



Policy Legacy FOI Team
Headquarters 38 (Irish) Brigade and Northern Ireland
Garrison
British Forces Post Office 825



E-Mail: 38X-PolicyLegacy-FOI-Mailbox@mod.gov.uk

Reference: FOI: 2019/05982

Date: 6 June 2018

Dear [REDACTED]

REQUEST FOR INFORMATION – THE HAZARDS OF NITRO BENZENE FROM THE EARLY 1970s

I can confirm that your request has been considered under the provisions of the Freedom of Information Act 2000 (FOI(A)), and the process is now complete.

You asked the following:

“My original request to the Forensic Science folk was simply to ask what they had in their archive from the early 1970s concerning the hazards from Nitro Benzene. I was expecting a copy of some type of HSE (or equivalent) document. If you can source it for me that would be excellent. The earliest I have at the moment is 2008 from Public Health England.”

The reason the Forensic Science suggested that you contact MOD is that they only held a copy of MoD documents. I can confirm that MoD do not hold a copy of documents produced by the Health and Safety Executive.

Under Section 16 of the FOI(A) (Duty to provide advice and assistance), I can advise that I have been able to locate a copy of a HQNI Document dated 22 January 1986 also a copy of a Letter from MoD dated 3 April 1986 entitled Protection Against Nitrobenzene (NB) Contamination this letter includes an attachment entitled Hazardous Materials, Occupational Health Bulletin No 18 dated November 1976. Copies of these documents are attached at Annex A.

Some of the information contained within the disclosure constitutes personal information, such as names and addresses. Under FOI(A) this information is exempt under Section 40 (2) by reason of the first condition under Section 40 (3) (a) (i), as disclosure would contravene data protection principles under the Data Protection Act 2018 (DPA 2018). This is an absolute exemption and does not require a public interest test to be conducted in order for this information to be exempt from disclosure. Therefore, all personal information has been redacted.

Please note MOD publishes any request that releases, or partially releases (including Section 21 (Information accessible to applicant by other means)) responses into the public domain via our website <https://www.gov.uk/government/collections/foi-responses-released-by-the-ministry-of-defence-2019>. All personal details in respect of your request have, where applicable, been removed to protect confidentiality.

If you have any queries regarding the content of this letter, please contact this office in the first instance.

If you wish to complain about the handling of your request, or the content of this response, you can request an independent internal review by contacting the Information Rights Compliance team, Ground Floor, MOD Main Building, Whitehall, SW1A 2HB (e-mail CIO-FOI-IR@mod.gov.uk). Please note that any request for an internal review should be made within 40 working days of the date of this response.

If you remain dissatisfied following an internal review, you may raise your complaint directly to the Information Commissioner under the provisions of Section 50 of the FOI(A). Please note that the Information Commissioner will not normally investigate your case until the MOD internal review process has been completed. The Information Commissioner can be contacted at: Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF. Further details of the role and powers of the Information Commissioner can be found on the Commissioner's website at <https://ico.org.uk/>.

Yours sincerely

38 (Irish) Brigade FOI Team

Enc – Annex A

Nitrobenzene G 1101 HQNI (2 double sided pages)

Protection Against Nitrobenzene (NB) Contamination MoD Ref D/SG(EMR)/3/6/6 (2 double sided pages)

Hazardous Materials, Occupational Health Bulletin No 18 (4 double sided pages)

HQN

CO 1101

22 January 1986

NITROBENZENE

$C_6H_5NO_2$ (oil of mirbane) TLV (skin) 1 ppm (5 mg m^{-3})

BP: 210 85°C

SpG: 1.198

Yellow oily liquid smelling of almonds

Toxicity

Nitrobenzene is toxic to both the central nervous system and red cells. The primary toxic effect is due to its capacity to convert haemoglobin to methaemoglobin. Methaemoglobin (in which iron is in the Fe^{3+} form) does not act as an oxygen carrier). Nitrobenzene also has a direct toxic effect on the CNS (Central Nervous System), and may induce anaemia by haemolysis of red blood cells.

EFFECTS IN MAN

1. Absorption across the skin

Nitrobenzene is well absorbed across the skin. A combination of cutaneous and inhalation exposure is common. The effects may be insidious in onset.

Symptoms: Headache, weakness, drowsiness progressing to unconsciousness and cyanosis. The direct effects of the compound on the nervous system can produce fatigue, headache, giddiness, ringing in the ears and a feeling of numbness in the limbs.

2. Ingestion of nitrobenzene

Symptoms are more rapid in onset and include: burning sensation in chest, shortness of breath, fainting progressing to unconsciousness.

Lower doses give rise to a slower onset of symptoms and vomiting and drowsiness may be the first signs in such cases.

Precautions and First Aid

1. Nitrobenzene is a dangerous compound. Exposure via the skin and by inhalation should be avoided. Spillages of nitrobenzene should be dealt with by staff adequately protected with gloves and breathing apparatus.

a. With reference to choice of gloves: neoprene rubber (as in NBC gloves. Some absorption into the rubber could occur and disposal of gloves after one useage seems a sensible precaution (CDE has no first-hand information on glove penetration by nitrobenzene). In 1976 (Int Arch Occup Environ Hlth 36: 161-168), the dangers of m-Dinitrobenzene penetration through latex gloves were reported. m-Dinitrobenzene has essentially the same pattern of toxic effects as nitrobenzene though it is a markedly more toxic (on a weight basis). Latex gloves would seem to offer poor protection against this sort of compound.

b. With reference to the inhalation hazard: breathing apparatus is clearly the complete answer but an S6 respirator or even a FACELET mask would be likely to offer good protection. The S6 canister should be changed after use for this purpose.

193
HQN

c. A spillage of nitrobenzene onto skin should be removed immediately by vigorous washing. Washing with dilute acetic acid is recommended.

Treatment of Casualties

Removal from exposure, rest, warmth and the administration of oxygen, if necessary, are usually all that is necessary in cases of mild poisoning. Severe poisoning may demand more aggressive management. Methylene blue (1-4 mg/kg in a 1% solution by intravenous administration) may be needed. Methylene blue itself leads to the production of methaemoglobin but because of the rapidly reversible reaction involved a general shift from methaemoglobin to haemoglobin is thought to occur in persons poisoned with nitrobenzene. This therapy could only be undertaken by an expert under hospital conditions.



Ministry of Defence

First Avenue House High Holborn London WC1V 6HE

Telex 22241

Telephone: 5635 (Direct Dialling)
01-430 5555 (Switchboard)

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CATO
HQ Northern Ireland
BFPO 825

EOD DISPATCH
- 8 APR 1986
HEADQUARTERS
NORTHERN IRELAND

Your reference
Our reference
D/SG (EMR) /3/6/6

Date
3 April 1986

	ACTION	INFO
CATO	✓	✓
SAFO	✓	
Admin Offr		
ATO		✓
SAT EOD		✓
SAT		
AT		
COMS		
CLERKS		
SIGS.		

PROTECTION AGAINST NITROBENZENE (NB) CONTAMINATION

Reference: HQNI's 603 EOD dated 7 March 1986.

- Detailed advice on protection from NB contamination is dependent upon a number of factors (such as whether the liquid itself is being used, vapour levels etc) which have not been stated. Nevertheless, despite operational constraints, it appears that protection for EOD operators is less than should be achieved given the relative toxicity of NB.
- At the enclosure is a bulletin concerning NB, the advisory content of which is still relevant.
- The use of NBC gloves by EOD operators is entirely appropriate. A coverall should be worn if NB is likely to contaminate working clothing.
- The type of respiratory protection required is primarily determined by whether NB vapour levels are above or below the exposure limit (1 ppm for an 8 hr exposure; 2 ppm for a 10 minute exposure). Filter respirators require supplementary environmental ventilation if vapour levels are above these limits or gas supplied breathing apparatus should be used.
- The Respirator Paint and Dope (CH 4240-99-461-4666) is not suitable for use in an NB atmosphere. It appears that this is an oro-nasal respirator manufactured by Martindale (Ref DM 12100 FX). It provides no protection to the face and eyes, it does not meet BS 2091 and is specifically recommended for non-toxic use only. Suitable alternatives include the Siebe Gorman PURETHA with a Type CC canister (the canister can be worn on the face or the back but problems can arise from visor condensation if used outdoors in the cold), the Siebe Gorman VISTARAMA fitted with a cartridge filter Type FC6 or even a service S6 NBC respirator. Other commercial respirators may be available but in all cases filter canisters/cartridges require regular replacement.
- EOD operators should have full blood screens immediately before and after a NI tour. A request should be made for a haemoglobin estimation and a blood film with a notation that the man works with nitrobenzene; liver function tests may be indicated.

7. Investigation of an acute toxic episode or suspected low level chronic effects will also require estimation of methaemoglobinaemia and urinary phenols. Advice should be sought from the laboratory which can undertake these tests for the nature of the samples they require.
8. Please do not hesitate to ask if we can be of further help.



Enclosure: DCMS(PE) OH Bulletin No 18

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DLSA
AS of A
11 Ord Bn (EOD)

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PROCUREMENT EXECUTIVE, MINISTRY OF DEFENCE
DIRECTORATE OF CIVILIAN MEDICAL SERVICES

Telephone 01-385-1244
Extension 2963

Empress State Building
Lillie Road
London, SW6 1TR

Date: November 1976.

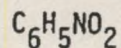
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HAZARDOUS MATERIALS, OCCUPATIONAL HEALTH BULLETIN No. 18

Prepared in conjunction with Safety Services Organisation MOD (PE) and the Hazardous Materials Working Party of EEA/BREMA/RCEMAF under the Chairmanship of Dr J H Chambers SMO DCMS(PE) Ministry of Defence.

Issued for Information and Guidance to Departmental Medical, Nursing and Safety Officers.

NITROBENZENE



A SKIN IRRITANT AND SYSTEMATIC POISON

1. SYNONYMS

Oil of Mirbane.

2. PROPRIETARY PREPARATIONS

None.

3. PROPERTIES

3.1. Physical State

A yellow liquid with an odour of bitter almonds.

3.2. Physical Constants

Molecular weight	123.11
Melting point	5.7°C
Boiling point	210°F
Flash point	190°F (closed cup)
Auto-ignition temperature	900°F
Relative density	1.918 at 25/4°C
Vapour pressure	1 torr at 44.4°C
Vapour density	4.25 (air = 1)

3.3. Relevant Physical and Chemical Properties

Slightly soluble in water, soluble in alcohol, ether benzene and oils.

A solvent of nitro-cellulose.

Mixtures of nitrobenzene and nitric acid can detonate depending on the amount of water present in the mixture.

4. INDUSTRIAL OCCURRENCE

The material is used in the production of aniline dyes, in shoe and floor polish, as a perfume in cheap soaps and as a vehicle in spray paints and enamels.

In the manufacture of explosives it is used as a solvent for nitro-cellulose.

It has also been used as a substitute for the natural essence of bitter almonds in confectionery and liquers.

5. STATUTORY REQUIREMENTS

The Factories Act 1961 - provisions regarding the removal of fumes should be observed and those in respect of the investigation of accidents or industrial disease should be carried out where necessary.

The National Insurance (Industrial Injuries) (Prescribed Diseases) Regulations 1959: S.I. 1959 No. 467: Prescribed Disease No. 8.

6. HAZARD

6.1. Health Hazard

Local Effects

Continued or repeated contamination of the skin by the liquid could produce dermatitis due to irritation and sensitisation of the skin.

Contamination of the eye will cause conjunctival irritation but prompt decontamination by flushing with water will prevent any permanent damage.

Systemic Effects

Routes of Entry

Nitrobenzene may be absorbed in toxic amounts by inhalation of the vapour, ingestion of the liquid and very rapidly by absorption through the unbroken skin. Inhalation and absorption through the skin are the most probable causes of absorption industrially.

Acute Systemic Effects

Nitrobenzene exerts its toxic effects on the red blood cells and

the central nervous system. The onset of the illness may be insidious and there may be a latent period of up to 4 hours between absorption and the appearance of symptoms

The material reacts with the haemoglobin in the red cells to produce methaemoglobin and in mild cases this can result in the appearance of varying degrees of cyanosis of the extremities (a bluish tinge of the lips, nose, lobes of the ears and tips of the fingers.) The cyanosis will not appear until the concentration of methaemoglobin in the blood reaches a level of 15% or more and the cyanosis may be accompanied by headache, giddiness, tiredness and irregular pulse.

In more severe cases of poisoning, the patient shows symptoms of central nervous system involvement - excitement and tremors followed by depression, unconsciousness, coma and death. The pulse becomes rapid and weak, the skin cold and damp with lowered blood pressure and irregular heart rate. Convulsions have been noted in some cases and there may be visual disturbances.

Where the vapour has been inhaled the patient may suffer from soreness and irritation of the throat and chest with tenderness of the tongue and palate.

If ingestion is the route of entry the patient will initially suffer from a burning taste in the mouth and throat, pain in the stomach, nausea, vomiting and diarrhoea.

Changes in the blood picture indicative of absorption of the material include a lowered red cell count, polychromatophilia, punctate basophilia, anisocytosis, poikilocytosis and in severe cases the appearance of normoblasts.

The blood vessels of the conjunctiva and fundus of the eye may show dark brown discolouration due to the presence of methaemoglobinemia in the blood. Jaundice may appear and the spleen may become enlarged.

Chronic Systemic Effects

The repeated or continued absorption of the material over a period of time, at concentrations not sufficiently high to produce acute toxic effects, may lead to chronic poisoning characterised by anaemia. Cyanosis may be present but normally disappears on removal from contact. Fatigue, headache and loss of appetite are common.

The liver may be affected and develop into acute yellow atrophy.

Recovery to normal may take several weeks.

NOTE The intake of alcohol, even in small amounts, aggravates the toxic nature of the material.

6.2. Additional Hazards

Fire

Vapour given off at elevated temperatures is flammable and can result in the production of toxic oxides of nitrogen. The lower limit

of flammability of the vapour is 1.8% by volume in air but under normal conditions of handling and storage there is little danger of a fire risk.

Explosion

The material does not normally present an explosive risk, but when exposed to heat or flame the vapours could form an explosive mixture in air.

Other Reactions

There do not appear to be any other reactions relevant to health and safety.

7. PREVENTIVE MEASURES

7.1. Personnel

Initial Medical Examinations

All personnel should be medically examined prior to working with this material and the examination should include examination of the blood, and special attention should be paid to histories of disorders of the liver.

Continued Medical Supervision

Personnel in continuous contact with the material should be kept under medical supervision and periodic medical inspections should be carried out to detect any possible signs of cyanosis. If this is present, the individual should be removed from contact, the working conditions investigated and the individual concerned medically examined, the examination including blood examination and a liver function test if considered necessary.

Personnel who are regularly employed handling this material should be medically examined on return from sickness absence and where there is any question of anaemia or other blood abnormality as the cause of the sickness absence a blood investigation should be carried out and assessed prior to the individual being returned to contact with the material.

Biological Examinations

Blood examinations should be carried out on all personnel prior to commencing work with this material and special attention should be paid to the red cells and the appearance of any abnormalities.

Dependent on the degree of exposure and the working conditions, routine periodic blood examinations should be carried out at regular intervals and in all cases at not less than 6 monthly intervals.

Examination of the urine of exposed personnel will reveal nitro and amino-phenols, the amounts corresponding to the degree of methaemoglobinemia in the blood.

Conditions Rendering Persons Unfit

Anaemic or any other blood abnormality

Chronic liver conditions

Regular alcohol drinkers.

Instructions to Personnel

All personnel in contact with this material should be made aware of the hazardous nature of it and the ease with which it can be absorbed, especially through the skin.

Because of the ease of absorption through the skin they should be advised to avoid skin contamination and if necessary to wear protective gloves, any accidental skin contamination being removed at once by thorough washing in soap and water.

Any symptoms of illness experienced while in contact with the material should be reported immediately to the Medical Department and personnel should be warned of the dangers of aggravation of the toxic effects of the material by the intake of alcohol.

Personnel Protective Equipment

Personnel should wear protective overalls or coats to prevent accidental contamination of every day clothing by the material. Should such protective clothing become contaminated by splashes it should be removed immediately and any contaminated skin thoroughly washed.

Protective gloves should be provided where there is any possibility of contamination of the hands.

Respirators should be available in the event of emergency and these should be self-contained or air supplied. For short exposure to levels in excess of the TLV. The Siebe Gorman Puretha with a "C" Canister (black) would be suitable.

7.2 Storage and Labelling

Nitrobenzene should be stored in firmly stoppered containers in as small bulk as possible. It should be labelled in accordance with the advice given in "Marking Containers of Hazardous Chemicals" issued by the Chemical Industries Association.

7.3 Transport

Transport of small amounts should present no special problems but in bulk, hauliers should be advised of the toxic nature of the material and the flammable risk in the event of an accident.

7.4 Working Conditions

Nitrobenzene should be handled under conditions of good ventilation and where necessary local extract ventilation should be used to remove any excess fumes.

Where small amounts are being used they should be handled in well ventilated fume cupboards.

Washing facilities should be adequate and readily available to the work place.

No food or drink should be allowed in the workshop and smoking should be forbidden.

7.5 Monitoring and Air Sampling

Samples may be collected by any standard method and quantitative analysis carried out by ultra-violet absorption, the vapour being dissolved in cyclohexane free from benzene.

7.6 Threshold Limit Value EXPOSURE LIMITS

1. ppm (8 hr TWA value) - long term exposure
- 2 ppm (10 min TWA value) - short term exposure

7.7 Instructions in the Event of Fire

Water fog or spray, carbon dioxide or drychemicals may be used in fires involving nitrobenzene.

7.8 Instructions in the Event of Spillage

Flush the area with large quantities of water and thoroughly ventilate the area. If this is impracticable the material may be absorbed by dry earth or its equivalent. Protective clothing should be worn to prevent skin contamination.

7.9 Disposal of the Material

Small amounts should be well diluted with water and disposed of according to local public health regulations. Large amounts should be disposed of through a Chemical Disposal Company.

8. FIRST AID

8.1. Advice to First Aiders

Local Effects

Any personnel complaining of localised skin irritation should be removed from contact and referred to the Medical Department.

Skin contamination by the material should be removed by immediate soap and water and any contaminated clothing removed and decontaminated prior to further use.

Contamination of the eye should be treated by irrigation with water for 10-15 minutes and the patient should then be referred to the Medical Department.

Systemic Effects

In the event of an individual suffering from acute systemic effects of the material they must be removed from contact immediately.

In cases of poisoning by ingestion the patient, if conscious should be given water to drink to dilute the material and referred to the Medical Department as soon as possible.

Where poisoning is the result of skin contamination, all contaminated clothing should be removed, preferably under running water, and the skin decontaminated by thorough washing.

In mild cases where the patient is conscious, removal from contact is normally all that is required. In more severe cases where the patient may have collapsed or become unconscious, then he should be treated as any unconscious patient and resuscitative measures applied if necessary.

All cases whether mild or serious and whatever the route of entry should be referred to the Medical Department.

8.2. Advice to Medical and Nursing Staff

Cases of poisoning by this material should be treated symptomatically and hospitalised if necessary. In severe cases oxygen therapy and stimulants may be necessary.

Vitamin C. (200 mg. daily) have been found effective in the treatment of severe cases and in some cases blood transfusion has been found necessary.

Cases of systemic poisoning due to this material necessitate an immediate investigation of the working conditions in which the patient is involved and the reasons for absorption of the material.

8.3. Special Equipment

Decontamination equipment and protective clothing
Oxygen giving equipment.

9. REFERENCES

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