

The term "Dioxin" has recently become a household word, as had asbestos, PCB's and DDT during the last decade. Actually, "Dioxin" is a term commonly used as the abbreviation for 2,3,7,8-tetrachlorodibenzo-p-dioxin, a polycyclic chlorinated compound. Dioxin is an unwanted contaminant formed during several chemical processes (such as 2,4,5-T production) and also during incineration of industrial and municipal wastes.

Here at the Nitro Plant 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), a herbicide, was produced from 1948 to 1969 in Buildings 41, 34, 51 and finally 92, which was demolished in 1972. On March 8, 1949 a violent reaction and decomposition occurred which released vapors and a tarry residue into the atmosphere. 121 personnel developed chloracne, a skin condition resembling but usually more severe than adolescent acne, who were either exposed during the release or during cleanup operations. It is believed that dioxin was the chemical that caused the chloracne.

There have been several other incidences of human dioxin exposure in recent years. Agent Orange, a herbicide used in Vietnam, was a 50:50 mixture of 2,4-D and 2,4,5-T with a dioxin contamination level estimated at 2 ppm. Studies to date have shown no differences in health status between those soldiers who were exposed to Agent Orange and a control group of soldiers who were not. In July of 1976, dioxin was released from a trichlorophenol plant in Seveso, Italy when a safety disc on a reactor ruptured. An area of about one square mile was contaminated with the settling reactor contents, potentially exposing upwards of 37,000 people. There have been 134 confirmed chloracne cases as a result of this release. Studies on the exposed groups continue, but to date there have been no increases in deaths, cancers or other health problems when compared to a non-exposed Italian control group.

Several incidences of dioxin contamination have also occurred in Missouri. In 1971, waste oil contaminated with dioxin was sprayed on horse arenas to keep dust down. Over 65 horses and other animals died and one girl developed an inflamed and bleeding bladder, which returned to normal after her exposure was stopped. The latest incident was in Times Beach, Missouri when contaminated soil from similar oil spraying activities on dirt roads and in landfill soil was found to contain various levels of dioxin. EPA was put under pressure to alleviate the problem, and because the human health effects besides chloracne are not known, they decided to buy out the residents and evacuate the town.

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There were no diagnosed cases of chloracne, which is considered to be the most sensitive indicator (clinical marker) of human exposure; however, the evacuated people were emotionally affected through national media coverage and simultaneous flooding of the Merrimac River.

As stated above, chloracne is the predominate health effect diagnosed in humans, and if absent, other adverse health effects are not likely. Following occupational exposures, symptoms have been reported of fatigue, nerve response changes and liver toxicity. Follow-up surveys have shown that these effects are reversible, except for possible permanent scarring from severe chloracne cases.

Extensive dioxin studies have been performed on a variety of animals with a wide range of results found.

Actually, animal studies are the reason for much of the concern and confusion about the toxicity of dioxin. For example, a very minute amount of dioxin can kill the guinea pig, whereas 5,000 times more is necessary to kill a hamster (however, still a small amount). Also, the cause of death or toxic effect often differs between animals making it difficult to anticipate what amount and what effect dioxin will have on humans.

Another important consideration when discussing dioxin is the route of exposure. In animal studies, the dioxin is usually administered either in food or injected directly into the body. Dioxin is a solid at room temperature so therefore doesn't evaporate and become an airborne vapor. Dioxin is essentially non-soluble in water and tends to attach firmly to soil particles. Sunlight has been shown to be effective at breaking down this chemical quickly, which diminishes potential health concerns on plants, upper layer of ground and equipment. But because dioxin is tightly bound to soil and does not dissolve in water, it tends to remain in the soil subsurface for a long period of time. The soil would have to be disturbed and either eaten or rubbed on the skin to be a potential health concern.

Studies continue on dioxin and it will be some time before the accurate toxic level and effects on man are known. It will remain an emotional issue probably for awhile and will continue as a national media story.

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1. What is dioxin?

The term "dioxin" has recently become a household word, as had asbestos, PCB's and DDT during the last decade. Actually, "dioxin" is a term commonly used as the abbreviation for 2,3,7,8-tetrachlorodibenzo-p-dioxin, a polycyclic chlorinated compound. Dioxin is an unwanted contaminant formed during several chemical processes (such as 2,4,5-T production) and also during incineration of industrial and municipal wastes.

2. How did we get dioxin at the Nitro Plant?

Here at Nitro 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), a herbicide, and its related intermediates were produced from 1948 to 1969 in Buildings 34, 41, 51, and finally 92, which was demolished in 1972. In March 1949, a violent reaction and decomposition occurred which released vapors and a tarry residue into the atmosphere. It is now believed that dioxin was formed during this "explosion" and was also present in trace amounts in the 2,4,5-T product.

3. What is a part per billion?

Dioxin has been found in the low part per billion (ppb) range in the soil, from none detected to 137 ppb. A ppb is a very small amount; the following examples all represent one ppb - one inch in 16,000 miles, one cent in \$10,000,000 (ten million dollars) or one thousandths of an ounce of salt in 62,500 pounds of sugar. Analytical techniques continue to analyze lower and lower levels of dioxin on down into the parts per trillion (ppt) range. One ppb equals 1,000 ppt.

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4. What were the results of the EPA's recent testing for dioxin?

5. Are we being exposed to dioxin now?

Exposure to any chemical can occur through three routes; inhalation, ingestion and skin absorption. Dioxin is a solid at room temperature and essentially has no vapor pressure (vapors are not given off). Since dioxin binds so tightly to soil, inhalation would be limited to breathing in contaminated soil which is unlikely because the soil is under several inches of gravel. Skin contact with or ingestion of contaminated soil is similarly unlikely. Remember that due to the very low levels of dioxin, an awfully lot of dirt would have to be inhaled or contacted with before any health hazard would be expected.

6. What are the health effects of exposure to dioxin?

Chloracne is the predominate health effect diagnoses in humans, and if absent, other adverse health effects are not likely. Following occupational exposures, symptoms have been reported of fatigue, nerve response changes and liver toxicity. Follow-up surveys have shown that these effects are reversible, except for possible permanent scarring from severe chloracne cases.

Extensive dioxin studies have been performed on a variety of animals with a wide range of results found.

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Actually, animal studies are the reason for much of the concern and confusion about the toxicity of dioxin. For example, a very minute amount of dioxin can kill the guinea pig, whereas 5,000 times more is necessary to kill a hamster (however, still a small amount). Also, the cause of death or toxic effect often differs between animals making it difficult to anticipate what amount and what effect dioxin will have on humans.

7. I recently heard of a study that linked dioxin to soft tissue cancer. Is that true?

Soft tissue sarcoma is a rare form of cancer that attacks the soft tissues; muscle, fat, nerves or connective fibers. A study by The National Institute of Occupational Safety & Health (NIOSH) that has not been published yet has suggested that soft tissue sarcomas may be a result of dioxin exposure. Due to incomplete data and the small workforce involved here at Nitro, it is not statistically possible to show any differences between us and the general population. NIOSH is performing similar studies with other work populations to obtain a larger number of employees for statistical evaluation. Little is known about soft tissue sarcomas because they are so rare, but because of the different tissues involved, more than one cause is suggested.

8. How will dioxin at the Nitro Plant affect my job?

Now that dioxin has been found at very low levels in the soil, only operations that require excavation will require changes. As stated in Question 5, good work practices warrant the use of some types of personal protective equipment to minimize skin contact and dust inhalation during ground breaking. An excavation procedure is being prepared to standardize protective equipment.

9. Is there any danger to the community from dioxin at the Nitro Plant?

Dioxin binds strongly to soils, especially clay, and is not soluble in water. Although it remains fairly long in the soil, sunlight has been shown to rapidly degrade it. For these reasons, the community is at no risk as the dioxin will stay in the locations where it was buried.

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10. I've heard of dioxin at Times Beach, Missouri; Midland, Michigan; and Seveso, Italy. What happened in those places?

There have been several incidences of dioxin contamination in recent years and will undoubtedly be more.

In July of 1976, dioxin was released from a trichlorophenol plant in Seveso, Italy when a safety disc on a reactor ruptured. An area of about one square mile was contaminated with the settling reactor contents, potentially exposing upwards of 37,000 people. There have been 134 confirmed chloracne cases as a result of this release. Studies on the exposed groups continue, but to date there have been no increases in deaths, cancers or other health problems when compared to a non-exposed Italian control group.

Several incidences of dioxin contamination have also occurred in Missouri. In 1971, waste oil contaminated with dioxin was sprayed on horse arenas to keep dust down. Over 65 horses and other animals died and one girl developed an inflamed and bleeding bladder, which returned to normal after her exposure was stopped. The latest incident was in Times Beach, Missouri when contaminated soil from similar oil spraying activities on dirt roads and in landfill soil was found to contain various levels of dioxin. EPA was put under pressure to alleviate the problem, and because the human health effects besides chloracne are not known, they decided to buy out the residents and evacuate the town.

In Midland, Michigan the major concern is that fish have been found with low levels of dioxin and the exact source has not been identified. A suspected source of contamination are the industrial and municipal incinerators in the area.

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