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NJ Fundamental & Expanded Occupational Health Surveillance
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LIST OF TERMS AND ABBREVIATIONS

AOEC	Association of Occupational and Environmental Clinics
BRFSS	Behavioral Risk Factor Surveillance System
CAA	Committee for the Advancement of Arboriculture
CDC	Centers for Disease Control and Prevention
CDRSS	Communicable Disease Reporting and Surveillance System
CPWR	Center for Construction Research and Training
CSTE	Council of State and Territorial Epidemiologists
DC	Death Certificate
DPW	Departments of Public Works
ED	Emergency Department
EMS	Emergency Medical Services
EPHT	Environmental Public Health Tracking
EpiCenter	NJ Syndromic Surveillance System
FACE	Fatality Assessment and Control Evaluation
HD	Hospital Discharge Data
ICD	International Classification of Diseases
MSHA	U.S Mine Health and Safety Administration
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety & Health
NJBRFS	New Jersey Behavioral Risk Factor Survey
NJDEP	NJ Department of Environmental Protection
NJDOH	New Jersey Department of Health
NJDLWD	New Jersey Department of Labor & Workforce Development
NJDOT	New Jersey Department of Transportation
NJPIES	New Jersey Poison Information and Education System
NJSHAD	New Jersey State Health Assessment Data System
OA	Occupational asthma
OHIs	Occupational Health Indicators
OHS	Occupational Health Surveillance

OFPAG	New Jersey Occupational Fatalities Prevention Advisory Group
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
PEOSH	Public Employees Occupational Safety & Health
RADS	Reactive Airways Dysfunction Syndrome
RCS	Respirable Crystalline Silica
SAS	Statistical Analysis Software
SENSOR	Sentinel Event Notification System for Occupational Risks
SIC	Standard Industrial Classification
SOAR	Silica Outreach and Research
SRTS	New Jersey Safe Routes to School Coalition
UB	Uniform Billing
WCD	Workers' Compensation Data
WRA	Work-Related Asthma

ABSTRACT

The Occupational Health Surveillance Unit in the New Jersey Department of Health has been conducting surveillance of work-related injuries and illnesses in New Jersey since 1981. This project works to enhance surveillance and prevention activities fundamental to an established program. The aims of this project are to: conduct population-based surveillance using existing state data sources; continue case-based surveillance of serious work-related conditions that require immediate public health response; foster integration of occupational health into ongoing public health activities; and promote collaboration with various stakeholders to improve state occupational health surveillance capacity. This project is broken into four areas of study, Occupational Health Indicators (OHI), Silicosis, Work-related Asthma (WRA) and Fatality Assessment Control and Evaluation (FACE). Presented below are the goals for each area of study.

- OHIs provide a snapshot of the health of workers in New Jersey. These indicators can be used by public health officials to track work-related adverse health effects and their causes.
- The WRA Surveillance project identifies potential cases of WRA; classifies cases in accordance with established case confirmation criteria; evaluates exposures associated with the cases; identifies new industries, occupations and causes associated with this condition; and implements interventions to prevent WRA in New Jersey.
- Occupational exposure to respirable crystalline silica is a serious but preventable health hazard. Exposure to RCS occurs in construction, mining, manufacturing and other industries, and can result in silicosis and other lung diseases. The overall goals of the Silicosis Surveillance Project are to: identify potential cases of silicosis; classify cases in accordance with established case confirmation criteria; evaluate exposures associated with the cases; identify new industries, occupations, and causes associated with this condition; and implement interventions to prevent silicosis in New Jersey.
- The overall goal of the FACE project is to maintain and expand the surveillance system for identifying work-related fatal injuries in New Jersey. FACE researchers seek to prevent work-related fatal injuries by identifying and investigating work situations at high risk for injury, and then formulating and disseminating prevention strategies to those who can intervene in the workplace.

Improvements have been seen in worker health and safety over the years. Fatality rates among construction workers reached a five year low in 2012 at 6.2 fatalities / 100,000 construction workers. Annual rates for New Jersey work-related hospitalizations have decreased from 143 per 100,000 in 2000 to 97 per 100,000 in 2011. Despite these positive statistics, challenges remain. For example, compared with other US workers, NJ workers experience higher rates of respiratory disease including pneumoconiosis. In addition, annual, age-standardized mortality rates between 2000 and 2011 (5.8-13.8 deaths per million residents) have been much higher for asbestosis in NJ than the US (5.2-6.9 deaths per million residents). Also, the annual, age-standardized rate of hospitalization due to asbestosis between 2000 and 2011 (170-277 hospitalizations/million residents) is also higher than the US (33-103 hospitalizations/million residents).

SECTION 1
Fundamental Occupational Health Surveillance

Under the NIOSH-funded Fundamental Surveillance grant, the Occupational Health Surveillance (OHS) Unit of the New Jersey Department of Health (NJDOH) accomplished the following: 1) Identified and obtained vital occupational disease surveillance data from new data sources necessary to identify potential occupational diseases and fatal occupational injuries for which intervention actions can be efficiently implemented; 2) Collaborated with department, state, federal, labor, academia, and private entities to achieve the goal of eliminating work-related health hazards and exposures; and 3) Assessed the effectiveness of the NJDOH fundamental occupational health surveillance system.

Significant (Key) Findings

- The OHS Unit has begun exploring two real-time data sources to enhance classification and situational awareness of work-related injuries and illnesses, thus leading to a better understanding of the burden of non-fatal work-related injuries and illnesses, and allowing for quicker response. For this purpose, data from the NJ Syndromic Surveillance System (EpiCenter) and the NJ Poison Information and Education System (NJPIES) were tested as possible data sources. EpiCenter was developed for early detection and monitoring of the health of NJ communities and uses chief complaints from people seeking acute care in hospital emergency rooms to identify health trends. NJPIES is the state's only certified poison control center that provides real-time data that can be used to develop and implement poison prevention and awareness strategies.

Translation of Findings

- To date, the use of NJPIES and EpiCenter systems has shown that it can yield real-time knowledge of incidents that have occurred in the workplace. Occupational surveillance currently involves collecting data on potential cases on a quarterly or yearly basis, often long after the diagnosis was made. However, using these real-time data sources allows staff to identify illnesses early so a timelier response can be initiated, reducing further risk of occupational injuries and illness.

Outcomes/Impact

- The use of multiple data sources can help identify populations, occupations and industries at high risk of a workplace injury and illness, and help to monitor trends of work-related injuries and illnesses over time. Also, underreporting of work-related injuries and illnesses is a major concern, identifying gaps can lead to improved, standardized methods, including better case definitions, reporting procedures, and data collection tools. The results will provide the project team the ability to put research into practice by making unique, relevant recommendations on data collection and interventions to mitigate worker health effects. Surveillance tools developed by the OHS Unit will be transferable to other states and agencies that conduct occupational health surveillance.

PART B: Collaborative Outreach to Disparate Populations

Significant (Key) Findings

- A project was undertaken to increase awareness of the NJ Child Labor Laws and Regulations (N.J.S.A. 34:2-21.1 *et seq.* and N.J.A.C. 12:58) among minors and their parents/guardians. A preliminary analysis of nonfatal and fatal work-related injuries in minors in NJ shows that many of these injuries may be the result of job tasks prohibited under these regulations. Knowledge and/or a clearer understanding of these regulations can help prevent work-related illnesses and injuries.

Translation of Findings

- The Division of Wage and Hour Compliance in the NJ Department of Labor and Workforce Development (NJDLWD) enforces the state's Child Labor regulations (N.J.A.C. 12:58) and has published various abstracts of the regulations and other publications. However, these materials are employer-focused and do not include injury data and prevention messages. Scripts for a bilingual (English and Spanish) internet-based application were completed and are being pilot-tested. This online application would provide an interactive tool for minors, 12 to 17 year olds, and their parents/guardians to quickly access occupational health and safety information related to N.J.A.C. 12:58.

Outcomes/Impact

- A interactive web-based application which allows minors to request occupational health information based on their current age is appropriate for this audience since the internet is the primary source of health information for teens, compared to TV, radio, magazines, and other print media. The web application would be hosted on a NJDOH dedicated webpage with links to other relevant resources and widely promoted and disseminated as directed by partners and stakeholders including the NJ Department of Children and Families, the NJ Department of Education, the NJ Council of County Vocational-Technical Schools, and NJDLWD.

PART C: Assess the Effectiveness of the Fundamental Occupational Health Surveillance System

Significant (Key) Findings

To ensure that the surveillance systems are serving a useful public health function and meeting stated objectives, OHS Unit staff completed the following two exercises:

1. *Occupational Health Indicators (OHIs)*: OHIs that are derived from hospital inpatient and emergency department data were evaluated for accuracy. OHIs are used to describe the health of the NJ's workforce. Errors in data entry and extraction were found upon analysis of outliers in years with state rates exceeding U.S. rates.
2. *Heavy Metals Registry*: OHS Unit staff worked with the NJ Office of Information Technology to consolidate all heavy metals reports into one registry. The web-based NJDOH Communicable Disease Reporting and Surveillance System (CDRSS) was the logical choice since many clinical labs already use this platform to report heavy metal poisonings, in addition to other mandated conditions.

Translation of Findings

- *OHIs*: All OHIs related to hospital discharge data were recalculated. New computer statistical analysis codes were developed to facilitate the retrieval of NJ hospital discharge data in a more efficient and accurate manner. These data sources are also used to identify cases of work-related asthma and silicosis for public health follow-up.
- *Heavy Metals Registry*: The CDRSS was created in compliance with the CDC's Public Health Information Network (PHIN) and National Electronic Disease Surveillance System (NEDSS) requirements using standardized Health Level 7 (HL7) language. Thus, OHS staff developed the appropriate case definitions and algorithms accordingly.

Outcomes/Impact

- *OHIs*: OHS staff created a new OHI webpage featuring narratives and completed trend analyses for 18 OHIs from 2000-2011, including employment demographics. This information will be updated annually. This is a major step in providing stakeholders and the public with quick access to comprehensive NJ occupational health and safety statistics. Links to related topics are also featured on the page. Furthermore, six more OHIs were added to the State Health Assessment Data (SHAD). SHAD is a NJDOH web portal which features numerous indicators of the health of NJ residents. The newly added OHIs include: Non-fatal Work-related Injuries and Illnesses Reported by Employers; Work-related Hospitalizations; Hospitalizations for Work-related Burns; Hospitalizations from or with Pneumoconiosis; and Mortality from or with Pneumoconiosis. In addition, three OHIs, namely, Fatal Work-Related Injuries; Mortality from or with Pneumoconiosis; and Elevated Blood Lead Levels among Adults were incorporated into the Healthy New Jersey 2020 as Occupational Health and Safety objectives.
- *Heavy Metals Registry*: Electronic laboratory reports are now fully operational. All adult blood lead and other heavy metal records have been transferred to the CDRSS platform which facilitates the timely reporting and immediate sharing of pertinent data including linking to other data sources such as poison control centers. This allows for the appropriate public health responses, be they single or multiple cases from workplaces. Case-finding activities are no longer labor-intensive.

NJ Fatality Assessment and Control Evaluation

Under the NIOSH Expanded Surveillance grant, the Occupational Health Surveillance (OHS) Unit of the New Jersey Department of Health (NJDOH) maintained and expanded the NJ Fatality Assessment and Control Evaluation (NJ FACE) surveillance system through: 1) identifying work-related fatalities; 2) investigating the incident to confirm the work-relatedness; 3) identifying trends in specific sub populations; and 4) developing and disseminating educational and outreach materials. The following represents highlights of findings and outcomes of the surveillance system, which have positively impacted working populations in NJ.

A. Barriers to the use of Fall Protection in Residential Construction

Significant (Key) Findings:

- Despite OSHA regulations, the existence of fall protection equipment, guidelines, and recommendations on best practices; falls were still identified as one of the top causes of work-related fatal injuries in NJ. As a result of these findings, OHS sought to characterize fall protection equipment usage patterns and barriers among residential construction workers in NJ employed by small construction companies (<10 employees). A convenience sample of individuals employed by residential construction companies with fewer than 10 employees in the state of NJ was asked to volunteer to participate in this pilot study, which consisted of three focus groups and a brief questionnaire.

Translation of Findings:

- The findings showed that employees (union and non-union) of small, residential construction companies face barriers to the use of fall protection equipment. The identified barriers to the use of fall protection equipment included availability, lack of training, ease of use, cultural differences and lack of employer oversight. Thirty-six residential construction workers volunteered to participate in a focus group. Participants ranged in age from 20-65 years, with an average age of 39 years, and 35 (97%) were male. Twenty-eight (78%) of the participants reported that retractable/shock absorbing/tie-off lanyards were never provided, and 14 (39%) were never provided guardrails by their current residential construction company. Sixteen (44%) indicated that their employer did not provide training on fall protection equipment and 18 (50%) indicated that their employer did not provide training on work safety. Seven (19%) did report that their employer provided job safety training more than once per month.

Outcomes/Impact:

- OHS recommended the following: smaller construction companies should utilize OSHA consultation services; state and federal agencies should collaborate with local organizations/stakeholders, such as New Labor, to identify and disseminate new, acceptable approaches to reduce falls in small residential construction companies; employer awareness should be raised regarding available, cost-effective fall-prevention tools such as the NIOSH Guardrail System, NIOSH ladder application, and others; and agencies with the authority to protect the health and safety of workers should organize formal alliances with residential construction companies to promote safe work environments.
- Data from this study will be used to develop intervention strategies to prevent falls in this target population.
- A manuscript "Assessing Barriers to the Use of Fall Protection in small Residential Construction Companies in New Jersey" has been accepted for publication in *New Solutions*: *A Journal of Environmental and Occupational Health Policy* (in press).
- A poster based on this pilot study entitled, "Assessing Barriers to the Use of Fall Protection in Small Residential Construction Companies" was presented at the Council of State and Territorial Epidemiologists, 2014 Conference and was nominated as an Outstanding Poster Award Finalist.

B. Work-related fatalities in the NJ Tree-care Industry

Significant (Key) Findings:

- Tree workers continue to suffer fatal work-related injuries in the US. Between 1992 and 2012, 1,604 work-related fatal injuries occurred in the US in the tree-care industry, and 70 in NJ. NJ FACE developed a collaborative approach aimed at preventing work-related fatalities in the tree-care

industry through a partnership with the Committee for the Advancement of Arboriculture (CAA), a non-profit organization of the major tree organizations, whose goal is education and training.

Translation of Findings:

- Specific recommendations for prevention of injuries through the reduction of job hazards have been developed and widely disseminated throughout the industry. In addition, the collaboration developed is a potential model for other occupational health surveillance programs, as it has proved successful in engaging an often difficult-to-reach population.

Outcomes/Impact:

- The research team partnered with new collaborators to help with accuracy and dissemination of the updated alerts. The "Wood Chipper" and "Tree Trimmer" hazard alerts were updated to include new data, case study and recommendations on the hazards of storm cleanup. Staff partnered with the NJ CAA, who provided expert content review and endorsed the updated hazard alerts and technical input on NJ FACE Report (12-NJ-078; Tree-care Worker is Crushed by Cut Tree Section During Storm Damage Cleanup). In addition, staff was invited to the Shade Tree Federation meeting and Garden State Tree Conference, approximately 200 alerts were distributed.

C. Fatal Injuries in Vulnerable Populations

Significant (Key) Findings:

- A retrospective analysis of the NJ FACE fatal occupational injury data (1990-2013) was completed for two vulnerable populations: workers who were under 25 years old and those coded with Hispanic ethnicity. A total of 216 victims aged 15-24 died on the job; 10 (0.4%) of these were <18 years old. Almost twice as many Hispanic workers (n=442) died on the job during this period. The number of fatal occupational injuries among Hispanics in NJ has slowly increased since 1990 from two to 17 fatalities in 2013. The number of deaths from 1990-2013 is highest among Whites (n=1,817; 74%) however the rate of deaths is higher among Hispanics (0.27-5.74 fatalities per 100,000 workers) compared to Whites (0.53-3.59 fatalities per 100,000 workers).

Translation of Findings:

- An infographic was developed that summarized the results and graphically described the most salient points. The younger workers infographic illustrated gender, age (including a section on minors), race and ethnicity, cause of death, and industry; the Hispanic workers infographic illustrated data by cause of death, counties with the highest numbers of fatalities, age, gender, and country of origin of the victims. Both infographics will be translated into Spanish and pilot-tested before they are disseminated as directed by partners and stakeholders.

Outcomes/Impact:

- Data visualization is effective for public health messaging, it transcends language barriers and low literacy levels. The multiple data points lend themselves to be clearly understood with an infographic as a framework and at the same time raise awareness of the occupational health and safety issues faced by these vulnerable populations.

D. Prevention Through Design

Significant (Key) Findings:

- A 51-year-old NJ construction worker died after falling from a metal warehouse roof under construction. The worker was wearing fall protection, but it was anchored to an unsecured leading edge. After the investigation was conducted, OHS published a FACE report which included the recommendation to use an anchor that was part of a permanent fall protection system.

Translation of Findings:

- The FACE report helps provide a real-life example of the components and limitations of fall arrest systems for employees to bring back to their jobs for implementation.

Outcomes/Impact:

- The FACE Report, entitled, "Hispanic Construction Worker Wearing Fall Protection Dies after Falling 40' from Roof" is used as a case study in the Atlantic Occupational Safety and Health Administration (OSHA) Training Center; Fall Protection.
- And was presented as an example in which designed prevention may have prevented the fatality in the NIOSH document entitled "Workplace design solutions: Preventing Falls from Heights through the Design of Embedded Safety Features."

Silicosis

Silicosis has been and continues to be a significant public health concern in NJ due to the many silica-using industries in the state, including foundries, potteries, glass manufacturers and sand, gravel and stone mines. From 2000-2011 there have been 485 hospitalizations due to silicosis in NJ. The annual age-standardized, rate of silicosis hospitalizations in NJ from 2000-2011 ranged from 3.4-7.1 hospitalizations per million residents compared to the US rate which ranged from 1.2-8.2 hospitalizations per million residents. In response to this public health concern, the NJ Department of Health (DOH) developed an active silicosis surveillance system in 1979. In 1984, support for this effort became available in the form of a capacity-building grant from the National Institute of Safety and Health (NIOSH). In 1987, NIOSH expanded the grant to a Sentinel Event Notification System for Occupational Risks (SENSOR) Program. The NJ Occupational Health Surveillance (OHS) Unit is a member of the NJ Silica Outreach and Research (SOAR) Alliance consisting of employers, government agencies and industry and labor organizations working together to prevent silicosis.

Part A: Cut Stone and Stone Products Manufacturing

Significant (Key) Findings

- An industry on the rise in NJ is cut stone and stone products manufacturing for home and commercial building products, such as hardscaping materials and countertops. The number of employees and establishments has nearly doubled in the past decade.[1] To accommodate the demand for stone products, more fabrication shops, many of which are small employers without substantial experience, have opened. A recent Occupational Safety and Health Administration (OSHA) inspection at a small employer revealed a lack of hazard training, inadequate dust controls, and language barriers between owners and workers.[2]

Translation of Findings

- At the April 2013 NIOSH/State Occupational Lung Disease Surveillance Meeting, NJ OHS staff initiated discussions about new silicosis cases reported in the literature among engineered stone countertop fabricators in Israel and Spain. Production and use of these artificial stone materials is rapidly expanding worldwide, and products are now manufactured, fabricated and installed in the US. The need to investigate this hazard was recognized by NIOSH, OSHA and the other surveillance states.

Outcomes/Impact

- NIOSH and OSHA partnered to develop a joint Hazard Alert on this topic and on February 18, 2015, released the publication entitled: "OSHA/NIOSH Hazard Alert: Worker Exposure to Silica during Countertop Manufacturing, Finishing and Installation."
- In advance of the joint Alert, NJ OHS staff, along with the NIOSH Division of Respiratory Disease Studies staff and surveillance state partners, posted in March 2014 an entry on the NIOSH Science Blog entitled "Silica Hazards from Engineered Stone Countertops." An outcome of the blog posting was the report of the first US silicosis case of this type by an occupational medicine physician to the Texas Department of Health. NJ OHS, the reporting physician, NIOSH and state partners published a case report entitled: Notes from the Field: Silicosis in a Countertop Fabricator – Texas, 2014, in the February 13, 2015 issue of the Center for Disease Control's Morbidity and Mortality Weekly Report.
- NJ OHS staff collaborated with engineers from the NIOSH Division of Applied Research and Technology on a NIOSH intramural project entitled: Engineering Control of Silica Dust from Stone Countertop Fabrication and Installation. The project was funded in January 2015 and NJ OHS staff brought together industry partners and NIOSH engineers to design and evaluate portable, affordable dust controls to prevent exposure.

Part B: Mining of Non-Metallic Minerals

Significant (Key) Findings

- NJ OHS staff continues to gain a better understanding of dust hazards in NJ mines and miners' health in general. Mining of non-metallic minerals continues to be an active industry sector in NJ. Sand mines predominate in the southern counties and sand and gravel mines in the northern counties. Twenty-five of the silicosis cases worked in sand and gravel mines.

Translation of Findings

- In 2014, NJ OHS staff brought together NJ Department of Labor and Workforce Development (DOLWD) and faculty from the Rutgers University, School Public Health which is working on a grant funded by the Alpha Foundation for the Improvement of Mine Safety and Health. De-identified data from the NJ Occupational Silicosis Registry from 1992 to 2011 was linked to data from the U.S Mine Health and Safety Administration (MSHA) publically available datasets to characterize: mine characteristics (e.g. commodity, number of employees, production, year so operation); history of citations (type, frequency, severity); and injury/illness reports (rates, type, severity). Multivariate regression was used to assess the contribution of silicosis in identifying mines with high rates of accidents and injuries. Forty-two miners were reported and confirmed to have silicosis. The average age was 69 years old when their silicosis diagnosis was reported with, on average, 26 years of relevant occupational exposure. All of the miners were male and non-Hispanic White. While mines are distributed fairly evenly across NJ counties, over 50% of cases had been exposed at mines from one county. Cases were more likely to be reported from sand and gravel mines compared with stone mines. A small percent of mines appear to account for a majority of cases.

Outcomes/Impact

- Educational materials, including a fact sheet "Tracking Silicosis in the NJ Mining Industry – What Have We Learned", and an NJ OHS webpage listing control measures and resources was developed and disseminated along with the latest dust control publications from NIOSH. This information was presented at the MSHA funded NJ New Miner Training class. At the trainer's request, the research team developed silicosis materials for the mandated NJ New Miner Training and Annual Refresher training.

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Work-Related Asthma

Work-Related Asthma (WRA) is considered the most common occupational illness according to the American Lung Association.[1] WRA continues to be a significant adverse health outcome for workers in the United States (US) and New Jersey (NJ). Analysis of the NJ Asthma Call-back Survey data (2008-2010), indicates that approximately 860,000 adults (18 and older) in NJ have a lifetime history of asthma. Of those, almost 300,000 respondents report some indicator of WRA and approximately 54,000 adult NJ residents with a lifetime asthma history have been diagnosed by a health professional as having WRA.[2] The NJDOH Occupational Health Surveillance (NJ OHS) staff have identified and confirmed 595 cases of WRA from 1993-2010. Approximately 60% of the cases were confirmed as new-onset asthma, which includes reactive airways dysfunction and occupational asthma. Twenty percent of the cases were work aggravated and the final 20% were not classifiable. From 1993-2010, 54% (n=321) of the 595 confirmed cases of WRA were female. Thirty-one percent (n=265) of the confirmed cases ranged in age from 35-49 years; 62% (n=369) were White; and 12% (n=71) were of Hispanic origin. Of the confirmed cases, a higher percentage of Whites (62%) reported WRA than Blacks (21%); however, confirmed cases of WRA amongst the Black (21%) population are overrepresented in regards to NJ's working population (13%).

Part A: Swimming Pool Workers

Significant (Key) Findings

- In New Jersey, 12 cases of WRA from exposure to chlorine-based products were identified in employees at fitness facilities, hospitals, and recreation pools, from 1990-2011. Exposure to chlorine-based chemicals while performing routine pool maintenance, including adjustment of pH and chlorine levels for disinfection, may be associated with WRA, the aggravation of preexisting asthma or new-onset asthma caused by workplace exposure. Symptoms of asthma include; wheezing, coughing, shortness of breath, and difficulty breathing. WRA is usually reversible, but permanent lung damage can occur if exposure continues.

Translation of Findings

- In response to the identified cases of WRA, a Health Alert, "Don't Get Sick When Applying Pool Chemicals", was produced along with a questionnaire. These materials were distributed to 782 NJ owners / operators of indoor and outdoor swimming pools and local NJ health departments. The questionnaire collected information on the application of chlorine-based products to pools and to assess the impact of the Health Alert. One hundred twenty-two (16%) questionnaires were returned. Over 70% of the participants manually adjust pH and chlorine levels. Maintenance was usually performed by a Certified Pool Operator or other maintenance employee (64%) or by the aquatic director (30%). Pool chemicals were usually applied to the pool directly (42%); 31% of employees are not required to wear PPE; and 20% indicated education and training was not provided on manual application. Results from this study indicate that manual application of chlorine-based products occurs regularly. New Jersey regulations require pool operators to add chemicals through an automated system. However, manual application of chlorine-based chemicals directly into the pool is sometimes necessary. This manual application may increase the risk of exposure to chlorine and the development of WRA. Previous studies found higher rates of asthma in lifeguards and an increased risk of asthma among pool employees. [3,4]

Outcomes/Impact

- NJ OHS developed and published a health alert, "Don't Get Sick When Applying Pool Chemicals," which has received over 1,000 web-hits during the last year. The alert was disseminated in a mass mailing to approximately 682 indoor pools and to 100 outdoor pools via email blast.
- Along with the health alert, a survey to determine the impact of the educational material was also disseminated. Results from the survey were presented at the Annual State-Based WRA Conference in April 2012 and included in a January 2013 NIOSH eNews article.
- The survey results were also presented in a poster entitled "Survey to Assess the Manual Application of Chlorine to Recreational Pools among Pool Employees, " at the 15th Annual American College of Chest Physicians Community Asthma and Chronic Obstructive Pulmonary Disease Coalitions Symposium, and the 2014 Council of State and Territorial Epidemiologist Annual Meeting.
- OHS staff participated and presented at the CDC's Water, Sanitation, and Hygiene April 2014 Webinar.

- OHS also collaborated with the Michigan and California state-based surveillance programs and published "Swimming facilities and work-related asthma" in the *Journal of Asthma*, September 2014.

Part B: Mold Contamination in the Workplace

Significant (Key) Findings

- In September of 2013, New Jersey Public Employees Occupational Safety and Health had informed the OHS of possible WRA cases at a local Justice Complex. Preliminary results show that 84/103 (82%) of the building occupants complained of adverse respiratory symptom, asthma experienced during work hours and were concerned these symptoms were associated with possible mold in the building. Inspection of the facility confirmed severe mold contamination in the heating, ventilation, and air conditioning system's air handlers units. The mold was related to maintenance issues of the units and periodic flooding that occurred over the past five years.

Translation of Findings

- In response to the potential cases of WRA reported at the local Justice Complex, a questionnaire was developed and administered on-site to the building occupants over a three day period. The survey collected information on exposure to mold, symptoms experienced by the occupants, asthma history, etc. Data from the survey have been entered into a database for analysis. Fifty-four (64%) of the occupants present during the three day visit had volunteered to complete the survey. Forty-six (85%) of the participants suffer from frequent sinusitis; 43 (80%) frequent coughs; and 30 (55%) complained of shortness of breath. Forty-four (82%) are currently taking asthma or allergy medications as a result of their symptoms. Fifteen (28%) indicated a history of asthma.
- To confirm WRA cases, medical records will be requested from individuals who have a history of asthma and from those who saw a physician while working at the Justice Complex.
- Also, a second survey was sent to the building occupants to evaluate their health status after mold remediation. Surveys are still being collected.

Outcomes/Impact

- Staff worked with the employer and employees to remediate the mold situation and make sure air handlers were cleaned and computers that control the system were replaced.
- Results from this study will be used in the implementation of intervention programs to prevent future cases of WRA.
- Results from the first survey were presented at the Annual State-Based WRA Conference in April 2014.
- The survey results were also presented in a poster entitled "Mold Contamination in the Workplace: Sick Building Syndrome or a Building Related Illness," at the 2015 Council of State and Territorial Epidemiologist Annual Meeting.

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SECTION 2

SCIENTIFIC REPORT
Fundamental Occupational Health Surveillance

A. Background

The OHS Unit has been conducting surveillance of work-related injuries and illnesses in New Jersey since 1981. This project builds on this experience to enhance surveillance and prevention activities fundamental to an established program. Aims of the project are the following: to conduct population-based surveillance using existing state data sources; to continue case-based surveillance of serious work-related conditions that require immediate public health response; to foster integration of occupational health into ongoing public health activities; and to promote collaboration with various stakeholders to improve state occupational health surveillance capacity. The injuries and illnesses that were proposed for surveillance include the Occupational Health Indicators (OHIs) identified by NIOSH and the Council of State and Territorial Epidemiologists (CSTE). Indicators are a construct of public health surveillance that defines a specific measure of health or risk status (i.e., the occurrence of a health event or of factors associated with that event) among a specified population.[1] Surveillance indicators allow a state to compare its health or risk status with that of other states, and evaluate trends over time within the state, guide priorities for prevention and intervention efforts. OHIs can provide information about a population's health status with respect to workplace injuries and illnesses or to factors that can influence health. Population-based surveillance of specified OHIs was conducted in order to estimate their magnitude and trends.

Table 1: List of Occupational Health Indicators

- Employment Demographic Profile
- 1-Non-Fatal Injuries and Illnesses
- 2-Work-Related Hospitalizations
- 3-Fatal Work-Related Injuries
- 4-Amputations Reported by Employers
- 5-Amputations Identified in State Workers' Compensation
- 6-Hospitalizations for Work-Related Burns
- 7-Musculoskeletal Disorders Reported by Employers
- 8-Carpal Tunnel Syndrome Cases Identified in State Workers' Compensation
- 9-Pneumoconiosis Hospitalizations
- 10-Pneumoconiosis Mortality
- 11-Acute Work-Related Pesticide Poisonings Reported to Poison Control Centers
- 12-Incidence of Malignant Mesothelioma
- 13-Elevated Blood Lead Levels Among Adults
- 14-Workers Employed in Industries with High Risk for Occupational Morbidity
- 15-Workers Employed in Occupations with High Risk for Occupational Morbidity
- 16-Workers in Occupations and Industries with High Risk for Occupational Mortality
- 17-Occupational Health and Safety Professionals
- 18-OSHA Enforcement Activities
- 19-Workers' Compensation Awards
- 20-Work-Related Low Back Disorder Hospitalizations
- 21-Asthma Among Adults Caused or Made Worse by Work

B. Progress Achieved Under Specific Aims

The overall goal of the work conducted by the OHS Unit under the Fundamental Occupational Health Surveillance grant had the following two broad objectives to enhance existing surveillance activities in NJ:

a) Conduct population-based surveillance of established occupational health indicators in order to estimate their magnitude and trends; and

b) Evaluate surveillance systems in order to enhance data collection, prevention and intervention activities in the State.

These objectives were achieved through the following Specific Aims:

Specific Aim 1:
Maintain and expand data collection of 19 specified occupational health indicators. Analyze data and disseminate findings to stakeholders.

As previously stated, OHIs (**Table 1**) are generated to describe the occupational health status of NJ's working population. OHS staff follows the CSTE OHI "how-to" guide, which is a step-by-step manual that describes the methods for acquiring the OHI data and how to calculate numbers and rates that need to be submitted to CSTE annually. NJ only collects 19 of the 21 OHIs. Since 2008, NJ no longer generates

Amputations Filed with State Workers' Compensation System (OHI #5) and Annual Number of Carpal Tunnel Syndrome Cases Filed with State Workers' Compensation System (OHI #8) because of changes in the requirements for the transmission of claims information from claims administrators (insurers, self-insured employers, and third party administrators) to the NJ Department of Labor and Workforce Development. Data for most of the indicators can be obtained from the NJ hospital discharge and emergency discharge data, online from the US Bureau of Labor Statistics, US Census Bureau, and the National Academy of Social Insurance. The NJDOH State Cancer Registry and Division of Healthcare System Analysis provide the mesothelioma and work-related hospitalizations data, respectively. Data for elevated blood lead levels among adults indicator are obtained from the NJDOH Heavy Metals Registry. Some OHI such as Occupational Safety and Health professionals (OHI #17) are compiled by CSTE for participating states. Examples of NJ OHIs are provided in **Tables 2** and **3** below.

Table 2. New Jersey Employment Demographics, 2011-2012

Demographics	2011	2012
Percentage of civilian workforce unemployed	9.4	9.5
Percentage of civilian employment self-employed	4.6	5.1
Percentage of civilian employment in part-time jobs	18.0	17.9
Percentage of civilian employment by number of hours worked		
<40 hours	32.8	30.4
40 hours	46.8	46.2
41+ hours	20.4	20.3
Percentage of civilian employment by sex		
Males	53.5	58.4
Females	46.5	52.0
Percentage of civilian employment by age group		
16 to 17	0.9	1.1
18 to 64	93.9	92.3
65+	5.5	6.6
Percentage of civilian employment by race/ethnicity		
White	78.4	76.6
Black	12.3	12.6
Hispanic origin	19.1	19.1
Other	9.4	10.8

Source: NJ Department of Labor and Workforce Development

Table 3. Selected 2011 and 2012 New Jersey Occupational Health Indicators

Occupational Health Indicator	2011	2012
Annual average # of adults (civilian non-institutionalized) working in NJ[1]	4,159,000	4,158,000
Estimated annual total number of work-related injuries and illnesses[2]	76,700	80,9000
Annual number of work-related traumatic fatalities[1]	99	92
Annual number of work-related hospitalizations	4,045	3,945

Sources: [1]National Bureau of Labor Statistics, [2]NJ Department of Labor and Workforce Development

In an effort to enhance OHI data analysis, OHS staff is collaborating with NIOSH to explore, pilot test, and develop guidance for all indicator states in conducting temporal/trend and other in-depth analysis of occupational health indicators. Staff has also recently pilot tested the sub-state level guidance manual. Both manuals should be completed by fall 2015.

A Microsoft Excel® database containing each of the 19 indicators has been created. The system contains complete data from 2000 through 2011 and most of the data for 2012. In order to complete the indicators for a pertinent year, staff obtains the required annual numbers (numerator) and population data (denominators) by following the CSTE how-to guide manual. The collected data are submitted to CSTE annually.

OHIs are analyzed and disseminated annually to stakeholders and the general public in various formats such as, annual reports published by the NJDOH, Grant Performance Reports published by NIOSH on their OEP Web page, the CSTE OHI webpage, NJDOH Occupational Health Statistics webpage at www.nj.gov/health/ohs/njohstats.shtml, NJDOH OHI webpage at http://nj.gov/health/surv/nj_ohi.shtml, and NJ State Health Assessment Data webpage at https://www26.state.nj.us/doh-shad/home/Welcome.html.

⊗ **Publication**:

- The OHS Unit staff collaborated with NJDOH Environmental Public Health Tracking (EPHT) researchers to continue to incorporate occupational health indicators into the NJDOH online indicator-based information system, NJ State Health Assessment Data (SHAD). NJ SHAD is hosted by the NJDOH Center for Health Statistics and features numerous other leading NJ health indicators. In addition to Fatal Work-Related Injuries (OHI #3) and Elevated Blood Lead Levels among Adults (OHI #13), currently posted on NJ SHAD, profiles were also created for the following OHIs: Non-Fatal Work-Related Injuries and Illnesses Reported by Employers (OHI #1); Work-Related Hospitalizations (OHI #2); Hospitalizations for Work-Related Burns (OHI #6); Hospitalizations from or with Pneumoconiosis (OHI #9); and Mortality from or with Pneumoconiosis (OHI #10).

Specific Aim 2:
Using the occupational health indicators framework, continue to conduct surveillance of occupational injuries and illnesses among "vulnerable populations" such as Hispanic, other racial/ethnic workers, teenagers, and older workers in NJ. Analyze data and disseminate findings to constituents.

Trend Analysis: Using the state's hospital discharge data, the OHS Unit was able to compose a picture of the frequency of common types of work-related injuries and illnesses among certain populations (specifically race/ethnicity, age, and industry/occupation group) for the period of 2000-2011. Project staff focused only on OHIs for which there is: current access to the data source, extensive experience, historical data, and for which race/ethnicity data are available:

1. *Fatal Work-Related Injuries*
   a. NJ annual rates from 2008 -2012, for all injuries, ranged from 2.3-2.6 fatalities / 100,000 employed persons in comparison to the U.S. rates of 3.4-3.7 fatalities / 100,000 employed persons. During 2012, fatal occupational injuries in NJ were predominantly male (95%) and 22% ranged in age from 45-54 years. Sixty-three percent of the decedents were White, non-Hispanic; 14% were Black, non-Hispanic; and 16% were Hispanic. The most common types of fatal occupational injury were transportation-related deaths (37%); assaults and violent acts (25%); and contact with objects and equipment (15%).
   b. Of the 92 workers who died in 2012 from work-related injuries, 14 (15%) of these deaths were among construction workers. Annual rates from 2008-2012 ranged from 6.2-12.7 fatalities / 100,000 construction workers. The leading causes of death among construction workers were transportation incidents; falls, slips, trips; and exposure to harmful substances or environments. Fatality rates among construction workers reached a five year low in 2012 at 6.2 fatalities / 100,000 construction workers.
2. *Hospitalizations for Work-Related Burns*
   a. In NJ there have been over 800 work-related burns between 2000 and 2011. The rate of work-related burns in NJ has been lower than the US rates for the same interval. NJ annual rates ranged from 0.9-2.9 hospitalizations/100,000 workers in comparison to the US rates of 0.8-5.9 hospitalizations/100,000 workers.

b. In 2011, there were 36 work-related burn hospitalizations in NJ. Of these 33 (92%) were male and the average age was 41 years. Fifteen (42%) of the hospitalized individuals were White; 4 (11%) were Black; and 11 (31%) were of Hispanic origin. Of the 36 reported cases of work-related burns in 2011, 28% of the burns were to face, head, and trunk; followed by upper limb except wrist and hand (28%); and lower limb(s) (22%).

3. *Pneumoconiosis Hospitalizations*
   a. There have been over 20,000 cases of pneumoconioses in NJ between 2000 and 2011. Hospitalization rates in NJ still remain higher than the US. Of the reported cases of pneumoconiosis hospitalizations, 91% (18,826) were due to asbestosis. The NJ annual, age-standardized rate of asbestosis between 2000 and 2011 (170-277 hospitalizations/million residents) is higher than the US (33-103 hospitalizations/million residents). Rates of asbestosis in NJ may be higher because the production of asbestos products and use of asbestos, especially in NJ's many shipyards. Several NJ studies have documented excess mesothelioma among NJ workers in industries with asbestos exposure, including NJ's most well-known asbestos products manufacturer, the Manville Corporation in Somerset County. The NJDOH has estimated that as many as 500,000 NJ workers may have been exposed to asbestos since 1940.
4. *Pneumoconiosis Mortality*
   a. The rate of mortality from or with pneumoconiosis in NJ has remained higher than US rates.
   b. In NJ, asbestosis resulted in the greatest number of deaths from pneumoconiosis, over 800 between 2000 and 2011. In NJ, asbestosis annual, age-standardized mortality rates between 2000 and 2011 (5.8-13.8 deaths per million residents) have been much higher than the US (5.2-6.9 deaths per million residents). The annual, age-standardized rate of hospitalization due to asbestosis between 2000 and 2011 (170-277 hospitalizations/million residents) is also higher than the US (33-103 hospitalizations/million residents). Rates of asbestosis in NJ may be higher due to the reasons listed above.
   c. Silicosis and coal workers' pneumoconiosis each resulted in less than 5 deaths per year between 2000 and 2011; therefore rates could not be accurately calculated.
5. *Non-Fatal Work-Related Injuries and Illnesses*
   a. In NJ, there have been over a million non-fatal work-related injuries and illnesses reported by employers between 2000 and 2011. NJ annual incidence rates decreased from 4,900 in 2000 to 3,000 injuries per 100,000 FTEs in 2011. NJ annual rates were lower than the US rates which ranged from 3,500-6,100 cases per 100,000 FTEs.
   b. Between 2000 and 2011, in NJ, there were over 150,000 estimated cases involving more than 10 days away from work. The incidence rate for cases involving full days away from work beyond the day of the incident was 1,100 cases per 100,000 FTEs in 2011.
6. *Work-Related Hospitalizations*
   a. In NJ there have been over 50,000 work-related hospitalizations between 2000 and 2011. In 2011 there were 4,045 work-related hospitalizations. Of these, 3,025 individuals (75%) were male and the average age was 48 years. Over 2,500 of the hospitalized individuals (72%) were White; 476 (12%) were Black; and over 650 (16%) were of Hispanic origin. NJ annual rates have slightly decreased from 143 per 100,000 in 2000 to 97 per 100,000 in 2011. NJ annual rates between 2000 and 2011 ranged from 97-143 inpatient hospitalizations per 100,000 employed persons in comparison to the US rates of 82-142 inpatient hospitalizations per 100,000 employed persons.
7. *Adult Lead Exposure*
   a. In NJ, there has been a trend towards decreasing blood lead levels in adults over time. However, this must be interpreted cautiously for a variety of reasons including the closing of a large lead acid battery manufacturing facility and an overall decrease in manufacturing in NJ. Despite these overall trends, OHS still routinely finds elevated blood lead values above 25 µg/dL in workers employed in certain industries. The 2007 North American Industrial Classification System (NAICS) code with the largest number of NJ adults found during 2010 to have elevated blood lead was code 238320 (painting and wall covering contractors). The majority of these 34 individuals worked in painting and paper hanging and bridge painting.

⊗ **Publication**:

- Analysis of these data is posted to the NJDOH OHI Web page [http://nj.gov/health/surv/nj_ohi.shtml]
- NJ State Health Assessment Data webpage [https://www26.state.nj.us/doh-shad/home/Welcome.html]

Collaboration: Rates of mesothelioma, an asbestos-related cancer, are higher in counties of NJ with substantial exposure from historic asbestos industries. Staff worked with a Rutgers University public health student to exam whether hospitalization or mortality due to asbestosis was also elevated in these same counties, and whether there are temporal trends in rates of these counties. This study found an association between the county risk group and rates of hospitalization and death from asbestosis. The adjusted rate ratio for asbestosis hospitalization in low-risk counties was 0.26 (95% CI: 0.25-0.27) compared to high-risk counties; the adjusted rate ratio for asbestosis deaths was 0.27 (95% CI: 0.22-0.32) comparing low- to high-risk counties. Asbestos-related disease remains a public health burden in NJ, and continued surveillance is warranted to track occurrence beyond the latency period. A poster based on this data was presented at the 2014 Annual CSTE Conference.

Specific Aim 3:
Utilize New Jersey's Hospital Discharge (HD) data real-time reporting system and initiate use of Emergency Department (ED) data in order to identify cases of reportable occupational injuries, illnesses, and poisonings. Analyze data from each of these surveillance systems and disseminate findings to stakeholders.

Hospital Discharge Data (HDD): OHS currently accesses HDD (also sometimes referred to as Uniform Billing Code data (UB)) from NJ acute care general hospitals. These data provide useful information for surveillance needs such as patient name, treating physician, and a variety of coded information on diagnosis, nature of injury, external cause, place of occurrence, and payment information. The data represent all hospital discharges for the entire state and can be searched by ICD (disease) and Ecode (external cause of injury).

Data needed to establish work as the cause of illnesses are collected through patient interviews. OHS has used HDD as a primary data source in its surveillance activities for silicosis, and as a secondary data source for work-related asthma. Cases with specific ICD-9 code are downloaded from the master file and a systematic process of data collection is conducted to confirm the diagnosis, identify place of occurrence, and provide outreach to the individual and employer.

Emergency Department Data (EDD): EDD data increased the sensitivity of our surveillance system by identifying non-hospitalized cases of occupational injuries, illnesses and poisonings missed by HDD and not reported by health care providers. Data collection, evaluation, and workplace intervention will proceed using the same methodology in place for HDD.

In both HD and ED datasets, workers' compensation payer was used to identify occupationally related injuries and illnesses. Data are collected for each ED visit and include patient demographics, time and date of treatment, Ecode, and Zcode. A Statistical Analysis Software® (SAS) macro is used to search both of these large datasets and cull records that match particular ICD and Ecodes. [2] The use of workers' compensation as a primary payer allows for obtaining injuries that occurred specifically in the workplace.

HD and ED data for work-related asthma, silicosis, and work-related fatal injury were routinely analyzed and disseminated via NJDOH and NIOSH annual reports

Table 4: List of NJ Reportable Occupational Conditions

- Asbestosis
- Coal workers' pneumoconiosis
- Silicosis
- Pneumoconiosis, other and unspecified
- Work-related asthma (possible, probable, and confirmed)
- Extrinsic allergic alveolitis
- Work-related carpal tunnel syndrome
- Adult lead, arsenic, mercury, or cadmium toxicity
- Work-related fatal injury
- Poisoning caused by known or suspected occupational exposure
- Work-related injury in children (<18 years)
- Pesticide toxicity
- Occupational dermatitis
- Other occupational diseases

and in presentations at local and national meetings.

Occupational Disease Reporting Regulation: New Jersey Administrative Code (N.J.A.C.) 8:57-3, a subchapter of 8:57 (Communicable Diseases), requires the reporting of occupational and environmental diseases, injuries, and poisonings to the NJDOH. In collaboration with the NJDOH Office of Legal and Regulatory Affairs, the OHS Unit submitted a proposal to readopt N.J.A.C. 8:57-3 with amendments. These amendments included recodifying N.J.A.C. 8:57-3 into its own chapter to N.J.A.C. 8:58, because occupational and environmental diseases, injuries, and poisonings are markedly different in scope, source, and prevention than communicable diseases.

N.J.A.C. 8:58 sets forth the requirements for hospitals and health care providers reporting of the conditions listed in **Table 4**. Physician Assistants were added to the list of reporting parties. The revised regulation and reporting form is posted on NJDOH website.

This reporting law which affects OHIs #2, 6, and 9 continues to establish the regulatory framework for NJDOH to conduct surveillance and research activities in order to prevent occupational disease and injury in New Jersey.

OHS staff has analyzed HDD and EDD for cases of occupational injuries, illnesses, and poisonings from 2008-2011 that are reportable by NJ law (**Table 5**), this includes carpal tunnel syndrome, asbestosis, poisoning due to alcohol, petroleum products, metals, etc. The most reported cases from 2008-2011 was from asbestosis, over 6,000 (50%), and alcohol poisoning, 2,120 (22%). Staff will use this data to update NJ's reporting regulations.

Table 5. Selected Occupational Injuries, Illnesses, and Poisonings Reportable by NJ Law, 2008-2011

Injury/Illness/Poisoning	2008	2009	2010	2011
Carpal tunnel syndrome*	29	17	11	8
Coal worker's pneumoconiosis	65	47	34	24
Pneumoconiosis, other dust inorganic	9	3	3	1
Asbestosis	1748	1583	1411	1279
Silicosis	42	25	34	24
Poisoning				
Alcohol	523	518	527	552
Petroleum products	11	13	10	14
Carbon monoxide	51	64	54	63

*Workers' compensation as payer
Sources: NJ Department of Labor and Workforce Development

Specific Aim 4:
Evaluate all of the above occupational injury and illness surveillance systems (occupational health indicators, HD, and ED datasets). Disseminate findings to stakeholders.

Staff recently began using the OHI Evaluation Tracking Tool designed by CSTE to collect information to assess the value of generating OHIs. The tool has shown that generating the NJ OHIs has led to new surveillance activity, such as incorporating EpiCenter, NJs syndromic surveillance system, and NJ Poison Information and Education System (NJPIES) to enhance the classification and capture of work-related non-fatal injuries. Utilizing the results from the data analyses, staff evaluated the HD and ED data sources and the OHI data systems to ensure that the surveillance system operates efficiently and that the systems are serving a useful public health function and meeting stated objectives. This has led to improved source data quality. For example, the creation of a new heavy metals database that more efficiently captures adult blood lead levels. The tool has also shown that generating the NJ OHIs has helped open dialogue for collaboration with existing partners such as NJDOH Public Employees Occupational Safety and Health Program (PEOSH) and EPHT and has led to new partnerships with NJPIES. The OHI data has been published on the NJDOH occupational website and in larger state databases such as NJSHAD; has

been published in Healthy NJ 2020; and has been used to respond to internal department requests which have helped raise awareness of occupational health in NJ.

- ***HD and ED Data Sets***: Besides generating data, the OHIs can help build capacity for using available data and open discussion for future partnerships with occupational health and other partners within states. OHS staff analyzed OHI data from 2000-2008 and utilizing the results evaluated the HD and ED data sources and the OHI data systems to ensure that the surveillance system operates efficiently and that the systems are serving a useful public health function and meeting stated objectives. Upon evaluating outliers and surveillance years with state rates exceeding U.S. rates, errors in data entry and extraction of HD and ED data were found. As a result, new SAS codes were developed to facilitate the retrieval of NJ HD and ED data in a more efficient and accurate manner.

- ***Heavy Metals Database***: Staff worked with the NJ Office of Information Technology to update and improve the data requirements for the new heavy metals database to capture work-related heavy metal exposure, thus allowing staff to better capture adult blood lead data for OHIs. NJ state regulations require reporting of all blood lead values from clinical laboratories, physicians, and hospitals (N.J.A.C. 8:44-2.11, N.J.A.C. 8:57-3.1., and N.J.A.C. 8:57-3.2). The Adult Blood Lead project collected 1,218 cases of employees (age 16 and older) with blood lead level ≥10 µg/dl in 2010; 2,195 cases in 2011; 1,746 cases in 2012; and 1,135 cases in 2013. With the completion of the database staff now plan to continue surveillance, conduct case follow-up and interventions among adults.

- ***EpiCenter (Syndromic Surveillance)***: OHS staff began exploring EpiCenter as a real-time surveillance system for occupationally related exposures. EpiCenter is a statewide Syndromic Surveillance system used by state and local public health agencies to detect, track, and characterize health events such as pandemic influenza, outbreaks, environmental exposures, and potential bioterrorism in real-time. OHS staff currently receives automatic electronic notifications whenever there are three or more cases of chemical exposures seen in emergency departments in NJ. OHS staff quickly reviews the cases using the secure EpiCenter website, and contacts the emergency department staff to obtain additional information to determine if it is occupational and conduct follow-up as needed. In the past year, occupational events detected via EpiCenter included: an exposure to toluene vapor at a nail polish manufacturing plant; six cases of pesticide exposure at a repacking facility; and carbon monoxide poisoning of two police officers due to exhaust problems in their vehicle. This experience has shown that the EpiCenter chief complaint reporting system can yield real-time knowledge of incidents and local conditions that OHS can assist with and identify prevention opportunities. This has also provided an opportunity for the OHS Unit to partner with the PEOSH to provide them with real-time data on work-related injuries occurring among public employees in NJ.

- ***NJ Poison Information and Education System (NJPIES)***: The OHS Unit is also collaborating with NJPIES as an additional data source. NJPIES was created by legislation (N.J.S.A. 26:2-119 et seq.) and began service on February 1, 1983, replacing 32 Poison Control Centers located in NJ hospitals. Its mission is to provide treatment and the provision of information concerning poisons, drugs, and targeted health issues through telephone management, consultation, education, and research. Occupational exposures are reportable under NJ state law. Thus, one of the areas NJPIES codes for is occupational exposure. NJPIES currently provides cases of occupational poisonings to the OHS Unit on a weekly basis in an effort to further enhance the classification and capture of work-related non-fatal injuries with possible improved efforts in prevention.

- ***NJ Behavioral Risk Factor Survey (BRFS)***: The New Jersey BRFS is a telephone survey that is a component of the CDC's BRFSS (Behavioral Risk Factor Surveillance System). The BRFSS monitors major behavioral risk factors and chronic conditions associated with disability and death among adults aged 18 and over who live at home. The questionnaire used in the NJBRFS is customized on an annual basis by supplementing required and optional modules from the BRFSS questionnaire with a set of state-designed questions approved by CDC. NJ and nine other occupational health surveillance states (CA, CT, KY, MA, MI, NY, OR, TX, WA) have collaborated on a project to estimate the prevalence of workers with work-related injuries and determine the magnitude of under-reporting to state

workers' compensation systems. The ten states submitted a five-question workers' compensation module to their respective 2007 state BRFSS surveys. These questions were developed by the NIOSH Industry and Occupation working group and the results are currently being analyzed. The NJDOH Center for Health Statistics was instrumental in getting this module included for a subset of New Jersey citizens participating in NJBRFS.

- ***NJDOH Office of Emergency Medical Services (EMS)***: In an ongoing effort to identify novel data sources for occupational health surveillance, the OHS Unit, with the assistance of a CSTE fellow, collaborated with the NJDOH Office of Emergency Medical Services (EMS) to evaluate the usefulness of their database. Using FRIL, an open-source program, EMS data were linked to HD and ED data by patient name, date of birth, gender, and date of admission. The results showed that EMS data can supplement current estimates of nonfatal work-related injuries and illnesses. A poster, "Linking Emergency Medical Services Data to Hospital and Emergency Department Discharge Data for the Surveillance of Work-Related Injuries in New Jersey, 2011," was presented at the 2013 CSTE Annual Conference, in Pasadena, CA.

Educational Outreach:

Occupational Health Indicators webpage: A major accomplishment of this project was the creation of a new OHI webpage [http://nj.gov/health/surv/nj_ohi.shtml] featuring the complete set of NJ OHIs. For this purpose, staff has written narratives and completed trend analyses for 19 OHIs from 2000-2011 including employment demographics. This is a major step in providing stakeholders and the public with quick access to comprehensive NJ occupational health and safety statistics.

NJ SHAD (State Health Assessment Data) System: To allow for increased visibility and integration into mainstream public health, staff continues to work with EPHT to incorporate OHIs into the NJDOH online indicator-based information system, NJ SHAD, where the OHIs are now featured with all the leading NJ health indicators. These OHIs are compiled in a new "Occupational Health and Safety" folder along with two previously posted OHIs Fatal Work-Related Injuries (OHI #3) and Elevated Blood Lead Levels among Adults (OHI #13). The newly added OHIs include: Non-fatal Work-related Injuries and Illnesses Reported by Employers (OHI #1); Work-related Hospitalizations (OHI #2); Hospitalizations for Work-related Burns (OHI #6); Hospitalizations from or with Pneumoconiosis (OHI #9); and Mortality from or with Pneumoconiosis (OHI #10). A sixth indicator, Incidence of malignant mesothelioma (OHI #12), is currently in the process of being added to SHAD along with construction fatalities as a subset of the work-related fatalities indicator. [http://www4.state.nj.us/dhssshad/indicator/Introduction.html].

Healthy New Jersey 2020: Three OHIs, Fatal Work-Related Injuries (OHI #3), Mortality from or with Pneumoconiosis (OHI #10), and Elevated Blood Lead Levels among Adults (OHI #13) were incorporated into Healthy NJ 2020 as Occupational Health and Safety objectives and referenced accordingly in the SHAD indicator system. [http://nj.gov/health/chs/hnj2020/environment/occupational/index.shtml]

Adult Blood Lead Project: The Adult Blood Lead project conducted lead evaluation and trainings at 51 worksites from 2010-2013. These site visits included an industrial hygiene evaluation, consultation, lead safety awareness training and recommendation on prevention strategies. Staff also conducted 345 telephone interviews to employers and employees from 2010-2013. These interviews collected demographic information, workplace information, such as number of employee, processes, PPE and training. Educational materials were sent after each interview.

C. Other Fundamental Occupational Health Surveillance Activities

(1) *Council of State and Territorial Epidemiologists (CSTE) Subcommittee*: The NJ Occupational Health Indicator Coordinator has been serving as the state-representative co-chair for the CSTE/NIOSH Occupational Health Indicators Work Group.

(2) *NIOSH State-Based Occupational Health Surveillance Clearinghouse*: The OHS Unit is currently cooperating with NIOSH to compile materials to be included in the Clearinghouse. All occupational

health publications will be included in the clearinghouse: grey literature, peer-reviewed publications, NIOSH-sponsored research articles, and materials that were not funded by NIOSH.

(3) *NJDOH Occupational Health Indicators Website*: Staff has completed trend analyses for all 19 NJ indicators from 2000-2011 and the data has been updated on the OHI webpage. This information will be updated annually. The webpage provides stakeholders and the public with quick access to comprehensive NJ occupational health and safety statistics. Links to related topics are also featured on the page.

(4) *Collaborations with Other Stakeholders:* OHS seeks out opportunities to collaborate with NJ State agencies and other stakeholders to address occupational health issues in NJ. OHS Unit staff attends meetings, participates in workgroups, and Listservs to explore possibilities for collaboration, and then selects and designs a collaboration including:
- NIOSH annual meetings and workshops with states;
- CSTE annual workgroups meetings;
- Northeast Regional Occupational Health annual meeting (CT, MA, ME, NH, NJ, NY, RI) in Connecticut.

D. Conclusions

The occupational health indicators continue to provide baseline data for the New Jersey Fundamental Surveillance Program. Understanding specific populations at risk and obtaining rates of fatal and non-fatal injuries provides an estimate of the risk in sub-groups which may be more informative than traditional counts of injuries. The Indicator process has been instrumental in establishing relationships with various data owners including the NJ Bureau of Workers' Compensation and the NJ Cancer Registry. The information gained by the OHS Unit's analyses of HD data has been useful in focusing interventions on a target group (Hispanic workers). Characterizing the populations most at risk for work-related illnesses and injuries assists the NJDOH in prioritizing occupational health needs at the national and state level, and in effectively directing resources. The Fundamental Surveillance Program has also allowed the NJDOH to expand its group of partners and develop strategic alliances in the effort to include occupational health into mainstream public health. Fundamental surveillance has transitioned into a core surveillance system with activities in chemical poisoning surveillance, data sharing through an environmental public health tracking initiative, workplace violence, environmental consumer product decision-making, and other scenarios having implications on workers' health.

LITERATURE CITED

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Fatality Assessment and Control Evaluation

A. Background

Since 1990, the New Jersey Department of Health (NJDOH), Occupational Health Surveillance (OHS) Unit has tracked fatal work-related injuries and conducted research oriented investigations of targeted deaths using the National Institute of Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) case-based model. Staff monitors all New Jersey (NJ) work-related fatal injuries to identify industries, types of occupations and work conditions that lead to these fatal injuries. Staff conducts in-depth investigations at facilities where the fatal injury occurred to learn and understand the root cause and contributing factors of the fatality. Targeted incidents have included deaths that occur in the tree care industry, solid waste industry and roofing. Each fatality investigation results in a FACE report with recommendations to prevent similar incidents.

B. Progress Achieved Under Specific Aims

The overall goal of the work conducted by the OHS Unit is to reduce fatal and non-fatal occupational injuries in New Jersey. The following (**Figure 1**) is a schematic of New Jersey's surveillance system model for fatal work-related injuries and includes: 1) identifying work-related fatalities; 2) investigating the incident to confirm the work-relatedness; 3) identifying trends in specific sub populations; and 4) developing and disseminating educational and outreach materials.

Figure 1. Work-Related Fatal Injury Surveillance System Flowchart

Specific Aim 1:
Maintain the NJFACE database by collecting information on fatalities through continued collaboration with our established data sources.

- **Established Data Sources**

NJ FACE is a case-based research activity. Staff monitors all NJ work-related fatal injuries to identify industries, types of occupations and work conditions that lead to fatal injuries. Staff conducts in-depth investigations at facilities where a fatal injury occurred to learn and understand the root cause and contributing factors of the fatality.

OHS collects death outcomes data from the NJ Electronic Death Registry System, which contain the ICD-10 code for underlying cause of death; the NJ Census of Fatal Occupational Injuries (CFOI), which assembles data on all occupational fatal injuries for each calendar year; and Medical Examiner Reports, which contains all notes, observations, data collected at the time of the death and the autopsy report. Through collaboration and the OSHA Directive CPL 02-00-134 - OSHA Support of NIOSH "FACE" Program, staff worked with Public Employee Occupational Safety and Health (PEOSH) and OSHA to access reports that include the safety narratives and list of citations. Staff also conducted daily searches of NJ, NY, and PA news media as a source of real-time notification of work-related fatalities.

- **New Data Sources**

***Syndromic Surveillance Data*:** NJFACE staff now have access to a real-time surveillance tool to track work-related emergency room visits throughout the state via EpiCenter, NJDOH's existing real-time surveillance system. NJ FACE receives automatic electronic notifications whenever emergency department visits exceed threshold levels. The cases are reviewed using the secure EpiCenter website, and the hospital ED is contacted to obtain additional information and conduct follow-up as needed. Recent occupational events detected via EpiCenter included an incident that occurred in 2013 at a nail polish manufacturing plant in northern, NJ. The EpiCenter system alerted NJ FACE staff of two plant workers (one of whom died) and four emergency responders who became ill after being exposed to toluene vapor. NJ FACE contacted OSHA and the employer immediately, and conducted an investigation of the incident.

- **Ascertainment of Work-Relatedness**

Once the research team becomes aware that a work-related fatality has occurred, background information is collected from the Medical Examiner's Report of Investigation and police reports, to confirm that the incident was work-related. Information about the employer, type of incident, location of injury, and demographic and employment information about the deceased are also reviewed and the Standard Industrial Code, Census Occupational Code, and International Classification (ICD) 9 and 10 External Cause of Injury codes (Ecodes) were determined.

Once confirmed as work-related, the information is used to further determine if the incident is in-scope for investigation, i.e., that it meets the targeting criteria that would make the case eligible for a NJFACE field investigation.

- **Data Collection and Data Entry**

Data regarding fatalities are entered into a Microsoft Access® database. This database is used to monitor trends and identify target groups for interventions. Data records are updated when new information is received.

Variables collected include industry type, number of employees, company safety program, victim demographics (e.g., age, sex, and occupation), production process, working environment, and the tools and machinery used by the victim. Additional variables collected include the victim's usual working hours and days (shift work), union membership, and if the victim was a temporary worker or permanent employee. If a new fatality type is targeted, a new data collection instrument is designed and field tested to gather specific information for that target. If a data collection instrument is not available for a given

fatality type, the investigator uses the relevant general information sections of an existing instrument as a field substitute.

Specific Aim 2:
Conduct field investigations of in-scope fatalities to identify risk factors and safety, environmental, and engineering issues which may lead to the development of prevention recommendations and replicable on-site interventions.

- **Identification of In-Scope Cases**

NIOSH Priority Areas
- Machine-related
- Highway Work Zones
- Youths
- Hispanics

NJ Priority Areas
- Renewable Energy
- Public Employees
- Falls

- **Incident Investigation Protocols**

All cases are investigated using the NJFACE Investigation Protocols. These protocols may vary with the circumstances of a given incident, but follow the following format:
Case Initiation: After identifying an in-scope incident, a NJFACE investigator immediately contacts OSHA to ask if they are aware of the incident. The investigator then gathers background information on the incident to confirm that it is in-scope. Copies of the Medical Examiner's Report of Investigation and police report are obtained by fax, when available. The NJFACE investigator schedules an independent investigation unless a joint investigation with the assigned OSHA compliance officer is possible.
Employer Notification: A NJFACE investigator telephones or otherwise contacts the employer for permission to conduct an investigation. An introductory letter and NJFACE brochure is faxed, e-mailed, or mailed to the employer before the investigation. If the incident occurred on the property of a third party, then a similar notification process is conducted with the owner of the incident site.
Opening Conference: Once on site, NJFACE investigators fully explain the goal of the FACE program and purpose of the visit to all involved parties including (but not limited to) the employer, incident site owner, witnesses, and labor unions. Verbal consent is obtained and any questions are addressed before starting the investigation. If conducting a joint investigation with OSHA, OSHA is the lead agency and directs the investigation.
Investigation: After the opening conference, NJFACE investigators explore the circumstances of the incident with the employer or their representative, by asking questions about the victim, production process, machinery, training, and safety policies. Witnesses and co-workers are also interviewed. NJFACE investigators inspect the incident site with the employer and witnesses whenever possible. Sketches and measurements of the site are taken, as well as specific information on any equipment involved. Investigators photograph the site and related equipment with the permission of the employer.
Closing Conference: After completing the incident site visit and all interviews, NJFACE investigators meet with the employer to discuss any findings, hazards, and recommendations. Documents, blueprints, photographs, or other company records examined during the investigation may be copied if the employer permits. Investigators answer any final questions and provide copies of non-confidential information the employer requests.
Post-Investigation: After completing the site visit, the NJFACE investigator obtains all available relevant background source information on the incident. This includes the police report, report of investigation by Medical Examiner, autopsy, toxicology reports, and OSHA files. If needed, additional site visits or calls to the employer are scheduled. NJFACE investigators also collaborate with any organizations or stakeholders that may assist in gathering information on the incident or related industry practices. OSHA or PEOSH routinely provides support on most investigations. The Committee for the Advancement of Arboriculture is also consulted for incidents regarding tree trimmers.

- **Investigation Reports:**

Following the completion of the investigation, the information is compiled into a comprehensive NJFACE investigation report. The report provides background on the employer and victim, a detailed description of the incident, and recommendations for preventing future incidents. Identifiers such as the name of the victim, employer, witnesses, site of fatality, or next-of-kin are not included in the report. An NJFACE report is composed of the following sections:

- Summary page: Includes a synopsis of the incident, contributing factors, and the list of recommendations.
- Introduction: Information on how NJFACE learned of the incident, along with important dates and sources of information, including a brief description of the employer and victim.
- Investigation: The main narrative of the report that fully describes the incident. The victim's job duties, the production process, and events leading up to the incident are covered in detail. Post-incident actions outline the attempts to save or treat the victim. All personal identifiers are omitted. Photographs are edited for the same purpose.
- Recommendations and Discussion: Detailed recommendations for preventing similar incidents in the future. Each recommendation has a discussion section to directly link it with the incident and explain how the incident could be avoided. When appropriate, prevention strategies that go beyond OSHA's emphasis on standards and regulations are recommended. Many reports include attachments to fully explain a recommendation, such as a NIOSH Alert or OSHA publication. A list of various safety information sources is included. This includes contact numbers and web addresses to OSHA and PEOSH, NJDLWD OSHA Consultation Service, the NJ State Safety Council, and other general sources of safety information.
- Other sections: References, attachments, and a distribution list of recipients.

After internal review by the OHS, the draft investigation report is sent to OSHA or PEOSH for review and comment. The final report is sent to the employer, site owners, and other concerned parties. The report is also posted on the NJ and NIOSH FACE websites.

Since 1990, a total of 246 field investigations and 233 investigation reports have been. **Table 1** summarizes all the cases that were initiated, conducted, or closed between July 1, 2010 and June 30, 2015**:**

Table 1. NJ FACE Cases from 7/1/10 to 6/30/15

NJFACE Case ID#	Incident Type	Summary
11-NJ-02	Machine	A Department of Public Works employee was crushed between the dumpster and rails of a roll-off truck.
09-NJ-99	Fall	A commercial roofer fell 40 feet from an industrial warehouse. The victim was wearing fall protection, but the force of the fall caused the anchor to break free.
12-NJ-10	Machine	A laborer was crushed when the bucket and arms of the skid-steer loader he was working underneath dropped down.
12-NJ-19	Struck-by	A laborer for a landscaping company was struck by a swinging slab of concrete that had been hoisted. He and other coworkers were trying to grade the ground underneath the slab.

NJFACE Case ID#	Incident Type	Summary
12-NJ-22	Machine	A mechanic was crushed when the three-ton wood-chipping machine that he was working underneath fell on top of him.
12-NJ-24	Struck-by	A ground worker for a landscaping company was struck by a large falling piece of tree branch that had just been cut by another worker at the top of the tree.
12-NJ-78	Struck-by	A tree surgeon for a landscaping company was struck-by one of the logs that he was cutting attached to a storm damaged tree.
12-NJ-86	Fall	A roofer was rolling out roofing material in the proximity of a skylight when he tripped and fell backwards, through the skylight, 20 feet to the floor below.
13-NJ-20	Fall	A laborer fell approximately 40' to the concrete below while clearing stones from a flat roof when he stepped on a portion of the roof that gave way.
13-NJ-15	Fall	A laborer fell approximately 40' to the concrete below while clearing stones from a flat roof when he stepped on a portion of the roof that gave way.
13-NJ-49	Fall	A warehouse laborer died after falling off a raised forklift, 17' to the concrete below
13-NJ-59	Chemical Exposure	A laborer was overcome by organic vapor after opening the cover of a tank of toluene at a manufacturing plant.
14-NJ-05	Electrocution	A tree worker was electrocuted while trimming a branch with a pole saw; the saw contacted a nearby energized power line.
14-NJ-10	Crushed by	A foreman for a steel warehouse was crushed to death when an unstable pile of steel I-beams fell on top of him
14-NJ-75	Machine related	A day laborer was killed when the bucket of a backhoe struck him in the head. The operator of the backhoe was swinging the boom, but did not see the worker standing near the bucket.
15-NJ-10	Struck by/Machine related	A sanitation worker was killed when a garbage truck backed over him.

NJFACE Case ID#	Incident Type	Summary
15-NJ-07	Struck by	A maintenance mechanic for a frozen food manufacturing company was removing parts from a nonworking electrical cabinet. The cabinet was a free standing unit 7'3" high by 5' wide, and weighed 993 lbs. While he was removing the parts, the cabinet fell forward and pinned the victim against the floor, killing him.
15-NJ-22	Fall	A stage technician for a casino worker fell approximately 17' while taking down temporary bleachers. He and a coworker were moving a 78-lb platform when the victim stepped backwards into an open spot and fell to his death.

Specific Aim 3:
Conduct statistical analysis of the NJFACE database to identify risk factors (such as job, age, industry, activity) of fatalities and to monitor trends of fatality rates in specific occupations, industries, and demographic groups.

NJFACE Trend Data Analysis: Trend analysis of the NJFACE database is conducted annually.

- 2,470 workers were fatally injured in NJ from 1990-2013:
  - The average annual rate of fatal work-related injuries was 2.7 deaths per 100,000 workers There has been no consistent increase or decrease in work-related fatalities since 1990;
  - 94% (2,331) were male; 74% (1,817) were white; 18% (451) were of Hispanic origin; and 25% (624) ranged in age from 40-49 years;
  - The three leading causes of death were MVA or Transportation, 30% (707); Falls, 17% (415); and Homicide/Assaults, 14% (338); and
  - Trend analysis has been completed from 1990-2013 and narrative is currently being written and will be incorporated into the new FACE data website.
- 97 workers were fatally injured in NJ in 2013:
  - 96% (93) were male; 73% (71) were white; 18 % (17) were of Hispanic origin; and the average age was 46 years;
  - Landscaping Services, Gasoline Stations with Convenience Stores, and General Freight Trucking, Long-Distance, Truckload had the greatest number of fatalities; and
  - The annual crude fatality rate increased from 2012 (2.2 per 100,000 full-time employees) to 2013 (2.5 per 100,000 full-time employees).

Analysis of Hospital Discharge and Emergency Department Data to Inform Targeted Interventions: OHS also looked at non-fatal injures for use as a predictor of future fatal events. Work-related cases from the hospitalizations and emergency department visits were taken from the Universal Billing Patient Discharge Data (UB). Work-related cases from both the Emergency Department (ED) and Hospital Discharge (HD) datasets were pulled that match specific E-codes associated with particular non-fatal injuries. This subset of data was used to calculate non-fatal incidence rates for nine injury categories (**Table 2**). Results indicated that the three leading non-fatal injury rates are among fall-related injuries, motor vehicle injuries and struck-by falling objects. Non-fatal injury rates for all nine categories will be compared to fatal injury rates using the same E-codes. A poster, "Demographic Risk Factors Related to Fatal and Non-Fatal Work-Related Injuries, New Jersey, 2005-2010", based on this data was presented at the 2013 Council of State and Territorial Epidemiologists Annual Conference.

Table 2. Incidence Rate of Occupational Injuries, 2010

Injury Type	E-code	Rate/100,000 Workers; (95% CI; upper, lower)
Struck by Falling Object	E916	34; (32, 35)
Fire/Explosion	E923, E890-E899	5.1; (4.4, 5.8)
Electrocution	E988.4, E994.8, E925.9, E925.8	0; (--, --)
Fall-Related	E880-E888	180; (177, 185)
Machine-Related	E919	24; (23, 26)
Motor vehicle	E810-E825	60; (59, 63)
Submersion [drowning]	E830-832,E910	0.03; (0.01, 0.18)
Confined space (submersion, suffocation)	E913.2, E867-869, E910-E913	3.1; (2.6, 3.7)
Caught by or between/Caught accidentally in or between objects	E918	26; (25, 28)

Source: NJ department of Health, Unified Billing data, 2010

Specific Aim 4:
Conduct outreach and disseminate educational materials generated from our surveillance findings to affected industries, other FACE states, NIOSH, and other appropriate stakeholders.

Crane Spreader Alert: As a result of two similar fatalities involving expandable lifting frames, NJ FACE developed and disseminated a Hazard Alert regarding Crane Spreaders and Lifting Frames. Included in the Alert is the following: two case studies; recommendations on safe use of these types of equipment; a graphic depicting the American Society of Mechanical Engineers standard hand signals for controlling container cranes (B30.24-2008); and a resources list. The Alert was mailed to all companies in NJ identified from the Dun & Bradstreet business database with primary NAICS codes 488320 (Marine Cargo Handling) and 488210 (Support Activities for Rail Transportation).

⊗**Publications**:

- Workers Killed During Maintenance of Cargo-Container Spreader and Expandable Lifting Frame [http://www.nj.gov/health/surv/documents/cargoindustry_njalert.pdf .]

Ladder Safety: According to NJFACE data and information reported by the CFOI, falls from ladders remain a leading cause of work-related fatalities in NJ, especially in the Hispanic worker population. Based on these data, NJFACE published an ad on ladder safety in the Immigration and American Citizenship Organization's magazine, La Guia del Inmigrante, which is dedicated to NJ Spanish–speaking immigrants. The magazine publishes two editions annually and has a circulation of 29,000. The ad is designed to raise awareness on safe ladder use among Spanish-speaking workers, who have a disproportionate number of injuries due to ladder falls.

⊗**Publications**:

- IACO: La Guia del Inmigrante. Volume 10. No. 2. Page 1. 2010. Available at: [http://iacoimmigration.org/documents/laguia/Vol_X/Vol_X_No_2.pdf]

Adult School Crossing Guard Project: Rutgers University, Bloustein School of Planning and Public Policy's Safe Routes to School project invited staff to participate in the project involving focus groups of crossing guards. Staff attended the first focus group where 14 crossing guards were asked specific questions on health, safety, training, etc. as related to their job. Staff was also invited to be members of the Crossing Guard Working Group, in which key stakeholders meet to address the health and safety needs of crossing guards and to develop a standardized, state-wide training program. Staff provided comments on the draft training program. Based on these meeting OHS updated the hazard alert and created a dedicated website [http://nj.gov/health/surv/crossing_guards.shtml]. To determine the impact of the hazard alert, a survey, was mailed to all 534 NJ Police Chiefs, who employ the crossing guards. One year later, a second survey was sent to the same people to determine the impact of the alert (eg. use and distribution of the alert in training, changes in practices based on recommendations). Results of the impact evaluation were published in a NIOSH Impact Sheet: "NIOSH-funded Program Partners with Chiefs of Police to Reduce Traumatic Injuries Among New Jersey School Crossing Guards."

⊗**Publications**:
- Crossing Guard, Be Seen. Be Safe [http://www.nj.gov/health/surv/documents/njcrossing_guards.pdf]
- NJ OHS Crossing Guard webpage [http://nj.gov/health/surv/crossing_guards.shtml].
- "STOP for the Crossing Guards … and the Children" was published on the NJDOH Commissioner's Blog, NJ Health Beat.
- Bergen County Record "Keeping kids safe poses growing risk for crossing guards." [www.northjersey.com/news/education/education_news/Keeping_kids_safe_poses_growing_risk_for_crossing_guards.html?page=all]
- NIOSH-funded Program Partners with Chiefs of Police to Reduce Traumatic Injuries Among New Jersey School Crossing Guards. (NIOSH) Publication No. 2011-193. [http://www.cdc.gov/niosh/docs/2011-193/]

Committee for the Advancement of Arboriculture: Tree workers continue to suffer fatal work-related injuries in the US. Between 1992 and 2012, 1,604 work-related fatal injuries occurred in the US in the tree-care industry, and 70 in NJ. NJFACE developed a collaborative approach aimed at preventing work-related fatalities in the tree-care industry through a partnership with the Committee for the Advancement of Arboriculture (CAA), a non-profit organization of the major tree organizations, whose goal is education and training. NJFACE staff presented an overview of the FACE project at the NJ Certified Arborists', NJ Chapter International Society of Arboriculture's Committee meeting. Three of the victims who died in the aftermath of Hurricane Sandy were working for landscaping and tree care companies. CAA reviewed and endorsed the OHS Unit's updated Tree and Wood Chipper Hazard Alert, which includes hazard awareness and recommendations regarding post-storm cleanup and they agreed to disseminate educational materials and encourage the organizations' over 600 members to participate in an evaluation of the educational material.

⊗**Publications**:
- Hazard Alert - Wood Chippers: English: [http://www.nj.gov/health/surv/documents/woodchip_eng.pdf]Spanish: [http://www.nj.gov/health/surv/documents/woodchip_sp.pdf]
- Hazard Alert - Tree Work is Dangerous -- Don't Get Hurt, Get Trained! English: [http://www.nj.gov/health/surv/documents/tree_alert.pdf]Spanish: [http://www.nj.gov/health/surv/documents/tree_alert_sp.pdf]

Falls: a) NJFACE Report, entitled, "Hispanic Construction Worker Wearing Fall Protection Dies after Falling 40' from Roof" is used as a case study in the Atlantic Occupational Safety and Health Administration (OSHA) Training Center (at Rutgers University) course # OSHA-3115; Fall Protection. The report details an incident in which a worker, who was installing corrugated metal roof decking on a large warehouse, fell. Although the victim was wearing fall protection, the anchor to which he was attached was not properly installed. The weight of his fall pulled the anchor free from the roof and he fell 40' to the

ground below. During the OSHA course, the students are given a copy of the report without the recommendations; they break into groups, read the report and try to develop prevention ideas and formulate recommendations. The NJFACE Report was also used as a case study in the NIOSH document entitled "Workplace design solutions: Preventing Falls from Heights through the Design of Embedded Safety Features."

⊗**Publications**:

- Preventing Falls from Heights through the Design of Embedded Safety Features. Publication Number 2014-124 DHHS (NIOSH). [http://www.cdc.gov/niosh/docs/wp-solutions/2014-124/]

b) National Falls Campaign/Stand-Down: NJFACE developed a hazard alert based on two work-related fatalities that involved falls through temporary wooden platforms on highway bridge deck construction worksites. The alert highlights the two cases, presents data on the number of construction fatalities in NJ, provides detailed recommendations on prevention and summarizes the impact of the alert and resulting outcome where a group of stakeholders worked to change the NJ Turnpike Authority's contract specifications to mandate safer temporary platforms in bridge deck repair jobs. The Alert was reviewed and endorsed by the New Jersey Health and Safety Laborers' Fund, and the Center for Construction Research and Training. In addition, the alert was posted on OSHA's Stand-Down Resources page.

⊗**Publications**:

- NIOSH-Funded Program and Stakeholders Work to Prevent Falls from Temporary Wooden Platforms on Bridge Decks. DHHS (NIOSH) Publication No. 2015-190. [http://www.cdc.gov/niosh/docs/2015-190/default.html]
- Two Construction Workers Fall to Their Death through Temporary Wooden Bridge Platforms. [http://www.nj.gov/health/surv/face/documents/nj_planksfalls.pdf]

c) Barriers to the use of Fall Protection in Residential Construction: Falls were identified as one of the top causes of work-related fatal injuries in NJ. OHS sought to characterize fall protection equipment usage patterns and barriers among residential construction workers in NJ employed by small construction companies (<10 employees). A convenience sample of individuals employed by residential construction companies with fewer than 10 employees in the state of NJ was asked to volunteer to participate in this study, which consisted of three focus groups and a short questionnaire. To enable maximum efficiency and increase numbers of eligible subjects, the focus group sessions were arranged to follow meetings of union or workers' centers. Volunteers attending these group meetings completed a short questionnaire and then participated in a focus group. The questionnaires were used to collect demographic information about them and their companies.

The findings showed that employees (union and non-union) of small, residential construction companies face barriers to the use of fall protection equipment. These barriers included to the use of fall protection equipment included: availability, lack of training, ease of use, cultural differences and lack of employer oversight. Thirty-six residential construction workers volunteered to participate in a focus group. Participants ranged in age from 20-65 years, with an average age of 39 years, and 35 (97%) were male. Twenty-eight (78%) of the participants reported that retractable/shock absorbing/tie-off lanyards were never provided, and 14 (39%) were never provided guardrails by their current residential construction company. Sixteen (44%) indicated that their employer did not provide training on fall protection equipment and 18 (50%) indicated that their employer did not provide training on work safety. Seven (19%) did report that their employer provided job safety training more than once per month.

⊗**Publications**:

- A manuscript "Assessing Barriers to the Use of Fall Protection in small Residential Construction Companies in New Jersey" has been accepted for publication *New Solutions: A Journal of Environmental and Occupational Health Policy* (in Press).
- Borjan B, Patel T, Lefkowitz D, Lumia M, and Campbell C. [2014]. Assessing Barriers to the Use of Fall Protection in Small Residential Construction Companies Poster presentation at the 2014 CSTE Annual Conference in Nashville, TN. Abstract# 3198.

New Educational Resources to Target New Jersey Solid Waste Industry: An updated "Solid Waste Haulers" hazard alert with detailed recommendations for both drivers and collectors was created. The alert was reviewed and endorsed by the National Solid Wastes Management Association, the Solid Waste Association of North America, the NJ Department of Labor and Workforce Development and NIOSH. The alert was sent to all NJ licensed solid waste haulers (n=1,362). An additional 1,021 copies were requested by 117 employers and it has been viewed on the OHS website 4,797 times in the last year. To ensure that this information reached as much of the target population as possible, staff presented an overview of the FACE project and industry-specific data to the NJ Chapter of the National Solid Wastes Management Association meeting; published a NIOSH eNews entitled, "New Alert for Worker's in New Jersey Solid Waste Industry;" and developed a webpage [http://nj.gov/health/surv/solidwaste_recycle.shtml] with links to relevant FACE reports, the hazard alert and NIOSH's Solid Waste Industry Fact Sheet. The research team is currently in the process of evaluating the impact of the hazard alert via an impact survey that was mailed with the Solid Waste hazard alert.

⊗**Publications**:

- Solid Waste and Recycling Workers topic page [http://www.nj.gov/health/surv/solidwaste_recycle.shtml]
- Solid Waste Haulers Hazard Alert English: [http://www.nj.gov/health/surv/documents/njsolidwaste.pdf] Spanish: [http://www.nj.gov/health/surv/documents/njsolidwaste_sp.pdf]
- New Alert for Worker's in New Jersey Solid Waste Industry. NIOSH eNews. Volume 11 Number 9 January 2014. [http://www.cdc.gov/niosh/enews/enewsV11N9.html#news]

NJFACE Reports Highlighted: The Safety and Health Magazine, National Safety Council, March 2015 edition highlighted a NJ FACE report, FACE Value, Worker Killed by Falling Tree Branch. This investigation report described an incident in which a worker was struck by a tree branch that had been cut. The worker walked into the exclusion zone (drop zone) while a worker in the tree was trimming a large branch. The Magazine also highlighted an NJ FACE report in the August 2011 edition. The Report was NJFACE # 07-NJ-044 FACE, "Road Maintenance Worker Killed By Wheel That Separated From Truck." This report details the death of a road worker who was killed when he was struck by a wheel that come loose from a passing truck.

⊗**Publications**:

- National Safety Council, Safety and Health Magazine. March 2015 Volume 191: Edition 3. [http://viewer.zmags.com/publication/b18b9cae#/b18b9cae/54]
- National Safety Council - Safety and Health Magazine , National Safety Council, August 2011, FACE Value, "Road Maintenance Worker Killed By Wheel That Separated From Truck." [http://www.safetyandhealthmagazine.com/contact]

NJ DOH State Health Assessment Data (NJSHAD) System*:* The NJSHAD System is a website which provides access to public health datasets and information on the health status of NJ residents. NJSHAD is maintained by the NJDOH Environmental Public Health Tracking (EPHT) Project, which is funded by CDC. The NJFACE Project collaborated with EPHT, added "Fatal Occupational Injuries" as an indicator on the SHAD site. The indicator page includes a figure that displays the incidence rate of fatal occupational injuries (US versus NJ, 2001-2005), and a chart of the percent of NJ fatal work-related injuries by type (1990–2007).

Specific Aim 5:
Utilize the FACE Consortium and Coordinating Committee, the New Jersey Occupational Fatalities Prevention Advisory Group, and other stakeholder groups in obtaining guidance and support for achieving the goals of the NJFACE Project.

FACE Consortium: NJFACE staff attended the FACE Consortium Coordinating Committee meetings, which took place as part of the annual FACE Conferences. Representatives of all the FACE states discussed the targeting of fatalities as in-scope. NJFACE staff member served as FACE Consortium Chair for two years. Discussions centered on updating and planning FACE business, including organizing and planning the future conferences.

New Jersey Occupational Fatalities Prevention Advisory Group (NJ OFPAG): The advisory group is made up of representatives from trade associations, occupational health professional associations, safety professionals, occupational physicians and nurses, labor unions, universities, and other state and federal agencies. The purpose of the OFPAG meetings is to: 1) identify the special safety needs and problems of small businesses (e.g., economic, social, and technological); 2) identify severe injury trends in industries not identified by NJFACE; 3) obtain input on new initiatives; 4) solicit feedback on educational materials including evaluations tools. The process of working with the OFPAG involves a two-way sharing of information between project staff and stakeholders to guide discussion of the anticipated effectiveness of intervention activities.

School Crossing Guards Outreach Project: NJFACE collaborated with the NJ Department of Transportation (NJDOT) and the NJ Safe Routes to School (SRTS) Coalition at Rutgers University's Bloustein School of Planning and Public Policy. SRTS is a federal, state and local effort to enable and encourage children, including those with disabilities, to walk and bicycle to school. NJFACE staff attended the coalition meetings and are assisting in drafting a guidance document on crossing guard safety to disseminate to their constituents.

NJ Safety at Rail Crossings: NJFACE staff were invited to participate in the NJ Safety at Rail Crossings Subcommittee at NJDOT. Pedestrian and worker safety along NJ Transit rail lines has been a significant issue and came to the forefront as a result of the recent deaths of three teenagers in Garfield and Wayne, NJ. Three breakout groups in the areas of enforcement, engineering and education were formed to develop strategies to improve safety near and along rail lines. These strategies became part of an implementation plan given to the NJDOT Commissioner.

Alaska NIOSH Field Office*:* In an effort to reduce occupational fatalities in the NJ fishing industry, NJFACE collaborated with NIOSH researchers stationed at the Alaska field office, who are national experts on the causes and mitigation of fatal injuries in the commercial fishing industry. The collaboration included culling the NJFACE database for fishing-related fatalities and analyzing each case. These data will be a part of a larger study investigating fishing fatalities along the East coast of the United States.

⊗**Publications**:

- Day ER, Lefkowitz DK, Marshall EG, Hovinga M. Utilizing United States Coast Guard Data to Calculate Incidence Rates and Identify Risk Factors for Occupational Fishing Injuries in New Jersey. J Agromedicine, 2010 Oct;15(4):357-62.

National Conferences: NJFACE has provided funding and support to send staff to professional conferences and meetings:

- Annual FACE Conferences: NJFACE staff gave presentations on current projects and shared information on findings from outreach and education activities with other FACE states and NIOSH FACE staff;
- Northeast Regional Occupational Disease and Injury Surveillance Annual Conferences; and
- CSTE Annual Meetings

Specific Aim 6:
Conduct Programmatic Evaluation of the NJ Fatal Occupational Injuries Surveillance Program on an ongoing basis.

- **Evaluation of Educational Outreach Materials**

Solid Waste Alert: The "Solid Waste Workers Killed on the Job" alert was sent to 1,138 licensed solid waste haulers in NJ. The mailings also included a survey to collect information on the hauler's practices and the usefulness of the alert. Three hundred and thirty-three (30%) of the surveys were completed and returned (**Table 3**). Of these 269 (80%) were haulers, 99 (40%) of these were private haulers. Employers indicated that workers experienced injuries on the job such as falls, slips, and sideswipes while riding the step (n=27, 10%). Twelve (5%) of the employers indicated that they did not provide safety and operations training to their workers while 173 (64%) provided new hire training. Employers were also asked if workers routinely wore personal protective equipment (PPE), 237 (88%) wore gloves and 216

(80%) wore reflective vests. There was a request for 2,324 additional copies of the hazard alerts (1950 English and 374 Spanish) by 144 hauling companies.

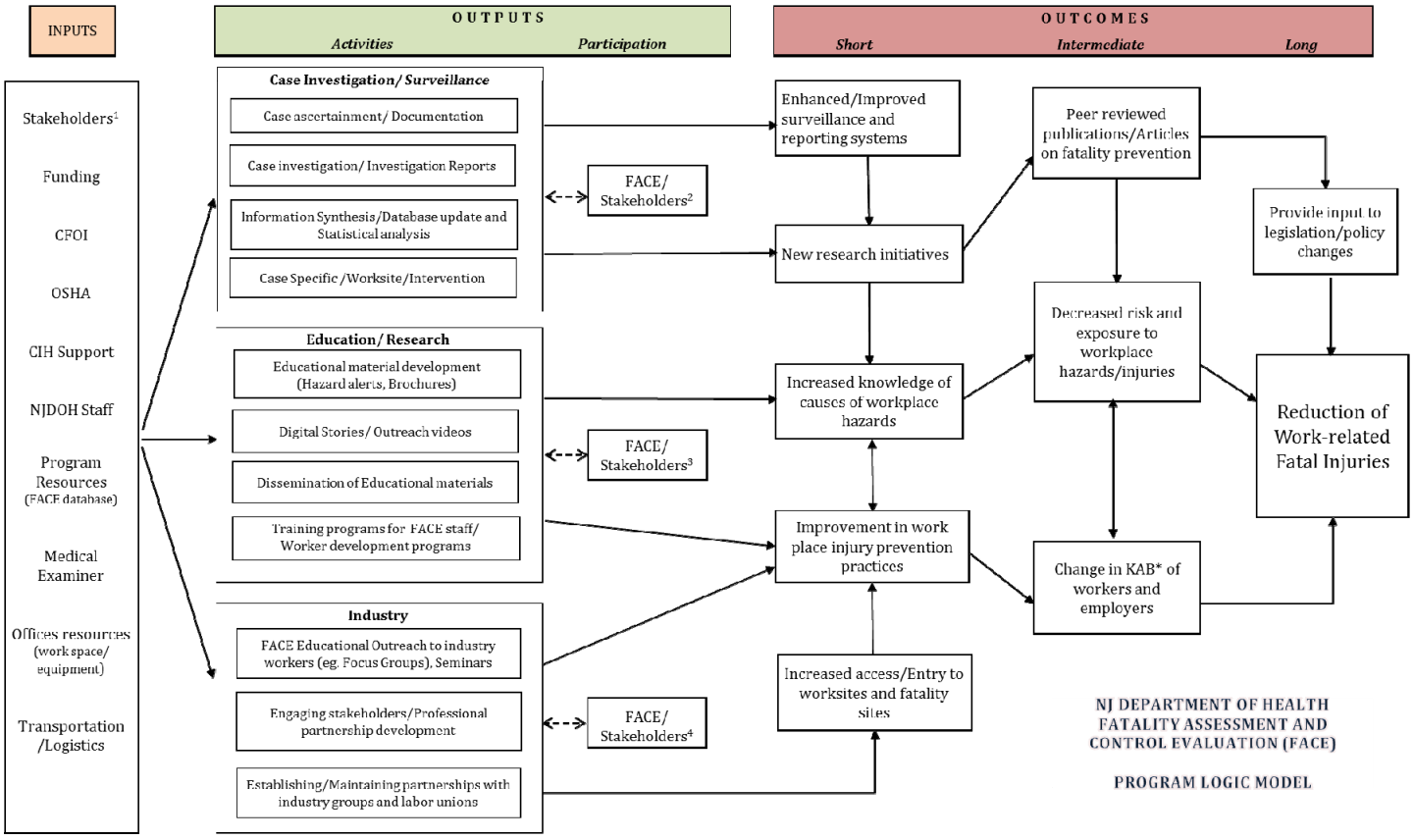
Table 3. Solid waste truck haulers survey responses, N=269

Type of injuries experienced	No.	%
Struck by refuse truck or another vehicle	9	3.3
Struck by , struck against, or caught in objects/equipment	13	4.8
Injured while on the riding step (falls, slips, sideswiped)	27	10.0
Overexertion (back injury, lifting, pushing)	26	9.7
Injured when truck collided with another vehicle	3	1.1
Heat/cold-related injuries (heat stroke/exhaustion, frostbite)	8	3.0
Other	22	8.2
Safety and operations training provided to workers		
New hire training	173	64.3
Classroom training	114	42.4
Tailgate training	84	31.2
Refresher training	137	50.9
No training	12	4.5
Other	34	12.6
Routinely worn PPE		
Reflective safety vest	216	80.3
Eye protection	153	56.9
Safety boots	214	79.6
Gloves	237	88.1
Hearing protection	76	28.3
Other	34	12.6

- **Logic Model**

The NJFACE logic model (**Figure 3**) contains several elements that describe overall program and includes the basic assets of the project.

Figure 3. NJ FACE Logic Model



Stakeholders[1]
- Federal OSHA, NJ State OSHA
- NIOSH
- Other FACE States (FACE Consortium Members)
- NJ OFPAG

Stakeholders[2]
- NJ State OSHA
- US Department of Labor / Bureau of Labor Statistics
- NJ Department of Law and Public Safety / Office of the Medical Examiner
- NJ Department of Labor and Workforce Development / Division of Workers Comp.

Stakeholders[3]
- Rutgers University, Department of Environmental and Occupational Health and Safety Services
- Rutgers School of Environmental and Biological Sciences
- NJ Department of Transportation
- NJDOH Office of Minority and Multicultural Health
- NJ Laborers Union, Public Employees Union
- NJ State Safety Council

Stakeholders[4]
- Federal OSHA, NJ State OSHA, NJ OFPAG
- Industrial Union Council
- New Labor, PR Association for Human Development (PHARD)

C. Conclusions

Work-related fatal and non-fatal injuries are serious public health concerns which can be prevented through education, engineering, regulation training and improved work practices. However, despite improvements in workplace safety, occupational fatalities still occur. The percentage of workers employed in industries and occupations at high risk for occupational mortality from 2000-2012 has increased in NJ. In 2012, there were over 300,000 workers employed in occupations at high risk for fatal injury in NJ, which is 9% of the employed population, and over 400,000 employed in industries at high risk for fatal injury, which is 11% of the employed population.[1] Over 4,000 workers have been fatally injured at work each year in the US since 2000.[1] In NJ, there have been 2,373 fatal occupational injuries from 1990-2012. The NJ average annual rate of fatal work-related injuries is 2.7 deaths per 100,000 workers with no consistent increase or decrease in work-related fatalities since 1990. During the previous project period, NJFACE identified 392 NJ work-related fatalities. The most frequent types of fatalities were: 1) MVA or Transportation Related (n=115, 29.3%); 2) Violence Related (Homicide and Suicide) (n=92, 23.4%); 3) Fall Related (n=60, 15.3%); 4) Struck by Object (n=28, 7.1%); 5) Caught by or between (n=19, 4.8%); 6) Machine Related (n=16, 4.1%); 7) Electrocution (n=15, 3.8%); and 8) Drowning (n=14, 3.6%).[2]

To help better understand why these fatalities continue to occur and to be able to develop strategies to overcome them, the research team took a multipronged approach. First, the research team conducted on-site investigation to determine the primary and contributing causes of the fatality. Using a prioritized scheme, cases were chosen based on the magnitude of the problem, if it is part of a trend or if a new cause of the fatality was identified. The research team interviewed co-workers and managers to learn about the victim, production process, machinery, training and safety policies, and inspected the incident site. During the last grant cycle, 18 fatal injury investigations were initiated and 12 investigation reports were published. These reports include the following types of fatalities: falls n=7, machine n=5, struck-by n=2 and one each of the following areas: chemical exposure, crushing, electrocution and drowning. Since 1990, 229 field investigations have been conducted. Published reports are available on the NJ OHS and NIOSH websites. The NJ FACE webpage has been visited 3,630 over the last year.

Work-related fatal and non-fatal injuries are still a serious public health concern even though they are preventable through occupational health surveillance efforts. Therefore, state-based occupational health surveillance is vital to the prevention of fatal and non-fatal occupational injuries since there is currently no comprehensive, nationwide system of surveillance for occupational injuries and hazards. Ongoing systemic data collection and analysis, identification of occupational hazards, interventions through on-site inspections, educational outreach, and evaluation of the effectiveness of these actions are an important part of New Jersey's multifaceted occupational health surveillance system.

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Other Publications

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Silicosis

A. Background

Silicosis has been identified for surveillance by National Institute for Occupational Safety and Health (NIOSH) as a priority area of concern and has been a priority for NJDOH for over 25 years. Silicosis is a significant public health concern in NJ due to the many silica-using industries in the state including foundries, potteries, glass manufacturers and sand mines. In response to this public health concern, NJDOH developed an active silicosis surveillance system in 1979 by identifying cases coded with the diagnosis of silicosis in hospital uniform billing (UB) data. In 1984, support for this effort became available in the form of a capacity-building grant from NIOSH. In 1987, NIOSH expanded the grant to a Sentinel Event Notification System for Occupational Risks (SENSOR) Program including surveillance of other occupational health conditions. The NJDOH had been awarded continued funding for silicosis surveillance since that time. The purpose of this tracking system is to describe the magnitude of silicosis in the state, the characteristics of cases, and to implement and evaluate strategies for reducing silica exposure in NJ workplaces. Aims of the project are the following: collecting surveillance data from a number of different sources, analyzing data, and interpreting the results to enable the planning, implementation, and evaluation of specific intervention activities. Findings and outcomes of surveillance projects are prepared for timely dissemination to appropriate individuals and stakeholders.

B. Progress Achieved Under Specific Aims

The overall goals of the Silicosis Surveillance Project are to:

a) Identify potential cases of silicosis;
b) Classify cases in accordance with established case confirmation criteria; evaluate exposures associated with the cases;
c) Identify new industries, occupations, and causes associated with this condition; and
d) Implement interventions to prevent silicosis in New Jersey.

These objectives were achieved through the following Specific Aims:

Specific Aim 1
Utilize New Jersey's hospital discharge electronic reporting system, death certificate registry, workers' compensation electronic data system, emergency department electronic data system, and the physician/advanced practice nurse/physician assistant reporting system to identify potential cases of silicosis

Hospital Discharge (HD) and Emergency Department (ED) Data: HD and ED data are gathered from the Universal Billing Patient Discharge Data (UB). The UB file collects information on dates of admission and discharge/visit, date of birth, address, coded diagnoses, race/ethnicity, socio-demographics, and payer. A Statistical Software (SAS) macro is used to search the HD and ED datasets by ICD-9 codes 502 (silicosis) and 505 (pneumoconiosis unspecified).

Death Data: Death certificate data is obtained from the NJ Electronic Death Registry System (EDRS) which contains ICD-10 medical code fields, the overall cause of death and Entity Axis 1-20 fields for multiple underlying causes of death. Silicosis death data is pulled from EDRS using ICD-10 codes J64 (silicosis) and J62.8 (pneumoconiosis unspecified). The data is provided quarterly to OHS in a text file. Number of deaths from or with pneumoconiosis with ICD-10 codes J60-66.8 as the underlying or contributing cause of death, age 15 years and older, is also requested yearly from the NJ Center for Health Statistics.

Health Care Provider Reports: In NJ, physicians, advanced practice nurses and physician assistants are required by law to report to NJDOH occupational diseases, including cases of work-related asthma and pneumoconiosis (other and unspecified). Patient identifiers and other information, including diagnosis from these reports can then be matched to UB data.

The largest source of confirmed cases has been the state-required reporting of persons with silicosis by hospitals. A total of 487 (87%) cases were identified the UB data. The diagnosis of silicosis was rarely the primary diagnosis; rather it was concurrent with other health conditions that prompted admission. Of the 74 remaining cases, 27 (5%) were identified through medical surveillance programs at companies, 22 (4%) were reported by health care providers, and 20 (3%) via death certificate data.

One effort undertaken to increase case identification was to communicate with the 42 primary care practitioners whose patients with silicosis were recently identified through other-than- physician reporting sources. Practitioners received a letter describing the NJ law requiring healthcare practitioners to report cases of silicosis; report forms and pre-paid envelopes; and a magnetic wall poster listing all of the reportable work-related and communicable diseases. Eight practitioners called back to obtain further information on the reporting requirements.

Specific Aim 2
Process potential cases of silicosis by means of patient and health care provider interviews, medical records review, chest radiograph interpretation, and work environment evaluation

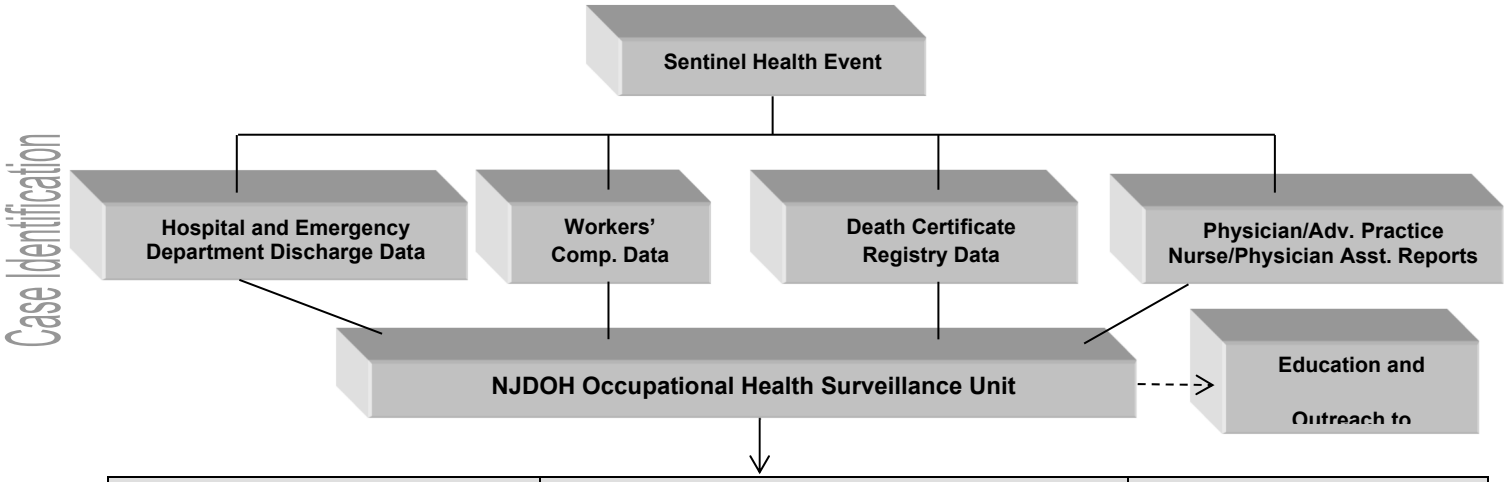
Identification of New Cases: Names of potential cases of silicosis are identified using source data as described under Specific Aim 1. In order to collect the data necessary to accomplish the goals of the project, the following steps were followed for cases that were identified from source data:

- *Preparation of New Cases*: The standard operating procedures for processing potential silicosis cases are outlined in the NJDOH manual, *Procedures for Identifying and Processing Cases – Silicosis Registry*. Medical records (including radiology and other imaging reports, etc) are requested from the treating physician or hospital. Consultations with treating physicians are conducted when appropriate. The NJDOH is not required to receive consent from the patient in order to obtain medical records and other information needed to process the case, as interpreted in N.J.A.C. 8:58. However, if an individual specifically denies access to their medical records, no attempt is made to obtain the records. If it is determined from the medical record that the patient has died, then the death certificate is obtained from the NJDOH Vital Records Unit. Project staff review and discuss records and those cases appropriate for follow-up are identified.

- *Patient Follow-up*: Attempts are made to contact the identified patient to conduct a telephone interview. If the patient is known to be deceased, the next-of-kin is contacted for a telephone interview. A minimum of six attempts are made to contact the individual or next-of-kin. Following the successful completion of an interview, a thank-you letter with educational materials, as appropriate, is sent to the patient or next-of-kin.

The following (**Figure 1**) is a schematic of New Jersey's surveillance system model for silicosis:

Figure 1. Silicosis surveillance system



Case Confirmation

Reported Individuals	Hospitals, Emergency Departments (ED), NJDOH Vital Records Unit, NJDOLWD-Division of Workers' Compensation (WC)	Reporting Physicians, Advanced Practice Nurses, and Physician Assistants
• Interview to: ➢ obtain occupation, employer, other core variables ➢ determine work-relatedness of data or report ➢ identify exposure source(s)	• Obtain medical and radiology records and WC data to: ➢ collect occupation, employer, other core variables ➢ determine work-relatedness of data or report Obtain X-rays for review by B-reader for confirmation of diagnosis	• Provide: ➢ educational materials ➢ thank you letter ➢ reporting forms ➢ outcome of reported workplace

Interventions

Individuals	Employers	Health Care Providers
REPORTED INDIVIDUALS • Provide educational materials on: ➢ health effects ➢ medical care ➢ workplace controls ➢ legal rights and remedies ***OTHER INDIVIDUALS AT RISK*** • Provide educational materials on: ➢ health effects ➢ medical care ➢ workplace controls ➢ legal rights and remedies Encourage medical screening with their own physician	***REPORTED WORKPLACES*** • Provide educational materials on: ➢ health effects ➢ workplace controls • Conduct telephone interview to: ➢ determine exposures and control measures ➢ determine other workers at risk • Conduct on-site evaluation to: ➢ gather information on exposures and control measures ➢ make recommendations for controls • Conduct follow-up to on-site evaluation: ➢ check compliance with recommendations ➢ make referrals to OSHA ***OTHER WORKPLACES AT RISK*** • Provide educational materials on: ➢ health effects ➢ workplace controls • Conduct mailed survey to: ➢ determine exposures and control measures ➢ determine other workers at risk Encourage medical screening of high-risk employees	• Implement education on: ➢ recognition of silicosis ➢ reporting requirements ➢ medical surveillance recommendations

Specific Aim 3
Analyze and interpret data to confirm cases of silicosis.

A critical component of the surveillance system is the review of the medical, demographic, and employment information collected for each case to determine if it meets the respective NIOSH/SENSOR Case Confirmation Criteria for silicosis. Under the NIOSH/SENSOR Silicosis Surveillance grant protocol, confirmation of a case of silicosis is based upon the following criteria: 1) history of occupational exposure to airborne silica dust; and either one or both of the following: 2a) a chest radiograph or other imaging technique interpreted as consistent with silicosis; 2b) pathologic findings characteristic of silicosis.

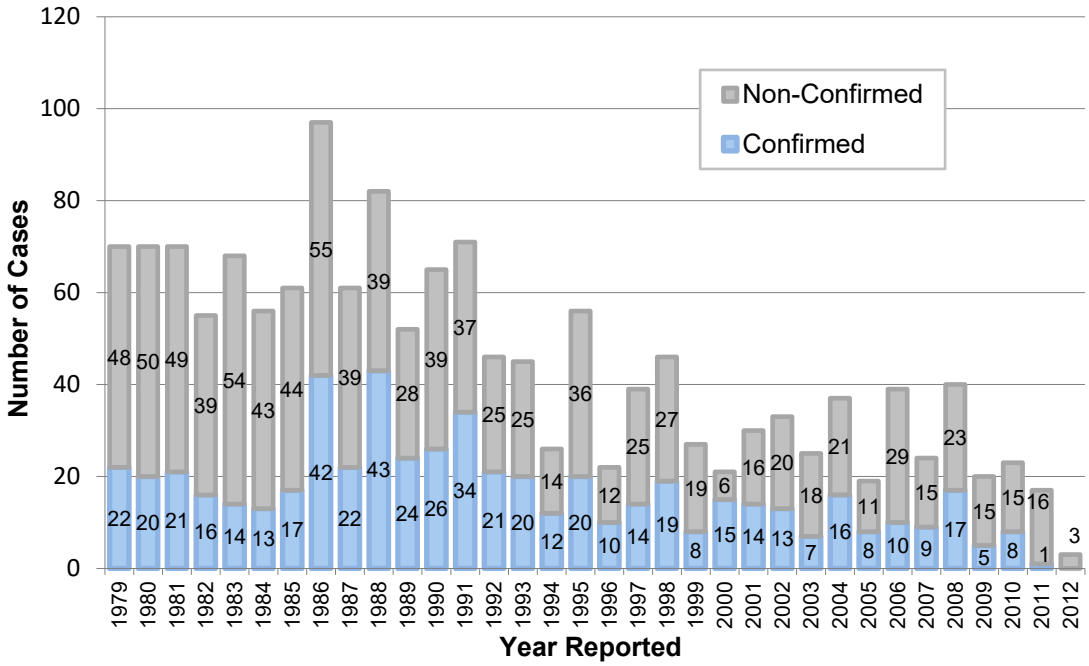
Review of Work Histories: After the patient follow-up process is completed, the Silicosis Coordinator reviews the case file. If the patient's work history is missing from the questionnaire, medical records and any other available information are reviewed to identify the patient's occupation, place of work, employer name, and specific exposure information. If still unavailable, the patient is interviewed to obtain a work history. Finally, an attempt to obtain the work history is made by mailing a Work History Survey. If confirmation of a suspect workplace or exposure to a specific causal agent cannot be obtained, the case is closed with no further follow-up.

Silicosis Case Confirmation: Reported cases of suspected silicosis are classified according to the *NIOSH/SENSOR Case Confirmation Criteria*. Reporting physicians are sometimes requested to participate in the confirmation/classification of silicosis cases.

1. The patient tracking/core variables form is updated with information from the interview and coded using the Association of Occupational and Environmental Clinics (AOEC) system. OHS staff reviews the work history to determine if there existed a potential for exposure to silicosis and also codes occupation and industry and determines type of employer follow-up.
2. OHS staff reviews the case file to determine if sufficient information is available to apply the Surveillance Case Definition Decision Logic. The three items to be considered are the following: a) is there a physician diagnosis of silicosis, b) is there evidence of a workplace exposure to silica, and c) is there pathology, radiology, or other medical imaging technique that is consistent with a diagnosis of silicosis. Evidence for these items is found in various parts of the interview questionnaire, reporting form, and/or medical record.
3. A chest radiograph is obtained, if possible, and classified by a NIOSH-certified B reader for the presence of pneumoconiosis, specifically silicosis.

After medical record review and patient interviews are conducted to obtain exposure information, OHS was able to confirm if cases met the NIOSH/SENSOR Case Confirmation Criteria for silicosis. Of 1,518 potential silicosis cases, a total of 561 cases were confirmed by the NJDOH between 1979 and 2012. Excluding 2012, with cases still being reported and processed, the total number of cases reported per year ranged from a low of 17 to a high of 97 cases whereas confirmed cases ranged from one to 43 cases (**Figure 2**).

Figure 2. Number of non-confirmed versus confirmed silicosis cases by year reported, 1997-2012 (N=1,518)



The majority of confirmed cases (n=503, 84%) were men. Of the 58 female cases, 43 worked in the manufacturing of pottery and tile from the 1960s to 1990s. Twenty-eight cases were clustered in a single county (Mercer), the hub of NJ's pottery and tile industry. Based on multiple cause-of-death data from the 2007 NIOSH Work-Related Lung Disease Surveillance Report, Mercer County also had the highest proportion (50%) of female vs. male deaths in a single U.S. county due to silicosis between 1995 and 2004 (**Table 1**).[1] Another industry employing multiple female silicosis cases was glass manufacturing.

Table 1. U.S. counties with highest percentage of female deaths from silicosis

County	State	% Female	Number of Deaths	Age-Adjusted Rate	Crude Rate
Mercer	New Jersey	50.0	8	2.9	2.9
Adams	Colorado	20.0	5	2.5	1.8
Franklin	Ohio	18.2	11	1.6	1.3
Stark	Ohio	16.7	6	1.6	2.0
Morgan	West Virginia	16.7	6	35.8	49.0
Stearns	Minnesota	9.1	11	12.3	10.3
U.S.	**-------**	**4.1**	**1,827**	**0.8**	**0.8**

The ages of confirmed cases ranged from 19 to 101 at the time they were identified by the NJDOH. Ninety-five percent (n=520) of the cases were age 50 or over with the greatest number of cases ranging in age from 70-79. Four-hundred-forty-eight (80%) of the cases were White, 64 (11%) were Black, two were Asian, one was American Indian, and ten (2%) were listed as "Mixed Race." Race was unknown for 36 (6%) of the cases. Hispanic ethnicity was not consistently tracked until 1993. Between 1993-2012, there were 14 (6.5%) confirmed Hispanic cases.

Confirmed NJ silicosis cases were occupationally exposed as early as 1908 and as late as 2002. Of the 424 cases for which dates of exposure are known, the greatest number of cases was first occupationally

exposed during the 1930s, 1940s, and 1950s. Cases whose exposure ended by 1992 were compared to those exposed in subsequent years. There was a lower proportion of female cases and a higher proportion of Black cases in the latter group. More of the cases exposed since 1992 (30.8%) were in construction than those exposed earlier (8.3%). Hispanic ethnicity data were not collected for the cases exposed prior to 1993 so could not be evaluated. The major occupational groupings of cases were stable across time.

Specific Aim 4
Conduct on-site industrial hygiene evaluations of workplaces where cases of silicosis have been identified

A review was done of all the confirmed cases of silicosis to identify places for site visits. Many workplaces have closed or are located outside of NJ. For the companies that were still in operation and located in-state, an Employer Silica Questionnaire was sent to determine whether exposure to silica dust persists. One of the companies (metal powder production), was no longer a production facility, another (underground utility construction) refused a visit although employees continue to be exposed when cutting through cement pipe.

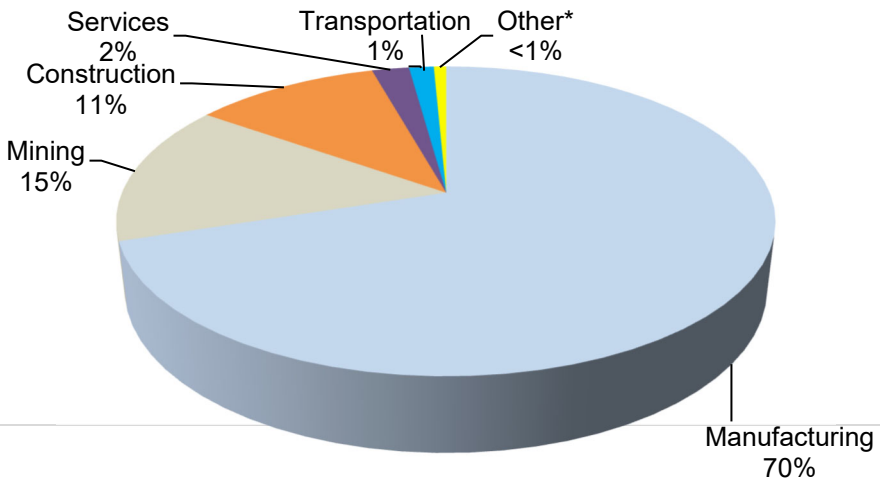
Specific Aim 5
Collaborate with partners and stakeholders to conduct industry-wide interventions for silicosis in the construction industry and other industries that are identified through surveillance data, and are widespread and growing in New Jersey

The decrease in the number of NJ business establishments historically associated with exposure to silica dust means that the landscape of ongoing silica hazards in NJ is changing. But the lessons learned about silica exposure and disease in NJ during the peak times of industrialization are important to catalogue and share. As industrialization expands around the globe, workers in developing countries are experiencing conditions and exposures similar to those of NJ's early silicosis cases – large, open, dusty workplaces, primitive dust controls, increasing mechanization and few if any protective regulations.

The NIOSH grant protocol defines "industry" as the industry at the time of the most causally-related exposure to silica dust. The type of industry recorded on patient interviews was coded by OHS staff using the U.S. Bureau of Labor Statistics' 1987 Standard Industrial Classification (SIC) System.[2] However, in each industry section, efforts were made to note the corresponding 2012 North American Industry Classification System (NAICS) codes.

The 551 cases, for which industry was known, were exposed while employed in the following sectors: Manufacturing (n=386, 70%), Mining (n=81, 15%), Construction (n=60, 11%), Services (n=12, 2%) and Transportation (n=8, 1%) sectors (**Figure 3**). Three sectors, namely, Agriculture, Retail Trade and Public Administration had two or fewer cases each.

Figure 3. Distribution of silicosis cases by major industrial sector, 1979-2012 (N=551)



Over the past three decades, the number of cases identified in Manufacturing and Mining declined, while those in Construction and the Services sectors increased (**Table 2**).

Table 2. Number of silicosis cases by major industry sector over three decades, 1980-2009

Major Industry Sector	1980-1989 (N=218)	1990-1999 (N=181)	2000-2009 (N=109)
Manufacturing	166 (76%)	136 (75%)	59 (54%)
Mining	33 (15%)	25 (14%)	19 (17%)
Construction	18 (8%)	18 (10%)	25 (21%)
Services	1 (<1%)	2 (1%)	6 (5%)

Note: percentages may not add to 100 due to rounding

Mining Industry Outreach: Mining of non-metallic minerals continues to be an active industry sector in NJ. Sand mines predominate in the southern counties and sand and gravel mines in the northern counties. Twenty-five silicosis cases worked in sand and gravel mines. OHS collaborated with the following organizations:

- NJ Department of Labor and Workforce Development, Office of Mining Enforcement and Office of Occupational Safety & Training (DOLWD)
- Mine Safety and Health Administration's (MSHA) Northeastern District, Wyomissing Field Office
- OSHA Region II, Parsippany Office
- NJ Concrete and Aggregate Association's Health & Safety Committee
- NIOSH Office of Mine Safety and Health Research
- Rutgers University, School Public Health

Educational materials, including a the fact sheet "Tracking Silicosis in the NJ Mining Industry – What Have We Learned," and an OHS webpage listing control measures and resources was developed and disseminated along with the latest dust control publications from NIOSH. This information was presented at the MSHA funded NJ New Miner Training class. At the trainer's request, the research team developed silicosis materials for the mandated NJ New Miner Training and Annual Refresher training.

NJ OHS staff continues to gain a better understanding of dust hazards in NJ mines and miners' health in general. In 2014, NJ OHS staff brought together DOLWD and faculty from the Rutgers University, School Public Health, which is working on a grant funded by the Alpha Foundation for the Improvement of Mine Safety and Health. De-identified data from the New Jersey Occupational Silicosis Registry from 1992 to 2011 was linked to data from MSHA publically available datasets to characterize: mine characteristics (e.g. commodity, number of employees, production, year so operation); history of citations (type, frequency, severity); and, injury/illness reports (rates, type, severity). Multivariate regression was used to assess the contribution of silicosis in identifying mines with high rates of accidents and injuries. Forty-two miners were reported and confirmed to have silicosis. The average age was 69 years old when their silicosis diagnosis was reported with, on average, 26 years of relevant occupational exposure. All of the miners were male and non-Hispanic White. While mines are distributed fairly evenly across NJ counties, over 50% of cases had been exposed in mines from one county. Cases were more likely to be reported from sand and gravel mines compared with stone mines. A small percent of mines appear to account for a majority of cases.

⊗ **Publication**:

- NJ Mining statistics are available on the "Silicosis in Mining" webpage [http://www.nj.gov/health/silicosis/mining/index.shtml].
- Tracking Silicosis in the NJ Mining Industry – What Have We Learned [http://www.nj.gov/health/silicosis/mining/documents/njmining_silicosis.pdf]

NJ Silica Outreach and Research (SOAR) Alliance: OHS is a member of the SOAR Alliance consisting of employers, government agencies and industry and labor organizations working together to prevent silicosis. Staff organized and hosted two teleconferences, presented NJ silicosis surveillance findings and

developed and disseminated slides describing the occupations of NJ silicosis cases in construction for use in worker training.

- "Occupations of NJ Silicosis Cases in the Construction Industry, 1979-2011." Presented at: NJ Silicosis Outreach and Research Alliance Teleconference, October 2012.
- "Tracking Silicosis in the NJ Mining Industry, 1979-2011." Presented at: NJ Silicosis Outreach and Research Alliance Teleconference, April 2013.

Staff participated on an SOAR subcommittee to develop a webinar that will illustrate construction tasks and tools most in need of dust controls as published in OSHA's 2013 Proposed Silica Rule. OHS facilitated the sharing of large video and graphics files among the subcommittee so that the most appropriate visuals could be chosen from the collections of unions, industry trade groups, NIOSH and OSHA.

The OHS Unit along with SOAR Alliance members assisted the Center for Construction Research and Training (CPWR) during the development and pilot-testing of their new "Work Safely with Silica" website [http://www.silica-safe.org/]. The OHS Unit also provided resources to CPWR for their testimony and post-hearing comments on OSHA's Proposed Silica rule.

Specific Aim 6
Contribute to statewide and national prevention efforts to control occupational exposure to silica

An industry on the rise in NJ is cut stone and stone products manufacturing for home and commercial building products, such as hardscaping materials and countertops. The number of employees and establishments has nearly doubled in the past decade.[3] To accommodate the demand for stone products, more fabrication shops, many of which are small employers without substantial experience, have opened. A recent OSHA inspection at a small employer revealed a lack of hazard training, inadequate dust controls, and language barriers between owners and workers.[4] At the April 2013 NIOSH/State Occupational Lung Disease Surveillance Meeting, OHS staff initiated discussions about new silicosis cases reported in the literature among engineered stone countertop fabricators in Israel and Spain. Production and use of these artificial stone materials is rapidly expanding worldwide, and products are now manufactured, fabricated and installed in the U.S. The need to investigate this hazard was recognized by NIOSH, OSHA and the other surveillance states. As a result, NIOSH and OSHA partnered to develop a joint Hazard Alert on this topic and on February 18, 2015, released the publication entitled: "OSHA/NIOSH Hazard Alert: Worker Exposure to Silica during Countertop Manufacturing, Finishing and Installation."

In advance of the joint Alert, OHS staff, along with the NIOSH Division of Respiratory Disease Studies staff and surveillance state partners, posted in March 2014 an entry on the NIOSH Science Blog entitled "Silica Hazards from Engineered Stone Countertops." An outcome of the blog posting was the report of the first U.S. silicosis case of this type by an occupational medicine physician to the Texas Department of Health. OHS, the reporting physician, NIOSH and state partners published a case report entitled: Notes from the Field: Silicosis in a Countertop Fabricator – Texas, 2014, in the February 13, 2015 issue of the Center for Disease Control's Morbidity and Mortality Weekly Report.

OHS staff collaborated with engineers from the NIOSH Division of Applied Research and Technology on a NIOSH intramural project entitled: Engineering Control of Silica Dust from Stone Countertop Fabrication and Installation. The project was funded in January 2015 and OHS staff brought together industry partners and NIOSH engineers to design and evaluate portable, affordable dust controls to prevent exposure.

⊗ **Publication**:

- NIOSH Science Blog "Silica Hazards from Engineered Stone Countertops" [http://blogs.cdc.gov/niosh-science-blog/2014/03/11/countertops/]
- Notes from the Field: Silicosis in a Countertop Fabricator – Texas, 2014 [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6405a5.htm]

Specific Aim 7
Generate and disseminate reports of silicosis surveillance findings and intervention outcomes

NJ is one of the few states in the U.S. with a long-term disease surveillance system for silicosis, NJ offers a rich source of information about the people and industries affected by this serious occupational lung disease. OHS submitted aggregate data (1993-2009) on Silicosis to the Data Coordination Center of the Consortium of State-based Surveillance using the core variables that have been established under the Silicosis surveillance project.

Specific Aim 8
Evaluate the silicosis surveillance systems and intervention projects

An evaluation of the NJDOH silicosis surveillance system was completed, utilizing the CDC's 2001 Guidelines for Evaluating Public Health Surveillance Systems.[5,6] The goal was to identify actions to increase surveillance system efficiency, with a particular focus on streamlining data management, improving data quality and enhancing information to better target interventions.

One critique of the system was that case detection relies on reporting sources which are likely to under-recognize and under-report cases. These sources include hospital and emergency department discharge data and death certificate data. All rely on health care practitioners' awareness of silicosis which continues to wane. The remaining source of cases is reporting by health care practitioners. Despite vigorous statewide outreach efforts to inform physicians, nurse practitioners, and physician assistants about the legal requirement to report, the number of provider reports continues to decline, even among occupational health specialists. OHS staff is proceeding with one other avenue to improve reporting, targeted outreach to health care providers in geographic areas and communities where industries and populations with ongoing silica exposure are located.

Another significant finding from the evaluation was identified. Although the gender and racial breakdown of confirmed cases is representative of the population of workers at risk of developing silicosis, the system is capturing a statistically significant smaller percentage (7%) of Hispanic workers as compared to the percentage of the potentially silica exposed Hispanic workforce (35%). This finding makes it imperative for OSH staff to accelerate implementation to explore collaborations with advocacy organizations representing Hispanic workers to identify opportunities to provide training and informational materials to this community.

An attribute of the NJ silicosis surveillance system viewed as problematic, was its complexity. Simplicity is considered a good attribute for a surveillance system. A model system should incorporate timely reporting of accurate data that allows for effective prevention. When time from diagnosis to follow-up was calculated for the NJ system, estimates ranged from six to 21 months. Two major factors hinder the simplicity of NJ's system and silicosis surveillance in general: The latency period between exposure and recognition of disease and the multi-step process required to confirm a clinical diagnosis of silicosis. The greatest promise for improving simplicity of silicosis surveillance and ultimately improving prevention is the development and standardization of clinical tests that allow for earlier diagnosis of silicosis. Short of that, a full complement of surveillance staff and close monitoring of case processing have recently reduced delays in case confirmation.

⊗ **Publication**:
- Gleason J, et al. Evaluation of the New Jersey Silicosis Surveillance System, 1993-2011: CSTE Annual Meeting June 2012.

C. Conclusions:

Confirmation of silicosis cases remains a labor-intensive process. Yet, maintaining the focus on silicosis surveillance has proven effective in identifying and acting on real-time silicosis hazards. Industry-specific outreach efforts were possible because the capacity to respond existed among the states and NIOSH. Vigilance is still required to monitor known industries and to be alert for new ones where workers are at

risk, particularly those most vulnerable. Developing partnerships in silicosis outreach and prevention efforts will become increasingly important in a time of shrinking public health resources.

Case-based surveillance for silicosis following the model established herein can directly result in the reduction in exposure to silica dust among targeted workers and industries. This reduction in exposure among workers exposed to silica-containing materials may ultimately result in a decrease in the incidence of silicosis statewide. Work partnerships, interventions, and dissemination of educational material targeting employers and at-risk workers will increase awareness and contribute to the reduction of silica exposure, leading to a decrease in the incidence of silicosis.

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1. Department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health. Work-Related Lung Disease Surveillance Report, 2007.

2. 1987 Standard Industrial Classification Manual on the U.S. Department of Labor, Occupational Safety and Health Association website: https://www.osha.gov/pls/imis/sic_manual.html.

3. US Department of Labor, Bureau of Labor Statistics. Employment: Quarterly, State and County Employment and Wages.

4. Office of Labor Planning and Analysis, New Jersey Department of Labor and Workforce Development. [Winter 2012-2013]New Jersey's Advanced Manufacturing Cluster.
5. Gleason J. Evaluation of the New Jersey Silicosis Surveillance System. New Jersey Department of Health and Senior Services, Division of Epidemiology, Environmental and Occupational Health, October 2011, unpublished data.

6. Updated Guidelines for Evaluating Public Health Surveillance Systems. MMWR, 2001; Rep 50(RR13); 1-35.

Work-related Asthma

A. Background

Asthma is a disease characterized by increased responsiveness of the trachea and bronchi to various stimuli.[1] Work-related asthma (WRA) is caused by a workplace exposure to such a stimulus. The number of agents that cause WRA is large and constantly growing. Approximately 400 substances have been associated with WRA, and the classes of substances implicated include certain microbial agents, specific animal proteins, several plant products, and numerous industrial chemicals. [1]

Asthma, in the form of work-aggravated asthma and new-onset asthma due to conditions at the workplace, has become the most common occupational lung disease.[2] This project has been committed to achieving the health promotion and disease prevention objectives of the comprehensive, nationwide agenda Healthy People 2020 and the statewide Healthy New Jersey 2020, including a reduction in asthma related deaths, hospitalizations, emergency department visits, missed work and activity limited days.[3, 4] Analysis of the NJ Asthma Call-back Survey data (2008-2010), indicates that approximately 860,000 adults (18 and older) in NJ have a lifetime history of asthma. Of those, almost 300,000 respondents report some indicator of WRA and approximately 54,000 adult NJ residents with a lifetime asthma history have been diagnosed by a health professional as having WRA. [5]

B. Progress Achieved Under Specific Aims

The overall goals of the work conducted by the OHS Unit under the NIOSH Expanded Surveillance grant for WRA include the following objectives:

a) Identify potential cases of WRA;
b) Classify cases in accordance with established case confirmation criteria; evaluate exposures associated with the cases; and
c) Identify new industries, occupations, and causes associated with this condition; and implement interventions to prevent WRA in NJ.

Specific Aim 1:
Utilize NJ's hospital discharge electronic reporting system, death certificate registry, workers' compensation electronic data system, emergency department electronic data system, physician/advanced practice nurse reporting system, and physician assistant voluntary reporting system and other sources to identify potential cases of work-related asthma.

Hospitalization Discharge (HD) and Emergency Department (ED) Data: HD and ED data were taken from the Universal Billing Patient Discharge Data (UB). The UB file collects information on dates of admission and discharge/visit, date of birth, address, coded diagnoses, race/ethnicity, socio-demographics, and payer. WRA cases were identified using 9th International Classification of Diseases (ICD-9) diagnostic codes. The codes for asthma include ICD-9 493.0-493.9 listed as a primary diagnosis; for respiratory conditions due to chemical fumes and vapors, either primary, secondary or tertiary diagnosis of ICD-9 506.0-506.9; all ED discharge data with any level of diagnosis, for ICD-9 codes 782.6 (cough) and 786.9 (other symptoms involving respiratory system and chest).

Death Data: The NJ Electronic Death Registry System provides death data and contains ICD-10 medical code fields, the overall cause of death and Entity Axis 1-20 fields for multiple underlying causes of death. The data will be filtered based on the ICD-10 codes for both asthma and pneumoconiosis and is provided quarterly to OHS in a text file. Number of deaths from or with pneumoconiosis with ICD-10 codes J60-66.8 as the underlying or contributing cause of death and age 15 years and older is requested yearly from the NJ Center for Health Statistics.

Health Care Provider Reports: In NJ, physicians, advanced practice nurses and physician assistants are required by law to report to NJDOH occupational diseases, including cases of work-related asthma and

pneumoconiosis (other and unspecified). Patient identifiers and other information, including diagnosis from these reports can then be matched to UB data.

From 1993-2008, the primary data sources have been health care providers reports HD data. Although physicians have been the most reliable source for ascertaining cases of WRA, underreporting has limited the utility of this surveillance source. Reporting by physicians has been historically poor in the absence of significant resources dedicated to this effort. In 2004, ED data became available as a promising new source of cases. ED data now shows improvement over HD data in both the total number of adult asthma cases and potential WRA cases (**Figure 1**). Since 2008, the combination of HD and ED data are the primary sources for case ascertainment (60%). Just fewer than 40% of the confirmed cases of WRA were reported by physicians to the health department (**Figure 2**). No cases of WRA were identified from the NJDOH death certificate registry or workers' compensation data from the NJ Department of Labor and Workforce Development, during this grant period. Since 1993 there has only been one confirmed case from the death certificate registry and two cases from the workers' compensation data in the WRA Registry.

Figure 1. Number of WRA Cases by Report Source Year and Data Source: New Jersey, 1993-2011 N= 659

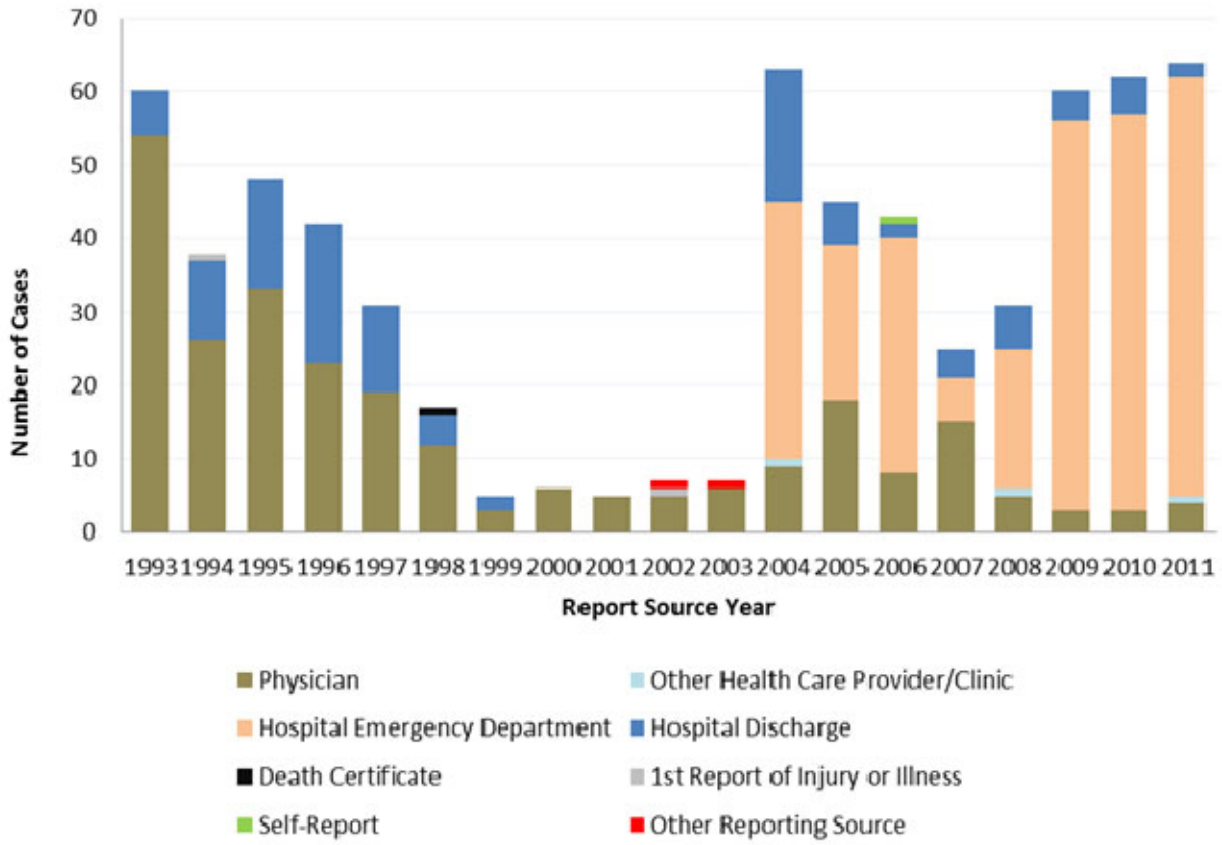
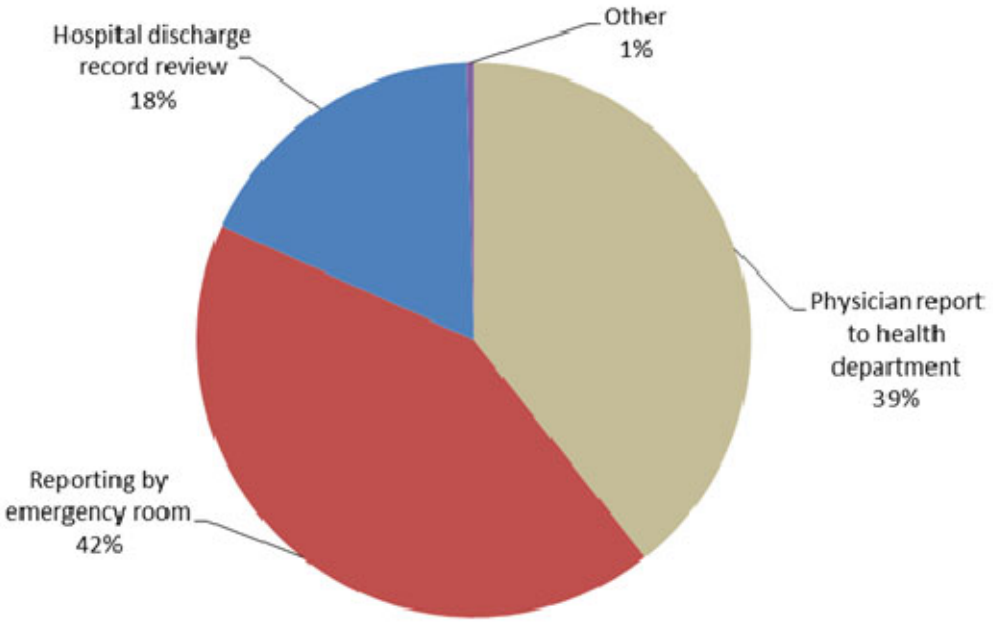


Figure 2. Distribution of Confirmed Cases by Reporting Source: New Jersey, 1993-2011
N= 659



Data were unavailable for the first year and half of the grant period due to the retirement of the Principal Investigator, Coordinator of the Occupational Lung Disease Surveillance Projects and the Data Coordinator from state service. By 2011, additional surveillance personnel were hired including, a Work-Related Asthma Coordinator, a Principal Investigator, a Data Coordinator and Special Services staff for data processing.

Specific Aim 2:
Process potential cases of WRA by means of patient and physician interviews, medical record review, and workplace identification/evaluation.

Identification of New Cases: Names of potential cases of WRA are identified using source data as described under Specific Aim 1. In order to collect the data necessary to accomplish the goals of the project, the following steps were followed for cases that were identified from source data:

- *Medical record review:* Medical records (including pulmonary function test results) are requested from the treating physician or hospital. Consultations with treating physicians are conducted when appropriate. The NJDOH is not required to receive consent from the patient in order to obtain medical records and other information needed to process the case, as interpreted in N.J.A.C. 8:58. However, if an individual specifically denies access to their medical records, no attempt will be made to obtain the records. Project staff reviews the medical record and those cases appropriate for follow-up are identified. Medical records are reviewed to identify the patient's occupation, place of work, employer name, specific exposure information and asthma history.

- *Interviews:* After a review of the medical records to determine if there is a diagnosis of asthma/other respiratory disease or symptoms from a healthcare provider and/or a history of occupational exposure, OHS staff will conduct a telephone interview with the case using a standardized questionnaire. Key information collected includes types of symptoms, onset of symptoms, work activities, and use of personal protective equipment (PPE). A minimum of five attempts are made over a three week period to contact (via phone call, email, letter or fax) the

identified employee. Cases unreachable by telephone are mailed a self- interview questionnaire after the phone attempts are completed. Following the successful completion of an interview, a "thank-you" letter with educational materials, as appropriate, is sent to the patient and the case is given to the WRA Coordinator for industrial hygiene determination.

- *Workplace identification/evaluation:* OHS reviews the case and determines the type of intervention (on-site visit, an Occupational Safety and Health Administration (OSHA) or Public Employee Occupational Safety and Health (PEOSH) referral, or a letter/educational mailing) appropriate based on information from the interview and medical records. OSHA may be consulted if refused entry, immediately dangerous to health, or a large number of diagnosed cases.

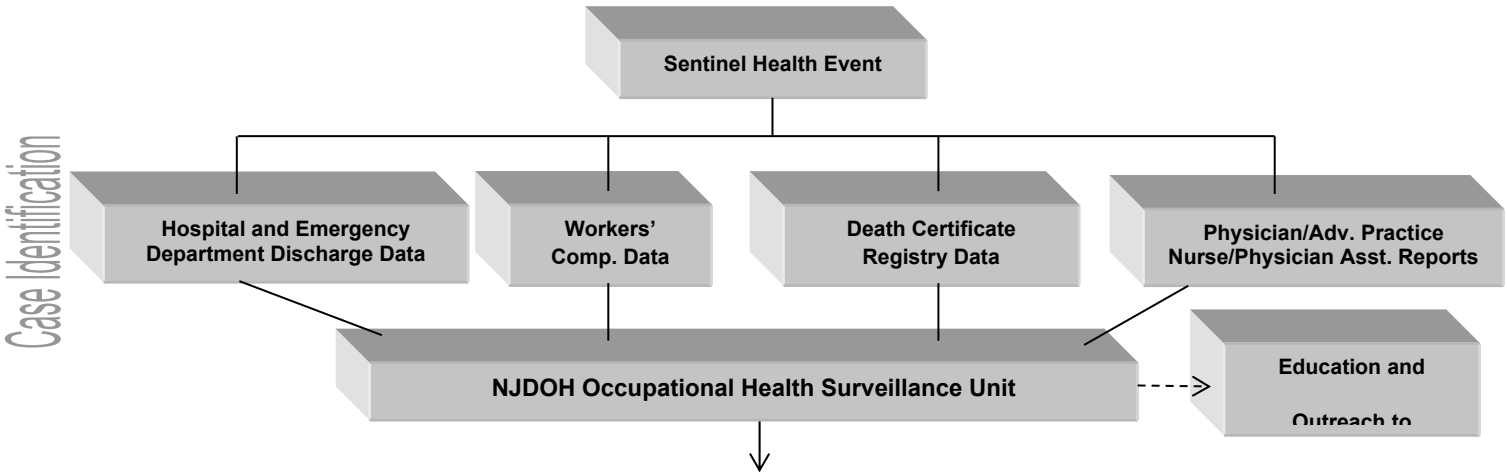
From 2014-2014, 406 potential cases of WRA have been processed (**Table 1**). Asthma data for 2011 have been validated by NIOSH. For 2011, 140 medical record requests were sent and 139 medical records were received. Twenty-six (19%) of these cases were confirmed as WRA. Cases for 2013 and 2014 are still being processed.

Table 1. **WRA asthma cases processed and confirmed between 2010-2014**

Year	Processed Cases	Confirmed WRA	Not Asthma	Not Work Related	Insufficient Data to Classify
2010	139	26	76	14	36
2011	123	29	68	4	35
2012	131	2	38	2	
2013	121	5	41	5	1
2014	20	4	15		
Total	406	66	189	74	74

Schematic of New Jersey's surveillance system for silicosis using this model is shown in **Figure 3** as follows:

Figure 3. Work-Related Asthma Surveillance System Flowchart



Case Confirmation

Reported Individuals	Hospitals, Emergency Departments (ED), NJDOH Vital Records Unit, NJDOLWD-Division of Workers' Compensation (WC)	Reporting Physicians, Advanced Practice Nurses, and Physician Assistants
● Interview to: ➢ obtain occupation, employer, other core variables ➢ determine work-relatedness of data or report ➢ identify asthmagen	● Obtain medical records, ED, death certificate, and WC data to: ➢ collect occupation, employer, other core variables ➢ determine work-relatedness of data or report	● Provide: ➢ educational materials ➢ thank you letter ➢ reporting forms ➢ outcome of reported workplace evaluation

Interventions

Individuals	Employers	Health Care Providers
REPORTED INDIVIDUALS Provide educational materials on: health effects medical care workplace controls legal rights and remedies ***OTHER INDIVIDUALS AT RISK*** Provide educational materials on: health effects medical care workplace controls legal rights and remedies Encourage medical screening with their own physician	***REPORTED WORKPLACES*** Provide educational materials on: health effects workplace controls Conduct telephone interview to: determine exposures and control measures determine other workers at risk Conduct on-site evaluation to: gather information on exposures and control measures make recommendations for controls Conduct follow-up to on-site evaluation: check compliance with recommendations make referrals to OSHA ***OTHER WORKPLACES AT RISK*** Provide educational materials on: health effects workplace controls Conduct mailed survey to: determine exposures and control measures determine other workers at risk Encourage medical screening of high-risk employees	Implement education on: recognition of work-related asthma reporting requirements medical surveillance recommendations

Specific Aim 3:
Analyze collected data to confirm and classify cases of WRA.

A critical component of the surveillance system is the review of the medical, demographic, and employment information collected for each case to determine if it meets the respective NIOSH Case Confirmation Criteria for WRA. Medical Records and interviews are both used to confirm cases.

Case Confirmation: To confirm the potential WRA case, OHS staff determines if the case meets the NIOSH case definition: 1) a healthcare professional's diagnosis consistent with asthma and 2) an association between symptoms of asthma and work. Evidence for these items is found in various parts of the interview questionnaire, reporting form, and/or medical record.

Case Classification: Once the cases are confirmed, they are classified into the following categories using the NIOSH Decision Logic for WRA Surveillance Case Identification and Classification. [6]

1) Work-aggravated asthma, which is pre-existing asthma exacerbated by workplace exposures; and
2) New-onset WRA (asthma in a previously health individual) which includes:
    a. Reactive airways dysfunction syndrome (RADS), or irritant-induced asthma, which is a non-immunologic asthma that is typically caused by a single exposure to high levels of irritating vapor, gas, fume, or smoke
    b. Occupational asthma (OA), which is an allergic, or immunologically-mediated, asthma which develops after a period of exposure to a sensitizing agent.

Exposure Timeline*:* If the case is missing information necessary for confirmation such as, the patient's work history, medical records and/or exposure timeline, OHS staff discusses the case, and fills out the unable-to-contact form. The WRA Coordinator decides if there is enough information to confirm and classify the case. If no timeline, the case is closed with no further follow-up.

OHS staff identified and confirmed 659 cases of WRA from 1993-2011. **Table 2** shows the classification of Confirmed WRA Cases by groups including: work-aggravated asthma, RADS, occupational asthma and insufficient data to classify. Fifty-five percent of cases were confirmed as new-onset WRA, which includes RADS and occupational asthma. Twenty-six percent of the cases could not be classified as new-onset or work-aggravated due to insufficient data. This lack of information often impeded patient follow-up activities.

Table 2. Classification of Confirmed WRA Cases by Classes in New Jersey, 1993-2011

Classification	Number of Cases	Percentage of Cases
Work-aggravated asthma	127	19
New-Onset WRA		
RADS	73	11
Occupational asthma	289	44
Insufficient data	170	26
Total	**659**	**100**

Listed below are highlights from our 1993-2011 data. Trend analysis and narrative, from 1993-2011 have been posted to the new NJ WRA website.[7]

659 cases of WRA were confirmed from 1993-2011:

- 54% (357) were female; 63% (415) were White; 12% (77) were of Hispanic origin; and 31% (209) ranged in age from 35-49 years;
- 44% (289) of these cases were classified as Occupational Asthma (Table 2 above);
- The largest percentage of cases was in the Health Services industry (18%), which may be due to an increased use of cleaning agents and disinfectants, formation of mold (in damp work environments) and generation of indoor air pollutants;
- The greatest number of cases was among those that worked in Production occupations (14%), which included machine operators, assemblers, and laborers; and

- The agents that are most commonly associated with WRA are Smoke, 7% (48); Chemicals, NOS, 7% (46); and Indoor Air Pollutants, 4% (28).

Specific Aim 4:
Conduct on-site industrial hygiene evaluations of workplaces where cases of WRA have been identified.

The workplace evaluation was designed to collect and interpret information about workplace processes, hazardous substances, effectiveness of exposure control methods, and other employee protection methods in place for preventing hazardous exposures. The information derived from these site evaluations was also used in the development of educational materials, publications and reports that were shared with the occupational community.

During the previous grant period, OHS conducted 30 work site investigations related to WRA. These site visits were comprised of six private sector work-site investigations which included a full-service, fitness and wellness center (chlorine/hydrogen chloride), four hospitals (pepper spray, floor stripping chemicals, quaternary compounds) and a day care (chlorine, green cleaning). Industrial hygiene reports were issued to each employer following the visit and included recommendations. Staff accompanied NJ PEOSH on 12 public sector work-site visits (office buildings, schools, long-term hospitals) following employee complaints on mold and asthma symptoms. Staff provided employers and employees educational information and specific written recommendations on green cleaning and WRA. NJ OHS staff also accompanied PEOSH to five NJ Medical Examiner's Offices addressing the development of WRA due to formaldehyde exposure. Educational packets including recommendations regarding PPE, respiratory protection and hazard communication training for use by medical examiners were disseminated.

Public Employees Occupational Safety and Health (Mold and WRA): The OHS Unit, in collaboration with PEOSH, conducted five site visits following employee complaints on mold and asthma symptoms (one school, two office buildings, and two long-term hospitals). OHS staff distributed educational packets to the employees and employers addressing the development of WRA due to mold exposure. The packets included recommendations regarding personal protective equipment, respiratory protection, hazard communication training and green cleaning.

In 2013, OHS staff completed a site visit at a police department with severe mold growth on the air handling units. An employee questionnaire on mold and WRA was developed specifically for the employees at this site and disseminated in 2014. Fifty-four of the employees voluntarily completed the survey. Preliminary results show that 46 (85%) of the participants suffered from frequent sinusitis; 43 (80%) had frequent coughs; and 30 (56%) complained of shortness of breath. Forty-four (81%) are currently taking asthma or allergy medications as a result of their symptoms. Fifteen (28%) indicated a history of asthma. To confirm WRA cases, medical records are being obtained from individuals who had a history of asthma and saw a physician while working at the police department. Following PEOSH's citation for microbial contamination, the employer removed the mold and replaced the HVAC system. A follow-up survey was sent to the original 54 respondents to determine if there was any improvement in their health after the recommendations were implemented. Preliminary results show that there was some improvement in the overall health of the employees. A poster, "Case Study: Mold Contamination in the Workplace and Associated Adverse Health Outcomes" was presented at the 2015 CSTE Annual Conference.

OHS along with PEOSH conducted an additional 12 public sector work-site visits (office buildings, schools, adult psychiatric hospitals) following employee complaints on mold/indoor air quality (IAQ) and asthma symptoms. Both psychiatric hospitals were issued industrial hygiene reports following the visits and included recommendations on hazard communication, green cleaning, respirators and response to indoor air quality complaints.

Medical Examiners (Formaldehyde and WRA): Formaldehyde is a known irritant and has resulted in WRA. The OHS Unit, in collaboration with the PEOSH, distributed educational packets to Medical Examiners addressing the development of WRA due to formaldehyde exposure. The packet included recommendations regarding personal protective equipment, respiratory protection and hazard

communication training for use by medical examiners. This outreach was initiated following the completion of industrial hygiene walkthroughs at five medical examiner facilities in NJ.

Floor Stripping Chemicals: Industrial hygiene consultations were provided for two area hospitals following floor finishing chemical exposures that resulted in WRA, namely monoethanolamine (an asthmagen by the Association of Occupational and Environmental Clinics) and a diethylene glycol ether (a potential respiratory irritant). A follow-up report is being drafted and includes recommendations on hazard communication and medical surveillance. In the interim, follow-up interviews of co-workers are also being conducted.

An industrial hygiene consultation was also provided for an elementary school following exposure to a polyurethane floor finishing product that resulted in WRA, namely isocyanates (an asthmagen by the Association of Occupational and Environmental Clinics). A follow-up report is being drafted and includes recommendations on hazard communication, respirators and medical surveillance.

Pepper Spray: An Industrial hygiene consultation was conducted at an acute-care hospital after an employee developed WRA due to exposure to pepper spray (capsaicin). Recommendations to control workers' exposures to pepper spray, particularly in an emergency response situation, using OSHA's First Responder Operations Level of the Hazardous Waste Operations and Emergency Response standard was sent to the hospital. Since the consultation, the hospital has indicated they have implemented most of the recommendations.

Cleaning Products: An Industrial hygiene consultation was provided for a child-care center following exposure to a bleach/acid mixture that resulted in WRA. A follow-up report is being drafted, which includes recommendations on Green Cleaning. In the interim, five material safety data sheets on cleaning products were sent.

Pools: Staff met with NJDOH's Public Health Sanitation and Safety Program to discuss a swimming pool industry focused alert on chlorine use in indoor pools. Based on discussion with the Sanitarians, OHS drafted a health alert on safe manual application of chlorine to pools during adjustment of pH and chlorine levels. This health alert was disseminated to approximately 1,000 indoor pools and to numerous outdoor pools, via local health departments in New Jersey.

An Industrial hygiene consultation was provided for a full-service, fitness and wellness facility that included a three-pool aquatic center. A follow-up report was sent and includes recommendations to control workers' exposures to chlorine and hydrogen chloride using work practices, respiratory protection and personal protective equipment.

Specific Aim 5:
Conduct interventions for WRA in affected industries and populations in New Jersey.

OHS continued collaborations with partners and stakeholders to conduct industry-wide intervention projects involving WRA in specific industries, users of a particular asthmagen, or especially affected populations. The selected projects are based on analysis of past WRA surveillance data from NJ and other states conducting surveillance for this condition. The decision to conduct a specific project relies on factors unique to NJ. Issues such as the magnitude of the problem, severity, number of individuals affected, feasibility, political/economic climate, and industry and labor support are all factors that are evaluated in determining the value of the project.

Based on analysis of the asthma surveillance data, OHS identified three target areas to focus on and develop interventions: swimming pool workers; the use of fogging disinfectants for cleaning; and hair salon workers.

Swimming Pool Workers: Between 1990 and 2011, 12 cases of WRA in NJ pool workers were confirmed. In response, OHS developed and published a health alert, "Don't Get Sick When Applying Pool Chemicals," which has received over 1,000 web-hits during the last year. The alert was disseminated in a mass

mailing to approximately 682 indoor pools and to 100 outdoor pools via email blast. It was presented at the Annual State-Based WRA Conference in April 2012 and included in a January 2013 NIOSH eNews article. Along with the health alert, a survey to determine the impact of the educational material was also disseminated. The survey results were presented in a poster entitled "Survey to Assess the Manual Application of Chlorine to Recreational Pools among Pool Employees, " at the 15th Annual American College of Chest Physicians Community Asthma and Chronic Obstructive Pulmonary Disease Coalitions Symposium, CDC's Water, Sanitation, and Hygiene April Webinar and the 2014 CSTE Annual Conference. OHS also collaborated with the Michigan and California state-based surveillance programs and published "Swimming facilities and work-related asthma" in the *Journal of Asthma*, September 2014.

⊗**Publications**:

- NJ Health Alert: *Don't Get Sick When Applying Pool Chemicals.* [http://nj.gov/health/eoh/survweb/wra/documents/poolchemicals.pdf]
- *NIOSH eNews, Volume 10 Number 9* January 2013[http://www.cdc.gov/niosh/enews/enewsv10n9.html]
- CSTE 2014 Poster: *Survey to Assess the Manual Application of Chlorine to Recreational Pools among Pool Employees.*
- NJDOH Health Matters, May 2014 *Keep the Pool Safe this Summer* [http://www.state.nj.us/health/newsletter/documents/may_2014_newsletter.pdf]
- *Journal of Asthma*, September 2014 "Swimming facilities and work-related asthma" [http://www.ncbi.nlm.nih.gov/pubmed/25158052]

Use of Fogging Disinfectants for Cleaning: The second area OHS targeted during the previous grant period was the use of fogging disinfectants during ambulance cleaning after identifying four cases of quaternary amine/phenol-related WRA in NJ Emergency Medical Service workers. A health alert entitled "Fogging Disinfectants for Ambulance Cleaning – What You Should Know" addressed worker exposures to fogging disinfectants for ambulance cleaning and disinfection. The alert was sent to over 800 NJ EMS agencies via the Health Alert Network for hospitals/ Emergency Medical Service Personnel and has been viewed 1,328 times over the last year. The alert was presented at the April 2013 Annual State-Based WRA Conference.

⊗**Publications**:

- NJDOH Health Alert: *Fogging Ambulances with Toxic Disinfectant May Cause Illness* [http://nj.gov/health/eoh/survweb/wra/documents/ems_fogging_alert.pdf]

Hair Salon Workers: A third intervention was initiated for the beauty salon industry, addressing worker exposures to hair-smoothing treatments (specifically Brazilian Blowout) using keratin-based hair and straightening products that contain formaldehyde. In 2014, staff presented a draft of the health advisory to the NJ State Board of Cosmetology. The Board agreed to distribute this advisory to 9,000 beauty salons in NJ during their annual inspections.

Specific Aim 6:
Coordinate activities under the *Physician and Nurse Outreach Advisory Board* to conduct outreach and education aimed at increasing WRA recognition, reporting, and medical surveillance by physicians, advanced practice nurses, and physician assistants.

The Physician and Nurse Outreach Advisory Board is no longer in existence. Instead, OHS staff participated in several physician and nurse outreaches, including symposiums; national initiatives (e.g. May is Asthma Awareness Month); as well as collaborating with various local partners on producing educational documents, with a special focus on WRA for health care providers.

⊗**Publications**:

- Reporting Work-Related Asthma - Important Information [http://www.nj.gov/health/eoh/survweb/wra/documents/reportwra.pdf]

- NJ Law Requires Physicians, Advanced Practice Nurses, and Physician Assistants to Report Individuals Diagnosed with Work-Related Asthma – office poster [http://nj.gov/health/eoh/survweb/wra/documents/officeposter.pdf]
- HIPAA and the Provision of Protected Health Information to NJDOH FAQs [http://nj.gov/health/eoh/survweb/wra/documents/hipaa.pdf]

Specific Aim 7:
Collaborate with partners and stakeholders to contribute to statewide and national prevention efforts for WRA.

NJDOH Family Health Services/Asthma Awareness and Education Program: The OHS Unit compiled NJ Surveillance data for the WRA chapter including a NJ Asthma Call-back Survey section using NJ Behavioral Risk Factor Surveillance System data for the Asthma in New Jersey report .

⊗**Publication**:

- Asthma in New Jersey Annual Report (Chapter 2: Work-related Asthma) [http://www.state.nj.us/health/fhs/asthma/documents/chapter2.pdf]
- NJ WRA Fact Sheet: Prevent Work-related Asthma [http://www.state.nj.us/health/ohs/documents/prevent_work_related_asthma.pdf]

Pediatric/Adult Asthma Coalition of New Jersey (PACNJ)/American Lung Association NJ: NJ OHS is a member of the PACNJ, a multi-partner team of health care professionals and organizations that provide resources to schools, child care providers, healthcare providers and other stakeholders to prevent and manage asthma. PACNJ developed three videos on recognizing asthma triggers and controlling asthma, OHS provided information on work-related triggers. OHS also participated in the annual Partners and Friends Statewide Meetings contributing to strategic planning and regional education and training workshops for child care centers on green cleaning.

⊗**Publication**:

- PACNJ: Controlling Asthma Triggers in the Child Care Setting (video) [https://vimeo.com/41861379]

NJDOH Public Employees Occupational Safety & Health (PEOSH) Unit: The OHS Unit participated in the NJ Association of Designated Persons Training/Workshops as part of the Designated Persons Training requirements in the PEOSH IAQ Standard. Between 1993-2010, six to eight training workshops were held yearly. Employees receive continuing education points for attendance. OHS trained 150 school nurses and 650 facility workers focusing on green cleaning and reducing asthma triggers in schools. All those participating were expected to return to their schools and initiate/participate in an indoor air quality team, another requirement for the award.

⊗**Publication**:

- IAQ Designated Persons Training slides for Nurses [http://www.nj.gov/health/peosh/documents/iaq_nurse_2.pdf]

Sustainable Jersey and the New Jersey School Boards Association: Sustainable Jersey for Schools is a voluntary certification program for NJ public and charter schools. This program provides public school districts and charter schools with tools, training and financial incentives to support and rewards communities as they pursue sustainability programs. The OHS Unit serves on the Health and Wellness Task Force, specifically in IAQ Management, reinforcing current laws and regulations and encouraging schools to implement best practices that go beyond the current laws and regulations. Approximately 100 NJ school districts across 21 counties participate in this program.

NJ School Buildings & Grounds Association (NJSBGA) Annual Custodial Summer Workshop: NJSBGA is a network of over 400 Certified Educational Facilities Managers statewide that are dedicated to safe healthy facilities. Their mission is for every school in NJ to be up to date on all of the latest codes and

safety requirements to keep our students and staff safe. OHS staff participated in two summer custodial workshops entitled 'Tool Box Tuesdays' in collaboration with NJSBGA for custodial and maintenance workers about reducing asthma triggers in school classroom ventilation and indoor air quality issues. Approximately, 40 people attended collectively.

***Annual American College of Chest Physicians-Community Asthma and Chronic Obstructive Pulmonary Disease Coalitions Symposium*:** The American College of Chest Physicians is a medical organization consisting of physicians and non-physician specialists in the field of chest medicine. Its mission is to promote the prevention and treatment of diseases of the chest through leadership, education, research, and communication. Staff was awarded a travel scholarship to the 14th Annual American College of Chest Physicians, Community Asthma and Chronic Obstructive Pulmonary Disease Coalitions Symposium to present a poster on the NJ WRA surveillance system.

Child Care Workers Pilot Study/Green Cleaning Initiative: An educational outreach, with an emphasis on Green Cleaning, a pilot-study for child care workers has been initiated with a local child care provider to collect information on the facilities current cleaning practices and on cleaning agents used. This provider has approximately 6 locations in NJ, with over 100 employees. The OHS Unit has completed the first draft of a survey that will be administered to the employees at each location. The employer requires a perusal of the survey before the study begins.

Community Health Fair: Asthma afflicts people of all ages, races, genders, and socioeconomic statuses. However, it occurs at disproportionately higher rates among some ethnic and racial populations. [8] According to WRA Registry data, 1993-2011, 12% (77) of OHS cases were of Hispanic origin. The OHS Unit participated in the Ethical Community Charter School's Community Outreach program for their Second Annual Community Health Fair in April 2015 in Jersey City, NJ. The community is diverse, and includes 65% minority populations. OHS staff distributed educational information (in English and Spanish) to employees, employers and the community addressing the development of WRA.

Specific Aim 8:
Generate and disseminate reports of WRA surveillance findings.

Multi-State WRA Data Analysis: The OHS Unit collaborated with NIOSH and other WRA surveillance states on peer-reviewed articles featuring WRA surveillance data.

⊗ Publications:

- Lefkowitz D, Pechter E, Fitzsimmons K, Lumia M, Stephens AC, Davis L, Flattery J, Weinberg J, Harrison RJ, Reilly MJ, Filios MS, White GE, Rosenman KD. Isocyanates and work-related asthma: Findings from California, Massachusetts, Michigan, and New Jersey, 1993-2008. *Am J Ind Med*. 2015 Sep 9. [Epub ahead of print]

- Quinn MM, Henneberger PK, Members of the National Institute for Occupational Safety and Health (NIOSH), National Occupational Research Agenda (NORA) Cleaning and Disinfecting in Healthcare Working Group: Braun B, Delclos GL, Fagan K, Huang V, Knaack JLS, Lee SJ, Moual NL, Maher KAE, McCrone SH, Mitchell AH, Pechter E, Rosenman K, Sehulster L, Stephens AC, Wilburn S, Zock JP. Cleaning and disinfecting environmental surfaces in health care: Toward an integrated framework for infection and occupational illness prevention. *Am J Infect Control*. 2015 May;43(5):424-434.

- White GE, Seaman C, Filios MS, Mazurek JM, Flattery J, Harrison RJ, Reilly MJ, Rosenman KD, Lumia ME, Stephens AC, Pechter E, Fitzsimmons K, Davis LK. Gender differences in work-related asthma: surveillance data from California, Massachusetts, Michigan, and New Jersey, 1993-2008. *J Asthma*. 2014 Mar 27.

Presentations at State and National Meetings: Presentations on the elements of WRA surveillance and intervention program, and the findings or various WRA surveillance-related projects have been prepared and presented by OHS at various meetings and conference (**Table 3**).

Table 3. Presentations at State and National Meetings

Presentation Title	Venue
Don't Get Sick When Applying Pool Chemicals. NJDOH Health Alert	Annual State-Based WRA Conference, 2012
NJDOH WRA Surveillance and Intervention	The NJ Asthma Symposium Princeton, NJ 2012
NJDOH WRA Surveillance System	14th American College of Chest Physicians (ACCP) Community Asthma and Chronic Obstructive Pulmonary Disease (COPD) Coalitions Symposium. (Atlanta, GA). October 2012
Survey to Assess the Manual Application of Chlorine to Recreational Pools among Pool Employees poster	15th ACCP Community Asthma and Chronic Obstructive Pulmonary Disease (COPD) Coalitions Symposium. Chicago, Illinois. October 2013.
	Council of State and Territorial Epidemiologists, 2014 Annual Conference in Nashville, Tennessee.
	CDC's Water, Sanitation, and Hygiene (WASH) April 2014 Webinar
Formaldehyde-Based Hair Straighteners Present a Particular Health Risk to Salon Workers draft health advisory alert	New Jersey State Board of Cosmetology and Hairstyling (Board) monthly public meeting, 2013
Fogging Ambulances with Toxic Disinfectant May Cause Illness NJDOH Health Alert	2013 NIOSH Occupational Lung Disease Surveillance Meeting (Oakland, CA)
Mold in the Workplace	2014 NIOSH Occupational Lung Disease Surveillance Meeting (Atlanta, GA)

Specific Aim 9:
Evaluate the WRA surveillance system.

1. Evaluation Using CDC Guidelines

In evaluating the WRA surveillance system, the NJDOH followed the *CDC Updated Guidelines for Evaluating Public Health Surveillance Systems*.[9] This evaluation was centered on the WRA registry database and data management in occupational health surveillance activities.

- ***Simplicity***: *Ability to structure and operate the WRA registry with ease.*

  The ease of data entry using the established WRA registry Microsoft Access® data entry form with pull down menus and range restrictions has eliminated data entry errors and translated to fewer errors in the data submitted to and validated by NIOSH. Additionally a standard operation procedure manual for WRA surveillance was created by OHS staff that details step by step WRA case processing and case confirmation.

- ***Flexibility***: *Ability to adapt the system for different diseases*

  The WRA registry is Microsoft Access® based; it was originally developed for silicosis and easily adapted for WRA. The windows based environment of the registry makes the database dynamic and

expandable. Particularly in addition of new or emerging variables or asthmagens; or retiring of old variables in which case entries were converted to new variables.

- ***Acceptability***: *Willingness of physicians and advance practice nurses to report cases of WRA. Willingness of hospitals to provide medical information of individuals with WRA. Willingness of reported individuals to provide information about the location and circumstances of their WRA. Willingness of employers to provide information in mail questionnaires, telephone interviews, on-site visits, and implementing recommendations for prevention of further cases of WRA.*

  Physicians and advanced practice nurses have not demonstrated willingness to report cases to NJDOH, despite of a state regulation that requires them to do so. An attempt to continually address this issue has occurred over the grant period, as indicated in **Specific Aim 6 and 7**

  The response time in acquisition of hospital medical records has improved compared with previous years due to improved computer technologies and the adoption of release of information services by NJ area hospitals. The time lag for exchange of protected information in medical records by health care facilities has been further mitigated with the use of the HIPAA factsheet developed by the OHS unit.

  The procedures to improve the tracking of patient phone numbers and methods for contacting patients to conduct the telephone interview have been fully implemented by OHS staff. The WRA telephone interview forms have been modified to include expedited interview and mailed questionnaires. An "email attached" fillable form is currently in development. These efforts have contributed to improved interview process and data collection in obtaining occupation, employer, and other core variables; determine work-relatedness of the case and identify the asthmagens involved.

- ***Data Quality***: *Completeness and validity of the data in the system.*

  → *Completeness*

  The WRA registry is continually modified to incorporate variables which were being collected but not data entered. Additionally, new variables were added to both the questionnaires and their associated databases to enable the tracking of case status within each project. This will enable the system to generate reports detailing the status of case processing and work site investigations, as well as to alert the project industrial hygienist when a work site follow-up evaluation is necessary.

  Prior to submissions of data sets from the WRA registries, the data is checked using the NIOSH Respiratory Disease Surveillance System Local Collection Module's Validation Program. Error logs were reviewed and case files pulled to ensure data were accurate and complete. In recent data submissions to NIOSH, fewer errors have been identified due to improving accuracy of the WRA registry. Any errors found by NIOSH are brought to the attention of OHS, and further review of case files is conducted in order to resolve the errors.

  → *Capture-Recapture Analysis*

  Not conducted during this grant period.

  → *Validity*

  The coding of workers compensation as a primary payer from NJ hospitals on patient medical records continues generate non-work related and non-respiratory entries in the UB discharge data. To improve the validity of cases entered into the WRA registry, medical records received from hospitals are further examined to determine if cases are work-related with respiratory conditions. A combination of one or more of the following indicators are identified including medical history, medication history, symptoms presented, exposure agent/asthmagen, medications given/prescriptions dispensed, final diagnosis and work-relatedness. This additional step improves the quality of valid potential WRA cases added to the registry. Cases with minimal information on their medical records are added to the registry by default based on ICD codes.

→ *Sensitivity: Ability to identify the workplaces for a high proportion of cases of WRA. Ability to identify cases that are work-related, and identify the workplaces where they occurred.*
The comparison of WRA registry data and the NJ Asthma Call-Back Survey data (2008-2010) shows a continued discrepancy in the number of identified and confirmed WRA cases in NJ. The WRA surveillance system has identified and confirmed 659 cases of WRA between the years 1993 -20011. Of the approximately 54,000 adults (18 and older) reported to be diagnosed with asthma by a health care provider in the Call-back Survey, 35, 000 respondents reported some indicator of WRA. In order to identify more workplaces and workers that have respiratory conditions from work related exposures, the OHS unit is working closely with PEOSH to identify potential cases through worksites complaint investigations (see Specific Aim 4). Further collaboration and interventions with PEOSH are being planned to reach more workplaces and workers.

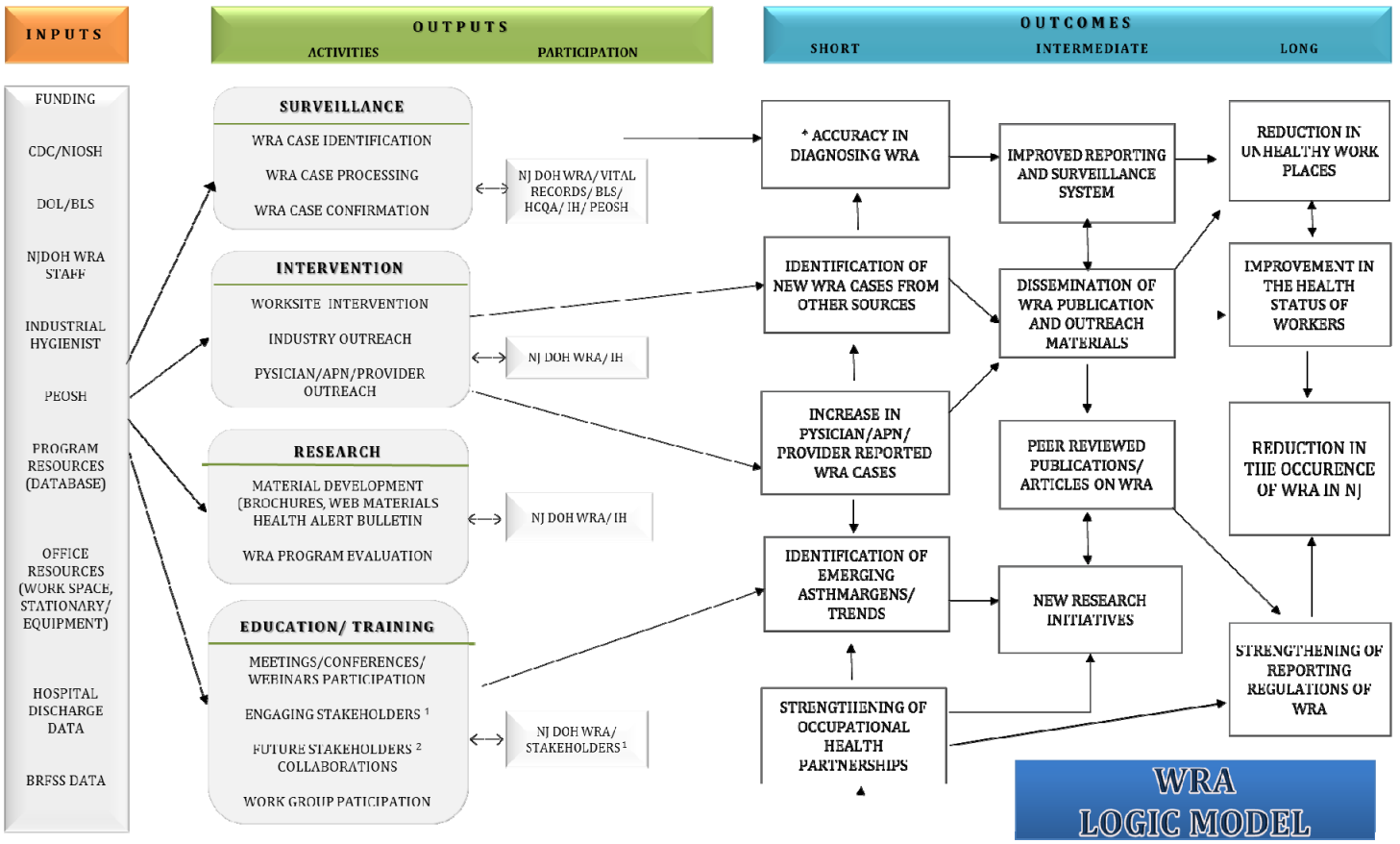
→ *Representativeness*: *Ability to accurately describe the occurrence of cases of WRA by demographics of affected individuals, period of time, geographical distribution, and type of workplace.*
This information is being compiled in the comprehensive evaluation report.

→ *Timeliness: Ability to perform the steps in the surveillance system without delay between steps. Ability to identify workplaces in time to intervene and prevent additional cases of WRA.*
The evaluation of the timeliness of WRA case processing is being carried out to determine if recent changes in case processing protocol have improved the Timeliness of the system. These results would be detailed in the comprehensive evaluation of the WRA surveillance program.

2. Logic Model

The WRA logic model (**Figure 4**) contains several elements that describe overall program includes the basic assets of the project.

Figure 4. WRA Logic Model



Notes:

Acronyms

WRA	Work Related Asthma
NJDOH	New Jersey Department of Health
CDC NIOSH	Center for Disease Control, National Institute for Occupational Safety and Health
DOL/BLS	Department of Labor / Bureau of Labor Statistics
PEOSH	Public Employees Occupational Safety and Health
IH	Industrial Hygienist
BRFSS	Behavioral Risk Factor Surveillance System
HCQA	Office of Health Care Quality Assessment, NJ Department of Health

Steakholders[1]

- PEOSH
- Rutgers Department of Environmental and Occupational Health and Safety Services (EOHSI)
- Consortium of Occupational State-Based Surveillance (COSS)
- NJDOH Environmental and Occupational Health Grant Workgroup

Steakholders[2]

- Physician and Nurse Outreach Advisory Board (PNOAB)
- Clinics Network including Allergists, Pulmonologists, and Occupational Medicine Physicians
- NJ State Society or Physician Assistants (PA) and PA Licensing Board: Collaborate to Promote Recognition and Voluntary Reporting of WRA
- NJDEP-Air Toxics Steering Committee: Serve as an advocate for occupational health-related issues, including WRA
- NJ Department of Education: Collaborate with teachers on mold and asthma
- NJ Clean Air Council: Serve as an advocate for occupational health-related issues
- Northeast States Coordinated Air Use Management (NESCAUM) Committee: Serve as an advocate for occupational health-related issues, including WRA

C. Conclusions

The OHS Unit continues to identify cases of WRA through various reporting sources. Ongoing surveillance, using the model established in the grant proposal, enables interventions to be directly targeted to industries and occupations at risk and working partnerships (i.e., PACNJ) to develop. It is only through case-based surveillance that acute and sentinel cases of WRA are likely to be identified which provide the real opportunities for primary prevention of occupational disease.

Over this grant period, OHS focused primarily on health surveillance and generally used sentinel WRA case data to drive interventions and outreach. While these data, along with on-site evaluations can provide unique and broad characterization of risk factors associated with WRA, there are some limitations associated with this approach. Interventions at the single case and employer level can be challenging because of the latency period between exposure and disease. Towards the end of the grant, OHS began to also focus more on hazard surveillance, which showed a clear exposure/health relationship. Focusing on the hazard, allowed OHS to concentrate on determining what preventative measures minimized or eliminated the exposure to the worker. OHS continued monitoring trends and emerging patterns in exposure for prediction and prevention of future WRA cases.

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5. New Jersey Department of Health. Asthma in New Jersey, 2012. Available at: http://www.state.nj.us/health/fhs/asthma/documents/introduction.pdf. Accessed 2015.

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7. NJDOH WRA website available at: http://nj.gov/health/eoh/survweb/wra/statistics.shtml.

8. American Lung Association State of Lung Disease in Diverse Communities 2010. Available at: http://www.lung.org/assets/documents/publications/solddc-chapters/asthma.pdf

9. CDC Updated Guidelines for Evaluating Public Health Surveillance Systems. http://www.cdc.gov/vaccines/pubs/surv-manual/appx/appendix21-up-guide-mmwr.pdf

HUMAN SUBJECTS RESEARCH

Human Subjects Involvement, Characteristics and Design
The target populations include workers seeking health care at hospitals and emergency departments for diseases and injuries that occur as a result of work or work activity; employers and employees who may have witnessed an occupational injury and/or fatality; any case of occupational and environmental disease, injury, or poisoning report by a health care provider; and patients found in the hospital discharge summary with worker's compensation listed as payer.

Women, minorities and children (16 to 20 years of age) will be included based on their proportions of identified working individuals and not specifically targeted. Based on the demographics of New Jersey, the study population will likely be comprised of the following approximate percentages of civilian employment by race: 35% White; 7% Black; 4% Asian; and 0.3% other. The percentages of civilian employment by Hispanic origin are 10% Hispanic and 90% Not Hispanic. The percentages of civilian employment by sex are 54% Male and 47% Female. The percentage of civilian employment for ages 16-20 years is 0.7%.

Sources of Materials
The primary source of research materials is from secondary data of existing health data/records of individuals containing private health information. These data are collected from hospital discharge data or Uniform Bill-Patient Summaries, a set of computerized records that hospitals create at the time of patient discharge, which contain information compiled by hospitals on each patient's stay, codes for the most relevant diagnosis and secondary diagnoses, procedures performed, primary payer and the admission and discharge dates. Other sources of research materials include death certificates from the NJ Electronic Death Registration System which contains a check-off box for a work-related fatality and the ICD-9 or 10 codes for underlying cause of death. Patient records will be obtained from the New Jersey State Cancer Registry, a population-based registry that collects data on all cancer cases diagnosed and/or treated in New Jersey since October 1, 1978. These data profile each patient including demographic and medical information on each cancer diagnosis (such as the anatomic site, histological type, stage of disease and treatment). All patients are followed annually and vital status is recorded. For deceased cases, the underlying cause of death is also included.

Based on specific information found in the previously mentioned research sources, some individuals may have been contacted for interviews and follow-up. Information obtained for the interviews included personal demographics, work history, job task performed, health related symptoms experience during work, training provided by the employer, use of personal protective equipment, etc.

Potential Risks
The primary risk is loss of confidentiality if the subject's health status, records, or interview/survey responses are revealed by accident, theft, or legal proceedings.

Adequacy of Protection Against Risks
Recruitment and Informed Consent
The research team obtained potential cases of occupational illnesses, injuries and fatalities from the secondary data sources mentioned previously. For the secondary data sources only, the research team received a waiver to the requirement to obtain informed consent, assent and parental permission pursuant to Federal Regulations for the protection of human subjects at 45 CFR 46.116(d). This portion of the research project involves no more than minimal risk to the subjects, the waiver did not adversely affect the rights and welfare of the subjects and this research could not have been practicably carried out without this waiver. Also, NJDOH is not required to receive consent from the patient in order to obtain medical records, X-rays, and other information needed, as interpreted in N.J.A.C. 8:58-1.5. However, if an individual specifically denies access to their medical records, no attempt was made to obtain the records.

For the portion of the research project that conducted surveys, interviews and site visits, informed consent was obtained. Each potential participant received a consent document describing the proposed project, time commitment, an explanation of the study purpose, study measures, confidentiality, the voluntary nature of the study and the benefits and risks of participating. Verbal informed consent was obtained from all interviewees prior

to collecting information. Participants may decline to answer questions or may terminate the survey or interview at any time.

Protections Against Risk
The risk of loss of confidentiality is minimized by maintaining the confidentiality of the names of individuals from existing health data/records. The main dataset was kept on the password-protected PCs and any paper records was kept in locked filing cabinets within the offices of the NJDOH Occupational Health Surveillance Unit. The door to this floor locks automatically and access to the building as a whole requires NJDOH identification and is patrolled by security.

For any children (age 16-20) that may have been interviewed, the additional safeguards listed in 45 CFR 46 Subpart D was implemented.

Potential Benefits of the Proposed Research to Human Subjects and Others and Importance of the Knowledge to be Gained
The risks associated with the reported data are minimal. There were considerable potential benefits to society from the proposed research. A better understanding of the causes of occupational illnesses, injuries and fatalities is important in providing employers, employees and policy makers information about a population's health status with respect to workplace injuries and illnesses and about factors that can influence health. Such knowledge may eventually lead to better interventions and prevention methods to decrease the number of occupational cases in the future.

Inclusion of Women and Minorities

Women and minorities were included based on their proportions of identified individuals. Inclusion criteria did not target or intentionally exclude any vulnerable populations, minorities or sub-groups. Inclusion is based purely on existence of records in the research sources. The study population was comprised of the following approximate percentages:

Based on 2015 population and labor force projections from the Dept. of Labor and Workforce Development (http://lwd.state.nj.us/labor/lpa/dmograph/lfproj/lfproj_index.html)

Percentage of civilian employment by Hispanic origin
Hispanic: 10%
Not Hispanic: 90%

Percentage of civilian employment by race:
White: 35%
Black: 7%
Asian: 4%
Other: 0.3%

Percentage of civilian employment by gender:
Male: 54%
Female: 47%

Note:
The 2000 and 2010 figures are based on the Census Modified Age-Race-Sex (MARS) data.
"Other Races" include American Indian, Alaska Native, Native Hawaiian and other Pacific Islander. Hispanic origin is not a race. Persons of Hispanic origin may be of any race.

Inclusion of Children

Children ages 16-17, who are employed, were included based on their proportions of identified individuals (0.7%). Inclusion criteria did not target or intentionally exclude any vulnerable populations, minorities or sub-groups. Inclusion was based purely on existence of records in the research sources.

CUMMULATIVE ENROLLMENT REPORTS

This report format should NOT be used for collecting data from study participants.

Study Title: Expanded Surveillance - Fatality Investigation

Comments:

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	12		0	0					12
Asian	11	93		0	1					105
Native Hawaiian or Other Pacific Islander				0	0					0
Black or African American	23	306		1	1					331
White	84	1432		7	282					1,805
More Than One Race	0	0								0
Unknown or Not Reported	7	106		4	85	0				202
Total	125	1,949	0	12	369	0	0	0	0	2,455

Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: New Jersey Silicosis Surveillance, 1979-2014

Comments:

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	2	0	2
Asian	0	7	0	0	0	0	0	0	0	7
Native Hawaiian or Other Pacific Islander	0	1	0	0	0	0	0	0	0	1
Black or African American	14	77	0	0	1	0	2	44	0	138
White	71	471	0	3	20	0	43	268	0	876
More Than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	3	11	0	5	22	0	56	481	7	585
Total	88	567	0	8	43	0	101	795	7	1,609

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OMB No. 0925-0001/0002
Cumulative Inclusion Enrollment Report

Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Expanded Surveillance -- Work-Related Asthma

Comments:

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	1	0							1
Asian	3	1	0							4
Native Hawaiian or Other Pacific Islander	0	0	0							0
Black or African American	81	42	0	8	10					141
White	204	179	0	15	17					415
More Than One Race	8	8	0	7	7					30
Unknown or Not Reported	37	31	0							68
Total	**333**	**262**	**0**	**30**	**34**	**0**	**0**	**0**	**0**	**659**

EQUIPMENT INVENTORY LIST AUTHORIZATION/PURCHASE

Report Date: 9/30/2015
Project Title: Fundamental & Expanded Occupational Health Surveillance
Grantee Name: New Jersey Department of Health
Grants Management Officer: Steve Inserra

Grant Number: 5U60OH008485-10
Project Period: 7/1/2010 to 6/30/2015

Project Officer: Margaret Lumia
Grants Specialist: Brandis Belser

Description of Item (i.e., pH Meter)	Mfr.[1] (i.e., Fischer)	Serial Number	Quantity	Condition	Location	Purchase Cost	Date Received
Laptop computer	Dell	XFD1M22D3C; FDLGWM1	2	Excellent	135 E State Street Trenton, NJ 08625	$2,839.92	7/7/2011
Helmet Camera & Accessories	Pelican	BEA502078	1	Excellent	135 E State Street Trenton, NJ 08625	$903.58	7/8/2014
Chair	Deptcor	NJERGOHBUM	1	Excellent	135 E State Street Trenton, NJ 08625	$425.00	8/8/2014
Camera and Accessories	Cannon	852032003872	1	Excellent	135 E State Street Trenton, NJ 08625	$405.00	7/3/2014
Projector and Scanner	Dell/Cannon	CN-OC89JN-S0081-44J-0156; SP1247A0010TC	1	Excellent	135 E State Street Trenton, NJ 08625	$1314.36	7/8/2014
Monitor	Dell	CN-0JMMT2-64180-456-0SES	1	Excellent	135 E State Street Trenton, NJ 08625	$351.19	7/7/2014
Desktop and Monitor	Dell	FSJ470303462; C/N-0KW14V-7426	1	Excellent	135 E State Street Trenton, NJ 08625	$991.04	7/11/2014

[1]Mfr. (Manufacturer)

Property Administrator & PO Disposition Recommendation and Instructions:

Description of Item (copy from above)	**Disposition**	**Address**[1]
Click here to enter text.	Choose an item. Click here to enter text.	Attn: Click here to enter text. Centers for Disease Control & Prevention Peachtree Distribution Center 3719 North Peachtree Road, #100 Chamblee, GA 30341
Click here to enter text.	Choose an item. Click here to enter text.	
Click here to enter text.	Choose an item. Click here to enter text.	
Click here to enter text.	Choose an item. Click here to enter text.	

1The CDC Warehouse is the central receiving point for the delivery of all non-hazardous and non-perishable supplies and equipment, CDC – AM – 2004-03, update 2010

FINAL INVENTION STATEMENT

Form Approved Through 08/31/2015
OMB No. 0925-0002

Department of Health and Human Services **Final Invention Statement and Certification** *(For Grant or Award)*	DHHS Grant or Award No. 5U60OH008485-10

A. We hereby certify that, to the best of our knowledge and belief, all inventions are listed below which were conceived and/or first actually reduced to practice during the course of work under the above-referenced DHHS grant or award for the period

7/1/2010 *original effective date* through 6/30/2015 *date of termination*.

B. **Inventions** (Note: If no inventions have been made under the grant or award, insert the word *"NONE"* under Title below.)

NAME OF INVENTOR	TITLE OF INVENTION	DATE REPORTED TO DHHS
	NONE	
(Use continuation sheet if necessary)		

C. **Signature** — This block ***must*** be signed by an official authorized to sign on behalf of the institution.

Title	Name and Mailing Address of Institution
State Epidemiologist/Assistant Commissioner	New Jersey Department of Health P.O. Box 369 Trenton, NJ 08625
Typed Name Christina G. Tan, MD, MPH	
Signature  Date 9/21/15	