

MEDICAL SCREENING AND SURVEILLANCE FOR WORKERS POTENTIALLY EXPOSED TO DIISOCYANATES

A GUIDE FOR THE EMPLOYER

Medical screening and medical surveillance are two fundamental strategies for optimizing employee health. Although the terms are often used interchangeably, they are quite distinct concepts. The fundamental purpose of screening is early diagnosis and treatment of the individual and thus has a clinical focus. The fundamental purpose of surveillance is to detect and eliminate the underlying causes such as hazards or exposures of any discovered trends and thus has a prevention focus. Both can contribute significantly to the success of worksite health and safety programs.^{1,2,3}

WHAT IS MEDICAL SCREENING?

Medical screening of workers is the administration of medical questionnaires, physical examinations and clinical tests to individuals who may be at higher risk for certain adverse health outcomes due to potential workplace exposures. It is one component of a comprehensive medical surveillance program. Individuals identified with early adverse health effects due to workplace exposures can be removed from additional exposure before developing chronic symptoms, permanent loss of function, or disability.

WHAT IS MEDICAL SURVEILLANCE?

Medical surveillance is the analysis of this health information to detect the underlying causes of adverse health trends and target them for intervention. Review of group results helps to identify potential problem areas and the effectiveness of existing worksite preventive strategies. For instance, if symptoms of diisocyanate exposure are detected in

workers in a certain department, the employer can evaluate sources of exposure and institute workplace controls. The employer can then review subsequent surveillance to determine whether health symptoms or illnesses have been eliminated. Thus, surveillance serves as a feedback loop to the employer.

WHAT IS THE DIFFERENCE BETWEEN A MEDICAL SURVEILLANCE PROGRAM AND RESPIRATOR MEDICAL EVALUATIONS?

Respirator medical evaluations are a type of fitness-for-duty evaluation in which a worker's ability to safely wear a respirator is determined. It does not evaluate for adverse health effects from potential workplace exposures as does medical screening. OSHA's Respiratory Protection Standard (29 CFR 1910.134) requires that employers provide a medical evaluation to determine the employee's ability to use a respirator before the employee is fit tested or required to use the respirator in the workplace.

Employees who are evaluated for medical fitness for duty to wear respirators may also benefit from medical surveillance.

WHAT IS THE SCOPE AND PURPOSE OF THIS GUIDANCE?

This Guidance specifically addresses potential adverse health effects due to diisocyanate exposure and the role of medical surveillance in preventing these effects.

Diisocyanates can cause work-related asthma (WRA) through several mechanisms. Diisocyanates are both irritants and sensitizers. Sensitization means an individual becomes allergic to diisocyanates.



Thus, occupational asthma due to diisocyanate exposure can be either irritant-induced or sensitizer-induced. A third mechanism is exacerbation of pre-existing asthma by diisocyanate exposure. This is termed “work-exacerbated asthma.”⁴

The longer an individual who has become sensitized to diisocyanates remains exposed to diisocyanates, the more likely he/she will have persistent breathing problems even after exposure has ended. Workers may initially notice symptoms such as throat irritation, shortness of breath, cough, chest tightness, and wheezing, that occur at or after work and get better outside of the workplace such as on weekends and vacations. Other symptoms and health effects caused by diisocyanate exposure include eye irritation, rhinitis (runny nose), contact dermatitis (rash), and rarely, hypersensitivity pneumonitis (a type of pneumonia).

Periodic medical screening can identify workers who develop symptoms possibly related to diisocyanate exposure so employers can identify the cause and, where needed, remove them from exposure, thereby reducing the likelihood of chronic disability. Studies show that workers who participate in medical surveillance programs have better health outcomes because problems are identified early and appropriate corrective actions are taken.

Diisocyanates can be used safely. The prevention of adverse health effects in employees working with diisocyanates can be achieved with a multi-faceted strategy based on the hierarchy of controls, with elements including:

- maintaining diisocyanate occupational exposure levels as low as possible through engineering and administrative controls;
- conducting environmental monitoring to document exposure levels;
- training workers on the symptoms and health effects of diisocyanates;
- training workers on the safe use and handling of diisocyanates;
- providing workers with appropriate personal protective equipment and training them on the proper use; and
- implementing an ongoing medical surveillance program.

WHO BENEFITS FROM INCLUSION IN A DIISOCYANATE MEDICAL SURVEILLANCE PROGRAM?

Workers who are exposed to diisocyanates in liquid, vapor, or aerosolized form through the respiratory or dermal routes benefit from a Medical Surveillance program. Workers involved in production, application, spillage clean-ups, and maintenance, including persons working in areas where there have been detectable levels of diisocyanates or where exposure to diisocyanates may occur in an emergency, stand to gain from medical surveillance. Also, workers who are to be assigned to a work area where diisocyanates are used or who have the potential for an occupational exposure to diisocyanates can be better protected by undergoing a pre-placement medical screening.

Employers benefit from a medical surveillance program as these programs provide an opportunity to identify problems early and take appropriate corrective actions.

WHAT ARE THE COMPONENTS OF A DIISOCYANATE MEDICAL SURVEILLANCE PROGRAM?

A medical surveillance program for workers with potential exposure to diisocyanates benefits from being developed, supervised and monitored by a physician or licensed health care professional (PLHCP) with a thorough knowledge of the toxicology and health effects of diisocyanates, such as a physician who is board certified/board eligible in Occupational Medicine or Pulmonary Medicine. Medical screening is most effective when performed prior to work with or potential exposure to diisocyanates (i.e. baseline) and periodically thereafter to monitor for any changes in health or new symptoms. The key component of a diisocyanate medical surveillance program is a medical history and symptom questionnaire. Other components may include a physical examination and pulmonary function testing.

The medical history questionnaire typically includes a work history, history of pre-existing respiratory conditions, such as asthma, and dermal conditions, such as dermatitis, a smoking history, and symptoms associated with or exacerbated by

diisocyanate exposure. The physical examination focuses on the pulmonary and dermal systems and evaluates any other areas identified in the questionnaire. See Resources below for further information or sample questionnaires⁵.

A pre-placement physical exam should be ordered at the discretion of the PLHCP who reviews the questionnaire. The purpose is to explore pre-existing conditions such as allergies, respiratory complaints including asthma, prior sensitization to diisocyanates, and skin conditions such as allergic dermatitis. The periodic examination focuses on new onset respiratory or skin complaints.

The performance of pulmonary function or spirometry testing requires considerable knowledge and expertise, so many companies rely on technicians who have completed an accredited training course such as one approved by the National Institute for Occupational Safety and Health (NIOSH). The American Thoracic Society (ATS) is one source for recommendations on testing equipment and protocols.^{6,7} Baseline pulmonary function testing may be helpful in determining if there are any current respiratory conditions or decreased lung function. Periodic pulmonary function testing should be ordered at the discretion of the PLHCP who reviews the questionnaire.⁸ Longitudinal evaluation of each worker's spirometry results merits particular attention to identify if the pulmonary function is declining faster than would be expected due to normal aging.⁹ Spirola software, available free from NIOSH, can assist in this analysis.¹⁰

After review of the questionnaire and any other tests, such as a physical examination or spirometry test, the PLHCP should discuss the results and recommendations with the worker in a confidential setting and provide the worker with a written copy of results and recommendations, including any medical opinion regarding recommended limitations on exposure to diisocyanates (while observing medical privacy/confidentiality commitments).

WHAT FURTHER EVALUATION IS BENEFICIAL IF A WORKER'S PULMONARY FUNCTION WORSENS, SYMPTOMS DEVELOP OR SENSITIZATION IS SUSPECTED?

Since decreases in pulmonary function may be intermittent, the medical history and symptom questionnaire may reveal the first signs of adverse health effects. Symptoms that occur at or after work and get better when away from work, such as on vacations, are of particular concern. Whether reported during medical screening or in-between periodic exams, symptoms or significant lung function declines require further confirmatory assessment. There are a variety of other causes of work-related respiratory symptoms which may not be attributable to asthma. Respiratory symptoms have insufficient specificity for establishing a diagnosis of occupational asthma. Further medical evaluation may be necessary. If individuals are suspected to have occupational asthma, it is necessary to first objectively establish the diagnosis of asthma and then to establish that any symptoms are work-related.^{4,11,12} Referral should be made to a physician, such as a physician who is board certified/board eligible in Occupational Medicine or Pulmonary Medicine, with sufficient expertise to evaluate employees with possible diisocyanate-related health effects.

When a diagnosis of occupational or work-related asthma is made, it is important that the worker be removed from further potential exposure to diisocyanates.

SUMMARY

Diisocyanates can be used safely. Periodic medical screening and surveillance for workers who are potentially exposed to diisocyanates is a good occupational health practice. A diisocyanate medical surveillance program can identify workers with adverse health effects or symptoms, so that they can be medically removed from exposure to reduce the likelihood of chronic disability or death. Diisocyanate medical surveillance also provides an important contribution to an effective worksite health and safety program.

OTHER HELPFUL RESOURCES

OSHA's Webpage on Isocyanates (includes information on both monoisocyanates and diisocyanates):

<https://www.osha.gov/SLTC/isocyanates/>

OSHA Fact Sheet "Do You Have Work-Related Asthma? A Guide for You and Your Doctor":

<https://www.osha.gov/Publications/OSHA3707.pdf>

Bernstein DI, 2017. A Guide for Primary Care Physicians in Evaluating Diisocyanate Exposed Workers for Occupational Asthma (includes a sample screening questionnaire).

Health Effects of Diisocyanates: Guidance for Medical Personnel:

<https://polyurethane.americanchemistry.com/Resources-and-Documents/Health-Effects-of-Diisocyanates-Guidance-for-Medical-Personnel.pdf>

Guidance for Working with MDI and Polymeric MDI: Things You Should Know:

<https://polyurethane.americanchemistry.com/Resources-and-Documents/11364.pdf>

Guidance for Working with TDI: Things You Should Know:

<https://polyurethane.americanchemistry.com/Resources-and-Documents/3857.pdf>

Guidance for Working with Aliphatic Diisocyanates:

<https://adi.americanchemistry.com/Guidance-for-Working-with-ADIs.pdf>

REFERENCES

¹ Baur X, Sigsgaard T, Aasen TB et. al. Guidelines for the management of work-related asthma. *Eur Respir J*, 2012; 39:529 <http://erj.ersjournals.com/content/erj/39/3/529.full.pdf>

² Tarlo SM and Liss GM. Diisocyanate-induced asthma: Diagnosis, prognosis and effects of medical surveillance measures. *Appl Occup Environ Hygiene*, 2002; 17:902.

³ Wilken D, Baur X, Barbinova L et. al. What are the benefits of medical screening and surveillance? *Eur Respir J*, 2012; 21:105.

<http://err.ersjournals.com/content/errev/21/124/105.full.pdf>

⁴ Tarlo et al. 2008. *Diagnosis and Management of Work-Related Asthma*. ACCP Consensus Statement. *Chest*. 134:1S-41

⁵ Labrecque M, Malo JL, Alaoui KM et. al. Medical surveillance programme for diisocyanate exposure. *Occup Environ Med*, 2011; 68:302.

⁶ Redlich et al. 2013. *Am J Respi Crit Care Med*. *Official American Thoracic Society Technical Standards: Spirometry in the Occupational Setting*. 189: 984-994

⁷ Culver BH, Graham BL, Coates AL et. al. Recommendations for a Standardized Pulmonary Function Report- An Official American Thoracic Society Technical Statement. *Am J Respi Crit Care Med*, 2017; 196:1463. <https://www.atsjournals.org/doi/pdf/10.1164/rccm.201710-1981ST>

⁸ Kraw M, Tarlo SM. Isocyanate medical surveillance: Respiratory referrals from a foam manufacturing plant over a five-year period. *Am J Ind Med*, 1999; 35:87.

⁹ Townsend. 2006. JOEM. Evaluating Pulmonary Function Change Over Time in the Occupational Setting. 47: 1307-1316

¹⁰ NIOSH. 2016. DHHS (NIOSH) Publication No. 2016-117. *SPIROLA: Spirometry Longitudinal Data Analysis Software*

¹¹ Jolly AT, Klees JE, Pacheco KA, Guidotti TL, Kipen HM, Biggs JJ, Hyman HM, Bohnker BK, Thiese MS, Hegmann KT, Harber P. ACOEM Practice Guidelines: Work-related Asthma. *J Occup Environ Med* 2015; 57(10): e121-e129.

¹² A Guide for the Primary Care Physician in Evaluating Diisocyanate Exposed Workers for Occupational Asthma: <https://dii.americanchemistry.com/Primary-Care-Physician-Asthma.html>

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