NIOSH PPT
Vision & Mission

The VISION is to be the leading provider of quality, relevant, and timely PPT research, training, and evaluation.

The MISSION of the PPT program is to prevent work-related injury, illness and death by advancing the state of knowledge and application of personal protective technologies (PPT).




PPT in this context is defined as the technical methods, processes, techniques, tools, and materials that support the development and use of personal protective equipment worn by individuals to reduce the effects of their exposure to a hazard.

PPT Program Overview

- NIOSH Sector Based Program
- PPT/PPE, Hierarchy of Controls, Standards
- PPT Program Organization
- PPT Logic Model

NIOSH Program Portfolio

Industry Sectors

- Agriculture, forestry, and fishing
- Construction
- Healthcare and social assistance
- Mining
- Manufacturing
- Services
- Transportation, warehousing, and utilities
- Wholesale and retail trade

Cross Sector Programs

- Authoritative Recommendations Development
- Cancer, reproductive, cardiovascular, neurologic & renal diseases
- Communications and information dissemination
- Emergency preparedness/response
- Global collaborations
- Health hazard evaluation (HHE)
- Hearing loss prevention
- Immune, dermal and infectious diseases
- Musculoskeletal disorders
- **Personal protective technology**
- Radiation dose reconstruction
- Respiratory diseases
- Training grants
- Traumatic injury
- Work organization and stress-related disorders

Emphasis Areas

- Economics
- Exposure assessment
- Engineering controls
- Work life initiative
- Occupational health disparities
- Small business assistance and outreach
- Surveillance
- Nanotechnology

NIOSH Divisions & Laboratories

- Office of the Director, NIOSH
- Office of Extramural Programs
- Pittsburgh Research Laboratory (PRL)
- National Personal Protective Technology Laboratory (NPPTL)
- Division of Respiratory Disease Studies (DRDS)
- Division of Safety Research (DSR)
- Health Effects Laboratory Division (HELD)
- Education and Information Division (EID)
- Division of Applied Research and Technology (DART)
- Division of Surveillance Hazard Evaluation and Field Studies (DSHEFS)
- Office of Compensation Analysis and Support (OCAS)
- Research to Practice (r2p)
- Spokane Research Laboratory

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Workplace Hierarchy of Controls

Eliminate the Hazard

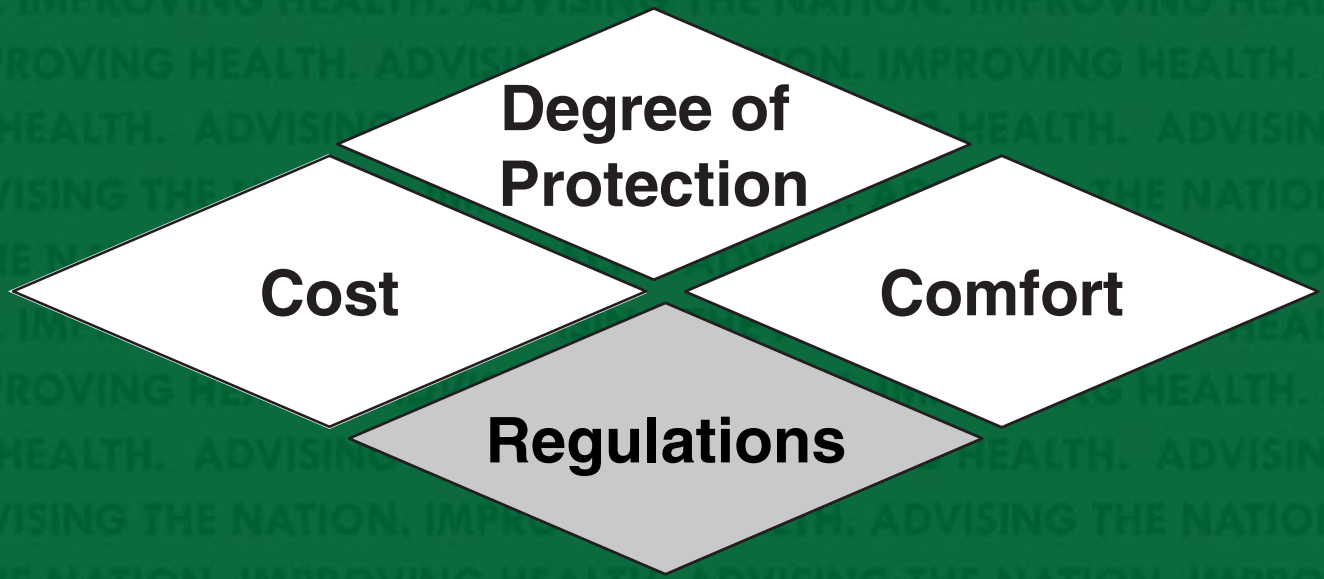
Minimize the Risk - Engineering Controls

Implement Administrative Controls

Provide Personal Protective Equipment

Personal Protective Technology

Design Drivers for PPE*



* From IOM Briefing to NPPTL, *Preparing for an Influenza Pandemic: Personal Protective Equipment for Healthcare Workers*, September 2007

PPT & Standards

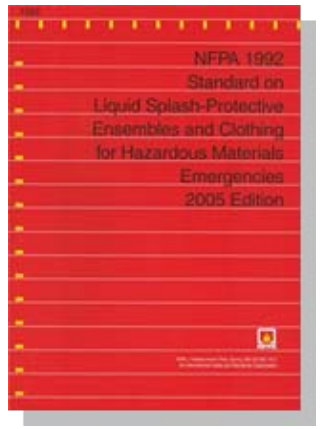
- Federally Mandated and Consensus Standards

- Federally Mandated and Administered
  - OSHA 29 Code of Federal Regulations (CFR) 1910.132-138
  - NIOSH 42 CFR, Part 84
  - Developed by federal agencies following rulemaking process

- Consensus Standards
  - Developed by Standards Setting Organizations (SDOs)
  - Standards Setting Committees with balanced representation:
    - Users
    - Academia
    - Labor
    - Subject Matter Experts
    - Government

PPT Participation with Standards Setting Organizations

- 42 Code of Federal Regulations (42 CFR)
- National Fire Protection Association (NFPA)
- American Society for Testing and Materials International (ASTM)
- American National Standards Institute (ANSI)
- International Organization for Standardization (ISO)
- International Safety Equipment Association (ISEA)



ISEA
INTERNATIONAL
SAFETY EQUIPMENT
ASSOCIATION

PPT Program
Goals/Objectives/Tactics

- **Strategic Goal 1**
  - Reduce Exposure to Inhalation Hazards
- **Strategic Goal 2**
  - Reduce Exposure to Dermal Hazards
- **Strategic Goal 3**
  - Reduce Exposure to Injury Hazards

- **Intermediate Objectives**
  - Goal 1 → 8 Objectives
  - Goal 2 → 3 Objectives
  - Goal 3 → 1 Objective

- **Tactics**
  - Comprehensive research
  - PPT standards development
  - Respirator certification and PPT evaluation activities
  - r2p → communications & outreach

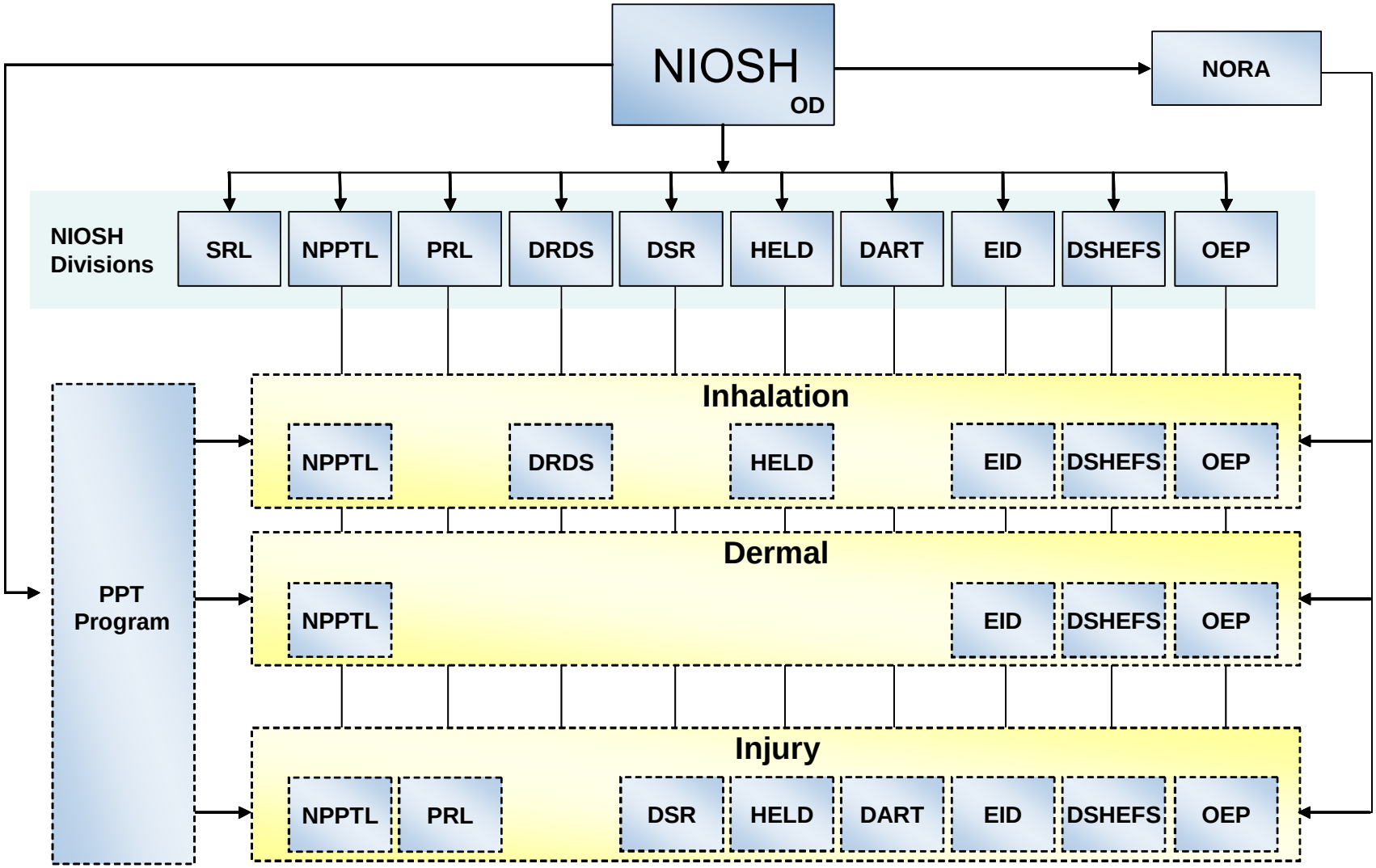
PPT Program Review Timeframe 2001 - Present

- 1998 NORA Workshop: *The Control of Workplace Hazards for the 21st Century: Setting the Research Agenda, March* 1998
- 1999 CBRN Workshop: *Chemical and Biological Respiratory Protection Workshop, March 1999*
- 2001 RAND Workshops and associated reports
- 2001 NPPTL created

PPT Activities within the NIOSH Program Matrix

PPT Goal	Primary Management Responsibility	Relevant NA Reviews
SG 1: Reduce Exposure to Inhalation Hazards	PPT Program	PPT Program
SG 2: Reduce Exposure to Dermal Hazards	PPT Program	PPT Program
SG 3: Reduce Exposure to Injury Hazards		
Area: Warning and Locator Devices	PPT Program	PPT Program
Area: Hearing Protection [App D]	Hearing Loss Research (HLR) Program	Hearing Loss Report (2006) The HLR program has developed an action plan to address issues raised in the report.
Area: Fall Protection [App D]	Traumatic Injury (TI) Program	Traumatic injury review (in progress)
Area: Anti-Vibration Gloves [App D]	Construction Program	Construction review (in progress)

PPT Program within NIOSH Organizational Structure – 2006 - Present



PPT Organizational Functional Components

PPT Program Management

- **Respirator Certification**
- **Policy & Standards Development**
- **Research**

Respirator Certification

- Respirator certification
  - Application processing
  - Respirator testing and QA Plan evaluation
- Post certification
  - Product and site audits
  - Respirator equipment evaluations

Policy & Standards Development

- CBRN Respirator Standards
- Powered Air Purifying Respirator (PAPR) Standard
- Mine Escape Respirator Standard
- Quality Assurance Provisions
- Total Inward Leakage Requirements
- Consensus Standards
- Guidance Documents

Research

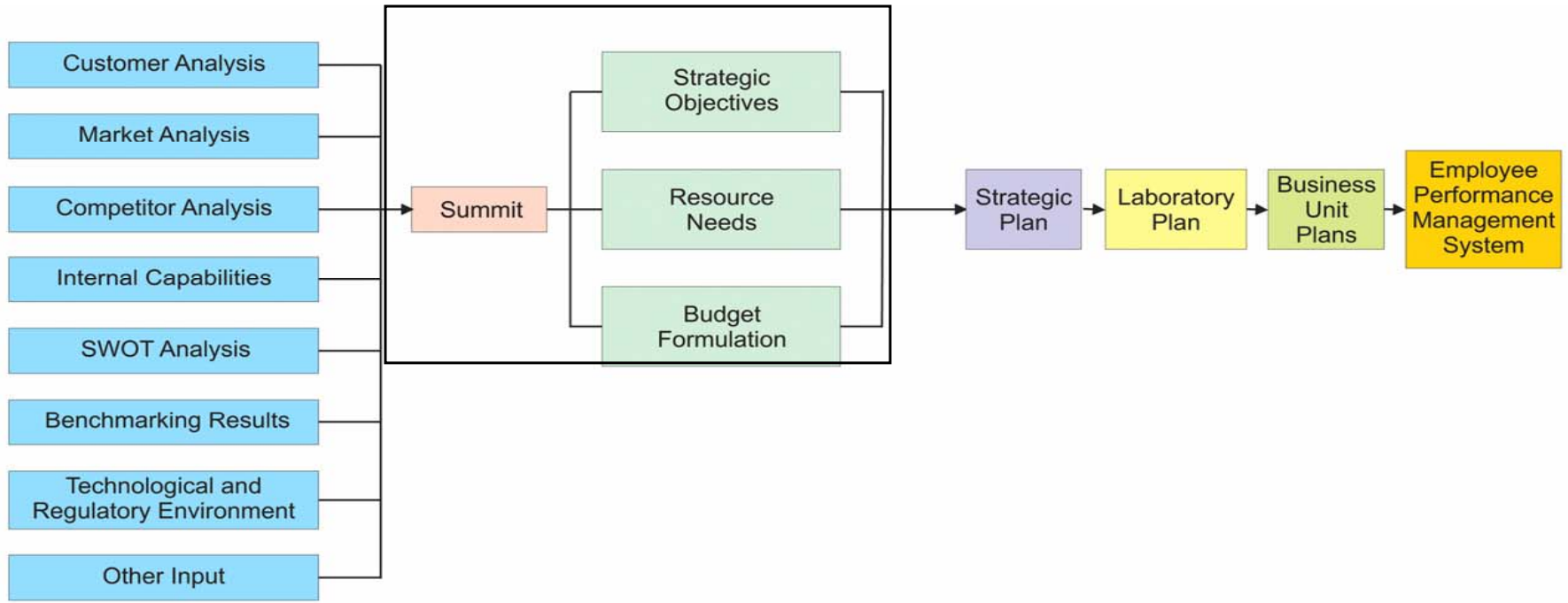
- Respiratory protection
- Human performance
- Sensors
- Ensembles

Achieving Performance Excellence (APEX)

- PPT Initiative for Performance Excellence

- Malcolm Baldrige Criteria – 7 Categories
  - Leadership
  - Strategic Planning
  - Customer / Market Focus
  - Measurement / Analysis / Knowledge Mgmt
  - Human Resource Focus
  - Process Management
  - Business Result

PPT Program Annual Strategic Planning Process



Achieving Performance Excellence (APEX)

NIOSH PPT Program

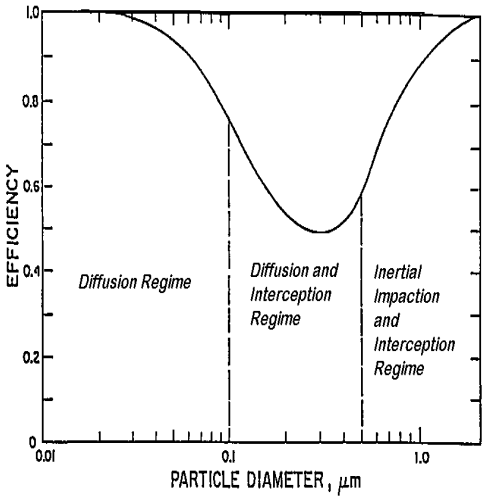
Value added Services: Relevance and Impact

Mine Escape Issues

- Mine Emergency Respirator Investigations
- New Technology Workshops
- Escape Respirator Research
- Escape Respirator Standards Development
- MSHA Collaboration

CBRN Issues

- Respirator Standards Development
- CBRN PPT Research
- Respirator Certification
- NFPA/IAFF Collaboration
- TSWG IAA
- OSHA Collaboration



Nanotechnology Issues

- Filtration Research
- Protective Clothing Research
- Respirator Research
- Respirator Certification
- Workplace Guidance

Pandemic Issues

- N95 Respirator Research
- Standards (Total Inward Leakage)
- Certification
- FDA Collaboration
- National Academies Activities
- Pandemic Planning

PPT Program Stakeholders and Partners

Stakeholders

Individuals/organizations with an interest in PPT activities.

Partners/ Stakeholders

actively involved in PPT activities.

Quality Performance Initiatives

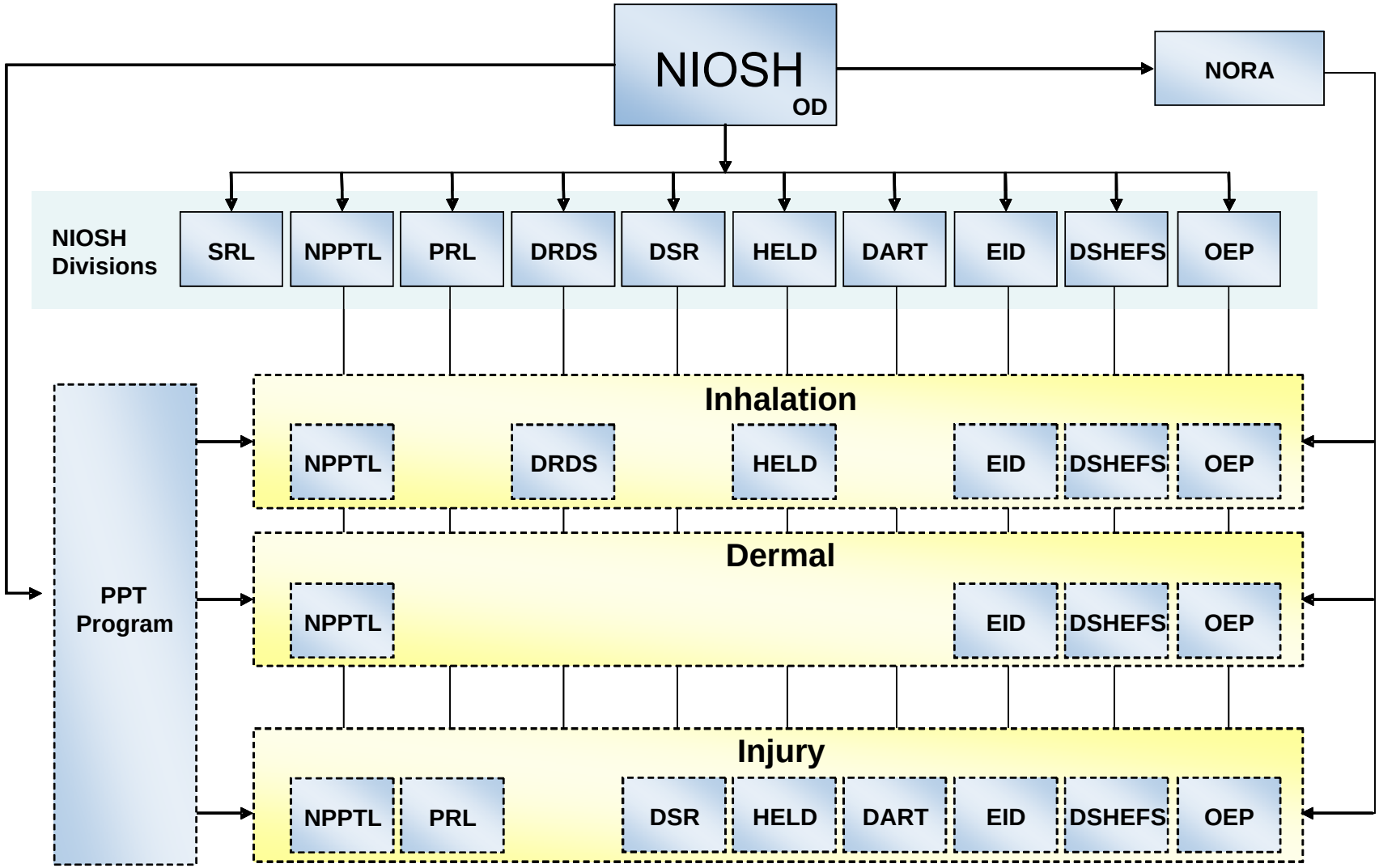
- **Evaluations**
  - *National Academies involvement in NPPTL*
  - *Scientific information product review*
  - *Benchmarking*

- **Customer Relationships and Satisfaction**
  - *Customer Satisfaction Surveys (CSS)*
  - *Direct Customer involvement*

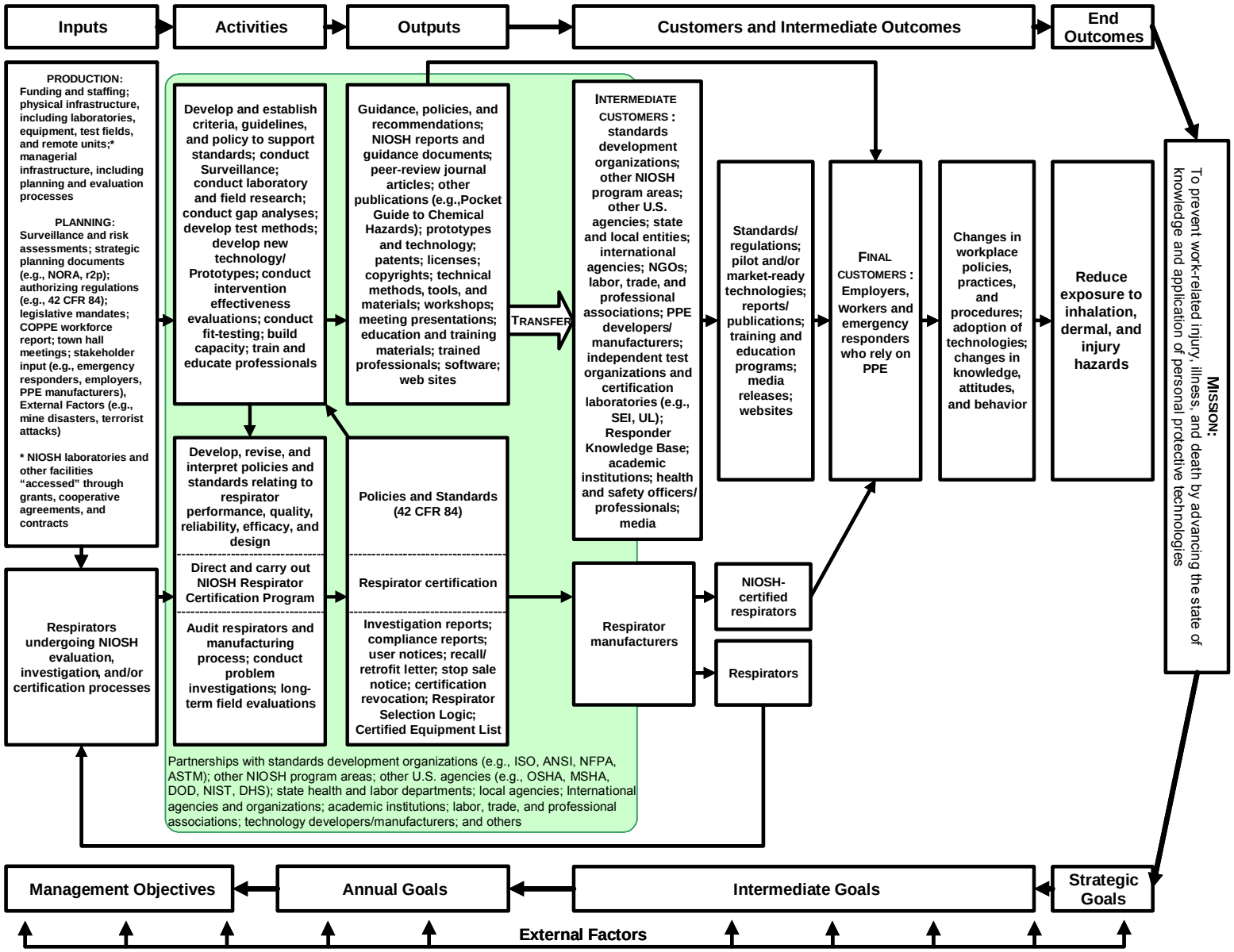
- **Customer and Market Knowledge**
  - *Standards Development Committee Involvement*
  - *Public Meetings and feedback*
  - *Customer Satisfaction Groups (Focus Groups)*

Academia - SDOs - Government Laboratories – Unions – Labor - Manufacturers

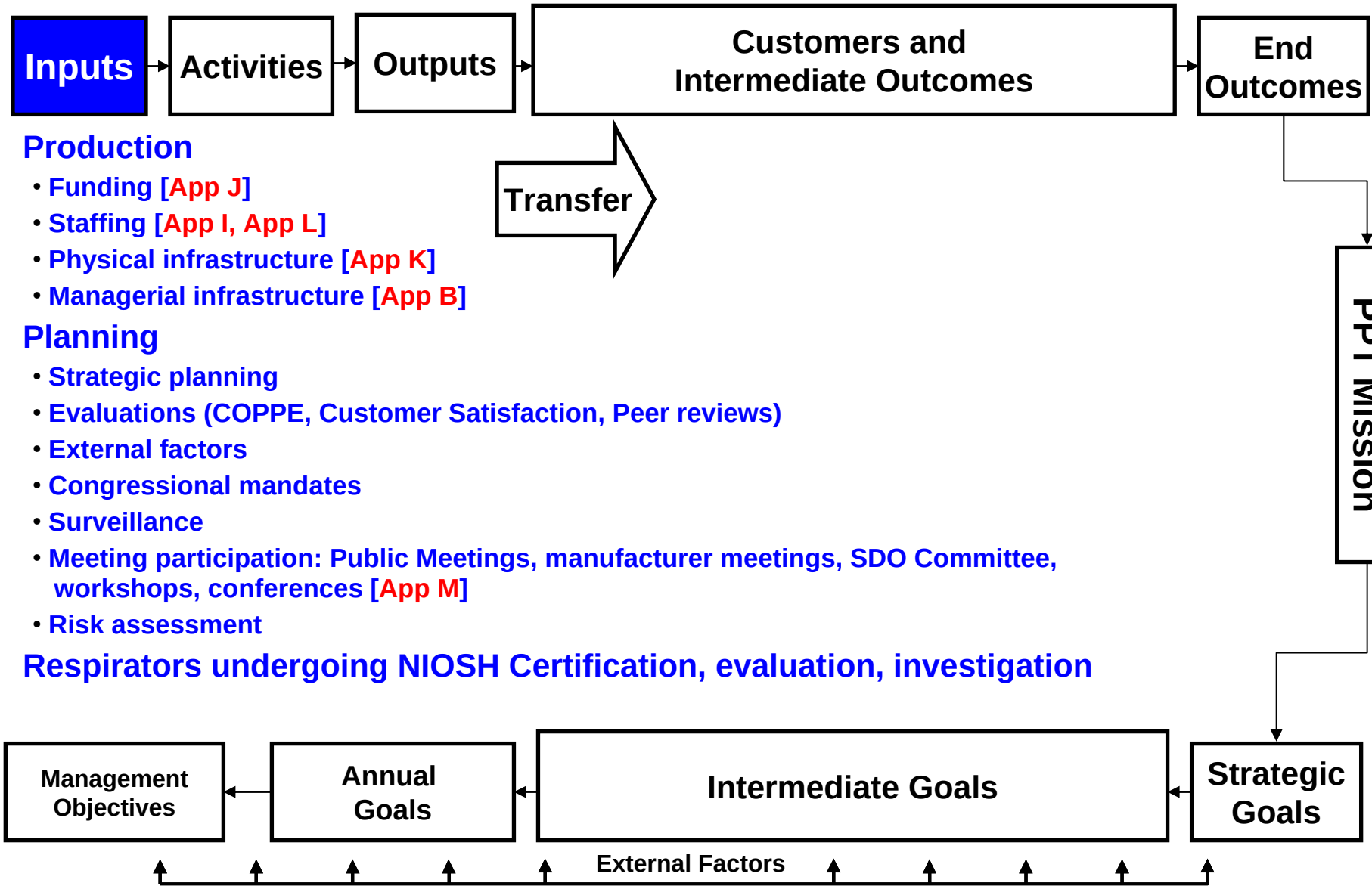
PPT Program within NIOSH Organizational Structure – 2006 - Present



PPT Program Logic Model



PPT Program Inputs



Production

- Funding [App J]
- Staffing [App I, App L]
- Physical infrastructure [App K]
- Managerial infrastructure [App B]

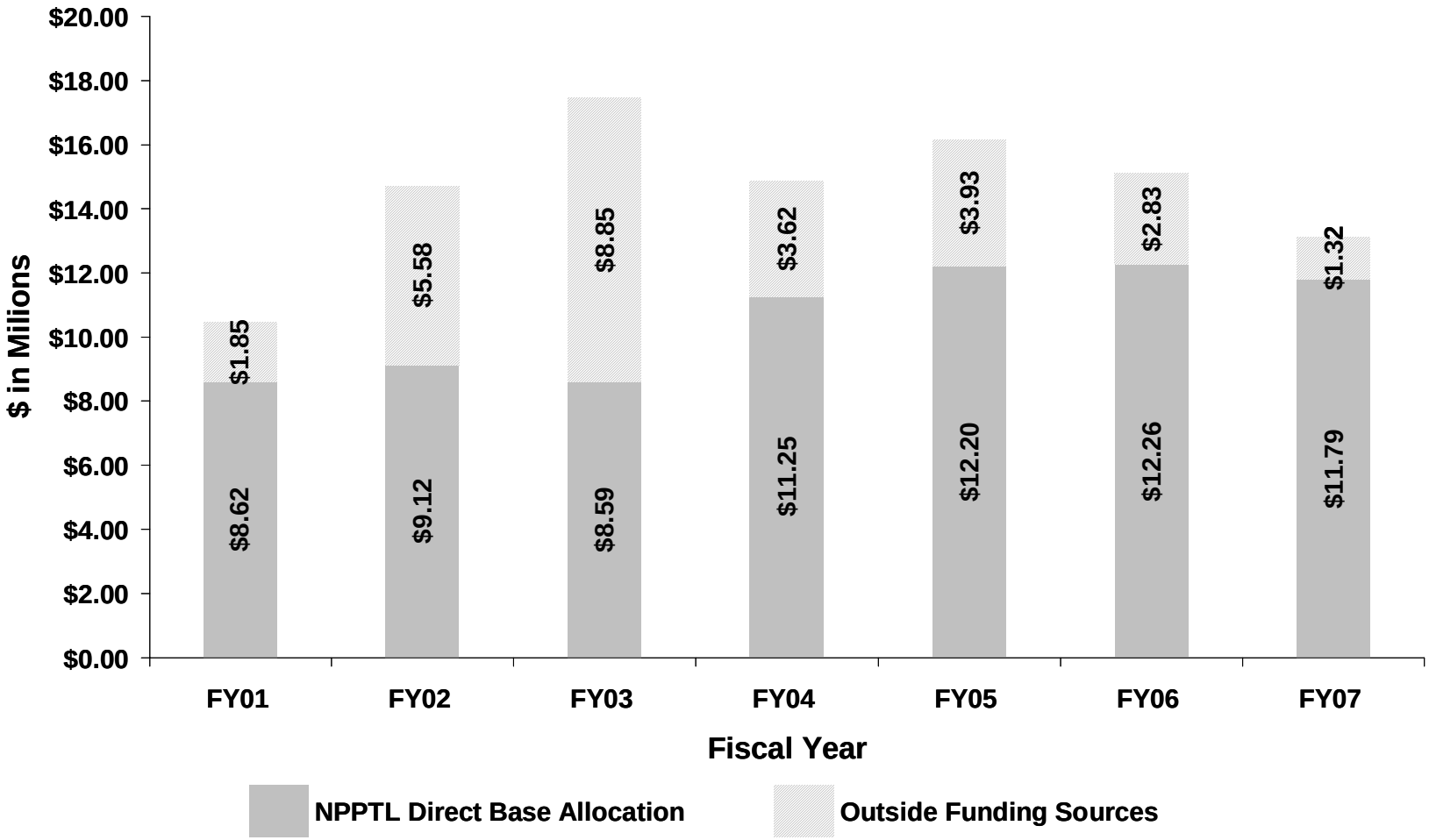
Planning

- Strategic planning
- Evaluations (COPPE, Customer Satisfaction, Peer reviews)
- External factors
- Congressional mandates
- Surveillance
- Meeting participation: Public Meetings, manufacturer meetings, SDO Committee, workshops, conferences [App M]
- Risk assessment

Respirators undergoing NIOSH Certification, evaluation, investigation

PPT Program Production Input

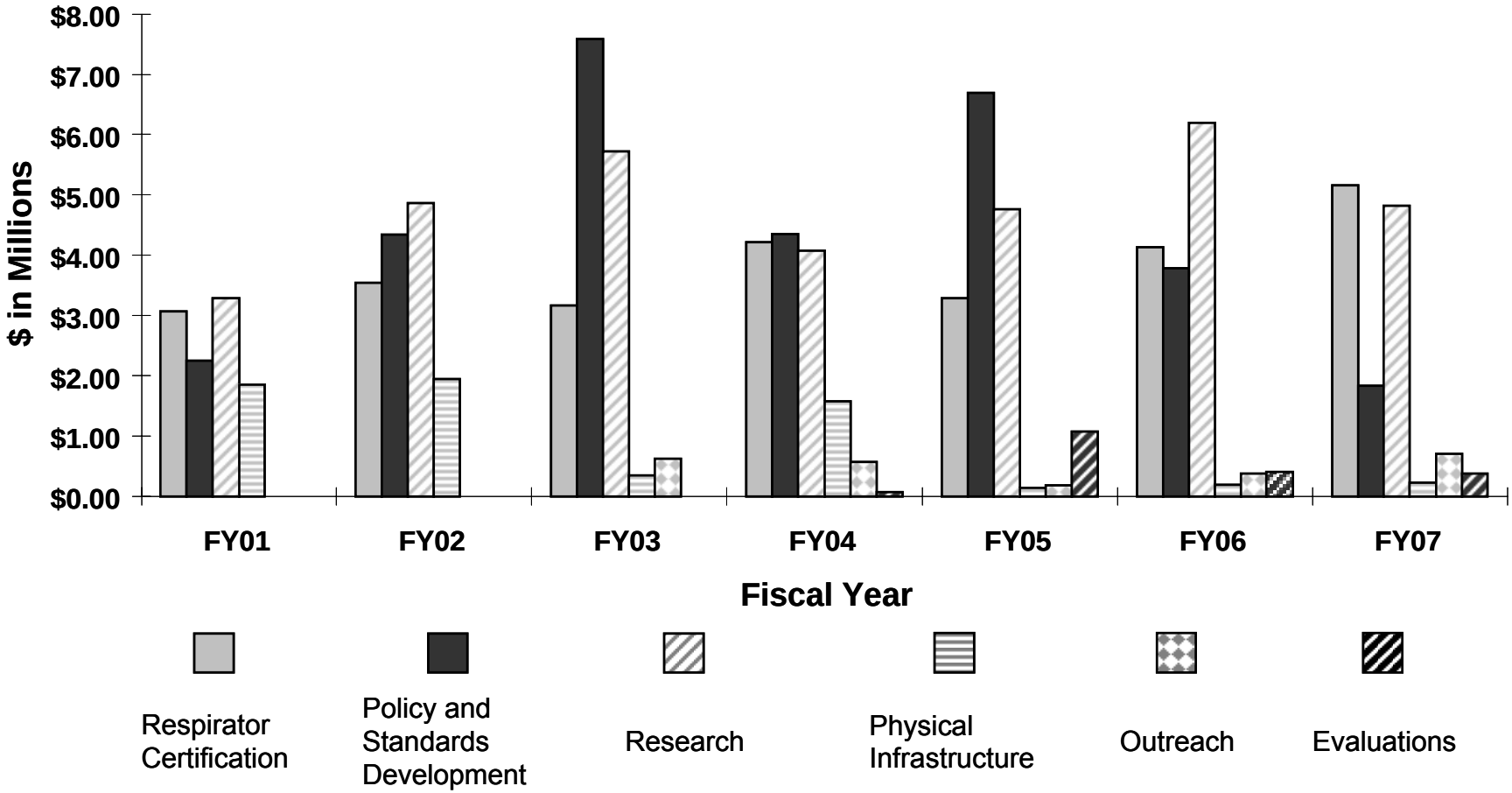
Funding Distribution (in Millions of $)



Total Funding Allocation FY01-FY07 = $101.79 Million

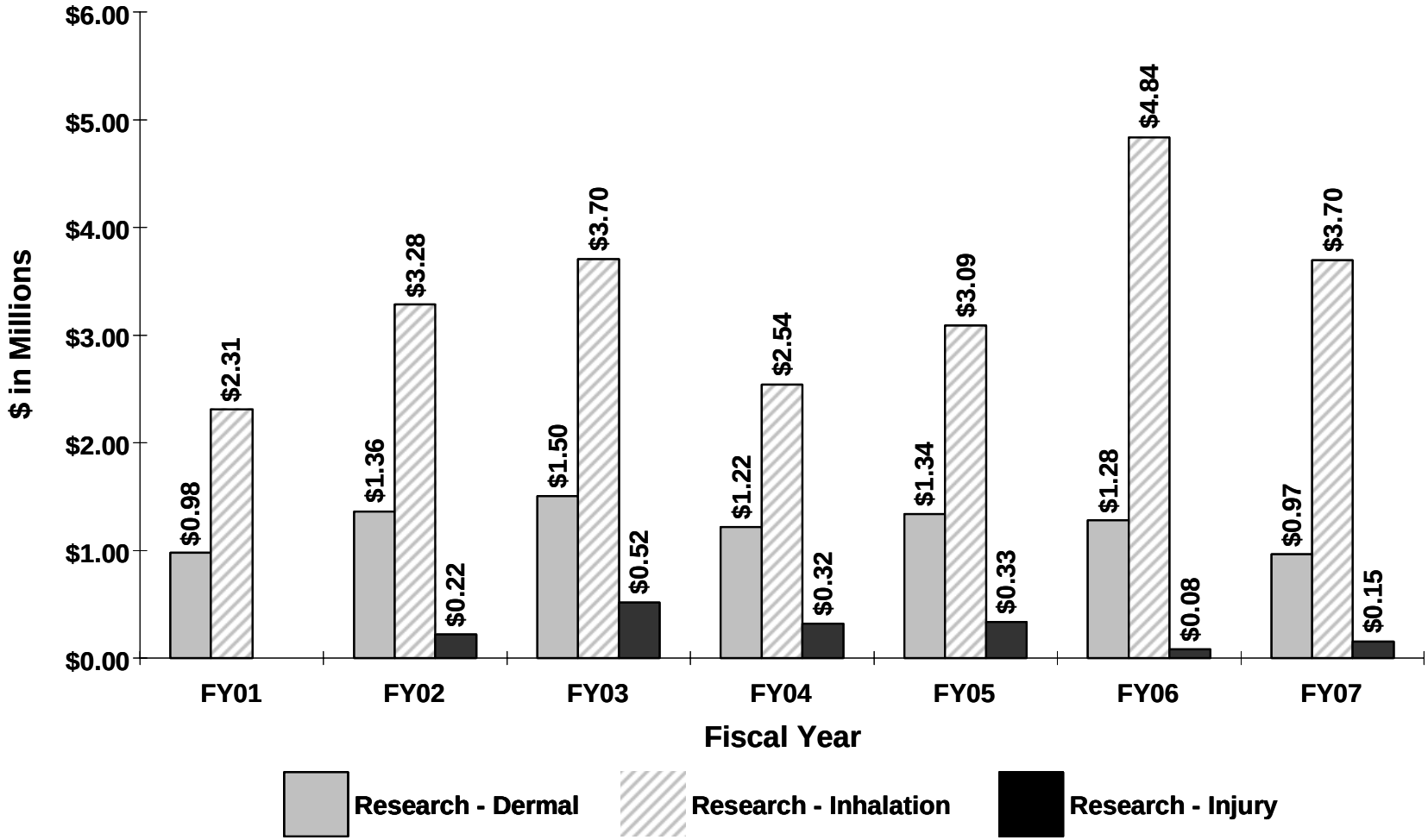
PPT Program Production Input

Funds Expended (in Millions of $)



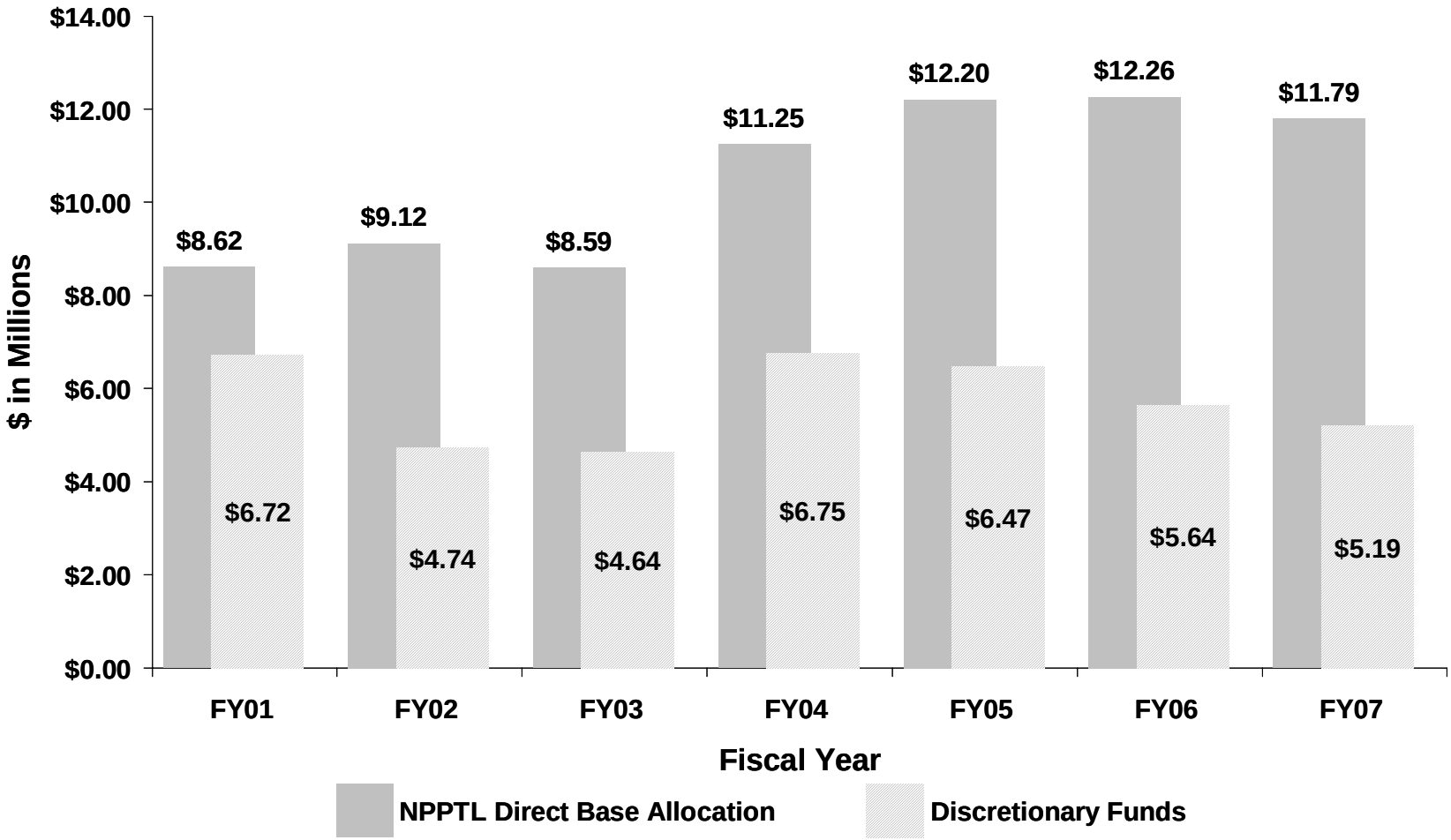
PPT Program Production Input

Research Funding Distribution (in Millions of $)



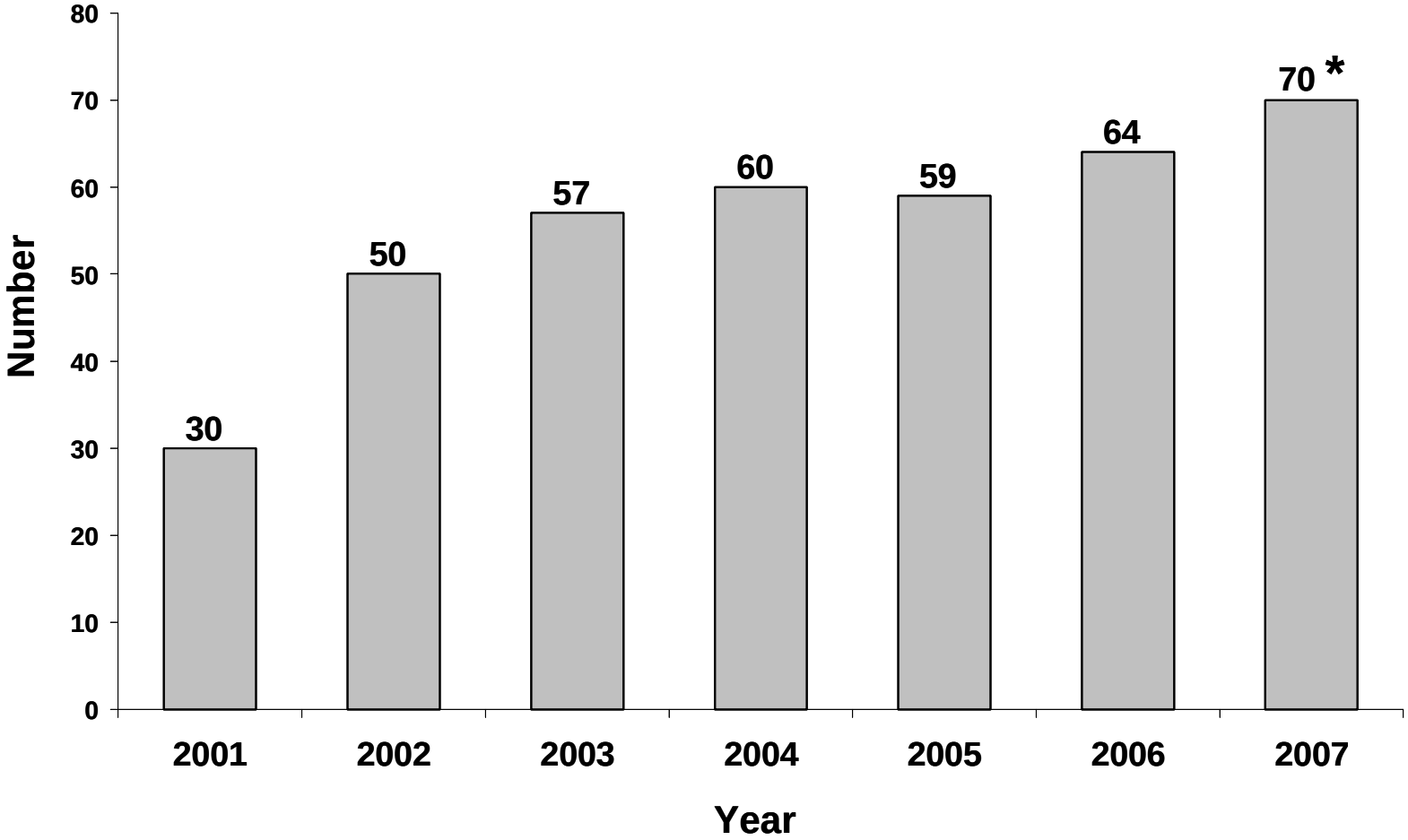
PPT Program Production Input

Discretionary Funding (in Millions of $)



PPT Program Production Input

Federal Employees (2001 – Present)

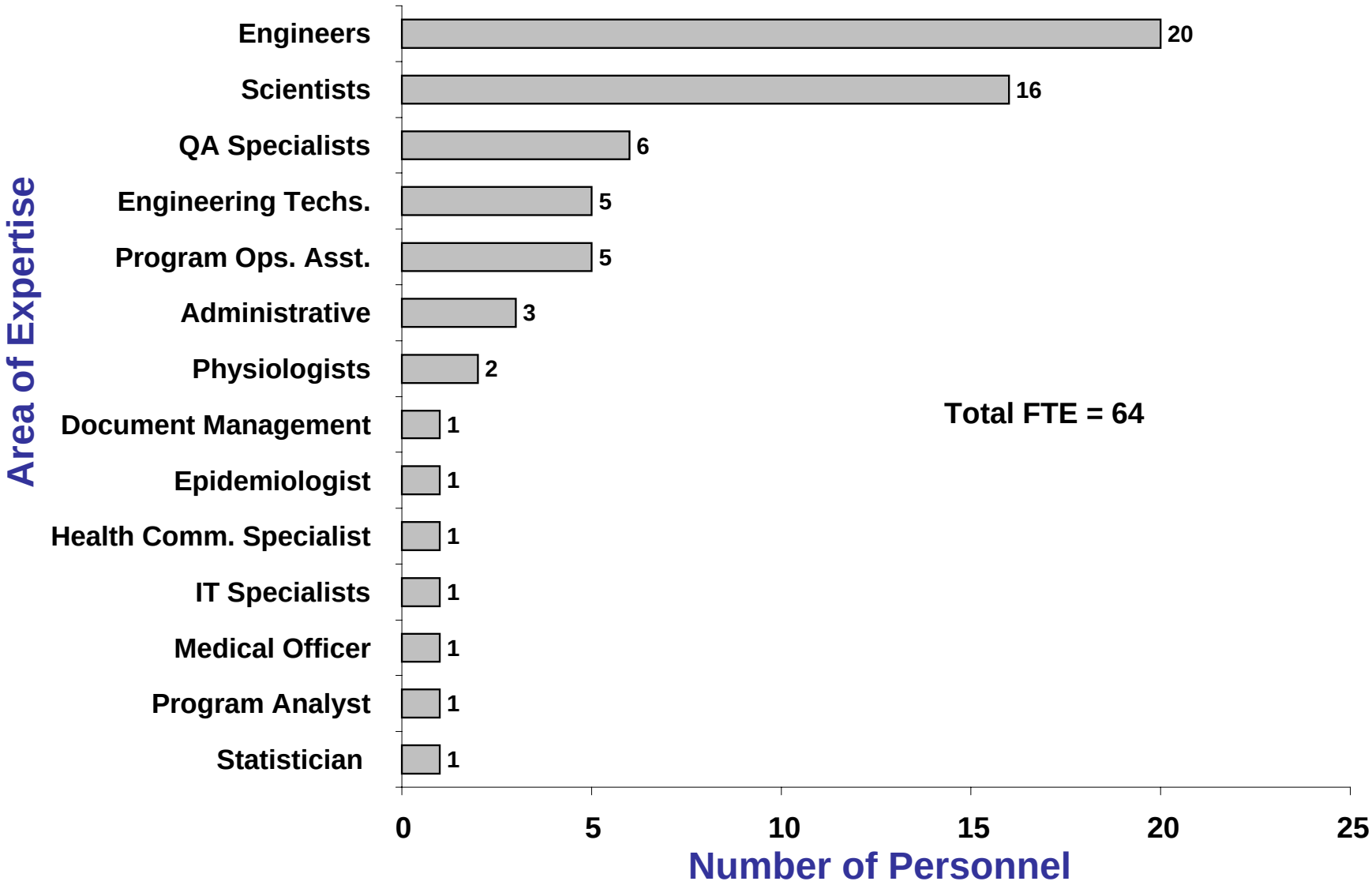


* Includes vacancies in process of being recruited.

These numbers do not reflect personnel associated with projects undergoing evaluation by other NIOSH Programs.

PPT Program Production Input

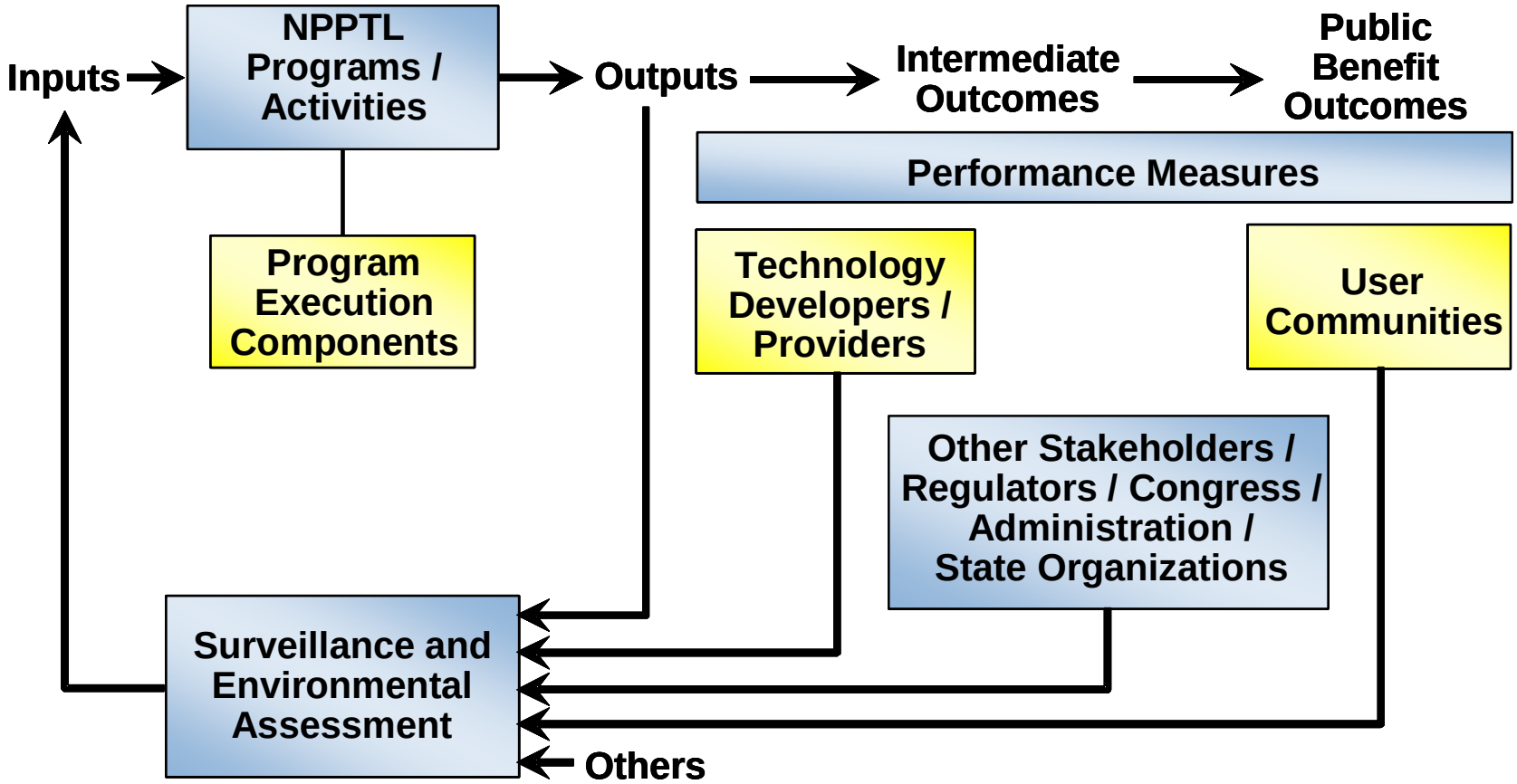
PPT Personnel by Specialty



These numbers do not reflect personnel associated with projects undergoing evaluation by other NIOSH Programs.

PPT Program Planning Input
Strategic Planning Foundation

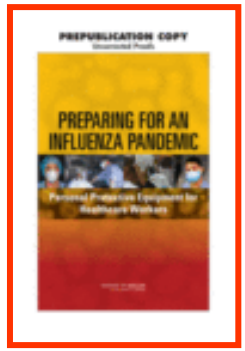
NPPTL Value Creation System



PPT Program Planning Input

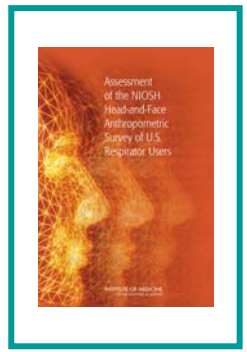
Evaluations - National Academies Involvement in PPT

- *Committee on PPE for the Workforce (COPPE)*
  - Three open meetings in FY06 and two in FY07
  - Workshop: Feb 22, 2007 – **PPE during an Influenza Pandemic: Research, Standards, Certification and Testing Directions**
  - **Final report received Sep 2007, Briefing Sep 7, 2007**
  - First meeting FY08, Oct 8-9, 2007



- *Review of Anthropometrics Survey and Respirator Panel Modifications*
  - Three open meetings in FY06
  - **Final report received Jan 2007, Briefing Jan 22, 2007**
  - Jan – Mar 2006 - *Support to HHS for Committee on the Development of Reusable Facemasks for Use During an Influenza Pandemic*

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

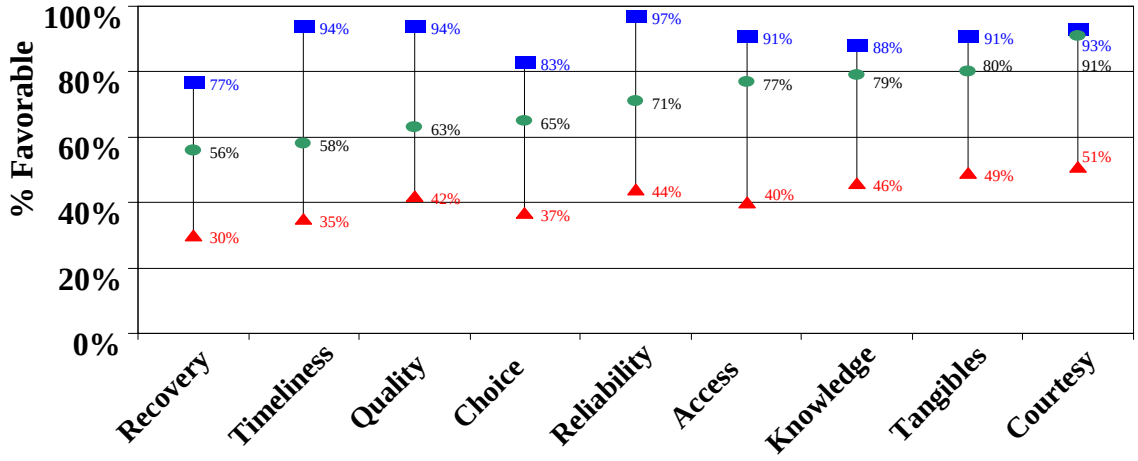


- *Review of BLS Survey of Respirator Use*
  - Three open meetings in FY06
  - **Final report received Dec 2006, Briefing Feb 2, 2007**

- *National Academies Evaluation of Personal Protective Technology (PPT) Cross Sector*
  - National Academies evaluation Sept 2007

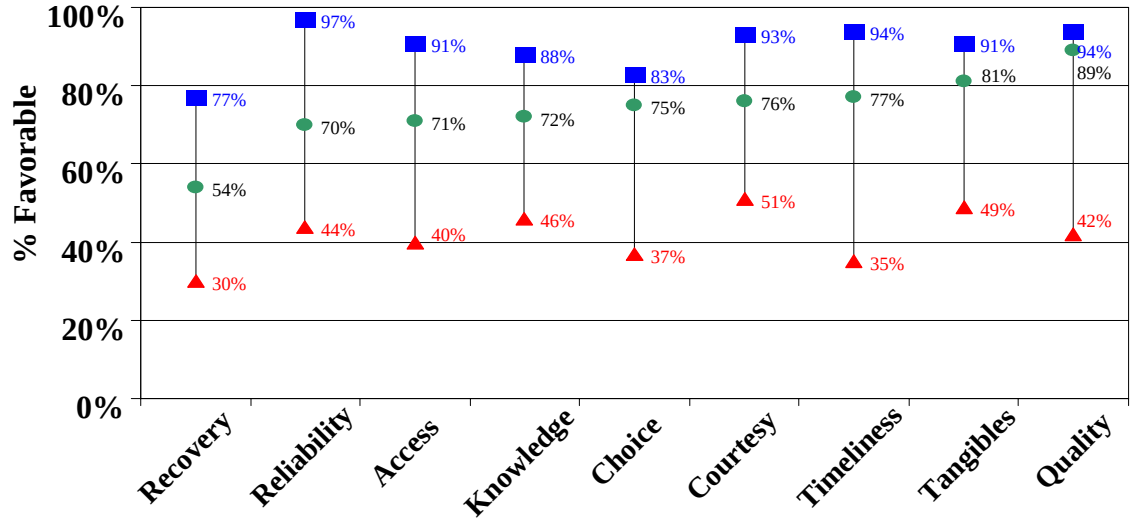
PPT Program Planning Input Evaluations - Customer Satisfaction Survey

Benchmarks: Manufacturers



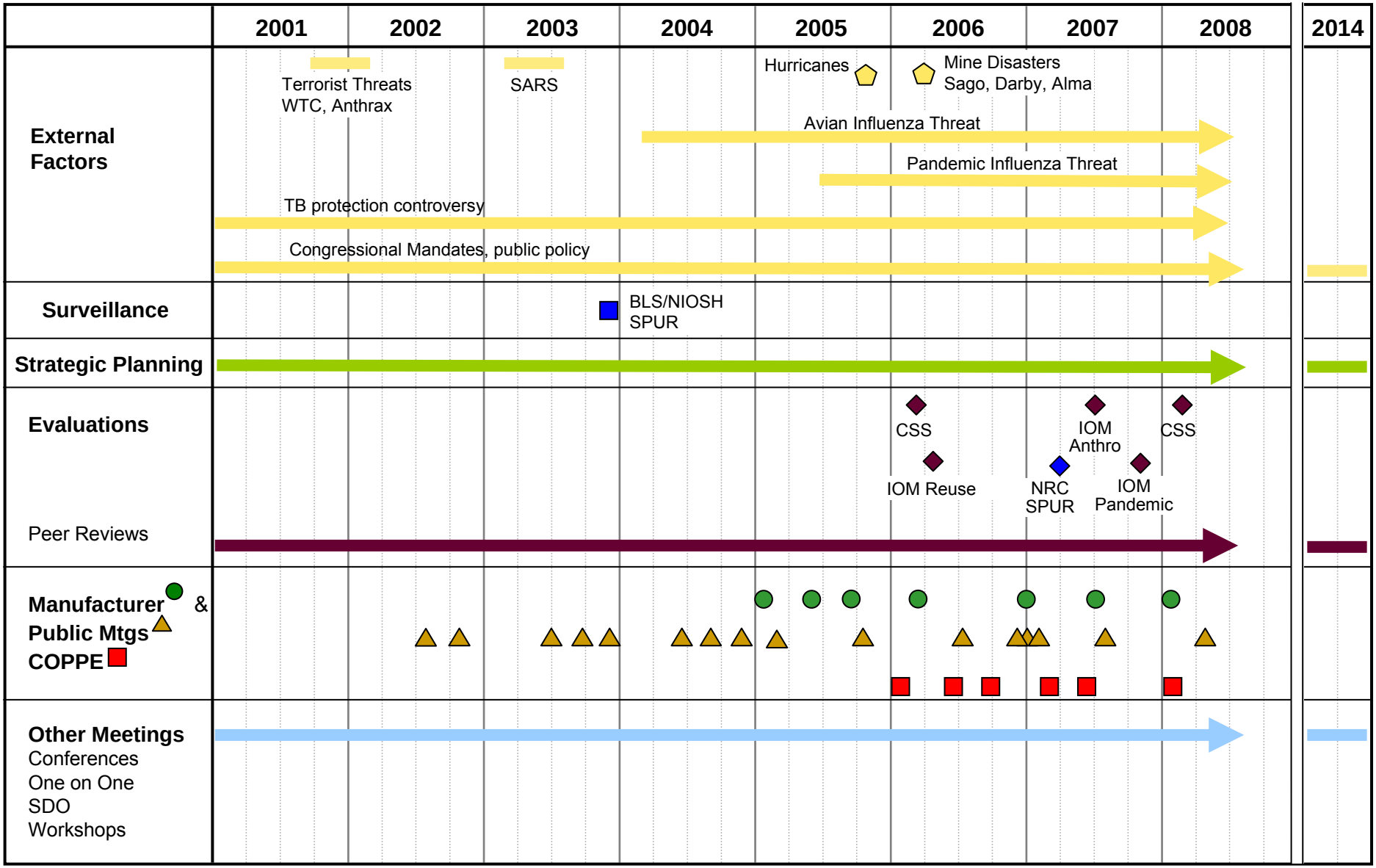
- High Benchmark
- Low Benchmark
- PPT Manufacturers

Benchmarks: Users

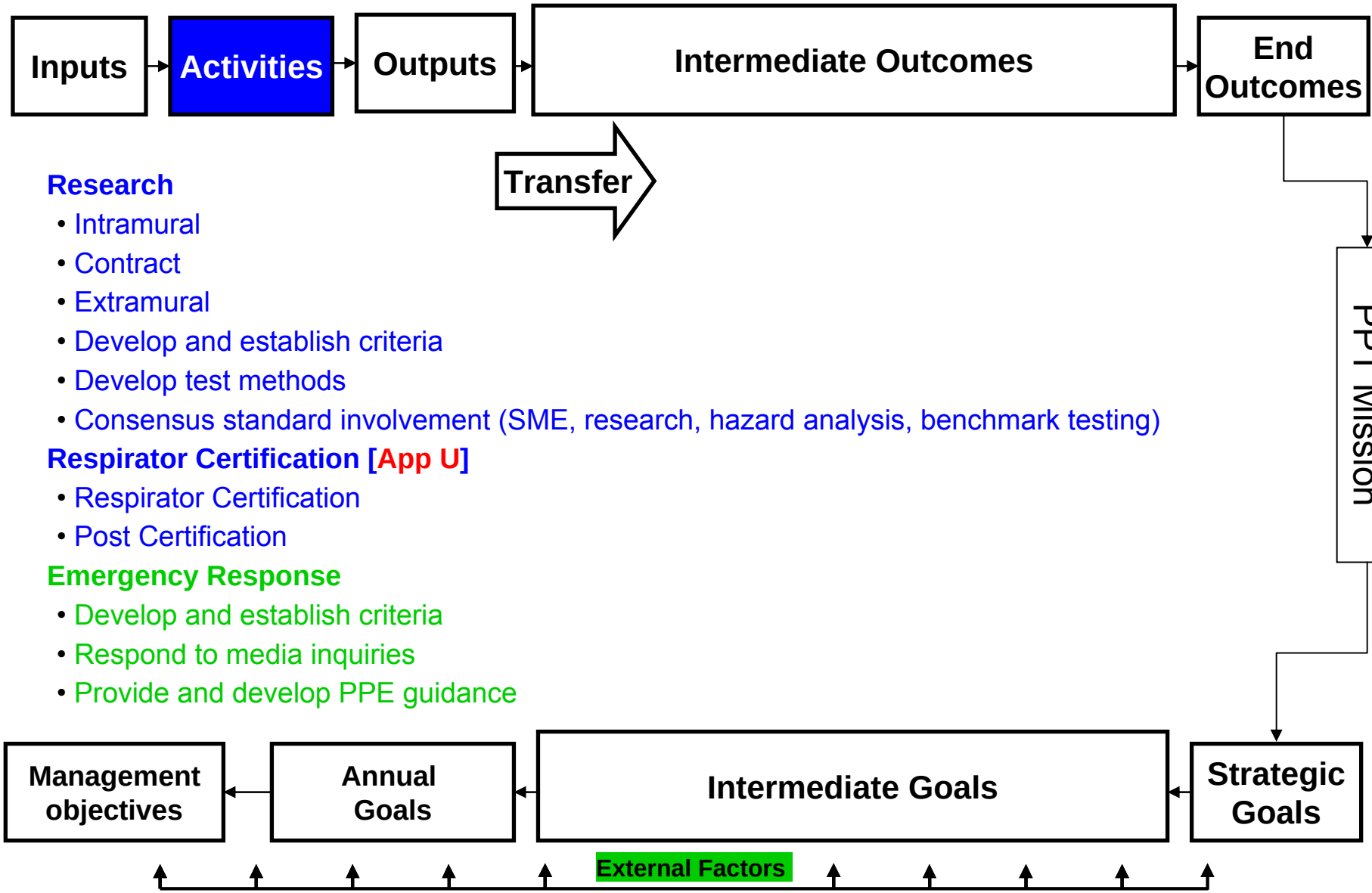


- High Benchmark
- Low Benchmark
- PPT Users

PPT Program Planning Inputs (by fiscal year)

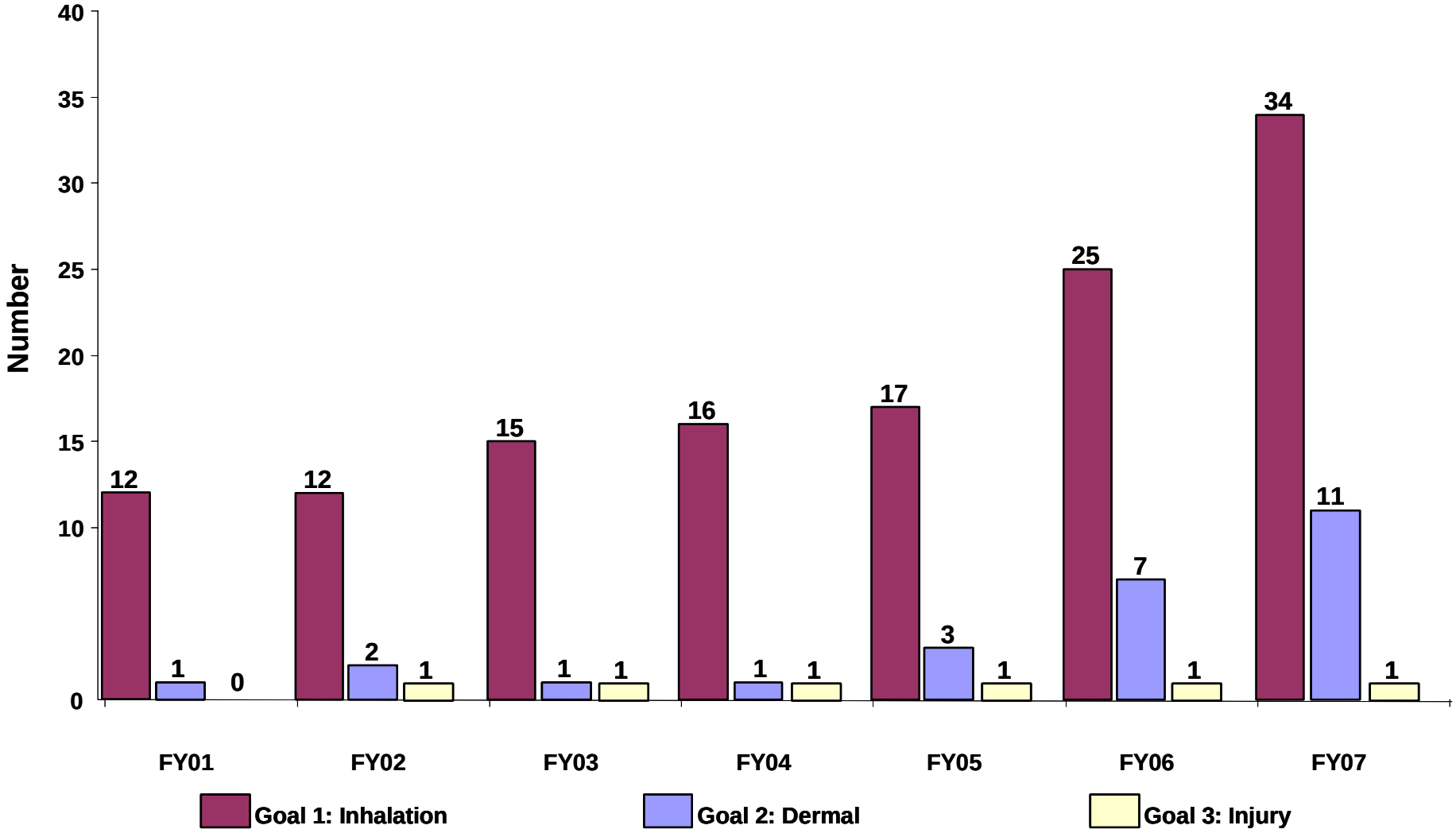


PPT Program Activities



PPT Program Activities

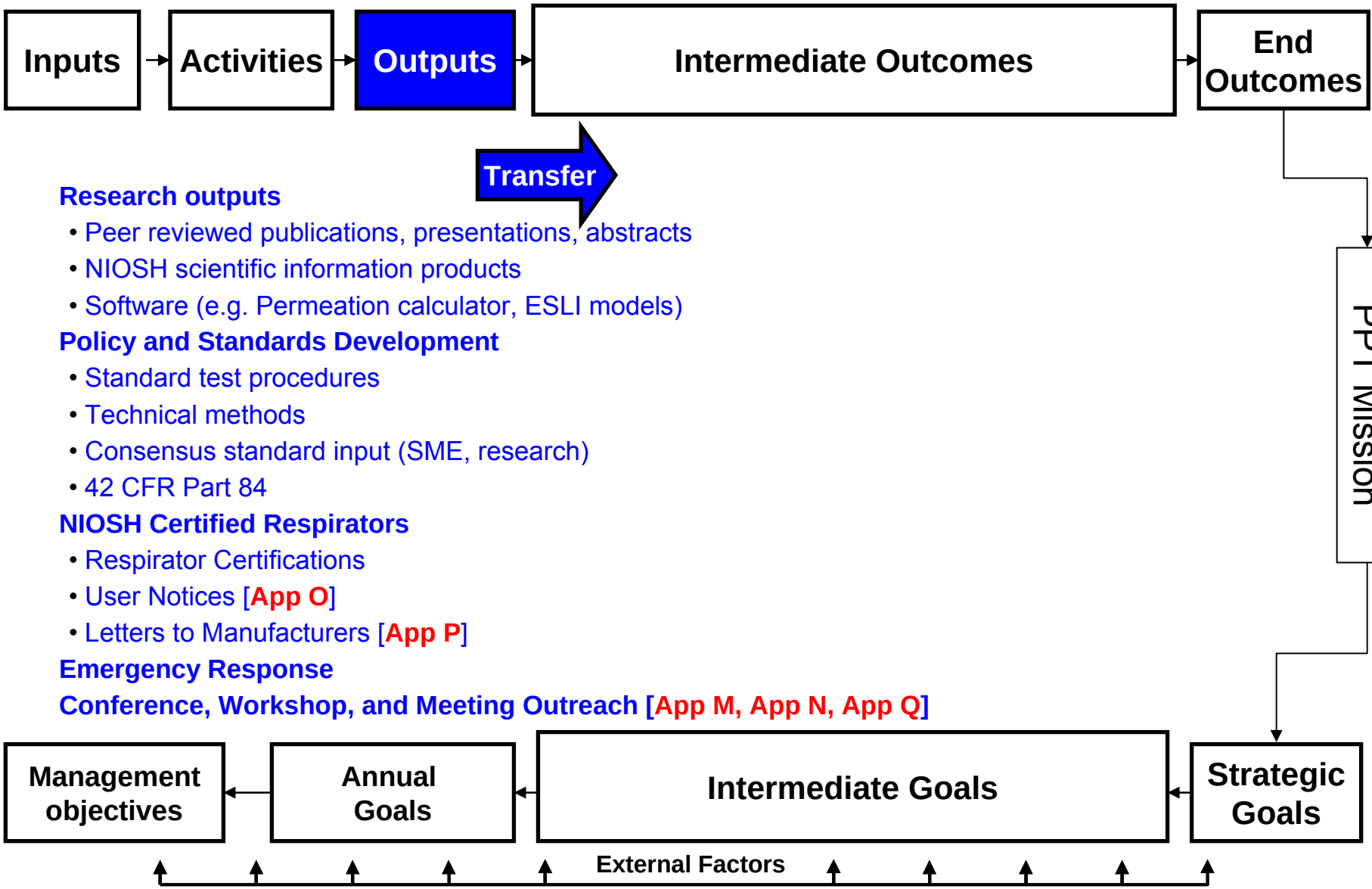
Number of Projects by Goal within Fiscal Years 01-07



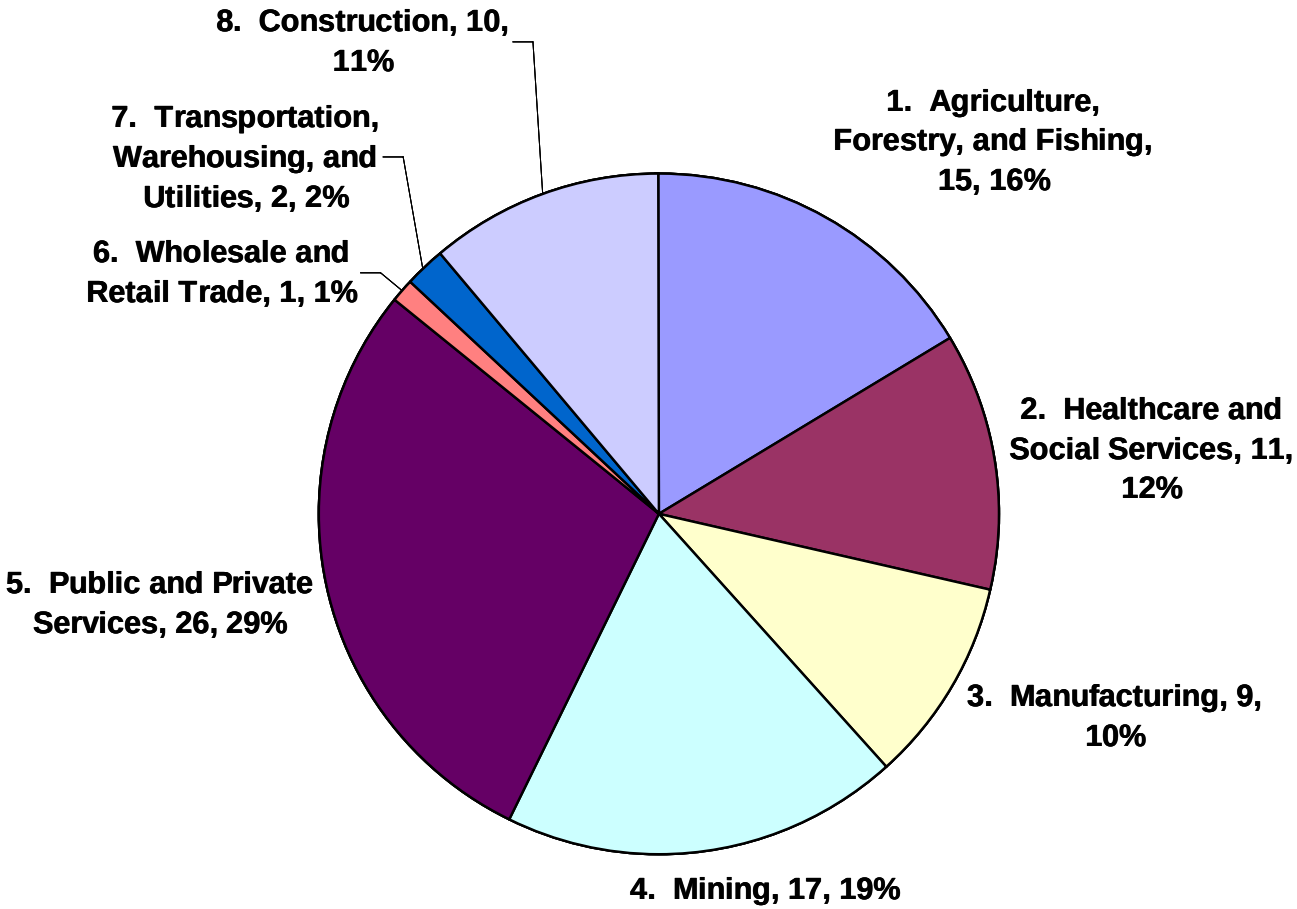
NIOSH Extramural Grants with a PPT/PPE component

- 24 OEP Grants awarded with PPT focus since FY01 [PPT Evidence Package Table 2.2]
- Total award value since 2001: $8.49M
- PPT involvement as requested by PI

PPT Program Outputs



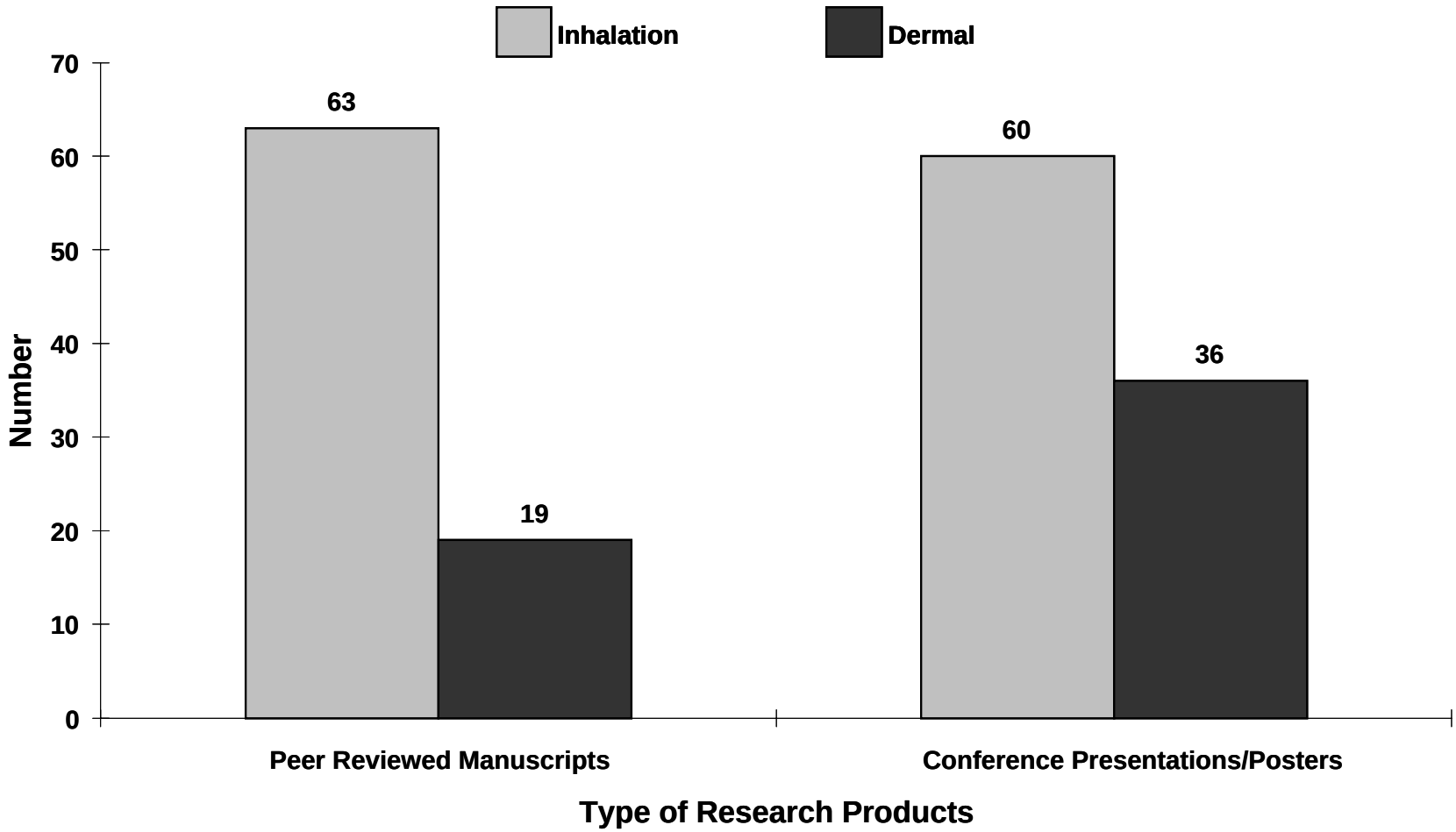
PPT Program Scientific Information Products by Workplace Sector 2001-2007



Total Research Products for Period = 91

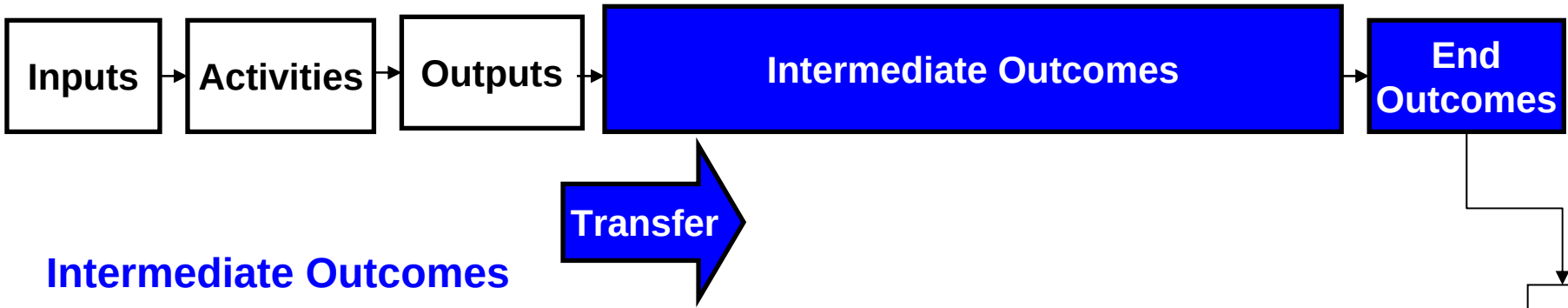
These numbers reflect products undergoing review by other NIOSH Programs.

PPT Program Peer Reviewed Manuscripts and Conference Presentations/Posters 2001-Present



Total Manuscripts = 82
Total Conference Presentations / Posters = 54

PPT Program Outcomes



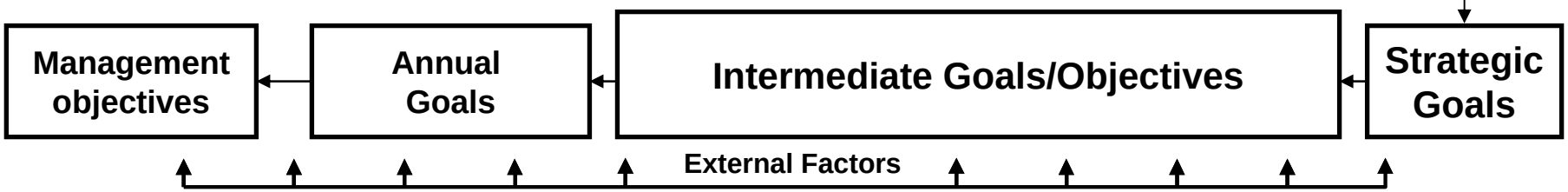
Intermediate Outcomes

- Consensus Standards use PPT input (NFPA, ASTM, ISO, ANSI)
- Stakeholder demonstrations of certified respirator use [App R]
- NIOSH Certified CBRN Respirator Purchases [App S]
- Industry and University Respirator Training Programs [App T]
- FDA acceptance of NIOSH research, tests, and certification
- Website posting by other organizations (e. g. OSHA, RKB, IAB, ISEA, IAFF, NFPA, AIHA)
- Changes in workplace practices

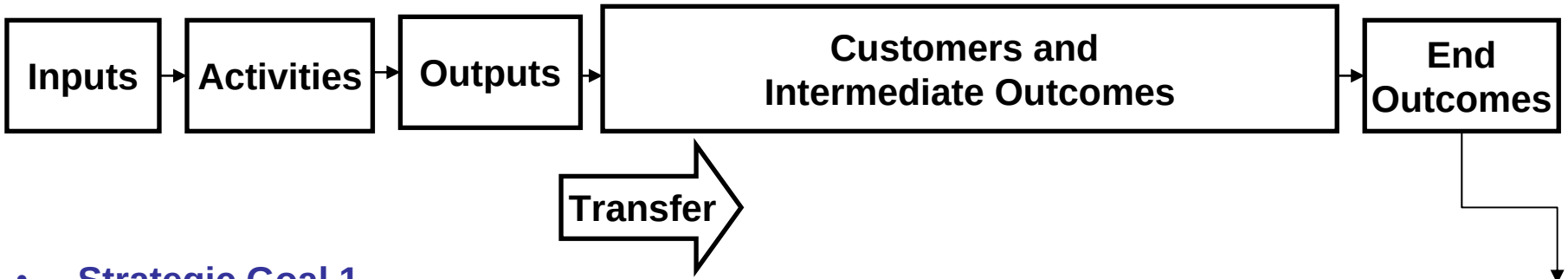
End Outcomes

- Miners' lives saved

PPT Mission



PPT Program Activities



- **Strategic Goal 1**
  - Reduce Exposure to Inhalation Hazards
- **Strategic Goal 2**
  - Reduce Exposure to Dermal Hazards
- **Strategic Goal 3**
  - Reduce Exposure to Injury Hazards

- **Intermediate Goals/Objectives**
  - Goal 1 → 8 Objectives
  - Goal 2 → 3 Objectives
  - Goal 3 → 1 Objective

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 1: Reduce Exposure to Inhalation Hazards

1: Respirator certification

2: CBRN respirator standards

3: Mine Emergency Respirators

4: Anthropometrics and fit

5: Pandemic preparedness

6: Nanotechnology

7: End-of-service-life indicator (ESLI)

8: Surveillance

SG 1: Reduce Exposure to Inhalation Hazards

Obj 1: Ensure Integrity of National Inventory of Respirators

Issue

National Inventory of Respirators needed to reduce exposure to inhalation hazards

External Factors

- Threat of terrorism
- Threat of pandemic influenza
- OS&H policies

Key Partners

- MSHA
- RDECOM
- SEI (MOU)
- FDA(MOU)
- Respirator Manufacturers
- OPM (IA)
- OSHA(MOU)

Diversity

- Respirators are tested to population representative panel
- CEL translated to French (in process)
- Fact sheets translated to Spanish (in process)

Approach

- Respirator Certification
  - Establish compliance with requirements
  - Respirator testing and QA plan evaluation
- Post Certification
  - Maintain compliance
  - Product and site post-approval audits
  - Respirator equipment investigations

Evaluations

- Customer Satisfaction Survey (Appendix H)
- CDC Organizational Excellence Assessment (OEA) Tool

Outputs and Transfer

- Over 8000 respirator certifications (NIOSH License)
- Over 240 CPIP investigations completed
- Certified Equipment List (CEL)
  - Web-based searchable CEL database
  - CEL Licensing agreement (French Version)
- Program updates provided to 2500 listserv self-subscribers in 30 countries

Outcomes

- CEL increases user knowledge about respirator selection
- Federal and NFPA regulations require NIOSH certified respirator use
- User notices issued by manufacturers

Respirator Certification by Category and Calendar Year (thru Aug 17, 2007)

	SCBA	CBRN SCBA	Gas Masks	CBRN APR	CBRN APER	CBRN PAPR (FF)	SAR	Particulate	Chem Cart	CBRN PAPR	FFR	Total per Year
2001	5	0	3	0	0	0	2	6	58	0	362	436
2002	22	3	3	0	0	0	0	4	33	0	181	246
2003	22	12	0	0	0	0	1	7	33	0	114	189
2004	1	21	0	2	0	0	9	4	16	0	137	190
2005	6	0	3	3	3	0	13	8	48	0	82	166
2006	4	0	2	1	1	0	5	12	14	0	99	138
2007	10	0	0	3	0	1	0	2	6	2	66	90
Total Since 2001	70	36	11	9	4	1	30	43	208	2	1041	1455
Overall Totals Since 1972	520	36	189	9	4	1	369	665	2247	2	4340	8382
Obsolete	66	0	27	0	0	0	71	489	370	0	437	1460
Active	454	36	162	9	4	1	298	176	1877	2	3903	6922
Total Active	490		176				298	176	1879		3903	6922

Strategic Goal 1 Obj 1 Outputs

Certified Product Investigation Process (CPIP) conducted by Year (thru Aug 17, 2007)

Fiscal Year	Opened Total	Closed Total
FY 07	17	10
FY 06	32	37
FY 05	38	65
FY 04	37	23
FY 03	39	31
FY 02	51	39
FY 01	44	43
Totals	**258**	**248**

User Notices Issued by Year (thru Aug 17, 2007)

Fiscal Year	# Issued	Rescind	Recall	Retrofit
FY 07	4	0	2	3
FY 06	16	4	2	11
FY 05	4	2	2	0
FY 04	0	0	0	0
FY 03	2	0	2	1
FY 02	5	2	1	3
FY 01	1	0	1	0
Totals	**32**	**8**	**10**	**18**

What's Next?

SG1 Obj 1: FY08 Projected Funding: $5,125,536

- Implement new technology for respirator certification
  (TIL, QA Module, Mine Escape Respirator Standards, others)
- Ongoing collaboration with FDA for respirator and surgical N95 respirator
- Process requests for approval within 90 days of application receipt
- Standard Test Procedures (STPs)
  - Develop STPs for innovative and/or novel technologies (antimicrobial, adhesive)
  - Update STPs as available
- Conduct 2 manufacturer meetings / year
- Perform customer satisfaction survey every 12 to 24 months

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 1: Reduce Exposure to Inhalation Hazards

1: Respirator certification

2: CBRN respirator standards

3: Mine Emergency Respirators

4: Anthropometrics and fit

5: Pandemic preparedness

6: Nanotechnology

7: End-of-service-life indicator (ESLI)

8: Surveillance

SG 1: Reduce Exposure to Inhalation Hazards

Obj 2: CBRN Respirator Standards Development

Issue

There is a need to identify threat levels and identify standards to protect against CBRN threats

External Factors

- 1998 Presidential Directive
- External funding sources ($27M)

Key Partners

- RDECOM (IA)
- OSHA (MOU)
- IAB
- DHS ($)
- NIJ ($)
- NIST ($)
- NFPA (MOU)
- IAFF (MOU)
- IAFC
- ISEA (MOU)
- SEI (MOU)

Diversity

- Use of updated anthropometric panel for neck sizes to consider diverse population
- Gender specific benchmark testing for escape hoods

Approach

- Provide leadership for 1999 NIOSH-DoD-OSHA workshop and Dec 2001 workshop to identify needs
- Conduct hazard analysis
- Define operational and protection requirements
- Evaluate existing standards
- Define standards requirements
- Obtain public comment (FRN, docket, conduct multiple public meetings, post concepts on web for comment)
- Develop reliability and quality assurance requirements
- Implement approval processes
- Actively participate in ISO, ANSI, and NFPA SDOs

Evaluations

Internal NIOSH scientific panel reviewed each CBRN standard prior to approval

Outputs and Transfer

- CBRN certifications posted as they occur
- 68 CBRN certified respirators approved
- Development and posting of 5 statements of standard
- Public meetings held twice annually to disseminate information and obtain public comment

Outcomes

- IAB endorses use of CBRN respirator standards
- DHS adopted NIOSH CBRN standards
- NFPA standards require CBRN approvals for SCBA and APR
- Over 46% of career firefighters have NIOSH certified CBRN respirators available by 2005
- More than 3,705 NIOSH certified CBRN respirators purchased since 2006
- PPT developed NIOSH CBRN standards technology adopted by BSI
- Respirators certified in all CBRN categories

What's Next?

SG1 Obj 2: FY08 Projected Funding: $1,631,124

- Increase national inventory of respirators by testing and evaluating CBRN respirators when received
- Continue to increase capacity for testing (e.g. LRPL, LAT)
- Develop CBRN standards for closed circuit, combination, and supplied air respirators via rulemaking
- Continue involvement with national and international SDOs (NFPA, Canadian Standards, BSI, ISO, etc.)
- PPT researchers involved in writing guidance documents for ISO human factors committee and eventual incorporation in CBRN standards

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SG 1: Reduce Exposure to Inhalation Hazards

Obj 3: Mine Emergency Respirators/Self Contained Self Rescuers

Issue

Readily available and reliable respirators are essential for miners to successfully escape hazardous atmospheres

External Factors

- Sago, Alma, Darby mine disasters
- MINER Act of 2006

Key Partners

- MSHA (MOU)
- UMWA
- USWA
- BCOA
- NMA

Approach

- Develop performance based standard using state of art technology
- Long Term Field Evaluation (LTFE)
  - Conduct testing of mine deployed respirators
  - Redesign LTFE program
- Obtain public comment (FRN, docket, conduct multiple public meetings, post concepts on web for comment)
- Facilitate use of new technology (workshops 2005/2006)
- Integrate new technology (hybrid and dockable)
- Provide support to MSHA

Evaluations

- Redesigned LTFE concept peer reviewed

Outputs and Transfer

- 9 user notices issued and posted on PPT website
- Mine escape respirator standard
  - More than 15 presentations to stakeholders
  - 4 public meetings and FRN announced
- Workshop reports used to defining requirements for next generation mine escape respirator
- Prototype hybrid and dockable respirators produced and in test
- Reports to MSHA on investigations

Outcome

- Escape respirator training modules distributed to approximately 3000 mines and 75 stakeholders
- LTFE reports posted on PPT Program website
- 10 Miners lives saved at Alma mine in Jan 2006 (WV report, 2007)

What's Next?

SG1 Obj 3: FY08 Projected Funding: $650,001

- Incorporate new mine escape respirator standards incorporated into 42 CFR through rule making
- Expand LTFE program to include evaluation of 400 respirators per year following defined protocol and follow through actions
- Certify hybrid and dockable escape respirators for use in mines
- Continue to support MSHA

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SG 1: Reduce Exposure to Inhalation Hazards

Obj 4: Facial Anthropometrics and Respirator Fit

Issue

A criterion for performance that influences PPE design to better fit a range of facial dimensions of respirator users in the U.S. workforce is needed to improve the reliability and level of protection provided by respirators.

External Factors

- Changing composition and diversity of US workforce
- Respirator fit issues raised at OSHA APF rulemaking hearings

Key Partners

- Respirator Manufacturers
- Anthrotech
- WVU
- ISEA
- FDA (MOU)
- ISO

Diversity

- Subjects represent diversity of the U.S. general population and workforce (ethnicity, age, gender)

Approach

- Provide leadership for 1998 NORA workshop to identify industry needs
- Fit testing research validation of corn oil and PortaCount Plus methods
- Facial Anthropometric survey conducted in 2003
- Benchmark testing of 101 respirator models for fit on updated panel
- Actively participate in SDOs

Evaluations

- Peer review of NIOSH anthropometric protocol, 2001
- Scientific and stakeholder peer review of TIL concept, 2004
- IOM review of 2004 Anthrotech report “Assessment of the NIOSH Head-and-Face Anthropometric Survey of U.S. Respirator Users”, 2007

Outputs and Transfer

- New fit test panels available for implementation
- 22 peer-reviewed journal articles
- 22 presentations, 1 report, and 1 book chapter published
- SME leadership on ISO standards and headform development
- 2 FRN and public meetings on TIL concept (2004, 2007)
- Participated in over 10 ISO SDO committee meetings

Outcomes

- Head and neck circumference data used in the NIOSH standard for CBRN escape respirators/hoods
- New fit test panels used in the TIL test for half facepiece respirators
- FDA requires NIOSH certification and accepts NIOSH panel
- Respirator manufacturers use the NIOSH panel as design and sizing tool

What's Next?

SG1 Obj 4: FY08 Projected Funding: $828,768

- Initiated research to assess the rate at which respirator fit changes as a function of time and investigate the factors that affect such change
- Developed plan for addressing the IOM recommendations on anthropometric study developed and to be posted for public comment
- Investigate adoption of new NIOSH panel for respirator certification testing
- Implement TIL testing as respirator certification activity
- Analyze population differences that might affect facial dimensions
- 2008 workshop to discuss knowledge gaps and research needs for a "no fit test" respirator and other innovative designs
- Continue to participate in ISO SDO committee meetings

Overview of Strategic Goals and Intermediate Objectives

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SG 1: Reduce Exposure to Inhalation Hazards

Obj 5: Pandemic Influenza Preparedness

Issue

A pandemic would cause increased reliance on respiratory protection. Estimated demand for N95 respirators by the healthcare sector alone could exceed 90 million for a 42 day outbreak.

External Factors

- Threat of a pandemic influenza

Key Partners

- FDA (MOU)
- VA
- EPA
- ASTM
- OSHA
- 6 respirator manufacturers (MOUs, confidentiality agreements)

Approach

- Provide leadership to HHS to develop and address reusability
- FDA criteria includes respirator fit testing requirements based on research as well as being a NIOSH certified N95 respirator
- Work with other government agencies and stakeholders to develop and prepare an influenza response
- Align resources in the certification activity for timely processing
- $1 million supplemental funding for research

Evaluations

- Peer reviews of all research protocols
- IOM report for protecting Healthcare workers; “Preparing for an Influenza Pandemic: PPE for Healthcare Workers” 2007

Outputs and Transfer

- 2004 CDC workshop on respiratory protection against infectious aerosols
- 4 peer reviewed publications and 3 conference presentations
- SME leadership on ASTM work item titled “Test method for evaluation of the effectiveness of biological decontamination procedures on viral contaminated air permeable material”
- RDECOM Final Report “Respirator filter efficiency against particulate and biological aerosols under moderate to high flow rates” demonstrates similar respirator filter performance against similarly-sized biological and non-biological particles
- IOM report delivered Sept 07: Preparing for an Influenza Pandemic: PPE for Healthcare Workers

Outcomes

- Served as SME to WHO to provide guidance on the protection provided by respirators certified by NIOSH and similar devices from other countries
- FDA new device class for use by the general public requires NIOSH certification
- IOM report of strategies to safely and effectively reuse disposable respirators; “Reusability of Facemasks During an Influenza Pandemic”, 2006

What's Next?

SG1 Obj 5: FY08 Projected Funding: $862,059

- **Continue to conduct priority research identified in IOM report Reusability of Facemasks during an Influenza Pandemic (2006)**
- **Assess strategies to prevent a respirator shortage during a pandemic**
  - **Conduct laboratory studies to (1) understand the efficacy and impact of decontamination methods on respirator performance; and (2) understand the risks associated with handling a respirator exposed to viral particles**
  - **Continue to improve test methods to determine the efficacy of viral decontamination techniques. Study the performance of antimicrobial technology incorporated into respirator filter media**
  - **In collaboration with the VA, conduct research to evaluate physiological burden and tolerability of placing a surgical mask over an N95 FFR**
- **Evaluate mask and respirator performance against cough-generated aerosols**
- **Evaluation of novel and innovative technologies for respiratory protection**
- **Continue to participate in SDO committee meetings**

Overview of Strategic Goals and Intermediate Objectives

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SG 1: Reduce Exposure to Inhalation Hazards

Obj 6: Evaluate the Nanofiber-Based Fabrics and NIOSH-Certified Respirators for Respiratory Protection Against Nanoparticles

Issue

- Possible health implications from exposure to nanoparticles
- Efficacy of respirators to provide expected protection to nanoparticles is not well characterized
- Nanotechnology can be used to improve the performance of respirators

External Factors

- National Nanotechnology Initiative
- Emerging use of nanotechnology

Key Partners

- ASTM
- ISO
- DuPont Nanotech Consortium (MOU)
- University of Minnesota, Center for Filtration Research
- North Carolina State University
- Carnegie Mellon University

Approach

- Actively participate in NIOSH NTRC, SDOs, and industry consortia to ensure consistency of test methods and appropriate interpretation of filtration results
- Research has focused on the filtration performance of filter media and respirators against nanoparticles
- Measured the filtration performance of various filter media against 3 - 20 nm silver aerosol challenges.
- Validated the filtration performance of NIOSH approved N95 filtering facepiece respirators against 20nm - 400 nm NaCl aerosol challenges
- Applications in nanofiber filter media and ESLI sensor

Evaluations

- Conducted scientific peer review of research protocols

Outputs and Transfer

- 4 NIOSH scientific information products
- 2 peer reviewed journal articles/manuscripts
- 5 sponsored conferences
- 15 conference presentations

Outcomes

- Information from the *Approaches to Safe Nanotechnology* document has been incorporated into draft ISO and ASTM standards and various workplace safety policies
- DuPont consortium used NIOSH recommended test procedures to conduct PPE evaluations

What's Next?

SG1 Obj 6: FY08 Projected Funding: $411,202

- Continue to support NIOSH NTRC, SDOs and key industry consortia
- Conduct research to fill key information gaps on the efficacy of PPE to provide guidance to workers handling nanomaterials
  - Assess the filtration performance of NIOSH approved (N95, P100), European certified (P2), and other filtering facepiece respirators using two nanoparticle test systems (4-30nm, silver) and (20 - 400nm, NaCl).
  - Determine whether faceseal leakage of nanoparticles is different than larger particles
- Monitor claims regarding NIOSH certified respirators and their performance claims

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SG 1: Reduce Exposure to Inhalation Hazards

Obj 7: Sensor Technology Development for ESLI

Issue

- OSHA requires use of ESLI or a formal plan
- Availability of ESLI is limited and there is no ESLI for organic vapors
- ~20 % of employers leave respirator cartridge change out to the discretion of the employees

Key Partners

- LANL
- API
- CMU
- NRL
- ISEA
- Respirator Manufacturers
- ORC
- OSHA
- SOCMA
- Air Force

Diversity

- Metabolic considerations for service life assessment

Approach

- ESLI modeling project to develop mathematical models to estimate respirator cartridge lifetime (Breakthough, GasRemove, and Multivapor)
- ESLI sensor project to develop technology for incorporating sensors into respirator cartridges to determine lifetime
- Conduct annual meetings with stakeholders

Evaluations

- Conducted scientific peer review of ESLI sensor research project, May 2005

Outputs and Transfer

- Breakthrough software posted to PPT website and downloaded 4500 times since Dec 2003
- Over 1000 Breakthrough CD ROMs requested
- 5 peer reviewed publications
- 2 Conference presentations
- Multivapor software model posted to PPT website Jul 2007
- Annual meetings with stakeholders
- FRN to solicit partners, 2004

Outcomes

- Downloadable copies of software models available through OSHA website
- Breakthrough software models used in university/industry training courses

What's Next?

SG1 Obj 7: FY08 Projected Funding: $658,076

- Construct and test prototype cartridges in collaboration with manufacturers to assess sensor efficacy and durability
- Make technology available to respirator cartridge manufacturers
- Evaluate approaches to assess impact of Breakthrough and Multivapor software models
- Determine potential applicability of Breakthrough and Multivapor software models to Hispanic community
- Transfer ESLI technology to applicable SDOs

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SG 1: Reduce Exposure to Inhalation Hazards

Obj 8: Respirator Use Surveillance and Dissemination

Issue

Insufficient information exists on the use of respirators in the workplace.

Key Partners

- BLS (MOU)
- OSHA
- ARTBA
- NDA
- SSPC

Approach

- PPT Program and BLS developed protocol to conduct survey in private sector firms
- Collaborated with BLS to conduct survey
- Survey results used to focus activities in construction industry
- Protocol developed for surveillance and interventions in construction
- Peer review redirected program to include intervention assessments in construction industry

Evaluations

- Peer Review of PPT Program Surveillance Activities, 2005
- National Academies Evaluation of the NIOSH/BLS “Respirator Use in Private Sector Firms, 2001”, 2007

Outputs and Transfer

- Respirator Usage in Private Sector Firms, 2001 Survey Report
- Over 12 peer reviewed manuscripts published
- 14 presentations

Outcomes

- BLS/NIOSH report used by various govt. organizations to develop alerts, notices, and regulatory updates and changes
- MSHA Health Hazard Alert for Airline Respirators, 2004
- OSHA Safety and Health Information Bulletin, 2004

What's Next?

SG 1 Obj 8: FY08 Projected Funding: $420,939

- Develop an action plan to address National Academies findings for future surveillance activities
- Continue to conduct intervention assessments in the construction industry
- Proposal to develop CBRN surveillance system submitted to NORA and the CDC Coordinating Office for Terrorism Preparedness and Emergency Response (COTPER)

Overview of Strategic Goals and Intermediate Objectives

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Discussion

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 3: Reduce Exposure to Injury Hazards

1: Warning devices for fire services

Strategic Goal 2: Reduce Exposure to Dermal Hazards

1: Chemical dermal hazards

2: Emergency responder protective clothing

3: Physiological and ergonomic impact

SG 3: Reduce Exposure to Injury Hazards

Obj 1: Develop and Evaluate Warning Devices for Fire Services

Issue

• Warning devices should incorporate technical advances to minimize firefighter risk to injury or fatality when becoming lost or trapped in a fire situation to facilitate their rescue.

• Limitations in current Personal Alert Safety Systems (PASS)

Key Partners

• NFPA
• NIST
• CMU
• IAFF
• IAFC
• RAND
• SEI

Approach

• Focus group findings and guidance documents from disasters used as inputs to set research priorities
• Need for a firefighter locator device identified
• Collaborative effort to develop a personal location device
• Monitoring efforts to develop a firefighter location system for collaboration opportunities
• A NIOSH OEP grant in 2004 was to develop a Bioelectronic Telemetry System For Fire Fighter Safety
• FFFIPP notification to NFPA initiated research on PASS system performance at fire scene environments at elevated temperatures

Evaluations

• 2005 peer review of development of a personal location device for emergency responders

Outputs and Transfer

• NIOSH/RAND Personal Protective Technology Conference, New York City, NY Dec 9-11, 2001
• Participated in NFPA 1982 Standard meetings, teleconferences and face to face meetings to recommend developmental testing to eliminate the potential for future PASS failure modes and NFPA 1982 Standard updates
• NIOSH email box to report PASS unit performance problems

Outcomes

• NFPA alert, "PASS alarm signals can fail at high temperatures"
• SEI email box to report PASS unit performance problems
• NFPA 1982 Standard on Personal Alert Safety Systems (PASS), 2007 Edition, Dec 2006

What's Next?

SG3 Obj 1: FY08 Projected Funding: $73,854

- Continue to participate in NFPA Electronic Safety Equipment Technical Committee meetings to support future revisions to NFPA 1982 PASS standard
- Support development of performance requirements for "wireless" PASS warning systems to warn a base station outside the fire scene of a firefighter in distress
- Research future technologies to permit monitoring of firefighter location and physiological status such as heart rate, skin and internal body temperatures to warn of impending health hazards
- Develop compact instrumentation that accurately characterizes firefighter thermal loading

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 2: Reduce Exposure to Dermal Hazards

1: Chemical dermal hazards

2: Emergency responder protective clothing

3: Physiological and ergonomic impact

SG 2: Reduce Exposure to Dermal Hazards

Obj 1: Improve Chemical/Barrier Protective Clothing Testing and Use Practices to Reduce Worker Exposure to Chemical Dermal Hazards

Issue

There is a need for improved use practices, test methods and performance standards for chemical and barrier protective clothing based on quality science.

Key Partners

- CLI
- UC Davis
- ICS Labs
- AIHA
- ASTM (MOU)
- ISEA (MOU)
- DuPont Nanotech Consortium (MOU)
- IPP Inc.
- TSWG ($)

Approach

- Support the NORA dermal research program. Conduct research on methods to evaluate permeation and in use performance of chemical protective gloves.
- Conduct research to evaluate the ability to effectively decontaminate selected clothing materials. Develop formal method for calculating permeation parameters to analyze permeation testing data
- Participate in NFPA and ASTM SDOs and other internal/external technical committees

Evaluations

- NORA evaluation of Dermal Program, 1999, 2005
- Expert assessment of colorimetric indicator efficacy, 2004
- Peer review of Permeation Calculator, 2006

Outputs and Transfer

- 9 peer reviewed publications describing colorimetric indicators and in-use testing of glove performance
- 4 peer reviewed publications describing decontamination research and ensemble testing
- Research findings disseminated at 25+ conferences
- Permeation Calculator version 2.4, NIOSH Pub. No. 2007-143C developed and posted to PPT website
- Permeation calculator has been incorporated into two ASTM work items
- 3 NIOSH scientific information products on nanotechnology

Outcomes

- AIHA guideline for the decontamination of chemical protective clothing and equipment, 2005

What's Next?

SG2 Obj 1: FY08 Projected Funding: $274,130

- Continue to support NIOSH NTRC, consensus standards development organizations (NFPA, ISO, ASTM), and key industry consortia

- Conduct research that will lead to improved barrier protective clothing
  - Investigate penetration of nanoparticles through protective clothing
  - Develop innovative methodologies for measuring aerosol particle penetration through protective clothing

- Conduct research that will lead to improved chemical protective clothing
  - Develop new ASTM test method to measure cumulative permeation and support risk based permeation criteria

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 2: Reduce Exposure to Dermal Hazards

1: Chemical dermal hazards

2: Emergency responder protective clothing

3: Physiological and ergonomic impact

SG 2: Reduce Exposure to Dermal Hazards

Obj 2: Improve Emergency Responder Protective Clothing to Reduce Exposure to Thermal, Biological, and Chemical Dermal Hazards

Issue

Protective technologies available for the responder community have specific performance gaps and lack appropriate test methods and standards based on quality science

External Factors

Threat of terrorism
Homeland Security Presidential Directives - HSPD
HSPD-5 Management of Domestic Incidents
HSPD-8 National Preparedness

Key Partners

- North Carolina State University
- IAB
- NFPA (MOU)
- ASTM (MOU)
- RAND
- IAFF
- DHS
- IPP, Inc.
- IACP
- IAFC
- NIST

Approach

- Provide leadership for 1998 NORA workshop to identify industry needs
- Conduct hazards and gaps analysis for emergency responder PPT
- Develop and incorporate CBRN dermal protection criteria and test methods into protective clothing and equipment standards
- Participate in NFPA and ASTM SDOs
- Develop performance criteria recommendations to predict burn injuries from stored thermal energy in firefighting protective ensembles
- Design and validate a test apparatus to measure protective clothing performance and predict burn injuries
- Conduct research to understand protection needs, and recommend design and performance criteria for emergency medical services and medical first receivers

Evaluations

- Conducted scientific peer review of research protocol, 2006

Outputs and Transfer

- 4 RAND reports published under contract with PPT Program
- Hazard and test method gaps analysis reports completed and posted to PPT website
- PPT Program contributed to more than 10 CDC/NIOSH websites where PPE recommendations are provided
- 8 Conference presentations/posters
- Participation in 18 ASTM and NFPA SDO committee meetings

Outcomes

- 7 NFPA and 2 ASTM standard have used PPT research and expertise as inputs to updated standards
- DHS Fire Safety Research Grant Program to conduct interlaboratory testing using the stored thermal energy test method and testing apparatus

What's Next?

SG2 Obj 2: FY08 Projected Funding: $550,059

- **Continue to participate in NFPA and ASTM SDOs committee meetings**
- **Complete research for the implementation of biological and radiological particulate hazard protection into NFPA standard for emergency medical service and medical first receivers**
- **Conduct research to validate and implement recommended preconditioning techniques into NFPA and ASTM protective clothing standards**
- **Develop and incorporate CBRN dermal protection requirements into NFPA and ASTM protective technology standards based on dermal cumulative dosage**
- **Identify additional opportunities to support standards development activities through direct input to SDOs or projects that meet SDO committee needs**
- **Improve test methods and investigate problems with protective clothing and equipment that affect dermal protection**
- **Maintain an active role with the IAB including Chairmanship of the IAB Personal Protective & Operational Equipment (PP&OE) Subgroup an membership on the Science & Technology Subgroup**

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 2: Reduce Exposure to Dermal Hazards

1: Chemical dermal hazards

2: Emergency responder protective clothing

3: Physiological and ergonomic impact

SG 2: Reduce Exposure to Dermal Hazards

Obj 3: Investigate Physiological and Ergonomic Impact of Protective Ensembles on Individual Wearers in Affecting Worker Exposures to Dermal Hazards

Issue

Research needed to better understand relationships between PPE and increased burden it may place on the user physiological and mission performance

Key Partners

- IAFF (MOU)
- TSWG ($)
- ASTM (MOU)
- IPP Inc.
- Morning Pride

Diversity

- Both female and male test subjects used in ensemble and footwear studies

Approach

- Provide leadership for 1998 NORA workshop to identify industry needs
- Conducted needs assessment for firefighter ensemble requirements
- Protocols developed and studies conducted to evaluate firefighter ensembles impact on user performance
- Protocol developed and studies conducted to evaluate firefighter footwear impact on user performance

Evaluations

- Protocols completed scientific peer review

Outputs and Transfer

- 6 Peer reviewed publications completed
- 8 conference presentations/posters presented
- PPT recommendations provided at 4 SDO meetings
- NIOSH/RAND Personal Protective Technology Conference, New York City, NY Dec 9-11, 2001
- 4 RAND reports published

Outcomes

- ASTM Standard Practice for Determining the Physiological Responses of the Wearer to Protective Clothing Ensembles, ASTM F2668

What's Next?

SG2 Obj 3: FY08 Projected Funding: $294,223

- Evaluate strategies to mitigate heat stress and potential for optimization of body cooling
- Evaluation of emergency response ensembles
- Continue analysis of data collected from HEROES initiative
- Continue to evaluate firefighter footwear incorporating new materials and design technologies
- Continue to research technology to incorporate in next generation firefighter ensemble
- Continue to participate in NFPA and ASTM SDOs committee meetings

Overview of Strategic Goals and Intermediate Objectives

Strategic Goal 3: Reduce Exposure to Injury Hazards

1: Warning devices for fire services

Strategic Goal 2: Reduce Exposure to Dermal Hazards

1: Chemical dermal hazards
2: Emergency responder protective clothing
3: Physiological and ergonomic impact

Discussion

National Academies' Review of the NIOSH Personal Protective Technology Program

Wrap up and discussion