NIOSH HHE Program and Respirator ESLI Research Update

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Agenda

- NIOSH
- NIOSH Health Hazard Evaluation Program
- NIOSH Respirator Research
  - End of Service Life Indicators
Who We Are

1970 OSHAct...

OSHA - DOL
  Regulatory
  Enforcement

NIOSH - DHHS/CDC
  Research
  Surveillance
  Training
  Service
NIOSH

Joined CDC in 1973
NIOSH Locations

NIOSH Staff: ~1,400

Washington, DC
Atlanta, GA
Cincinnati, OH
Morgantown, WV
Pittsburgh, PA
Spokane, WA
Anchorage, AK
Boston, MA
Denver, CO
NIOSH Mission

- Conduct research to prevent occupational illnesses and injuries
- Make recommendations to regulatory agencies (OSHA)
- Train occupational health professionals
- Respond to requests for investigations of workplace hazards
The NIOSH HHE Program

- Congressionally mandated
- Responds to requests for assistance
- Provides current health hazard data to employees and employers
- Identifies problems and recommends workplace solutions
- Precipitates research and generates human exposure and toxicity data
Reasons to Request an HHE

- Workers with illnesses from unknown cause
- Exposure to unregulated hazards
- Adverse health effects and exposure below the PEL
- Medical or epidemiological studies needed
- Higher than expected illness rate in an exposed group
- Exposure to a new or unrecognized hazard
HHE Requests

- Employers
- Employees
- Employee Representatives
- Other Government Agencies
Hazard Evaluation

- Background Assessment
- Initial Field Investigation
- Environmental and Medical Studies
- Hazard Determination
HHE Procedures

- Telephone Contact
- Site Visit(s)
  - Opening conference
  - Walk-through survey/process review
  - Confidential employee interviews
  - Environmental monitoring
  - Medical evaluation
  - Closing conference
- Report
Final Report

- Summary
- Introduction and Background
- Evaluation Methods
- Evaluation Criteria
- Results and Discussion
- Conclusions and Recommendations
- References
Report Distribution

- Requesters
- Employer
- OSHA
- Other appropriate agencies
- Public distribution from NTIS
Examples of Health Hazard Evaluation Projects
SAFETY

FIRST

Please NO
Perfumes or Lotions

Perfumes & Lotions make Gwen, Cindy, Pat & Sue unable to breathe
Illnesses of Unknown Cause

- Bronchiolitis obliterans, asthma
- Related to diacetyl/flavorings
Old Problems in New Places

- Silica
- Noise
- Cement roofing tiles
Emerging Diseases
Progressive Inflammatory Neuropathy
Pork Processing Plant

On October 26, 2007, the Minnesota Department of Health (MDH) was notified by the MSHSL of a cluster of unexplained neurologic illnesses among workers in a swine slaughterhouse (Plant A) in southeastern Minnesota. As a result, MDH initiated an investigation at Plant A to characterize the outbreak. This report describes the ongoing investigation and control measures undertaken by state public health officials and CDC.

Plant A, located in southeastern Minnesota, employs approximately 1,700 workers and processes 18,000 pigs per day. After being notified of the illnesses, MDH investigators initiated active case finding, interviewed workers at Plant A, and reviewed the plant's occupational health and employment records. As of January 28, 2008, a total of 12 workers at Plant A had been identified, confirmed (eight workers), probable (two), or possible (two) progressive inflammatory neuropathy (PIN). The onset of PIN ranged from November 2006 through November 2007. Median age of the 12 patients was 31 years (range: 21–51 years); six patients were female. All 12 patients reported being healthy before the onset of neurologic symptoms.

Symptoms ranged from acute parasthesia to gradually progressive symmetric weakness over periods ranging from 8 to 213 days. Severity ranged from minor weakness and numbness to paralysis predominantly in the lower extremities affecting mobility. Eleven patients had evidence of axonal or demyelinating peripheral neuropathy by electrodiagnostic testing. Cerebrospinal fluid was obtained from seven patients. All seven had elevated protein levels (median: 125 mg/dL; range: 75–301 mg/dL; normal: 14–45 mg/dL) with no or minimal pleocytosis (median: 1 cell/mL; range: 0–73 cells/mL in a nonsteroidal anti-inflammatory drug [NSAID] group; five patients had evidence of inflammation on spinal magnetic resonance imaging (four patients in peripheral nerves or roots and one patient in the anterior spinal cord). All 12 patients reported either working at or having regular contact with an area where swine heads were processed (known as the head table), which was located within a larger processing area in Plant A known as the warm room. A case-control study was conducted among Plant A workers to identify specific risk factors associated with illness. The 10 patients with confirmed probable cases were included.
Enriching the HHE Mix

Interest in HHE projects that:
- Involve new and emerging issues
- Have potential for industry-wide impact
- Provide opportunities for collaboration
- Add to the science base (e.g., analytical)
- Help solve existing or suspected workplace health problems
Respirator Research at NIOSH

End of Service Life Indicators
ESLI Research

- Background
- Computer Modeling
  - Multiple Vapors
  - Humidity Effects
- Cartridge Sensors
ESLI’s - Background

- OSHA revised respiratory protection standard in 1998
- Selection and use of chemical cartridges for respirators
  
  Either an end-of-service-life indicator (ESLI) or a changeout schedule is required to determine when cartridges need to be replaced
- Prior to the revision, odor detection was permitted as the determination method for changing cartridges.
Background - Continued

- BLS/NIOSH report:
  - approximately 250,000 establishments use respirators
  - 20% leave respirator cartridge changeout up to the discretion of the workers

- The availability of end-of-service-life indicators is very limited
  - there are currently no ESLI indicators for organic vapors.

- Sensor systems that can detect multiple gases and vapors are needed
Modeling

- Multi Vapor Version 2.1.3
  - Estimate Breakthrough times of one or a mixture of organic vapors through OV APR Cartridges at any humidity
- Available on the NIOSH Website

Modeling, Continued

Modeling Program for Reactive gases (e.g., Chlorine) has been developed but not yet released.
NIOSH Sensor Research

- Research objective is to produce a system that provides the user with the condition of the cartridge
  - Residual Service Life (alert user at ≤ 10% of cartridge life)
  - End of Service Life
- Focus on low power, small, low cost sensors that can be integrated into air purifying respirator cartridges
- Different modalities of sensing
  - Chemiresistor
  - Gravimetric
  - Combination
- Potential application to other PPE
Sensor package has been successfully designed

- Allows independent sensing of target organic vapors with up to three independent signals.
- Electronic circuitry modified to reduce thermal and electrical drift and interferences in the sensor signals.
APR Respirator with ESLI Sensor
Collaboration with Manufacturers

- Draeger
- MSA
- North Safety Products
- Scott Health & Safety
- Sunstrom Safety AB
- Survivair
Challenges/Plans

- Cost effective sensor design
- Reliability
- Ruggedness
- 30-36 month estimated timeline
- Investigating wireless capability
Comments/Questions

NIOSH would like to engage with and obtain input from the user community.

ESLI Project Contact Information:

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Thank you for your Attention

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