



# Identifying New and Emerging Occupational Risks in the United States

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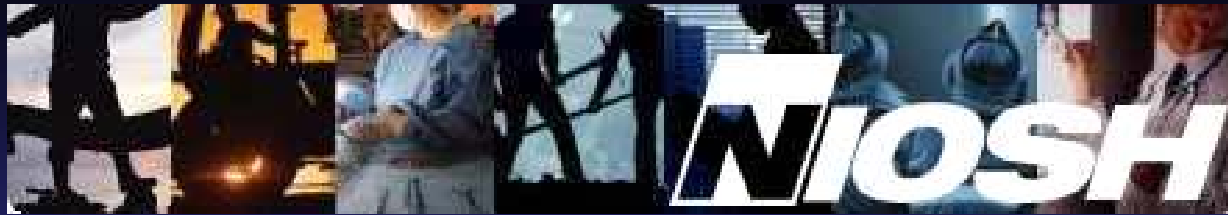
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# Outline

- I. Introduction
- II. Overview of NIOSH
- III. New and Emerging Occupational Illnesses
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## Mission

To provide leadership in research to prevent work-related illness, injury, disability, and death.



# NIOSH Overview

- Conduct surveillance to assess job-related illnesses and exposures to hazardous agents
- Evaluate work sites to identify new and existing hazards and recommends ways to reduce those hazards
- Conduct research into the cause of acute and chronic disease in workers
- Provides recommendations to OSHA regarding workplace health and safety regulations
- NIOSH is not involved with enforcing regulations





# Components of a system needed to identify new and emerging occupational conditions

- Sentinel observers
  - Health care professionals
    - Alert, knowledgeable, conscientious, courageous, generous
- Dedicated health department staff
  - To receive/triage reports of potential emerging problems
  - Need to raise awareness that these staff exist
- Surveillance systems
  - To identify patterns present in diffuse clusters (e.g. birth defects, asthmagens, new emerging pesticide hazards)
- Capacity to conduct investigations/site inspections
  - Need ability to follow-up on emerging issues
  - Need multidisciplinary team: medical staff, epidemiologists, industrial hygienists
- Longitudinal follow-up of exposed populations to evaluate preventive interventions



# New and Emerging Occupational Conditions

- New Exposure
  - Bronchiolitis obliterans from flavoring chemicals
  - Work-related asthma
  - Pyraclostrobin fungicide poisoning
- New Disease
  - Flock workers' lung
- New Setting
  - Birth defects associated with pesticide exposure



# Principals that promote recognition of new and emerging occupational conditions

- Science must be conducted without unjustified restrictions
  - Growth of private funding of research is a challenge
- Research must be communicated honestly and expeditiously
  - Need to discourage rewards to conceal or confuse findings and limitations
- Government support is essential to produce discoveries that benefit the public good
  - Often industry doesn't have a unique stake in assessing toxins and such research often doesn't involve revenue generation
  - Threat of liability and regulation is another powerful disincentive for private funding



# Regulatory science vs. research science

- **Regulatory science** needs to provide timely answers to pressing policy questions
- **Research science** has no comparable time pressures...can wait indefinitely to produce results
- Reliability of regulatory science should not be measured according to the same criteria as research science
  - Often public health actions can't wait until research findings are beyond all reasonable doubt
  - Well-intentioned single negative peer review can delay/derail public health action





# Sentinel Observers

- These can be clinicians, workers, worker's families, lawyers, public health surveillance systems
- Clinicians
  - In US, they receive little training to recognize occupational and environmental conditions
  - Often aren't aware of public health reporting requirements
  - May not have time or interest in reporting unusual diseases
- Public health Agencies
  - May not have resources to investigate reports received from clinicians



# Public Health Surveillance Systems

## Uses of Public Health Surveillance

- Estimate magnitude of the problem
- Determine distribution of illness, injury
- Monitor changes in exposures, hazards
- Detect epidemics
- Portray the natural history of a disease
- Generate hypotheses, stimulate research
- Evaluate control measures
- Facilitate planning
- Detect changes in health practices



# Public Health Surveillance Systems

## The SENSOR Model



- State-based surveillance
- Began in 1987
- “Sentinel” case identification and follow-up
- Timely opportunities for prevention/intervention
  - Directed to index case, co-workers and similar workplaces
- Standardized case definition, variables, and severity index
- Case ascertainment
  - Originally used networks of sentinel physicians (1987)
  - Currently use multiple sources for case
    - Including poison control center reports, workers’ compensation records



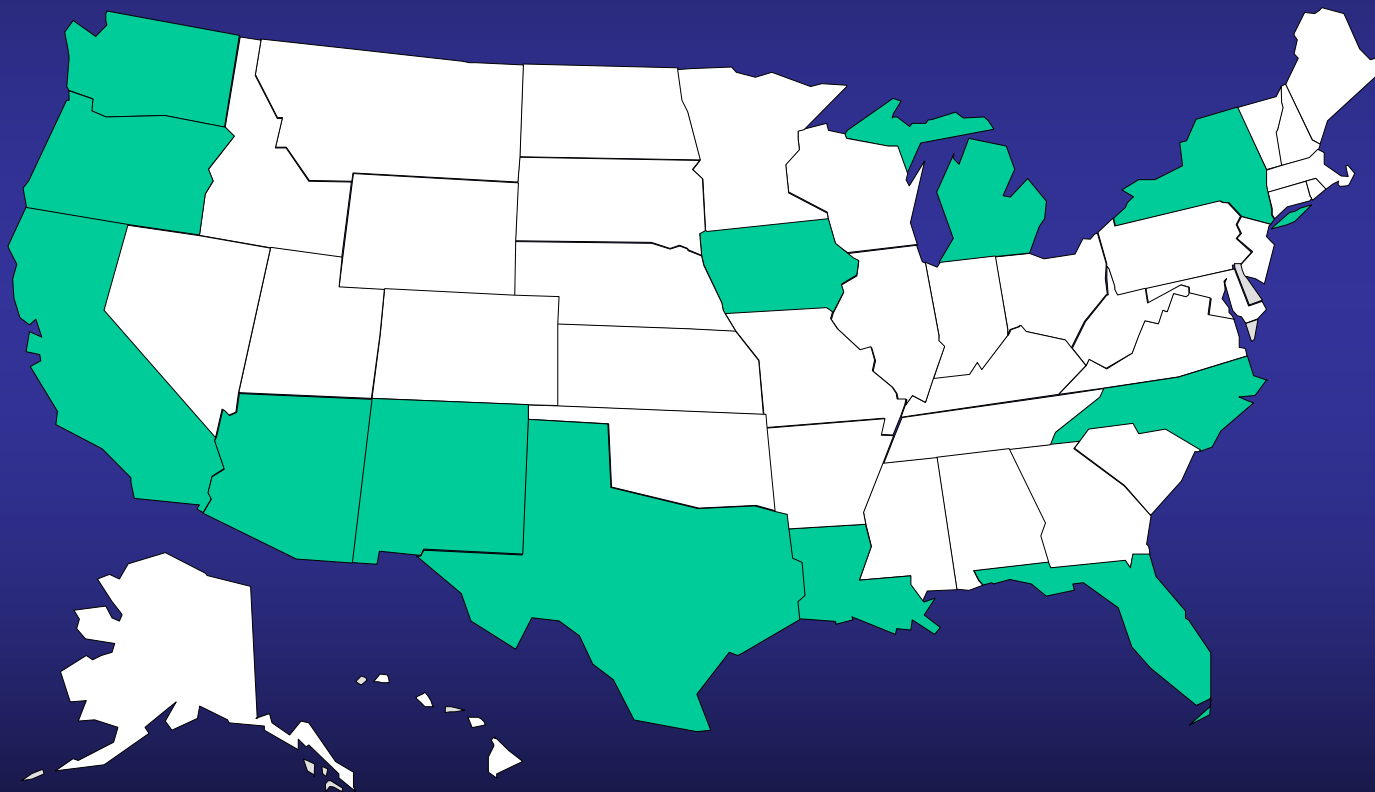
# SENSOR-Pesticides

## Recommended Resources

- Reporting rule or statute
  - Prerequisite for reliable reporting at the state level
  - Any *suspected* or confirmed case should be reportable
- Recruit useful reporting sources:
  - Poison control centers (best source of non-occupational cases)
  - Workers' compensation providers (can be excellent for occupational cases)
  - State Department of Agriculture
  - Health care professionals
  - Hospital discharge/ER department logs
  - Clinical Laboratories
- Other issues to consider
  - Right of entry for on-site investigations
  - Data analysis and data dissemination
  - Interventions



# States participating in SENSOR-Pesticides (n=12)





# Outbreaks/emerging problems recently identified

- Illnesses associated with mosquito-control efforts in nine states – 1999-2001.
  - **Impact:** EPA proposed revisions to adulticide labels to incorporate some of the recommendations made in this report
- Illnesses associated with off-target drift of chloropicrin - California, 2003
  - **Impact:** Reinforced the need for a reevaluation of chloropicrin, and supports the need for funds to cover medical expenses of pesticide-drift victims.
- Illnesses associated with pesticide use at schools, US 1998-2001
  - **Impact:** Article received extensive media coverage, raising awareness of the need to reduce pesticide exposures at schools.
- Acute pesticide-related illnesses among emergency responders, 1993-2002
  - **Impact:** First paper to examine the incidence of pesticide poisoning among firefighters, law enforcement officers and emergency medical technicians
- Illnesses associated with pesticide exposures at retail establishments, US 1998-2004
  - **Impact:** Measures taken by large retailers to reduce exposures through training, better product placement, and modified packaging
- Cluster of severe birth defects among infants born to three female farmworkers who worked on same farm
  - **Impact:** Reinforced the need for stronger farmworker protections, and research on birth defects and pesticides
- First detailed multi-state assessment of acute pesticide poisoning among agricultural workers
  - **Impact:** Providing information to inform the debate about needed revisions to the Worker Protection Standard



# Outbreak identified with Italian colleagues



- Hydrogen cyanamide
  - Plant growth regulator
  - Applied to many deciduous plants (e.g. grapes, apricots, kiwi, cherries) to stimulate uniform budbreak after dormancy
  - Highly toxic: irritation and ulceration of eyes, skin, respiratory mucosa. Also inhibits aldehyde dehydrogenase
  - Poisoning cases in US are rare (6 cases since 1981).
  - Highly regulated in US (closed systems required, no alcohol consumption before, during and 24 hours after consumption)



# Outbreak identified with Italian colleagues



- Pilot pesticide poisoning surveillance system established in Italy in 2000.
  - Italian National Institute of Health, Milan Poison Control Center, Ragusa Local Health Unit
- Outbreak of hydrogen cyanamide-related illnesses was identified in 2001
  - 28 cases from throughout Italy (14 in Ragusa)
  - Sales and usage of hydrogen cyanamide suspended for 14 months
- Additional cases identified during the suspension (n=14) and after it was lifted (n=14)
  - Surveillance system vital to detection





# Outbreak identified with Iowa colleagues

- Pyraclostrobin
  - Relatively new agricultural fungicide
  - Inhibits mitochondrial respiration
  - Toxicity category II (warning): irritating to eyes, skin. Fatal if swallowed
  - Restricted entry period is 7 days
  - Approved for use on restricted crops in 2002; approved for use on corn in December 2004
  - Use in 2007 was expected to increase dramatically



# Outbreak identified with Iowa colleagues

- Iowa joined the SENSOR-Pesticides program in October 2006
- Five poisoning events associated with pyraclostrobin identified in 2007
- Largest involved off-target drift from an aerial application
  - 27 farmworkers sickened while detasseling corn in a neighboring field
  - Symptoms included upper respiratory and pleural pain
- First report of human illness caused by exposure to pyraclostrobin or any of the other strobilurin fungicides
- Recommendations
  - Need to comply with existing pesticide regulations, pesticide label requirements
  - Avoid aerial applications of pesticides when workers are in nearby fields
  - farmers should consider the potential human adverse effects when weighing the risks and benefits of prophylactic pesticide use.





# Linking diffuse clusters: Birth defects and pesticide exposure

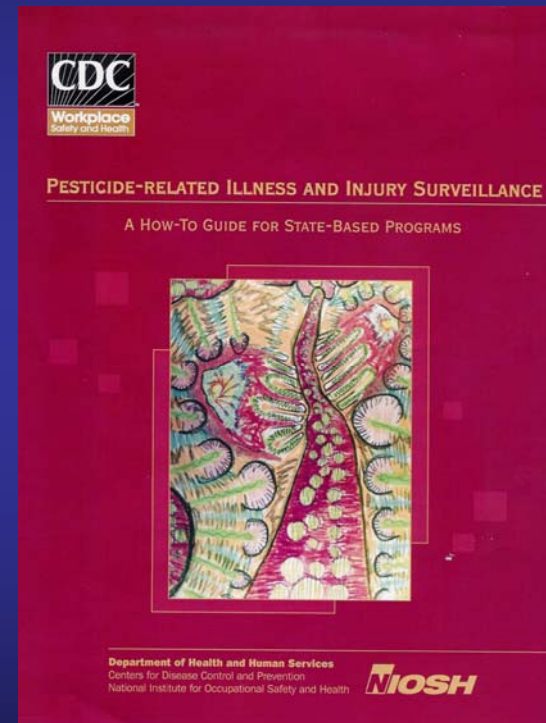


- Three farmworkers gave birth to infants with birth defects closely grouped in time and place
  - Births were within 8 weeks of each other among mothers living in Immokalee, FL (December 2004 – February 2005)
  - In 2004, all three mothers worked for the same grower on farms located in Florida and North Carolina
  - Among the 191 Hispanic women working on grower's farm, estimated 6 live births per quarter
  - All mothers were Mexican with undocumented immigrant status
  - All unknowingly worked in tomato fields that were under a restricted entry interval (REI)
  - Cluster received widespread media coverage in Florida and North Carolina



# Other Accomplishments

- Webpage for SENSOR-pesticides
  - <http://www.cdc.gov/niosh/pestsurv/>
- How-to guide for pesticide poisoning surveillance
  - Published in November 2005
  - First NIOSH guide on developing a state-based occupational/environmental surveillance program





# Capacity to conduct investigations/site inspections

## NIOSH Health Hazard Evaluation (HHE) Program

- Authorized by the 1970 federal law that established NIOSH
  - Occupational Safety and Health Act of 1970
- Allows NIOSH to conduct on-site toxicity determinations
- Respond to written request by employer or authorized representative of employees
- NIOSH has right-of-entry to conduct an HHE investigation
  - NIOSH employees can enter any place of employment to conduct an investigation
- Determine whether any substance found in the place of employment has potentially toxic effects
- Investigation findings are provided to employers and affected employees
- Submit data to OSHA/MSHA if the substance is not covered by a standard





## When an HHE Can Help



- New hazards, exposures, or processes
- Illnesses from an unknown cause
- Exposure to unregulated agents
- Adverse health effects at exposures less than current standards
- Occupational physicians or epidemiologists are needed



# Evaluation of a New Hazard via the HHE program

- Microwave popcorn facility in Missouri
- Workers with obstructive lung disease
  - Butter flavoring mixing room
  - Microwave popcorn packaging area
- Multiple site visits conducted
  - Medical tests: spirometry, diffusing capacity, and chest x-rays
  - Exposure assessment
  - Engineering control assessment



# Microwave Popcorn Facility



- Medical results
  - Worker lung obstruction significantly higher than national rates (3.3X – all; 10.8X – never-smokers)
  - Bronchiolitis obliterans identified in 8 workers
- Exposure assessment results
  - Predominant ketone identified as diacetyl (an artificial butter flavoring)
  - Mean area diacetyl concentration ranged from ND to 98 ppm
    - Peak exposures suspected to be as high as 1,230 ppm
- Engineering control assessment results
  - Engineering controls reduced diacetyl concentrations to less than 1 ppm





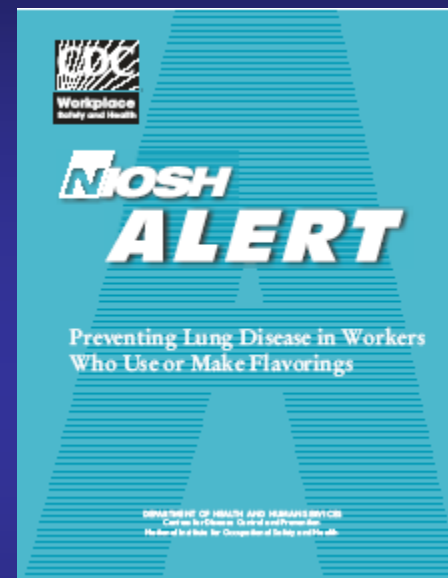
# Microwave Popcorn Facility

## ■ Conclusion

- Strong dose-response demonstrated between cumulative diacetyl exposure and lung obstruction
- Inhalation of butter flavoring chemicals is a new risk factor for bronchiolitis obliterans

## ■ Actions/Impact

- NIOSH Alert published in 2004 to inform the flavoring industry to take steps to prevent obstructive lung disease in workers who use or make flavorings
- OSHA is in the process of developing regulations to reduce exposures





# Flavorings-related Bronchiolitis Obliterans

- 34 high priority chemicals identified by Flavoring and Extract Manufacturers Association
  - Diacetyl may be the predominant chemical
- Identified to public health authorities in 2001
- First cases reported in 1986
  - Two BO cases of unknown etiology in flavoring manufacturer
- Additional cases identified in mid-1990s in Ohio, but not reported to public health authorities
- How long has chemical been used in flavorings industry?
- What occupational health problems have yet to be identified?



# Longitudinal Follow-up

- Has an intervention been undertaken?
- Have the number of disease cases decreased?
- Active follow-up via investigation
  - For example, in the Missouri microwave popcorn plant, engineering controls lowered diacetyl exposures. Exposed workers no longer had excessive declines in pulmonary function
- Passive follow-up via public health surveillance
  - Has the surveillance system identified fewer cases?



# National Survey Data



# National Survey Data

- **National Health and Nutrition Examination Survey (NHANES)**
  - Consists of face-to-face interviews and medical examinations
  - 5,000 individuals are examined annually
- **National Health Interview Survey (NHIS)**
  - Consists of face-to-face interviews
  - Approximately 50,000 adults interviewed annually, of whom ~20,000 are workers
- **Bureau of Labor Statistics Annual Survey of Occupational Illnesses and Injuries (SOII)**
  - Of 7 million US workplaces, 230,000 are surveyed annually
- **Behavioral Risk Factor Surveillance System (BRFSS)**
  - World's largest, on-going telephone health survey system
  - 350,000 adults interviewed each year
  - Collects information on health risk behaviors, preventive health practices, and health care access



# National Survey Data

## ■ Strengths

- Can assess magnitude and trend of occupational disease (NHIS, NHANES) and injury (NHIS, SOII)

## ■ Limitations

- Lack of timeliness
- 22% of US workforce is excluded from SOII
- Information of work-relatedness is often missing (NHIS, NHANES, BRFSS)



# Conclusions

- Sentinel observers and surveillance systems are vital to identifying emerging occupational health problems
- Multidisciplinary follow-up is needed to characterize the emerging problem and to recommend prevention activities
- Preventive measures can be strengthened through follow-up evaluations