NITROGEN DIOXIDE (NO2)

Physical Characteristics and Sources

In its pure state, nitrogen dioxide is a reddish-orange-brown gas with a characteristic pungent odor. It is corrosive and a strong oxidizing agent. Approximately 78% of air is composed of nitrogen and about 21% is oxygen. During high temperature combustion the nitrogen in the air reacts with oxygen to produce oxides of nitrogen (NOx). Most of the NOx created during this process is nitric oxide (NO). Nitrogen dioxide (NO2) is formed as NO combines with oxygen in the air (oxidation). This N02 is the predecessor of gaseous nitric acid and nitrate aerosols, and is the oxide of nitrogen which has the biggest health impact. The relative amounts of NOx, NO, N02, nitric acid, and nitrate aerosols that exist in the ambient air are neither constant nor directly related. The exact reactions that are going on in the ambient air are not very well known.

The major sources of N02 are combustion associated processes, such as, motor vehicles, power plants, space heating, aircraft, as well as any high temperature combustion process used in industrial work.

Health and Welfare Effects

Effects of NOx on man's environment, personal comfort, and well being include impacts on vegetation, materials, visibility, rates of acidic deposition and symptomatic effects on humans. Table 4-1 contains a summary of nitrogen dioxide health effects experienced at various exposure levels. Nitrate aerosols have been consistently linked to a major part of the Wasatch Front's urban visibility problems. These nitrates resulting from gaseous oxides of nitrogen emissions not only have direct health consequences but also, indirectly affect visibility problems.

Standards

The current standard for N02 is an annual arithmetic mean (average) value not to exceed .053 ppm. This means that for a violation to occur, N02 concentrations would have to be high enough that the average over the entire year would have to exceed .053 ppm.

In 1985, the N02 standard was reviewed and a short-term standard was considered. However, it was not felt that there was sufficient health effects evidenced to warrant adoption of the proposed standard at that time.

Monitoring

The monitoring effort for N02 in Utah has been centered in areas where there is a reasonable expectation that N02 concentrations could exist. These are generally urban areas. Monitors are sited to represent the actual exposure to the population in the area and monitor on a continuous, 24 hour per day basis. The State operates N02 analyzers at four locations along the Wasatch Front.

The monitors are extremely sensitive and are capable of detecting less than two parts of N02 per billion parts of air. They operate on a chemiluminescent method which simply means that the instruments measure the amount of N02 by detecting the amount of light produced during a reaction between ozone and NO. The ozone is created by the monitor specifically to react with any NO in the ambient air. The amount of light given off is always proportional to the concentration of NO and therefore the concentration of NO is easily calculated. To detect nitrogen dioxide, the air to be analyzed is diverted through a converter which changes all oxides of nitrogen into nitric oxide. The difference between the NO measurement and the converted NO gas is assumed to be N02.

Summary and Impacts in Utah

Photochemical reactions convert NO into N02 during the day. All areas in Utah are currently in attaiment for nitrogen dioxide, no violations are expected in the near future. However, projected increases in the traffic along the Wasatch Front are expected to increase NOx emissions by 20 - 30% over the next 20 years. Long range planning and analysis of future growth impacts, such as review of transportation plans, will be needed to ensure continued compliance with the standards.

TABLE : UNITED STATES AIR QUALITY CRITERIA FOR NITROGEN DIOXIDE

Concentrations (ppm) of nitrogen dioxide in air	**Exposure time**	**Human symptoms and effects on vegetation, materials, and visibility..**
300	---	Rapid death
150	---	Death after 2 or 3 weeks by bronchiolitis fibrosa obliterans
50	---	Reversible, nonfatal bronchiolitis
10	---	Impairment of ability to detect odor of nitrogen dioxide
5	15 min	Impairment of normal transport of gases between the blood and lungs in healthy adults
2.5	2 hr	Increased airway resistance in healthy adults
2	4 hr	Foliar injury to vegetation
1.0	15 min	Increased airway resistance in bronchitics

1.0	48 hr	Slight leaf spotting of pinto bean, endive, and cotton
0.3	---	Brownish color of target I km distant
0.25	---	Growing season Decrease of growth and yield of tomatoes and oranges
0.2	8 hr	Yellowing of white fabrics
0.12	---	Odor perception threshold of nitrogen dioxide
0.1	12 weeks	Fading of dyes on cotton and rayon
0.1	20 weeks	Reduction of growth of Kentucky bluegrass
0.05	12 weeks	Fading of dyes on cotton and rayon
0.03	---	Brownish color of target 10 km distant
0.003	---	Brownish color of target 100 km distant

Sources: Draft Air Quality Criteria for Oxides of Nitrogen, U.S. Environmental Protection Agency, Research Triangle Park, NC, 1981 (not released for distribution as of September, 1983); Review of the National Ambient Air Quality Standard for Nitrogen Dioxide, Assessment of Scientific and Technical Information, EPA-450/5-82-002. United States Environmental Protection Agency, Research Triangle Park, NC; March 1982; as of September, 1983, no new U.S. National Ambient Air Quality Standards for Nitrogen Dioxide bad been promulgated to supersede the 1971 standard of 0.05 ppm arithmetic mean annual average.