

ISOCYANATES

Exposure to isocyanates can cause sensitization of the respiratory tract, which causes greatly heightened future respiratory symptoms with lower level exposure.¹ Isocyanates are potent lung sensitizers.¹ Nonspecific long-standing reactive airway disease (with reactivity and symptoms induced by future low dose irritant exposure) is also induced by isocyanates.¹⁻³ Even brief exposures to isocyanates can cause these changes.¹ Asthma was induced in 30% of workers exposed to one third of a part of isocyanate to 1 trillion parts of air.⁴ Further deterioration in symptoms can occur after cessation of exposure,⁵ and persistence of serious respiratory symptoms for years is not uncommon.^{6,7} Higher exposures can cause lung scarring.⁸

Isocyanate chemicals stimulate the brain vanilloid receptor.⁹ This receptor activates the NMDA receptor,¹⁰ which then increases peroxynitrite and sets in motion neural sensitization. Vanilloid stimulation also increases release of immune substance P.¹¹ Increased substance P is involved in the mechanism of reactive airway disease.¹²

Isocyanates are used in polyurethane foams, coatings and adhesives.¹³ Isocyanates can be released for weeks after coating and other isocyanate product application.¹³ Heating, grinding, cutting, and sanding such products can release isocyanates.¹³

Sensitization can occur from skin as well as breathing exposure.¹³

Serial testing of isocyanate workers who went on to develop isocyanate induced asthma/chronic respiratory inflammation found that isocyanate IgE testing was not a sensitive method of diagnosis.¹⁴ IgE antibodies to isocyanates were found in only a minority of workers diagnosed as having developed isocyanate asthma.^{6,14-16} IgE isocyanate antibodies were more likely to be found in those tested less than 30 days from last exposure and very unlikely to be found in testing more than 6 months after last exposure.¹⁵ IgG antibodies are also not useful in diagnosis.⁶ Methacholine challenge was not an adequate or reliable diagnostic tool for isocyanate lung disease.¹⁷

Long persisting brain effects can persist after exposure has stopped.¹⁸ Symptoms include headaches, forgetfulness, impaired concentration, irritability.¹⁸ Neurocognitive testing documents reduction in concentration, learning ability, and information processing.¹⁸ Persisting brain and neurologic effects have also been documented from significant isocyanate vapor/gas exposure.¹⁹

POLYURETHANE FOAM WITH ISOCYANATES

Isocyanates can be linked chemically to form polyurethane foams. These foams can also contain other toxic chemicals: fire retardants, surfactants, and catalysts such as tertiary amines or organotin compounds.²⁰

A detailed literature review of numerous scientific published studies was done to determine exposures which occur with combustion/burning of polyurethane foams. Carbon monoxide was typical of a toxic gas released.²⁰ Dozens of other chemicals were found, the vast majority being respiratory irritants and many others were also neurotoxic.²⁰ Burning spray polyurethane foam can release toxic and irritating gases including isocyanates, carbon monoxide, nitrogen oxides, hydrogen cyanide and other compounds.²¹ Chronic exposure to isocyanate/polyurethane foam can cause chronic effects at low levels (0.02 ppm).²²

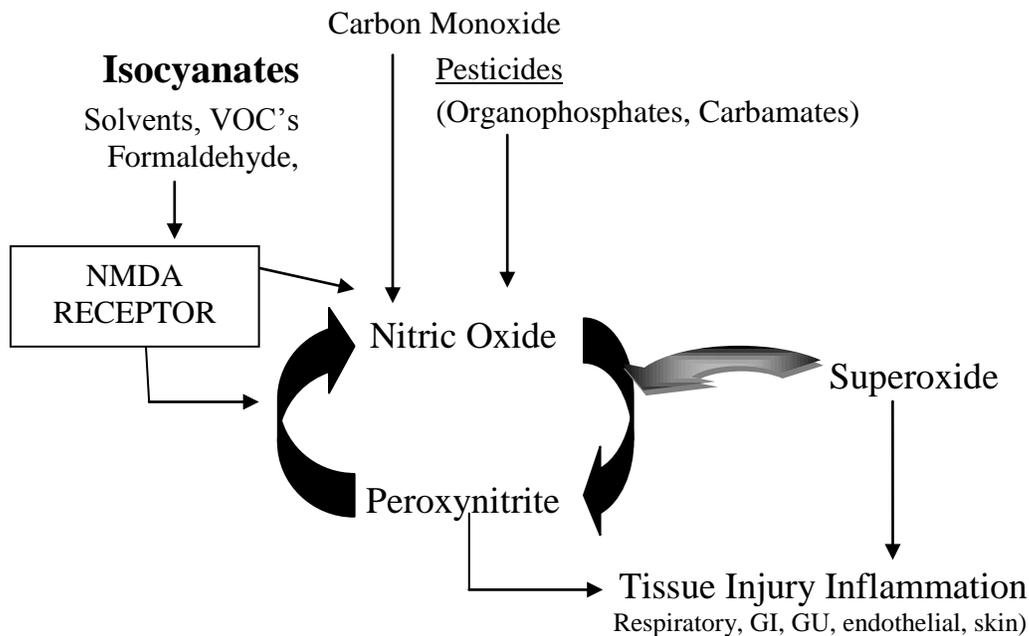
Welders exposed to isocyanates in fumes from heated polyurethane foam can develop multiple health symptoms and numerous immune changes in cellular immunity and lymphocyte and white blood cell

changes.²³ Respiratory inflammation and immune inflammation markers have been documented in workers heating polyurethane.²⁴

Symptoms in isocyanate foam workers include shortness of breath, cough, chest tightness, aching muscles and joints.²⁵

Spray foam insulation in homes can lead to chronic respiratory effects²⁶ for home residents, due to sensitizing isocyanates²⁷ and toxic organophosphorus flame retardants.²⁸ The levels of organophosphorus from spray foam found in house dust was a predictor of chronic asthma and also rhinitis.²⁸ Exposure to spray foam insulation in confined/less ventilated areas also creates excess exposure^{29,30} and onset of asthma.³⁰ Persisting respiratory effects from spray foam has forced residents to have to leave their home, as remediation removal did not resolve the problem once respiratory effects became chronic.²⁷

Because polyurethane foams are often more flammable than more natural products, flame retardants are typically added. These include TCPP, which can cause lung injury, headache, nausea, dizziness and other brain effects.



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