

Pollution of isocyanates developing in environmental atmosphere in Japan

N.P.O. Protection from the air pollution by volatile organic compounds

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Inhalation or skin contact to isocyanates, polyurethane monomer, can sensitize and strongly affect human by even if their concentration is at very low level under ppm. Isocyanate has been well known as one of agents which cause asthma and hypersensitivity pneumonitis, and the health impairment caused by isocyanate has been observed only at urethane factories and occupational sites using isocyanates. That is, isocyanate health impairment has been strictly categorized only into one of occupational disorders.

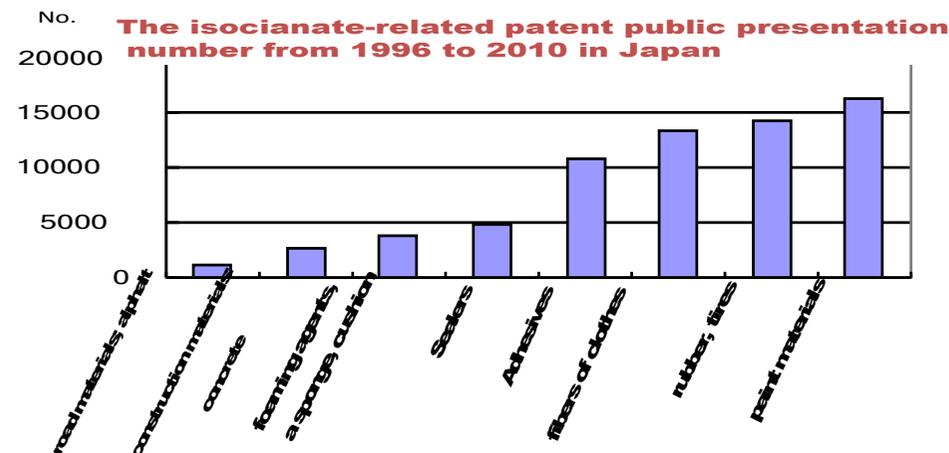
Urethane-related technology has made rapid progress during the 1/4th century of these. Over 65,000 patents related with isocyanates in Japan have been submitted from 1993 to 2010 by the report of Japan Patent Office. Although not all of them were put in practical use, of course, it can guess that the directions for isocyanate and urethane have rapidly changed these 20 years. Such every forms as monomer, prepolymer, and suspending particles of them are toxic. A lot of kinds of isocyanates species have been utilized for so many usages and their contamination have widely spread not only into manufacture factories but into residential area, such as for building houses, road surface, furniture, and so on. We should consider that the health impairment caused by isocyanates has already spread from the labor environment to our living environment.

In Japan, those who suffer from irritable symptoms such as sudden cough, short of breath, skin eruption have broken out around several refuse disposal places and various kinds of factories. In Tokyo's Sugunami Ward in 1996, more than 80 residents living near a year-old waste relay station complained of difficulty breathing and numbness in limbs, and a few have been hospitalized. The Tokyo Government insists that there is no obvious link between the relay station and what has become known as "Sugunami disease." The outbreak of resemble patients as Sugunami Ward has occurred near refuse disposal places. Their symptoms bear a strong resemblance to those observed as multiple chemical sensitivity. We suspect that those mass outbreaks would be the health impairment caused by isocyanates.

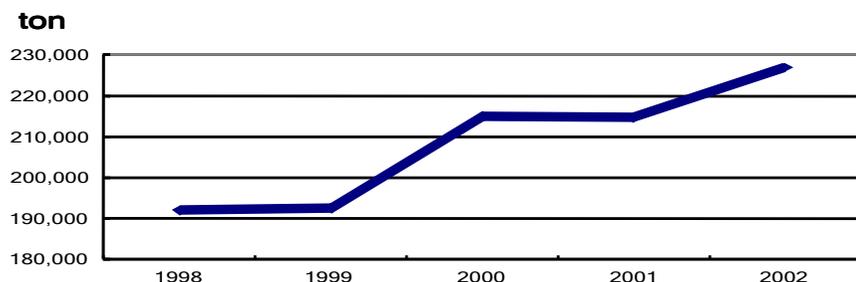
The effects of isocyanates on human health have been investigated by a lot of researchers in several decades. It becomes as a result, isocyanates are harmful to a human body, and clear that it is a compound which should be kept from touching. It is so difficult, however, to monitor the concentration of isocyanates in environment. Specific analytical technology would apply to those researches on their behavior in environment and being body. Analytical investigation of isocyanates in environment would prevent pollution-related illness caused by their spreading usage.

Background

There is potential for rapid growth of urethane-related technology, manufacturing and consumer products in Japan. The Japan Patent Office has reported that over 65,000 patents have been submitted from 1993 to 2010. Given the expected rapid growth of isocyanates in both consumer and occupational settings including waste near plants that produce or manufacturer products with isocyanates there is the need to enhance monitoring of isocyanates exposure and assess potential health effects.



TDI product in Japan



Purpose

The usage of isocyanates has grown dramatically in Japan in the last two decades. It is hypothesized that more thorough environmental monitoring for isocyanates will enable identification of sources of pollution and enable corrective action to reduce exposures and exposure-related illness.

Methods or Proposed Methods

It is proposed that environmental monitoring be conducted in environments where health effects are observed that are consistent with isocyanate exposure.

Findings or Proposed Data Collection

In Tokyo's Sugunami Ward in 1996, more than 80 residents living near a year-old waste relay station complained of difficulty breathing and numbness in limbs, and a few have been hospitalized.

There was insufficient environmental monitoring to determine the cause of these illnesses or if they could be associated with isocyanate exposure.

The Suginami Waste Transship Plant

From 1996 to 2009

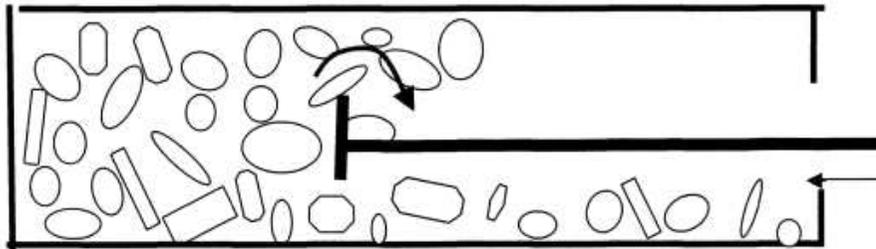
The scrap disposal plant made for the purpose of the capacitance decrease of mainly plastic waste.

Total work / one day : 10t/container x 20containers = 200t

Garbages in a container: 1t/pile x 10piles = 10 t

Container size: 2 m (W) x 2 m(H) x 4.8 m(L)

Press load : 55 ton; Mean velocity: 0.5m/s; Stroke: 4.8m



Numbers of those who suffer from several symptoms around the waste facility in 1996

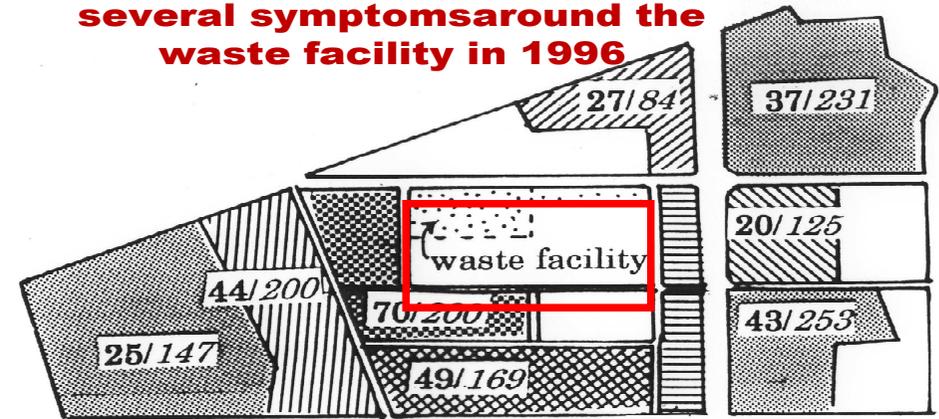
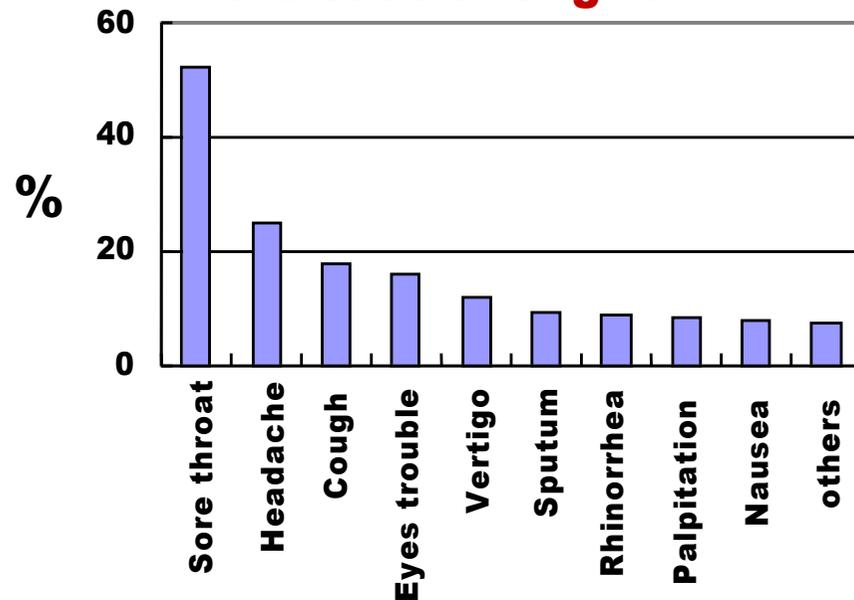


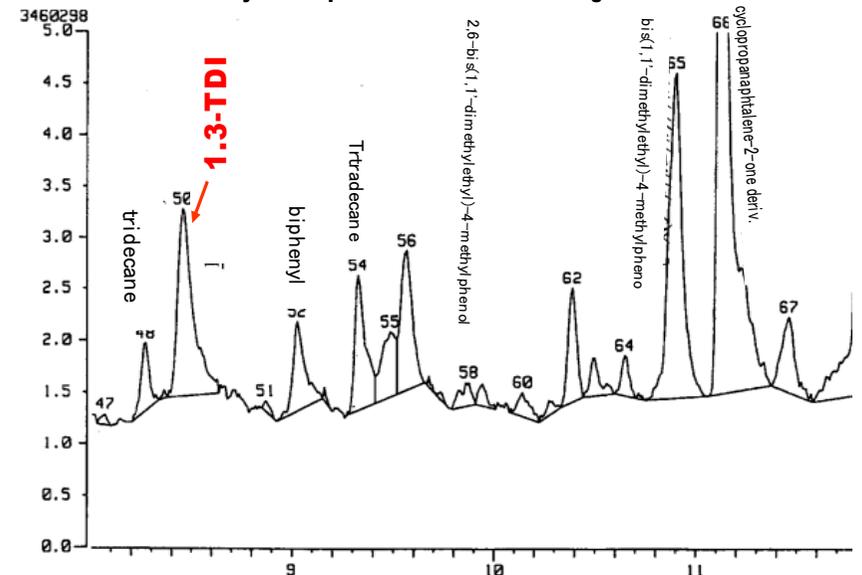
Fig.3 Distribution of physical damaged residents (disorder persons/responses).

Percentages of suffering symptoms in the case of Suginami

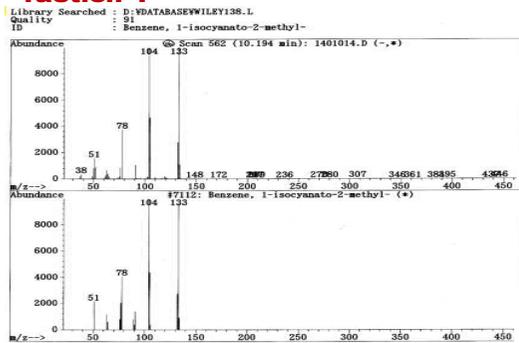


Analysis using GC-MS in the atmosphere of a residential section around the Suginami waste facility a 200-meter point on the south from the facility. Jan. 30th 1997

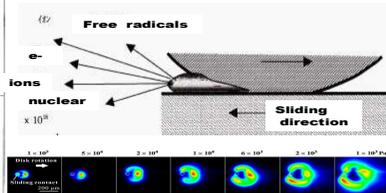
SHIMADZU TECHNO. RESEARCH Co. measures by commission of Environmental Bureau of the Tokyo Metropolitan Government and Suginami-ward



Methylbenzene isocyanate, another name toluene isocyanate, was also detected from near the facility with GC-MS. Since this is a compound which is not usually circulating, it is presumed to be the isocyanate which arose by mechano-chemical reaction*.

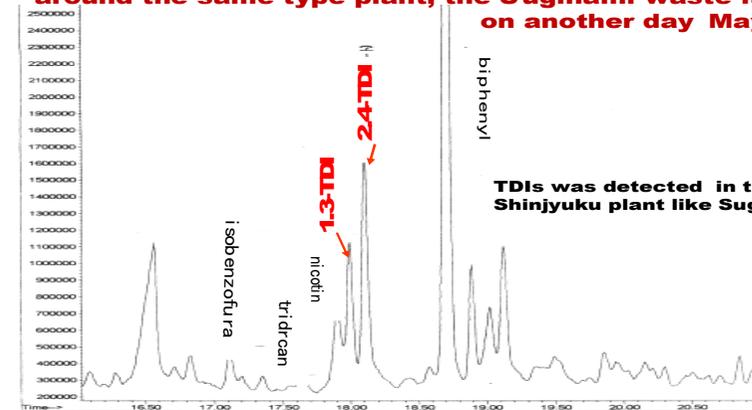


***Reference Verification of the Decomposition of Perfluoropolyether Flueuid to Tribonitroplazuma Keiji Nakayama and MD.Mirza: Tribo. Trans., 49 17-25p, 2006.**



Generating of the minute plasma in friction; it changes by climate conditions, such as atmospheric pressure.

Analysis using GC-MS in the atmosphere of a residential section around the same type plant, the Sugunami waste facility on another day May. 5th 1998

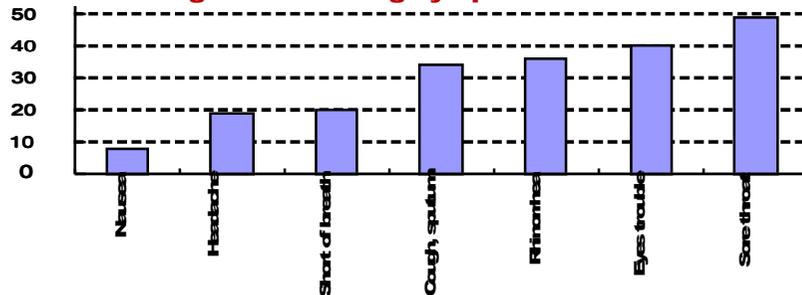


TDIs was detected in the Shinjuku plant like Sugunami one.

Garbage incineration and pulverization facilities

The same health disturbance as Sugunami occurred around within 2 km of the industrial waste facility newly made in Noda-city, Chiba in April, 2017. This facility has both incineration and pulverization plants. Which plant discharged toxic substances was examined.

Percentages of suffering symptoms in case of Noda-city



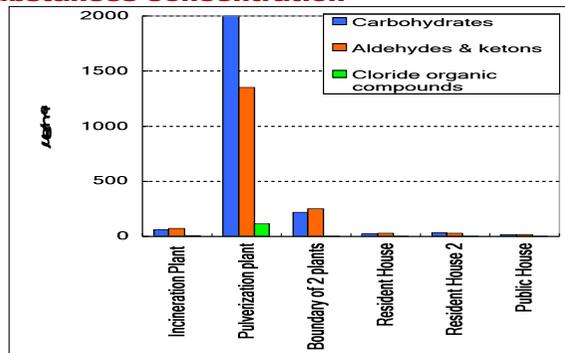
Chemical substances by which discharge was checked from the facility

Material group	Number of species	Detected compounds
Nitrogen containing organic compounds,	7	Methyl isonitroile, 2-Hydroxy - 2-methylpropane nitrile, Methoxyacetonitrile, Acetonitrile, Acrylonitrile, o-Nitrophenole, n,n-Dimethyl-o-hidroxyamine
Halogenide organic compounds,	15	1,1-Dichloro-1-fluoroethane, 1,3,5-Trichlorobenzene, 1,3-Dichloropropene, 1,3-Dichlorobenzene, chlorobenzene, Trichloromonoffluoromethane, Vinyl chloride
Ketone & Ketene,	8	Dimethylketene, MIBK, Acetone, MEK, 1,3-Butadiene, 1,4-Dioxane, tected2-Butanone, 3-Heptanone
Aldehyde,	8	Formaldehyde, Aetoaldehyde, Etylhexanal, Heptanal, Octanal, Nonanal, Decanal, Dodecanal
Alcohol,	4	Isopropanol, .Ethanol, etc.
Silicone,	3	Tetramethoxysilane, etc.
Hydrocarbon,	53	Toluene, Benzene, etc.

Detection chemical substances concentration around the facility

Noda A crush institution is high concentration from a waste incineration plant. It is high concentration from under an incineration exhaust gas also in a site boundary.

It can guess that a reactant living thing occurs by mechano-chemical reaction in the mechanical treatment of waste from this.



Conclusions

Although isocyanate consumption in Japan is high compared to other countries, there is insufficient monitoring to evaluate environmental levels and potential exposures. We are eager to conduct wider personal monitoring to evaluate environmental exposures and determine their association with observed health effects. This monitoring would enable reduction of exposures and associated health effects related to the expanding use of isocyanates.