

ภาคผนวก

ภาคผนวก ก
ข้อมูลที่เกี่ยวข้อง

ตารางภาคผนวกที่ ก1 Heat of explosion and other explosive properties of Nitrocellulose

| Nitrogen content | 13.5% | 13.3% | 12.5% | 12.5% | Observation |
|--|-----------------|----------------|-----------------|-------|---|
| Heat of combustion (constant volume) (J/g) | 9475 | - | 10069 | 10660 | CO ₂ and H ₂ O liquid |
| Heat of formation (J/g) | | | | | Determined from elements At standard state |
| - constant volume | 2386 | 2482 | 2641 | 2901 | |
| - constant pressure | 2294 | 2206 | 2549 | 2805 | |
| Heat of explosion (J/g) | | | | | Measured in a calorimetric Bomb |
| | 4601 | 4053 | 3559 | - | (H ₂ O vapor) |
| | - | 4409 | - | - | (H ₂ O liquid) |
| Detonation velocity (m/s) | 7300 (d=1.2) | - | 2630 (d=0.3) | - | d:density for the measurement |
| Specific gas volume by detonation (l/kg) | 920 | 841 | 880 | - | |
| Shock sensitivity (J) | - | 3 | 1.2 | - | Julius Peters impact machine Bruceton method |
| Friction sensitivity (J) | No reaction | No reaction | 10% | - | Julius Peters impact machine Bruceton method |

ที่มา: Folly และคณะ (2004)

ตารางภาคผนวกที่ ก2 เปรียบเทียบคุณสมบัติระหว่าง CO₂, CO และ HCN

| สารเคมี | คาร์บอนไดออกไซด์ | คาร์บอนมอนอกไซด์ | ไฮโดรเจนไซยาไนด์ |
|-----------------------------------|--|---|--|
| ชื่อเคมี | Carbon dioxide | Carbonmonoxide | Hydrogen cyanide |
| สูตรโมเลกุล | CO ₂ | CO | HCN |
| Cas No. | 124-38-9 | 630-08-0 | 74-90-8 |
| UN No. | 1013 | 1016 | 1051 |
| การใช้ประโยชน์ | ใช้เป็นสารให้ความเย็นในการผลิตตู้เย็น การผลิตน้ำอัดลม เครื่องดับเพลิง อุตสาหกรรมหล่อ เหล็กและการผลิต สารเคมี | ใช้ในการผลิต แอมโมเนีย ใช้ใน ปฏิกิริยา Catalytic oxidation ใช้ในการ ผลิตแอลกอฮอล์ การ ผลิตแบตเตอรี่ กระบวนการ OXO | ส่วนใหญ่ใช้ในการ ผลิตสารเคมีอื่นๆ ใช้ ในอุตสาหกรรมยา สารมควัน สารกำจัด สัตว์กัดแทะ |
| <u>ค่ามาตรฐานและความเป็น พิษ</u> | | | |
| - LD ₅₀ (มก./กก.) | - | - | - |
| - LC ₅₀ (มก./ม.3) | - | - | - |
| - IDLH (ppm) | 40,000 | 1,200 | 50 |
| - PEL-TWA (ppm) | 5,000 | 50 | 10 |
| - PEL-STEL (ppm) | - | - | - |
| - PEL-C (ppm) | - | - | - |
| - TLV-TWA (ppm) | 5,000 | 25 | - |
| - TLV-STEL (ppm) | 30,000 | - | - |
| - TLV-C (ppm) | - | - | 4.7 |
| <u>คุณสมบัติทางกายภาพ และเคมี</u> | | | |
| - จุดเดือด (°C) | - 78 | - 192 | 25.6 |
| - จุดหลอมเหลว (°C) | - 56.6 | - 205 | -13.2 |
| - ความถ่วงจำเพาะ | 1.977 ที่ 20 °C | 0.96 | 0.688 ที่ 20°C |

| | | | |
|---|--|--|---|
| <ul style="list-style-type: none"> - ความดันไอ (mmHg) - ความหนาแน่นไอ - ความสามารถในการละลายน้ำ - ความเป็นกรด-ด่าง - ข้อมูลทางกายภาพและเคมีอื่นๆ | <p>831 ที่ 20 °C</p> <p>1.519</p> <p>ละลายน้ำได้เล็กน้อย</p> <p>-</p> <p>ละลายได้ในไฮโดรคาร์บอน, ตัวทำละลายอินทรีย์</p> | <p>> 220.4</p> <p>0.967</p> <p>ละลายน้ำได้เล็กน้อย</p> <p>-</p> <p>-</p> | <p>620 ที่ 20 °C</p> <p>0.94</p> <p>ละลายน้ำได้ดี</p> <p>เป็นกรดอ่อนๆ</p> <p>-</p> |
| <p><u>อันตรายต่อสุขภาพอนามัย</u></p> <ul style="list-style-type: none"> - สัมผัสทางหายใจ - สัมผัสทางผิวหนัง - กินหรือกลืนเข้าไป | <p>การหายใจเข้าไปทำให้คลื่นไส้ หัวใจเต้นผิดปกติ ปวดศีรษะ มึนงง ระบายการมองเห็น หายใจไม่ออก โคม่า</p> <p>กรณีเป็นของเหลวเมื่อสัมผัสถูกผิวหนังจะเป็นแผลพองเหมือนน้ำแข็งกัด</p> <p>กรณีเป็นของเหลวจะมีอาการเหมือนน้ำแข็งกัดบริเวณริมฝีปาก ปากและเยื่อเมือก จะมีผลทำลายตับ</p> | <p>การหายใจเข้าไปจะไปจับกับเลือดเกิดเป็นคาร์บอกซีฮีโมโกลบิน ซึ่งทำให้ออกซิเจนไม่สามารถถ่ายเท ปวดศีรษะ มึนงง หัวใจเต้นเร็ว อ่อนเพลีย ชัก หมดสติ และอาจทำให้เสียชีวิตได้</p> <p>จะก่อให้เกิดการระคายเคืองต่อผิวหนัง</p> <p>ไม่มีผลกับร่างกาย</p> | <p>หากได้รับความเข้มข้นมากกว่า 20-40 ppm อาจทำให้เสียชีวิตภายในเวลาไม่กี่นาที</p> <p>ระคายเคือง คัน อักเสบ และอาจเป็นแผลไหม้</p> <p>อ่อนเพลีย มีนศีรษะ ความดันโลหิตต่ำลงอย่างรวดเร็ว ระบบทางเดินหายใจ ล้มเหลวและอาจเสียชีวิตได้</p> |

| | | | |
|--|---|---|--|
| <p>- สัมผัสถูกตา</p> <p>- การก่อมะเร็ง, ความผิดปกติอื่นๆ</p> | <p>จะก่อให้เกิดการระคายเคือง การมองเห็นไม่ชัดเจน</p> <p>สารนี้เป็นสารก่อมะเร็งตาม OSHA, NTP, IARC</p> | <p>จะก่อให้เกิดการระคายเคืองต่อตา</p> <p>ทำให้เกิดความผิดปกติต่อระบบเลือด การหายใจ อัตรการเต้นของหัวใจ และระบบไหลเวียนโลหิต สามารถทำให้เกิดผลกระทบต่อระบบประสาทและการทำลายสมองได้</p> | <p>ระคายเคืองตา ทำให้การมองเห็นภาพไม่ชัดเจน อาจทำให้สูญเสียการมองเห็น</p> <p>-</p> |
|--|---|---|--|

ที่มา: กองอาชีพอนามัย กรมอนามัย กระทรวงสาธารณสุข

ภาคผนวก ข
มาตรฐานที่เกี่ยวข้อง



Common Name: **NITROCELLULOSE**

CAS Number: 9004-70-0

DOT Number: UN 0340 UN 2059 UN 0341 UN 2555

UN 0342 UN 2556 UN 0343 UN 2557

HAZARD SUMMARY

- * **Nitrocellulose** can affect you when breathed in.
- * Contact can irritate the skin and eyes.
- * Breathing **Nitrocellulose** can irritate the nose and throat.
- * High exposure to **Nitrocellulose** can cause dizziness, difficulty breathing and loss of consciousness.
- * **Nitrocellulose** is a HIGHLY FLAMMABLE, EXPLOSIVE and REACTIVE chemical and a DANGEROUS FIRE and EXPLOSION HAZARD.

IDENTIFICATION

Nitrocellulose is a pulpy, cotton-like solid or a slightly yellow or clear, syrupy liquid which smells like *Ether*. It is used in making explosives, rocket propellants and celluloid.

REASON FOR CITATION

- * **Nitrocellulose** is on the Hazardous Substance List because it is cited by DOT and NFPA.
- * This chemical is on the Special Health Hazard Substance List because it is **FLAMMABLE** and **REACTIVE**.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.

* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

RTK Substance number: 1366

Date: June 1986 Revision: April 2001

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Nitrocellulose**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.

* Wear protective work clothing.

* Wash thoroughly immediately after exposure to **Nitrocellulose**.

* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Nitrocellulose** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Nitrocellulose**:

- * Contact can irritate the skin and eyes.
- * Breathing **Nitrocellulose** can irritate the nose and throat.
- * High exposure to **Nitrocellulose** can cause dizziness, difficulty breathing and loss of consciousness.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Nitrocellulose** and can last for months or years:

Cancer Hazard

- * According to the information presently available to the New Jersey Department of Health and Senior Services, **Nitrocellulose** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

- * According to the information presently available to the New Jersey Department of Health and Senior Services, **Nitrocellulose** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

- * **Nitrocellulose** has not been tested for other chronic (longterm) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

Any evaluation should include a careful history of past and present symptoms with an exam.

Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider:

(1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

- * Where possible, automatically transfer solid **Nitrocellulose** or pump liquid **Nitrocellulose** from drums or other storage containers to process containers.
- * Before entering a confined space where **Nitrocellulose** may be present, check to make sure that an explosive concentration does not exist.

- * Keep **Nitrocellulose** wet at all times. Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:
- * Workers whose clothing has been contaminated by **Nitrocellulose** should change into clean clothing promptly.
- * Do not take contaminated work clothes home. Family members could be exposed.
- * Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Nitrocellulose**.
- * Eye wash fountains should be provided in the immediate work area for emergency use.
- * If there is the possibility of skin exposure, emergency shower facilities should be provided.
- * On skin contact with **Nitrocellulose**, immediately wash or shower to remove the chemical.
- * Do not eat, smoke, or drink where **Nitrocellulose** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
- * For solid **Nitrocellulose** use a wet method to reduce dust during clean-up. **DO NOT SWEEP UP DRY MATERIAL.**

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT.

However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

- * Avoid skin contact with **Nitrocellulose**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- * All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- * For solid **Nitrocellulose** wear impact resistant eye protection with side shields or goggles.
- * Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- * Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- * Where the potential for overexposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

HANDLING AND STORAGE

- * Prior to working with **Nitrocellulose** you should be trained on its proper handling and storage.
- * **Nitrocellulose** must be stored to avoid contact with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) since violent reactions occur.
- * Store **Nitrocellulose** away from HIGH TEMPERATURES and DIRECT SUNLIGHT. DO NOT ALLOW MATERIAL TO BECOME DRY.

- * Sources of ignition, such as smoking and open flames, are prohibited where **Nitrocellulose** is used, handled, or stored.
- * Metal containers involving the transfer of **Nitrocellulose** should be grounded and bonded.
- * Use only non-sparking tools and equipment, especially when opening and closing containers of **Nitrocellulose**.
- * Wherever **Nitrocellulose** is used, handled, manufactured, or stored, use explosion-proof electrical equipment and fittings.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

The following information is available from:

New Jersey Department of Health and Senior Services Occupational Health Service

PO Box 360

Trenton, NJ 08625-0360

(609) 984-1863

(609) 292-5677 (fax)

Web address: <http://www.state.nj.us/health/eoh/odisweb/>

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations.

A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

- * Use water spray to keep fire-exposed containers cool.
- * Vapors may travel to a source of ignition and flash back.
- * FIRE MAY RESTART AFTER IT HAS BEEN EXTINGUISHED.
- * If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If liquid **Nitrocellulose** is spilled or leaked, or solid **Nitrocellulose** is spilled, take the following steps:

- * Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
- * Remove all ignition sources.
- * Immediately flood spill area with water, collect material and deposit in sealed containers. **DO NOT SWEEP UP DRY MATERIAL.**
- * Ventilate and wash area after clean-up is complete.
- * Keep **Nitrocellulose** out of a confined space, such as a sewer, because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.
- * It may be necessary to contain and dispose of **Nitrocellulose** as a **HAZARDOUS WASTE**. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- * If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300

NJDEP HOTLINE: 1-877-WARN-DEP

FIRST AID

In NJ, for POISON INFORMATION call 1-800-764-7661

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

* Remove contaminated clothing. Wash contaminated skin with soap and water.

Breathing

* Remove the person from exposure.

* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.

* Transfer promptly to a medical facility.

PHYSICAL DATA

Flash Point: 55°F (12°C) (wet with *Alcohol*)

Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name: Cellulose, Nitrate

Other Names: Flexible Collodion; Synpor; Guncotton

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES

Right to Know Program

PO Box 368, Trenton, NJ 08625-0368

(609) 984-2202