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2-NITROPROPANE

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*Awarded by*

The Division of Surveillance,  
Hazard Evaluations and Field Studies  
National Institutes for Occupational Safety and Health



THE FRANKLIN INSTITUTE  
RESEARCH LABORATORIES

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## 2-NITROPROPANE: SYNOPSIS

First produced in 1940, but not on a large scale until 1955, this material is manufactured at a single plant in Louisiana by Commercial Solvents Corporation. It is apparently in increasing demand, to some extent as a replacement for solvents more prone to contribute to air pollution, as a general solvent in resin coating and printing ink applications.

Inhalation at levels double the recommended TLV on a chronic basis would likely only produce non-pathological symptoms which disappear shortly after cessation of exposure. Since the room temperature vapor pressure is about 700-1000x the TLV, ventilation or respiratory equipment is in order.

Exposure at the production site is minimal in terms of people involved and per person. ~~Exposure elsewhere is expected to involve thousands because of the nature of the usage.~~ Fortunately, it causes sufficiently aggravating personal discomfort at levels not far above the TLV that chronic exposure to higher, toxic levels is unlikely.

Substance 2-Nitropropane

Date \_\_\_\_\_

Initials \_\_\_\_\_

CHEMICAL NOMENCLATURE

Sponsor-assigned name 2-Nitropropane

CA 9th Coll. Index name Propane, 2-Nitro-

CA 8th Coll. Index name Propane, 2-Nitro-

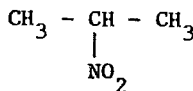
CAS Registry No. 79469

Toxic Substances List No. TZ52500

Wiswesser Line Notation WNY1&1

Molecular formula C<sub>3</sub>H<sub>7</sub>NO<sub>2</sub>

Molecular structure, if applicable



Trade Names NiPar S-20 Solvent

NiPar S-30 Solvent

Synonyms Dimethylnitromethane

Isonitropropane

Nitroisopropane

2-Nitropropane

Substance 2-Nitropropane

CHEMICAL AND PHYSICAL PROPERTIES

Date \_\_\_\_\_

Initials \_\_\_\_\_

Chemical properties

1. Flammability \_\_\_\_\_

Flash point 39.44°C (Tag open-cup); 27.78°C (Tag closed-cup)

Autoignition temperature 428°C

2. Explosive properties Lower explosive limit in air: 2.6% by volume; May explode

on heating above boiling point (see ref. 15)

3. Chemical reactions (with light, O<sub>2</sub>, etc.) Photochemically inactive according to

ref. 1a.

4. Toxic substances produced during combustion Nitrogen oxides (see ref. 12a)

5. Others pH at 25°C, 0.01 M in water: 6.2

Physical properties

6. Molecular weight 89.09

9. Vapor pressure (room temperature) 13 torr

7. Melting point -93°C

10. Specific gravity 0.9876 (20/4)

8. Boiling point 120°C

11. Solubility in water and in other solvents

Water: 1.7% by weight at 25°C

Organic solvents: miscible with many

12. Other Index of refraction: 1.3944 (20/D); Vapor density: 3.06 (air=1)

Sources Refs.: 7, 9, 13, 14

Task 2-Nitropropane  
 Date \_\_\_\_\_  
 Initials \_\_\_\_\_

PRODUCTION INFORMATION AND DATA

Date of 1st industrial production 1940

Methods of synthesis or production (include reaction, if any, and description of process)

SOURCE

Gas phase reaction of propane with nitric acid at 370-450°C and 8-12 atm;  
unreacted propane is recycled; nitric oxide is converted back to nitric acid and  
recycled; other nitroalkanes are separated by distillation

Ref. 7

Production Figures (in 1,000 lbs):

1974      1973      1972      1971      1970      1969      1968      1967      1966      1965

U. S. Not available

Import \_\_\_\_\_

Export \_\_\_\_\_

U. S. Producers

Name	Central Office	Chemical Plant Sites	No. Employed in Chemical Production	
Commercial Solvents Corp.	New York City, N.Y.	Sterlington, LA (since 1955)	38-40	Ref. 1b, 7 & phone call
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Users

Type of Industry	Description of Users	No. Employed	
Chemical	Plastic & Resin Coatings		Ref. 7
Advertising	Printing Inks		Ref. 7
Shoe	Leather stainers		Ref. 8
_____	_____	_____	_____

## PRODUCT INFORMATION AND DATA

A check through Chemical Abstracts 1967-1975 for notable concentrations of patents revealed an apparent declining interest in 2-nitropropane-metal systems as catalysts for the polymerization of olefins, cyclic ethers, etc. There was also some interest in stabilization of chlorinated hydrocarbons. Quoting from one abstract (67:3746s (1967): "2-nitropropane used to solve some of the formulating problems arising from compliance with limitations on solvent emission of Los Angeles (smog) Rule 66."

In general it was not possible to determine if there were any large scale synthetic applications, as the discussions which did mention this use of nitroparaffins were all nonspecific, and did not name products obviously derived directly from this particular one. However, Commercial Solvents is promoting (as a formaldehyde donor) 2-nitro-2-methyl-1-propanol, in the developmental stage, which may possibly be made from formaldehyde and 2-nitropropane (ref. 1a). Similar reactions with other carbonyl-containing compounds were noted in the CA search (see also ref. 7, p. 871-872).

Traditionally, this material has been used as a solvent or **cosolvent** for cellulose esters, resins (including vinyls), printing inks, dyes, stains, etc., for coating applications and coloring. If it still is used in leather dyes, it may be available for hobbyists doing leather crafting. The other users are widely distributed down into light industry. The current price of 31¢/lb, tankcar basis (ref. 1), would not appear to present any deterrence from general use. Further complicating any attempt to estimate human involvement is the sale by Commercial Solvents of both pure 2-nitro-, and a mixture of 1- and 2-nitro- isomers (ref. 1a). For other possible uses see refs. 1, 3, 7 (p. 879-883), 8,

The Health and Safety Dept. at Commercial Solvents Louisiana plant was contacted by phone and the following information received about the

operation; ~~eight workers plus a supervisor are involved in each shift in~~ the propane nitration and product purification steps; there are four shifts; one person takes care of loading tankcars and tank trucks; one ~~or two persons~~ load drums; loading, at least of tanks, is a daytime-only operation; thus, ~~there are at most 40 people involved.~~ The system is entirely enclosed, consisting of three nitration lines feeding into one distillation line, and is located within a 100-yard square portion of the complex. The only persons apt to be exposed to the vapors are the samplers and the loaders, and that is minimal. Any of the post-purification work involving further reaction or blending is also entirely enclosed, with no open reaction vessels. These same personnel would be exposed to the other nitroparaffins which are produced in the nitration step, and which are isolated and marketed on their own merit. When operation began in 1955, there were only 3-4 operators per shift.

Substance 2-Nitropropane

Date \_\_\_\_\_

Initials \_\_\_\_\_

SOURCE \_\_\_\_\_

## BIOLOGICAL, EPIDEMIOLOGICAL AND TOXICOLOGICAL INFORMATION AND DATA

Biological or Epidemiological Studies (See attached sheets)

Daily exposure of humans to 20-45 ppm at work

Ref. 9

Part-time exposure of humans to 10-30 ppm at work

Ref. 9

Lowest lethal doses by mouth or injection; lowest lethal concentration in air; various animals

Ref. 4

Toxicological Studies

a. Acute toxicity studies (includes lethal dose, carcinogen dose, etc.)

Study Name, Place	Animal/Species	Sex/No. Age	Dose	Route	Site	Vehicle	Duration	Source
			(mg/kg of body wt.)					
LD50 (Commercial Solvents Corp.)	Rat		725	Oral				Ref. 7

b. Other toxicological studies (include all studies not included above; e.g., inhalation studies, carcinogenic, mutagenic, teratogenic and other relevant studies on attached discussion sheets).

Carcinogenicity test by chronic inhalation, various laboratory mammals

Ref. 11

(see attached sheet)Mutagenicity: possible study on bacteria

Ref. 9a

## BIOLOGICAL, EPIDEMIOLOGICAL AND TOXICOLOGICAL INFORMATION AND DATA

A manual search of Chemical Abstracts for 1967-1975 revealed only one paper on this topic, but it was not especially novel (ref. 4a). Of the older work covered in standard reference sources, the most relevant of the laboratory animal tests is one covered in refs. 9 and 11. Cats, guinea pigs, monkeys, rabbits, and rats breathed 83 ppm in their air, 7 hours/day, 130 times (probably 5 days a week); in addition, guinea pigs, rabbits, and rats breathed a higher dose, 317 ppm, under the same conditions. No tumors were found after 191 or 199 days, respectively. The lower dosage produced no "signs or symptoms" in any of the animals. Multiple exposures to 328 ppm resulted in no internal injury except to the cats (which have a much higher capacity for producing nitrite ion from nitro compounds), some of which died. Methemoglobin and Heinz body formation was noted in the cats, and to a lesser extent, in the rabbits. At still higher, acute dosages there was seen lethargy, prostration, weakness, dyspnea, cyanosis, convulsions, coma, and death, to varying degrees, and at various times post-exposure, dependent on the species. Internal damage was edema and hemorrhage of the lungs, disintegration of brain cells, hepatocellular, and vascular endothelial tissue injury.

Studies of humans exposed at work showed 20-45 ppm for 8 hours/day responsible for daily anorexia, nausea with vomiting, headache, and diarrhea—recuperation overnight (refs. 2, 3, 9). Exposure to 10-30 ppm for only 4 hours/day, 3 days/week was asymptomatic over a one-year period (refs. 2, 9). Heavy exposure for a single day resulted in liver injury and death for one of two workers (ref. 2).

Toxic symptoms can result from inhalation or ingestion, but apparently not from skin contact. Once in the blood stream some leaves unchanged

via the lungs, while the metabolites nitrite and nitrate are excreted in the urine (ref. 9).

The accepted TLV is 25 ppm (90 mg/m<sup>3</sup>) (ref. 2).

Only two pertinent abstracts turned up from online searching of these data bases: TOXLINE, CA (for 1976), BA, NTIS, AGRICOLA (NAL), CIN, SCISEARCH, ENVIROLINE, POLLUTION. ABS., APTIC, COMMONWEALTH AGR. BUR. One of these was an expanded version of ref. 4a, and the other was a possible mutagenicity study on bacteria (ref. 9a); it was not clear in the latter if the chemical had been tested before the organism was subjected to ultraviolet radiation.

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