropriate transfer activities for completed research
  - Score of 5 for impact

Research program had major contributions to worker safety and health on the basis of end outcomes or well-accepted intermediate outcomes

NAS Review of NIOSH Programs



Second Independent Review (185 scientists)



NIOSH programs developed plans for implementation  
of NAS recommendations



NIOSH Board of Scientific Counselors (BSC)  
review and scoring



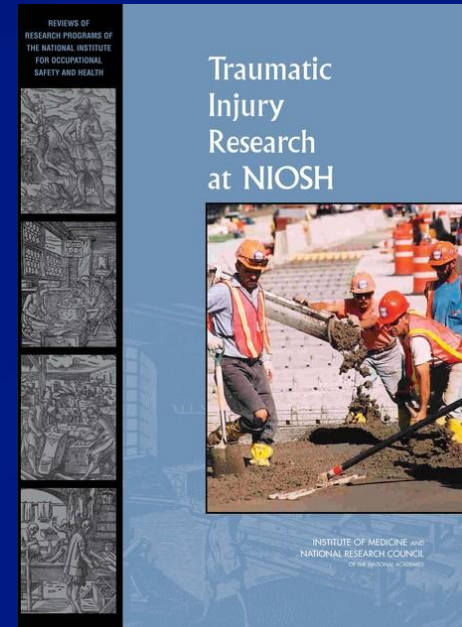
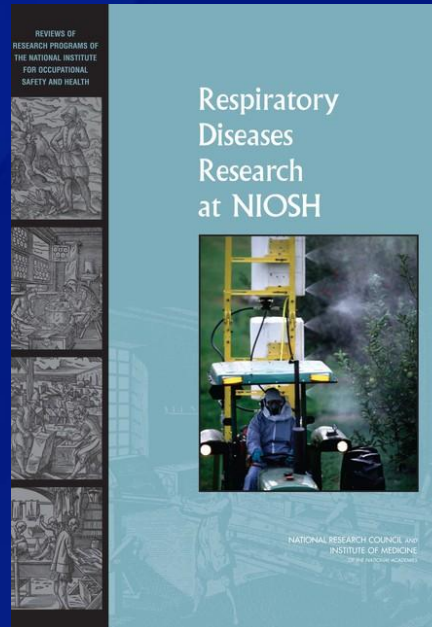
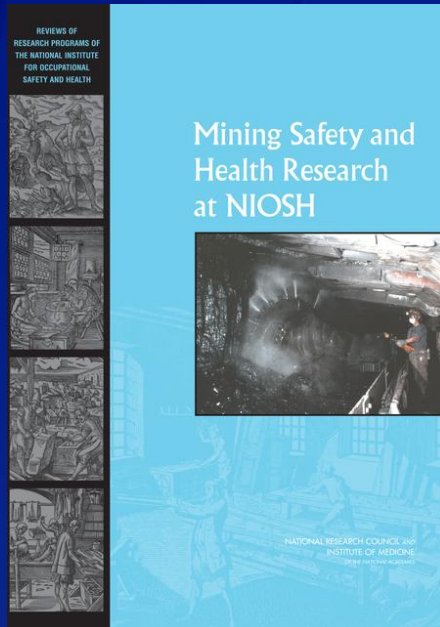
NIOSH program implemented recommendations



BSC Review of NIOSH Programs

- Relevance
- Sustainability
- Progress
- Potential impact

# Examples of Published NAS Review Reports



In all of these reviews, NIOSH received high scores for relevance and impact.

# **National Academies Review of Respiratory Disease Research at NIOSH**

## **Review Follows Five Strategic Goals**

- ❑ Prevent and reduce work-related airway diseases
- ❑ Prevent and reduce work-related interstitial lung diseases
- ❑ Prevent and reduce infectious respiratory diseases
- ❑ Prevent and reduce work-related respiratory malignancies
- ❑ Prevent respiratory and other diseases potentially resulting from occupational exposures to nanomaterials

# **NAS Rating of NIOSH Respiratory Disease Program**

Overall a score of 5 for relevance

- Activities related to subgoals – highest priority
- Highly relevant to improvements in the workplace
- Program engaged in transfer activities at a significant level

Overall a score of 4 for impact

- Most subprograms have made major contributions to worker health and safety on the basis of end and well-accepted as intermediate outcomes



## Five Examples

1. Protocol-based studies
2. National Academies Review
3. **Review of second decade of NORA**
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# 3

## **In Progress: Review of the Second Decade of NORA (2006–2016)**

- ❑ In second decade, NIOSH utilized
  - 10 industrial sectors
  - 24 cross-sectors Program Portfolio
- ❑ Review of NIOSH Program Portfolio

# NIOSH Program Portfolio: Cross-Sector Programs

- ❑ Authoritative Recommendations
- ❑ Cancer, Reproductive, and Cardiovascular Diseases
- ❑ Communications and Information Dissemination
- ❑ Economics
- ❑ Emergency Preparedness and Response
- ❑ Engineering Controls
- ❑ Exposure Assessment
- ❑ Global Collaborations
- ❑ Health Hazard Evaluation
- ❑ Hearing Loss Prevention
- ❑ Immune and Dermal Diseases
- ❑ Musculoskeletal Disorders
- ❑ Nanotechnology
- ❑ Occupational Health Disparities
- ❑ Personal Protective Technology
- ❑ Prevention through Design
- ❑ Radiation Dose Reconstruction
- ❑ Respiratory Diseases
- ❑ Small Business Assistance and Outreach
- ❑ Surveillance
- ❑ Total Worker Health
- ❑ Training Grants
- ❑ Traumatic Injury
- ❑ Work Organization & Stress Related Disorders

# **Second Decade of NORA Review of NIOSH Program Portfolio**

- ❑ What did NIOSH do?
- ❑ How well did it do?
- ❑ What was the impact?

## Overview

## Sectors and Cross-Sectors

## Partnerships

## Research

What was done?

**Q1: Sector Council Member Survey:**

Cross-sectional survey of key informants

**Q2: Sector and Cross-Sector Program Survey:**

Cross-sectional survey of NIOSH sector and cross-sector program leaders

**Partner and Public Comment:**

Responses to questions on NORA review website by the public with special outreach to program-level partners

Descriptive analysis of Institute-level partners

Intermediate Outcome Exercise (abstraction from existing databases)

Bibliometrics Analysis (abstraction from existing databases)

How well was it done?

What were the outputs & impacts?

Collection of **Impact Stories** from NIOSH Sector and Cross-Sector program leaders

Impact data collected from outside agencies influenced by NIOSH

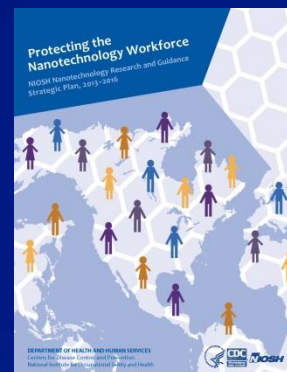
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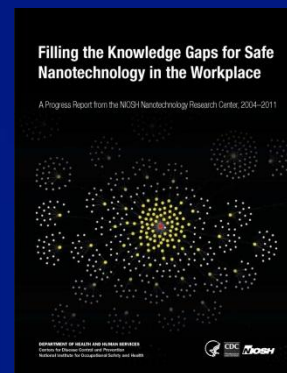
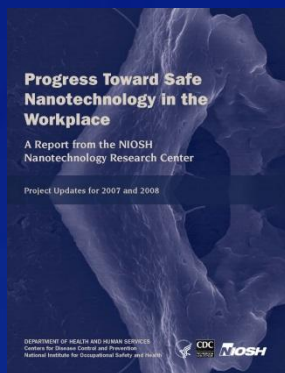
# 4

## Review of NIOSH Nanotechnology Research Center (NTRC)

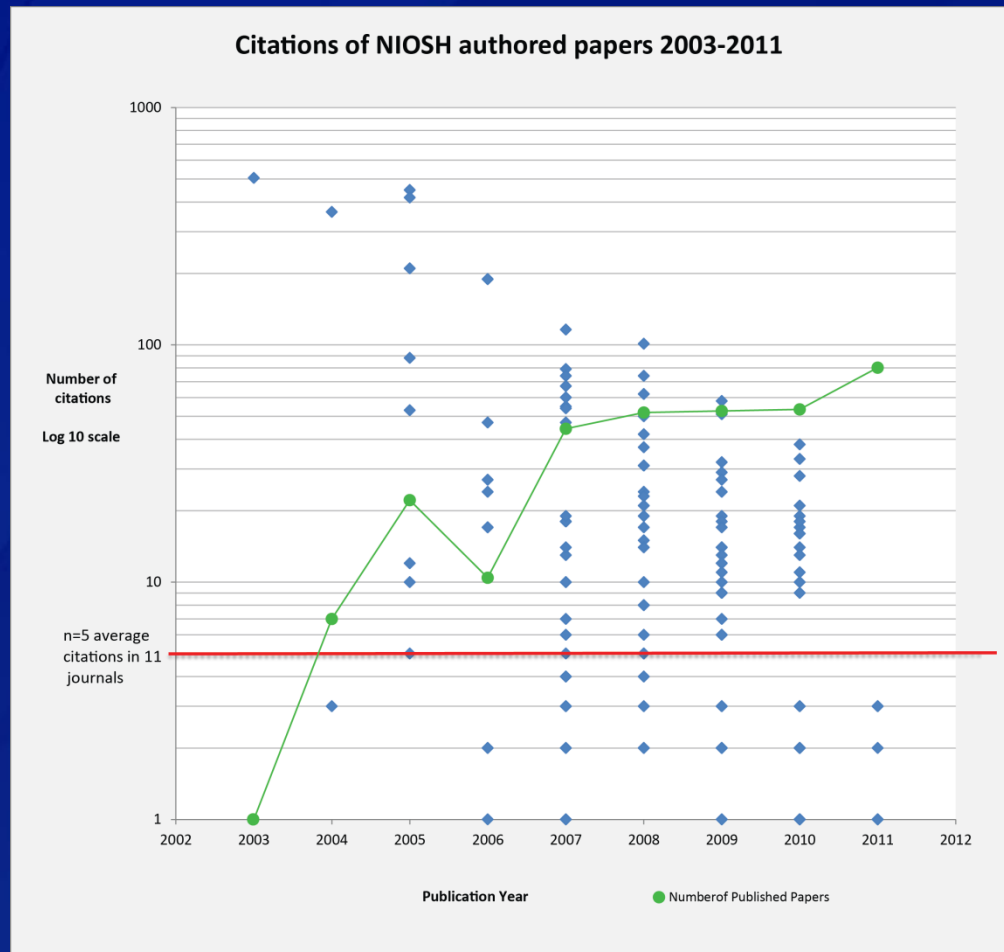
- Two Board of Scientific Counselor Reviews of strategic plans



- Two Progress Reports

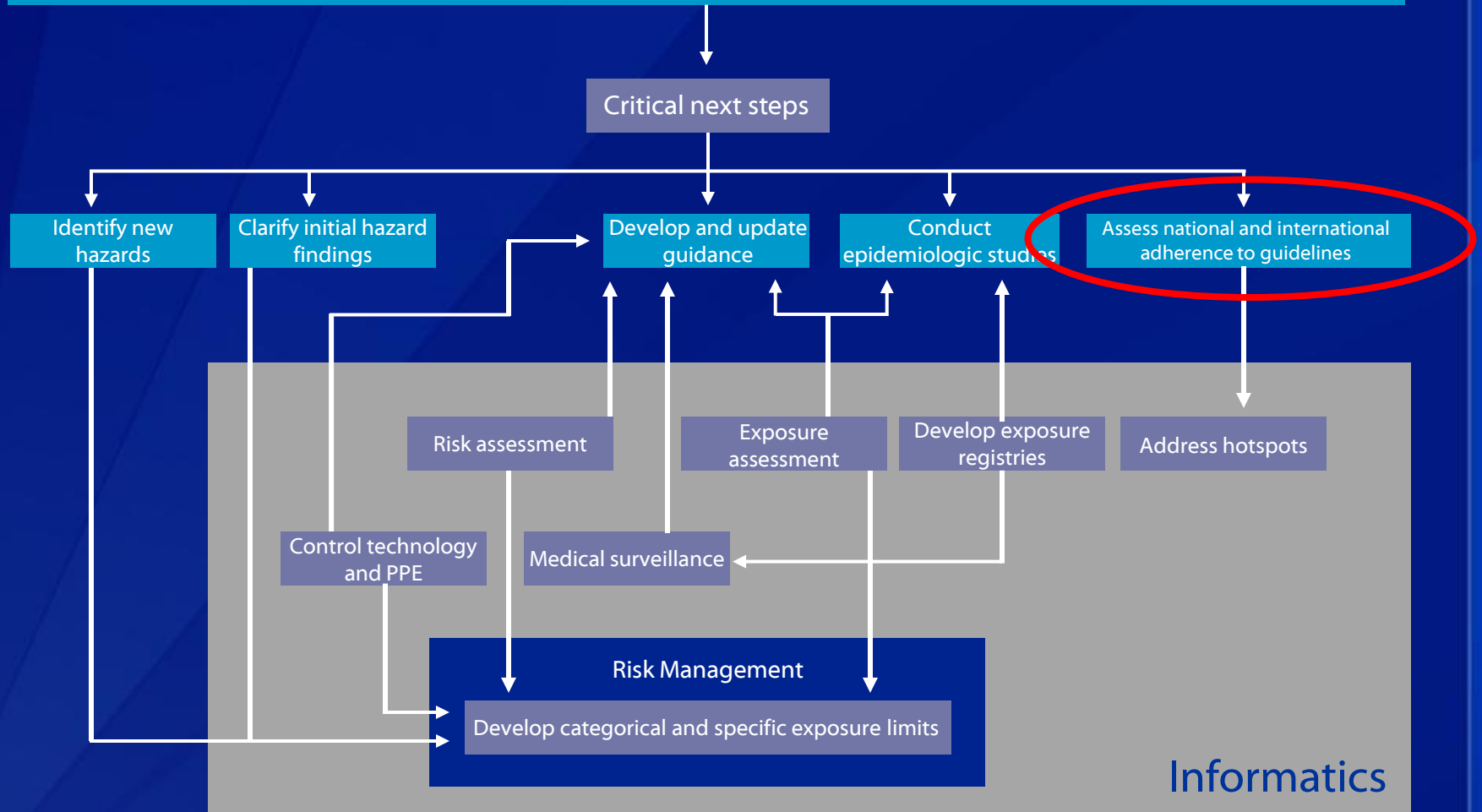


# Review of NTRC: Bibliometrics





# Protecting the Nanotechnology Workforce



## Five Examples

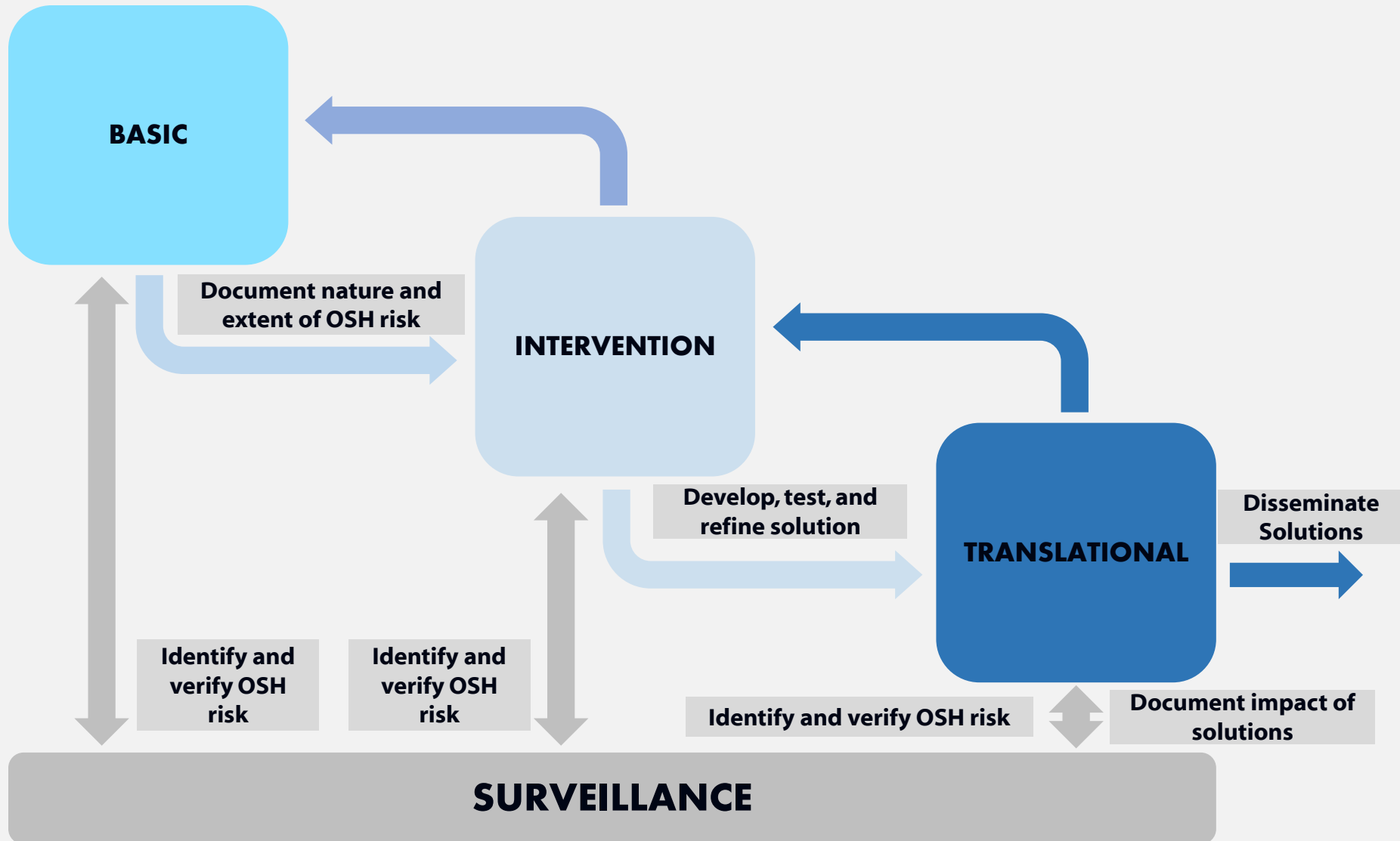
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# 5

## **Identification of Metrics to Advance Demonstration and Assessment of NIOSH Program Impact**

- ❑ Engaged Science and Technology Policy Institute (STPI)
- ❑ Utilized a multi-method approach
- ❑ Reviewed 4 representative categories of programs and research for FY10–FY14
  - Healthcare (Basic, intervention, translational)
  - Construction (Intervention and surveillance)
  - Hearing Loss Prevention (Intervention)
  - Nanotechnology (Basic)

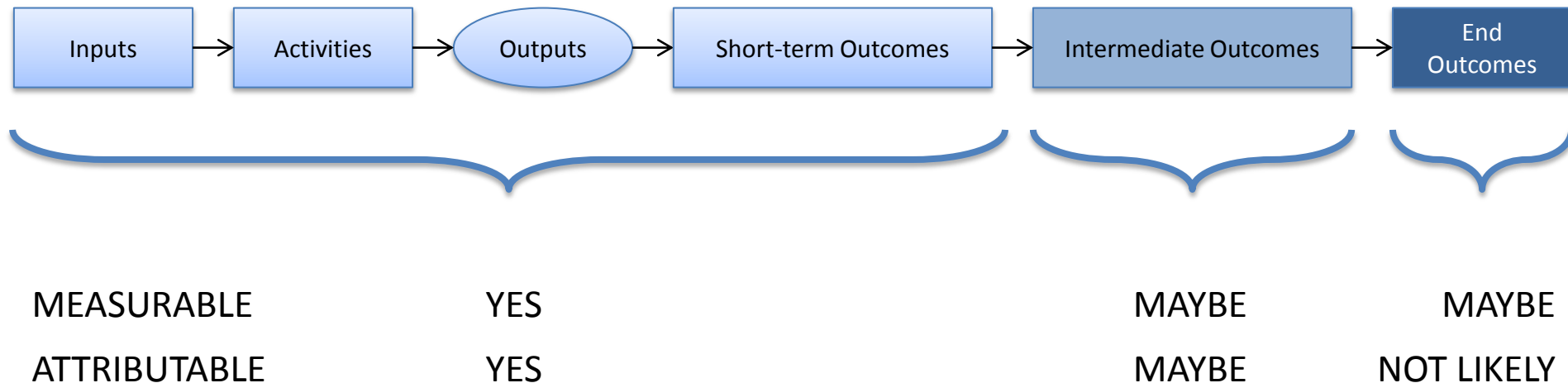
# NIOSH Research Continuum



# Evaluation Framework Design Choices

## Recommendation No. 1

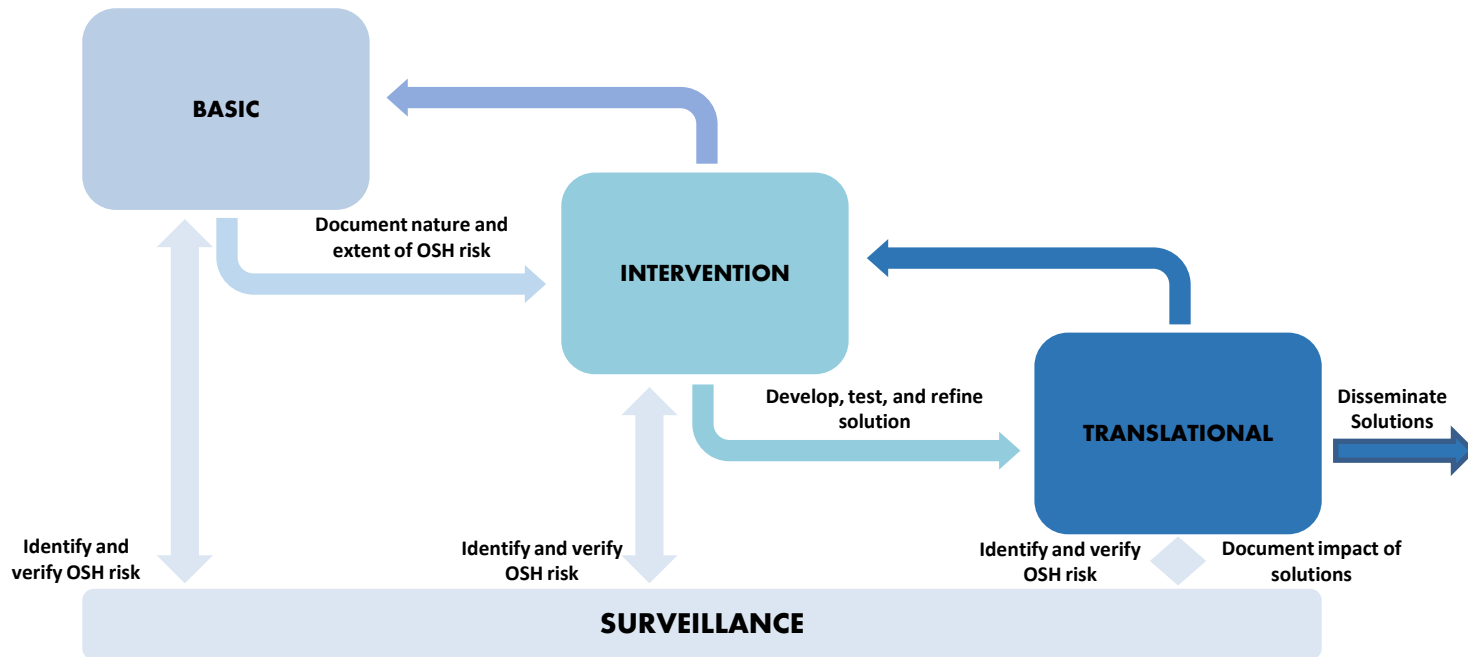
NIOSH should consider focusing its research evaluation on measuring outputs and short-term outcomes that are dependent mostly on its own activities.



# Evaluation Framework Design Choices

## Recommendation No. 2

NIOSH should consider applying metrics specific to each category of research to account for differing activities and goals.



# Perspective

# Science of Impact Assessment

- ❑ 50 years of practice
  - Program evaluation
  - Knowledge and research utilization
- ❑ Utilized highly simplified logic model



- ❖ **Difficulty:** under-development of models of the processes that lie between research outputs and the measured outcomes [Cozzens & Bortagaray 2002]



# Barriers

- ❑ Linkage of outputs to outcomes is difficult.
  - Often mediated
  - Result of interactive processes

“As soon as they are produced, the outputs of research activities join the pool of knowledge and human resources

that is fed not just by one agency’s activities...”

[Cozzens 1997]

“Research organizations can track outputs of activities they fund into the [Knowledge] pool ...”

But, if they try to track each drop, they have contributed through the pool to its outcomes, they will end up spending more money tracking than they spent on research.

[Cozzens 1997]

# Challenges

- ❑ Need to improve “impact science” to track outcomes and tie them to outputs
- ❑ Not been a focus of occupational safety and health research
- ❑ Need to develop methods, tools, and study designs
- ❑ Ultimately, the goal is not to just demonstrate impact, but to use impact assessments to improve outputs