

## Chemical/Dust Irritants and Lung Disease

Acute, high level exposure to chemicals or dusts that are irritants can cause lung disease with either immediate and/or long term adverse health effects. Table I summarizes acute effects, while Table II summarizes possible long term sequelae.

**Table I. Acute Effects of Chemical/Dust Irritants**

**Adult Respiratory Distress Syndrome, or Chemical Pneumonitis, or Pulmonary Edema**

Examples: Chlorine, oxides of nitrogen, ozone, smoke from fires, boot or tent water-proofing sprays (SENSOR News Vol. 19 (1) Winter/Spring 2007-2008)\*

**Bronchospasm, or Irritative Acute Bronchitis, or Upper Airway Irritation**

Examples: Ammonia, sulfur dioxide, smoke from fires

\*Copies of previous newsletters can be found at [www.oem.msu.edu](http://www.oem.msu.edu)

**Table II. Possible Long Term Sequelae after Acute Exposure to Chemical/Dust Irritants**

**Asthma – Reactive Airways Dysfunction Syndrome (RADS)**

Examples: Ammonia, chlorine

**Bronchiolitis Obliterans (SENSOR News, Vol. 18 (4), Fall 2007)\***

Examples: Oxides of nitrogen, diacetyl, Iraqi and Afghanistan war veterans

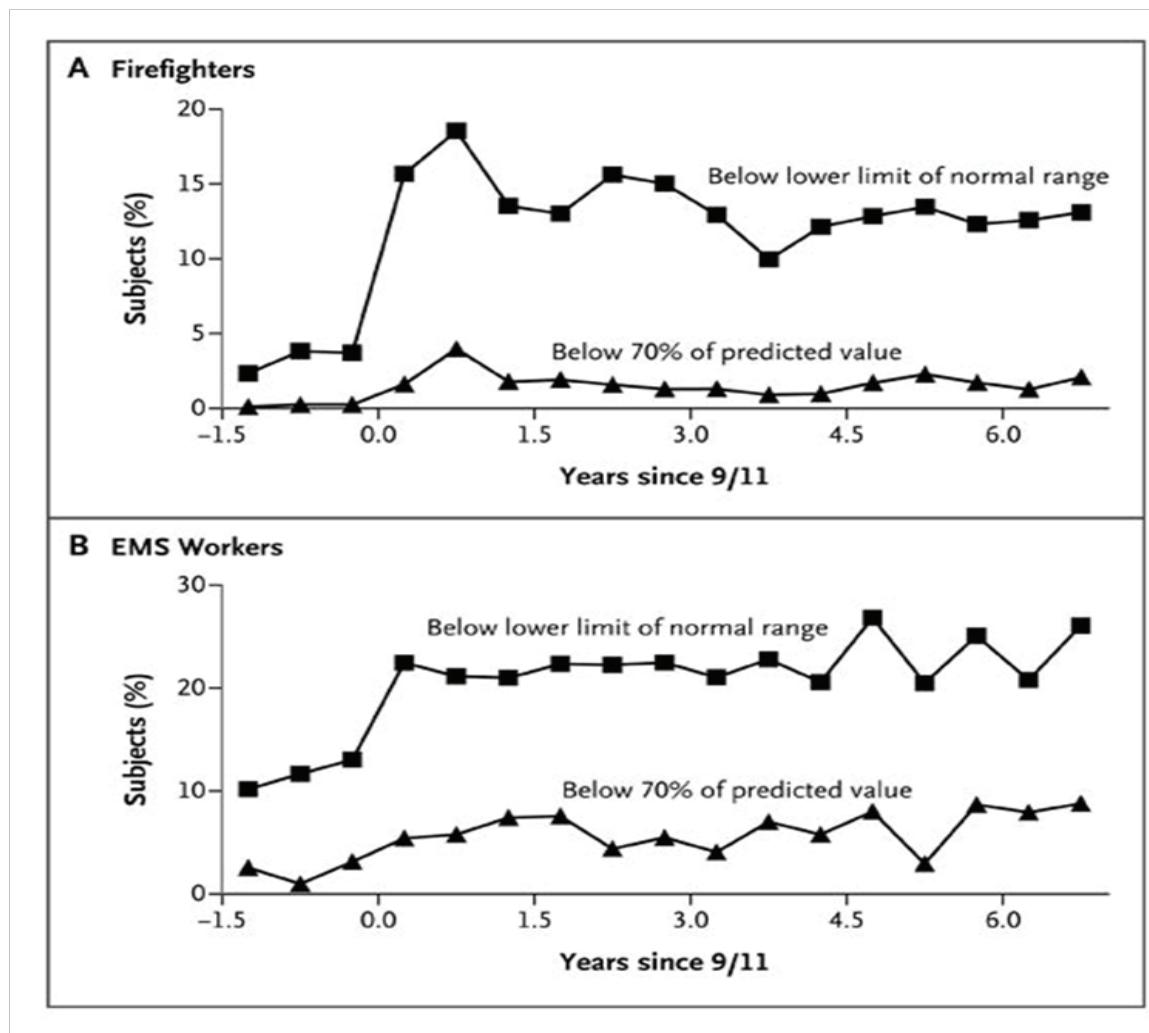
**Vocal Cord Dysfunction (SENSOR News Vol. 22 (1), Winter 2010-2011)\***

Examples: Ammonia, sulfuric acid

\*Copies of previous newsletters can be found at [www.oem.msu.edu](http://www.oem.msu.edu)

Adverse effects can occur after high level exposure to single substances as well as after intense exposure to a mixture of materials even when the levels of exposure to any single substance may not be particularly great, such as occurred after the destruction of the World Trade Center Towers. Long term follow up of New York firefighters and emergency medical technicians who had worked at the World Trade Center in the two week period after 9/11 showed a large drop in forced expiratory volume in one second on spirometry as compared to test results from the same individuals prior to 9/11 (Aldrich et al, 2010). This drop persisted over the next 7 years (Figure 1).

**Figure 1. Abnormal Lung Function in Firefighters and Emergency-Medical-Services (EMS) Personnel Who Had Never Smoked Who Worked at the World Trade Center Site during the First 2 Weeks after 9/11**



ALDRICH et al, 2010

Chronic exposure not just acute exposure to irritants may also be associated with respiratory disease. There have been recent reports of respiratory symptoms in soldiers who served in Iraq or Afghanistan. In a case series reported in 2011 in the New England Journal of Medicine, 38 soldiers who were unable to meet the army's 2 mile run fitness standard were found to have diffuse constrictive bronchiolitis on biopsy (King et al, 2011). There were 35 men and 3 women, aged 23 – 44.

***As always we are interested in receiving reports of occupational and environmental related respiratory disease. Dr. Kenneth Rosenman can provide diagnostic and management advice on individual patients. Our toll-free number is 1-800-446-7805.***

Table III shows the results of their evaluation. Abnormalities on radiographs or pulmonary function testing were relatively minor but greater than one would expect in relatively young active duty service people who had previously passed vigorous physical fitness standards. Of the 12 who had a methacholine challenge, only one was positive. The presumed etiology were exposures from trash burn pits, incinerated waste, sulfur mine fire and/or sand storms. This study was critiqued in follow up letters to the journal that these soldiers had relatively minor symptoms when typically constrictive bronchiolitis is a progressive disease, that the authors did not evaluate the soldiers for asthma or vocal cord dysfunction and the reliability of the pathologist's interpretation of the biopsies. A study published at the same time reported more symptoms and more spirometric abnormalities in Iraq/Afghanistan veterans versus troops deployed elsewhere (14.5% vs. 1.8%, p < 0.001) (Szema et al, 2011). Ongoing studies of respiratory status in Iraq/Afghanistan veterans will hopefully better characterize risk and findings to improve diagnosis and management in this group.

Clinicians should be aware of the potential for irritants used both in the workplace and at home to cause both acute and chronic respiratory disease. There is the potential for exposure across all occupations. However, certain occupations such as construction workers, firefighters, janitors, housekeepers and others who use cleaning agents, farmers, sewage and water work employees, and welders appear to be more frequently affected. One of the most common types of exposure related visits due to chemical irritants seen in patients presenting to emergency departments in Michigan are from exposure to cleaning agents in homes including the mixing of bleach and acid or bleach and ammonia, which generates chlorine and chloramines, respectively.

## References:

Aldrich TK, Gustave J, Hall CB, Cohen HW, Webber MP, Zeig-Owens R, Cosenza K, Christodoulou V, Glass L, Al-Othman F, Weiden MD, Kelly KJ, Prezant DJ. Lung Function in Rescue Workers at the World Trade Center after 7 years. *New Eng J Med* 2010; 362:1263-1272.

King MS, Eisenberg R, Newman JH, Tolle JJ, Harell FE, Nian H, Ninan M, Lambright ES, Sheller JR, Johnson JE, Miller RF. Constrictive Bronchiolitis in Soldiers Returning from Iraq and Afghanistan. *New Eng J Med* 2011; 365:222-230.

Szema AM, Salihi W, Savary K, Chen JJ. Respiratory Symptoms Necessitating Spirometry Among Soldiers with Iraq/Afghanistan War Lung Injury. *J Occup Environ Med* 2011; 53:961-965.

**Table III. Exposure History and Evaluation Summary for 38 Soldiers with Constrictive Bronchiolitis**

Variable	Value No.(%)
Smoking status	
Current	6 (16)
Former	7 (18)
Never	25 (66)
Exposure history	
Sulfur-mine fire in 2003	28 (74)
Incinerated solid waste	24 (63)
Incinerated human waste	18 (47)
Dust storms	33 (87)
Combat smoke	17 (45)
Chest radiography	
Normal	37 (97)
Lingular nodule	1 (3)
Computed tomography	
Normal	25 (68)
Mild air trapping	6 (16)
Multiple nodules <1 cm	2 (5)
Solitary nodule <1 cm	1 (3)
Pleural thickening	1 (3)
Bibasilar scarring	1 (3)
Apical bullae	1 (3)
Pulmonary-function testing	
Normal	13 (34)
Normal with low carbon monoxide diffusing capacity	19 (50)
Obstructive	2 (5)
Restrictive	3 (8)
Mixed obstructive and restrictive	1 (3)

(King et al, 2011)

\*P<sub>roject</sub>  
S<sub>E.N.S.O.R.</sub> *News*

**Michigan State University  
College of Human Medicine  
117 West Fee Hall  
East Lansing, MI 48824-1316  
Phone (517) 353-1846**

**Address service requested.**

In this issue: v23n2: Chemical/Dust Irritants and Lung Disease

\*P<sub>S</sub> Remember to report all cases of occupational disease!

Printed on recycled paper.

The Project SENSOR News is published quarterly by Michigan State University-College of Human Medicine with funding from the National Institute for Occupational Safety and Health and is available at no cost. Suggestions and comments are welcome.  
117 West Fee Hall  
MSU-CHM  
(517) 353-1846  
James Bliesman, M.D., M.P.H.  
Wayne State University  
Gail Cook-Higham, M.D.  
President, Michigan Allergy and  
Asthma Society  
Michael Harbut, M.D., M.P.H.  
President, Michigan Environmental  
Center for Occupational Medicine  
University of Michigan  
Thomas G. Robbins, M.D., M.P.H.  
University of Michigan  
Saima Siddiqui, M.D., Ph.D.  
Division of Occupational Medicine  
President, Michigan Occupational  
Environmental Medical Association  
President, Michigan Thoracic Society  
Amyan Souabni, M.D.

**Advisory Board**

The Project SENSOR News is published quarterly by Michigan State University-College of Human Medicine with funding from the National Institute for Occupational Safety and Health and is available at no cost. Suggestions and comments are welcome.  
117 West Fee Hall  
MSU-CHM  
(517) 353-1846  
E-mail: [REPORT@msu.edu](mailto:REPORT@msu.edu)  
www.chem.msu.edu  
E-Mail: [www.chem.msu.edu](mailto:www.chem.msu.edu)  
Fax: [\(517\)432-3606](tel:(517)432-3606)  
Phone: [1-800-446-7805](tel:1-800-446-7805)  
Services Division  
Management and Technical  
Administration (MTOSHA)  
Michigan Occupational Safety &  
Health Administration  
Project SENSOR Office Staff:  
Melissa Miller-May, M.S., Ph.D.  
Project SENSOR Coordinator  
Mary Jo Reilly, M.S.  
Project SENSOR, Co-Director  
Kemeth D. Rossmann, M.D.  
Professor of Medicine  
James Bliesman, M.D., M.P.H.  
Wayne State University  
Gail Cook-Higham, M.D.  
President, Michigan Allergy and  
Asthma Society  
Michael Harbut, M.D., M.P.H.  
President, Michigan Environmental  
Center for Occupational Medicine  
University of Michigan  
Thomas G. Robbins, M.D., M.P.H.  
University of Michigan  
Saima Siddiqui, M.D., Ph.D.  
Division of Occupational Medicine  
President, Michigan Occupational  
Environmental Medical Association  
President, Michigan Thoracic Society  
Amyan Souabni, M.D.

Project SENSOR Staff  
At the Michigan Occupational  
Safety & Health Administration  
(MTOSHA)  
Douglas J. Kalinowski, M.S., C.I.H.,  
Co-Director  
Director MTOSHA, Project SENSOR,  
Douglas J. Kalinowski, M.S., C.I.H.,  
Project SENSOR, Co-Director  
Mary Jo Reilly, M.S.  
Project SENSOR Coordinator  
Melissa Miller-May, M.S., Ph.D.  
Tracey Carey  
Ruth Vandewall  
Patient Interviewers:  
Andrea Babat  
Melinda Maille  
Saima Siddiqui, M.D., Ph.D.  
School of Public Health  
University of Michigan  
Thomas G. Robbins, M.D., M.P.H.  
University of Michigan  
Saima Siddiqui, M.D., Ph.D.  
Division of Occupational Medicine  
President, Michigan Occupational  
Environmental Medical Association  
President, Michigan Thoracic Society  
Amyan Souabni, M.D.

Reporting can be done by:  
Web: [www.chem.msu.edu](http://www.chem.msu.edu)  
E-Mail: [REPORT@msu.edu](mailto:REPORT@msu.edu)  
Fax: [\(517\)432-3606](tel:(517)432-3606)  
Phone: [1-800-446-7805](tel:1-800-446-7805)  
Services Division  
Management and Technical  
Administration (MTOSHA)  
Michigan Occupational Safety &  
Health Administration  
Project SENSOR Office Staff:  
Melissa Miller-May, M.S., Ph.D.  
Project SENSOR Coordinator  
Mary Jo Reilly, M.S.  
Project SENSOR, Co-Director  
Kemeth D. Rossmann, M.D.  
Professor of Medicine  
James Bliesman, M.D., M.P.H.  
Wayne State University  
Gail Cook-Higham, M.D.  
President, Michigan Allergy and  
Asthma Society  
Michael Harbut, M.D., M.P.H.  
President, Michigan Environmental  
Center for Occupational Medicine  
University of Michigan  
Thomas G. Robbins, M.D., M.P.H.  
University of Michigan  
Saima Siddiqui, M.D., Ph.D.  
Division of Occupational Medicine  
President, Michigan Occupational  
Environmental Medical Association  
President, Michigan Thoracic Society  
Amyan Souabni, M.D.

1-800-446-7805

Or

calling (517) 322-1817

Reporting forms can be obtained by

Lansing, MI 48909-8149

P.O. Box 30649

Services Division

MTOSHA

Michigan Occupational Safety &

Health Administration

Management and Technical

Administration (MTOSHA)

Michigan Occupational Safety &

Health Administration

Project SENSOR Office Staff:

Melissa Miller-May, M.S., Ph.D.

Project SENSOR Coordinator

Mary Jo Reilly, M.S.

Project SENSOR, Co-Director

Kemeth D. Rossmann, M.D.

Professor of Medicine

James Bliesman, M.D., M.P.H.

Wayne State University

Gail Cook-Higham, M.D.

President, Michigan Allergy and

Asthma Society

Michael Harbut, M.D., M.P.H.

President, Michigan Environmental

Center for Occupational Medicine

University of Michigan

Thomas G. Robbins, M.D., M.P.H.

University of Michigan