

## IX. APPENDIX I

### SAMPLING AND ANALYTICAL METHOD FOR NG AND EGDN

This analytical method for NG and EGDN is adapted from NIOSH Method No. P&CAM 203 (classification E) [105]. A Class E method is defined by NIOSH as "Proposed: A new, unproved, or suggested method not previously used by industrial hygiene analysts but which gives promise of being suitable for the determination of a given substance." The proposed validation range for NG is 0.1-100 mg/cu m in a 10-liter sample, and for EGDN the range is 0.01-100 mg/cu m, also in a 10-liter sample. Although the method has not yet been validated at the recommended action level of 0.05 mg/cu m total NG and EGDN in a 20-liter sample, it shows promise of being suitable.

#### General Requirements

Collect breathing zone samples representative of the individual employee's exposure. Collect enough samples to permit calculation of a representative ceiling concentration for every operation or location in which there is exposure to NG or EGDN. At the time of the sample collection, record a description of the sampling location and conditions, equipment used, time and rate of sampling, and any other pertinent information.

### Principle of the Method

The nitroesters are sorbed on Tenax-GC, a porous organic polymer, as a known volume of air containing the analytes is drawn through a small bed of the sorbent in a glass tube. The nitroesters are extracted from the sorbent with ethanol; the resulting solution is analyzed by gas chromatography with an electron-capture detector. Areas under the nitroester peaks from sample unknowns are compared with areas under the peaks from nitroester standards.

### Range and Sensitivity

The minimum amount of EGDN measurable in a single injection by the gas-chromatographic method is substantially smaller than 0.25 ng. This sensitivity easily permits the detection of EGDN in a 20-liter air sample containing 0.005 mg/cu m. The minimum amount of NG detectable in a single injection by the gas-chromatographic method is smaller than 2.5 ng. This sensitivity permits the measurement of NG in a 20-liter air sample containing 0.05 mg/cu m.

The capacity of the sorbent tubes is at least 1 mg of either EGDN or NG. Thus, it is unlikely that an excessive amount of sample will ever be collected even when the concentration greatly exceeds the recommended standard of 0.10 mg/cu m. This retention of EGDN or NG by the sorbent tubes is not significantly different when samples are taken from atmospheres of low and high relative humidities [103].

### Interferences

Ethylene glycol mononitrate, if present in a high concentration relative to that of EGDN, produces a gas-chromatographic peak that tails into the EGDN peak. This interference, although troublesome, does not prohibit a reasonably satisfactory analysis for EGDN. The combined selectivity of Tenax-GC and electron-capture detection practically eliminates other interference. Water vapor does not interfere.

### Precision and Accuracy

The coefficient of variation of the analytical method for the determination of EGDN is estimated to be about 0.03 at an EGDN concentration of 2 mg/cu m in 15-liter samples. The precision of the measurement of NG concentrations is approximately the same at a concentration of 0.27 mg/cu m.

The precision of the overall sampling and analytical method has not been adequately determined. The coefficient of variation for the total method has been estimated to be about 0.10 at an EGDN concentration of 2 mg/cu m and an NG concentration of 0.3 mg/cu m. Since both EGDN and NG are sorbed on Tenax-GC at ambient temperature with 100% efficiency, it can be expected that the overall precision will be determined by variations in the measurement of sample volume.

In laboratory measurements not involving a personal sampling pump, the average recovery of EGDN from vapor samples at concentrations of 0.27-3.93 mg/cu m in 30- to 90-liter samples was 104% and that of NG was 102% at a concentration of 0.28 mg/cu m in 60-liter samples.

### Advantages and Disadvantages of the Method

The sampling device is small and portable and involves no liquids. The contents of the tubes are analyzed by means of gas chromatography, a rapid instrumental method. Interferences in the chromatographic method are minimal.

The principal difficulties are those associated with the use of electron-capture detection. They include the limited linear range of electron-capture detectors and operating variables such as the effects of column bleed, moisture, and oxygen. The effects of these variables may be minimized by analyzing standards at the same time as samples. The electron-capture detector is about 500 times as sensitive to the nitroesters as a hydrogen flame ionization detector and provides a substantial advantage in specificity.

The precision of the method is limited by the reproducibility of the pressure drop across the tubes and, therefore, by the flowrate through the tubes. Because the pump is usually calibrated for one particular tube, differences in flowrates can occur when sampling through other tubes and can cause sample volumes to vary.

The method can be applied to a wide range of sample sizes. However, repeated dilutions of the ethanol extract may be necessary to bring the amount of sample injected into the proper range for the electron-capture detector.

### Apparatus

(a) A properly calibrated personal sampling pump certified by NIOSH as intrinsically safe for use in coal mines. Calibrate the pump with

a representative sorbent tube in the sampling line, using a wet or dry test meter or glass rotameter capable of measuring the appropriate flowrates (<1 liter/minute) within an accuracy of  $\pm 5\%$ .

(b) Sorbent tubes, 70 mm long and 5-mm internal diameter, containing two sections of 35/60-mesh Tenax-GC separated and held in place by glass-wool plugs. The front section contains 100 mg of sorbent and the backup section contains 50 mg. Since the pressure drop must be limited to 1 inch of mercury at 1.0 liter/minute, it is necessary to avoid overpacking with glass wool.

(c) Gas chromatograph equipped with an electron-capture detector.

(d) Glass column, 2.5-foot x 0.25-inch, packed with 10% of OV-17 on 60/80-mesh Gas Chrom Q.

(e) An electronic integrator, or an equivalent means of measuring areas under peaks.

(f) Microliter syringe: 10- $\mu$ l.

(g) Pipets.

(h) Volumetric flasks.

### Reagents

The only reagent required is absolute ethanol for extraction of the sorbent. The gas chromatograph requires a supply of helium and an argon-methane mixture, or other carrier, or purge gases as required for the particular instrument used.

## Procedure

(a) Cleaning of equipment. All glassware for the laboratory analysis should be washed with detergent and thoroughly rinsed with tap and distilled water. Particular attention should be paid to the cleaning of the microliter syringe with ethanol.

(b) Collection and shipping of samples.

(1) Immediately before sampling, break the ends of the tube to provide openings at least 2 mm in diameter.

(2) The smaller section of sorbent is used as a backup and should be positioned nearest the sampling pump.

(3) The sorbent tube should be placed in a vertical position with the larger section of sorbent pointing up during sampling to minimize channeling of EGDN and NG through the sorbent tube.

(4) Air being sampled should not be passed through any hose or tubing before entering the sorbent tube. This is particularly important with the nitroesters, since they are strongly sorbed on most surfaces, including glass.

(5) The flowrate and time (or volume) must be measured as accurately as possible. The sample should be taken at a flowrate of 1 liter/minute or less to attain the total sample volume required (20 liters).

(6) At the time personal samples are taken, relatively large volumes of air should be sampled through other sorbent tubes also. These bulk air samples will be used by the analyst to identify possible interferences before the personal samples are analyzed.

(7) The temperature and pressure of the atmosphere being sampled should be measured and recorded if either differs greatly from standard values (25 C and 760 mmHg).

(8) The Tenax-GC tubes should be capped with the supplied plastic caps immediately after sampling. Under no circumstances should rubber caps be used.

(9) One tube should be handled in the same manner as the sample tube (break, seal, and transport), except that no air is sampled through this tube. This tube should be labeled as a blank.

(10) Capped tubes should be packed tightly before they are shipped to minimize tube breakage during shipping.

#### Analysis of Samples

(a) Preparation and desorption of samples. The sorbent tube is scored with a file near the front end and is broken open. The first glass-wool plug and the front (100-mg) section of the sorbent are transferred to a small vial or test tube. The remaining glass-wool plug and the backup section of sorbent are transferred to another small vial. Two milliliters of ethanol are added to each vial, the vials are stoppered, and the contents are shaken for about 1 minute. It may be necessary to dilute the ethanol solution before taking a sample aliquot for injection if the concentrations of the nitrate esters are high.

(b) Gas-chromatographic conditions. Typical operating conditions for the gas-chromatographic analysis are:

(1) Column: 10% OV-17 on 60/80-mesh Chrom Q, 2.5-foot x 0.25-inch glass column.

(2) Helium carrier gas flow, 100 ml/minute.

- (3) Argon/methane purge gas flow, 125 ml/minute.
- (4) Column temperature, 130 C.
- (5) Injection port temperature, 160 C.
- (6) Detector temperature, 280 C.

(c) Injection. The first step in the analysis is the injection of the sample into the gas chromatograph. To eliminate difficulties arising from blowback or distillation within the syringe needle, one should employ the solvent-flush injection technique. The 10- $\mu$ l syringe is first flushed with solvent several times to wet the barrel and plunger. Two microliters of solvent are drawn into the syringe to increase the accuracy and reproducibility of the injection sample volume. The needle is removed from the solvent and the plunger is pulled back about 0.4  $\mu$ l to separate the solvent flush from the sample with a pocket of air to be used as a marker. The needle is then immersed in the sample, and a 5- $\mu$ l aliquot is withdrawn to the 7.4- $\mu$ l mark (2  $\mu$ l solvent + 0.4  $\mu$ l air + 5  $\mu$ l sample = 7.4  $\mu$ l). After the needle is removed from the sample and prior to injection, the plunger is pulled back a short distance to minimize evaporation of the sample from the tip of the needle. Duplicate injections of each sample and standard are made. No more than a 3% difference in area is to be expected. Automatic sampling devices may be used also.

(d) Measurement of area. The area under the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.



### Determination of Desorption Efficiency

Only small differences in desorption efficiency in the described procedure are to be expected because of differences between lots of Tenax-GC. If the efficiency of desorption should be questioned for some other reason, it can be checked by following the procedure detailed in Section 8.5 of Analytical Method Number P&CAM 127 [164], entitled "Organic Solvents in Air." However, since it is not possible to accurately measure the small quantities of the nitrate esters that are to be added to sorbent tubes, 15- $\mu$ l aliquots of appropriate ethanol solutions are added. Ethanol is also the solvent used to desorb the nitrate esters from the sorbent.

### Calibration and Standards

If pure NG and EGDN are available, standard solutions in ethanol may be prepared and analyzed under the same gas-chromatographic conditions and during the same time period as the unknown samples. In the course of the development of this method, several reference materials were obtained from manufacturers of nitroester products. This experience indicated that the following materials can be obtained for the preparation of standards.

(a) Solutions of known concentrations of NG and EGDN in ethanol were provided by a dynamite manufacturer.

(b) A sample of analyzed dynamite containing EGDN but no NG was also provided by a dynamite manufacturer. Since dynamite is a heterogeneous material, care must be taken to obtain a representative sample.

(c) Pharmaceutical-grade sublingual NG tablets may be obtained from wholesale drug dealers. These tablets are manufactured to meet US Pharmacopeia specifications, which require that the actual NG content be

between 80 and 120% of the stated value. The actual NG content of a specific lot of tablets may be obtained from the manufacturer. For use, the tablets are weighed, crushed, and extracted with ethanol, the solution is filtered and diluted to a fixed volume, and aliquots are injected.

(d) An alternate standard was a material of known NG content, called "NG Lactose Trituration," provided by a pharmaceutical manufacturer. This material is used for quality control in the manufacture of NG tablets.

An experimental comparison of the NG and EGDN contents of aliquots of these standard materials gave coefficients of variation of 0.04 for the NG contents and 0.02 for the EGDN contents.

It is necessary that standards be analyzed concurrently with samples to minimize the effects of variations in detector response and other factors. Calibration curves are established by plotting concentration in mg/2.0 ml versus peak area.

#### Calculations

(a) Read the weight, in mg, corresponding to each peak area from the standard curve. No volume corrections are needed, because the standard curve is based on mg/2.0 ml and the volume of sample injected is identical to the volume of the standard injected.

(b) Corrections for the blank must be made for each sample.

$$\text{Corrected mg} = \text{mg sample} - \text{mg blank}$$

where:

mg sample = mg found in front section of sample tube

mg blank = mg found in front section of blank tube

A similar procedure is followed for the backup sections.

(c) Add the corrected amounts present in the front and backup sections of the same sample tube to determine the total measured amount of EGDN or NG in the sample.

(d) The concentration of each compound in air may be expressed in mg/cu m:

$$\text{mg/cu m} = \frac{\text{corrected weight (mg)}}{\text{volume of air sampled (liters)}} \times 1,000 \text{ liters/cu m}$$

(e) The concentrations of each compound expressed in mg/cu m can then be added together to get the total concentration of NG and EGDN combined.

(f) The concentration of each compound may also be expressed in terms of ppm by volume:

$$\text{ppm} = \text{mg/cu m} \times \frac{24.45}{\text{MW}} \times \frac{760}{\text{P}} \times \frac{\text{T}+273}{298}$$

where:

24.45 = molar volume (liter/mole) at 25C and 760 mmHg

MW = molecular weight

P = pressure (mmHg) of air sampled

T = temperature (C) of air sampled

However, the concentrations expressed in ppm cannot be added together to get the combined concentration of NG and EGDN.

## X. APPENDIX II

### MATERIAL SAFETY DATA SHEET

The following items of information which are applicable to a specific product or material shall be provided in the appropriate block of the Material Safety Data Sheet (MSDS).

The product designation is inserted in the block in the upper left corner of the first page to facilitate filing and retrieval. Print in upper case letters as large as possible. It should be printed to read upright with the sheet turned sideways. The product designation is that name or code designation which appears on the label, or by which the product is sold or known by employees. The relative numerical hazard ratings and key statements are those determined by the rules in Chapter V, Part B, of the NIOSH publication, An Identification System for Occupationally Hazardous Materials. The company identification may be printed in the upper right corner if desired.

(a) Section I. Product Identification

The manufacturer's name, address, and regular and emergency telephone numbers (including area code) are inserted in the appropriate blocks of Section I. The company listed should be a source of detailed backup information on the hazards of the material(s) covered by the MSDS. The listing of suppliers or wholesale distributors is discouraged. The trade name should be the product designation or common name associated with the material. The synonyms are those commonly used for the product, especially formal chemical nomenclature. Every known chemical designation or competitor's trade name need not be listed.

(b) Section II. Hazardous Ingredients

The "materials" listed in Section II shall be those substances which are part of the hazardous product covered by the MSDS and individually meet any of the criteria defining a hazardous material. Thus, one component of a multicomponent product might be listed because of its toxicity, another component because of its flammability, while a third component could be included both for its toxicity and its reactivity. Note that a MSDS for a single component product must have the name of the material repeated in this section to avoid giving the impression that there are no hazardous ingredients.

Chemical substances should be listed according to their complete name derived from a recognized system of nomenclature. Where possible, avoid using common names and general class names such as "aromatic amine," "safety solvent," or "aliphatic hydrocarbon" when the specific name is known.

The "%" may be the approximate percentage by weight or volume (indicate basis) which each hazardous ingredient of the mixture bears to the whole mixture. This may be indicated as a range or maximum amount, ie, "10-40% vol" or "10% max wt" to avoid disclosure of trade secrets.

Toxic hazard data shall be stated in terms of concentration, mode of exposure or test, and animal used, eg, "100 ppm LC50-rat," "25 mg/kg LD50-skin-rabbit," "75 ppm LC man," or "permissible exposure from 29 CFR 1910.1000," or, if not available, from other sources of publications such as the American Conference of Governmental Industrial Hygienists or the American National Standards Institute Inc. Flashpoint, shock sensitivity, or similar descriptive data may be used to indicate flammability,

reactivity, or similar hazardous properties of the material.

(c) Section III. Physical Data

The data in Section III should be for the total mixture and should include the boiling point and melting point in degrees Fahrenheit (Celsius in parentheses); vapor pressure, in conventional millimeters of mercury (mmHg); vapor density of gas or vapor (air = 1); solubility in water, in parts/hundred parts of water by weight; specific gravity (water = 1); percent volatiles (indicated if by weight or volume) at 70 F (21.1 C); evaporation rate for liquids or sublimable solids, relative to butyl acetate; and appearance and odor. These data are useful for the control of toxic substances. Boiling point, vapor density, percent volatiles, vapor pressure, and evaporation are useful for designing proper ventilation equipment. This information is also useful for design and deployment of adequate fire and spill containment equipment. The appearance and odor may facilitate identification of substances stored in improperly marked containers, or when spilled.

(d) Section IV. Fire and Explosion Data

Section IV should contain complete fire and explosion data for the product, including flashpoint and autoignition temperature in degrees Fahrenheit (Celsius in parentheses); flammable limits, in percent by volume in air; suitable extinguishing media or materials; special firefighting procedures; and unusual fire and explosion hazard information. If the product presents no fire hazard, insert "NO FIRE HAZARD" on the line labeled "Extinguishing Media."

(e) Section V. Health Hazard Information

The "Health Hazard Data" should be a combined estimate of the hazard of the total product. This can be expressed as a TWA concentration, as a permissible exposure, or by some other indication of an acceptable standard. Other data are acceptable, such as lowest LD50 if multiple components are involved.

Under "Routes of Exposure," comments in each category should reflect the potential hazard from absorption by the route in question. Comments should indicate the severity of the effect and the basis for the statement if possible. The basis might be animal studies, analogy with similar products, or human experiences. Comments such as "yes" or "possible" are not helpful. Typical comments might be:

Skin Contact--single short contact, no adverse effects likely; prolonged or repeated contact, possibly mild irritation.

Eye Contact--some pain and mild transient irritation; no corneal scarring.

"Emergency and First Aid Procedures" should be written in lay language and should primarily represent first-aid treatment that could be provided by paramedical personnel or individuals trained in first aid.

Information in the "Notes to Physician" section should include any special medical information which would be of assistance to an attending physician including required or recommended preplacement and periodic medical examinations, diagnostic procedures, and medical management of overexposed employees.

(f) Section VI. Reactivity Data

The comments in Section VI relate to safe storage and handling of hazardous, unstable substances. It is particularly important to highlight instability or incompatibility to common substances or circumstances, such as water, direct sunlight, steel or copper piping, acids, alkalies, etc. "Hazardous Decomposition Products" shall include those products released under fire conditions. It must also include dangerous products produced by aging, such as peroxides in the case of some ethers. Where applicable, shelf life should also be indicated.

(g) Section VII. Spill or Leak Procedures

Detailed procedures for cleanup and disposal should be listed with emphasis on precautions to be taken to protect employees assigned to cleanup detail. Specific neutralizing chemicals or procedures should be described in detail. Disposal methods should be explicit including proper labeling of containers holding residues and ultimate disposal methods such as "sanitary landfill" or "incineration." Warnings such as "comply with local, state, and Federal antipollution ordinances" are proper but not sufficient. Specific procedures shall be identified.

(h) Section VIII. Special Protection Information

Section VIII requires specific information. Statements such as "Yes," "No," or "If necessary" are not informative. Ventilation requirements should be specific as to type and preferred methods. Respirators shall be specified as to type and NIOSH or the Mining Enforcement and Safety Administration (MESA) or its successor approval class, ie, "Supplied air," "Organic vapor canister," etc. Protective equipment must be specified as to type and materials of construction.



(i) Section IX. Special Precautions

"Precautionary Statements" shall consist of the label statements selected for use on the container or placard. Additional information on any aspect of safety or health not covered in other sections should be inserted in Section IX. The lower block can contain references to published guides or in-house procedures for handling and storage. Department of Transportation markings and classifications and other freight, handling, or storage requirements and environmental controls can be noted.

(j) Signature and Filing

Finally, the name and address of the responsible person who completed the MSDS and the date of completion are entered. This will facilitate correction of errors and identify a source of additional information.

The MSDS shall be filed in a location readily accessible to employees exposed to the hazardous substance. The MSDS can be used as a training aid and basis for discussion during safety meetings and training of new employees. It should assist management by directing attention to the need for specific control engineering, work practices, and protective measures to ensure safe handling and use of the material. It will aid the safety and health staff in planning a safe and healthful work environment and in suggesting appropriate emergency procedures and sources of help in the event of harmful exposure of employees.

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## MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION		
MANUFACTURER'S NAME	REGULAR TELEPHONE NO EMERGENCY TELEPHONE NO	
ADDRESS		
<b>TRADE NAME</b>		
<b>SYNONYMS</b>		
II HAZARDOUS INGREDIENTS		
MATERIAL OR COMPONENT	%	HAZARD DATA
III PHYSICAL DATA		
BOILING POINT (760 MM HG)		MELTING POINT
SPECIFIC GRAVITY (H <sub>2</sub> O=1)		VAPOR PRESSURE
VAPOR DENSITY (AIR=1)		SOLUBILITY IN H <sub>2</sub> O, % BY WT
% VOLATILES BY VOL		EVAPORATION RATE (BUTYL ACETATE=1)
APPEARANCE AND ODOR		

<b>IV FIRE AND EXPLOSION DATA</b>				
FLASH POINT (TEST METHOD)		AUTOIGNITION TEMPERATURE		
FLAMMABLE LIMITS IN AIR, % BY VOL.		LOWER		UPPER
EXTINGUISHING MEDIA				
SPECIAL FIRE FIGHTING PROCEDURES				
UNUSUAL FIRE AND EXPLOSION HAZARD				
<b>V HEALTH HAZARD INFORMATION</b>				
HEALTH HAZARD DATA				
ROUTES OF EXPOSURE				
INHALATION				
SKIN CONTACT				
SKIN ABSORPTION				
EYE CONTACT				
INGESTION				
EFFECTS OF OVEREXPOSURE				
ACUTE OVEREXPOSURE				
CHRONIC OVEREXPOSURE				
EMERGENCY AND FIRST AID PROCEDURES				
EYES				
SKIN				
INHALATION				
INGESTION				
NOTES TO PHYSICIAN				

<b>VI REACTIVITY DATA</b>	
CONDITIONS CONTRIBUTING TO INSTABILITY	
INCOMPATIBILITY	
HAZARDOUS DECOMPOSITION PRODUCTS	
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION	
<b>VII SPILL OR LEAK PROCEDURES</b>	
STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	
NEUTRALIZING CHEMICALS	
WASTE DISPOSAL METHOD	
<b>VIII SPECIAL PROTECTION INFORMATION</b>	
VENTILATION REQUIREMENTS	
SPECIFIC PERSONAL PROTECTIVE EQUIPMENT	
RESPIRATORY (SPECIFY IN DETAIL)	
EYE	
GLOVES	
OTHER CLOTHING AND EQUIPMENT	

**IX SPECIAL PRECAUTIONS**

PRECAUTIONARY  
STATEMENTS

OTHER HANDLING AND  
STORAGE REQUIREMENTS

PREPARED BY \_\_\_\_\_

ADDRESS \_\_\_\_\_

DATE \_\_\_\_\_

XI. TABLES

TABLE XI-1

PHYSICAL AND CHEMICAL PROPERTIES OF NG AND EGDN

Compound	Nitroglycerin	Ethylene glycol dinitrate
Formula	C <sub>3</sub> H <sub>5</sub> O <sub>3</sub> (NO <sub>2</sub> ) <sub>3</sub>	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub> (NO <sub>2</sub> ) <sub>2</sub>
Formula Weight	227.09	152.06
Appearance	Pale yellow oil	Yellowish liquid
Odor	Slightly sweet	none
Melting point	13.3 C (Unstable form, 2.0 C)	-22.3 C
Boiling point	256 C	197-200 C
Explosive point	270 C	114 C
Specific gravity	1.59	1.49
Vapor pressure (20 C)	0.00012-0.011 mmHg	0.038-0.050 mmHg
Saturated vapor (20 C)	1.49-134 mg/cu m	310-408 mg/cu m
Solubility:		
Water	Slightly soluble	Insoluble
Alcohol	Soluble	Soluble
Benzene	"	Very soluble
Ether	Very soluble	Soluble
Acetone	"	Very soluble
Conversion factors, (25 C, 760 mmHg)	1 mg/liter = 110 ppm 1 mg/cu m = 0.110 ppm 1 ppm = 9.1 mg/cu m 1 ppm = 9.1 µg/liter	1 mg/liter = 164 ppm 1 mg/cu m = 0.164 ppm 1 ppm = 6.1 mg/cu m 1 ppm = 6.1 µg/liter

Adapted from references 5,7,8,9

TABLE XI-2

## SYNONYMS FOR NG, EGDN, AND NG:EGDN MIXTURES

<u>Nitroglycerin</u>	(continued)	<u>NG:EGDN Mixtures</u>
1,2,3-Propanetriol trinitrate*	1,2,3-Propanetriol trinitrate	Nitroglycerine
Angibid	Nitromel	Nitroglycerol
Anginine	Nitrong	Nitroglycol
Angiolingual	Nitrorectal	Nitroglyn
Angorin	Nitroretard	Nitrogranulogen
Blasting gelatin	Nitro-Span	alpha-Nitroguanidine
Blasting oil	Nitrostat	beta-Nitroguanidine
Cardamist	Nitrozell retard	2-Nitro-2-heptene
Glondin	NTG	3-Nitro-2-heptene
Glycerin trinitrate	Nysconitrine	3-Nitro-3-heptene
Glycerol trinitrate	Perglottal	4-Nitro-3-heptene
GTN	Propanetriol trinitrate	2-Nitro-2-hexene
Lenitral	1,2,3-Propanetriyl nitrate	
Myoglycerin	S.N.G.	
NG	Soup	
Niglycon	Trinalgon	
Nitric acid triester of glycerol	Trinitrin	
Nitrine-TDC	Trinitroglycerin	
Nitro-glycerin	Trinitroglycerol	
Nitroglycerin, liquid undesensitized**	Vasoglyn	
Nitroglycerine	<u>Ethylene Glycol Dinitrate</u>	
Nitroglycerol		
Nitroglyn	1,2-Ethanediol dinitrate*	
Nitrol		
Nitrolan	EGDN	
Nitro-lent	Ethylene dinitrate	
Nitrolingual	Ethylene nitrate	
Nitrolowe	Glycol dinitrate	
	Nitroglycol	

\*International Union of Pure and Applied Chemistry (IUPAC) common name

\*\*Department of Transportation (DOT)

Adapted from reference 10

TABLE XI-3

OCCUPATIONS WITH POTENTIAL EXPOSURE  
TO NG AND EGDN

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Chemical and explosives workers

Drug makers

Dynamite makers

Miners

Missile technicians

Munitions loaders

Munitions workers

Nitroglycerin workers

Rocket fuel makers

Shell fillers

Smokeless-powder makers

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Adapted from Key et al [16]



DEPARTMENT OF  
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