HAZARD ANALYSIS #18

Activity: OPERATING IN RESTRICTED AREA Analysed By/Date BUDDY EANES 8/24/95 Reviewed By MIKE MURRAY 8/24/ 95

Principal Steps	Potential Hazards	Recommended Controls
ENTERING RESTRICTED AREA TO WORK AND/OR OBSERVE	UNEXPLODED ORDNANCE	1. RECEIVE AUTHORIZATION FROM AND COORDINATE ACTIVITES WITH UXO RANGE CONTROL OFFICER.
	FRAGMENTATION FROM ACCIDENTAL DETONATION	2. REMAIN IN CLEAR AREAS UNLESS ESCORTED BY UXO SPECIALIST.
	VEHICULAR TRAFFIC	3. SELF-ESCORT QUALIFIED PERSONNEL MUST COMPLY WITH THE "BUDDY SYSTEM" AND ARE NOT ALLOWED TO ESCORT ANY PERSONNEL THAT HAVE NOT COMPLETED THE SELF ESCORT TRAINING SCHEDULED BY EDDTECH DIV
	HEAVY EQUIPMENT TRAFFIC	4. DO NOT TOUCH OR DISTURB ANY ORDNANCE.
	HELICOPTER	5. LEVEL D PPE. EAR PROTECTION IN HIGH 85 DBA NOISE LEVELS.

Equipment to be Used	Inspection Requirements	Training Requirements
VARIOUS	AS REQUIRED BY TASK	ORDNANCE AWARENESS CONTINUAL TRAINING 40 HR HAZWOPER OTHER TRAINING REQUIRED BY TASK.

APPENDIX 1
SHSP Change Approval Form

SITE SAFETY PLAN CHANGE APPROVAL FORM

Contract No.: ____________________ *Delivery Order :* ____________________

Project Name: ____________________ *Project Number:* ____________________

Section of SHSP: _____ Page Number: _____ Date of Change: ____________

Change to read ____

____

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Reason for change ____

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Approvals:

____
Site Superintendent

____
Site Safety Officer

____
Health & Safety Manager

____
Navy Technical Representative

APPENDIX 2
SHSP Acknowledgement

SAFETY PLAN ACKNOWLEDGMENT SHEET

This is to certify that I have read the Site Safety Plan and understand its contents. Failure to comply with the requirements contained in this plan may result in my removal from the project.

PRINT NAME	SIGNATURE	DATE

APPENDIX 5
UXO Safety Concepts

Rev 16 Dec 92

ANNEX F

U.S. ARMY CORPS OF ENGINEERS, HUNTSVILLE DIVISION
SAFETY CONCEPTS AND BASIC CONSIDERATIONS FOR UNEXPLODED EXPLOSIVE ORDNANCE (UXO) OPERATIONS

INTRODUCTION

There is no "safe" procedure for dealing with UXO, merely procedures which are considered least dangerous. However, maximum safety in any UXO operation can be achieved through adherence to applicable safety precautions, a planned approach and intensive supervision. Only those personnel absolutely essential to the operation shall be allowed in the restricted area/exclusion zone during UXO activities(DoD 6055.9-STD). Safety must become a firmly established habit when working with UXO. Safety is the leading edge of quality.

1.GENERAL SAFETY CONCERNS.

a. Care must be observed in searching for, probing for, excavating, moving, and handling UXO. Operations on the UXO should be conducted only after the establishment of a complete plan for the operation involved and careful preparation to insure its implementation. Plans shall be based upon the minimum number of essential personnel, for a minimum amount of time, to the minimum amount of UXO consistent with efficient operations and maximum safety.

b. Only UXO qualified personnel shall be involved in UXO procedures. UXO procedures consist of gaining access (manual excavation) to subsurface UXO, identification, transportation, storage, and disposal of UXO. All personnel engaged in UXO operations shall be thoroughly trained in explosive safety and be capable of recognizing hazardous explosive exposures. Only personnel who have graduated from the US Naval EOD School, Indian Head MD are authorized to handle UXO and perform UXO procedures. Hazardous Devices Technicians who have graduated from the Hazardous Devices School, Redstone Arsenal AL are not trained nor qualified to handle military UXO and will not be involved in UXO operations on a CE project.

c. The use of electroexplosive devices (EED) susceptible to EMR devices in the radio frequency (RF) range, that is, radio, radar, and television transmitters, has become almost universal. Radio frequency electromagnetic radiation consists of waves of electrical energy at radio transmission frequencies. These waves are radiated in a line-of-sight from the antennas of electronic devices that transmit radio, radar, television, or other communication or navigation radio frequency signals. The energy is usually equally radiated in all directions; however, certain types of antennas focus the energy, transmitting it in a single direction or sector only. EMR (RF) can also be reflected from large metallic surfaces or objects into areas not directly reached by the line-of-sight-radiated electric energy.

[redacted] [redacted]

(1) Under highly undesirable conditions, enough of the energy may be picked up by portions of the EED, associated circuitry, or related objects acting as receiving antennas, to initiate the EED.

(2) Since the strength of the radiation decreases as the distance from the transmitter increases, the further away the ordnance item is, the less hazardous the situation. The energy can pass directly through materials that do not conduct electricity, such as wood or plastic. Therefore, using these materials as a barrier is of little value. The factors to be considered when evaluating the degree of hazard that the EMR (RF) energy represents are: 1) the strength of the field, that is, its power; 2) the nature of the frequencies transmitted; 3) the distance from the transmitter antenna to the ordnance, and; 4) the amount or type of protection available.

d. Some ordnance is particularly susceptible to EMR (RF) emission. This susceptibility is usually caused by the design of the ordnance item or the type of EED that is used. HERO categories have been established under which ordnance is classified as safe, susceptible, and unsafe. A knowledge of ordnance that is normally unsafe in the presence of EMR (RF) is important so that preventive steps can be taken if the ordnance is encountered in a suspected EMR (RF) field.

(1) In general, all ordnance items, even those normally safe when intact, are hazardous when extensively damaged. The damage may expose components, trailing wires, or breaks in shielding integrity that permit the entrance of EMR (RF) energy into the ordnance item and then into the EED.

(2) The presence of antennas, communication and radar devices should be a point of interest on initial site visits and preliminary assessments.

(3) The site shall be surveyed for electromagnetic radiation (EMR) radio frequency (RF) transmitters and appropriate action taken. Minimim safe distances between mobile RF transmitters, TV, and FM broadcasting transmitters and electric UXO demolition procedures are listed in Tables 2-3 and 2-4, TM 9-1375-213-12.

(4) Do not wear outer or undergarments made of wool, silk, or synthetic textiles such as rayon and nylon while working on UXO. These materials can generate sufficient static charge to ignite fuels or initiate explosives. Any person coming in contact with an UXO, shall ground himself prior to touching EEDs. This must be done to discharge any electrostatic charge accumulation from the body.

[redacted] [redacted]

2. SITE CHARACTERIZATION

a. Make every effort to identify the UXO. Carefully examine the item for markings and other identifying features such as shape, size, and external fittings. However, do not move the item to inspect it. If an unknown UXO is encountered, photographs shall be taken and express-mailed to NAVEODTECH DIV which has access to the TM 60-Series publications.

b. Foreign UXO were returned to the United States for exploitation and disposal. Records search should indicate the possibility of foreign UXO being on the site.

c. If the records search indicates UXO containing military toxic chemical agents may be on the site, a decontamination plan shall be approved prior to entry onto the site. Any time a suspected chemical UXO is encountered, the 2-man concept is immediately implemented and notification shall be made through proper channels. The UXO shall be secured until the military arrives and assumes ownership.

d. UXO which penetrates the earth to a depth where the force of the explosion is not enough to rupture the earth's surface forms an underground cavity called a camouflet. Camouflets will be filled with the end product of the explosion, carbon monoxide gas. Camouflet detection and precautions must be considered if records search indicates the site was used as an impact area.

e. Avoid inhalation of, and skin contact with smoke, fumes, and vapors of explosives and related hazardous materials.

f. Consider UXO which has been exposed to fire and detonation as extremely hazardous. Chemical and physical changes may have occurred to the contents which render it much more sensitive that it was in its original state.

g. Do not rely on the color coding of UXO for positive identification of contents. Munitions having none, incomplete, or improper color coding have been encountered.

h. **Avoid the area forward of the nose of a munition until it can be determined** that the item is not a shaped charge and High **Explosive Anti-tank** (HEAT) UXO. The explosive jet can be fatal to **great** distances forward of the longitudinal axis of the item. **Assume any shaped charge munition to contain a piezoelectric (PZ) fuzing system until the fuzing is otherwise identified. A PZ fuze is extremely sensitive, can fire at the slightest physical change, and may remain hazardous for an indefinite period of time.**

i. Examine a projectile for the presence or absence of an unfired tracer.

[redacted]

[redacted]

j. Approach an unfired rocket motor from the side. Ignition will create a missile hazard and hot exhaust.

(1) Do not expose electrically fired rocket motors within 25-feet of any exposed electronic transmitting equipment or exposed antenna leads.

(2) If an unfired rocket motor must be transported, it shall be positioned in the direction which offers the least exposure to personnel in the event of the accidental ignition.

k. Consider an emplaced landmine armed until proven otherwise. It may not be possible to tell, or it may be intentionally rigged to deceive.

(1) Many training mines contain firing indicator charges capable of inflicting serious injury.

(2) Exercise care with wooden mines that have been buried for a long time. Because of soil conditions, the wood deteriorates and the slightest inadvertent pressure on top may initiate the fuze.

l. Assume a practice UXO contains a live charge until it can be determined otherwise. Expended pyrotechnic/practice devices may contain red/white phosphorus residue. Due to incomplete combustion, phosphorus may be present and reignite spontaneously if subjected to friction or if the crust is broken.

m. Do not approach a smoking white phosphorus (WP) UXO. Burning WP may detonate the burster or dispersal explosive charge at any time.

n. The detection and identification of suspect explosive materials shall be accomplished IAW Chapter 13, TM 9-1300-214, "Military Explosives".

3. ORDNANCE RELATED HTRW ACTIVITIES.

a. 29 CFR 1926.100(a) requires personnel to wear protective helmets in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock or burns. During field activities on ordnance projects, hardhats need not be worn unless a head injury threat is present.

b. Soil samples, test pit excavation, and/or monitoring well installation are sometimes conducted in areas where subsurface UXO may be found. These intrusive activities must be preceded by a magnetometer survey to assure the safety of the sampling crews.

c. Prior to the drilling rig coming on site, a magnetometer and a hand-held auger shall be utilized to assure the drilling spot is clear of subsurface UXO.

[redacted]

(1) After finding an area the magnetometer indicates is clear of detectable UXO, the hand-held auger should be used to start the drill hole. At not more than 2-foot depth, the hand-held auger shall be withdrawn and the magnetometer probe shall be lowered into the auger hole. This procedure will ensure small UXO items(20mm projectiles and grenades), undetectable from the surface, are now detectable. This procedure shall be repeated until the maximum depth of the hand-held auger.

(2) Borehole monitoring shall continue at 2-foot intervals until virgin soil is encountered.

4. RESTRICTED AREA/EXCLUSION OPERATIONS.

a. Do not allow unauthorized or unnecessary personnel to be present in the vicinity of UXO. During the timeframe that UXO procedures are being accomplished, only necessary UXO personnel shall be within the restricted area/exclusion zone. When non-UXO personnel enter the restricted area/exclusion zone, all UXO procedures will cease. Limit personnel exposure time. UXO operations will always be based upon minimum exposure consistent with efficient operations.

(1) Plan for, provide, and know the measures to be taken in the event of an accident.

(2) Provide a designated emergency vehicle in the area in case of an accident or other emergency.

(3) Coordination with the appropriate airspace representative shall be conducted and the appropriate notification procedures arranged.

b. Before any movement of an UXO, the fuze condition must be ascertained. If the condition is questionable, consider the fuze armed. The fuze is considered the most hazardous component of an UXO, regardless of type or condition.

(1) In general, the condition of a BD fuze in an unexploded projectile cannot be determined through examination of its external features. When there is evidence that the projectile has been fired, the BD fuze is considered to be in the armed condition.

(2) Arming wires and popout pins on unarmed fuzes should be secured by taping in place prior to movement.

(3) Perform any initial movement of an armed fuze remotely and avoid any unnecessary movement of an armed fuze.

c. Personnel working with explosives and explosive ordnance shall comply with the following:

(1) Do not carry fire or spark-producing devices on-site.

[redacted]

[redacted]

(2) Do not smoke, except in authorized areas.

(3) Do not have fires for heating or cooking, except in authorized areas.

(4) Do not conduct operations without approved Standing Operating Procedures (SOP) and proper supervision.

(5) Do not become careless by reason of familiarity with ammunition.

(6) Do not conduct explosive operations during electrical, sand, dust or snow storms.

(7) Do not conduct explosive operations between sunset and dawn.

d. When multiple search teams are operating on a site, the teams shall not work immediately adjacent to each other. A safe separation distance shall be established between each search team. This distance shall be based on the type of UXO expected to be encountered, but the distance shall never be less than 50m.

e. Perform initial movement of an embedded projectile remotely. First movement of an embedded projectile may cause fuze functioning. During this remote operation, precautions shall be taken for a high-order detonation.

(1) DO NOT dismantle, strip, or subject any UXO to unnecessary movement, except in response to a valid requirement.

(2) Do not depress plungers, turn vanes, or rotate spindles, levers, setting rings, or other external fittings on the UXO. Such action may arm, actuate, or function the UXO.

(3) Do not subject a mechanical time fuze to any unnecessary movement.

(4) Do not unscrew a fuze from a fuze well that does not contain a fuze cavity liner. High explosives may be on the threads.

f. Expended pyrotechnic/practice devices may contain red/white phosphorus residue. Due to incomplete combustion, red and white phosphorus may be present and reignite spontaneously if subjected to friction or if the crust is broken.

g. Do not undertake the handling or disposal of liquid propellant fuels or oxidizers if not familiar with the characteristics of the material.

[redacted]

h. Civil War projectiles shall be treated as any other UXO, especially projectiles with uncut Bormann time fuses and projectiles with percussion fuses, brass in particular. These have generally provided a watertight seal, even if they have been in the ground over one-hundred years. No projectile should be exposed to excess heat, the ignition point of black powder, used as a bursting charge in all Civil War projectiles is 457 degrees F. Under no circumstances should an attempt be made to drill a hole in a projectile, either through the fuse or the body of the projectile.

i. Extra care shall be taken when uncovering a buried UXO, if records search indicated WP munitions were fired or destroyed in the area. A buried WP munition may be damaged and when exposed to air, may start burning and detonate. An ample supply of water and mud shall be immediately available if excavation reveals a WP UXO. Appropriate protective equipment (leather gloves, face shield, and flame-retardant clothing) and first aid shall also be immediately available.

5. STORAGE.

a. UXOs, UXO-components, packing materials or empty boxes will not be stored in magazines containing explosives.

b. A fire plan for the storage of explosives shall be prepared and coordination with the nearby fire department shall be conducted.

6. EXCAVATION OPERATIONS.

a. The usual method for uncovering buried UXO is to excavate by hand. Hand excavation is the most reliable method for uncovering UXO, but unless the UXO is very near the surface, hand excavation exposes more people to the hazard of detonation for a longer period of time than any other method. Hand excavation will be accomplished only by UXO personnel.

b. Earth moving machinery (EMM) may be used to excavate buried UXO, if the UXO is estimated to be deeper than 12 inches. EMM shall not be used to excavate within 12 inches of an UXO. When excavation gets within 12 inches of an UXO, hand excavation shall be used to uncover the UXO. EMM may be operated by non-UXO personnel, under the direct supervision of UXO personnel.

(1) If more than one EMM will be used on the same site, they will be separated by at least 100m during excavation,

(2) During excavation operations, only those personnel absolutely necessary for the operation shall be within the restructed area/exclusion zone.

(3) Excavation and trenching shall comply with the provisions of 29 CFR 1926 subpart P.

[redacted]

7. DISPOSAL OPERATIONS.

a. As a general rule, UXO will be detonated in place when the situation allows. All detonation-in-place should be conducted by electrical means to assure maximum control of the site, except is extreme sandy soil which creates a static electricity hazard. Non-electrical means can be used when the situation dictates.

(1) Do not allow one person to work alone in disposal operations. At least one person shall be available near the disposal site to give warning and assist in rescue activities in the event of an accident. Only UXO qualified personnel shall be involved in on-site disposal operations.

(2) Initiating explosives include lead azide, mercury fulminate, lead styphnate, and tetracene. They manifest extreme sensitivity to friction, heat, and impact. When involved in a fire, they can be expected to detonate without burning. In storage, initiating explosives shall be kept wet with water or water/alcohol mixture. Every effort shall be made to prevent the liquid from freezing; frozen explosives material will not be handled. Lead azide shall not be allowed contact with copper, zinc, or alloys containing any concentration of such metals because of the likely formation of other azides that are more sensitive than the original lead azide. Likewise, mercury fulminate shall not be allowed contact with aluminum, magnesium, zinc, brass or bronze.

(3) If loose, bulk explosives are to be disposed of by detonation, detonate only one kind of explosive in any one given shot.

(4) Exercise extreme care in handling and preparing high explosives for detonation. They are sensitive to detonation by heat, shock, and friction.

(5) Keep initiating explosives in a water-wet condition at all times until ready for final preparation for detonation. The sensitivity of these explosives is greatly increased when dry.

(6) Do not pack a bomb fuze well with explosives unless it can be positively confirmed that the fuze well does not contain any fuze components.

(7) Photoflash bombs must be handled with the same care as black powder, and with even greater care than explosive-loaded bombs.

(8) Some practice bombs do not contain any positive safety features. Positively identify and review all safety precautions prior to handling practice bombs.

(9) WP UXO shall not be detonated into the ground. The UXO shall be counter-charged on the bottom-center-line.

(10) Photoflash powder will react with moisture and generate hydrogen gas, and this reaction may generate sufficient heat or pressure to detonate the UXO. Do not look directly at photoflash UXO during detonation.

b. When disposing of high explosives by detonation, do not approach the disposal site for at least 30 minutes in the event of a misfire.

(1) Carry blasting caps in approved containers and keep them out of the direct rays of the sun.

(2) Do not handle, use, or remain near explosives during the approach or progress of an electrical storm. All persons should retire to place of safety.

(3) Do not use explosives or accessory equipment that are obviously deteriorated or damaged. They may detonate prematurely or fail completely.

(4) Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling. This will minimize injury should the item explode.

(5) Use only standard blasting caps of at least the equivalent of a commerical No. 8 blasting cap.

(6) Use electric blasting caps of the same manufacture, whenever possible, for each demolition shot involving more than one cap.

(7) Keep blasting caps in approved containers, located at least 25 feet from other explosives, until they are needed for priming.

(8) Do not bury blasting caps. Use detonating cord to position blasting caps above the ground. Buried blasting caps are subject to unobserved pressures and movement which could lead to premature firing or misfires.

(9) Test electric blasting caps for continuity at least 25 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.

c. A post-search of the detonation site shall be conducted to assure a complete disposal was accomplished.

[redacted]

[redacted]

d. If the situation dictates, protective measures to reduce shock, blast, and fragmentation damage shall be taken. Army Technical Manual (TM) 5-855-1, Fundamentals of Protective Design for Conventional Weapons and associated software program "CONWEP" contains data on blast effects, groundshock, cratering, ejecta, and fragmentation.

(1) For non-fragmenting explosive materials, evacuation distance should be a minimum of 1250 feet.

(2) For fragmenting explosive materials, evacuation distance should be a minimum of 2500 feet. For bombs and projectiles with caliber 5-inch or greater, use a minimum evacuation distance of 4000 feet.

(3) Items with lugs and/or strongbacks and nose and/or tail plate sections should be oriented away from personnel locations.

e. Consideration shall be given to tamping the UXO to control fragments, if the situation warrants. Fragments shall be minimized not only to protect personnel but property such as buildings, trees, etc.

f. Open burning of explosives and smokeless powder or chemical decomposition of explosives shall not be accomplished without prior approval of the contracting officer.

(1) Do not inhale the smoke or fumes of burning pyrotechnic or incendiary materials. The fumes and dust from many of these materials are irritating and/or toxic if inhaled.

(2) Do not use water on incendiary fires. Water may induce a violent reaction or be completely ineffective, depending on the mixture.

(3) Bury incendiary-loaded munitions in sand when transporting them. This will smother any fire which should start until other corrective action can be taken.

(4) Anticipate a high-order detonation when burning pyrotechnics or incendiary-loaded UXO. Safety measures for personnel and property must be based on this possibility.

g. Inert UXO will not be disposed of or sold for scrap until the internal fillers have been exposed and unconfined. Heat generated during a reclamation operation can cause the inert filler, moisture and air to expand and burst sealed casings. Venting or exposure may be accomplished in any way necessary to preclude rupture due to confined pressure.

8. TRANSPORTATION.

a. If UXO must be transported off-site for disposal, the provisions of 49 CFR 100-199, NAVSEA OP2234 and state and local laws shall be followed.

[redacted]

b. When transporting a possible armed fuze, position the fuze in the most neutral orientation possible.

c. Do not transport a WP munition, unless it is immersed in water, mud or wet sand.

d. If loose pyrotechnic, tracer, flare, and similiar mixtures are to be transported, they shall be placed in #10 mineral oil or equivalent to minimize fire and explosion hazard.

e. If an unfired rocket motor must be transported, it shall be positioned in the direction which offers the least exposure to personnel in the event of an accident ignition.

f. If base-ejection type projectiles must be transported to a disposal area or collection point, the base shall be oriented to the rear of the vehicle and the projectile secured, in the event the ejection charge functions in route.

g. If an OEW, with exposed hazardous filler (HE, etc), has to be moved to a disposal area, the item shall be placed in a heavy duty plastic bag to prevent migration of the hazardous filler. Padding should also be added to protect the exposed filler from heat, shock, and friction.

[redacted]

APPENDIX 6
Record Keeping Forms

OHM Corporation

DAILY SAFETY MEETING LOG

Date:______________________ Client:______________________

Specific Location:______________________ Job No.:______________________

SAFETY TOPICS PRESENTED:

Protective Clothing/Equipment:______________________

____

Ordnance Hazards:______________________

____

Physical Hazards:______________________

____

Emergency Procedures:______________________

____

Hospital/Clinic:______________________ Phone:______________________

Hospital Address:______________________

EMS Phone:______________________

Special Equipment:______________________

____

Other:______________________

____

ATTENDEES:

Name Printed:	Signature:

Meeting Conducted By:

______________________ ______________________

Name Printed Signature

DAILY SAFETY MEETING LOG
(CONTINUATION PAGE)

Date:

Client:

Specific Location:

Job Nc.

SAFETY TOPICS PRESENTED:

ATTENDEES:

Name Printed:	Signature:

PROJECT SAFETY CHECKLIST

Project: ____

Job No.: ____________________________ Date: ______________

The following safety checklist must be filled out on a weekly basis by the Project Supervisor or his designee. Records of this weekly site safety inspection must be kept in the project files and available for review.

N/A	Yes	No	
___	___	___	OSHA Posters, Site Safety Plan, Hazard Communication Program, OSHA Log 200, Health and Safety Procedures Manual, Weekly Safety Checklist
___	___	___	Site Safety Plan signed by all site personnel
___	___	___	First Aid Kit, Eye Wash, Safety Shower
___	___	___	Fresh water available for drinking and washing
___	___	___	MSDS for chemicals brought onto site
___	___	___	All chemical containers properly stored and labeled
___	___	___	Good housekeeping with a tidy, orderly appearance
___	___	___	Work Zones clearly defined and established
___	___	___	Decontamination line set up in transition zone
___	___	___	PPE appropriate for task
___	___	___	Hard hat, safety glasses, steel toe shoes for all personnel
___	___	___	Fire extinguishers present with up to date inspection record
___	___	___	Generators/Fuel tanks grounded
___	___	___	Appropriate air monitoring equipment on site properly used and maintained
___	___	___	Compressed gas cylinders stored upright and secured
___	___	___	Defective equipment tagged and taken out of service

Explanation of "NO" checks or other comments

____

____

____

OHM Corporation

OHM Corporation
Project Site Safety Inspection Checklist

Project Name:____
Project Number:______________________________________
Project Location:______________________________________
Site Supervisor:_______________________________________
Inspector's Name:_____________________________________

MEDICAL AND FIRST AID	YES	NO
1. Are First Aid Kits accessible and identified?	____	____
2. Are emergency eye wash and safety showers available?	____	____
3. Are daily logs for first aid present and up to date?	____	____
4. Are First Aid Kits inspected weekly?	____	____

PERSONAL PROTECTIVE EQUIPMENT		
1. Have levels of personnel protection been established?	____	____
2. Do all employees know their level of protection?	____	____
3. Are respirators used decontaminated, inspected, and stored according to standard procedures?	____	____
4. Have employees been fit-tested?	____	____
5. Is defective personal protective equipment tagged?	____	____
6. Does compressed breathing air meet CGA Grade "D" minimum?	____	____
7. Are there sufficient quantities of safety equipment and repair parts?	____	____
8. Does Level D protection consist of safety glasses, hard hats, and steel toe boots?	____	____

FIRE PREVENTION		
1. Is smoking prohibited in flammable storage areas?	____	____
2. Are fire lanes established and maintained?	____	____
3. Are flammable dispensing systems grounded and bonded?	____	____
4. Are approved safety cans available for storage of flammable liquids?	____	____
5. Has the local fire department been contacted?	____	____
6. Are fire extinguishers available near refueling areas?	____	____

AIR MONITORING		
1. Is air monitoring being conducted as required by the site safety plan?	____	____
2. Are air monitoring instruments calibrated daily?	____	____
3. Is the air monitoring logbooks up to date?	____	____
4. Are user manuals available?	____	____
5. Are instruments clean and charged?	____	____

WELDING AND CUTTING (29 CFR 1926 Subpart J)

1. Are fire extinguishers present at welding and cutting operations? ____ ____
2. Are confined spaces; such as, tanks, pipelines, and trenches; tested prior to cutting and welding operations? ____ ____
3. Are Hot Work Permits available? ____ ____
4. Are proper helmets, goggles, aprons, and gloves available for welding and cutting operations? ____ ____
5. Are welding machines properly grounded? ____ ____
6. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart? ____ ____
7. Are only trained personnel permitted to operate welding and cutting equipment? ____ ____

HAND AND POWER TOOLS (29 CFR 1926 Subpart I)

1. Are defective hand and power tools tagged and taken out of service? ____ ____
2. Is eye protection available and used when operating power tools? ____ ____
3. Are guards and safety devices in place on power tools? ____ ____
4. Are power tools inspected before each use? ____ ____
5. Are non-sparking tools available? ____ ____

MOTOR VEHICLES

1. Are vehicles inspected daily? ____ ____
2. Are personnel licensed for the equipment they operate? ____ ____
3. Are unsafe vehicles tagged and reported to supervision? ____ ____
4. Are vehicles shut down before fueling? ____ ____
5. When backing vehicles, are spotters provided? ____ ____
6. Is safety equipment on vehicles? ____ ____
7. Are loads secure on vehicles? ____ ____
8. Are vehicle occupants using safety belts if provided? ____ ____

EMERGENCY PLANS

1. Are emergency telephone numbers posted? ____ ____
2. Have emergency escape routes been designated? ____ ____
3. Are employees familiar with the emergency signal? ____ ____
4. Has the emergency route to the hospital been established and posted? ____ ____

MATERIALS HANDLING

1. Are materials stacked and stored as to prevent sliding or collapsing? ____ ____
2. Are flammables and combustibles stored in non-smoking areas? ____ ____
3. Is machinery braced when personnel are performing maintenance? ____ ____
4. Are tripping hazards labeled? ____ ____
5. Are semi-trailers chocked? ____ ____
6. Are fixed jacks used under semi-trailers? ____ ____
7. Are riders prohibited on materials handling equipment? ____ ____
8. Are cranes inspected as prescribed and logged? ____ ____
9. Are OSHA approved manlifts provided for the lifting of personnel?
10. Are personnel in manlifts wearing approved fall protection devices? ____ ____

FIRE PROTECTION

1. Has a fire alarm been established? ____ ____
2. Do employees know the location and use of all fire extinguishers? ____ ____
3. Are fire extinguisher locations marked? ____ ____

FIRE PROTECTION (Continued)

4. Are combustible materials segregated from open flames?
5. Have fire extinguishers been professionally inspected during the last year?
6. Are fire extinguishers visually inspected monthly?

ELECTRICAL (29 CFR 1926 Subpart K)

1. Is electrical equipment and wiring properly guarded?
2. Are electrical lines, extension cords, and cables guarded and maintained in good conditions?
3. Are extension cords kept out of wet areas?
4. Is damaged electrical equipment tagged and taken out of service?
5. Have underground electrical lines been identified by proper authorities?
6. Has positive lock-out system been established by a certified project electrician?
7. Are GFCI's being used as needed?
8. Are extension cords being inspected daily for ground continuity and structural integrity? (i.e., group pin in place, no unapproved splices)
9. Are warning signs exhibited on high voltage equipment (250V or greater)?
10. Is extension cord inspection documented?

CRANES AND RIGGING (29 CFR 1926.550)

1. Are cranes inspected daily?
2. Are crane swing areas barricaded or demarked?
3. Is all rigging equipment tagged with an identification number and rated capacity?
4. Is rigging equipment inspection documented?
5. Are slings, chains, and rigging inspected before each use?
6. Are damaged slings, chains, and rigging tagged and taken out of service?
7. Are slings padded or protected from sharp corners?
8. Do employees keep clear of suspended loads?
9. Are employees in the lift area wearing hard hats?

COMPRESSED GAS CYLINDERS

1. Are breathing air cylinders charged only to prescribed pressures?
2. Are like cylinders segregated in well ventilated areas?
3. Is smoking prohibited in cylinder storage areas?
4. Are cylinders stored secure and upright?
5. Are cylinders protected from snow, rain, etc.?
6. Are cylinder caps in place before cylinders are moved?
7. Are fuel gas and 02 cylinders stored a minimum of 20 feet apart?
8. Are propane cylinders stored and used outside the structure?

SCAFFOLDING (29 CFR 1926.451)

1. Is scaffolding placed on a flat, firm surface?
2. Are scaffold planks free of mud, ice, grease, etc.?
3. Is scaffolding inspected before each use?
4. Are defective scaffold parts taken out of service?
5. Does mobile scaffold height exceed 4 times the width or base dimension?
6. Does scaffold planking overlap a minimum of 12 inches?
7. Does scaffold planking extend over end supports between 6 to 18 inches?
8. Are employees restricted from working on scaffolds during storms and high winds?
9. Are all pins in place and wheels locked?
10. Is perimeter guarding (top rail, mid rail, and toe board) present?

WALKING AND WORKING SURFACES

1. Are ladders a Type I or Type II? ____ ____
2. Are accessways, stairways, ramps, and ladders clean of ice, mud, snow, or debris? ____ ____
3. Are ladders being used in a safe manner? ____ ____
4. Are ladders kept out of passageways, doors, or driveways? ____ ____
5. Are broken or damaged ladders tagged and taken out of service? ____ ____
6. Are metal ladders prohibited in electrical service? ____ ____
7. Are stairways and floor openings guarded? ____ ____
8. Are safety feet installed on straight and extension ladders? ____ ____
9. Is general housekeeping up to OHM standards? ____ ____
10. Are ladders tied off? ____ ____

SITE SAFETY PLAN

1. Is a site safety plan available on site or accessible to all employees? ____ ____
2. Does the safety plan accurately reflect site conditions and tasks? ____ ____
3. Have potential hazards been described to employees on site? ____ ____
4. Is there a designated safety official on site? ____ ____
5. Have all employees signed the acknowledgement form? ____ ____

SITE POSTERS

1. Are the following documents posted in a prominent and accessible area?

   A. Minimum Wage ____ ____
   B. OSHA Health and Safety ____ ____
   C. Equal Employment Opportunity ____ ____

SITE CONTROL

1. Are work zones clearly defined? ____ ____
2. Are support trailers located to minimize exposure from a potential release? ____ ____
3. Are support trailers accessible for approach by emergency vehicles? ____ ____
4. Is the site properly secured during and after work hours? ____ ____

HEAVY EQUIPMENT (29 CFR 1926 Subpart O)

1. Is heavy equipment inspected as prescribed by the manufacturer? ____ ____
2. Is defective heavy equipment tagged and taken out of service? ____ ____
3. Are project roads and structures inspected for load capacities and proper clearances? ____ ____
4. Is heavy equipment shut down for fueling and maintenance? ____ ____
5. Are back-up alarms installed and working on equipment? ____ ____
6. Are designated operators only operating equipment? ____ ____
7. Are riders prohibited on heavy equipment? ____ ____
8. Are guards and safety appliances in place and used? ____ ____

EXCAVATION (29 CFR 1926 Subpart P)

1. Has a "competent person" been designated to supervise this excavation activity? ____ ____
2. Have utility companies been advised of excavation activities? ____ ____
3. Prior to opening excavations, are utilities located and marked? ____ ____
4. Has a professional engineer evaluated all excavations greater than 20 feet deep? ____ ____
5. Is there rescue equipment on-site and accessible to excavation? ____ ____
6. Is excavated material placed a minimum of 24 inches from the excavations? ____ ____
7. Are the sides of excavations sloped or shored to prevent caving in on employees? ____ ____

EXCAVATION (29 CFR 1926 Subpart P - Continued)

8. Has excavation greater than 4-feet deep been monitored for hazardous atmospheres (i.e. LEL/02 deficiency)? ____ ____
9. Are ladders used in excavations over 4-feet deep? ____ ____
10. Are ladders present every 25 feet? ____ ____
11. Are barriers, i.e. guardrails or fences placed around excavations near pedestrian or vehicle thoroughfares? ____ ____
12. Is excavation inspected daily by competent persons and documented? ____ ____

CONFINED SPACES (Proposed Regulation 29 CFR 1910.146)

1. Have employees been trained in the hazards of confined spaces? ____ ____
2. Are confined space permits available on project site? ____ ____
3. Is the contractors confined space safety procedure on the project? ____ ____
4. Has a rescue plan been established? ____ ____

PERSONNEL DECONTAMINATION

1. Are decontamination stations set up on site? ____ ____
2. Are waste receptacles available for contaminated clothing? ____ ____
3. Are steps taken to contain liquids used for decontamination? ____ ____
4. Have decontamination steps and procedures been covered by the site supervisor or safety official? ____ ____
5. Is all personal protective equipment and respiratory equipment being cleaned on a daily basis? ____ ____

EQUIPMENT DECONTAMINATION

1. Has equipment decontamination been established? ____ ____
2. Is contamination wash water properly contained and disposed of? ____ ____
3. Are all pieces of equipment inspected for proper decontamination before leaving the site? ____ ____
4. Is all equipment being cleaned on a daily basis? ____ ____

HAZARD COMMUNICATION (29 CFR 1926.59)

1. Is there a written program on-site? ____ ____
2. Is there a MSDS FOR EACH CHEMICAL present on-site? ____ ____
3. Are all containers properly labeled, as to content, hazard? ____ ____
4. Have employees been trained on chemical hazards? ____ ____
5. Are employee's trained on chemical hazards while doing non-routine tasks? ____ ____
6. Do employees (including subcontractors) know and understand the acute and chemical effects of exposure from the chemicals on-site? ____ ____
7. Have all subcontractors signed the Haz-Comm acknowledgement form? ____ ____

I have reviewed this inspection checklist with the safety inspector and fully understand the recommendation and will make every attempt to correct them immediately.

	Signature	Date
Site Supervisor:	____________________	________
Project Manager:	____________________	________
OHM Compliance Inspector:	____________________	________

OHM Corporation

DAILY HEAVY EQUIPMENT SAFETY INSPECTION CHECKLIST

EQUIPMENT I.D. NO.: ____________ EQUIPMENT NAME: ____________________ WEEK OF: ____________

ITEM INSPECTED	**MONDAY**	**TUESDAY**	**WEDNESDAY**	**THURSDAY**	**FRIDAY**	**SATURDAY**	**SUNDAY**
Falling Object Protective Structure (FOP)							
Roll-Over Protective Structure (ROP)							
Seat Belts							
Operator Seat Bar(s)							
Side Shields, Screens or Cab							
Lift Arm Restraining Device							
Grab Handles							
Back-Up Alarm - Working							
Lights							
Guards							
Horn							
Anti-Skid Tread Steps Clear of Mud							
Safety Signs (i.e. counterbalance swing area)							
Fire Extinguisher							
General Condition							
Fuel Connection							
Oil (full and no leaks)							
Clear Of Extra Materials							
Controls function properly							
Damaged Parts							
Hydraulic System (full and no leaks)							
Parking brake							
Lift Arm and Bucket							
Tires/Tracks							
Steering							
Inspectors Name and Employee No.							

INSTRUCTIONS - Inspect all applicable items indicated, each shift. **If an unsatisfactory condition is observed, suspend operation of the equipment and report the**

OHM Corporation

PORTABLE FIRE EXTINGUISHER CHECKLIST

Office/Shop Location________________________

INVENTORY

Serial No.	Location	Serial No.	Location

Inspection Points

1. Fire extinguisher is in assigned location
2. Access is not obstructed
3. Fire extinguisher is fully charged
4. Lock-pin in place
5. Test tag attached and current

INSPECTIONS COMPLETED

Month	Initials	Month	Initials
January		July	
February		August	
March		September	
April		October	
May		November	
June		December	

Site Visitor's Log

CONTRACT NUMBER: ______________________

DELIVERY ORDER #: ______________

LOCATION: ______________________

Date	Name	Company	Safety Briefing Received	Time		Escort Required
				In	Out	

OHM Corporation

ACCIDENT/INJURY/ILLNESS REPORT FORM

Form 0084
H & S Dept.
6/91

☐ Accident	☐ Injury	☐ Illness
Property Damage	☐ Yes	☐ No
Vehicle Involved	☐ Yes	☐ No

Health & Safety Use Only

Case # ____________________
☐ First Aid Only
☐ Medical Treatment
☐ Lost Workdays – Restricted Activity
☐ Lost Workdays – Away from Work
☐ Fatality

Exact Date and Time of Incident ____________________ ____ a.m. ____ p.m. Shift ☐ 1st ☐ 2nd ☐ 3rd

OHM CORPORATION ____
(Employee's Home Division/Regional Office/Subsidiary)

Address ____
City State

PROJECT IDENTIFICATION (Project Related Incidents Only)

Project No. ____________ Project Start Date ____________ Completion Date ____________

Location (Full Address) ____

Telephone ____________ Project Manager ____

EMPLOYEE INFORMATION

Employee's Full Name ____ Employee No. ____________

☐ Regular Full Time ☐ Regular Part Time ☐ Temporary ☐ Non-Employee

Home Address ____

Date of Birth ____________ Age ____ Social Security No. ____ - ____ - ______ Sex ☐ M ☐ F

Job Title ____________ Department ____________ Date Hired ____________

Length of Employment ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs. Time in Job Class ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs.

Name of Employee's Direct Supervisor ____

Supervision at Time of Accident ☐ Directly Supervised ☐ Indirectly Supervised ☐ Not Supervised

Specific Location Where Incident Occurred ____

____ ☐ OHM Facility ☐ Project Site ☐ Other ____________

To Whom Was Incident Reported? ____ When? ____________

Witness Name/Address ____

Witness Job Title/Reason in Area ____

Describe Employee's Job Duties Being Performed When Injured ____

____

____

Describe Fully the Events Which Resulted in the Accident/Injury/Illness ____

____

____

PLEASE CONTINUE ON BACK OF THIS FORM

(Use Extra Page if Needed)

Describe the Injury/Illness in Detail; Indicate Part of Body Affected

Name of Object/Substance Which Directly Injured Employee

Has/Will Employee Seek Treatment? ☐ Yes ☐ No Did Employee Die? ☐ Yes ☐ No

Name/Address of Hospital/Doctor

Describe Treatment Given

Was Employee Able To Return To Work? ☐ Yes ☐ No

If YES: ☐ Regular Work ☐ Work with Restricted Activities

Restriction

If NO: Date Lost Time Began Date/Est. Date To Return

Identify Personal Protective Equipment Used by Injured Employee

What Training or Instruction Had Been Given?

How Could This Accident Have Been Prevented?

Corrective Action

Are You Reporting This Incident as an Industrial Injury/Illness? ☐ Yes ☐ No

Signature (Employee) Date

Signature (Supvr/Manager) Date

Signature (Safety Officer) Date

Signature (Proj. Manager) Date

Signing This Report does Not Constitute Certification of an Industrial Claim

DISTRIBUTION Original To: Division Secretary at Employee's Home Office

Copy To: ☐ Corporate Health & Safety ☐ Regional Health & Safety Manager

☐ Project Manager ☐ Site Safety File

OHM Corporation

Form 0085
H & S Dept.
6/91

INJURY/ILLNESS STATUS REPORT

Employee ____ Social Security No. ____ - ____ - ____

Home Address ____ Phone ____

Job Title ____ Home Division ____

Date/Time of Injury/Illness ____ ____ a.m. Location: ☐ OHM Facility ☐ Project Site

____ p.m. ☐ Other ____

Description of Injury/Illness ____

AUTHORIZATION TO RELEASE INFORMATION

I hereby authorize all physicians, hospitals, clinics and all persons to discuss with, and release to OHM Corporation and its authorized agents any information or copies thereof acquired in the course of my examination or treatment for the injury identified above. This authorization sha not extend to any other medical condition, past or present, unless the same is causally or historically relevant or related to the injury referred to above.

Employee Signature ____ Date ____

PHYSICIANS OR MEDICAL PERSONNEL TO COMPLETE REMAINDER OF FORM

WORK STATUS

☐ Patient may return to work with no limitations

____
Date

☐ Patient may return to work on ____
Date
with limitations indicated. These restrictions are in effect until ____ or until Reevaluation
Date
on ____
Date

Patient may work ____ hours in a work day.

☐ Patient is totally incapacitated at this time. Patient will be reevaluated on ____
Date

DEGREE

☐ **Sedentary Work.** Lifting 10 pounds maximum and occasionally lifting and/or carrying such articles as dockets, ledgers, and small tools. Although a sedentary job is defined as one which involves sitting, a certain amount of walking and standing is often necessary in carrying out job duties. Jobs are sedentary if walking and standing are required only occasionally and other sedentary criteria are met.

☐ **Light Work.** Lifting 20 pounds maximum with frequent lifting and/or carrying of objects weighing up to 10 pounds. Even though the weight lifted may be only a negligible amount, a job is in this category when it requires walking or standing to a significant degree or when it involves sitting most of the time with a degree of pushing and pulling of arm and/or leg controls.

☐ **Medium Work.** Lifting 50 pounds maximum with frequent lifting and/or carrying of objects weighing up to 25 pounds.

☐ **Heavy Work.** Lifting 100 pounds maximum with frequent lifting and/or carrying of objects weighing up to 50 pounds.

☐ **Very Heavy Work.** Lifting objects in excess of 100 pounds with frequent lifting and/or carrying of objects weighing 50 pounds or more.

LIMITATIONS

1. The patient may:
   - a. Stand/walk
     ☐ None ☐ 1-4 hours
     ☐ 4-6 hours ☐ 6-8 hours
   - b. Sit
     ☐ 1-3 hours ☐ 3-5 hours
     ☐ 5-8 hours
   - c. Drive
     ☐ 1-3 hours ☐ 3-5 hours
     ☐ 5-8 hours
2. Patient may use hands for repetitive:
   ☐ Single grasping ☐ Pushing & pulling
   ☐ Fine manipulation
3. Patient may use feet for repetitive movement as
   operating foot controls:
   ☐ Yes ☐ No
4. Patient is able to:

	Frequently	Occasionally	Not at All
a. Bend	☐	☐	☐
b. Squat	☐	☐	☐
c. Climb	☐	☐	☐

PHYSICIANS REPORT

Diagnosis ____

Prognosis ____

Other ____

____

☐ Referred to company physician
☐ Patient referred/admitted:

To Whom ____

Address ____

Phone ____

Date ____ Time ____

Date of this Report ____ Physician's Signature ____

Address ____ Phone ____

White – OHM
Canary – Clinic Copy

16406 U.S. Route 224 E. • P.O. Box 551 • Findlay, OH 45839-0551 • (419) 425-6064

WITNESS FORM

NAME AGE

ADDRESS

PHONE MARITAL STATUS

OCCUPATION

DATE ACCIDENT WITNESSED TIME

LOCATION OF ACCIDENT

MY POSITION AT TIME OF ACCIDENT

MY LOCATION AT TIME OF ACCIDENT

NARRATIVE REPORT

Describe in your own words what happened. (What did you see, hear, smell, do, etc.):

I have read the above report and it is true and correct to the best of my knowledge. I do not recall any other facts of this accident.

(Signature of witness)

/ /
(date)

OHM Corporation

NOTICE OF LOST TIME INJURY/DEATH

Please Type or Print

Employee's Name: ______________________________

Employee's No.: ______________

Location: ______________________________

Supervisor's Name: ______________________________

Date of Injury/Death: ____________________ Time: __________

Brief Description of Incident: ______________________________

____

____

Immediate Corrective Action: ______________________________

____

____

Tentative Follow-up Corrective Action: ______________________________

____

Signature: ____________________ Supervisor Manager

Date: ____________

Distribution

- **Fax to the following:**
  1) Fred Halvorsen, Vice President, Health and Safety
     Fax (419) 425-6039; Phone (419) 424-4910
  2) Regional Manager
- **Original:** Corporate Health and Safety
- **Copy:** Site Safety File

	CONTRACTOR QUALITY CONTROL REPORT (ATTACH ADDITIONAL SHEETS IF NECESSARY)			DATE
PHASE	Y-YES, N-NO, SEE REMARKS, BLANK-NOT APPLICABLE		IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT	
PREPARATORY	THE PLANS AND SPECS HAVE BEEN REVIEWED			
	THE SUBMITTALS HAVE BEEN APPROVED			
	MATERIALS COMPLY WITH APPROVED SUBMITTALS			
	MATERIALS ARE STORED PROPERLY			
	PRELIMINARY WORK WAS DONE CORRECTLY			
	TESTING PLAN HAS BEEN REVIEWED			
	WORK METHOD AND SCHEDULE DISCUSSED			
INITIAL	PRELIMINARY WORK WAS DONE CORRECTLY			TESTING PERFORMED & WHO PERFORMED TEST
	SAMPLE HAS BEEN PREPARED/APPROVED			
	WORKMANSHIP IS SATISFACTORY.			
	TEST RESULTS ARE ACCEPTABLE			
	WORK IS IN COMPLIANCE WITH THE CONTRACT			
WORK COMPLIES W/ CONTRACT AS APPROVED IN INITIAL PHASE				TESTING PERFORMED & WHO PERFORMED TEST
FOLLOW UP				

REWORK ITEMS IDENTIFIED TODAY (**NOT CORRECTED BY CLOSE OF BUSINESS**)	REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

REMARKS

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report

AUTHORIZED QC MANAGER AT SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT	DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE DATE

MEDEVAC EMERGENCY INFORMATION BRIEF SHEET

The information required on this form is the minimum necessary in order to ensure that proper preparations can be completed to adequately care for the patient. You must ensure that all information is passed to the MEDEVAC helicopter and to the receiving medical facility.

1. UNIT REPORTING CASUALTY: Kaho'olawe Range Control

2. TIME OF REPORT:__________ TIME OF INJURY:__________

3. PATIENT INFORMATION

a. Name: ____________________

b. Command: ____________________

c. Race: ____________________

d. Age: ____________________

e. SSN: ____________________

f. SEX: Male/Female

4. PATIENT'S SYMPTOMS

a. Respiration: ____________________

b. Pulse: ____________________

c. Temperature: ____________________

d. Symptoms: ____________________

e. Nature of Injury/Illness: ____________________

5. MEDICAL

a. Type Medication Given: ____________________

b. Amount: ____________________

c When Last Given ____________________

d. First Aid Administered (type): ____________________

e. On Scene Medical Expertise (Circle One):

(1) Doctor

(2) Medical personnel

(3) None

(4) Medical Expertise Will Accompany (Y/N)

6. COMMUNICATIONS CAPABILITY

a. VHF

(1) 148.350 MHz (Rx)

(2) 148.945 MHz (Tx)

(3) Marine Band CH 16/22 (Rx/Tx)

b. UHF

(1) 272.5 MHz (Rx)

c. FM

(1) 41.15 MHz (Rx)

7. RECEIVING HOSPITAL

a. Tripler Army Medical Center (TAMC)

b. Maui Memorial Hospital

8. WEATHER CONDITIONS AT SCENE

a. Seas: ________________________________

b. Visibility: ________________________________

c. Ceiling: ________________________________

d. Wind Speed: ________________________________

e. Wind Direction ________________________________

f. Barometer: ____________________________

9. ASSISTANCE DESIRED

a. MEDEVAC: ____________________________

b. Medical Technician: ____________________________

10. ON SCENE COMMANDER

a. Name: ____________________________

b. Rank: ____________________________

c. Branch: ARMY/NAVY/USAF/USMC/USCG

d. Command/Unit: ____________________________

e. Unit Phone: ____________________________

MACHINERY & MECHANIZED EQUIPMENT CERTIFICATION FORM

From: (Contractor)____

(Sub-Contractor)____________________________________

Contract No.____________ Title: ____________________________

____

____

To: Contracting Officer/ROICC/COTR

Subj: CERTIFICATION OF MACHINERY AND MECHANIZED EQUIPMENT

Ref: (a) U. S. Army Corps of Engineers, EM 385-1-1
Safety and Health Requirements Manual

1. Inspection and certification of machinery and mechanized equipment, as required by reference (a) has been made as shown below:

a. Identification of equipment:

(1)____________________________________ Date____________

(2)____________________________________ Date____________

(3)____________________________________ Date____________

(4)____________________________________ Date____________

(5)____________________________________ Date____________

2. The above listed equipment is CERTIFIED TO BE IN SAFE OPERATING CONDITION BY A COMPETENT MECHANIC and as outlined in reference (a).

Name, Title, and signature of competent mechanic making the inspection:

Name____________________________ Title____________________

Firm____

Signature____

Copy to :

PACNAVFACENGCOM Code 00K
Pearl Harbor, HI 96860-7300
Contract File

APPENDIX 7
Material Safety Data Sheets
Chemical Data Sheets

Index:

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP

No. 61
NITROGEN
(Revision A)

Issued: April 1980
Revised: April 1986

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: NITROGEN

DESCRIPTION: Gas supplied in cylinders (2000+ psig) or cold liquid supplied in vented Dewar containers.

OTHER DESIGNATIONS: N_2, CAS #7727-37-9, ASTM #D1933

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Air Products & Chemicals, Inc., Industrial Gas Division, PO Box 538,
Allentown, PA 18105; Telephone: (215) 481-4911
Airco Industrial Gases of the Boc Group, Inc., 575 Mountain Avenue,
Murray Hill, NJ 07974; Telephone: (201) 464-81000
Union Carbide Corp., Linde Div., 39 Old Ridgebury Rd., Danbury, CT 06817; Telephone: (203) 794-5300

HMIS
H 2
F 0
R 0
PPE*
* See Sect. 8

0
3 0

(Liquified)

R 1
I 1
S 2 (Liquid)
K 0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Nitrogen, CAS #7727-37-9	>99.5	No TLV Established.
Oxygen, CAS # 7782-44-7	< 0.5	

SECTION 3. PHYSICAL DATA

Boiling Point, 760 mm Hg ... -320.4°F (-195.8°C)
Vapor Density (Air = 1) ... 0.967
Solubility in Water @ 20°C, Vols./100 vols. ... 1.6
Density (liq.), g/cm^3 ... 0.8
Melting Point ... -345.7°F (-209.86°C)

Critical Temperature ... -232.5°F (-147.1°C)
Critical Pressure, Atm ... 33.5
Molecular Weight ... 28.01
Expansion Ratio, Liquid to Gas @ 70°F ... 1:696

Appearance and odor: A colorless, odorless, tasteless gas or a cryogenic liquid.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
Not Found	Not Found	Nonflammable	Not Found	Not Found

Use extinguishing media that are appropriate to the surrounding fire. Do not discharge solid streams of water into liquid N_2. Use water spray to cool fire-exposed containers or, if desirable, to increase the rate of evaporation of the liquid if the increased rate can be controlled (cryogenic liquid will rapidly freeze water). Nitrogen is a nonflammable material that will not support combustion. It presents no unusual explosion hazard unless the compressed gas is exposed to fire; then containers may rupture violently. Nitrogen cylinders are equipped with pressure-relief devices that are designed to vent N_2 when they are exposed to elevated temperatures and pressures. When liquid nitrogen is spilled it can release a rapidly vaporizing cloud that will create an oxygen-deficient atmosphere.

SECTION 5. REACTIVITY DATA

Nitrogen is stable when stored in closed containers. It does not polymerize. Nitrogen is noncorrosive and is nearly inert at room temperature. At high temperatures it can combine with oxygen to form oxides, and with hydrogen to form ammonia. When heated with carbon in the presence of alkalies or barium oxide it may form cyanides. It can form nitrides with lithium, silicon, calcium, strontium, and barium when it is at a red heat.

It has been reported that nitrogen can be oxidized explosively by ozone.

Lithium and titanium at an elevated temperature can burn in a nitrogen atmosphere. Berylium can be ignited in a mixed nitrogen-and-carbon dioxide atmosphere.

Nitrogen will react with oxygen in the presence of sparking (from an electric arc or a gas-fired furnace) to produce nitric oxide gas.

Material Safety Data Sheet

From Genium's Reference Collection

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP

No. 61
NITROGEN
(Revision A)

Issued: April 1980
Revised: April 1986

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: NITROGEN

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OTHER DESIGNATIONS: N_2, CAS #7727-37-9, ASTM #D1933

MANUFACTURER/SUPPLIER: Available from several suppliers, including:

Air Products & Chemicals, Inc., Industrial Gas Division, PO Box 538,
Allentown, PA 18105; Telephone: (215) 481-4911

Airco Industrial Gases of the Boc Group, Inc., 575 Mountain Avenue,
Murray Hill, NJ 07974; Telephone: (201) 464-81000

Union Carbide Corp., Linde Div., 39 Old Ridgebury Rd., Danbury, CT 06817; Telephone: (203) 794-5300

HMIS
H 2
F 0
R 0
PPE*
* See Sect. 8

(Liquified)

R 1
I 1
S 2 (Liquid)
K 0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Nitrogen, CAS #7727-37-9	>99.5	No TLV Established.
Oxygen, CAS # 7782-44-7	< 0.5	

SECTION 3. PHYSICAL DATA

Boiling Point, 760 mm Hg ... -320.4°F (-195.8°C)
Vapor Density (Air = 1) ... 0.967
Solubility in Water @ 20°C, Vols./100 vols. ... 1.6
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Melting Point ... -345.7°F (-209.86°C)

Critical Temperature ... -232.5°F (-147.1°C)
Critical Pressure, Atm ... 33.5
Molecular Weight ... 28.01
Expansion Ratio, Liquid to Gas @ 70°F ... 1:696

Appearance and odor: A colorless, odorless, tasteless gas or a cryogenic liquid.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
Not Found	Not Found	Nonflammable	Not Found	Not Found

Use extinguishing media that are appropriate to the surrounding fire. Do not discharge solid streams of water into liquid N_2. Use water spray to cool fire-exposed containers or, if desirable, to increase the rate of evaporation of the liquid if the increased rate can be controlled (cryogenic liquid will rapidly freeze water). Nitrogen is a nonflammable material that will not support combustion. It presents no unusual explosion hazard unless the compressed gas is exposed to fire; then containers may rupture violently. Nitrogen cylinders are equipped with pressure-relief devices that are designed to vent N_2 when they are exposed to elevated temperatures and pressures. When liquid nitrogen is spilled it can release a rapidly vaporizing cloud that will create an oxygen-deficient atmosphere.

SECTION 5. REACTIVITY DATA

Nitrogen is stable when stored in closed containers. It does not polymerize. Nitrogen is noncorrosive and is nearly inert at room temperature. At high temperatures it can combine with oxygen to form oxides, and with hydrogen to form ammonia. When heated with carbon in the presence of alkalies or barium oxide it may form cyanides. It can form nitrides with lithium, silicon, calcium, strontium, and barium when it is at a red heat.

It has been reported that nitrogen can be oxidized explosively by ozone.

Lithium and titanium at an elevated temperature can burn in a nitrogen atmosphere. Berylium can be ignited in a mixed nitrogen-and-carbon dioxide atmosphere.

Nitrogen will react with oxygen in the presence of sparking (from an electric arc or a gas-fired furnace) to produce nitric oxide gas.

SECTION 6. HEALTH HAZARD INFORMATION

Nitrogen is not listed as a carcinogen by the NTP, IARC, or OSHA.

This material is nontoxic and is classified as a simple asphyxiant by virtue of its displacement of oxygen. Symptoms of exposure depend on the degree and the duration of oxygen deficiency. They can include increased frequency and volume of breathing, increased pulse rate, muscular incoordination, fatigue, nausea, vomiting, and collapse. Inhalation of pure nitrogen atmosphere produces immediate loss of consciousness; death follows unless air/oxygen breathing can be quickly restored. Contact with liquid nitrogen or cold vapors can cause cryogenic burns (severe frostbite/freeze burns).

FIRST AID: CONTACT WITH LIQUID NITROGEN: Promptly flush areas affected with lots of tepid water to reduce freezing of tissue. (Do not apply direct heat to affected areas!) Do not rub frozen areas. Loosely apply dry, sterile, bulky dressings to protect area from infection and from further injury. Get medical help.*

INHALATION: Caution! Would-be rescuers need to be concerned with their own safety in oxygen-deficient areas. Use self-contained breathing equipment. Remove victim to fresh air. Quickly restore and/or support his breathing as required, administering oxygen if available. Get medical help.*

INGESTION: Get medical help.* ACUTE EFFECTS: Gas - Simple asphyxiation by displacement of oxygen. Liquid - Cryogenic burns. PRIMARY ENTRY: Inhalation

* GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of major nitrogen leaks or spills. Shut off leak if you can do so without risk. Evacuate all personnel from the danger area until ventilation can restore a safe oxygen level. Emergency personnel need self-contained breathing equipment. Minor leaks (which are dangerous in enclosed areas) can be detected by painting the suspected area of leakage with a soap solution. Prevent liquid nitrogen from contacting vulnerable steel structures and vehicle tires (see sect. 9). Allow spilled liquid to evaporate.

DISPOSAL: Remove a liquid nitrogen container or leaking cylinder outdoors or place into a hood with good forced ventilation. Allow gas to discharge at a moderate rate. Defective cylinders should be tagged to indicate defect. Close the valve and return the defective cylinder to supplier.

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide adequate general and local exhaust ventilation to prevent workplace atmospheres from becoming oxygen deficient (minimum O_2 volume = 18%). Provide air-supplied or self-contained breathing equipment for emergency or nonroutine situations where the nitrogen level is excessive. Use a safety line and a standby worker when respirator-protected personnel enter a hazardously nitrogen-enriched area. (The standby worker should have a self-contained breathing apparatus immediately available.) Those working with liquid nitrogen should wear approved insulating gloves, safety glasses, and other protective clothing as required by use conditions to prevent any skin contact with liquid nitrogen. Cuffless trousers should be worn outside high-topped shoes. Safety shoes are recommended for those handling cylinders of gases.

Wear safety gloves and approved insulated gloves. Use air-supplied or self-contained breathing apparatus.

Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store in a cool, dry, well-ventilated, low fire-risk area. Protect containers against physical damage.

SPECIAL HANDLING/STORAGE: Protect containers from extremes of temperature and weather. (Do not allow any part of a compressed gas cylinder to be exposed to temperatures above 125°F [51.6°C]). Follow general safety procedures for handling and securing compressed gas cylinders. Liquid nitrogen storage areas should be kept clean and free from flammable materials. Make sure that liquid nitrogen containers are properly vented to prevent buildup of pressure. All pressure equipment and process lines should be designed so that the minimum burst pressure is at least four (4) times the expected maximum pressure. Certain materials are unsuitable for service in contact with liquid nitrogen because they become extremely brittle and can be readily shattered by impact.

DOT Classification: Nonflammable Gas UN1066 (Compressed); UN1977 (Cryogenic Liquid)

LABEL: Nonflammable Gas

Data Source(s) Code: 1, 4-11, 14, 17, 25, 51, 63, 82, 84, CK

Approvals

Indust. Hygiene/Safety

Medical Review

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
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No. 56

SULFUR
(Revision A)
Issued: October 1979
Revised: August 1988

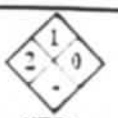
SECTION 1. MATERIAL IDENTIFICATION

Material Name: SULFUR

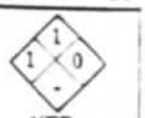
Description (Origin/Uses): Used in manufacturing sulfuric acid, carbon disulfide, sulfites, insecticides, plastics, enamels, metal-glass cements; in vulcanization and synthesis of rubber; in making gunpowder and matches; for bleaching wood pulp, straw, wool, silk, felt, and linen.

Other Designations: Brimstone; S; CAS No. 7704-34-9

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



NFPA
Fire



NFPA
Nonfire

HMIS
H 1
F 1
R 1
PPG*
*See sect. 8

R 1
I 2
S 2
K 1

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Sulfur, CAS No. 7704-34-9	Ca 100	**Toxicity Data*** Human, Eye Irritation: 8 ppm

*See NIOSH, *RTECS* (No. WS4250000), for additional data.

Comments: Powdered sulfur may be considered a nuisance dust per the ACGIH. If this classification applies to your work environment, follow the TLV-TWA of 10 mg/m^3 for total dust containing no asbestos and less than 1% crystalline silica.

SECTION 3. PHYSICAL DATA

Melting Point: >212°F (100°C)
Specific Gravity (H_2O = 1): Ca 2

Water Solubility (%): Insoluble
Molecular Weight: 32 Grams/Mole

Appearance and Odor: Yellow crystals, granules, powders, sticks, lumps, etc.; pure sulfur is odorless and tasteless. Sulfur exists in different forms (allotropes) that have slightly different physical properties.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
*	*	% by Volume	*	*

Extinguishing Media: *Sulfur is a combustible solid. Use a water fog or mist to fight sulfur fires; this will lessen the possibility of formation of a sulfur dust cloud. Applying a direct water spray is not recommended because it may scatter molten sulfur and dust. Steam and carbon dioxide may be useful in special cases.

Unusual Fire or Explosion Hazards: Sulfur dust particles suspended in air can explode, especially if they are in contact with oxidizing agents. Should a sulfur dust cloud form, immediately eliminate all possible sources of ignition (sparks, open flame, etc.) and take appropriate precautions such as spraying the affected area with a water mist or fog. When powdered sulfur is exposed to heat or sources of ignition, it is a weak fire and explosion hazard; its solid metallic form is even less reactive.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Sulfur is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: This material is a very reactive metal, especially in its powdered form. Hazardous reactions are reported between sulfur and aluminum, nitrates, chlorates, charcoal, bromates, iodates, and others. See Genium reference 84 (pp. 491M - 202 to 491M - 205) as well as the references cited in section 9 for a complete list of these hazardous reactions.

Conditions to Avoid: Avoid contact with incompatible chemicals and exposure to sources of ignition like heat, sparks, etc. Do not create dusty working conditions.

Hazardous Products of Decomposition: Toxic sulfur dioxide gas (SO_2) is produced during sulfur fires.

ECTION 6. HEALTH HAZARD INFORMATION

fur is not listed as a carcinogen by the NTP, IARC, NIOSH, ACGIH, or OSHA.

mmary of Risks: This material is very low in vapor pressure and toxicity. Sulfur dust can irritate the mucous membranes of the respiratory tract and the inner surface of the eyelids. For some individuals, skin sensitization may occur from repeated skin contact with sulfur.

Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Eyes, skin.
Primary Entry: Inhalation; skin or eye contact. **Acute Effects:** Irritation of the skin, eyes, and mucous membranes.
Chronic Effects: Possible skin sensitization reactions.

FIRST AID

Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.
Skin: Wash the affected area with soap and water.
Inhalation: Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.
Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. If the exposed person is responsive, induce vomiting. This is most effective within 30 minutes of ingestion.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. Remove any worker who has allergic reactions to sulfur from further exposure; consult with a physician before that worker is permitted to return to work in areas where exposure to sulfur is likely.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate all nonessential personnel, and provide adequate ventilation. Cleanup personnel need protection against contact with and inhalation of dust (see sect. 8). Scoop up spilled sulfur into suitable containers for disposal. Carefully sweep or vacuum up small spills or residues without creating dust clouds.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 1910.1000 Subpart Z): Not Listed
EPA Designations (40 CFR 302.4): Not Listed

CTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Consult the *NIOSH Pocket Guide to Chemical Hazards* for general recommendations on respirators. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, and aprons, etc., as required by the work environment to prevent prolonged or repeated skin contact. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of sulfur below the exposure limit cited in section 2.
Safety Stations: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling.
Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Particles can adhere to contact lenses and cause corneal damage. Do *not* wear contact lenses in any work area.
Comments: Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale sulfur dust.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store sulfur in a cool, dry, well-ventilated area in closed containers away from sources of ignition and incompatible chemicals (see sect. 5).

Special Handling/Storage: Build all storage facilities with an explosion-relief design to minimize damages from possible dust cloud explosions. Ground and bond all containers used in the shipping and transferring operations of bulk powdered sulfur.

Engineering Controls: To decrease sources of ignition of dust cloud explosions, make all engineering systems of maximum explosion-proof design.

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Sulfur (Solid) or Sulfur (Molten)
T ID Nos. UN1350 (Solid); UN2448 (Molten)
Label: None
DOT Hazard Class: ORM-C
IMO Label: Flammable Solid (Solid and Molten)
IMO Class: 4.1 (Solid and Molten)

References: 1, 2, 34, 73, 90-93.

Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: MJ Hardies, MD

MERCURY FULMINATE (DRY)

CAS RN: 628864 NIOSH #: OW 4050000
mf: $C_2HgN_2O_2$, mw: 284.63

White solid; mp: explodes; d: 4.42.

SYNS:
FULMINATE OF MERCURY, DRY
MERCURY FULMINATE (DOT)

TOXICITY DATA:
DOT: Forbidden FEREAC 41,57018,76. Occupational Exposure to Inorganic Mercury recm std: Air: TWA 0.05 mg(Hg)/m3 NTIS** Reported in EPA TSCA Inventory, 1980.

THR: See also mercury compounds.

Fire Hazard: Dangerous; should be kept moist until used.

Explosive Hazard: Dangerous. See also fulminates.

Disaster Hazard: When heated to decomp it emits very tox fumes of Hg and NO_x.

MERCURY FULMINATE (WET)

CAS RN: 628864 NIOSH #: OW 4055000
mf: $C_2HgN_2O_2$, mw: 284.63

SYNS:
FULMINATE OF MERCURY, WET
INITIATING EXPLOSIVE FULMINATE OF MERCURY (DOT)

TOXICITY DATA: 3
DOT: Class A Explosive, Label: Explosive A FEREAC 41,57018,76. Occupational Exposure to Inorganic Mercury recm std: Air: TWA 0.05 mg(Hg)/m3 NTIS**

THR: An explosive A. It can be kept more safely in wet form for use. See also mercury fulminate (dry).

Disaster Hazard: When heated to decomp it emits very tox fumes of Hg and NO_x.

Material Safety Data Sheet

From Genium's Reference Collection
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(518) 377-8855

GENIUM PUBLISHING CORP.

No. 429
DIBUTYL PHTHALATE
(Revision A)

Issued: May 1980
Revised: May 1986

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: DIBUTYL PHTHALATE

OTHER DESIGNATIONS: DBP, Di-n-butyl Phthalate, 1,2-Benzenedicarboxylic Acid DiButyl Ester, $C_6H_4(COOC_4H_9)_2$, CAS #0084-74-2, ASTM D608.

TRADE NAME/MANUFACTURER:
KODAFLEX DBP, Eastman Chemical Products, Inc., PO Box 431, Kingsport, TN 37662;
Telephone: 800-EASTMAN
STAFLEX DBP, Reichhold Chemicals, Inc., 525 North Broadway, White Plains, NY 10603;
Telephone: (914) 682-5700
FLEXOL DBP, Union Carbide Corp., Specialty Chemicals Div., Old Ridgebury Rd., Danbury, CT 06817; Telephone: (203) 794-2737

HMIS
H 0
F 1
R 0
PPE*
* See Sect. 8

R 1
I 2
S 1
K 1

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Dibutyl Phthalate, CAS #0084-74-2	> 99	8-hr. TWA: 5 mg/m³*
		Reproductive Effects: Rat, Oral (7 Days, Male), TDLo: 8400 ug/kg Rat, Interperitoneal (5-15 days pregnant), TDLo: 305 mg/kg
		Human, Oral, TDLo: 140 mg/kg
		Rat, Oral, LD$_{50}$: 12 g/kg

* Current OSHA PEL and ACGIH (1985-86) TLV.

SECTION 3. PHYSICAL DATA

Boiling Point, 1 atm ... 644°F (340°C)
Vapor Pressure @ 115°C, mm Hg ... 0.1
Vapor Density (Air = 1) ... 9.6
Solubility in Water @ 20°C, % ... 0.46

Specific Gravity (H_2O = 1) ... 1.05
Viscosity @ 20°C, cp ... 20.3
Freezing Point ... -31°F (-35°C)
Molecular Weight ... 278

Appearance and odor: A clear, colorless, nonvolatile, oily liquid; odorless or with a slight aromatic odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
315°F (157°C) CC	757°F (402°C)	Vol. % (at 456°F (240°C))	0.47	Not Found

EXTINGUISHING MEDIA: Use water spray, dry chemical, CO_2, or foam. Water or foam may cause frothing. Use water to cool fire-exposed containers.

This OSHA class IIIB combustible liquid is a slight fire hazard when exposed to heat or flame.

UNUSUAL FIRE/EXPLOSION HAZARDS: This material reacts explosively with chlorine.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should use self-contained breathing apparatus.

SECTION 5. REACTIVITY DATA

Dibutyl phthalate is stable. Hazardous polymerization cannot occur.

CHEMICAL INCOMPATIBILITIES: This material is combustible and can react vigorously with oxidizing agents. When heated with chlorine, for example, it can explode. Strongly acidic or alkaline materials can hydrolyze the ester to butyl alcohol and phthalic acid (or its salt).

CONDITIONS TO AVOID: It is incompatible with nitrates, strong oxidizers, strong alkalies, strong acids, and chlorine. Products of hazardous decomposition of DBP include oxides of carbon.

ECTION 6. HEALTH HAZARD INFORMATION

Dibutyl phthalate is not listed as a carcinogen by the NTP, IARC, or OSHA.

DBP is low in acute oral toxicity, but it has higher toxicity than di-(2-ethylhexyl) phthalate (see Genium MSDS #414). Its low vapor pressure makes it a low inhalation hazard unless it is heated or misted; inhaled vapor or mist can be irritating to the respiratory tract. Liquid contact with the eyes can be irritating and painful, causing tearing. Ingestion of 10g of DBP by a young male adult induced nausea and vertigo. Signs of keratitis and excess albumin and blood cells in the urine were observed; recovery with no aftereffects was reported.

TARGET ORGANS: Respiratory tract, gastrointestinal tract. PRIMARY ENTRY: Inhalation, ingestion, skin. ACUTE EFFECTS: Eye irritation with profuse tearing.

FIRST AID: EYE CONTACT: Flush thoroughly with running water, including under the eyelids, for 15 minutes. Get medical help.* SKIN CONTACT: Wash affected area well with soap and water. Remove contaminated clothing. INHALATION: Remove victim to fresh air. Get medical help if symptoms persist.* INGESTION: Get medical help for treatment, observation, and support.* (If the amount swallowed was large and medical help or advice is unavailable, give victim milk or water to drink and induce vomiting.) Do not give anything by mouth to someone who is unconscious or convulsing.

*GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of major DBP spills. Provide ventilation. Contain spills and collect material for recovery or disposal. Prevent flushing waste to a sewer or to a watercourse. Pick up small spills and residues with paper or another absorbent solid for disposal. Those involved in cleanup need protection against contact with liquid and vapor or mist inhalation.

DISPOSAL: Burn waste material and scrap in an approved incinerator. Combustibility may be improved by mixing with more flammable solvents such as waste alcohols. Follow Federal, state, and local regulations in disposing of this material.

NOTE: DBP at low chronic concentrations may be detrimental to the reproduction processes of aquatic organisms. It has a moderate biological oxygen demand.

CTION 8. SPECIAL PROTECTION INFORMATION

Wear chemical safety goggles and rubber or neoprene gloves.

Where vapors are heated or misted, use NIOSH-approved respiratory equipment for nonroutine or emergency situations.

Provide general and local exhaust to meet TLV requirements.

Workers should use additional protection such as aprons or face shields where needed to avoid repeated or prolonged skin contact.

An eyewash station and washing facilities should be available where DBP is handled.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store DBP in closed containers in a cool, dry, well-ventilated area away from acids, bases, and strong oxidizing agents. Protect containers from physical damage.

Because chronic effects are not fully known, practice good hygiene. Wear clean work clothing. Wash hands and face after working with this material and before eating or smoking. Avoid prolonged or repeated contact with DBP. Avoid breathing its mist or vapors.

Those with kidney impairment or disease should not work with this material without a physician's approval and surveillance, because urinary excretion is a major path of elimination of this material.

DOT Classification: ORM-E

Data Source(s) Code: 1-12, 14, 20, 23, 25, 31, 38, 42, 47, 48, 55, 82. CK

Approvals

Indust. Hygiene/Safety

Medical Review

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Material Safety Data Sheets Collection:

Sheet No. 842
Nitrocellulose/Collodion

Issued: 1/93

Section 1. Material Identification

Nitrocellulose/Collodion [$C_{12}H_{17}(NO_3)_3O_7$ or $C_{12}H_{16}(NO_3)_4O_6$] **Description:** Nitrocellulose is derived by treating cellulose with a mixture of nitric and sulfuric acids. Widely different products are obtained by varying the strength of the acids, temperature, reaction time, and acid/cellulose ratio. Collodion is a solution of nitrocellulose in an alcohol/ether mixture. Typical composition for 100 ml is 4 g nitrocellulose + 75 ml ether + 25 ml alcohol. Nitrocellulose is used in fast-drying automobile lacquers, high explosives, flashless propellant powder, leather finishing, collodion manufacture and for coating book-binding cloth. Collodion is used in cements; for process engraving, lithography, and photography; as a solvent for drugs, and medicinally in corn removers and sealing small wounds (veterinary).

Other Designations: CAS No. 9004-70-0 (same for nitrocellulose and collodion). *Nitrocellulose*: cellulose nitrate, guncotton, nitrocotton, pyroxylin; *collodion*: Kodak LR 115, Synpor, Tsapolak 964, xyloidin.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

Cautions: Nitrocellulose and Collodion are used interchangeably throughout literature, the major difference being that nitrocellulose is highly reactive (particularly when dry) and non-toxic and Collodion is the reverse: non-reactive and toxic (due to the alcohol and ether). Both are flammable.

Nitrocellulose, *colloided*

HMIS			
H	2	R	3
F	3	I	2
R	0	S	2
PPE-Sec. 8		K	4

NFPA
3
2 0

Nitrocellulose, *alcohol wet*

HMIS			
H	1	R	3
F	3	I	2
R	2	S	2
PPE-Sec. 8		K	4

3
2 2

Nitrocellulose, *water wet*

HMIS			
H	0	R	3
F	2	I	0
R	2	S	1
PPE-Sec. 8		K	4

2
1 2

Section 2. Ingredients and Occupational Exposure Limits

Nitrocellulose/Collodion, ca 100%. Collodion may contain 2% camphor and 3% castor oil as plasticizers.

1992 OSHA PELs
Transitional and Final Rule Limits:
8-hr TWA: 1000 ppm (1900 mg/m³), as *ethyl alcohol* in collodion
8-hr TWA: 400 ppm (1200 mg/m³), as *ethyl ether* in collodion
Final Rule Limit:
STEL: 500 ppm (1500 mg/m³), as *ethyl ether* in collodion

1992 NIOSH REL
None established

1992-93 ACGIH TLV
None established

1992 Toxicity Data*
Rat, oral, LD_{50}: > 5 gm/kg

1991 DFG (Germany) MAK
None established

* National Technical Information Service publication AD-8011-150

Section 3. Physical Data

Water Solubility: Insoluble

Other Solubilities: *Low* nitrogen nitrocellulose is soluble in acetone and alcohol ether solution; *high* nitrogen nitrocellulose is soluble only in acetone. Collodion is soluble in methanol, acetone, amyl acetate, and glacial acetic acid.

Melting Point: Ignites at 338 °F (170 °C), nitrocellulose

Molecular Weight: 459 to 594 (nitrocellulose)

Specific Gravity: *Nitrocellulose*, 1.66 at 68 °F (20 °C); *collodion*, 0.772 at 77 °F (25 °C)

Appearance and Odor: Nitrocellulose is a pulpy, cotton-like solid (block, flakes, granules, or powder). Collodion is colorless or slightly yellow, clear or slightly opalescent with an ether odor. It evaporates leaving a tough, colorless film.

Section 4. Fire and Explosion Data

Flash Point: 55 °F (13 °C)*, < 0 °F (< -18 °C)† | **Autoignition Temperature:** 338 °F (170 °C)† | **LEL:** 1.9% v/v† | **UEL:** 36% v/v†

Extinguishing Media: For small fires, use dry chemical, earth, sand, water spray, or regular foam. For large fires, use water spray, fog, or regular foam. Nitrocellulose wetted with water is harder to ignite and burns slower than collodion or nitrocellulose wetted with alcohol or other solvent.

Unusual Fire or Explosion Hazards: If wetting agent evaporates, nitrocellulose ignites readily, burns with intense heat and explodes if exposed to shock. Containers may explode in heat of fire. Nitrocellulose contains sufficient oxygen (O_2) self-sustain burning even in O_2 deficient atmospheres.

Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters protective clothing provides only limited protection. Apply cooling water to container sides until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Do not release runoff from fire control methods to sewers or waterways; dike for proper disposal.

* Nitrocellulose, † Collodion

Section 5. Reactivity Data

Stability/Polymerization: *Dry* nitrocellulose is shock-sensitive and can explode. If nitrogen content is > 12.6% it is considered explosive, regardless of whether or not it is damp. Collodion decomposes on prolonged storage especially when exposed to light. Collodion containing camphor as a plasticizer decomposes at lower temperatures (100 °F/ 38 °C) then it normally would. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Incompatible with acetyl peroxide, bromoazide, chlorine, strong oxidizers, acids, bases, and liquid air.

Conditions to Avoid: Exposure to sunlight, heat, ignition sources, and incompatibles. *Do not* allow nitrocellulose to dry out!

Hazardous Products of Decomposition: Thermal oxidative decomposition of nitrocellulose can produce carbon oxides (CO_x), nitrogen oxides (NO_x), and hydrogen cyanide (HCN) gas. Plasticized collodion also releases camphor.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list nitrocellulose or collodion as a carcinogen.

Summary of Risks: Nitrocellulose is not associated with any toxic effects. Collodion, which contains ether and ethanol can produce symptoms associated with exposure to these materials. Ethanol is not considered toxic by inhalation but skin contact causes dryness and irritation.

Continue on next page

ction 6. Health Hazard Data, *continued*

gested drunken behavior will ensue (*Genium* MSDS No. 361). Exposure to the ether contained in collodion is the most likely source of toxicity. apor inhalation leads to various degrees of central nervous system (CNS) depression. Skin contact causes dryness and possible irritation. **Medical Conditions Aggravated by Long-Term Exposure:** None reported **Target Organs:** CNS, skin, eyes, heart.

Primary Entry Routes: Inhalation, skin/eye contact. **Acute Effects:** Vapor inhalation (ether) causes irritation of the eyes and respiratory tract, dizziness, and drowsiness. High concentrations or prolonged exposure can damage the heart (ventricular fibrillations), convulsions, unconsciousness, and death due to respiratory failure. Consult *Genium* MSDS No. 343 for further information. **Chronic Effects:** Repeated inhalation (ether) can cause weight loss, insomnia, irritability, polycythemia (abnormally high number of red blood cells), and nephritis (kidney inflammation).

FIRST AID

Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute; *do not* induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against inhalation and skin/eye contact. Wet spill with water and carefully scoop into dry container. Flush large spill with water to containment area for reclamation or disposal. Prevent entry into sewers, drains, and waterways. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Treat waste with an alkali followed by biological treatment. A 5% suspension of nitrocellulose will decompose to cellulose by heating in a 10% aqueous ammonia solution at 75 °C for 8 hr. Suspended collodion in waste water can effectively be removed by lime and polyelectrolyte addition, flash mixing, flocculation, and sedimentation. The waste water should then be sent for biologic treatment. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.21): D001, Characteristic of Ignitability

Listed "Unlisted Hazardous Waste, Characteristic of Ignitability" as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [* per RCRA, Sec. 3001]

SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed

A Toxic Chemical (40 CFR 372.65): Not listed

A Designations

Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Listed under the Process Safety Standard as a Highly Hazardous Chemical (29 CFR 1910.119), TQ: 2500 lb

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires written a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Butyl rubber is a suitable material for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage/Handling Requirements: Store in upright steel containers in a cool, dry, well-ventilated area away from ignition sources, sunlight, and incompatibles (Sec. 5). Do not allow nitrocellulose to dry out! Storage and workrooms should be fire-resistant and water must be easily available. Equip storage tanks with decomposition and explosion venting. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. To prevent static sparks, electrically ground and bond all equipment used with nitrocellulose and collodion.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers.

Transportation Data (49 CFR 172.101)*

DOT Shipping Name: Nitrocellulose (> or = 25 % alcohol by mass)
T Hazard Class: 1.3 C
.: UN0342
Packing Group: II
DOT Label: Explosive 1.3 C
Special Provisions (172.102): —

Packaging Authorizations
a) **Exceptions:** None
b) **Non-bulk Packaging:** 173.62
c) **Bulk Packaging:** None

Quantity Limitations
a) **Passenger Aircraft or Railcar:** Forbidden
b) **Cargo Aircraft Only:** Forbidden

Vessel Stowage Requirements
a) **Vessel Stowage:** B
b) **Other:** 1E, 5E

* There are several different classifications of nitrocellulose depending on nitrogen content, solvent content, and plasticization. Consult the CFR for detailed listings.

MSDS Collection **References:** 1, 73, 101, 103, 124, 126, 127, 132, 136, 139, 153, 159, 168, 169, 183

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** TW Thoburn, MPH, MD

GP

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Material Safety Data Sheets Collection:

Sheet No. 811
2,4-Dinitrotoluene

Issued: 3/92

Section 1. Material Identification

2,4-Dinitrotoluene [$C_6H_3CH_3(NO_2)_2$] **Description:** The most important isomer of dinitrotoluene derived by nitration of toluene with nitric acid in the presence of concentrated sulfuric acid to yield about 80% 2,4- and 20% 2,6-isomers from which the 2,4-isomer is not usually separated. Used in manufacturing explosives and dyes, in inorganic synthesis, as a chemical intermediate, a plasticizer, and a modifier for smokeless powders in the munitions industry.

Other Designations: CAS No. 121-14-2, (2,4-dinitrotoluene); CAS No. 25321-14-6 (all isomers), DNT, dinitrotoluol, methyldinitrobenzene, NCI-CO1865.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(TM) for a suppliers list.

R 3
I 3
S 3*
K 2
* Skin absorption

NFPA
1
3 3
-

HMIS
H 3
F 2
R 3
PPG*
* Sec. 8

Cautions: 2,4-Dinitrotoluene is combustible and explosive. This material is highly toxic by skin absorption, inhalation, and ingestion.

Section 2. Ingredients and Occupational Exposure Limits

2,4-Dinitrotoluene, ca 80% 2,4- and 20% 2,6-, with <5% other isomers

1990 OSHA PEL (Skin)
8-hr TWA: 1.5 mg/m³

1990 IDLH Level
200 mg/m³, *all isomers. Treat as a potential human carcinogen.*

1990 NIOSH REL (Skin)
TWA: 1.5 mg/m³, *all isomers**

1991-92 ACGIH TLV (Skin)†
TWA: 1.5 mg/m³, *all isomers*

1990 DFG (Germany) MAK
Danger of cutaneous absorption
MAK-A2

1985-86 Toxicity Data‡
Rat, oral, LD_{50}: 268 mg/kg; toxic effects not yet reviewed
Rat, oral, TD_{Lo}: 2620 mg/kg administered for 78 continuous weeks caused skin and appendage tumors
Rat, oral, TD_{Lo}: 3094 mg/kg administered to a 13-week-old male produced effects on fertility (pre-implantation mortality)

* NIOSH recommends controlling potential carcinogens at the lowest possible level.
† Notice of intended change to 0.15 mg/m³
‡ See NIOSH, *RTECS* (XT1575000), for additional irritation, mutation, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 482 °F (250 °C)
Melting Point: 158 °F (70 °C); decomposes spontaneously at 536 °F (280 °C)
Vapor Pressure: 1 mm Hg at 68 °F (20 °C)
Vapor Density (air = 1): 6.27
Refraction Index: 1.442
Molecular Weight: 182.14
Specific Gravity: 1.3 *liquid*, 1.5 *solid* at 68 °F (20 °C)
Water Solubility: Insoluble
Other Solubilities: Soluble in alcohol, acetone, benzene, carbon disulfide, ether, and pyridine

Appearance and Odor: Orange to yellow crystalline solid or liquid with a slight odor.

Section 4. Fire and Explosion Data

Flash Point: 404 °F (207 °C), CC
Autoignition Temperature: None reported
LEL: None reported
UEL: None reported

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray, or regular foam. For large fires, use water spray, fog, or regular foam.

Unusual Fire or Explosion Hazards: 2,4-Dinitrotoluene is combustible and can become highly explosive when exposed to heat, friction, or contamination. 2,4-Dinitrotoluene's explosive energy is approximately 85% of TNT (a well-known, powerful explosive). Closed containers may rupture violently when heated. DNT decomposes spontaneously at 482 °F (250 °C, anaerobic) and 536 °F (280 °C, self-sustaining) and causes an explosion if confined. Contamination of DNT with organic materials lowers the decomposition temperature and increases the risk of explosion.

Special Fire-fighting Procedures: Since fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing is *ineffective* for fires involving DNT. Use extreme caution and fight fire from as far away as possible. Apply cooling water to container sides until long after fire is extinguished. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: 2,4-Dinitrotoluene is explosive when exposed to heat, friction, or contamination. It can be detonated but only by a very strong initiator. DNT is slightly sensitive to impact shock, with the liquid form less so than the solid form.

Chemical Incompatibilities: 2,4-Dinitrotoluene is incompatible with organic materials; strong reducing agents such as sodium sulphide, zinc powder, sodium hyposulphite, and metallic hydrides; strong oxidizing agents such as bichromates, peroxides, and chlorates (especially during transit); caustics; and metals such as tin and zinc. DNT corrodes some forms of plastics, rubber, and coatings.

Conditions to Avoid: Exposure to heat, friction, and incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of 2,4-dinitrotoluene can produce carbon dioxide (CO_2) and toxic nitrogen oxides (NO_x).

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, NIOSH recommends treating dinitrotoluene as a potential human carcinogen. The ACGIH and Germany (DFG) list it as Class A2 (probably carcinogenic to humans) and MAK-A2 (unmistakably carcinogenic in animals only), respectively. However, neither NIOSH, ACGIH, or MAK specify *which* or *how many* isomers are involved.

Summary of Risks: Highly toxic 2,4-dinitrotoluene is dangerous through all routes of human exposure. Skin absorption is more prevalent than inhalation (due to low vapor pressure) and ingestion. Cyanosis and anemia are the usual manifestations of exposure.

Medical Conditions Aggravated by Long-Term Exposure: Persons with blood disorders may be at increased risk.

Target Organs: Blood, liver, central nervous (CNS) and cardiovascular (CVS) systems.

Primary Entry Routes: Skin absorption, inhalation, ingestion.

Acute Effects: Skin absorption and inhalation cause many of the same effects. The major effect of exposure to DNT is cyanosis (a purplish discoloration of skin and mucous membranes due to lack of oxygenated blood) which occurs when methemoglobin (brownish blood pigment of the blood that cannot

Continue on next page

Section 6. Health Hazard Data, *continued*

mbine reversibly to molecular oxygen) concentration in the blood reaches 15% or more. Other possible symptoms include headache, irritability, izziness, weakness, nausea, vomiting, dyspnea (difficulty in breathing), drowsiness, and unconsciousness. If treatment is not prompt, death may occur usually by cardiovascular collapse. Ingestion can cause irritation of mouth and stomach, stomach cramps, and diarrhea. In addition to absorption symptoms, skin contact can cause irritation, small blisters, redness, swelling, ulceration, and necrosis (death of living tissue). Contact with eyes may produce irritation, redness and swelling of eyelids, pain on exposure to light, and severe eye damage. If molten, 2,4-dinitrotoluene can cause thermal burns. Ingestion of alcohol at time of exposure can increase an individual's susceptibility to toxicity.

Chronic Effects: Repeated or prolonged exposure to DNT may cause anemia (a deficiency in red blood cells, hemoglobin, or both). 2,4-Dinitrotoluene affects the liver's drug-metabolizing enzymes and is a liver mutagen and carcinogen in rodents.

FIRST AID *Emergency personnel should protect against contamination.*

Eyes: Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. *Do not* let victim rub or keep eyes tightly shut. Consult a physician immediately.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash entire body from head to foot with soap and water. Pay special attention to the hair, scalp, finger and toenails, nostrils, and ear canals. Repeat skin cleansing if the methemoglobin concentration appears to rise after 3 to 4 hr. Carefully dispose of contaminated clothing.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Consult a poison control center. Unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Determine the methemoglobin concentration in the blood every 3 to 6 hr. Urine excretion of dinitrotoluene in excess of 25 mg/L of urine indicates significant absorption. Consider giving intravenously 10 mL of 1% methylene blue solution at or below a 2-mL/min rate for victims with methemoglobin levels above 20%. Watch patient for 48 hr after apparent recovery to detect relapsing cyanosis and advanced anemia.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources—no flames, flares, or smoking in hazard area. Cleanup personnel should wear fully encapsulating vapor-protective clothing for spills with no fire. Use a water spray to reduce vapors. For small spills, carefully place in suitable, clean, dry containers (steel drums are preferred). Remove containers from area. For large spills, flush area with hot water to remove solid DNT and contain any liquid runoff. Cool and settle solid for disposal in steel drums. Follow applicable OSHA regulations (29 CFR 1910.120).

Environmental Transport: DNT released into water absorbs slightly to sediments and suspended solids with an estimated half-life of 438 days. When released into the atmosphere, DNT has an estimated half-life of 8 hr.

Soil Absorption/Mobility: DNT is slightly mobile in soil.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U105

sted as a CERCLA Hazardous Substance* (40 CFR 302.4): Reportable Quantity (RQ), 10 lb (4.54 kg) [* per RCRA, Sec. 3001, Clean Water ct, Sec. 311(b)(4), and Clean Water Act, Sec. 307(a)]

RA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective face shields (8-in. minimum), per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: training, fit-testing, periodic environmental monitoring, maintenance, cleaning, and convenient, sanitary storage areas.

Other: Wear chemically protective gloves, boots, aprons, and gauntlets (butyl rubber is the most effective material for protective clothing) to prevent all skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Separate contaminated clothing so that personnel who handle, dispose of, or clean it have no direct contact with it. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in cool, dry, well-ventilated area away from incompatibles. DNT is normally stored as a molten liquid; be sure to keep hot water coils lower than 194 °F (90 °C).

Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control the airborne contaminants and to maintain concentrations at the lowest possible level. Totally enclosed equipment systems are preferred. Be aware of mist escaping from hot charges, eaking lines, steaming operations, and hot drainage ditches because they are sources of serious skin exposure and worker environment contamination.

dministrative Controls: Suggested measures of protection include respiratory protection, job rotation, exposure time limitations, and use of protective hing and whole body protection. Consider preplacement and periodic medical examinations of exposed workers that include blood and urine analysis, ver function tests.

Transportation Data (49 CFR 172.102)

IMO Shipping Name: Dinitrotoluenes, solid; Dinitrotoluenes, molten

IMO Hazard Class: 6.1; 6.1

ID No.: UN1600; UN2038

IMO Label: Poison; Poison

IMDG Packaging Group: II; II

MSDS Collection **References:** 26, 38, 73, 89, 100, 101, 103, 126, 127, 136, 139, 140, 142, 148, 149, 153, 159, 162, 163, 164

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** AC Darlington, MPH, MD; **Edited by:** JR Stuart, MS

Material Safety Data Sheet

From Genium's Reference Collection

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GENIUM PUBLISHING CORP

No. 603

2-CHLOROACETOPHENONE

Issued: May 1986

SECTION 1. MATERIAL IDENTIFICATION

21

MATERIAL NAME: 2-CHLOROACETOPHENONE

OTHER DESIGNATIONS: alpha-Chloroacetophenone, Chloro Methyl Phenyl Ketone, Mace, Phenacyl Chloride, Phenylchloromethyl Ketone, Phenyl Chloromethyl Ketone, C_8H_7ClO, CAS #0532-27-4.

MANUFACTURER/SUPPLIER:
Haarmann & Reimer Corp., Aroma Chemical Div., PO Box 175,
111 US Hwy. 22, N. Springfield, NJ 07081; Telephone: (201) 686-3132

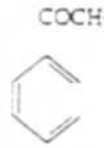
1
2 0
-

HMIS
H: 2
F: 1
R: 1
PPE*
*See Sect. 8

R 1
I 4
S 3
K 1

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
2-Chloroacetophenone, CAS #0532-27-4	ca 100	8-hr. TWA: 0.05 ppm or 0.3 mg/m^3* Rat, Oral, LD$_{50}$: 127 mg/m^3 Human, Inhalation, LCLo: 159 mg/m^3/20 min. Human, Inhalation, TCLo: 20 mg/m^3: Irritation Rabbit, Eye: 3 mg, Severe



* Current (1985-86) ACGIH TLV or OSHA PEL.

SECTION 3. PHYSICAL DATA

Boiling Point, 1 atm ... 477°F (247°C)
Vapor Pressure @ 20°C, mm Hg ... 0.012
Water Solubility @ 20°C ... Insoluble
Vapor Density (Air = 1) ... 5.32
Evaporation Rate ... Not Found

Specific Gravity (H_2O = 1) ... 1.324
Melting Point ... 138°F (59°C)
Percent Volatile by Volume ... ca 100
Molecular Weight ... 154.60

Appearance and odor: Colorless-to-gray crystalline solid with a sharp, irritating floral odor. The odor threshold for 2-chloroacetophenone is 0.1 mg/m^3.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	LOWER	UPPER
244°F (118°C) CC	Not Found	Not Found	–	–

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, foam, water fog. Water or foam may cause frothing. Use water spray to cool tanks/containers exposed to fire.

This OSHA class IIIB combustible liquid is a slight fire hazard when exposed to heat, sparks, or open flame. When involved in a fire, 2-chloroacetophenone emits toxic and corrosive vapors.
Fire fighters should use self-contained breathing apparatus and fully protective clothing when fighting fires involving this material.

SECTION 5. REACTIVITY DATA

2-Chloroacetophenone is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

This material is incompatible with strong oxidizers. It reacts slowly with water or steam, generating hydrogen chloride.

Thermal decomposition or burning produces toxic vapors and gases such as carbon monoxide and fumes of chlorine.

SECTION 6. HEALTH HAZARD INFORMATION

2-Chloroacetophenone is not listed as a carcinogen by the NTP, IARC, or OSHA.
This material is a potent irritant and lacrimator (promotes tears). It is highly toxic by inhalation and ingestion. Symptoms of overexposure include tingling in the nose, lacrimation, burning of and/or pain in the eyes, blurred vision, rhinorrhea, burning in the chest, difficulty in breathing, and nausea. In extreme cases pulmonary congestion and edema may result, with onset of edema appearing several hours to days after exposure. Humans exposed to levels of 200 to 340 mg/m^3 could not tolerate exposure for more than 30 seconds. 2-Chloroacetophenone is irritating to the skin and intensely irritating to the eyes. Overexposure of eyes can cause severe conjunctivitis; corneal haziness; pain; and, in severe cases, permanent partial opacity (leukoma). Contact with the skin may cause a burn, especially if the skin is moist or wet. It can also cause dermatitis and skin sensitization. The TLV of 0.05 ppm is set to prevent lacrimation and irritation. The irritation threshold for 2-chloroacetophenone ranges from 0.15 to 0.4 mg/m^3; while the lacrimation threshold is 0.3 to 0.4 mg/m^3. No chronic effects are reported. FIRST AID: EYE CONTACT: Promptly flush eyes, including under the eyelids, with running water for at least 15 minutes. Get medical help.* SKIN CONTACT: Promptly flush skin with running water for at least 15 minutes while removing contaminated clothing and shoes. Get medical help if irritation persists.* INHALATION: Remove victim to fresh air. Restore and/or support his breathing as required. Keep him/her warm and quiet. Observe victim for symptoms of pulmonary edema. Get medical help.* INGESTION: Give victim 1 or 2 glasses of water or milk to drink as quickly as possible. Contact a physician or poison control center. Do not induce vomiting unless directed to do so. Never give anything by mouth to someone who is unconscious or is convulsing.*

GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large 2-chloroacetophenone spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Evacuate the spill area and limit access to necessary personnel only. Remove any leaking containers to a safe place, if feasible. Those involved in cleanup need protection against contact with the solid form and inhalation of dust and vapor (see sect. 8).

Scoop, shovel, or vacuum spilled material into closed containers. Use caution to avoid generating dust. Flush spill area with water and collect flushings and waste water for disposal. Do not flush waste to a sewer, watershed, or waterway.

Place waste in a suitable container for disposal by a licensed contractor, dispose of it in a landfill, or dissolve it in an organic solvent and burn it in an approved incinerator equipped with an afterburner and a scrubber. Follow all Federal, state, and local regulations.

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 lfm (linear feet per minute). For emergency or nonroutine exposures where the TLV may be exceeded, use an appropriate NIOSH-approved respirator.

Impervious gloves, face shield, apron, boots, plastic coveralls, and other protective clothing and equipment should be available and worn as necessary to prevent contact with skin or clothing. Wear safety goggles to prevent any possibility of 2-chloroacetophenone coming in contact with the eyes. Remove contaminated clothing immediately and do not wear it again until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store 2-chloroacetophenone in closed containers in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, and open flame. Storage area must be suitable for combustible solids. Protect containers from physical damage. Ground and bond conveying equipment and storage containers when transferring the solid to prevent the possibility of a dust explosion. Any bulk storage system should have an explosion-relief design. Do not smoke in use or handling areas. Use only with adequate ventilation. Avoid inhalation of dust and vapor and contact with skin, eyes, and clothing. Practice good industrial hygiene when handling this material. Avoid generating dust. Emptied containers retain product residues; handle them accordingly!

Preplacement and periodic physical examinations should be provided to those who work with this material. Individuals with histories of chronic respiratory, skin, or eye disease may be at increased risk from exposure.

DOT Classification: Irritating Material. DOT No. UN1697
Data Source(s) Code: 2, 4, 5, 7, 8, 23, 34, 47, 63, 69, 75, 78, 79-82. CR

Approvals
Indust. Hygiene/Safety
Medical Review

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Material Safety Data Sheets Collection:

Sheet No. 471
Charcoal (Activated)

Issued: 12/81 Revision: A, 9/91

Section 1. Material Identification

Charcoal (Activated) Description: Relatively pure carbon obtained by the destructive distillation of wood, nut shells, animal bones, or other carbonaceous material. It is activated by heating to 1472 to 1652 °F (800 to 900 °C) with steam or carbon dioxide. Activation results in a porous internal structure (honeycomb-like) with an internal surface area of approximately 10,000 ft²/g. This large surface area gives charcoal a high absorptivity for many gases, vapors, and colloidal solids. Used in water and air purification, waste treatment, solvent recovery, removal of sulfur dioxide from stack gases and "clean" rooms, removal of jet fumes from airports, decolorizing of sugar, catalyst natural gas purification, chromium electroplating, air conditioning, brewing, and as a deodorant.

Other Designations: CAS No. 64365-11-3; activated carbon (DOT); Carboraffin;® Carborafine;® charcoal, activated (DOT); Karborafin;® Nuchar 722.®

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*™ for a suppliers list.

Cautions: Charcoal dust is a respiratory irritant. It is a flammable solid.

R
I
S
K

Section 2. Ingredients and Occupational Exposure Limits

Charcoal*

1990 OSHA PEL†	1990-91 ACGIH TLV†	1990 NIOSH REL	1985-86 Toxicity Data‡
None established	None established	None established	None listed

* An approximate composition of charcoal (coconut shell) is ca 80% carbon, <20% volatiles (including ca 2% water) and <5% ash content (residue after 1697 °F (925 °C) ignition).

† Related dust exposures are established for carbon black and graphite, synthetic.

‡ Monitor NIOSH, *RTECS* (FL7242500), for future toxicity data.

Section 3. Physical Data

Melting Point (carbon): >6332 °F (>3500 °C)
Volatiles at 302 °F (150 °C), %wt: <20*
Water Solubility: Insoluble

Appearance and Odor: Porous, hard, black granules or powder; odorless.

* Pertains to coconut shell charcoal.

Section 4. Fire and Explosion Data

Flash Point: None reported
Autoignition Temperature: >1346 °F (>730 °C)*
LEL: 0.14 g/l†
UEL: None reported

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or standard foam. Us water spray to cool fire-exposed containers.

Unusual Fire or Explosion Hazards: Activated charcoal is a moderate fire hazard. Depending on particle size, volatiles, and moisture level, charcoal dust can be an explosion hazard when exposed to heat or flame.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing provides limited protection. If feasible, remo containers from fire-hazard area. Avoid creating dusty conditions. Do not release runoff from fire control to sewers or waterways.

* 80% coconut shell charcoal, <74 µm diameter.

† This value is for charcoal.

Section 5. Reactivity Data

Stability/Polymerization: Activated charcoal is stable when stored dry at room temperature in closed containers under normal storage and handling conditions. Finely divided carbon particulate reportedly undergo spontaneous combustion when moist, when coated with drying oils when freshly calcined. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Activated charcoal may react vigorously or violently (explosion) when mixed with strong oxidizing agents, especially when heated. It can slowly react with oxygen in air at room temperature to create an oxygen-deficient atmosphere in a closed but not easily ignited, but oxidation rate increases with temperature and oxygen availability.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: If combustion of this material occurs with a deficiency of oxygen, carbon monoxide can be formed.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA do not list activated charcoal as a carcinogen.

Summary of Risks: Charcoal itself is not toxic, but by absorption or inclusion it may contain toxic materials. When fine particulate is airborne, it can be irritating to eyes and the respiratory tract. Excessive inhalation can be damaging to the respiratory systems.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Respiratory tract.

Primary Entry Routes: Inhalation.

Acute Effects: Eye contact is irritating and may cause conjunctivitis. Dust inhalation can cause respiratory tract irritation.

Chronic Effects: None reported.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Activated charcoal is used as a treatment to absorb specific, ingested chemicals. If activated charcoal is ingested, have *conscious and alert* person drink one to two glasses of water to dilute. Activated charcoal may cause vomiting. Never give anything by mouth to an unconscious or convulsing person.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of large spills and remove all heat and ignition sources. Cleanup personnel should protect against dust inhalation and eye contact. Avoid dispersing dust in air. For small spills, use a clean shovel to place charcoal into a clean, dry container for disposal. Cover containers and remove from spill area. For large spills, dike for later disposal. After cleanup is complete, pick up or vacuum residues and place in closed containers for recovery or disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

ARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations*

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

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* Related dust exposures are listed for carbon black and graphite, synthetic.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves to prevent prolonged or repeated skin contact.

Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a dry area, away from heat and ignition sources and oxidizing agents. Protect containers from physical damage.

Engineering Controls: Avoid dust inhalation. Consider a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Follow good handling and housekeeping procedures; avoid spills and dust generation and accumulation.

Transportation Data (49 CFR 172.102)

IMO Shipping Name: Carbon, activated

O Hazard Class: 4.2

No.: UN1362

IMO Label: Spontaneously combustible

IMDG Packaging Group: III

MSDS Collection References: 1-9, 12, 14, 25, 73, 103, 126, 127, 132, 136, 143, 146

Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: AC Darlington, MD; Edited by: JR Stuart, MS

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
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GENIUM PUBLISHING CORP.

No. 216

MAGNESIUM METAL
(Ribbons/Turnings)

Issued: August 1987

SECTION 1. MATERIAL IDENTIFICATION

23

MATERIAL NAME: MAGNESIUM METAL (RIBBONS/TURNINGS)
DESCRIPTION (Origin/Uses): Prepared by electrolysis of a mixture of magnesia and mercuric oxide. Used in alloys of light metals, in pyrotechnics, flashbulbs and flares; as a Grignard reagent; for recovery of titanium.
OTHER DESIGNATIONS: Mg; NIOSH *RTECS* #OM2100000; CAS #7439-95-4
TRADE NAMES/VENDORS: MAGNESIUM METAL, Reade Manufacturing Co.
MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Reade Manufacturing Co., Ridgeway Blvd., Lakehurst, NJ 08733; Telephone: (201) 657-6451
COMMENTS: Combustible magnesium metal in the form of fine powder, thin sheets, and turnings is easily ignited and burns with intense heat. Powders form explosive mixtures in air that can be ignited by a spark.

HMIS
H 1
F 3
R 3
PPE*
* See sect. 8

R 1
I 1
S 1
K 4

SECTION 2. INGREDIENTS AND HAZARDS

	%
Magnesium Metal, CAS #7439-95-4, NIOSH *RTECS* #OM2100000	100
Magnesium Oxide (Fumes), CAS #1309-48-4; NIOSH *RTECS* #OM3850000	

* Current 1987-88 ACGIH TLV

Comments: Primarily hazardous as a combustible metal.

HAZARD DATA

Hazard and Toxicity Data
TLV: 10 mg/m^3 as
Magnesium Oxide*
TLV: Magnesium Metal: None Established

Toxic Dose for Magnesium Oxide
Human, Inhalation, TC$_{Lo}$: 400 mg/m^3 (Toxic Effects: Unspecified in Source)
Hamster, Intratracheal, TD$_{Lo}$: 480 mg/kg (30 Weeks, Intermittent Toxic Effects: Equivocal Tumorigenic Agent)

SECTION 3. PHYSICAL DATA

Boiling Point ... 2025°F (1107°C)
Vapor Pressure ... 1 Torr at 1150°F (621°C)
Water Solubility ... Insoluble
Vapor Density ... Negligible
Evaporation Rate ... Negligible

Specific Gravity ... 1.740
Melting Point ... 1300°F (649°C)
Percent Volatile by Volume ... Not Found
Molecular Weight ... 24.31 Grams/Mole
pH ... Water Solution Alkaline (pH >7)

Appearance and odor: Silvery white metal. Odorless.

Comments: Solvent solubility: mineral acids, concentrated hydrofluoric acid ammonium salts.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Combustible	Not Found	Not Found	Not Found	Not Found

EXTINGUISHING MEDIA: Use G-1® graphite powder, Met-L-X® powder, powdered talc, dry graphite, powdered sodium chloride, soda ash, or other suitable powders. WARNING: Do not use foam, carbon tetrachloride, carbon dioxide, or water to extinguish magnesium fires, because dangerous reactions will occur (see sect. 5). UNUSUAL FIRE/EXPLOSION HAZARDS: Magnesium may react with moisture or acids to evolve hydrogen gas (H_2), which is a highly dangerous fire or explosion hazard. It will react violently with oxidizing materials. SPECIAL FIRE-FIGHTING PROCEDURES: During machining, magnesium fires may result from use of dull cutting tools or making light (thin) cuts at high speed. Magnesium turnings and borings should be collected frequently during working hours. Store them in clean, dry, metal-covered containers labeled "Magnesium Only." Fire fighters should protect their eyes and skin from flying particles. In order to prevent eye injury, do not look directly at magnesium fires. Wear protective breathing apparatus. In the case of massive magnesium fires, protect nearby facilities and let the fire burn.

SECTION 5. REACTIVITY DATA

Magnesium is stable. Hazardous polymerization cannot occur.
CHEMICAL INCOMPATIBILITIES: This material will react violently with chlorinated solvents, methanol, hydrogen peroxide, oxidizing agents, sulfur compounds, animal and vegetable oils, water, metal oxides, metal cyanides, metal oxide salts, oxygen, and tellurium compounds. CONDITIONS TO AVOID: Magnesium may ignite itself if it is exposed to air or in the presence of moisture. It may reignite itself after the fire is extinguished. Its violent reaction with water will generate hydrogen. Prohibit open flames or electrical or gas cutting or welding equipment where magnesium dust is produced or handled. Special precautions are needed to prevent ignition while dressing grinding wheels. Use nonsparking tools in dusty situations. PRODUCTS OF HAZARDOUS DECOMPOSITION: Magnesium oxide. COMMENTS: Fire fighters should not breathe fumes from magnesium fires. Smoking must be prohibited in all areas where magnesium is found.

SECTION 6. HEALTH HAZARD INFORMATION

Magnesium is not listed as a carcinogen by the NTP, IARC, or OSHA.

SUMMARY OF RISKS: Magnesium metal does not have well-characterized toxicity. Magnesium particles imbedded in the skin can produce sores that resist healing and an accumulation of gas under the skin and gaseous blebs (small blisters). Inhalation of magnesium fumes may cause metal fume fever. Magnesium oxide (MgO) fumes can irritate the nose and throat. Magnesium oxide has a TLV of 10 mg/m^3, while the TLV for magnesium metal is unavailable. TARGET ORGANS: Upper respiratory tract and lungs, skin, eyes, and central nervous system. PRIMARY ENTRY: Inhalation or oral ingestion of magnesium salts. ACUTE EFFECTS: Magnesium fumes in oxide form can irritate the eyes, nose and throat and cause metal fume fever with febrile conditions, cough, a feeling of pressure on the chest, and leukocytosis (an increase in the number of leukocytes circulating in the blood). Spills of molten magnesium can cause skin burns. CHRONIC EFFECTS: None reported. MEDICAL CONDITIONS AGGRAVATED BY LONG-TERM EXPOSURE: Intoxication may be caused by oral administration of magnesium salts to someone with kidney disease.

FIRST AID: EYE CONTACT: Immediately flush eyes, including under the eyelids, gently but thoroughly for at least 15 minutes. Get medical help.* SKIN CONTACT: Wash thoroughly after handling magnesium. Get medical help.* INHALATION: Remove victim to fresh air; restore and/or support his breathing as needed. Avoid prolonged or repeated exposure to magnesium. If victim is not breathing, give him artificial respiration. Get medical help.* INGESTION: Rinse victim's mouth with water; give him 2 or 3 glasses of water to drink. Do not induce vomiting. Never give anything by mouth to someone who is unconscious or convulsing. Magnesium metal has a low oral toxicity. Get medical help.*

* GET MEDICAL ASSISTANCE = IN PLANT, PARAMEDIC, COMMUNITY. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Remove any sources of ignition from a magnesium spill. Do not use water in cleanup or get spilled material wet. Use nonsparking tools. Place waste in clean, dry, metal containers and remove them to clean, dry storage.

WASTE DISPOSAL: Magnesium scrap is usually reclaimed for economic value. Small amounts may be disposed of in landfills. Follow Federal, state, and local regulations.

EPA Hazardous Waste Number (40 CFR 261.21, Ignitability): D001

Both magnesium metal and magnesium oxide are reported in the 1980 EPA TSCA Inventory.

Aquatic Toxicity Rating: TLm96: Over 1000 ppm for magnesium oxide.

Magnesium is not designated as a hazardous substance by the EPA (40 CFR 116.4).

EPA Reportable Quantity (40 CFR 117.3): Not Listed

SECTION 8. SPECIAL PROTECTION INFORMATION

GOGGLES: Wear dust-resistant goggles or face shields to prevent eye contact with magnesium. GLOVES: Wear impervious gloves to prevent prolonged contact with skin. RESPIRATOR: Where high dust levels prevail, use a NIOSH-approved dust mask. VENTILATION: Where dusty conditions prevail, provide dry, explosion-proof ventilation. Eliminate all possible sources of ignition/explosion.

SAFETY STATIONS: Eyewash stations, washing facilities, and safety showers should be available in areas of use and handling.

CONTAMINATED EQUIPMENT: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Particles may cling to contact lens surfaces and cause corneal injury.

COMMENTS: Practice good personal hygiene. Keep materials off your clothes and equipment. Avoid transferring materials from hands to mouth while eating, drinking, or smoking.

In all cases prevent contact with fire sources or possible chemical mixing, because this metal is highly reactive (see sect. 5).

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store magnesium in tightly closed containers in a cool, dry, well-ventilated area away from fire sources or combustibles. Protect containers from physical damage. SPECIAL HANDLING/STORAGE: Use nonsparking tools when working with or near this material. Store massive amounts of magnesium bars in the open, as is done with aluminum or steel. ENGINEERING CONTROLS: Install ventilation systems that maintain airborne levels of magnesium oxide below 10 mg/m^3. Ground and bond all metal containers. Eliminate all possible sources of ignition.

OTHER PRECAUTIONS: Avoid inhaling dust or letting it come in contact with your eyes. Practice good personal hygiene when handling this material. Prohibit all use of tobacco near magnesium. COMMENTS: Do not take this material out of your work area or to your home on your clothing or equipment.

TRANSPORTATION DATA (per 49 CFR 172.101-2):

DOT Shipping Name: Magnesium Metal DOT Hazard Classification: Flammable Solid DOT ID No. UN1869

DOT Required Label: Flammable Solid; Dangerous When Wet Additional DOT Requirements: Segregation, the same as for flammable solids labeled Dangerous When Wet.

References: 1-12, 18, 24, 37, 39, 44, 82, 84, 87-102. OW

Approvals	
Indust. Hygiene/Safety	
Medical Review	Geoff Goldsmith, MD

Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 209

STRONTIUM PEROXIDE

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

22

MATERIAL NAME: STRONTIUM PEROXIDE

DESCRIPTION/USES: Derived by passing oxygen over heated strontium oxide or from the reaction of strontium hydroxide and hydrogen peroxide. Used in bleaching; fireworks; and as an antiseptic.

OTHER DESIGNATIONS: Strontium Dioxide, SrO_2, CAS #1314-18-7

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803;
Telephone: (516) 349-8800
Barium and Chemicals, Inc., PO Box 218, Steubenville, OH 43952;
Telephone: (614) 282-9776

HMIS
H 1
F 0
R 1
PPE*
*See Sect. 8

R 1
I --
S 2
K 0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Strontium Peroxide, CAS #1314-18-7	>99%	ACGIH TLV: None Established. OSHA PEL: None Established. Toxicity Data: None Found.

SECTION 3. PHYSICAL DATA

Melting Point ... 419°F (215°C) (Decomposes)
Boiling Point ... Not Found
Specific Gravity ... 4.56
Vapor Presure at 20°C ... Negligible

Evaporation Rate ... Not Found
Solubility in Water ... Decomposes
Molecular Weight .. 119.6

Appearance and odor: White-tan powder. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Found	Not Found	Not Found	--	--

EXTINGUISHING AGENTS: Smother a strontium peroxide fire with soda ash, sodium chloride, sand, or another dry chemical agent. Use water cautiously on nearby burning combustibles.

UNUSUAL FIRE/EXPLOSION HAZARDS: This material is a strong oxidizing agent. Organic materials, combustibles, and reducing agents in contact with strontium peroxide can be ignited easily, causing fire and/or explosions by friction or on contact with moisture. Oxygen is evolved on contact with water and on exposure to heat. The oxygen formed will greatly intensify the fire.

SPECIAL FIRE-FIGHTING PROCEDURES: Remove containers from the fire area if it is safe to do so. Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Strontium peroxide is stable at room temperature; however, it gradually decomposes on exposure to air and moisture. It does not polymerize.

This material is a powerful oxidizer and is incompatible with organic materials, combustibles, and reducing agents. When mixed with strontium peroxide, the two materials readily ignite on contact with moisture. Reactions can be explosive. Strontium peroxide is decomposed by moisture with the evolution of oxygen.

Oxygen is a highly reactive hazardous product of decomposition.

SECTION 6. HEALTH HAZARD INFORMATION

ontium peroxide has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA. This material can enter the body if it is inhaled or swallowed. It can also come in contact with the skin and eyes.

Skin contact with strontium peroxide can cause irritation, and eye contact may result in chemical burns. Dust inhalation may cause irritation of the mucous membranes of the nose and respiratory tract. Gastrointestinal irritation with vomiting and diarrhea may occur following ingestion. There are no reports of chronic effects in workers exposed to strontium.

FIRST AID: EYE CONTACT: Immediately flush eyes, including under the eyelids, with a large amount of running water. Get prompt medical help.* SKIN CONTACT: Flush contaminated skin with plenty of water. Get medical help if irritation persists.* INHALATION: Remove victim from exposure. Get medical help if irritation or discomfort persists.* INGESTION: If victim is conscious, give him a large quantity of water to drink. Get medical help immediately.* Keep victim warm and at rest.

* GET MEDICAL ASSISTANCE = In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Prevent contact of strontium peroxide with combustible materials and reducing agents. Cleanup personnel should wear personal protective equipment as necessary to prevent skin and eye contact and dust inhalation. Carefully scoop material into a suitable container for reclamation or disposal. Avoid generating dust.

Scrap strontium peroxide requires disposal as a hazardous waste. Reclaim material when possible. Contact your supplier or a licensed chemical waste disposal contractor for treatment and disposal of unsalvageable material. Follow all applicable Federal, state, and local regulations.

Reportable Spill Quantity: Not listed in 40 CFR 117.3, "Reportable Quantities of Hazardous Substances."
EPA Hazardous Waste Number: D001 (Ignitability, 40 CFR 261.21)

SECTION 8. SPECIAL PROTECTION INFORMATION

ocal exhaust ventilation to minimize airborne strontium peroxide dust levels.

Wear a NIOSH-approved respirator that provides protection against dust where dusty conditions exist. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).

Wear dust-proof chemical safety goggles when handling this material. Wear impervious gloves and protective clothing (apron, coveralls, etc.) to prevent skin contact.

Safety showers and eyewash stations should be provided in work areas where this material is handled.

Contact lenses pose a special hazard: soft lenses may absorb irritants and all lenses concentrate them. Particles may adhere to lens surfaces and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store strontium peroxide in closed containers in a cool, dry, well-ventilated location on a noncombustible surface (do not store it on a wooden surface). Store it away from organic materials, reducing agents, flammable and combustible materials, and sources of heat and ignition. Protect containers from physical damage.
Practice good housekeeping to prevent accumulation of dust. Clean up spills promptly. Minimize dust generation during handling and cleanup. Keep material dry and away from heat and sources of ignition. Follow good personal hygiene. Wash hands thoroughly after handling strontium peroxide and before eating, drinking, and smoking. Remove contaminated clothing promptly and launder it before wearing it again. Avoid inhaling strontium peroxide dust and its contact with the skin and eyes. Do not eat this material. Do not take this material out of your work area or to your home on your clothes or equipment.

DOT Hazard Classification: Oxidizer (49 CFR 172.101) DOT ID No. UN1509 DOT Label: Oxidizer
Data Source(s) Code: 2, 4-6, 9, 12, 14, 25, 44, 55, 58, 61, 62, 82, CV

Approvals
Indust. Hygiene/Safety
Medical Review

Material Safety Data Sheet

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No. 205

POTASSIUM NITRATE

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: POTASSIUM NITRATE
DESCRIPTION/USES: Used in pyrotechnics; explosives; matches; as a specialty fertilizer; reagent; to modify burning properties of tobacco; in glass manufacture; tempering steel; curing foods; as an oxidizer in solid rocket propellants.
OTHER DESIGNATIONS: Nitric Acid, Potassium Salt; Niter; Saltpeter; KNO_3, CAS #7757-79-1
MANUFACTURER/SUPPLIER: Available from several suppliers, including: Aldrich Chemical Co., Inc., PO Box 355, Milwaukee, WI 53201; Telephone: (414) 273-3850

Nonfire

Fire

HMIS
H 1
F 0
R 1
PPE*
*See Sect. 8

R 1
I –
S 2
K 0

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Potassium Nitrate, CAS #7757-79-1	>99%	ACGIH TLV: None Established. OSHA PEL: None Established. Oral, Rat, LD_{50}: 3750 mg/kg Oral, Rabbit, LD_{50}: 1901 mg/kg

SECTION 3. PHYSICAL DATA

Melting Point ... 633°F (334°C)
Boiling Point ... 400°C (Decomposes)
Specific Gravity @ 16°C ... 2.11
Vapor Pressure @ 20°C ... Negligible
% Volatiles ... 0
Evaporation Rate ... Not Found

Solubility in Water, at 0°C ... 13.3 g/100 cc
at 100°C ... 247 g/100 cc
pH of 5% Solution, at 25°C ... 4.5-7.0
Molecular Weight ... 101.1

Appearance and odor: White crystalline powder or granules. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Found	Not Found	Not Found	--	--

Potassium nitrate is not combustible. However, it is a strong oxidizer and can initiate and intensify combustion of flammable materials.
EXTINGUISHING AGENTS: Flood fires involving this material with water. Keep fire-exposed containers cool with water spray. Remove containers from the fire area if it can be done safely.
UNUSUAL FIRE/EXPLOSION HAZARDS: At high temperatures this material can fuse or melt; application of water when large quantities are involved can result in extensive scattering of molten material.
SPECIAL FIRE-FIGHTING PROCEDURES: Toxic fumes/gases can be evolved in a fire situation. Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Potassium nitrate is stable at room temperature. It does not polymerize.

Violent reactions (including fire and explosion) may occur on its contact with organic materials, combustible materials, and reducing agents. Specific incompatibles under various conditions include aluminum, titanium, antimony, germanium, zinc, zirconium (and other metals), calcium disilicide, chromium nitride, metal sulfides, boron, carbon, sulfur, phosphorus, phosphides, sodium phosphinate, sodium thiosulfate, citric acid, tin chloride, sodium acetate, and thorium carbide.

Potassium nitrate decomposes at approximately 752°F (400°C) with the evolution of oxygen and oxides of nitrogen (toxic).

Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 205

POTASSIUM NITRATE

Issued: January 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: POTASSIUM NITRATE
DESCRIPTION/USES: Used in pyrotechnics; explosives; matches; as a specialty fertilizer; reagent; to modify burning properties of tobacco; in glass manufacture; tempering steel; curing foods; as an oxidizer in solid rocket propellants.
OTHER DESIGNATIONS: Nitric Acid, Potassium Salt; Niter; Saltpeter; KNO_3; CAS #7757-79-1
MANUFACTURER/SUPPLIER: Available from several suppliers, including: Aldrich Chemical Co., Inc., PO Box 355, Milwaukee, WI 53201; Telephone: (414) 273-3850

Nonfire

Fire

HMIS
H 1
F 0
R 1
PPE*
*See Sect. 8

R 1
I —
S 2
K 0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Potassium Nitrate, CAS #7757-79-1	>99%	ACGIH TLV: None Established. OSHA PEL: None Established. Oral, Rat, LD_{50}: 3750 mg/kg Oral, Rabbit, LD_{50}: 1901 mg/kg

SECTION 3. PHYSICAL DATA

Melting Point ... 633°F (334°C)
Boiling Point ... 400°C (Decomposes)
Specific Gravity @ 16°C ... 2.11
Vapor Pressure @ 20°C ... Negligible
% Volatiles ... 0
Evaporation Rate ... Not Found

Solubility in Water, at 0°C ... 13.3 g/100 cc
at 100°C ... 247 g/100 cc
pH of 5% Solution, at 25°C ... 4.5-7.0
Molecular Weight ... 101.1

Appearance and odor: White crystalline powder or granules. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Found	Not Found	Not Found	--	--

Potassium nitrate is not combustible. However, it is a strong oxidizer and can initiate and intensify combustion of flammable materials.
EXTINGUISHING AGENTS: Flood fires involving this material with water. Keep fire-exposed containers cool with water spray. Remove containers from the fire area if it can be done safely.
UNUSUAL FIRE/EXPLOSION HAZARDS: At high temperatures this material can fuse or melt; application of water when large quantities are involved can result in extensive scattering of molten material.
SPECIAL FIRE-FIGHTING PROCEDURES: Toxic fumes/gases can be evolved in a fire situation. Fire fighters should use self-contained breathing apparatus and wear full protective gear.

SECTION 5. REACTIVITY DATA

Potassium nitrate is stable at room temperature. It does not polymerize.

Violent reactions (including fire and explosion) may occur on its contact with organic materials, combustible materials, and reducing agents. Specific incompatibles under various conditions include aluminum, titanium, antimony, germanium, zinc, zirconium (and other metals), calcium disilicide, chromium nitride, metal sulfides, boron, carbon, sulfur, phosphorus, phosphides, sodium phosphinate, sodium thiosulfate, citric acid, tin chloride, sodium acetate, and thorium carbide.

Potassium nitrate decomposes at approximately 752°F (400°C) with the evolution of oxygen and oxides of nitrogen (toxic).

SECTION 6. HEALTH HAZARD INFORMATION

Potassium nitrate has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA.
This material can enter the body if it is inhaled or swallowed.

EFFECTS OF OVEREXPOSURE: Inhalation of excessive concentrations may be irritating to the nose, throat, and respiratory tract. Prolonged exposure may cause anemia, methemoglobinemia (the presence of methemoglobin, a soluble brown crystalline blood pigment that differs from hemoglobin in that it contains ferric iron and is unable to combine reversibly with molecular oxygen), and kidney injury (nephritis). Ingestion can cause severe gastrointestinal distress with abdominal pain, nausea, vomiting, and diarrhea. Eye contact may cause irritation.

FIRST AID: EYE CONTACT: Flush eyes, including under the eyelids, with a gentle flow of running water. Get medical help.* SKIN CONTACT: Wash affected area with mild soap and water. If irritation persists, prevent further contact and get medical help.* INHALATION: Remove victim from exposure. Get medical help if irritation or discomfort persists.* INGESTION: Give victim a large quantity of water to drink. Induce vomiting and get prompt medical help.* Keep him warm and at rest.
NOTE: Never give anything by mouth or induce vomiting if the victim is unconscious.
* GET MEDICAL ASSISTANCE = In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Ventilate the potassium nitrate spill area. Prevent contact of spilled material with combustible and incompatible materials. Cleanup personnel should wear personal protective equipment as necessary to prevent skin/eye contact and dust inhalation. Carefully scoop spilled material into a suitable container for reclamation or disposal. Avoid generating dust during cleanup. Absorb small solution spills on inert (noncombustible) material such as dry sand or earth.
Disposal: Potassium nitrate requires disposal as a hazardous waste. Reclaim material when possible. Contact your supplier or a licensed chemical waste disposal contractor for treatment and disposal instructions. Follow all applicable Federal, state, and local regulations.

Reportable Spill Quantity: Not listed in 40 CFR 117.3, "Reportable Quantities of Hazardous Substances."
EPA Hazardous Waste Number: D001 (Ignitable, 40 CFR 261.21)

SECTION 8. SPECIAL PROTECTION INFORMATION

Use local exhaust ventilation to control airborne levels where potassium nitrate dust, mist, or fumes are generated.

Use an appropriate NIOSH-approved respirator for protection against potassium nitrate dust/mist where airborne levels are excessive. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).

Wear protective clothing (aprons, coveralls, etc.) where the possibility of skin or clothing contamination exist. Wear rubber gloves and safety goggles when handling this material.

Eyewash stations and washing facilities should be readily accessible to workers handling this material.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Particles may adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store potassium nitrate in closed containers in a cool, dry location on a noncombustible surface. Store it away from flammable and combustible materials, reducing agents, and other incompatible materials (see sect. 5). Protect containers from physical damage.

Practice good housekeeping. Clean up spills promptly. Use procedures and techniques that minimize dust generation. Practice good personal hygiene. Wash thoroughly after handling this material and before eating, drinking, and smoking. Do not eat, drink, or smoke in the work area. Remove contaminated clothing promptly. Launder it before wearing it again. Do not take this material out of your work area or to your home on your clothing or equipment.

DOT Hazard Classification: Oxidizer (49 CFR 172.101) DOT ID No. UN1486 DOT Label: Oxidizer

Data Source(s) Code: 4, 5, 6, 9, 25, 49, 58, 77, 32, CV

Approvals

Indust. Hygiene/Safety

Medical Review

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 173

BARIUM NITRATE

Issued: February 1986

SECTION 1. MATERIAL IDENTIFICATION

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MATERIAL NAME: BARIUM NITRATE

OTHER DESIGNATIONS: Barium Dinitrate; Nitrobarite; Nitric Acid, Barium Salt; Ba $(NO_3)_2$; CAS #10022-31-8.

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Atomergic Chemetals Corp., 100 Fairchild Avenue, Plainview, NY 11803; Telephone: (516) 349-8800

Fire

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SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	HAZARD DATA
BARIUM NITRATE, Ba $(NO_3)_2$ * Current (1985-86) ACGIH TLV and OSHA PEL for soluble barium compounds.	>99	8-hr TWA: 0.5 mg/m³, as Ba* -------------------- Rat, Oral, LD_{50}: 355 mg/kg -------------------- Rabbit, Skin: 500 mg/24 Hrs. Mild Irritation -------------------- Rabbit, Eye: 100 mg/24 Hrs. Severe Irritation

SECTION 3. PHYSICAL DATA

Melting Point ... 1097.6°F (592°C)
Boiling Point ... Decomposes
Specific Gravity ... 3.24
Vapor Pressure @ 20°C ... Negligible

Solubility in Water:
@ 0°C ... 5.0 g/100g
@ 20°C ... 9.2 g/100g
@ 100°C ... 34.2 g/100g

Molecular Weight ... 261.35

Appearance and odor: White powder or crystals. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
NA	NA	NA		

EXTINGUISHING MEDIA: This material is nonflammable. However, it is an oxidizer and can accelerate and intensify combustion of flammable and combustible materials. Flood fires involving this material with water. Keep containers that have been exposed to fire cool with water spray.

UNUSUAL FIRE/EXPLOSION HAZARDS: At high temperatures this material can fuse or melt; application of water when large quantities are involved can result in extensive scattering of molten material.

SPECIAL FIRE-FIGHTING PROCEDURES: Toxic and irritating fumes/gases can be evolved in a fire situation. Fire fighters should wear self-contained breathing apparatus and full protective gear.

SECTION 5. REACTIVITY DATA

INCOMPATIBILITIES: Barium nitrate is an oxidizer and can react violently (possibly causing fire and/or explosion) with reducing agents, organic matter, and flammable and combustible materials. Examples of incompatibles include wood, paper, sulfur, aluminum, phosphorous, hydroxylamine, phosphinates, alkyl esters, tin (II) chloride, and flammable liquids.

Barium nitrate does not polymerize. It is stable at room temperature.

HAZARDOUS DECOMPOSITION PRODUCTS: At temperatures above its melting point, barium nitrate decomposes with evolution of oxides of nitrogen (TOXIC!).

SECTION 6. HEALTH HAZARD INFORMATION | TLV

PRIMARY ROUTES OF ENTRY: This material can enter the body when inhaled or swallowed. EFFECTS OF OVEREXPOSURE: Dust and mist containing barium nitrate may cause irritation of the eyes, nose, throat, and respiratory tract. Prolonged or repeated contact with dust or solutions may also cause skin irritation. Soluble barium compounds are poisonous on ingestion. Acute effects of ingestion include abdominal pain; irregular heartbeat; slow pulse rate; vomiting; diarrhea; convulsions; muscular spasms and paralysis; and hemorrhage of the stomach, intestines, and kidneys. CARCINOGENIC ASSESSMENT: Barium nitrate has not been identified as a known or suspected carcinogen by the NTP, IARC, or OSHA.

FIRST AID: EYE CONTACT: Flush eyes (including under eyelids) with a gently flow of running water for at least 15 minutes. Get medical attention.* SKIN CONTACT: Thoroughly wash affected area with water (remove contaminated clothing). If irritation or redness persists, seek medical attention.* INHALATION: Remove from exposure. Restore/aid breathing as necessary. Seek medical attention.* If victim is conscious, induce vomiting. Give him/her 2 tablespoons of sodium or magnesium sulfate (Epsom salts) dissolved in a glass of water (never give anything by mouth or induce vomiting if person is unconscious or is in convulsions.) Call physician or emergency medical personnel immediately.

* GET MEDICAL ATTENTION = In plant, paramedic, community.

NOTE TO PHYSICIAN: Administration of sodium sulfate is indicated in cases of barium poisoning to precipitate the barium as the nontoxic sulfate. Acute barium poisoning results in a rapid decrease in blood potassium called hypokalemia. Administration of potassium supplement is advisable in the presence of this condition.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Ventilate spill area. Prevent contact of spilled material with combustible and incompatible materials. Cleanup personnel should wear personal protective equipment as necessary to prevent skin/eye contact and dust inhalation. Carefully scoop spilled material into a suitable container for reclaim or disposal. Avoid dust generation during cleanup. Absorb small solution spills on inert material such as dry sand or earth.

DISPOSAL: Barium nitrate requires disposal as a hazardous waste. Reclaim material when possible. Contact supplier or a licensed chemical waste disposal contractor for treatment/disposal instructions. Follow Federal, state, and local regulations.

Applicable EPA Hazardous Waste Numbers: D001 (Ignitable, 40 CFR 261.21)
D005 (EP Toxic, 40 CFR 261.24)

SECTION 8. SPECIAL PROTECTION INFORMATION

ENTILATION: Use local exhaust ventilation sufficient to limit airborne concentrations to below the TLV. RESPIRATORS: NIOSH-approved respirators should be worn in emergency and nonroutine operations and whenever airborne levels exceed the TLV. High-efficiency particulate filter respirators are suitable for concentrations up to 5 mg/m3; 25 mg/m3 with full facepiece. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).

OTHER PROTECTIVE EQUIPMENT: Gloves and protective clothing should be worn as required by the work situation to prevent prolonged or repeated skin contact. Chemical safety goggles should be worn when handling this material. A face shield is also recommended when handling solutions. Eyewash stations and washing facilities should be accessible in areas of use.

Contact lenses pose a special hazard; soft lenses may absorb and all lenses concentrate irritants.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

PRECAUTIONS IN STORAGE: Store in closed containers in a cool, dry location on noncombustible surface. Store away from flammable and combustible materials and reducing agents. Protect containers from physical damage. Keep away from foods and food products.

PRECAUTIONS IN HANDLING: Maintain good housekeeping procedures. Clean up spills promptly. Use procedures and techniques that minimize dust generation. Follow good personal hygiene practices. Wash thoroughly after handling and before eating, drinking, and smoking. Do not eat, drink, or smoke in the work area. Remove contaminated clothing promptly. Launder before reuse. DO NOT INGEST! Avoid inhalation of dust/mist and contact with skin and eyes.

DOT Hazard Class: Oxidizer (49 CFR 172.101) I.D. No.: UN1446 Label: Oxidizer

Data Source(s) Code: 2, 4, 5, 9, 12, 14, 25, 27, 49, 55, 58, 61, 80, 82, 84, CV

Approvals
Indust. Hygiene/Safety
Medical Review

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Material Safety Data Sheets Collection:

Sheet No. 17
Zirconium Metal/Powder

Issued: 10/77 Revision: C, 7/91

Section 1. Material Identification

Zirconium (Zr) Metal/Powder Description: Derived by two different processes. In the Kroll process, the ore is converted to a cyanonitride, then chlorinated to obtain zirconium tetrachloride. This compound is then reduced by magnesium in an inert atmosphere to create a metal sponge. The magnesium chloride is melted and drained off, and the remaining zirconium sponge crushed, melted, and formed into molds. The VanArkel-de Boer process begins with heating the crude metal with iodide at low temperatures to form volatile iodides of zirconium, which thermolyze at 2372 °F (1300 °C). This process deposits the recovered metal as bright, extremely pure metal crystals. Used in corrosion-resistant alloys, photoflash bulbs (foil), flashlight powder, acid-manufacturing plants, coating nuclear fuel rods, manufacturing cast iron and steel; and as an ingredient of priming or explosive mixtures, an opacifier (making impervious to light transmission) and a polishing powder for lens and television tubes, a "getter" in vacuum tubes, a pigment in plastics, a tanning agent, a reflective surface agent on satellites, a catalyst in organic reactions, and refractory lining for electric furnaces.
Other Designations: CAS No. 7440-67-7, Zircat;® zirconium (liquid); zirconium metal, dry; zirconium metal, wet; zirconium shavings; zirconium sheets (DOT); zirconium turnings.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*™ for a suppliers list.

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Cautions: Zirconium is highly flammable and combustible.

Section 2. Ingredients and Occupational Exposure Limits

Zirconium metal/powder, ca 100%

1990 OSHA PEL	1990-91 ACGIH TLVs	1990 NIOSH REL	1985-86 Toxicity Data*	1987 IDLH Level
8-hr TWA: 5 mg/m³	TWA: 5 mg/m³ STEL: 10 mg/m³	None established	None listed	500 mg/m³

* monitor NIOSH, *RTECS* (ZH7070000), for future data.

Section 3. Physical Data

Boiling Point: 6471 °F (3577 °C)
Melting Point: 3375 °F (1357 °C)
Vapor pressure: ~0 mm Hg
Molecular Weight: 91.22
Specific Gravity: 6.506 at 68 °F (20 °C)
Water Solubility: Insoluble in water

Appearance and Odor: A bluish-black, amorphous powder, or grayish-white lustrous metal (platelets or flakes) of hexagonal lattice below 1589 °F (865 °C) and body-centered cubic above 1589 °F (865 °C). Zirconium metal is hard and brittle when impure, and soft and malleable when pure.

Section 4. Fire and Explosion Data

Flash Point: None reported
Autoignition Temperature: *
LEL: 40 oz/1000 ft³
UEL: None reported

Extinguishing Media: Zirconium is highly flammable and combustible. For small fires, use dry chemical, soda ash or lime, a pulverized mineral carbonate such as dolomite, or sand. Water use in fires involving zirconium and its compounds is controversial since water has a higher oxygen content than air. Although water is used to put out fires, zirconium re-ignites in the presence of water and burns more violently with the increased oxygen availability. *Assess the risk of re-ignition before using water in fires involving zirconium and its compounds.* For a large fire, flood area with water from a distance; cool containers with a water spray from the side until fire is well out (do not get water inside container). If possible without risk, move container from fire area. For massive fire in cargo area, use monitor nozzles or unmanned hose holder. If impossible, withdraw from area and let fire burn. Isolate area for 1/2 mile if fire involves a tank car or truck.
Unusual Fire or Explosion Hazards: Zirconium may ignite if exposed to air, and re-ignite and burn with an intense, brilliant flame after the fire is out. The powder ignites easier than the solid and is very susceptible to ignition in air by static electricity. Since releasing zirconium dust into the air generates sufficient static to cause an explosion, first treat it with a 1% hydrogen fluoride solution to decrease static electricity. Since dust may travel to an ignition source and flash back; use Class II, Group E, electrical equipment in atmospheres containing zirconium dust.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode, and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

* There are no specific autoignition temperature data available; be aware that ignition upon exposure to air at many temperatures is likely. Explosive range is 0.16 g/l in air.

Section 5. Reactivity Data

Stability/Polymerization: Zirconium solid is generally stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. When dealing with zirconium powder, take special care not to allow it to contact air or water since it ignites readily.
Chemical Incompatibilities: Zirconium reacts with hydrofluoric acid, aqua regia, hot phosphoric acid, chromates, dichromates, sulfates, alkali hydroxides, carbon tetrachloride, copper oxide, lead, lead oxide, phosphorus, potassium nitrate, nitryl fluoride, potassium chlorate, and molybdates and tungstates of lithium, sodium, potassium, rubidium and cesium. Zirconium mixed with borax explodes when heated. It reacts explosively with oxidizing agents.
Conditions to Avoid: Avoid ignition sources and sparks, exposure to air, dust generation, and contact with heat. Keep away from oxidizing agents and water.
Hazardous Products of Decomposition: Thermal oxidative decomposition of zirconium can produce carbon dioxide (CO_2) and toxic fumes.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the NTP and IARC do not list zirconium metal/powder as a carcinogen.

ummary of Risks: Zirconium is considered a minor health hazard. There is very little toxicity data available at this time. Repeated application rconium salts to skin (for example, zirconium lactate in some deodorants) can cause a specific type of skin rash (granulomas).

edical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Skin

Primary Entry Routes: Inhalation, ingestion

Acute Effects: Acute toxicity appears to be minimal, although animal studies indicate possible systemic effects at high levels of exposure to zirconium compounds.

Chronic Effects: Repeated contact with zirconium-containing deodorants in the past caused a specific type of dermatitis (granulomas) in the axilla (underarm), with eruptions of small papules (raised bumps on skin). Based on this experience, minimize chronic skin exposure on the job. Although chronic inhalation and ingestion toxicity is believed to be very low, avoid excessive exposure, as with any chemical. Animal studies indicate the potential for damage to the lungs at high levels of inhalation exposure.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water. Consult a physician.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment should be symptomatic and supportive.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel immediately. Shut off all ignition sources—no flares, smoking, or flames in hazard area. Do not touch spilled material. If threat of ignition is small, flood area with large amounts of water. Keep powdered metal wet with 25% by weight of water at all times to avoid ignition. *Do not get water inside container.* Collect and store under water in a metal drum for disposal. For a large spill, dike for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

ARA Toxic Chemical (40 CFR 372.65): Not listed

HA Designations

d as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses, chemical safety goggles, and face shield of flame-resistant material, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator, especially in areas of dust accumulation or high fume concentrations. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Clothing should be of static-free material.

Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing immediately!

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store zirconium in a cool, low fire risk area away from incompatibles. To reduce ignition, completely immerse fine powder in water. You can also store dry powder under argon. Protect containers from physical damage. Periodically examine storage containers for signs of rust and moisture content. Isolate zirconium from oxidizing materials and water. To prevent static sparks, electrically ground and bond all engineering systems used in receiving, transferring, or shipping operations. Use Class II, Group E, electrical equipment in atmospheres containing zirconium dust. Use nonsparking tools.

Engineering Controls: Avoid powder inhalation and skin contact. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Pay constant attention to immaculate housekeeping since dry powder is ignitable at room temperature by static electricity or simple friction. When possible, use small quantities (<700 g) to minimize fire hazards in working operations.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Zirconium metal, dry

OT Hazard Class: Flammable solid

No.: UN2008

Label: Flammable solid

Packaging Exceptions: None

DOT Packaging Requirements: 173.214

IMO Shipping Name: Zirconium metal powder

IMO Hazard Class: 4.2

ID No.: UN2008

IMO Label: Spontaneously combustible

IMDG Packaging Group: II

MSDS Collection **References:** 26, 38, 73, 84, 85, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 146, 148, 149

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 25

PHOSPHORUS (YELLOW)
(Revision B)
Issued: September 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: PHOSPHORUS (YELLOW)

Description (Origin/Uses): Used in gas analysis and in the manufacture of rat poisons, fireworks, and fertilizers.

Other Designations: Elemental Phosphorus; Yellow Phosphorus; White Phosphorus; Crystalline Phosphorus; P_4; CAS No. 7723-14-0

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

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SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Phosphorus (Yellow), CAS No. 7723-14-0 *See NIOSH, *RTECS* (TH3500000), for additional data with references to reproductive effects.	Ca 100	**OSHA PEL** 8-Hr TWA: 0.1 mg/m³ **ACGIH TLV, 1988-89** TLV-TWA: 0.1 mg/m³ **Toxicity Data*** Human, Oral, TD_{Lo}: 16 mg/kg Human, Oral, LD_{Lo}: 1400 ug/kg Rat, Oral, LD_{50}: 3030 ug/kg

SECTION 3. PHYSICAL DATA

Melting Point: 111°F (44°C)
Vapor Pressure: 0.028 Torr at 70°F (21°C)
Vapor Density (Air = 1): 4.42
Molecular Weight: 124 Grams/Mole (P_4)
Solubility in Water (%): Insoluble
Specific Gravity (H_2O = 1): 1.82 at 68°F (20°C)

Appearance and Odor: A white-to-pale yellow, soft, translucent, waxy, crystalline solid (it darkens on exposure to air and light); characteristic, pungent odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	LEL	UEL
*	*	*	*

Extinguishing Media: *Yellow phosphorus ignites spontaneously in moist air without any added source of ignition at temperatures greater than 86°F (30°C). Fight a phosphorus fire by flushing it with plenty of water until it is extinguished and the phosphorus has solidified. Use fog nozzles or small hoses to avoid splashing or scattering the molten phosphorus. Do not use a direct, forceful stream of water. After the phosphorus fire is extinguished, cover the involved materials with wet sand or earth. **Unusual Fire or Explosion Hazards: Danger:** When phosphorus ignites spontaneously in air, it produces large volumes of toxic, dense, white phosphorus pentoxide smoke as well as considerable heat. During fires, enter confined spaces with caution because all of the available oxygen may have been displaced by this fume. Danger is greatest in low-lying, confined, or enclosed spaces. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. **Comments:** Perform cleanup operations after a phosphorus fire very carefully because the phosphorus may reignite on renewed exposure to air. This danger increases if the phosphorus is allowed to dry before cleanup operations.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Yellow phosphorus is stable in closed, airtight containers during routine work operations. Hazardous polymerization cannot occur. **Chemical Incompatibilities: Danger:** Phosphorus is an extremely reactive chemical: *its reactivity with air is so great that it must be stored under water*. The more common materials that are incompatible with it are air; halogens; strong caustics; and all oxidizing agents, including sulfur. This list is not exhaustive; for a more detailed listing consult Genium reference 84. **Conditions to Avoid:** Control exposure to incompatible chemicals. Always establish the compatibility of phosphorus with another material by using a small test quantity under conditions that replicate the expected conditions of the bulk operation. **Hazardous Products of Decomposition:** Phosphorus pentoxide (P_2O_5) is produced during phosphorus fires.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Yellow phosphorus is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Phosphorus causes severe burns if handled while it is hot. Ingested phosphorus can be absorbed by the gastrointestinal tract, causing local irritation, nausea, vomiting, severe abdominal pain, and liver damage. The skin yellows 2 to 15 days later from this liver damage. Ingestion may result in a symptom-free period lasting from days to weeks, but then severely deteriorating systemic toxicity involving all major organs can occur. Contact with the eyes is particularly dangerous; severe burns and permanent damage can occur. Exposure to phosphorus oxide vapor can cause eye irritation. Inhalation overexposure can produce chronic poisoning, irritation, severe burns, anemia, loss of appetite, gastrointestinal complaints, chronic cough, pallor, and necrosis of the jaw. Prolonged absorption of small amounts of phosphorus may cause mossy teeth (which can be detected by a dental examination) and brittle bones. Yellow phosphorus is an extremely toxic inorganic substance; a single dose of 1 mg/kg has reportedly caused death. A garlic odor may be noted on the breath or

SECTION 6. HEALTH HAZARD INFORMATION, cont.

in skin burn wounds. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, respiratory system, teeth, blood, liver, kidneys, and jaw. **Primary Entry:** Inhalation, contact with skin or eyes. **Acute Effects:** Severe burns of the skin, eyes, and respiratory system are expected if phosphorus contacts the exposed person's body or if it is inhaled. Ingestion of yellow phosphorus is extremely dangerous, and severe systemic poisoning can occur. Inhaling the fume from burning phosphorus is irritating to the respiratory system. Other acute effects include hypotension and shock due to direct toxicity to the heart, headache, and neurotoxicity. **Chronic Effects:** Pain and loosening of the teeth; ulcerative stomatitis; leukopenia (abnormally low number of white blood cells circulating in the blood); anemia; hepatomegaly (enlargement of the liver); jaundice; periostitis (inflammation of the periosteum) with suppuration; ulceration, and necrosis of the mandible (phossy jaw). Hypotension and shock may develop during the third stage; chronic chemical bronchitis may occur; also hepatic encephalopathy (neurotoxicity from liver failure); and kidney failure.
FIRST AID: **Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. An occupational physician should monitor and treat the eye for phosphorus burns. **Skin.** Immediately rinse the area with plenty of water while removing grossly contaminated clothing and shoes. Immerse burned skin in water, then wash it with a 3% solution of copper sulfate. Apply follow-up therapy for general burns. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion.** Never give anything by mouth to someone who is unconscious or convulsing. Induce vomiting. An occupational physician or a medical emergency-response technician can administer a gastric lavage with potassium permanganate (1:5000 or 1 part of $KMnO_4$ to 5000 parts water) followed by installation of 100 to 200 ml of liquid petrolatum. Gastric contents and stool may be smoking, luminescent in the dark, or fluorescent under ultraviolet light. **Get medical help (in plant, paramedic, community) for all exposures.** Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to Physician:** Monitor hepatic and renal functions carefully. Monitor the exposed person for heart rhythm disturbances. Surgical intervention combined with appropriate therapy may be used to treat phossy jaw. Remove sequestered bones. Take regular X rays of the jaws of exposed workers; carefully investigate workers' complaints relating to the teeth, jaw, or chewing of food. Watch for low blood sugar, altered calcium level, unexplained fever, and bleeding disorder.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Preplan emergency response to phosphorus spills. All spills that expose phosphorus to air will cause fires. Notify safety personnel, evacuate unnexcessary personnel, and provide adequate ventilation to remove the phosphorus pentoxide smoke. Cleanup personnel need protection against skin or eye contact with phosphorus and as well as inhalation of phosphorus pentoxide fume (see sect. 8). Extinguish the fire with plenty of water as outlined in section 4. Prevent runoff from directly entering streams, surface waters, waterways, watersheds, or sewers. Cleanup personnel must be equipped with self-contained breathing apparatus (SCBA). Cover the spilled phosphorus with wet sand; keep the sand wet with a water spray. Transfer it to a bucket of water; remove it after 24 hours and repackage it.
Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Follow all applicable Federal, state, and local regulations. Consider returning the scrap phosphorus to the original supplier or distributor in a shipment approved by the DOT.

OSHA Designations
Air Contaminant (29 CFR 1910.1000 Subpart Z)
EPA Designations (40 CFR 302.4)
CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per the Clean Water Act (CWA), § 311 (b) (4).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Consult Genium reference 88 for recommendations for selecting the proper respirator for use around phosphorus. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear rubber gloves, boots, aprons, gauntlets, and coveralls. Make sure that clothing is nonflammable. **Ventilation:** Install and operate general and local explosion-proof ventilation systems powerful enough to maintain airborne levels of phosphorus below the OSHA PEL cited in section 2. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store phosphorus in closed, airtight containers in a cool, dry, well-ventilated area separate from incompatible chemicals (see sect. 5). Store it away from strong oxidizing agents. **Special Handling/Storage:** Protect containers of phosphorus from physical damage. Store and ship phosphorus under water in hermetically sealed containers. Type 316 stainless steel is the preferred material for storage and handling. Phosphorus is not corrosive to steel, lead, or bronze; it does not attack copper.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Phosphorus	**ID No.** UN1381	**IMO Class:** 4.2
DOT Hazard Class: Flammable Solid	**DOT Label:** Flammable Solid and Poison	**IMO Label:** Spontaneously Combustible

ferences: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: W Silverman, MD

POTASSIUM CHLORATE

CAS RN: 3811049 NIOSH #: FO 0350000
mf: $ClO_3 \cdot K$; mw: 122.55

Transparent colorless crystals or white powder, cooling, saline taste. mp: 368.4°, bp: decomp @ 400°, d: 2.32.

SYNS:

- CHLORATE DE POTASSIUM (FRENCH)
- CHLORATE OF POTASH
- FEKABIT
- KALIUMCHLORAAT (DUTCH)
- KALIUMCHLORAT (GERMAN)
- OXYMURIATE OF POTASH
- POTASH CHLORATE (DOT)
- POTASSIO (CHLORATO DI) (ITALIAN)
- POTASSIUM CHLORATE (DOT)
- POTASSIUM (CHLORATE DE) (FRENCH)
- POTASSIUM OXYMURIATE

TOXICITY DATA: 2-1	CODEN:
unk-hmn LDLo:429 mg/kg	AEXPBL 21,169,1886
orl-rat LDLo:7000 mg/kg	JPETAB 35,1,29
ipr-rat LDLo:1500 mg/kg	JPETAB 35,1,29
ipr-gpg LDLo:1800 mg/kg	JPETAB 35,1,29
orl-dog LDLo:1200 mg/kg	HBTXAC 1,242,56
orl-rbt LDLo:2000 mg/kg	AEXPBL 21,169,1886

Aquatic Toxicity Rating: TLm96:1000-100 ppm WQCHM* 4,-,74. DOT: Oxidizer. Label: Oxidizer FEREAC 41,57018,76. Reported in EPA TSCA Inventory, 1980.

THR: HIGH unk. hmn tox. MOD ipr; LOW orl. See chlorates. emits very tox fumes of Cl^- and K_2O.

Human Tox: Irr to G.I. tract, kidney. Can cause hemolysis of red blood cells and methemoglobinemia. Tox dose approx 5 g. Combination of iodine and perchlorate not recommended.

Disaster Hazard: Very reactive. When heated to decomp it emits very tox fumes of Cl^- and K_2O.

Incomp: Reacts violently with Al; NH_3; NH_4Cl; NH_4^+ salts; $(NH_4)_2SO_4$; Sb_2S_3; As; barium hypophosphite; BaS; B; calcium hypophosphite; CaS; C; charcoal; Cr; Cu; Cu_3P_2; gallic acid; Ge; HI; Mg; ($Mg + CuSO_4$ (anhydrous) $+ NH_4NO_3 + H_2O$); MnO_2; Hg_3P_4; metal sulfides; dibasic organic acids; organic matter; P; Ag_2S; $NaNH_2$; S; SO_2; H_2SO_4; Zn; Zr; Ti; thiocyanates; thorium dicarbide; sodium amide; fabrics; KOH; HI; metal phosphides; metal hypophosphites; metals; metal thiocyanates; non-metals; aqua regia; ruthenium; CN^-; Ni_2O_3.

STRONTIUM(II) NITRATE (1:2)

CAS RN: 10042769 NIOSH #: WK 9800000
mf: $N_2O_6 \cdot Sr$; mw: 211.64

White powd. mp: 570°; d: 2.986.

SYNS:
NITRATE DE STRONTIUM (FRENCH)
NITRIC ACID, STRONTIUM SALT

TOXICITY DATA: 2	CODEN:
orl-rat LD50:2750 mg/kg	GISAAA 41(5),28,76
orl-mus LD50:1826 mg/kg	GISAAA 41(5),28,76
ipr-rat LD50:540 mg/kg	AIHOAX 1,637,50

DOT: Oxidizer, Label: Oxidizer FEREAC 41,57018,76. Reported in EPA TSCA Inventory, 1980. EPA TSCA 8(a) Preliminary Assessment Information Proposed Rule FERREAC 45,13646,80.

THR: MOD orl, ipr. See also nitrates and strontium compounds.

Disaster Hazard: When heated to decomp it emits tox fumes of NO_x.

STRONTIUM PEROXIDE

CAS RN: 1314187 NIOSH #: WL 0100000
mf: O_2Sr; mw: 119.62

White powder; mp: decomp; d: 4.56.

SYN: STRONTIUM PEROXIDE (DOT)

TOXICITY DATA: 3 CODEN:
DOT: Oxidizer, Label: Oxidizer FEREAC 41,57018,76.
Reported in EPA TSCA Inventory, 1980.
THR: A powerful oxidizer. An irr to skn, eyes and mu mem. See also peroxides and strontium compounds.

SODIUM (I) NITRATE (1:1)

CAS RN: 7631994 NIOSH #: WC 5600000
mf: $NO_3 \cdot Na$; mw: 85.01

Colorless, transparent, odorless crystals, saline, slightly bitter taste. mp: 306.8°, bp: decomp @ 380°, d: 2.261.

SYNS:
NITRATE DE SODIUM (FRENCH) SODA NITER
NITRIC ACID, SODIUM SALT

TOXICITY DATA: 3	CODEN:
mmo-omi 1000 ppm	POASAD 34,114,53
mnt-ham-orl 250 mg/kg	MUREAV 66,149,79
otr-ham-orl 250 mg/kg	MUREAV 66,149,79
cyt-ham:fbr 7200 mg/L/48H	MUREAV 48,337,77
msc-ham-orl 125 mg/kg	MUREAV 66,149,79
orl-rat LDLo:200 mg/kg	12VXA5 8,962,68

Toxicology Review: 27ZTAP 3,101,69. DOT: Oxidizer, Label: Oxidizer FEREAC 41,57018,76. Reported in EPA TSCA Inventory, 1980.

THR: MUT data. HIGH orl.

Explosion Hazard: Explodes when heated to over 1000°F, or when mixed with cyanides, (S − charcoal), sodium hypophosphite, BP, Sb.

Fire Hazard: Mod; when mixed with organic matter, it will ignite on friction. See nitrates.

Disaster Hazard: Dangerous; see nitrates.

Incomp: Acetic anhydride; aluminium, or aluminium oxide; barium thiocyanate; fibrous material; non-metals; sodium; sodium phosphinate; sodium thiosulphate; wood.

SODIUM OXALATE

CAS RN: 62760 NIOSH = KI 1750000
mf: $C_2O_4 \cdot 2Na$; mw: 134.00

White crystalline powder. d: 2.34.

TOXICITY DATA: 3 CODEN:
scu-mus LDLo: 100 mg/kg AIPTAK 3.255.01

Toxicology Review: 27ZTAP 3.107.69. Reported in EPA TSCA Inventory, 1980.
THR: HIGH scu and oral. See also oxalates.

DU PONT

MATERIAL SAFETY DATA SHEET

PRODUCT IDENTIFICATION

NAME : PETN
CHEMICAL FAMILY : Aliphatic Nitrate Esters
TRADE NAMES AND SYNONYMS :
Pentaerythritol Tetranitrate
MANUFACTURER/DISTRIBUTOR : E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-800-441-7515
MEDICAL EMERGENCY PHONE : 1-800-441-3637
TRANSPORTATION EMERGENCY PHONE : CHEMTREC 1-800-424-9300

CAS NAME : 1,3-propanediol,2,,2-bis(nitrooxy)methyl-,dinitrate ester
CAS NO. : 78-11-5
FORMULA : $C(CH_2ONO_2)_4$
MOLECULAR WEIGHT : 316

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

THE PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES IS A RESULT OF CAREFUL PLANNING AND OBSERVANCE OF THE BEST KNOWN PRACTICES. THE EXPLOSIVES USER MUST REMEMBER THAT HE IS DEALING WITH A POWERFUL FORCE AND THAT VARIOUS DEVICES AND METHODS HAVE BEEN DEVELOPED TO ASSIST HIM IN DIRECTING THIS FORCE. HE SHOULD REALIZE THAT THIS FORCE, IF MISDIRECTED, MAY EITHER KILL OR INJURE BOTH HIM AND HIS FELLOW WORKERS.

WARNING

ALL EXPLOSIVES ARE DANGEROUS AND MUST BE CAREFULLY HANDLED AND USED FOLLOWING APPROVED SAFETY PROCEDURES EITHER BY OR UNDER THE DIRECTION OF COMPETENT, EXPERIENCED PERSONS IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, REGULATIONS AND ORDINANCES. IF YOU HAVE ANY QUESTIONS OR DOUBTS AS TO HOW TO USE ANY EXPLOSIVE PRODUCT, DO NOT USE IT BEFORE CONSULTING YOUR SUPERVISOR, OR THE MANUFACTURER IF YOU DO NOT HAVE A SUPERVISOR. IF YOUR SUPERVISOR HAS ANY QUESTIONS OR DOUBTS, HE SHOULD CONSULT THE MANUFACTURER BEFORE USE. SEE "ADDITIONAL INFORMATION AND REFERENCES" BELOW.

* * *

HAZARDOUS COMPONENTS

Wood Cortice

CHEMICAL	CAS NUMBER
PETN	78-11-5
Methanol	67-56-1

* * *

PHYSICAL DATA

Melting Point : 141 deg C
Specific Gravity : 1.77 at 20 deg C
Solubility in H20 : Slight
Odor : Odorless
Form : Crystalline solid
Color : White
Boiling Point: 200-225 degC with decomposition Shipped water-wet.
Methahol sometimes added as antifreeze

****

HAZARDOUS REACTIVITY

INSTABILITY : Unstable with heat. Unstable with shock. Unstable with static charges.
INCOMPATIBILITY : Incompatible with acids, alkalies, oxidants.
DECOMPOSITION : Hazardous gases produced are nitrogen oxides. Decomposes with heat, shock and static charges.
POLYMERIZATION : Polymerization will not occur.

FIRE AND EXPLOSION DATA

Explosion Temp.: 272 degC, 0.1 sec exposure. Impact Sensitivity: 2 kg wt, 17 cm, 100% detonations.

FIRE AND EXPLOSION HAZARDS

Class A Explosive (DOT). Will detonate if suitably primed, with severe impact, or by heat or flame. Hazardous gases produced in fire are nitrogen oxides.

EXTINGUISHING MEDIA

None

SPECIAL FIRE FIGHTING INSTRUCTIONS

Do not fight fire. Isolate area. Evacuate personnel to a safe area. Guard against intruders.

****

HEALTH HAZARD INFORMATION

PRINCIPAL HEALTH HAZARDS

PETN is a Class A Explosive and detonation may cause severe physical injury, including death. As shipped, PETN is wet with at least 40% water which is sometimes diluted with methanol as an antifreeze.

In animal tests, ingestion and inhalation of PETN dust caused a drop in blood pressure. Extended studies showed no adverse effect on growth or the blood picture. PETN showed no carcinogenic effect in one animal study. PETN is not a skin irritant or skin sensitizer to humans.

HEALTH HAZARD INFORMATION - CONTINUED

METHANOL
Inhalation LC50, 1 hour: 14,500 ppm in rats.
Skin Absorption LD50: 15,800 mg/kg in rabbits.
Oral LD50: 9,100 mg/kg in rats.

METHANOL is a skin and eye irritant. Toxic effects described in animals from short exposures by inhalation, ingestion or skin or eye contact include anaesthetic effects, liver effects, blindness and acidosis. It did not show mutagenic activity or embryotoxic effects in animal tests.

Human health effects of overexposure by inhalation, skin or eye contact, or ingestion may initially include nonspecific discomfort such as nausea, headache or weakness, temporary nervous system depression with anaesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness, or blindness. Higher exposures may lead to abnormal liver function as detected by laboratory tests, abnormal kidney function as detected by laboratory tests, or fatality from gross overexposure. As little as 100 mg of ingested methanol may cause blindness or fatality. Skin permeation can occur in amounts capable of producing the effects of systemic toxicity. Individuals with preexisting diseases of the retina or liver may have increased susceptibility to the toxicity of excessive exposures.

NITROGEN OXIDE FUMES FROM DETONATION
NITROGEN OXIDES are skin, eye and respiratory system irritants. Systemic toxicity resulting from oxidation of lung tissue includes emphysesma, bronchitis and bronchopneumonia. Acute exposure can lead to death from asphyxia or pulmonary edema. In animals, nitrogen oxide caused methemoglobinemia, was not carcinogenic, but caused embryotoxicity and reproductive effects.

CARCINOGENICITY

NONE OF THE COMPONENT(S) OF THIS MATERIAL IS LISTED AS A CARCINOGEN BY NTP, IARC, OR OSHA.

EXPOSURE LIMITS

TLV * (ACGIH) : None established.
PEL (OSHA) : None established.
* TLV is a registered trademark.

Methanol:	AEL (Du Pont):	200ppm, 8 hr TWA, Skin 100ppm, 12 hr TWA, Skin
	TLV (ACGIH):	200ppm, Skin
	PEL (OSHA):	200ppm

SAFETY PRECAUTIONS

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Avoid breathing dust. Wash thoroughly after handling. Wash clothing after use. Avoid breathing fumes from detonation.

FIRST AID

HALATION :
If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician. Applies to inhalation of methanol fumes and fumes fromdetonation.

SKIN CONTACT :
Flush skin with water.

EYE CONTACT :
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION :
If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

NOTE: Get medical attention immediately if detonation causes physical injury.

****

PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES and PRECAUTIONS
Use only with adequate ventilation. Keep away from heat, sparks and flames. Keep container in a cool place. Keep container tightly closed. void dust generation. Do not mix with acids, alkalies, or oxidants.Do not consume food, drink or tobacco in areas where they may become contaminated with this material. Use sparkproof tools and equipment. Use sparkproof ventilation equipment.

START Down [illegible]

PERSONAL PROTECTIVE EQUIPMENT
Filter respirator : NIOSH-certified dust respirator. Chemical Cartridge Respirator : Organic vapor cartridge if exposure to methanol fumes is likely. Impervious gloves such as NEOPRENE if contact with methanol is likely. Otherwise, protective cotton gloves.

****

AQUATIC TOXICITY : LC50, 96 hrs.: 27,000 ppm, fathead minnows.

SPILL, LEAK, OR RELEASE
Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Remove source of heat, sparks, flame, impact, friction or electricity. Pick up by hand for disposal. Do not use power equipment. Do not use damaged or wet material. Control access to area and remove sources of heat or impact. Use nonsparking tools and equipment for cleanup.

WASTE DISPOSAL
Do not burn. Consult an explosives manufacturer for recommended methods f destroying explosive materials. Comply with applicable Federal egulations under the authority of the Resource Conservation and Recovery Act (40 CFR, parts 260-271). Do not flush to surface water or sanitary sewer system.

****

FIRST AID

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If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician. Applies to inhalation of methanol fumes and fumes fromdetonation.

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****

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START D[illegible]

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WASTE DISPOSAL
Do not burn. Consult an explosives manufacturer for recommended methods f destroying explosive materials. Comply with applicable Federal egulations under the authority of the Resource Conservation and Recovery Act (40 CFR, parts 260-271). Do not flush to surface water or sanitary sewer system.

****

SHIPPING INFORMATION

DOMESTIC OTHER THAN AIR (DOT)
Shipping Name : Initiating Explosive
Hazard Class : Class A Explosive
UN/NA no. : UN - 0150
DOT Placard : EXPLOSIVE A

INTERNATIONAL WATER OR AIR (IMO/ICAO)
Shipping Name : PETN
Hazard Class : 1.10
UN no. : 0150
IMO/ICAO Label : EXPLOSIVE
Special Information : IATA: PETN, FORBIDDEN

* * *

STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Keep container tightly closed. Do not store with acids, alkalies, and oxidants. Stor in accordance with Federal Regulations. Do not store or consume food, drink, or tobacco in areas where they may become contaminated with th material. Store in approved type magazine.

* * *

ADDITIONAL INFORMATION AND REFERENCES

See attached sheet giving PROPERTIES OF PENTAERYTHRITOL TETRANITRATE (PETN).

IT IS OBVIOUSLY IMPOSSIBLE TO INCLUDE WARNINGS OR APPROVED METHODS FOR EVERY CONCEIVABLE SITUATION. ADDITIONAL INFORMATION IS AVAILABLE IN THE BLASTERS' HANDBOOK, PUBLISHED BY E. I. DU PONT DE NEMOURS AND COMPANY, ORDNANCE SAFETY MANUAL, PUBLISHED BY THE U. S. ARMY ORDNANCE DEPARTMENT, AND IN THE INSTITUTE OF MAKERS OF EXPLOSIVES SAFETY LIBRARY PUBLICATIONS LISTED BELOW. COPIES OF THESE IME PUBLICATIONS MAY BE OBTAINED BY WRITING THE INSTITUTE OF MAKERS OF EXPLOSIVES, 1575 EYE STREET, N. W., SUITE 550, WASHINGTON, D. C. 20005, OR FROM YOUR EXPLOSIVES SUPPLIER: CONSTRUCTION GUIDE FOR STORAGE MAGAZINES (NO. 1); AMERICAN TABLE OF DISTANCES (NO. 2); SUGGESTED CODE OF REGULATIONS FOR THE MANUFACTURE, TRANSPORTATION, STORAGE, SALE, POSSESSION, AND USE OF EXPLOSIVES AND BLASTING MATERIALS (NO. 3); SAFETY GUIDE FOR THE STORAGE, HANDLING AND USE OF EXPLOSIVES MATERIALS (NO. 17); SAFETY GUIDE FOR THE PREVENTION OF RADIO FREQUENCY RADIATION HAZARDS (NO. 20); IME DESTRUCTION OF COMMERCIAL EXPLOSIVES (NO. 21); IME STANDARD FOR THE SAFE TRANSPORTATION OF CLASS C COMMERCIAL DETONATORS (BLASTING CAPS) IN A VEHICLE WITH OTHER CERTAIN EXPLOSIVES (NO. 22).

* * *

Date of latest Revision : 01-Nov-85
Person Responsible for MSDS : Product Manager, EP, F & FP
Address : E. I. Du Pont de Nemours & Co.,Inc.
Wilmington, DE 19898
Telephone : 302-774-3120

Formula		$C_5H_8(NO_3)_4$
Molecular Weight		316.14
Specific Gravity		1.77
Melting Point		141°C
Boiling Point	decomposes at	200°C
Crystal Form		Long Needles
Solubility in Water		0.01 gm/100 gm H_2O @ 50°C
in Acetone	T°C	Solubility % PETN (g/100g Solve
	0	14.37
	20	20.26
	40	30.56
	60	42.68
in TNT*	80	19.3
	90	32.1
	100	48.6
	110	70.0
	120	115.0
	125	161.0

*Eutectic at 13% PETN/87% TNT at 76°C.

Heat of Formation		383 cal/gn
Heat of Fusion		24 K cal/mol
Specific Heat		0.4 cal/gm/°C
Heat of Explosion		1530 K cal/kg
Gas Volume		768 liters/kg
Oxygen Balance		-10.1
Temperature of Explosion		4230°C
Detonation Velocity	Dry	7295 m/sec
	10% H_2O	7445 m/sec
	Pressed	8300 m/sec
Impact Sensitivity	2 kg wt	17 cm
	1 lb wt	6 in
Bullet Impact		100% detonations
Explosion Temperature	0.1 sec	272°C
	1.0 sec	244°C
Sensitivity to Electrostatic Discharge	Unconfined	0.06 joules
	Confined	0.21 joules

DUPONT

SHIPPING INFORMATION

DOMESTIC OTHER THAN AIR (DOT)
Shipping Name : Initiating Explosive
Hazard Class : Class A Explosive
UN/NA no. : UN - 0150
DOT Placard : EXPLOSIVE A

INTERNATIONAL WATER OR AIR (IMO/ICAO)
Shipping Name : PETN
Hazard Class : 1.10
UN no. : 0150
IMO/ICAO Label : EXPLOSIVE
Special Information : IATA: PETN, FORBIDDEN

* * *

STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Keep container tightly closed. Do not store with acids, alkalies, and oxidants. Stor in accordance with Federal Regulations. Do not store or consume food, drink, or tobacco in areas where they may become contaminated with th material. Store in approved type magazine.

* * *

ADDITIONAL INFORMATION AND REFERENCES

See attached sheet giving PROPERTIES OF PENTAERYTHRITOL TETRANITRATE (PETN).

IT IS OBVIOUSLY IMPOSSIBLE TO INCLUDE WARNINGS OR APPROVED METHODS FOR EVERY CONCEIVABLE SITUATION.
ADDITIONAL INFORMATION IS AVAILABLE IN THE BLASTERS' HANDBOOK, PUBLISHED BY E. I. DU PONT DE NEMOURS AND COMPANY, ORDNANCE SAFETY MANUAL, PUBLISHED BY THE U. S. ARMY ORDNANCE DEPARTMENT, AND IN THE INSTITUTE OF MAKERS OF EXPLOSIVES SAFETY LIBRARY PUBLICATIONS LISTED BELOW. COPIES OF THESE IME PUBLICATIONS MAY BE OBTAINED BY WRITING THE INSTITUTE OF MAKERS OF EXPLOSIVES, 1575 EYE STREET, N. W., SUITE 550, WASHINGTON, D. C. 20005, OR FROM YOUR EXPLOSIVES SUPPLIER: CONSTRUCTION GUIDE FOR STORAGE MAGAZINES (NO. 1); AMERICAN TABLE OF DISTANCES (NO. 2); SUGGESTED CODE OF REGULATIONS FOR THE MANUFACTURE, TRANSPORTATION, STORAGE, SALE, POSSESSION, AND USE OF EXPLOSIVES AND BLASTING MATERIALS (NO. 3); SAFETY GUIDE FOR THE STORAGE, HANDLING AND USE OF EXPLOSIVES MATERIALS (NO. 17); SAFETY GUIDE FOR THE PREVENTION OF RADIO FREQUENCY RADIATION HAZARDS (NO. 20); IME DESTRUCTION OF COMMERCIAL EXPLOSIVES (NO. 21); IME STANDARD FOR THE SAFE TRANSPORTATION OF CLASS C COMMERCIAL DETONATORS (BLASTING CAPS) IN A VEHICLE WITH OTHER CERTAIN EXPLOSIVES (NO. 22).

* * *

Date of latest Revision : 01-Nov-85
Person Responsible for MSDS : Product Manager, EP, F & FP
Address : E. I. Du Pont de Nemours & Co.,Inc.
Wilmington, DE 19898
Telephone : 302-774-3120

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 79
Ammonium Nitrate

Issued: 7/81 Revision: A, 8/90

Section 1. Material Identification

Ammonium Nitrate (NH_4NO_3) Description: Derived by the reaction of nitric acid and ammonia in the presence of water. Used in fertilizers, herbicides and insecticides, explosives (prills/oil mixture of 94% NH_4NO_3 and 6% oil), pyrotechnics, cosmetic preparation (hair dyes, tints, and colorings), and in manufacturing nitrous oxide; as an ingredient of freezing mixtures, an oxidizer in solid rocket propellents, a dessicant for cotton, a nutrient for antibiotics and yeast, a catalyst, and an absorbent for nitrogen oxides.

Other Designations: CAS No. 6484-52-2; nitric acid, ammonium salt; norway saltpeter.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R 1
I -
S 2
K 0

Nonfire
NFPA
0
0 3
OXY

Fire
0
2
OXY

HMIS
H
F
R
PPG*
* Sec.

Cautions: A powerful oxidizer and an allergen, ammonium nitrate is irritating to the eyes, nose, throat, and mucous membranes.

Section 2. Ingredients and Occupational Exposure Limits

Ammonium nitrate, ca 100%

1989 OSHA PEL	1990 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data*
None established	None established	None established	Rat, oral, LD_{50}: 4820 mg/kg

* Monitor NIOSH, *RTECS* (BR9050000), for future toxicity data.

Section 3. Physical Data

Boiling Point: 410 °F (210 °C)
Melting Point: 337.3 °F (169.6 °C)
pH: (0.1 M solution in water): 5.43
Molecular Weight: 80.06
Specific Gravity (H_2O = 1 at 4 °C): 1.725 at 25 °C
Water Solubility: 118.3 g/100 cc of H_2O at 32 °F (0 °C)

Appearance and Odor: A hygroscopic, colorless, crystalline solid; odorless. Prill form is needle-shaped (acicular) lumps.

Section 4. Fire and Explosion Data

Flash Point: None reported | **Autoignition Temperature:** None repoorted | LEL: None reported | UEL: None reported

Extinguishing Media: Use flooding amounts of water in early stages of fire. When applying water to fused or molten material, use extreme caution to avoid eruptive scattering and spread of fire.

Unusual Fire or Explosion Hazards: This material is an oxidizing agent which supports combustion and an explosive hazard if heated under confinement that allows high pressure buildup. Prevent contamination of NH_4NO_3 with other combustible materials that may cause possible explosion of the entire mass. A mixture of diesel oil with NH_4NO_3 is used as an industrial explosive.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Approach fires from upwind. If large quantities of ammonium nitrate are involved, fight fire with unmanned hoseholders and withdraw to a safe area. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Ammonium nitrate is stable when stored and used under proper storage and handling conditions (Sec. 9). Hazardous polymerization cannot occur.

Chemical Incompatibilities: Ammonium nitrate is a strong oxidizing agent that reacts with strong alkalies to liberate ammonia. It can also react vigorously with reducing materials. Ignites on contact with ammonium dichromate, potassium dichromate, potassium chromate, chromium (VI) salts, barium chloride, sodium chloride, and potassium nitrate. Violent or explosive spontaneous reactions occur with hot water, urea, sawdust, barium nitrate, copper iron (II) sulfide, acetic anhydride + nitric acid, ammonium chloride + water + zinc, and ammonium sulfate + potassium. Many powdered metals react violently or explosively with fused NH_4NO_3 below 392 °F (200 °C): aluminum, antimony, bismuth, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, tin, zinc, and brass. This material forms heat- or shock-sensitive explosive mixtures with hydrocarbon oils, nonmetals (e.g. charcoal), organic fuels (e.g. wax), sugar, potassium permanganate, sulfur, trinitroanisole, acetic acid, aluminum + calcium nitrate + formamide (a blasting explosive), chloride salts, and charcoal + metal oxides.

Conditions to Avoid: Avoid contaminating ammonium nitrate with oil, charcoal, or other organic substance. If contaminated with these combustible materials, ammonium nitrate can be considered an explosive capable of detonation by combustion or by shock from adjacent explosions. Sensitivity to detonation increases when heated.

Hazardous Products of Decomposition: Thermal oxidative decomposition of ammonium nitrate can produce toxic gases of nitrogen oxides.

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list ammonium nitrate as a carcinogen.
Summary of Risks: Ammonium nitrate is a powerful oxidizer and allergen. It is irritating to the eyes, nose, throat, and mucous membranes. ividuals may be exposed to nitrogen oxides due to decomposition of NH_4NO_3 at high temperatures. Nitrogen oxides are toxic gases that can ckly cause acute respiratory problems.
dical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Eyes, skin, and mucous membranes.
Primary Entry Routes: Inhalation (for nitrogen oxides), ingestion (for ammonium nitrate salts).
Acute Effects: Inhalation causes mucous membrane and respiratory tract irritation, severe lung congestion, difficult breathing, and urination and acid urine. Inhalation of large amounts causes systemic acidosis and abnormal hemoglobin. Contact with skin may cause mild skin irritations. Any tissue changes are readily reversible and disappear after exposure stops. There is some discomfort. There are also reports of faintness and low blood pressure in workers exposed to ammonium nitrate.
Chronic Effects: None reported.
FIRST AID
Eyes: Gently lifting the eyelids, flush immediately and continuously with flooding amounts of running water until medical help arrives. Transport immediately to an emergency medical facility.
Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water. Treat as a strong oxidant ingestion. *Do not induce vomiting in the field!* Call Poison Control. Transport to an emergency medical facility.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: Ammonium nitrate is very quickly soluble in water. Supportive measures for methemoglobinemia are the most important treatment.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate the hazard area, and issue an "Oxidizer" warning. Remove heat and ignition sources and provide adequate ventilation. Cleanup personnel should protect against skin and eye contact and vapor inhalation. Sweep spill into a noncombustible container and dissolve in a large amount of water. Add soda ash. Mix and neutralize with 6M-HCl (acid gas hazard). Do not release to sewers or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Neutralized sludge may be buried in an approved landfill. Incineration requires scrubbers for NO_x and oxidation or reduction process for NO. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

ction 8. Special Protection Data

gles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
spirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at a level that promotes worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store separate from other chemicals and combustible materials in tightly closed, multi-ply paper or plastic bags in a cool, dry, well-ventilated area in a building made of noncombustible materials and equipped with an automatic sprinkler system. Protect plastic bags from physical damage. Store on clean concrete floors or wooden pallets. If stored directly on the floor, first cover the floor with a moisture insulator such as a polyethylene sheet. Prevent NH_4NO_3 entrapment by eliminating floor drains and depressions. Do not store above 130 °F (54.5 °C).
Engineering Controls: Avoid vapor inhalation and contact with skin or eyes. Use only with appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Provide general exhaust ventilation in the workplace and storage area. Store ammonium nitrate under cool and dry conditions. Prevent contamination of ammonium nitrate since it is a potential explosive hazard when contaminated.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Ammonium nitrate (no organic coating)
DOT Hazard Class: Oxidizer
D No.: UN1942
Label: Oxidize
Packaging Requirements: 173.182
DOT Packaging Exceptions: 173.153

IMO Shipping Name: Ammonium nitrate, with not more than 0.2% of combustible substance including any organic substance calculated as carbon, to the exclusion of any other add substance
IMO Hazard Class: 5.1
IMO Label: Oxidizer
IMDG Packaging Group: III
ID No.: UN1942

MSDS Collection **References:** 4-11, 25, 73, 84, 85, 103, 109, 124, 126, 127, 132, 133, 136
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** DJ Seeley, MD; **Edited by:** JR Stuart, MS

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN ST., SCHENECTADY, NY 12303 USA (518) 377-8854

MSDS # 139
STRONTIUM NITRATE

Issued: December 1985
Revised:

From Genium's MSDS Collection, to be used as a reference.

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: STRONTIUM NITRATE

OTHER DESIGNATIONS: Nitric acid, Strontium salt; Sr(NO$_3$)$_2$; CAS #10042 76 9.

SUPPLIERS: Available from several suppliers, including:
J.T. Chemical Co.
222 Red School Lane
Phillipsburg, NJ 08865
(201) 859-2151

R 1
I 1
S 2
K 0

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	HAZARD DATA
STRONTIUM NITRATE, Sr(NO$_3$)$_2$	ca 99%	No TLV or PEL has been established Oral, rat: LD50: 2750 mg/kg Oral, mouse: LD50: 1826 mg/kg

NOTE: Purity levels vary with grade. Some grades may contain significant levels (ca 1%) of barium nitrate. Refer to supplier's specifications for exact composition information.

SECTION 3. PHYSICAL DATA

Melting point .... 570°C
Boiling point .... decomposes
Specific gravity 2.986
Molecular weight 211.63

Solubility in water, g/100cc:
@ 18°C 70.9
@ 90°C 100
Vapor pressure @ 20°C .... negligible

APPEARANCE & ODOR: white crystalline powder. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower	Upper
N/A	N/A	N/A		

This material is not combustible. However, as an oxidizer, it can initiate and intensify combustion. Use extinguishing agents that are appropriate for the burning material.

Toxic gases can be evolved under fire conditions. Firefighters should wear self-contained breathing apparatus and full protective gear.

SECTION 5. REACTIVITY DATA

This material is stable at room temperature. Decomposition begins at approximately 500°C with the evolution of oxides of nitrogen (toxic).

Strontium nitrate is an oxidizer and can react with oxidizable substances such as flammable liquids and combustible materials (wood, paper, plastics, sulfur, aluminum, etc.). Ignition of these materials may occur. Mixtures of strontium nitrate and reducing agents can be explosive and may detonate by heat and shock.

It does not polymerize.

MSDS # 159. Issued 12/85 STRONTIUM NITRATE

SECTION 6. HEALTH HAZARD INFORMATION

TLV None established

Skin contact can cause irritation. Chemical burns can occur on eye contact. Inhalation of dust and mist of strontium nitrate can cause irritation of the mucous membranes of the nose, throat, and respiratory tract. Inhalation of strontium nitrate by laboratory rats produced changes in the kidney, liver, and other organ systems (ref. #14). However, there are no reports of adverse effects resulting from industrial exposure and, in general, strontium salts are considered to exhibit a low degree of toxicity. Strontium nitrate has not been identified as a suspected carcinogen by the NTP, IARC, or OSHA.

FIRST AID: EYE CONTACT: Immediately flush eyes, including under the eyelids, with large amounts of running water. Get prompt medical attention.* SKIN CONTACT: Flush contaminated skin with plenty of water. Seek medical attention if irritation persists. INHALATION: Remove from exposure. Seek medical attention for treatment of any symptoms. INGESTION: If person is conscious, give him a large quantity of milk or water to drink. Induce vomiting and get prompt medical attention.*

* MEDICAL ATTENTION - In Plant, Community, Paramedic.

SECTION 7. SPILL, LEAK AND DISPOSAL PROCEDURES

Ventilate spill area. Cleanup personnel should wear protective equipment as necessary to prevent skin and eye contact and dust inhalation. Scoop up spilled material and place in a suitable container for reclaim or disposal. Avoid dust generation. Wash residue on contaminated surfaces with large amounts of water.

DISPOSAL: Reclaim material when possible. Contact supplier or licensed chemical waste disposal contractor for treatment/disposal instructions. Follow local, state, and Federal regulations.

EPA HAZARDOUS WASTE NO.: D001 (Oxidizer, 40 CFR 261.21).

Note: Some grades may be considered a hazardous waste by virtue of their soluble barium content.

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide local exhaust ventilation to minimize airborne dust concentrations. Use NIOSH-approved respirators where dusty conditions exist. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134). Wear gloves and other protective clothing (boots, apron, etc.) as required to prevent skin contact. Chemical goggles or faceshield should be worn when handling this material and its solutions. If clothing becomes contaminated, fresh clothing should be obtained promptly. Launder contaminated clothing before reuse.

Safety showers and eyewash stations should be provided in work areas where this material is handled.

Contact lenses pose a special hazard; soft lenses may absorb and all lenses concentrate irritants.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry location on noncombustible surface. Store away from flammable and combustible materials and reducing agents. Protect containers from physical damage. Maintain good housekeeping procedures. Clean up spills promptly.

Follow good personal hygiene practice. Wash hands thoroughly after handling and before eating and smoking.

Avoid inhalation of dust/mist and contact with skin and eyes. Do not ingest!

DOT CLASSIFICATION: Oxidizer DOT ID NO.: UN1507 DOT LABEL: Oxidizer

DATA SOURCE(S) CODE (See Glossary) 1,4,5,9,14,44,55,58,61,62. V

APPROVALS	3/86
INDUST. HYGIENE/SAFETY	3-86
MEDICAL REVIEW:	Mar 86

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

No. 101
SODIUM NITRATE
(Revision A)

Issued: April 1982
Revised: February 1987

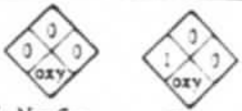
SECTION 1. MATERIAL IDENTIFICATION

* MATERIAL NAME: SODIUM NITRATE

DESCRIPTION/USES: Inorganic material; sodium salt of nitric acid. Used as an oxidizing agent, solid rocket propellant, fertilizer flux, refrigerant, anaphrodisiac, food preservative; used in glass making, dyes, pharmaceuticals, pottery enamel, and in tobacco products to modify burning properties.

OTHER DESIGNATIONS: Nitratine, Soda Niter, Chile Saltpeter, $NaNO_3$, CAS #7631-99-4

MANUFACTURER: Available from several suppliers, including:
Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 455-4400



HMIS	Nonfire	Fire
H	0	
F	0	R 1
R	0	I --
PPE*		S 1
*See Sect. 8		K 0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Sodium Nitrate, CAS #7631-99-4	>99	No TLV Established. Rat, Oral, LDLo: 200mg/kg Human, Oral, LDLo: 500 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point, 1 atm ... Decomposes at 716°F (380°C)
Vapor Pressure, 20°C, mm Hg ... Negligible
Water Solubility, g/100 g at 0°C ... 73
Vapor Density (Air = 1) ... Negligible
Evaporation Rate ... Not Found

Specific Gravity (H_2O=1) ... 2.26
Melting Point ... 586°F (308°C)
Percent Volatile by Volume ... Not Found
Molecular Weight ... 85.0
pH (aqueous solution) ... 7.0

Appearance and odor: Colorless, transparent crystals or white powder, granules, or other solid. Odorless. Anhydrous salt is deliquescent in moist air.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Flammable	See Below	Not Found	--	--

EXTINGUISHING MEDIA: Flood fire with water or cover it with fine sand. Sodium nitrate is an oxidizing agent. Use a lot of water to drench this material in the early stages of a fire and to cool containers and surrounding combustibles. When heated in a fire, sodium nitrate can melt; a water stream directed at the melt can scatter molten material, increasing the flammability of any combustible material it contacts (see sect. 5). It can decompose explosively when heated to >1000°F (538°C).

UNUSUAL FIRE/EXPLOSION HAZARDS: Sodium nitrate in contact with combustible and oxidizable substances can give violent combustion or explosion upon ignition. (It can be friction or shock sensitive.)

SPECIAL FIRE-FIGHTING PROCEDURES: Approach the fire with caution. Clothing contaminated with sodium nitrate can become highly flammable. Fire fighters should use self-contained breathing apparatus and wear fully protective clothing.

SECTION 5. REACTIVITY DATA

Sodium nitrate is stable. Hazardous polymerization cannot occur.

Oxidizable materials, including barium rhodanide, antimony, boron phosphide, cyanides, sodium hypophosphite, sulfur plus charcoal, powdered aluminum or aluminum oxide, sodium thiosulphate, metal sulfides, sodium acetate, fluorine, zinc, and trichloroethylene are incompatible with this material. Fibrous organic material such as jute, wood, and similar cellulose-based material can become highly combustible by nitrate impregnation.

Hazardous products of decomposition can include oxides of nitrogen (NOx).

SECTION 6. HEALTH HAZARD INFORMATION

Sodium nitrate is not listed as a carcinogen by the NTP, IARC, or OSHA.

Inhalation of dust or mist may cause local irritation to the upper respiratory tract. Contact with eyes or skin may cause local irritation. Prolonged exposure to nitrate may cause blood disorders in infants. This material is used as a food additive in very small amounts, but excessive ingestion may cause gastroenteritis, abdominal pains, vomiting, and muscular weakness.

TARGET ORGANS: Eyes, skin. PRIMARY ENTRY: Inhalation. ACUTE EFFECTS: Eyes, skin, and mucous membrane irritation. CHRONIC EFFECTS: Unknown.

FIRST AID: EYE CONTACT: Flush eyes thoroughly, including under eyelids, with running water for 15 minutes. Get medical help.* SKIN CONTACT: Remove contaminated clothing. Flush affected area with water and wash with soap and water. Get medical help.* INHALATION: Remove victim to fresh air. Restore and/or support his breathing as required. Get medical help.* INGESTION: Give victim 2 to 3 glasses of water to drink to dilute material. Induce vomiting. Repeat until vomit fluid is clear. Never give anything by mouth to someone who is unconscious or convulsing. Get medical help.*

* GET MEDICAL ASSISTANCE = In plant, community, paramedic. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of sodium nitrate spills. Provide adequate ventilation. Remove sources of heat or ignition. Cleanup personnel need protection against inhalation of dust or mist. Sweep up or vacuum waste promptly, avoid dusting conditions, and place it in an appropriate closed container for reclamation or disposal. Absorb liquid spills on dry sand. Flush residue with a lot of water.

If spilled material is intermixed with combustibles it may be desirable to wet it with water and mix it with wet sand before it is picked up for disposal.

If allowable, scrap can be dissolved in a large amount of water and flushed to the drain with high dilution; otherwise, bury mixture diluted with wet sand in an approved landfill.

Follow Federal, state, and local regulations.

EPA, Clean Water Act, Reportable Spill Quantity: Not Listed.

SECTION 8. SPECIAL PROTECTION INFORMATION

When dusty or misty conditions occur, use a NIOSH-approved dust respirator or mist mask.

Maintain general ventilation in storage and workplace area. Use local exhaust where dusty or misty conditions prevail. Wear body-protective clothing (hat, gloves, etc.) appropriate to the work situation to minimize skin contact. Prevent eye contact by wearing chemical safety goggles where dusty or misty conditions occur or where splashing is possible. Wear rubber gloves to prevent repeated or prolonged skin contact. Launder soiled clothing before wearing it again. Clothing contaminated with the dust or liquid of this oxidizing agent can become highly flammable. Use water, *not* a fire blanket or smothering technique, to extinguish a clothing fire.

Eyewash stations and washing facilities should be available to areas of use and handling.

Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Particles can adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store sodium nitrate in closed containers in a cool, dry, well-ventilated area away from sources of heat and ignition and separate from combustible or readily oxidizable material. Protect containers from physical damage. Practice good housekeeping to prevent the accumulation of dust. Avoid storing this material on wood floors.

Avoid breathing sodium nitrate dust. Minimize skin contact by wearing proper gloves and suitable work clothing. Practice good personal hygiene. Wash thoroughly after handling this material. Do not take it out of your work area or to your home on your clothing or equipment. Do not eat sodium nitrate.

DOT Classification: Oxidizer DOT ID No. UN1498 Label: Oxidizer (Rail) Yellow

Data Source(s) Code: 1, 4-11, 20, 25, 34, 58, 63, 81, 82, 84. CK

Approvals

Indust. Hygiene/Safety

Medical Review

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

No. 220

POTASSIUM CHLORATE

Issued: November 1987

SECTION 1. MATERIAL IDENTIFICATION

24

Material Name: POTASSIUM CHLORATE

Description (Origin/Uses): Used in explosives, matches, prints, dyes; in chemical analysis; and as a source of oxygen.

Other Designations: Pearl Ash; Potassium Salt of Chloric Acid; Potassium Oxymuriate; Potcrate; Salt of Tartar; $KClO_3$; NIOSH *RTECS* No. FO0350000; CAS No. 3811-04-9

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyer's Guide* (Genium ref. 73) for a list of suppliers.

HMIS			Not Found
H	1		
F	2	R	1
R	3	I	NA
PPG*		S	2
*See sect. 3		K	0

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Potassium Chlorate, CAS No. 3811-04-9	ca 100	TLV Not Found **Toxicity Data*** Human, Unknown, LD_{Lo}: 429 mg/kg Rat, Oral, LD_{50}: 1870 mg/kg

*See NIOSH *RTECS* for additional data.

SECTION 3. PHYSICAL DATA

Boiling Point: Decomposes
Vapor Density (Air = 1): 4.2
Water Solubility: 7.1%

Specific Gravity (H_2O = 1): 2.32
Melting Point: 673°F (356°C)
Molecular Weight: 122.55 Grams/Mole
% Volatile by Volume: 0

Appearance and Odor: Colorless, lustrous crystals or white granules/powder; data on odor not found.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
*	*	- % by Volume	*	*

Extinguishing Media: *Potassium chlorate does not burn by itself; however, under fire conditions this strong oxidizer intensifies the fire. Use extinguishing agents suitable for the surrounding fire if this material is not involved. Otherwise, flooding amounts of water are recommended to fight potassium chlorate fires.

Unusual Fire or Explosion Hazards: Potassium chlorate decomposes readily to yield oxygen and becomes very reactive, especially during fire conditions. When mixed with or contaminated by combustibles like wood, oils, paper, cloth, or metal powders, violent reactions can occur. Even during nonfire conditions this material can be sensitive to heat, friction, or impact. **Warning:** Containers of potassium chlorate may rupture explosively during fires. Use a water spray to cool fire-exposed containers.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode for protection against the dust, mist, and/or fume that can occur during fire conditions.

SECTION 5. REACTIVITY DATA

Potassium chlorate is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Potassium chlorate is incompatible with organic matter, any oxidizable substances, sulfuric acid, hypophosphite, iodides, tartaric acid, sulfur, phosphorus, sulfites, powdered metals, ammonium compounds, and sulfur dioxide.

Conditions to Avoid: Avoid exposure to chemical incompatibles; potassium chlorate is a powerful oxidizing material and it can react explosively with any easily oxidizable material. Friction and/or heat may initiate these dangerous reactions. Do not allow situations to develop where these hazardous reactions are promoted, especially during fire conditions.

SECTION 6. HEALTH HAZARD INFORMATION

Potassium chlorate is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: This material is irritating to the gastrointestinal (GI) tract and kidneys. Ingestion causes hemolysis of red blood cells and anoxia (a condition resulting in the decreased oxygen-carrying capability of the red blood cells).
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Eyes, skin, and hematopoietic (blood) system. **Primary Entry:** Inhalation, skin contact.
Acute Effects: Irritation of the skin, eyes, nose, and upper respiratory tract (URT) may be caused by exposure to potassium chlorate.
Chronic Effects: None reported.

FIRST AID.
Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes to remove particles.
Skin Contact: Wash the affected area with soap and water.
Inhalation: Remove victim to fresh air.
Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. If the victim is responsive, give him several glasses of water to drink. Induce vomiting by giving him an emetic such as two tablespoons of salt in a glass of warm water.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. **Seek prompt medical assistance for further treatment, observation, and support after first aid.**

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and prevent contact with chemical incompatibles (see sect. 5). Avoid excessive generation of dust. If dust is generated, wear appropriate respiratory protection (see sect. 8). Ventilate the affected area; carefully scoop or vacuum waste, using an appropriate filter, into a suitable container for reclamation or disposal.
Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not Listed
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. D003 (Reactivity)
CERCLA Hazardous Substance: Not Listed

SECTION 8. SPECIAL PROTECTION INFORMATION

oggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 9 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. **Other Equipment:** Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent excessive skin contact or contamination. **Ventilation:** Install and operate general and local ventilation systems of sufficient power to maintain airborne levels of potassium chlorate below the OSHA PEL standard cited in section 2.
Safety Stations: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling.
Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment. **Danger:** Clothing contaminated with solid potassium chlorate or its aqueous solution is very flammable and must be immediately removed because of this hazard.
Comments: Practice good personal hygiene; always wash thoroughly after using potassium chlorate. Keep this material off of your clothing and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Do not create dusty working conditions!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store potassium chlorate in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).
Special Handling/Storage: Protect containers from physical damage and sudden shocks. Use with adequate ventilation. Do not create dusty working conditions and practice good housekeeping to minimize the accumulation of potassium chlorate dust. Do not store this material on wooden floors or near organic materials.
Comments: Potassium chlorate is a strong oxidizer that is very reactive, and all engineering systems in storage, production, holding, and shipping areas, etc., must be designed accordingly.

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Potassium Chlorate
DOT Hazard Class: Oxidizer
IMO Class: 5.1 (Solid or Solution)

DOT ID No. UN1845 (Solid); UN2427 (Solution)
IMO Label: Oxidizer (Solid or Solution)
DOT Label: Oxidizer

References: 1, 12, 73, 84-94, 103. PJI

Approvals
Indust. Hygiene/Safety
Medical Review

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
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(518) 377-8855

No. 175

IRON (III) OXIDE
(Revision A)
Issued: February 1986
Revised: November 1987

SECTION 1. MATERIAL IDENTIFICATION

24

Material Name: IRON (III) OXIDE

Description (Origin/Uses): Used in polishing compounds, pigments, magnetic tape, and metallurgy.

Other Designations: Ferric Oxide; Iron Sesquioxide; Red Iron Oxide; Fe_2O_3; NIOSH *RTECS* No. NO7400000; CAS No. 1309-37-1

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyer's Guide* (Genium ref. 73) for a list of suppliers.

Not Found

HMIS
H 0
F 0
R 0
PPG*
*See sect. 8

R 1
I 2
S 1
K 0

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Iron (III) Oxide, CAS No. 1309-37-1 *See NIOSH *RTECS* for additional data.	ca 100	**ACGIH TLVs, 1987-88** TLV-TWA: 5 mg/m³ (Dust and Fume: Total Particulate, as Fe) **OSHA PEL (Iron Oxide Fume)** 8-Hr TWA: 10 mg/m³ **Toxicity Data*** Rat, Intraperitoneal, LD_{50}: 5500 mg/kg

SECTION 3. PHYSICAL DATA

Vapor Pressure: 0 Torr at 68°F (20°C)
Specific Gravity (H_2O = 1): 5.24
Melting Point: 2849°F (1565°C)
Molecular Weight: 160 Grams/Mole

Appearance and Odor: Iron (III) Oxide is a red-brown dust or fume with a metallic taste. The amount of combined water and size of particles determine the exact color and appearance of this material.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
*	*	% by Volume	*	*

Extinguishing Media: *Iron (III) Oxide does not burn. Use extinguishing agents suitable for the surrounding fire.

Unusual Fire or Explosion Hazards: None.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode for protection against the dust, mist, and/or fumes that can occur during fire conditions.

SECTION 5. REACTIVITY DATA

Iron (III) Oxide is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Iron (III) Oxide is incompatible with hydrazine, calcium hypochlorite, performic acid, and bromine pentafluoride.

Conditions to Avoid: Avoid generating dusts and/or fumes.

Hazardous Products of Decomposition: None.

SECTION 6. HEALTH HAZARD INFORMATION

Iron (III) oxide is not listed as a carcinogen by the IARC, NTP, or OSHA.

Summary of Risks: As a nuisance dust, iron (III) oxide does not produce significant changes in the upper respiratory tract (URT) hen exposures to it are kept within reasonable limits. It may cause mechanical irritation of the eyes, skin, and mucous membranes like y other nuisance dust.

Medical Conditions Aggravated by Long-Term Exposure: Existing respiratory ailments may be aggravated by long-term exposure to iron (III) oxide. Periodic physical exams emphasizing pulmonary functions, including chest X rays, are recommended for those with potential long-term exposure. **Target Organs:** Respiratory system. **Primary Entry:** Inhalation. **Acute Effects:** Excessive dust/fume levels produce nonspecific irritation of the eyes and respiratory system. **Chronic Effects:** Prolonged inhalation (6-10 years) of iron (III) oxide dust/fume may produce siderosis with changes visible on a chest X ray. This benign pneumoconiosis is not associated with pulmonary fibrosis or disability unless there is a concurrent exposure disease. The TLV cited in section 2 "is recommended to prevent the development of X-ray changes in the lung on long-term exposure" (Genium ref. 89).

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin Contact:** Wash the affected area with soap and water. **Inhalation:** Remove victim to fresh air.
Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. If the victim is responsive, give him several glasses of water to drink. Induce vomiting by giving him an emetic.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. **Seek prompt medical assistance for further treatment, observation, and support after first aid.**

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Avoid excessive generation of dust. If dust is generated, wear appropriate respiratory protection (see sect. 8). Ventilate the affected area; carefully scoop or vacuum waste, using an appropriate filter, into a suitable container for reclamation or disposal.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (Iron (III) Oxide Fume) (29 CFR 1910.1000, Subpart Z)
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste: Not Listed
CERCLA Hazardous Substance: Not Listed

ECTION 8. SPECIAL PROTECTION INFORMATION

ggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. **Other Equipment:** Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent excessive skin contact or contamination. **Ventilation:** Install and operate general and local ventilation systems of sufficient power to maintain airborne levels of iron (III) oxide dust below the OSHA PEL standard cited in section 2.
Safety Stations: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep this material off of your clothes and equipment. Avoid transferring iron (III) oxide dust from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Do not create dusty conditions!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store iron (III) oxide in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).

Special Handling/Storage: Protect containers from physical damage, use with adequate ventilation, do *not* create dusty conditions, and practice good housekeeping to minimize the accumulation of iron (III) oxide dust.

Transportation Data (49 CFR 172.101-2)
Iron (III) oxide is not listed in the shipping regulation tables of 49 CFR 172.101-2.

References: 1, 2, 4, 5, 9, 12, 27, 43, 55, 58, 73, 82-94, 103. CV/PJI

Approvals	
Indust. Hygiene/Safety	
Medical Review	

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1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 277
Potassium Perchlorate

Issued: 8/89

Section 1. Material Identification

Potassium Perchlorate Description: Used in explosives, pyrotechnics, photography, and analytical chemistry.
Other Designations: Potassium hyperchlorate; $KClO_4$; CAS No. 7778-74-7.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
I
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Genium
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PPG*
* Sec.

Section 2. Ingredients and Occupational Exposure Limits

Potassium perchlorate, ca 100%

OSHA PEL	ACGIH TLV, 1988-89	NIOSH REL	Toxicity Data*
None established	None established	None established	(Reproductive effects) Rat, oral, TD_{Lo}: 27.675 mg/kg Rabbit, oral, TD_{Lo}: 2100 mg/kg

*See NIOSH, *RTECS* (SC9700000), for additional data with references to reproductive effects.

Section 3. Physical Data

Boiling Point: *
Melting Point: 1130 °F (610 °C)
Molecular Weight: 138.55 g/mol

Specific Gravity (H_2O = 1): 2.52
Water Solubility: 65 parts cold water
15 parts boiling water
insoluble in alcohol

Appearance and Odor: Colorless or white crystals or powder; odorless.

* When heated to 752 °F (400 °C), potassium perchlorate starts decomposing.

Section 4. Fire and Explosion Data

Flash Point: Not found	Autoignition Temperature: Not found	LEL: Not found	UEL: Not found

Extinguishing Media: Use dry chemical, carbon dioxide (CO_2), water spray, or foams to put out fires involving potassium perchlorate.
Unusual Fire or Explosion Hazards: Potassium perchlorate is a powerful oxidizer that can greatly increase the intensity of nearby fires by providing an oxygen source for burning materials.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Section 5. Reactivity Data

Stability/Polymerization: Potassium perchlorate is stable at room temperature during routine operations. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Potassium perchlorate is a powerful oxidizer and a reactive material. Hazardous reactions involve it and aluminum and magnesium; charcoal; fluorine; magnesium; nickel and titanium; sulfur; and reducing agents such as lithium aluminum hydride and sodium hydride.
Conditions to Avoid: Prevent direct contact with the incompatible chemicals listed above. Always establish chemical compatibility before mixing them by testing small quantities of the materials under conditions similar to the anticipated use.
Hazardous Products of Decomposition: Thermal oxidative degradation of potassium perchlorate can produce oxides of chlorine (Cl_xO_y) and/or potassium fumes/compounds.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists potassium perchlorate as a carcinogen.

Summary of Risks: Absorbed potassium perchlorate can cause methemoglobinemia and kidney injuries. Exposure has been associated with lastic anemia.

edical Conditions Aggravated by Long-Term Exposure: None reported

Target Organs: Skin, eyes, respiratory systems, renal (kidney) system, and red blood cells (RBCs).

Primary Entry: Inhalation, skin contact.

Acute Effects: Severe and immediate irritation of the skin, eyes, and mucous membranes lining the respiratory system. Shortness of breath and difficult breathing may be seen with the presence of methemoglobinemia. Ingestion likely causes nausea, vomiting, and abdominal cramping.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: After rinsing affected area with flooding amounts of water, wash it with soap and water.

Inhalation: Remove the exposed person to fresh air and support breathing as needed. Have qualified medical personnel administer oxygen as required.

Ingestion: Unlikely. If ingested, have the exposed person drink 1 to 2 glasses of water. If ingestion is substantial, induce vomiting by administering Syrup of Ipecac. his treatment is most useful if initiated within 30 min of ingestion. Contact your local physician or poison control for further assistance. Never induce vomiting if the person is having a seizure, is unconciousness, or appears at risk of losing consciousness.

After first aid, get appropriate in-plant, paramedic, or community medical attention and support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a potassium perchlorate spill control and countermeasure plan (SCCP).* When a spill occurs, notify safety personnel, eliminate heat or ignition sources, provide optimum explosion-proof ventilation, and implement the SCCP. Cleanup personnel must wear personal protective equipment (Sec. 8) to prevent skin contact or dust/powder inhalation. Do not create dusty conditions during cleanup operations. Shovel, scoop, or vacuum the spilled material into appropriate disposal or recovery containers.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

A Extremely Hazardous Substance (40 CFR 355): Not listed

RA Toxic Chemical (40 CFR 372.65): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Wear a NIOSH-approved respirator if necessary. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems that maintain minimal airborne concentrations. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store potassium perchlorate in closed containers in a cool, dry, well-ventilated, fireproof area away from heat or ignition sources and incompatible chemicals. Protect these containers from physical damage.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Potassium perchlorate	**IMO Shipping Name:** Potassium perchlorate
DOT Hazard Class: Oxidizer	**IMO Hazard Class:** 5.1
DOT ID No.: UN1489	**IMO Label:** Oxidizer
T Label: Oxidizer	**IMDG Packaging Group:** II

Packaging Requirements: 49 CFR 173.219

MSDS Collection **References:** 1, 6, 7, 84-94, 100, 116, 117, 119, 120, 122

Prepared by: PJ Igoe, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman

TETRYL

Other names: US – 2, 4, 6,–trinitrophenylmethylnitramine, N–methyl–N, 2, 4, 6–tetranitroaniline, tetralite, tetrylite, pyronite; UK–Composition Exploding, C.E.; GR–Tetra.

Composition: $(NO_2)_3C_6H_2N(NO_2)CH_3$

State: Finely divided crystalline powder.

Color: Colorless when freshly prepared and highly purified; rapidly acquires a yellow color when exposed to light. Turns gray when graphite is added as a lubricant during loading.

Melting point: 130° C (266° F).

Solubility: Very soluble in acetone; slightly soluble in ethyl alcohol and benzene.

Sensitivity: Sensitivity is intermediate between TNT and PETN. More sensitive than picric acid. More easily detonated than TNT or ammonium picrate. Should be considered as sensitive as mercury fulminate when finely divided. Will usually detonate when subjected to bullet impact. May be ignited by spark; however, does not take fire from the spit of a fuse.

Velocity of detonation: 7,500 m/sec (24,600 ft/sec) at a density of 1.6 grams/cm^3.

Detonating temperature: Ignites at approximately 257° C (494° F) in 5 seconds.

Stability: Shows no serious decomposition when stored at ordinary temperatures. Slightly hygroscopic, but not adversely affected by moisture. First melts, then decomposes and explodes when heated. Maximum safe working temperature is 100° C (212° F). Flammable and burns readily. Will corrode steel when wet or dry. In the presence of moisture, reacts slightly with iron, zinc, and brass.

Toxicity: Principle evidences of exposure are dermatitis, discoloration of the skin and hair, irritation of the upper respiratory tract, and possibly, systemic poisoning. The areas usually affected by dermatitis are the eyes, the neck, the bend of the elbow, and the forearms. Severe reactions result in acute inflammation of those parts with spreading to the other areas. Continual handling may stain the hands, face, scalp, and hair a yellow color. Inhalation, ingestion, or skin absorption may cause systemic poisoning with such symptoms as nosebleed, sneezing, unproductive cough, pain in the chest, mild nausea, and abdominal cramping.

Method of loading: Melting point is too high to allow it to be melted and cast. Loaded by being mixed with a lubricant, such as graphites, stearic acid, or magnesium stearate, while being pressed into pellets.

Method of unloading: May be washed out with a suitable solvent. Steaming out is impractical because of its high melting point.

Use: The standard United States booster explosive. Used extensively as a booster and the main charge for small–caliber projectiles. Also used as the base charge in compound detonators. Will not burn under water.

Remarks:

PETN

Other names: US – Pentaerythritol tetranitrate (PETRIN), tetranitropentaerythritol, pentaerythrite tetranitrate, penta, niperyth, niperite, pentyl; FR – Penthrite; GR – Penthrite, Nitropenta, NP, Nitropentaerythrit, Pentrit; IT – Pentrite.

Composition: $C(CH_2ONO_2)_4$

State: Fine crystalline or granular powder.

Color: White when pure; may be light gray due to impurities. Color may vary due to addition of wax as a desensitizer.

Melting point: 141° C (286° F).

Solubility: Insoluble in water. Soluble in acetone and methyl acetate.

Sensitivity: Most sensitive of the military explosives not classed as a primary explosive. In the finely divided state it should be considered as sensitive as mercury fulminate. Very sensitive to heat, shock, and friction. Sharp blows or friction of metal on metal is sufficient to cause detonation. Readily detonated by bullet impact and may be ignited by sparks. Will not normally ignite or be detonated by static electricity generated on the body or in routine handling. Extremely sensitive to initiation by lead azide. Does not take fire from the spit of a fuse. Very insensitive to flame, shock, and friction in Primacord, and therefore must be detonated by a cap. Will not detonate under a long, slow pressure.

Velocity of detonation: 7,900 m/sec (25,900 ft/sec) at a density of 1.6 grams/cm^3.

Detonating temperature: Approximately 175° C (347° F).

Stability: Stability in storage is good. Usually stored wet when in bulk. Nonhygroscopic and not adversely affected by moisture. When moist, reacts to some extent with most metals, stainless steel, and aluminum. Most metals are unaffected by the dry material. Decomposed slowly by the action of caustic soda. Decomposition is fairly rapid in a solution of boiling ferrous chloride.

Toxicity: Even though considered not unduly toxic, exposure should be minimized. Contact with the skin does not generally cause dermatitis, although absorption through the skin is possible. Small doses either absorbed through the skin or inhaled may cause a decrease in blood pressure; larger doses causes difficult or labored breathing and convulsions.

Method of loading: Loaded by pressing.

Method of unloading: May be washed out with an available suitable solvent. Steaming is impractical because of its high melting point.

Use: A booster explosive used primarily as the explosive core of detonating cord such as Primacord (U.S.) and Corditex (U.K.). Also used as a booster and detonator base charge.

Remarks: Will not burn under water.

BLACK POWDER

Other names: US – Black cannon powder, black shell powder, black fuze powder, sodium nitrate black, spherohexagonal black, Type A black powder, Type B black powder; FR – Poudre noir, Poudre N; GR – Schwarzpulver; SZ – Amidogene.

Composition: A mechanical mixture of finely pulverized potassium or sodium nitrate, charcoal, and sulfur (usually 75:15:10–percent).

State: Grains of various sizes. Grains may be pressed into plates, prisms, cubes, and other regular shapes.

Color: Slate–gray color having a dull polish. Individual grains are usually coated with graphite which reduces sliding friction and imparts a shiny black appearance.

Melting point: Does not melt.

Solubility: Desensitized when placed in water because the potassium or sodium nitrate dissolves out. The water, washing, however, must be separated from the residue because, if wet and permitted to dry, black powder may resume its explosive properties.

Sensitivity: Considered the most sensitive of all bulk explosives. Very sensitive to friction, heat, and impact.

Burning rate: The burning rate is difficult to control. A representative burning rate is 370 m/sec (1,200 ft/sec).

Detonating temperature: Approximately 356° C (673° F) in 10 seconds.

Stability: Very stable when properly stored. Unaffected by moderately high temperatures, and is not subject to spontaneous combustion at ordinary storage temperatures. Very hygroscopic. Deteriorates irregularly when exposed to moisture. Attacks all common metals, except stainless steel, when wet or excessively moist.

Toxicity: Not markedly toxic and generally does not cause dermatitis.

Method of loading: Granular loaded or pressed.

Method of unloading: May be poured, or washed out with water. Steaming may be used; however, water washing is the preferred method.

BLACK POWDER – CONT.

Use: Present military use is limited to ignition and primer charges, time rings in time and combination fuzes, delay pellets for primers and fuzes, base detonating torpedo impulse and propellant charges, blank ammunition, smoke–puff and spotting charges, bursting charges for practice bombs and shells, and ignition pads for bags of smokeless powder.

Remarks:

TNT

Other names: US – 2, 4, 6–trinitrotoluene, triton, trilite, tritol, trinol, tritone, trotol; UK – Trotyl; FR – Tolite; GE – Fullpulver 02, Fp 02, Sprengmunition 02, Tutol; IT – Tritolo.

Composition: $C_6H_2CH_3(NO_2)_3$.

State: A flaked, granular, or crystalline material.

Color: Straw yellow to yellowish brown, depending on purity.

Melting point: 80 to 81° C (176 to 178° F).

Solubility: Soluble in acetone, ethyl alcohol, benzene, and dimethylformamide.

Sensitivity: One of the most insensitive high explosives. Relatively insensitive to shock, friction, and flame, but can be detonated by moderate force when confined between metal surfaces such as on threads of bolts. Cannot generally be exploded by a single rifle bullet, but may be detonated by concentrated machine gun or rifle fire. Can be detonated by a No. 6 blasting cap when in a crystalline or pressed granular form. When highly compressed can be detonated by a No. 8 blasting cap. An Engineer Corps special blasting cap, however, should be used for consistent detonation. When cast, requires a booster for consistent detonation. Distinctly more sensitive when decomposed by light.

Velocity of detonation: 6,800 m/sec (22,300 ft/sec) at a density of 1.6 grams/cm^3.

Detonating temperature: Approximately 465° C (869° F).

Stability: Very stable when stored at prescribed storage temperatures. However, when stored at elevated temperatures, may exude an oily liquid which is relatively insensitive alone, but when mixed with wood or cotton forms a low explosive which is easily ignited, burns rapidly, and may detonate. Nonhygroscopic and not adversely affected by moisture. Does not react with metals except in the presence of dilute nitric acid; then the product is dangerous. Reacts readily with alkalies such as ammonia, sodium hydroxide, and sodium carbonate to form compounds which are dangerously sensitive to heat and impact.

Toxicity: Highly poisonous. Main channel to entrance into the body is by absorption through the skin. Inhalation of dust and fumes as well as ingestion may be equally important. Absorption into the body can cause watery eyes, visual trouble, jaundice, and possible loss of vision. In addition to systemic poisoning, dermatitis through contact with the skin can occur.

Method of loading: Usually cast, but may be pressed (tamped).

Method of unloading: May be steamed out.

Use: A main–charge explosive used as a filler for high–explosive shells, bombs, depth charges, large coastal mines, rockets, and as a demolition charge. Employed as a booster in pressed granular form. When flaked, may be used in small–caliber shells and projectiles, and in fragmentation hand grenades.

Remarks: Will not burn under water.

BARIUM PEROXIDE

CAS RN: 1304296 NIOSH #: CR 0175000
mf: BaO_2; mw: 169.34

Grayish-white powder. mp: 450°, bp: —O @ 800°, d: 4.96.

SYNS:

BARIO (PEROSSIDO DI) (ITALIAN)
BARIUM BINOXIDE
BARIUM DIOXIDE
BARIUMPEROXID (GERMAN)
BARIUMPEROXYDE (DUTCH)
BARIUM SUPEROXIDE
DIOXYDE DE BARYUM (FRENCH)

TOXICITY DATA: 3	CODEN:
scu-mus LD50: 50 mg/kg	ZVKOA6 19,186,74

DOT: Oxidizer, Label: Oxidizer FEREAC 41,57018,76. Reported in EPA TSCA Inventory, 1980.

THR: HIGH scu. See also barium compounds (sol) and peroxides. Powerful oxidizer.

Incomp: H_2S, water, peroxy formic acid, hydroxylamine sol, mixture of ($Mg-Zn+Ba(NO_3)_2$), organic matter.

CALCIUM RESINATE

CAS RN: 9007130 NIOSH #: EW 3970000
mf: $Ca(C_{44}H_{62}O_4)_2$; mw: 1349.50

Yellowish white amorphous powder or lumps.

SYN: LIMED ROSIN

TOXICITY DATA:

DOT: Flammable Solid. Label: Flammable Solid FEREAC 41,57018,76. Reported in EPA TSCA Inventory, 1980.

THR: Unk.

Fire Hazard: Mod. when heated; can react with oxidizing materials.

Disaster Hazard: When heated to decomp it emits acrid smoke.

CALCIUM RESINATE (FUSED)

NIOSH #: EW 3971000

SYN: LIMED ROSIN, FUSED

TOXICITY DATA:

DOT: Flammable Solid. Label: Flammable Solid FEREAC 41,57018,76.

THR: NO data.

Disaster Hazard: When heated to decomp it emits acrid smoke.

LEAD(IV) AZIDE

mf: $N_{12}Pb$;   mw: 275.27

THR: Crystalline product spontaneously decomposes explosively. See also azides, lead compounds.

Disaster Hazard: When heated to decomp it emits very tox fumes of NO_x and Pb.

SPECTRUM ACQUISITIONS, INC.
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FULGHUM STREET
HORNSBY, TN 38044
(901)658-9050

MATERIAL SAFETY DATA SHEET

SECTION 1 - IDENTIFICATION

PRODUCT TRADE NAME:	Husqvarna 30 Weight Bar & Chain Oil
REVISION DATE:	02/23/90
INFORMATION/EMERGENCY PHONE NO:	(901)658-9050
CHEMICAL FAMILY:	Petroleum Lubricating Oil

SECTION 2 - HAZARDOUS INGREDIENTS

NAME	REGULATORY AGENCY	EXPOSURE LIMIT
Comples Mixture of Petroleum Hydrocarbons	OSHA/ACGIH	5mg/m3 Mist

See Section 6, Chronic Effects, for potential over-exposure hazard.

SECTION 3 - PHYSICAL DATA

VAPOR PRESURE(mmHg):	<1
SPECIFIC GRAVITY:	.94
WATER SOLUBILITY:	Negligible
BOILING POINT:	Wide Range
VAPOR DENSITY (Air=1):	>1
EVAPORATION RATE (BUAC=1):	<1
ODOR:	Mild Hydrocarbon Odor
APPEARANCE:	Amber Colored Liquid

SECTION 4 - FIRE AND EXPLSION HAZARDS

FLASH POINT:	Not Determined
UPPER FLAMMABLE LIMIT:	Not Determined
LOWER FLAMMABLE LIMIT:	Not Determined
EXTINGUISHING MEDIA(s):	Water Fog, Chemical Foam, Dry Chemical Powder, CO_2
SPECIAL FIREFIGHTING PROCEDURES:	Cool exposed containers with water spray. Avoid breathing fumes.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	Pressure increase in over heated closed containers. Cool containers

with water spray.

SECTION 5 - REACTIVITY DATA

STABILITY:	Stable
INCOMPATIBILITY:	Avoid strong oxidants.
POLYMERIZATION:	Will not occur.
THERMAL DECOMPOSITION:	Partial burning produces fumes, smoke and carbon monoxide.

SECTION 6 - HEALTH HAZARD DATA

INHALATION:	Inhalation of fumes may result in dizziness, headache and respiratory irritaion.
EYE CONTACT:	Contact with eyes may cause minimal irritaion.
SKIN CONTACT:	Mild irritaion my occur with prolonged or repeated contact.
INGESTION:	Slightly toxic. Pulmonary aspiration hazard if vomiting occurs.
TLV:	$5mg/m^3$ as mist. ACGIH 1984-85
CHRONIC EFFECTS:	Product has a low order of acute oral toxicity. Ingredients of this product are not listed as potential carcinogens in N.T.P. Annual Report on Carcinogens, I.A.R.C. Monographs, or by O.S.H.A. HCS (g) (2) (vii).

Emergency First Aid Procedures

SKIN:	Wash skin with soap and warm water. Wash Clothing before re-use.
EYE:	If splashed into eyes flush eyes with clear water for five(5) minutes.
INHALATION:	If overcome by fumes remove from exposure immediately.
ORAL:	If ingested, do not induce vomiting. Call a physician.

SECTION 7 - SPECIAL PROTECTION INFORMATION

VENTILATION PROCEDURE:	Ventilate as needed to comply with exposure limit.
GLOVES PROTECTION:	Use impervious gloves to avoid repeated/prolonged skin contact.
EYE PROTECTION:	Use goggles/face shield to avoid eye contact.
WORK/HYGENIC PRACTICES:	If clothing becomes contaminated,

SPECTRUM ACQUISITIONS, INC.
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(901)658-9050

MATERIAL SAFETY DATA SHEET

SECTION 1 - IDENTIFICATION

PRODUCT TRADE NAME:	Huscvarna Pro Forest 30 Weight Bar & Chain Oil
REVISION DATE:	12/15/92
INFORMATION/EMERGENCY PHONE NO:	(901)658-9050
FAX NO:	(901)658-3591

FOR CHEMICAL EMERGENCY
SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT
CALL CHEMTREC-DAY OR NIGHT
(800)424-9300
TOLL-FREE IN THE CONTINENTAL U.S.
ADD LONG-DISTANCE ACCESS NUMBER IF REQUIRED
483-7616 IN DISTRICT OF COLUMBIA
FOR CALLS ORIGINATING OUTSIDE THE CONTINENTAL U.S.,
202-483-7616 WASHINGTON, D.C. COLLECT
ALL CALLS ARE RECORDED

CHEMICAL FAMILY:	Vegetable Oil(Sunflower Oil) CAS# Confidential Petroleum Lubricating Oil CAS#64742-52-5

	Health	Fire	Reactivity	Protective Equipment
NFPA CODE:	1	1	0	C or D
HMIS CODE:	1	1	0	C or D

SECTION 2 - HAZARDOUS INGREDIENTS

NAME	REGULATORY AGENCY	EXPOSURE LIMIT
Mixture of Vegetable Oil and Petroleum Hydrocarbons	OSHA/ACGIH	5mg/m3 Mist

See Section 6, Chronic Effects, for potential over-exposure hazard.

SECTION 3 - PHYSICAL DATA

VAPOR PRESSURE(mmHg):	<1 mm Hg at 20°C
SPECIFIC GRAVITY:	.94 at 60° F
WATER SOLUBILITY	Slightly
BOILING POINT:	Wide Range

VAPOR DENSITY	>1
EVAPORATION RATE (BUAC = 1):	<1
ODOR:	Mild Hydrocarbon Odor
APPEARANCE:	Amber Colored Liquid
VISCOSITY AT 100° C. —	10.4 CST

SECTION 4 - FIRE AND EXPLOSION HAZARDS

FLASH POINT:	450° F
UPPER FLAMMABLE LIMIT:	Not Determined
LOWER FLAMMABLE LIMIT:	Not Determined
FIRE POINT:	>500° F
EXTINGUISHING MEDIA (s):	Water Fog, Chemical Foam, Dry Chemical Powder, CO_2
SPECIAL FIREFIGHTING PROCEDURES:	Cool exposed containers with water spray. Avoid breathing fumes.
UNUSUAL FIRE AND EXPLOSION HAZARDS.	Pressure increase in over heated closed containers. Cool containers with water spray.

SECTION 5 - REACTIVITY DATA

STABILITY:	Stable
INCOMPATIBILITY:	Avoid strong oxidants.
POLYMERIZATION:	Will not occur.
THERMAL DECOMPOSITION:	Partial burning produces fumes, smoke and carbon monoxide.

SECTION 6 - HEALTH HAZARD DATA

INHALATION:	Inhalation of fumes may result in dizziness, headache and respiratory irritation.
EYE CONTACT.	Contact with eyes may cause minimal irritation.
SKIN CONTACT.	Mild irritation may occur with prolonged or repeated contact.
INGESTION:	Slightly toxic. Pulmonary aspiration hazard if vomiting occurs.
TLV:	5mg/m3 as mist. ACGIH 1984-85
CHRONIC EFFECTS:	Product has low order of acute oral toxicity. Ingredients of this product are not listed as potential carcinogens in N.T.P Annual Report on Carcinogens, I.A.R.C. Monographs, or by O.S.H.A. HCS (g) (2) (vii).

EMERGENCY FIRST AID PROCEDURES

SKIN:	Wash skin with soap and warm water. Wash clothing before re-use.
EYE:	If splashed into eyes flush eyes with clear water for five (5) minutes.
INHALATION:	If overcome by fumes remove from exposure immediately.
ORAL:	If ingested, do not induce vomiting. Call a physician.

SECTION 7 - SPECIAL PROTECTION INFORMATION

VENTILATION:	Ventilate as needed to comply with exposure limit.
GLOVES PROTECTION:	Use impervious gloves to avoid repeated/prolonged skin contact.
EYE PROTECTION:	Use goggles/face shield to avoid eye contact.
WORK/HYGIENIC PRACTICES:	If clothing becomes contaminated, change to fresh clean clothing. Do not wear until thoroughly laundered.

SECTION 8 - SPILL OR LEAK PROCEDURES

SPILL PROCEDURES:	Remove ignition sources. Recover liquid. Add absorbent to spill area. Ventilate confined spaces. Advise authorities if product enters sewers, etc.
WASTE DISPOSAL:	Assure conformity with applicable disposal regulations. Dispose of absorbed material at approved waste site.

SECTION 9 - SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTIONS:	Keep containers closed when not in use. Do not handle or store near heat or flames. Use chemical resistant gloves and apron.

The Data presented herein is based upon tests and information which we believe to be reliable. However, users should make their own investigations to determine the suitability of the information for their particular purpose.

SPECTRUM ACQUISITIONS, INC.
P.O. BOX 130
FULGHUM STREET
HORNSBY, TN 38044
(901)658-9050

MATERIAL SAFETY DATA SHEET

SECTION 1 - IDENTIFICATION

PRODUCT TRADE NAME:	Husqvarna 50:1 Two-Cycle Engine Oil
REVISION DATE:	2/11/91
INFORMATION/EMERGENCY PHONE NO:	(901)658-9050
CHEMICAL FAMILY:	Petroleum Lubricating Oil

SECTION 2 - HAZARDOUS INGREDIENTS

NAME	REGULATORY AGENCY	EXPOSURE LIMIT
Complex Mixtrue of Petroleum Base Stocks.	OSHA	5mg/m3 Mist

See Section 6, Chronic Effects, for potenital over-exposure hazard.

SECTION 3 - PHYSICAL DATA

VAPOR PRESSURE(mmHg):	<1
SPECIFIC GRAVITY:	Not Determined
WATER SOLUBILITY:	Negligible
BOILING POINT:	600°F+
VAPOR DENSITY (Air=1)	>5
EVAPORATION RATE(BUAC=1)	<1
ODOR:	Mild Petroleum Odor
APPEARANCE:	Dark Blue Colored Liquid

SECTION 4 - FIRE AND EXPLOSION HAZARDS

FLASH POINT:	475°
UPPER FLAMMABLE LIMIT:	7%
LOWER FLAMMABLE LIMIT:	.09%
EXTINGUISHING MEDIA(s):	Water Fog, Chemical Foam, Dry Chemical Powder, CO_2
SPECIAL FIREFIGHTING PROCEDURES:	Cool exposed containers with water spray. Avoid breathing fumes.
UNUSUAL FIRE & EXPLOSION HAZARDS:	Pressure increase in over heated closed containers. Cool containers with water spray.

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NAME	REGULATORY AGENCY	EXPOSURE LIMIT
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See Section 6, Chronic Effects, for potenital over-exposure hazard.

SECTION 3 - PHYSICAL DATA

VAPOR PRESSURE(mmHg):	<1
SPECIFIC GRAVITY:	Not Determined
WATER SOLUBILITY:	Negligible
BOILING POINT:	600°F-
VAPOR DENSITY (Air=1)	>5
EVAPORATION RATE(BUAC=1)	<1
ODOR:	Mild Petroleum Odor
APPEARANCE:	Dark Blue Colored Liquid

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STABILITY:	Stable
INCOMPATIBILITY: —	Avoid strong oxidants.
POLYMERIZATION:	Will not occur.
THERMAL DECOMPOSITION:	Partial burning produces fumes, smoke and carbon monoxide.

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INHALATION:	Inhalation of fumes may result in dizziness, headache and respiratory irritaion.
EYE CONTACT:	Contact with eyes may cause minimal irritaion.
SKIN CONTACT:	Mild irritaion my occur with prolonged or repeated contact.
INGESTION:	Slightly toxic. Pulmonary aspiration hazard if vomiting occurs.
TLV:	5mg/m3 as mist. ACGIH 1984-85
CHRONIC EFFECTS:	Product has a low order of acute oral toxicity. Ingrediants of this product are not listed as potential carcinogens in N.T.P. <u>Annual Report on Carcinogens</u>, I.A.R.C. <u>Monographs</u>, or by O.S.H.A. HCS (g) (2) (vii).

Emergency First Aid Procedures

SKIN:	Wash skin with soap and warm water. Wash Clothing before re-use.
EYE:	If splashed into eyes flush eyes with clear water for five(5) minutes.
INHALATION:	If overcome by fumes remove from exposure immediately.
ORAL:	If ingested, do not induce vomiting. Call a physician.

SECTION 7 - SPECIAL PROTECTION INFORMATION

VENTILATION PROCEDURE:	Ventilate as needed to comply with exposure limit.
GLOVES PROTECTION:	Use impervious gloves to avoid repeated/prolonged skin contact.
EYE PROTECTION:	Use goggles/face shield to avoid eye contact.
WORK/HYGENIC PRACTICES:	If clothing becomes contaminated, change to fresh clean clothing.

Do not wear until thoroughly laundered.

SECTION 8 - SPILL OR LEAK PROCEDURES

SPILL PROCEDURES: Remove ignition sources. Recover liquid. Add absorbent to spill area. Ventilate confined spaces. Advise authorities if product enters sewers, etc.

WASTE DISPOSAL: Assure conformity with applicable disposal regulations. Dispose of absorbed material at approved waste site.

SECTION 9 - SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTIONS: Keep containers closed when not in use. Do not handle or store near heat or flames. Use chemical resistant gloves and apron.

The Data presented herein is based upon tests and information which we believe to be reliable. However, users should make their own investigations to determine the suitability of the information for their particular purpose.

FOR CHEMICAL EMERGENCY
SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT
CALL CHEMTREC-DAY OR NIGHT
*800-424-9300
TOLL-FREE IN THE CONTINENTAL U.S.
*ADD LONG-DISTANCE ACCESS NUMBER IF REQUIRED
483-7616 IN DISTRICT OF COLUMBIA
FOR CALLS ORIGINATING OUTSIDE THE CONTINENTAL U.S.:
202-483-7616-WASHINGTON, DC, COLLECT
ALL CALLS ARE RECORDED

Do not wear until thoroughly laundered.

SECTION 8 - SPILL OR LEAK PROCEDURES

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202-483-7616-WASHINGTON, DC, COLLECT
ALL CALLS ARE RECORDED

MOBIL OIL CORPORATION MATERIAL SAFETY DATA BULLETIN

REVISED: 11/09/94

********************** I. PRODUCT IDENTIFICATION **********************

MOBIL UNLEADED

SUPPLIER:
MOBIL OIL CORP.
CHEMICAL NAMES AND SYNONYMS:
HYDROCARBONS AND ADDITIVES
USE OR DESCRIPTION:
UNLEADED MOTOR FUEL

24-HOUR EMERGENCY (CALL COLLECT):
609-737-4411
CHEMTREC:
800-424-9300 202-483-7616
PRODUCT AND MSDS INFORMATION:
800-662-4525 703-849-3265

************ II. TYPICAL CHEMICAL AND PHYSICAL PROPERTIES ************

APPEARANCE: Yellow to Orange Liquid ODOR: Hydrocarbon PH: NA
VISCOSITY AT 40 C, CS: < 1.0
VISCOSITY AT 100 C, CS: NA
FLASH POINT F(C): -40(-40) (ASTM D-56)
MELTING POINT F(C): NA
POUR POINT F(C): NA
BOILING POINT F(C): > 73(23)
VOC: NE
RELATIVE DENSITY, 15/4 C: 0.7-0.76
SOLUBILITY IN WATER: Slight
VAPOR PRESSURE-mm Hg 20C: > 400.0

NA=Not Applicable NE=Not Established D=Decomposes
FOR FURTHER INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE.

**************** III. POTENTIALLY HAZARDOUS INGREDIENTS ****************

			-- EXPOSURE LIMITS --				
			---TWA---		----STEL---		NOTE
	Wt.%	Source	ppm	mg/m3	ppm	mg/m3	
GASOLINE (8006-61-9)	100%						
		MOBIL	300	890			
		OSHA	300	900	500	1500	
		ACGIH	300	890	500	1480	
COMPONENTS OF MIXTURE							
XYLENE (1330-20-7)	10%						
O, M, P, -Isomers		MOBIL	100	434			
		OSHA	100	435	150	655	
		ACGIH	100	434	150	651	
ISOPENTANE (78-78-4)	9%						
		MOBIL	600	1770			
TOLUENE (108-88-3)	5%						
Skin		MOBIL	50	188			
Skin		OSHA	100	375	150	560	
		ACGIH	50	188			
PSEUDOCUMENE (95-63-6)	5%						
		MOBIL	25	125			

[illegible]	4%					
		MOBIL	300	1900		
		OSHA	300	1900		
		ACGIH	300	1900		
2-METHYLPENTANE (107-83-5)	4%					
Isomer of N-Hexane		MOBIL	500	1760		
		ACGIH	500	1760	1000	3500
PENTANE (109-66-0)	4%					
		MOBIL	600	1770		
		OSHA	600	1800	750	2250
		ACGIH	600	1770	750	2210
ETHANOL (64-17-5)	3%					
		MOBIL	1000	1880		
		OSHA	1000	1900		
		ACGIH	1000	1880		
TRIMETHYL BENZENE (25551-13-7)	3%					
		MOBIL	25	123		
		OSHA	25	125		
		ACGIH	25	123		
BENZENE (71-43-2)	2%					
		MOBIL	1	3.2		
		OSHA	1		5	
		ACGIH	10	32		
ETHYL BENZENE (100-41-4)	2%					
		MOBIL	100	434		
		OSHA	100	435	125	545
		ACGIH	100	434	125	543
N-HEXANE (110-54-3)	2%					
N-Hexane		MOBIL	50	176		
Other Isomers		MOBIL	500	1760		
		OSHA	50	180		
N-Hexane		ACGIH	50	176		
Other Isomers		ACGIH	500	1760	1000	3500
3-METHYLPENTANE (96-14-0)	2%					
Isomer of N-Hexane		MOBIL	500	1760		
		ACGIH	500	1760	1000	3500

2,3-DIMETHYLBUTANE 2%
79-29-8

Isomer of N-Hexane

MOBIL	500	1760		
ACGIH	500	1760	1000	3500

3- METHYLHEXANE (589-34-4) 2%

MOBIL	400	1640

METHYLCYCLOHEXANE 1%
(108-87-2)

MOBIL	400	1610
OSHA	400	1600
ACGIH	400	1610

2- METHYLHEXANE (591-76-4) 1%

MOBIL	400	1640

NOTE: The concentration of the components shown above may vary substantially. Because of volatility considerations, gasoline vapor may have concentrations of components very different from those of liquid gasoline. The major components of gasoline vapor are: butane, isobutane, pentane and isopentane. Oxygenates such as MTBE or ethanol may or may not be present depending on regional environmental requirements. The reportable component percentages, shown in the Regulatory Information section, are based on API's evaluation of a typical gasoline mixture.

See Sections XII and XIII for regulatory and further compositional data.
NOTE: Limits shown for guidance only. Follow applicable regulations.

************************ IV. HEALTH HAZARD DATA ************************

--- INCLUDES AGGRAVATED MEDICAL CONDITIONS, IF ESTABLISHED ---

EFFECTS OF OVEREXPOSURE: Eye irritation, respiratory irritation, dizziness, nausea, loss of consciousness. Skin irritation. Studies (sponsored by API) conducted in the U.S. examining the mortality experience (causes of death) of distribution workers with long-term exposure to gasoline have not found any gasoline-related health effects. Case reports of chronic gasoline abuse (such as gasoline sniffing) and chronic misuse of gasoline as a solvent or as a cleaning agent have reported a range of neurological effects (nervous system effects), sudden deaths from cardiac arrest (heart attacks), hematologic changes (blood effects) and leukemia. These effects are not expected to occur at exposure levels encountered in the distribution and use of gasoline as a motor fuel.

****************** V. EMERGENCY AND FIRST AID PROCEDURES ******************
--- FOR PRIMARY ROUTES OF ENTRY ---

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.

SKIN CONTACT: Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse.

INHALATION: Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a physician. If breathing has stopped, use mouth to mouth resuscitation.

INGESTION: Not expected to be a problem. However, if greater than 1/2 liter(pint) ingested, immediately give 1 to 2 glasses of water and call a physician, hospital emergency room or poison control center for assistance. Do not induce vomiting or give anything by mouth to an unconscious person.

NOTE TO PHYSICIANS: Material if ingested may be aspirated into the lungs and can cause chemical pneumonitis. Treat appropriately.

****************** VI. FIRE AND EXPLOSION HAZARD DATA ******************

FLASH POINT F(C): -40(-40) (ASTM D-56)

FLAMMABLE LIMITS. LEL: 1.4% UEL: 7.6%

EXTINGUISHING MEDIA: Carbon Dioxide, Foam, Dry Chemical, Water Fog.

SPECIAL FIRE FIGHTING PROCEDURES: Evacuate area. For large spills, fire fighting foam is the preferred agent and should be applied in sufficient quantities to blanket the gasoline surface. Water spray may be used to flush spill away from exposures, but good judgement should be practiced to prevent spreading of the gasoline into sewers, streams or drinking water supplies. If a leak or spill has not ignited, apply a foam blanket to suppress the release of vapors. If foam is not available, a water spray curtain can be used to disperse vapors and to protect personnel attempting to stop the leak.

SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable. Vapor accumulation could flash and/or explode if in contact with open flame.

NFPA HAZARD ID: Health: 1, Flammability: 3, Reactivity: 0

************************ VII. REACTIVITY DATA ************************

STABILITY (Thermal, Light, etc.): Stable

CONDITIONS TO AVOID: Heat, sparks, flame and build up of static electricity.

INCOMPATIBILITY (Materials to Avoid): Halogens, strong acids, alkalies, and oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide.

HAZARDOUS POLYMERIZATION: Will not occur.

******************** VIII. SPILL OR LEAK PROCEDURE ********************

ENVIRONMENTAL IMPACT: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Eliminate all ignition sources. Runoff may create fire or explosion hazard in sewer system. Absorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.

WASTE MANAGEMENT: Product is suitable for burning for fuel value in compliance with applicable laws and regulations.

****************** IX. SPECIAL PROTECTION INFORMATION ******************

EYE PROTECTION: If splash with liquid is possible, chemical type goggles should be worn.

SKIN PROTECTION: Impervious gloves should be worn. Good personal hygiene practices should always be followed.

RESPIRATORY PROTECTION: Approved respiratory equipment must be used when airborne concentrations are unknown or exceed the TLV.

VENTILATION: Use in well ventilated area with local exhaust ventilation. Ventilation required and equipment must be explosion proof. Use away from all ignition sources.

************************ X. SPECIAL PRECAUTIONS ************************

HANDLING: NEVER SIPHON GASOLINE BY MOUTH. GASOLINE SHOULD NOT BE USED AS A SOLVENT OR AS A CLEANING AGENT. Use non-sparking tools and explosion-proof equipment. Avoid contact with skin. Avoid inhalation of vapors or mists. Use in well ventilated area away from all ignition sources.

STORAGE: Drums must be grounded and bonded and equipped with self-closing valves, pressure vacuum bungs and flame arresters. Store away from all ignition sources in a cool area equipped with an automatic sprinkling system. Outside or detached storage preferred. Storage containers should be grounded and bonded.

MATERIALS MUST BE LABELED AS FOLLOWS: Extremely Flammable. Vapor Harmful. See Appendix for Precautionary Label: MPL-304

*********************** XI. TOXICOLOGICAL DATA ***********************

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Irritant. (Primary Irritation Index: 3 or greater but less than 5). ---Based on testing of similar products and/or the components.

OTHER ACUTE TOXICITY DATA: Inhalation of vapors/mists may cause respiratory system irritation. HAZARDS OF COMBUSTION PRODUCTS: Exposure to high concentrations of carbon monoxide can cause loss of consciousness, heart damage, brain damage and death. Exposure to high concentrations of carbon dioxide can cause simple asphyxiation by displacing oxygen.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

90-day oral gavage studies with rats resulted in kidney effects at 1200 mg/kg MTBE, but these effects are not considered significant to humans. Thirteen week inhalation studies with rats on MTBE resulted in increased organ weights and decreased body weight and anaesthetic effects at levels > 800 ppm.

---NEUROTOXICOLOGY (SUMMARY)---

No significant adverse effects were observed at 8000 ppm MTBE in a 90-day neurotoxicity study with rats.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Inhalation teratology studies with mice at 8000 ppm MTBE during gestation resulted in maternal and fetal toxicity, reduced viable implantations and an increased incidence of cleft palate. The NOEL was 1000 ppm. In another study, mice showed some evidence of fetotoxicity at 250 ppm, but no significant adverse effects occurred in rats exposed to 2500 ppm during gestation. In a single-generation inhalation reproductive/fertility study with rats, no significant effects were observed at 2500 ppm. Two-generation reproductive/fertility studies in rats showed no reproductive effects at 8000 ppm MTBE.

---CHRONIC TOXICOLOGY (SUMMARY)---

An increased incidence of kidney and liver tumors was observed in laboratory animals exposed to > 3000 ppm MTBE. These effects are not considered significant to humans.

---SENSITIZATION (SUMMARY)---

****Skin sensitization: Negative guinea pig test.

---OTHER TOXICOLOGY DATA---

Gasoline and Refinery Streams: Studies conducted by the American Petroleum Institute examined a reference unleaded gasoline for mutagenic, teratogenic and sensitization potential: no evidence of these hazards was found. However, isolated constituents of gasoline may display these or other potential hazards in laboratory tests. There were no significant adverse effects in three-month subchronic inhalation studies in rats or monkeys, or in a two-year skin cancer study in mice. Studies with laboratory animals have shown that gasoline vapors administered at high concentrations over a prolonged period of time caused kidney damage and kidney cancer in male rats and liver cancer in female mice. Studies carried out by Mobil's Environmental and Health Sciences Laboratory on some of the major refinery streams from which gasoline is formulated support the results of the API studies. There was no evidence of significant adverse systemic or reproductive effects for light catalytic cracked naphthas and reformed naphthas. Components: Gasoline consists of a complex blend of petroleum/processing derived paraffinic, olefinic, naphthenic and aromatic hydrocarbons which include up to 5% benzene (with 1-2% typical in the U.S.), n-hexane, mixed xylenes, toluene, ethylbenzene and trimethyl benzene. Repeated exposures to low levels of benzene have been reported to result in blood abnormalities including anemia and, in rare cases, leukemia in both animals and humans. Prolonged exposure to n-hexane may result in nervous system damage, including numbness of the extremities and, in extreme cases, paralysis. The adverse effects associated with these components have not been observed in studies with gasoline or the refinery streams from which it is formulated. Generally, human exposures to gasoline vapors are considerably less than those used in the animal toxicity studies. As far as scientists know, low level or infrequent exposures to gasoline vapor are unlikely to be associated with cancer or other serious diseases in humans.

===================== XII. REGULATORY INFORMATION =====================

GOVERNMENTAL INVENTORY STATUS: All components comply with TSCA, and EINECS/ELINCS.

Transport Information: Please see Section XIV.

EEC LABEL CLASS: F- T (R12-45-38-22 S53-45-2-23-24-29-43-62)

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined to be hazardous.

RCRA INFORMATION: The disposal of the unused product may be subject to RCRA regulations per 40 CFR Part 261 for the reasons including but not limited to ignitability, corrosivity, reactivity or formulation with the contaminants listed in the Toxicity Characteristic (TC) Rule as determined by the Toxicity Characteristic Leaching Procedure (TCLP). Disposal of the used product may be regulated.

BENZENE: 2.3200 PCT (TCLP)
FLASH: -40(-40) F(C)

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III: This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA 311/312 REPORTABLE HAZARD CATEGORIES:
FIRE CHRONIC ACUTE

This product contains the following SARA 313 Toxic Release Chemicals:

BENZENE(COMPONENT ANALYSIS)	71-43-2	2.32%
PSEUDOCUMENE(COMPONENT ANALYSIS)	95-63-6	4.55%
ETHYL BENZENE(COMPONENT ANALYSIS)	100-41-4	1.6%
TOLUENE(COMPONENT ANALYSIS)	108-88-3	4.65%
XYLENES(COMPONENT ANALYSIS)	1330-20-7	9.9%
METHYL-TERT-BUTYL ETHER(COMPONENT ANALYSIS)	1634-04-4	2.7%

THE FOLLOWING PRODUCT INGREDIENTS ARE CITED ON THE LISTS BELOW:

CHEMICAL NAME	CAS NUMBER	LIST CITATIONS
ETHYL ALCOHOL (COMPONENT ANALYSIS)	64-17-5	1, 10, 17, 18, 19, 20, 21, 22, 24, 25, 26
BENZENE (COMPONENT ANALYSIS) (2.32%)	71-43-2	1, 3, 4, 6, 9, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
ISOPENTANE (COMPONENT ANALYSIS)	78-78-4	19, 21, 24, 25
2,3-DIMETHYLBUTANE (COMPONENT ANALYSIS)	79-29-8	19, 21, 24, 25
PSEUDOCUMENE (COMPONENT ANALYSIS)	95-63-6	11, 15, 20, 24, 25
PENTANE, 3-METHYL- (COMPONENT ANALYSIS)	96-14-0	19, 25
METHYL CYCLOPENTANE (COMPONENT ANALYSIS)	96-37-7	11, 15, 19, 21, 24, 25, 26
ETHYL BENZENE (COMPONENT ANALYSIS)	100-41-4	1, 10, 18, 19, 20, 21, 23, 24, 25, 26
BUTANE (COMPONENT ANALYSIS)	106-97-8	1, 10, 19, 20, 21, 23, 24, 25, 26
PENTANE, 2-METHYL- (COMPONENT ANALYSIS)	107-83-5	19, 23, 25
METHYLCYCLOHEXANE (COMPONENT ANALYSIS)	108-87-2	1, 10, 18, 19, 20, 21, 23, 24, 25, 26
TOLUENE (COMPONENT ANALYSIS) (4.65%)	108-88-3	1, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
PENTANE (COMPONENT ANALYSIS)	109-66-0	1, 10, 18, 19, 20, 21, 23, 24, 25, 26
N-HEXANE (COMPONENT ANALYSIS)	110-54-3	1, 10, 11, 15, 18, 19, 20, 21, 23, 24, 25, 26
2-METHYL 2-BUTENE (COMPONENT ANALYSIS)	513-35-9	19, 25
3-METHYLHEXANE (COMPONENT ANALYSIS)	589-34-4	19, 25
HEXANE, 2-METHYL- (COMPONENT ANALYSIS)	591-76-4	19, 25
1-HEXENE (COMPONENT ANALYSIS)	592-41-6	19, 24, 25
XYLENES (COMPONENT ANALYSIS) (9.90%)	1330-20-7	1, 10, 18, 19, 20, 21, 22, 23, 24, 25, 26
METHYL-TERT-BUTYL ETHER (COMPONENT ANALYSIS)	1634-04-4	11, 15, 24, 25
GASOLINE	8006-61-9	1, 10, 18, 19, 20, 21, 23, 24, 26
TRIMETHYL BENZENE (COMPONENT ANALYSIS)	25551-13-7	1, 10, 19, 20, 21, 23, 24, 25, 26

--- REGULATORY LISTS SEARCHED ---

1 = ACGIH ALL	6 = IARC 1	11 = TSCA 4	17 = CA P65	22 = MI 293
2 = ACGIH A1	7 = IARC 2A	12 = TSCA 5a2	18 = CA RTK	23 = MN RTK
3 = ACGIH A2	8 = IARC 2B	13 = TSCA 5e	19 = FL RTK	24 = NJ RTK
4 = NTP CARC	9 = OSHA CARC	14 = TSCA 6	20 = IL RTK	25 = PA RTK
5 = NTP SUS	10 = OSHA Z	15 = TSCA 12b	21 = LA RTK	26 = RI RTK

CARC = CARCINOGEN; SUS = SUSPECTED CARCINOGEN

NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

XIV. TRANSPORT AND LABEL INFORMATION

USA DOT:

SHIPPING NAME:	Gasoline
HAZARD CLASS & DIV:	3
ID NUMBER:	UN1203
ERG NUMBER:	27
PACKING GROUP:	PG II
STCC:	4908173
DANGEROUS WHEN WET:	No
POISON:	No
LABEL(s):	Flammable Liquid
PLACARD(s):	Flammable
PRODUCT RQ:	NA
MARPOL III STATUS:	NA

IMO:

HAZARD CLASS & DIV:	3.1
UN NUMBER:	1203
PACKING GROUP:	PG II
SHIPPING NAME:	Gasoline
LABEL(s):	Flammable Liquid
MARPOL III STATUS:	NA

ICAO/IATA:

HAZARD CLASS & DIV:	3
ID/UN Number:	1203
PACKING GROUP:	PG II
SHIPPING NAME:	Gasoline
SUBSIDIARY RISK:	NA
LABEL(s):	Flammable Liquid

XIII. INGREDIENTS

INGREDIENT	PERCENT	CAS NUMBER
GASOLINE	100.00	3006-61-9

PRECAUTIONARY LABEL TEXT:

GASOLINE.

DANGER:

EXTREMELY FLAMMABLE LIQUID AND VAPOR.
VAPORS MAY CAUSE FLASH FIRE: EYE, NOSE, THROAT OR LUNG IRRITATION, DIZZINESS, NAUSEA, LOSS OF CONSCIOUSNESS.
LIQUID MAY CAUSE SKIN IRRITATION.
LOW VISCOSITY MATERIAL. IF INGESTED, MAY BE ASPIRATED AND CAN CAUSE SERIOUS OR FATAL LUNG DAMAGE.
LONG-TERM EXPOSURE TO GASOLINE VAPOR HAS CAUSED KIDNEY AND LIVER CANCER IN LABORATORY ANIMALS.

KEEP AWAY FROM HEAT, SPARKS AND FLAME.
AVOID PERSONAL CONTACT AND PROLONGED EXPOSURE TO VAPOR.
KEEP CONTAINER CLOSED.
USE IN WELL VENTILATED AREA.

MISUSE MAY CAUSE SERIOUS INJURY OR ILLNESS.
FOR USE AS A MOTOR FUEL ONLY.
DO NOT USE AS A SOLVENT OR CLEANING AGENT.
NEVER SIPHON BY MOUTH.

FIRST AID: IF INHALED AND SYMPTOMS DEVELOP, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET MEDICAL ATTENTION.
IF SWALLOWED, DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION. ONLY INDUCE VOMITING AT THE INSTRUCTION OF A PHYSICIAN NEVER INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONCIOUS PERSON.
IN CASE OF CONTACT, WASH SKIN WITH SOAP AND PLENTY OF WATER. REMOVE CONTAMINATED CLOTHING AND WASH BEFORE REUSE. IF IRRITATION OCCURS, GET MEDICAL ATTENTION.

EMPTY CONTAINERS MAY CONTAIN PRODUCT RESIDUE, INCLUDING FLAMMABLE OR EXPLOSIVE VAPORS. DO NOT CUT, PUNCTURE OR WELD ON OR NEAR THE CONTAINER. ALL LABEL WARNINGS AND PRECAUTIONS MUST BE OBSERVED UNTIL CONTAINER HAS BEENTHOROUGHLY CLEANED OR DESTROYED.

THIS WARNING IS GIVEN TO COMPLY WITH CALIFORNIA HEALTH AND SAFETY CODE 25249.6 AND DOES NOT CONSTITUTE AN ADMISSION OR A WAIVER OF ANY RIGHTS.

DETECTABLE AMOUNTS OF CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER, BIRTH DEFECTS, OR OTHER REPRODUCTIVE HARM MAY BE FOUND IN THIS PRODUCT. READ AND FOLLOW LABEL DIRECTIONS AND USE CARE WHEN HANDLING OR USING THIS PRODUCT. REFER TO PRODUCT MATERIAL SAFETY DATA BULLETIN FORFURTHER SAFETY AND HEALTH INFORMATION.

MPL-304 (10/94)

**************************** APPENDIX ********************************

PRECAUTIONARY EEC LABEL TEXT:

F+ T - Extremely flammable. Toxic.

R12-45-38-22 - Extremely flammable. May cause cancer. Irritating to skin. Harmful if swallowed.

S53-45-2-23-24-29-43-62 - Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Keep out of the reach of children. Do not breathe vapor. Avoid contact with skin. Do not empty into drains. In case of fire use foam/drypowder/CO2/Halon. If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

FOR MOBIL USE ONLY: MHC: 1* 1* 1* 1* 2*, MPPEC: C, PPEC:, US931216
APPROVE CODE:2 11/09/94 REQ: US - MARKETING

****

****

PREPARED BY: MOBIL OIL CORPORATION
ENVIRONMENTAL HEALTH AND SAFETY DEPARTMENT, PRINCETON, NJ
FOR FURTHER INFORMATION, CONTACT:
MOBIL OIL CORPORATION, PRODUCT FORMULATION AND QUALITY CONTROL
3225 GALLOWS ROAD, FAIRFAX, VA 22037 (800) 227-0707 X3265

MOBIL OIL CORPORATION MATERIAL SAFETY DATA BULLETIN

REVISED:08/04/94

********************** I. PRODUCT IDENTIFICATION **********************

NO. 2 DIESEL FUEL (0.05 WT% S)

SUPPLIER:
MOBIL OIL CORP.
CHEMICAL NAMES AND SYNONYMS:
* PETROLEUM HYDROCARBONS
USE OR DESCRIPTION:
DIESEL FUEL

24-HOUR EMERGENCY (CALL COLLECT):
609-737-4411
CHEMTREC:
800-424-9300 202-483-7616
PRODUCT AND MSDS INFORMATION:
800-662-4525 703-849-3265

************ II. TYPICAL CHEMICAL AND PHYSICAL PROPERTIES ************

APPEARANCE: Clear (May Be Dyed) Liquid ODOR: Hydrocarbon PH: NA
VISCOSITY AT 40 C, CS: 2.7
VISCOSITY AT 100 C, CS: > 1.0
FLASH POINT F(C): > 125(52) (ASTM D-93)
MELTING POINT F(C): NA POUR POINT F(C): 0(-18)
BOILING POINT F(C): > 300(149) VOC: NE
RELATIVE DENSITY, 15/4 C: 0.82-0.87 SOLUBILITY IN WATER: Negligible
VAPOR PRESSURE-mm Hg 20C: 0.5

NA=Not Applicable NE=Not Established D=Decomposes
FOR FURTHER INFORMATION, CONTACT YOUR MARKETING REPRESENTATIVE.

*************** III. POTENTIALLY HAZARDOUS INGREDIENTS ***************

			-- EXPOSURE LIMITS --				
			---TWA---		----STEL---		NOTE
	Wt.%	Source	ppm	mg/m3	ppm	mg/m3	
DIESEL FUEL (68334-30-5)	100%						

See Sections XII and XIII for regulatory and further compositional data.
NOTE: Limits shown for guidance only. Follow applicable regulations.

********************** IV. HEALTH HAZARD DATA **********************

--- INCLUDES AGGRAVATED MEDICAL CONDITIONS, IF ESTABLISHED ---

EFFECTS OF OVEREXPOSURE: Respiratory irritation, dizziness, nausea, loss of consciousness. Prolonged, repeated skin contact may result in skin irritation or more serious skin disorders. Note: This product contains polycyclic aromatic hydrocarbons, some of which have been reported to cause skin cancer in humans under conditions of poor personal hygiene, prolonged repeated contact, and exposure to sunlight. Toxic effects are unlikely to occur if good personal hygiene is practiced.

V. EMERGENCY AND FIRST AID PROCEDURES
--- FOR PRIMARY ROUTES OF ENTRY ---

EYE CONTACT: Flush thoroughly with water. If irritation occurs, call a physician.

SKIN CONTACT: Dry-wipe the skin. Cleanse the area with waterless hand cleaner, and follow by washing thoroughly with soap and water. Remove contaminated clothing. Launder clothing before reuse. Discard shoes if material has penetrated to inside surface.

INHALATION: Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a physician. If breathing has stopped, use mouth to mouth resuscitation.

INGESTION: Do not induce vomiting. Give 1 to 2 glasses of water. Get medical assistance.

NOTE TO PHYSICIANS: Material if aspirated into the lungs may cause chemical pneumonitis. Treat appropriately.

VI. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT F(C): > 125(52) (ASTM D-93)

FLAMMABLE LIMITS. LEL: 0.6% UEL: 7.0%

EXTINGUISHING MEDIA: Carbon dioxide, foam, dry chemical and water fog.

SPECIAL FIRE FIGHTING PROCEDURES: Use water to keep fire exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect personnel attempting to stop leak. Water spray may be used to flush spills away from exposures. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.

SPECIAL PROTECTIVE EQUIPMENT: For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Material is combustible.

NFPA HAZARD ID: Health: 1, Flammability: 2, Reactivity: 0

VII. REACTIVITY DATA

STABILITY (Thermal, Light, etc.): Stable

CONDITIONS TO AVOID: Heat, sparks, flame and build up of static electricity.

INCOMPATIBILITY (Materials to Avoid): Halogens, strong acids, alkalies, and oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide.

HAZARDOUS POLYMERIZATION: Will not occur.

VIII. SPILL OR LEAK PROCEDURE

ENVIRONMENTAL IMPACT: Report spills as required to appropriate authorities. U. S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: Adsorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.

WASTE MANAGEMENT: Product is suitable for burning for fuel value in compliance with applicable laws and regulations.

IX. SPECIAL PROTECTION INFORMATION

EYE PROTECTION: If splash with liquid is possible, chemical type goggles should be worn.

SKIN PROTECTION: Impervious gloves must be worn. If contact is likely oil impervious clothing must be worn.

RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.

VENTILATION: Use in well ventilated area. Ventilation desirable and equipment should be explosion proof.

X. SPECIAL PRECAUTIONS

HANDLING: Harmful in contact with or if absorbed through the skin. Avoid inhalation of vapors or mists.

STORAGE: Store in a cool area. A flammable atmosphere can be produced in storage tank headspaces even when stored at a temperature below the flashpoint. Monitor and maintain headspace gas concentrations below flammable limits. Ensure that there are no ignition sources in the area immediately surrounding filling and venting operations. Avoid sparking conditions. Ground and bond all transfer equipment. Store in a cool area.

MATERIALS MUST BE LABELED AS FOLLOWS: Combustible. See Appendix for Precautionary Label: MPL-102

XI. TOXICOLOGICAL DATA

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Repeated dermal application to rats for 13 weeks was carried out with aromatic oils similar to some of the components of this product. Resulting effects included increased mortality and decreased body and thymus weights. Severe skin irritation was also observed at the site of application.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Repeated dermal application to pregnant rats was carried out using aromatic oils similar to some of the components used in this product. Results included maternal toxicity, decreased fetal body weights and decreased fetal survival in some cases. No fetal malformations were observed.

---CHRONIC TOXICOLOGY (SUMMARY)---

Expected to be carcinogenic in lifetime mouse skin painting bioassays.

****************** IX. SPECIAL PROTECTION INFORMATION ******************

EYE PROTECTION: If splash with liquid is possible, chemical type goggles should be worn.

SKIN PROTECTION: Impervious gloves must be worn. If contact is likely oil impervious clothing must be worn.

RESPIRATORY PROTECTION: No special requirements under ordinary conditions of use and with adequate ventilation.

VENTILATION: Use in well ventilated area. Ventilation desirable and equipment should be explosion proof.

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HANDLING: Harmful in contact with or if absorbed through the skin. Avoid inhalation of vapors or mists.

STORAGE: Store in a cool area. A flammable atmosphere can be produced in storage tank headspaces even when stored at a temperature below the flashpoint. Monitor and maintain headspace gas concentrations below flammable limits. Ensure that there are no ignition sources in the area immediately surrounding filling and venting operations. Avoid sparking conditions. Ground and bond all transfer equipment. Store in a cool area.

MATERIALS MUST BE LABELED AS FOLLOWS: Combustible. See Appendix for Precautionary Label: MPL-102

********************** XI. TOXICOLOGICAL DATA **********************

---ACUTE TOXICOLOGY---

ORAL TOXICITY (RATS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

DERMAL TOXICITY (RABBITS): Practically non-toxic (LD50: greater than 2000 mg/kg). ---Based on testing of similar products and/or the components.

INHALATION TOXICITY (RATS): Practically non-toxic (LC50: greater than 5 mg/l). ---Based on testing of similar products and/or the components.

EYE IRRITATION (RABBITS): Practically non-irritating. (Draize score: greater than 6 but 15 or less). ---Based on testing of similar products and/or the components.

SKIN IRRITATION (RABBITS): Practically non-irritating. (Primary Irritation Index: greater than 0.5 but less than 3). ---Based on testing of similar products and/or the components.

---SUBCHRONIC TOXICOLOGY (SUMMARY)---

Repeated dermal application to rats for 13 weeks was carried out with aromatic oils similar to some of the components of this product. Resulting effects included increased mortality and decreased body and thymus weights. Severe skin irritation was also observed at the site of application.

---REPRODUCTIVE TOXICOLOGY (SUMMARY)---

Repeated dermal application to pregnant rats was carried out using aromatic oils similar to some of the components used in this product. Results included maternal toxicity, decreased fetal body weights and decreased fetal survival in some cases. No fetal malformations were observed.

---CHRONIC TOXICOLOGY (SUMMARY)---

Expected to be carcinogenic in lifetime mouse skin painting bioassays.

---OTHER TOXICOLOGY DATA---

Skin cleansing studies with aromatic oils show that toxic effects are not likely to occur in humans if good personal hygiene practices are used. Overexposure to diesel exhaust fumes may result in eye irritation, headaches, nausea, and respiratory irritation. Animal studies involving lifetime exposure to high levels of diesel exhaust have produced variable results, with some studies indicating a potential for lung cancer. Limited evidence from epidemiological studies suggest an association between long-term occupational exposure to diesel engine emissions and lung cancer. Diesel engine exhaust typically consists of gases and particulates, including carbon dioxide, carbon monoxide, nitrogen compounds, oxides of sulfur, and hydrocarbons. Diesel exhaust composition will vary with fuel, engine type, load cycle, engine maintenance, tuning and exhaust gas treatment. Use of adequate ventilation and/or respiratory protection in the presence of diesel exhaust is recommended to minimize exposures.

XII. REGULATORY INFORMATION

GOVERNMENTAL INVENTORY STATUS: All components comply with TSCA, and EINECS/ELINCS.

NOTE: The flash point of this material is > 125F. Regulatory classifications vary as follows:

DOT: Flammable Liquid OR Combustible Liquid - (49CFR 173.120(b)(2))
OSHA: Combustible Liquid
IATA/IMO: Flammable Liquid
EC: Flammable Liquid

Transport Information: Please see Section XIV.

EEC LABEL CLASS: Xn (R40 S24-2-46)

US OSHA HAZARD COMMUNICATION STANDARD: Product assessed in accordance with OSHA 29 CFR 1910.1200 and determined to be hazardous.

RCRA INFORMATION: The disposal of the unused product may be subject to RCRA regulations per 40 CFR Part 261 for the reasons including but not limited to ignitability, corrosivity, reactivity or formulation with the contaminants listed in the Toxicity Characteristic (TC) Rule as determined by the Toxicity Characteristic Leaching Procedure (TCLP). Disposal of the used product may be regulated.
FLASH: > 125(52) F(C)

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III: This product contains no "EXTREMELY HAZARDOUS SUBSTANCES".

SARA (311/312) REPORTABLE HAZARD CATEGORIES:
FIRE CHRONIC

This product contains no chemicals reportable under SARA (313) toxic release program.

THE FOLLOWING PRODUCT INGREDIENTS ARE CITED ON THE LISTS BELOW:

```
CHEMICAL NAME                                 CAS NUMBER     LIST CITATIONS
DIESEL OIL..C9-20                             68334-30-5     26

                      --- REGULATORY LISTS SEARCHED ---
1 = ACGIH ALL     6 = IARC 1       11 = TSCA 4     17 = CA P65    22 = MI 293
2 = ACGIH A1      7 = IARC 2A      12 = TSCA 5a2   18 = CA RTK    23 = MN RTK
3 = ACGIH A2      8 = IARC 2B      13 = TSCA 5e    19 = FL RTK    24 = NJ RTK
4 = NTP CARC      9 = OSHA CARC    14 = TSCA 6     20 = IL RTK    25 = PA RTK
5 = NTP SUS      10 = OSHA Z       15 = TSCA 12b   21 = LA RTK    26 = RI RTK

CARC = CARCINOGEN: SUS = SUSPECTED CARCINOGEN

        NOTE: MOBIL PRODUCTS ARE NOT FORMULATED TO CONTAIN PCBS.

*************************** XIII. INGREDIENTS ***************************
              INGREDIENT                        PERCENT        CAS NUMBER
<---------------------------------------------> <-----> <-------------------->
DIESEL FUEL                                      100.00            68334-30-5
```

****************************** XIV. TRANSPORT AND LABEL INFORMATION ******************************

USA DOT:

SHIPPING NAME:	Diesel Fuel
HAZARD CLASS & DIV:	COMBUSTIBLE LIQUID
ID NUMBER:	NA1993
ERG NUMBER:	27
PACKING GROUP:	PG III
STCC:	4915168
DANGEROUS WHEN WET:	No
POISON:	No
LABEL(s):	NA
PLACARD(s):	Combustible
PRODUCT RQ:	NA
MARPOL III STATUS:	NA

IMO:

HAZARD CLASS & DIV:	3.3
UN NUMBER:	1202
PACKING GROUP:	PG III
SHIPPING NAME:	Gas Oil
LABEL(s):	Flammable Liquid
MARPOL III STATUS:	NA

ICAO/IATA:

HAZARD CLASS & DIV:	3
ID/UN Number:	1202
PACKING GROUP:	PG III
SHIPPING NAME:	Gas Oil
SUBSIDIARY RISK:	NA
LABEL(s):	Flammable Liquid

Precautionary Label Text:

CONTAINS AROMATIC PETROLEUM OIL

WARNING:

HARMFUL IF IN CONTACT WITH OR ABSORBED THROUGH THE SKIN.

COMBUSTIBLE.

PROLONGED SKIN CONTACT ON LABORATORY ANMIMALS HAS CAUSED SERIOUS TOXIC EFFECTS INCLUDING SKIN CANCER, LIVER DAMAGE, BLOOD EFFECTS AND EFFECTS ON THE UNBORN.

AVOID CONTACT WITH SKIN AND CLOTHING.
AVOID BREATHING VAPOR OR MIST.
KEEP AWAY FROM HEAT AND FLAME.
USE WITH ADEQUATE VENTILATION.
WEAR OIL IMPERVIOUS GLOVES AND CLOTHING.

FIRST AID: IN CASE OF SKIN CONTACT, PROMPTLY DRY-WIPE THE SKIN. CLEANSE THE AREA WITH WATERLESS HAND CLEANER AND FOLLOW BY WASHING THOROUGHLY WITH SOAP AND WATER.

LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
DISCARD SHOES IF MATERIAL HAS PENETRATED TO INSIDE SURFACE.

IN CASE OF FIRE, USE WATERSPRAY, FOAM, DRY CHEMICAL OR CO2.

ATTENTION!
EMPTY CONTAINERS MAY CONTAIN PRODUCT RESIDUE, INCLUDING FLAMMABLE OR EXPLOSIVE VAPORS. DO NOT CUT, PUNCTURE OR WELD ON OR NEAR CONTAINER. ALL LABEL WARNINGS AND PRECAUTIONS MUST BE OBSERVED UNTIL CONTAINER HAS BEEN THOROUGHLY CLEANED OR DESTROYED.

FOR INDUSTRIAL USE ONLY.
NOT INTENDED OR SUITABLE FOR USE IN OR AROUND A HOUSEHOLD OR DWELLING.

THIS WARNING IS GIVEN TO COMPLY WITH CALIFORNIA HEALTH AND SAFETY CODE 25249.6 AND DOES NOT CONSTITUTE AN ADMISSION OR A WAIVER OF RIGHTS.

DETECTABLE AMOUNTS OF CHEMICALS KNOWN BY THE STATE OF CALIFORNIA TO CAUSE CANCER MAY BE FOUND IN THIS PRODUCT. READ AND FOLLOW LABEL DIRECTIONS AND USE CARE WHEN HANDLING OR USING THIS PRODUCT.

REFER TO PRODUCT MATERIAL SAFETY DATA BULLETIN FOR FURTHER SAFETY AND HEALTH INFORMATION.

MPL-102

****************************** APPENDIX **********************************

PRECAUTIONARY EEC LABEL TEXT:

Xn - Harmful .

R40 - Possible risks of irreversible effects.

S24-2-46 - Avoid contact with skin. Keep out of the reach of children. If swallowed, seek medical advice immediately and show this container or label.

FOR MOBIL USE ONLY: MHC: 1* 1* 1* 1* 1*, MPPEC: I, PPEC:, US931216
APPROVE CCODE:3 06/22/94 REO: US - MARKETING

INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

PREPARED BY: MOBIL OIL CORPORATION
ENVIRONMENTAL HEALTH AND SAFETY DEPARTMENT, PRINCETON, NJ
FOR FURTHER INFORMATION, CONTACT:
MOBIL OIL CORPORATION, PRODUCT FORMULATION AND QUALITY CONTROL
3225 GALLOWS ROAD, FAIRFAX, VA 22037 (800) 227-0707 X3265

109274

AC 10W30

THIS MSDS COMPLIES WITH 29 CFR 1910.1200 (THE HAZARD COMMUNICATION STANDARD).

Product Name: AC 10W30

PARTS WAREHOUSE INC
DBA FAIRFAX AUTO PARTS
3858 E. PICKETT ROAD

FAIRFAX VA 22030

ATTN: PLANT MGR / SAFETY DIR.

08 70 000 0866646-000

PRODUCT: 12900012
INVOICE: 407003
INVOICE DATE: 12/08/92
TO:

Data Sheet No: 0170829-010.000
Prepared: 02/08/93
Supersedes: 06/08/92

SECTION I PRODUCT IDENTIFICATION

General or Generic ID: PETROLEUM BASED-LUBRICATING OIL

DOT Hazard Classification: NOT REGULATED

SECTION II COMPONENTS

IF PRESENT, IARC, NTP AND OSHA CARCINOGENS AND CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA TITLE III SECTION 313 ARE IDENTIFIED IN THIS SECTION. SEE DEFINITION PAGE FOR CLARIFICATION.

INGREDIENT	% (by WT)	PEL	TLV	Note
DETERGENT/ DISPERSANT ENGINE OIL PACKAGE	5-10			(1)
PETROLEUM LUBE OIL CAS #: 64742-65-0	70-85	5 MG/M3	5 MG/M3	(2)

Notes:

(1) THIS PROPRIETARY MATERIAL CONTAINS 10.7% ZINC COMPOUNDS. ZINC COMPOUNDS ARE REPORTABLE UNDER SECTION 313 OF SARA TITLE III.

(2) PEL/TLV IS FOR OIL MIST. ACGIH SHORT TERM EXPOSURE LIMIT (STEL) FOR OIL MIST IS 10 MG/CUM.

SECTION III PHYSICAL DATA

Boiling Point	for PRODUCT	570.00 Deg F (298.88 Deg C) @ 760.00 mm Hg
Vapor Pressure	for COMPONENT(70-85%)	< 0.10 mm Hg @ 68.00 Deg F (20.00 Deg C)
Specific Vapor Density		HEAVIER THAN AIR
Specific Gravity		.879 @ 60.00 Deg F (15.56 Deg C)
Percent Volatiles	NOT APPLICABLE	
Evaporation Rate		SLOWER THAN ETHER
Appearance		LIGHT AMBER
State		LIQUID
Form		HOMOG SOLN

SECTION IV FIRE AND EXPLOSION INFORMATION

FLASH POINT(COC) > 400.0 Deg F (204.4 Deg C)

EXPLOSIVE LIMIT UNAVAILABLE

EXTINGUISHING MEDIA: REGULAR FOAM OR CARBON DIOXIDE OR DRY CHEMICAL

HAZARDOUS DECOMPOSITION PRODUCTS: MAY FORM TOXIC MATERIALS:, CARBON DIOXIDE AND CARBON MONOXIDE, VARIOUS HYDROCARBONS, OXIDES OF SULFUR, NITROGEN AND PHOSPHORUS, ETC.

FIREFIGHTING PROCEDURES: WEAR SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN THE POSITIVE PRESSURE DEMAND MODE WHEN FIGHTING FIRES.

WATER OR FOAM MAY CAUSE FROTHING WHICH CAN BE VIOLENT AND POSSIBLY ENDANGER THE LIFE OF THE FIREFIGHTER, ESPECIALLY IF SPRAYED INTO CONTAINERS OF HOT, BURNING LIQUID.

DENSE SMOKE MAY BE GENERATED WHILE BURNING.

SPECIAL FIRE & EXPLOSION HAZARDS: NEVER USE WELDING OR CUTTING TORCH ON OR NEAR DRUM (EVEN EMPTY) BECAUSE PRODUCT (EVEN JUST RESIDUE) CAN IGNITE EXPLOSIVELY.

NFPA CODES: HEALTH- 1 FLAMMABILITY- 1 REACTIVITY- 0

CONTINUED ON PAGE: 2

SECTION V HEALTH HAZARD DATA

IBLE EXPOSURE LEVEL: NOT ESTABLISHED FOR PRODUCT. SEE SECTION II.

OF ACUTE OVEREXPOSURE:

RODUCT IS NOT HAZARDOUS AS DEFINED BY OSHA (29 CFR 1910.1200) BASED ON TESTING OF SIMILAR PRODUCTS AND/OR COMPONENTS.

EYES - NOT EXPECTED TO CAUSE IRRITATION DURING NORMAL CONDITIONS OF USE.

SKIN - PROLONGED OR REPEATED CONTACT MAY BE MILDLY IRRITATING TO SKIN AND MAY CAUSE DERMATITIS.

SWALLOWING - NOT EXPECTED TO BE TOXIC BY INGESTION. PRODUCT HAS LAXATIVE PROPERTIES AND MAY CAUSE NAUSEA, ABDOMINAL CRAMPS AND DIARRHEA.

INHALATION - NOT EXPECTED TO BE AN INHALATION HAZARD AT NORMAL ROOM TEMPERATURE. HOWEVER, IF EXPOSURES EXCEED THE PEL/TLV OF 5 MG/M3 FOR OIL MIST, THEN INHALATION OF MIST MAY RESULT IN RESPIRATORY IRRITATION AND POSSIBLE DISCOMFORT.

FIRST AID:

IF ON SKIN: THOROUGHLY WASH EXPOSED AREA WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING. LAUNDER CONTAMINATED CLOTHING BEFORE RE-USE.

IF IN EYES: FLUSH WITH LARGE AMOUNTS OF WATER, LIFTING UPPER AND LOWER LIDS OCCASIONALLY. GET MEDICAL ATTENTION, IF IRRITATION PERSISTS.

IF SWALLOWED: DO NOT INDUCE VOMITING, KEEP PERSON WARM AND QUIET, AND GET MEDICAL ATTENTION.

IF BREATHED: IF AFFECTED, REMOVE INDIVIDUAL TO FRESH AIR. IF BREATHING IS DIFFICULT, ADMINISTER OXYGEN. IF BREATHING HAS STOPPED GIVE ARTIFICIAL RESPIRATION. KEEP PERSON WARM, QUIET AND GET MEDICAL ATTENTION.

EFFECTS OF CHRONIC OVEREXPOSURE:

NONE CURRENTLY KNOWN FOR THE PRODUCT.

CAUTION: USED MOTOR OIL HAS BEEN SHOWN TO CAUSE SKIN CANCER IN CERTAIN LABORATORY ANIMALS CONTINUALLY EXPOSED TO USED MOTOR OIL BY REPEATED APPLICATIONS. AVOID PROLONGED OR REPEATED CONTACT TO SKIN.

SECTION VI REACTIVITY DATA

HAZARDOUS POLYMERIZATION: CANNOT OCCUR

STABILITY: STABLE

INCOMPATIBILITY: AVOID CONTACT WITH:, STRONG OXIDIZING AGENTS

SECTION VII SPILL OR LEAK PROCEDURES

TEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

ILL: ABSORB LIQUID ON VERMICULITE, FLOOR ABSORBENT OR OTHER ABSORBENT MATERIAL.

AR ILL: PREVENT RUN-OFF TO SEWERS, STREAMS OR OTHER BODIES OF WATER. IF RUN-OFF OCCURS, NOTIFY PROPER HORITIES AS REQUIRED, THAT A SPILL HAS OCCURED.

SONS NOT WEARING PROTECTIVE EQUIPMENT SHOULD BE EXCLUDED FROM AREA OF SPILL UNTIL CLEAN-UP HAS BEEN COMPLETED. STOP SPILL AT SOURCE. DIKE AREA OF SPILL TO PREVENT SPREADING. PUMP LIQUID TO SALVAGE TANK. REMAINING LIQUID MAY BE TAKEN UP ON SAND, CLAY, EARTH, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND SHOVELED INTO CONTAINERS.

ASTE DISPOSAL METHOD:

MALL SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

ARGE SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION VIII PROTECTIVE EQUIPMENT TO BE USED

SPIRATORY PROTECTION: NOT REQUIRED UNDER NORMAL CONDITIONS OF USE. HOWEVER, IF OIL MISTS ARE GENERATED ABOVE RECOMMENDED PEL/TLV OF 5 MG/M3, THEN A NIOSH/MSHA APPROVED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. (SEE YOUR SAFETY EQUIPMENT SUPPLIER.)

NTILATION: NOT REQUIRED UNDER NORMAL CONDITIONS OF USE. HOWEVER, IF UNUSUAL OPERATING CONDITIONS EXIST, THEN PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW PEL/TLV (S).

OTECTIVE GLOVES: NOT NORMALLY REQUIRED. HOWEVER, WEAR RESISTANT GLOVES SUCH AS NITRILE RUBBER TO PREVENT IRRITATION WHICH MAY RESULT FROM PROLONGED OR REPEATED SKIN CONTACT WITH PRODUCT.

E PROTECTION: NOT REQUIRED UNDER NORMAL CONDITIONS OF USE. HOWEVER, IF MISTING OR SPLASHING CONDITIONS EXIST, THEN SAFETY GLASSES OR CHEMICAL SPLASH GOGGLES ARE ADVISED.

THER PROTECTIVE EQUIPMENT: NORMAL WORK CLOTHING COVERING ARMS AND LEGS.

SECTION IX SPECIAL PRECAUTIONS OR OTHER COMMENTS

NTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED. SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES (VAPOR, LIQUID, AND/OR SOLID), ALL HAZARD PRECAUTIONS GIVEN IN THIS DATASHEET MUST BE OBSERVED.

E INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE WHETHER ORIGINATING WITH THE COMPANY OR NOT. RECIPIENTS ARE ADVISED TO CONFIRM IN ADVANCE OF NEED THAT THE INFORMATION IS CURRENT, APPLICABLE, AND SUITABLE TO THEIR CIRCUMSTANCES.

SECTION X LABEL INFORMATION

UTION!

CAUSE SLIGHT EYE IRRITATION.

CONTINUED ON PAGE: 3

SECTION X - LABEL INFORMATION (Continued)

PROLONGED OR REPEATED CONTACT MAY CAUSE SKIN DISORDERS.

INHALATION OF OIL MIST MAY CAUSE RESPIRATORY IRRITATION.

SWALLOWING MAY CAUSE STOMACH CRAMPS AND DIARRHEA.

HANDLING & STORAGE:

AVOID CONTACT WITH EYES AND SKIN. WEAR SAFETY GLASSES OR GOGGLES, RESISTANT GLOVES, AND OTHER APPROPRIATE PROTECTIVE EQUIPMENT ESSENTIAL FOR YOUR OPERATION. KEEP WORKPLACE AIRBORNE CONCENTRATIONS BELOW LEGAL AND RECOMMENDED LIMITS. USE NIOSH-APPROVED RESPIRATOR IF EXPOSED TO OIL MIST. DO NOT TRANSFER TO UNLABELED CONTAINER. DO NOT USE CUTTING OR WELDING TORCH ON THIS CONTAINER (EVEN EMPTY). BEFORE USE, REVIEW MATERIAL SAFETY DATA SHEET FOR MORE DETAILED INFORMATION, INCLUDING CHRONIC HEALTH EFFECTS.

FIRST AID:

EYES: FLUSH THOROUGHLY WITH WATER. GET MEDICAL ATTENTION IF IRRITATION PERSISTS.

SKIN: WASH EXPOSED AREAS WITH SOAP AND WATER. GET MEDICAL ATTENTION IF SKIN DISORDERS DEVELOP.

INHALATION: IF AFFECTED BY OIL MIST, REMOVE TO FRESH AIR.

INGESTION: DO NOT INDUCE VOMITING. CALL A PHYSICIAN OR POISON CONTROL CENTER IMMEDIATELY.

CHRONIC INFORMATION:

OVEREXPOSURE CURRENTLY UNKNOWN FOR THE PRODUCT. CAUTION! USED MOTOR OIL HAS BEEN SHOWN TO CAUSE SKIN CANCER IN CERTAIN LABORATORY ANIMALS CONTINUALLY EXPOSED TO USED MOTOR OIL BY REPEATED APPLICATIONS. AVOID PROLONGED OR REPEATED CONTACT TO SKIN. CONTAINS: PETROLEUM OIL

*** COMPONENTS APPEAR IN SECTION II ***

Post-it® Fax Note 7671	Date 11-9 | # of pages > 4
To Tom Yancy	From Eddie Potter
Co./Dept.	Co. Parts Whse
Phone #	Phone # 978-5300
Fax #	Fax #

LAST PAGE--SEE ATTACHMENT PAGE ENCLOSED--LAST PAGE

SLURRY
EXPLOSIVE
CORPORATION

T-100 Liquid
Safety Data

SPORTSMEN PIT ROAD • HALLOWELL • P.O. BOX 348 • COLUMBUS, KS 66725 • (316) 597-2552

SECTION I - PRODUCT IDENTIFICATION

TRADE NAME:	Slurran T-100 Liquid
SYNONYM:	Blue to Green explode
CHEMICAL FAMILY:	Nitromethane
FORMULA:	$CH_3\ NO_2$
CAS NUMBER:	75-52-5
UN/NA NUMBER:	UN1261
DOT HAZARD CLASS:	Flammable Liquid

SECTION II - HEALTH ALERT

DANGER - If misused or disposed of improperly material could and cause death or serious injury.

DO NOT HANDLE WHEN IN DOUBT
See Section. VIII - Personal Protection

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SECTION III - HEALTH HAZARD INFORMATION

EYE: May cause moderate irritation.
SKIN: May cause moderate irritation characterized by redness and pain.
INHALATION: Inhalation of decomposition products may irritate the respiratory tract. Prolonged exposure to these fumes may result in respiratory difficulties (shortness of breath, etc.)and possible more severe toxic effects.
INGESTION: Swallowing large quantities may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia and unconsciousness, abdominal spasms, nausea, and pain.

SECTION IV - EMERGENCY AND FIRST AID PROCEDURES

ACT: Flush with large amounts of water. Seek medical aid.
TACT: Remove contaminated clothing. Wash skin thoroughly with soap and water.
ON: Remove from exposure. If breathing stops or is difficult, administer artificial respiration or oxygen. Seek medical aid.
INGESTION: Give 1-2 large glasses of milk or water. Induce vomiting. Seek medical aid.

SECTION V - RECOMMENDED OCCUPATIONAL EXPOSURE LIMIT/HAZARDOUS INGREDIENTS

EXPOSURE LIMIT (PRODUCT): None required for product.

HAZARDOUS INGREDIENTS	PERCENT	EXPOSURE LIMIT	PPM	MG/M3
Nitromethan	Min. 95-100	8 Hours	100	

SECTION VI - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Heat (confinement); Stacking (burning).
NCOMPATIBILITY: Can react violently or explode, with reducing agents and organic materials. Avoid amines, strong alkalies & acids.
HAZARDOUS REACTION/DECOMPOSITION PRODUCTS: At high temperatures, especially)374 F, may emit severe toxic fumes of nitrogen oxides.
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: Not applicable.

SECTION VII - FIRE AND EXPLOSION HAZARD INFORMATION

LASH POINT & METHOD: 36 C (96 F) Tag Closed Cup
AUTOIGNITION TEMPERATURE: EXPLODES
LAMMABLE LIMITS (% BY VOLUME/AIR): LOWER: 7.3 UPPER: NA
XTINGUISHING MEDIA: Water, Foam, CO2
IRE-FIGHTING PROCEDURES: When explosive is burning, EVACUATE AREA. Avoid breathing vapor.
IRE [illegible] XPLOSION HAZARDS: Dangerous when exposed to heat or flame. Can support combustion of other materials involved in a fire , capable of undergoing detonation if heated to high temperatures especially under any confinement including being piled elf in a burning fire. When heated to decomposition, highly toxic fumes may be emitted. Do not return to area of explosion moke and fumes have dissipated. Dry alkali or amine salts are explosive.

THE BEST PRODUCT MADE
FOR THE PURPOSE

SECTION VIII - PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Safety goggles approved for the handling of explosives materials.
SKIN PROTECTION: Neoprene, natural rubber, polyethylene or polyvinyl chloride gloves. Use barrier creams, hand protection and protective clothing.
RESPIRATORY PROTECTION: Not normally required. Mechanical filter or supplied air type respirator as required for concentrations exceeding the occupational exposure limit.
VENTILATION: Maintain adequate ventilation. Use local exhaust if needed.

SECTION IX - PERSONAL HANDLING INSTRUCTIONS

HANDLING: Explosives should not be abandoned at any location for any reason. Do not handle during electrical storms.
STORAGE: Store in a cool, dry, well-ventilated area remote from operations. Storage area should be of non-combustible construction. Organic materials, flammable substances and finely divided metals should be stored separately. Flames, smoking and unauthorized personnel are prohibited where this product is used or store. Protect against physical damage, static electricity and lightning.
WARNING: Use of this product by persons lacking adequate training, experience and supervision may result in death or serious injury. Obey all federal, state and local laws and regulations applicable to transportation, storage, handling and use of explosives.
DISTANCE: Always stay from area of explosion or disposal sites. Stay behind suitable barriers.

SECTION X - SPILL AND LEAK PROCEDURES

OCEDURES IF MATERIAL IS RELEASED OR SPILLED (IN ADDITION SEE SECTION VIII): Isolate area. Eliminate ALL sources of ignition.
d skin contact. Scrape up. Remove soiled clothing.
ISPOSAL - USE APPROPRIATE METHOD(S): Disposal of unexploded or deteriorated explosives material can be hazardous. Expert
stance is positively recommended in destroying explosives. Accidents can be prevented by thorough planning and handling in
accordance with approved methods. Consult your supervisor, or the nearest SEC Regional Office for assistance. If improperly
disposed of, material could explode and cause death or serious injury.

In all cases, follow facility emergency response procedures. Contact Facility Environmental Manager for assistance. Report any discharge of oil or hazardous substance that may enter surface waters to the National Response Center 800/424-8802.

Observe all applicable local, state and federal environmental spill and water quality regulations.

SECTION XI - PHYSICAL DATA

ILING POINT:	101 C (219 F)	SPECIFIC GRAVITY:	1.13
LTING POINT:	-28.6 C	VOLATILE BY VOLUME:	100
POR PRESSURE:	36.6 mmg @ 25 C	EVAPORATION RATE (N-BUTYLACETATE=100):	139
APOR DENSITY (AIR=1):	2.1	VISCOSITY:	0.647 cp @ 20 C
SOLUBILITY IN WATER:	1.8% by wt. @ 20 C	APPEARANCE/ODOR:	Blue to Green Liquid, Aromatic Odor

SECTION XII - COMMENTS

This product is classified as a flamable liquid, ltd quanties, and need not be stored in a high explosive magazine, except where equired by local regulations. Storage should be in a well constructed, well ventilated, dry structure located to conform with local, tate and federal regulations.

erating conditions are assumed unless otherwise stated. If any given information is not clear or does not apply to your
, STOP, store the material suitable; and seek appropriate help from your supervisor, Institute of Makers of Explosives or
losive Corporation. Disposal sites must be clear of people at the time of disposal.

OTICE: The data and recommendations presented herein are based upon data which are considered to be accurate. However, Slurry makes guarantee or warranty, either expressed or implied, of the accuracy or completeness of these data and recommendations.

SLURRY
EXPLOSIVE
CORPORATION

T-100 Solid
Safety Data

SPORTSMEN PIT ROAD • HALLOWELL • P.O. BOX 348 • COLUMBUS, KS 66725 • (316) 597-2552

SECTION I - PRODUCT IDENTIFICATION

TRADE NAME: Slurran T-100 Solid
SYNONYM: Yellow or Green Sticks
CHEMICAL FAMILY: Ammonium Nitrate
FORMULA: Mixture
CAS NUMBER: None
UN/NA NUMBER: UN1942
DOT HAZARD CLASS: Oxidizer

SECTION II - HEALTH ALERT

DANGER - If misused or disposed of improperly material could explode and cause death or serious injury.

DO NOT HANDLE WHEN IN DOUBT

See Section. VIII - Personal Protection
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SECTION III - HEALTH HAZARD INFORMATION

EYE: May cause moderate irritation.
SKIN: May cause moderate irritation characterized by redness and pain.
INHALATION: Inhalation of decomposition products may irritate the respiratory tract. Prolonged exposure to these fumes may result in respiratory difficulties (shortness of breath, etc.) and possible more severe toxic effects.
INGESTION: Swallowing large quantities may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia and unconsciousness, abdominal spasms, nausea, and pain.

SECTION IV - EMERGENCY AND FIRST AID PROCEDURES

TACT: Flush with large amounts of water. Seek medical aid.
ONTACT: Remove contaminated clothing. Wash skin thoroughly with soap and water.
ION: Remove from exposure. If breathing stops or is difficult, administer artificial respiration or oxygen. Seek medical aid.
ION: Give 1-2 large glasses of milk or water. Induce vomiting. Seek medical aid.

SECTION V - RECOMMENDED OCCUPATIONAL EXPOSURE LIMIT/HAZARDOUS INGREDIENTS

EXPOSURE LIMIT (PRODUCT): None required for product.
HAZARDOUS INGREDIENTS

	PERCENT	EXPOSURE LIMIT	PPM	MG/M3
Ammonium Nitrate	(95	NONE		
Sodium Nitrate	(20	NONE		
Urethane Prepolymer	(5	8 Hours	0.1	100

SECTION VI - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Heat (confinement); Stacking (burning).
INCOMPATIBILITY: Can react violently or explode, with reducing agents and organic materials. Avoid amines, strong alkalies & acids.
HAZARDOUS REACTION/DECOMPOSITION PRODUCTS: At high temperatures, especially)374 F, may emit severe toxic fumes of nitrogen oxides.
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: Not applicable.

SECTION VII - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT & METHOD: NA
FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER: NA
UPPER: NA
AUTOIGNITION TEMPERATURE: EXPLODES
EXTINGUISHING MEDIA: Water
F ING PROCEDURES: When explosive is burning, EVACUATE AREA. Avoid breathing vapor.
F EXPLOSION HAZARDS: Dangerous when exposed to heat or flame. Can support combustion of other materials involved in a fire
capable of undergoing detonation if heated to high temperatures especially under any confinement including being piled
..self in a burning fire. When heated to decomposition, highly toxic fumes may be emitted. Do not return to area of explosion
until smoke and fumes have dissipated. Dry alkali or amine salts are explosive.

SECTION VIII - PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Safety goggles approved for the handling of explosives materials.
SKIN PROTECTION: Neoprene, natural rubber, polyethylene or polyvinyl chloride gloves. Use barrier creams, hand protection and protective clothing.
RESPIRATORY PROTECTION: Not normally required. Mechanical filter or supplied air type respirator as required for concentrations exceeding the occupational exposure limit.
VENTILATION: Maintain adequate ventilation. Use local exhaust if needed.

SECTION IX - PERSONAL HANDLING INSTRUCTIONS

HANDLING: Explosives should not be abandoned at any location for any reason. Do not handle during electrical storms.
STORAGE: Store in a cool, dry, well-ventilated area remote from operations. Storage area should be of non-combustible construction. Organic materials, flammable substances and finely divided metals should be stored separately. Flames, smoking and unauthorized personnel are prohibited where this product is used or store. Protect against physical damage, static electricity and lightning.
WARNING: Use of this product by persons lacking adequate training, experience and supervision may result in death or serious injury. Obey all federal, state and local laws/regulations applicable to transportation, storage, handling and use of explosives.
DISTANCE: Always stay from area of explosion or disposal sites. Stay behind suitable barriers.

SECTION X - SPILL AND LEAK PROCEDURES

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED (IN ADDITION SEE SECTION VIII): Isolate area. Eliminate ALL sources of ignition. Avoid skin contact. Scrape up. Remove soiled clothing.
WASTE DISPOSAL - USE APPROPRIATE METHOD(S): Disposal of unexploded or deteriorated explosives material can be hazardous. Expert assistance is positively recommended in destroying explosives. Accidents can be prevented by thorough planning and handling in accordance with approved methods. Consult your supervisor, or the nearest SEC Regional Office for assistance. If improperly disposed of, material could explode and cause death or serious injury.

. all cases, follow facility emergency response procedures. Contact Facility Environmental Manager for assistance. Report any discharge of oil or hazardous substance that may enter surface waters to the National Response Center (800) 424-8802.

Observe all applicable local, state and federal environmental spill and water quality regulations.

SECTION XI - PHYSICAL DATA

BOILING POINT:	NA		
MELTING POINT:	170 C (338 F)	BULK DENSITY:	0.91 g/cc
VAPOR PRESSURE:	NA	VOLATILE BY VOLUME:	NA
VAPOR DENSITY (AIR=1):	NA	EVAPORATION RATE (ETHER=1):	NA
SOLUBILITY IN WATER:	110g/100/g H20 @ 0 C	VISCOSITY:	NA
APPEARANCE/ODOR:	Cast white or yellowish-white powder enclosed in plastic container.		

SECTION XII - COMMENTS

This product is classified as an oxidizer and need not be stored in a high explosive magazine, except where required by local regulations.Storage should be in a well constructed, well ventilated, dry structure located to conform with local, state and federal regulations.

Normal operating conditions are assumed unless otherwise stated. If any given information is not clear or does not apply to your s' tion, STOP, store the material suitable, and seek correct help from your supervisors, Institute of Makers of Explosives or S. y Explosive Corporation. Disposal sites must be clear of people at the time of disposal.

_E: The data and recommendations presented herein are based upon data which are considered to be accurate. However, Slurry no guarantee or warranty, either expressed or implied, of the accuracy or completeness of these data and recommendations.

Date of Revision: August 17 [illegible]

DYNO

Dyno Nobel Inc

MATERIAL SAFETY DATA SHEET
DYNO NOBEL INC
11TH FLOOR CROSSROADS TOWER
SALT LAKE CITY, UTAH 84144
801-364-4800 TELEX 388353
FOR 24 HOUR EMERGENCY CALL 800-424-9300

MSDS# 1076

DATE: 07/20/93

Supersedes MSDS
1076 04/14/93

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): Electric Super: LP, SP, Coal, Seismic
INSTADET
IREDET Super Coal, Instant, Gas, SP, LP
TRONA
VIBRODET

Product Class: Commercial Electric Detonators and Accessory Products

Product Appearance & Odor: Metal cylinder with varying length and diameter of attached plastic tubing.

DOT Hazard Shipping Description: Detonators, Electric (1.1B UN0030) or (1.4B UN0255) II

SECTION II - HAZARDOUS INGREDIENTS

ngredients:	CAS#	MAXIMUM %	TLV-ACGIH
ngsten	7440-33-7	.47	
arium Chromate	10294-40-3	1.2	0.1 mg $(Cr_2O_3)/m^3$
ttowa Silica	7631-86-9	.07	0.5 mg $(Ba)/m^3$
Lead Dioxide	1309-60-9	< 1	0.05 mg $(Pb)/m^3$
Pentaerythritol Tetranitrate (PETN)	78-11-5	3.7	No Value Established
Boron	7440-42-8	.21	No Value Established
Potassium Perchlorate	7778-74-7	.50	No Value Established
DDNP (Diazodinitrophenol)*	4682-03-5	.26-1.3	No Value Established
Nitrocellulose	9004-70-0	< .1	No Value Established

*1.3 found in Instadet and Vibrodet only.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations.

SECTION III - PHYSICAL DATA

Boiling Point: N/A

Vapor Pressure: N/A

Vapor Density: N/A

Density: N/A

Percent Volatile by Volume: N/A

Solubility in Water: N/A

Evaporation Rate (Butyl Acetate = 1): N/A

N/A = Not Applicable or Not Available

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A — **Flammable Limits:** N/A

Extinguishing Media: None

Special Fire Fighting Procedures: Do not fight fires involving explosive materials. Evacuate personnel to predetermined safe location.

Unusual Fire and Explosion Hazards: Can explode under fire conditions. Burning material may product toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: No exposure to chemical hazards anticipated with normal handling procedures.

Skin: No exposure to chemical hazards anticipated with normal handling procedures.

Ingestion: No exposure to chemical hazards anticipated with normal handling procedures.

Inhalation: Avoid breathing the fumes from detonation.

Systemic or Other Effects: Accidental detonation of an explosive device can cause lacerations, punctures and/or traumatic injury. Severity of injuries is dependent on the number and the proximity of the detonations.

Emergency and First Aid Procedures

Eyes: Seek medical attention.

Skin: Seek medical attention.

Ingestion: Seek medical attention.

Inhalation: If detonation fumes are inhaled, remove to fresh air. If breathing stops, give artificial respiration.

Special Considerations: N/A

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock, or high energy projectile impact especially when confined or in large quantities.

Conditions to Avoid: Keep away from heat, flame, ignition sources, strong shock, and electrical impulse. Do not attempt to disassemble.

Materials to Avoid (Incompatibility): Corrosives

Hazardous Decomposition Products: As a result of detonation only: N_2, CO, H_2O, NO_x, Pb and various oxides and complex oxides of metals.

azardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: In case of fire evacuate area not less than 2500 feet. Protect from all ignition sources. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, repackage devices in original packaging, accounting for every device. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Dispose of in accordance with Federal, State, and local regulations. If product becomes a waste, it is potentially regulated as a hazardous was as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR part 261.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required. Avoid breathing fumes from detonation.

Protective Clothing: Cotton clothing suggested.

Eye Protection: Safety glasses suggested.

Other Precautions Required: N/A

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources, and strong shock.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
Barium Chromate	10294-40-3	1.2

DYNO NOBEL INC Disclaimer

The statements contained herein are offered for information purposes only and are intended only for persons having related technical skills. Because conditions and manner of use are outside our control, it is the user's responsibility to determine the conditions of safe use of the product. While the information is believed to be correct, DYNO NOBEL Inc. shall in no event be responsible for any damages whatsoever, directly or indirectly, resulting from the publication or use of or reliance upon data contained herein. No warranty, either expressed or implied, of merchantability, or fitness, or of any nature with respect to the product, or to the data, is made herein.

MATERIAL SAFETY DATA SHEET

DETONATING CORD

DATE NOVEMBER 1993 MSDS NO. C-1 PAGE 1 of 2

Issued by the Safety and Compliance Dept.

SECTION I

AUSTIN POWDER COMPANY
25800 SCIENCE PARK DRIVE
CLEVELAND, OHIO 44122
EMERGENCY PHONE
DAY 216-464-2400
NIGHT 216-464-2407

TRADE NAME AND SYNONYMS
Lite Line, Scotch Cord, A-Cord, Tuff-Kote, No. 40, No. 50 No. 60, etc. Seismic Detonating Cord, Slide Line Series, Heavy Duty Series, Cordeau Detonant Fuse, Cord, Detonating, Flexible

SECTION II HAZARDOUS INGREDIENTS

PETN, Pentaerythritol Tetranitrate, $C_5H_8N_4O_{12}$, CAS No. 78-11-5

SECTION III PHYSICAL DATA

BOILING POINT	N/A	VAPOR PRESSURE (mm Hg)	Negligible at 20 °C
SPECIFIC GRAVITY (H_2O = 1)	1.76	VAPOR DENSITY (Air = 1)	N/A
PERCENT VOLATILE BY VOL. (%)	N/A	EVAPORATION RATE:	N/A
SOLUBILITY IN WATER:	Negligible		

ARANCE AND ODOR: Flexible cord with an explosive core of PETN protected within a textile casing covered by a seamless polyethylene and/or ethylene-co-vinyl acetate jacket and an optional outer layer of yarn and wax. PETN is a white crystalline solid. No odor.

SECTION IV FIRE AND EXPLOSION DATA

FLASH POINT:	N/A
FLAMMABLE LIMITS:	N/A
EXTINGUISHING MEDIA:	See below
SPECIAL FIREFIGHTING PROCEDURES:	Do not fight fire. Withdraw personnel immediately . Allow fire to burn itself out.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	May explode when subjected to fire or shock. Avoid toxic fumes from fire.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: ACGIH: PETN-None
OSHA : PETN-None

EFFECTS OF OVEREXPOSURE: Ingestion of PETN may cause headache and nausea. PETN is a vasodilator and produces dilation of blood vessels.

EMERGENCY AND FIRST AID PROCEDURES:
IMES: Remove to fresh air.
INGESTED: Obtain medical attention immediately.

MATERIAL SAFETY DATA SHEET

DETONATING CORD

DATE NOVEMBER 1993 MSDS NO. C-1

Issued by the Safety and Compliance Dept.

SECTION VI REACTIVITY DATA

STABILITY: Stable under normal conditions. May explode when subjected to fire or shock.

INCOMPATIBILITY (MATERIALS TO AVOID): Avoid contact with strong acids or alkalies.

HAZARDOUS DECOMPOSITION PRODUCTS: Gaseous Nitrogen Oxides and Carbon Oxides

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Sweep up and dispose of all spilled material immediately. Do not permit smoking or open flames near spill site.

WASTE DISPOSAL METHOD: Dispose of under direct supervision of a qualified person according to local, state and federal regulations. Call Austin Powder for recommendations and assistance. This material may become a hazardous waste under certain conditions and must be collected, labeled and disposed of per state and federal hazardous waste regulations.

TRANSPORTATION EMERGENCIES INVOLVING SPILLS, LEAKS, FIRES OR EXPOSURES
LL CHEMTREC: 1-800-424-9300

CTION VIII SPECIAL PROTECTION INFORMATION:

RESPIRATORY PROTECTION:	Not required under normal conditions.
VENTILATION:	Not required under normal conditions.
PROTECTIVE GLOVES:	Not required except to prevent abrasive injuries.
EYE PROTECTION:	Not required under normal conditions.

SECTION IX SPECIAL PRECAUTIONS

COMPLY WITH "ALWAYS AND NEVER" AS ADOPTED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES. TRANSPORTATION, STORAGE AND USE MUST COMPLY WITH OSHA SAFETY AND HEALTH STANDARDS 29CFR1910.109, APPLICABLE MSHA REGULATIONS, THE DOT AND HAZARDOUS MATERIALS REGULATIONS BATF REQUIREMENTS AND STATE AND LOCAL TRANSPORTATION, STORAGE AND USE REGULATIONS AND ORDINANCES.

DOT CLASSIFICATION: Cord, Detonating, Flexible 1.1D, PG II

UN NUMBER: UN0065 IMO HAZARD CLASS: 1.1D

* May be offered for transportation domestically and transported as Cord, Detonating (UN 0289), Division 1.4 compatibility Group D (1.4D) Explosives, if the explosive content does not exceed 100 grains per linear foot and the gross weight of all packages of detonating cord does not exceed (45 KG) 99 pounds per vehicle. See 49 CFR 173.63

T maximum recommended temperature for detonating cord is 160°F (71°C).

f the components are listed in the 1987 IARC Monographs, Group 1, 2A or 2B as known, probable, or possible ca ogens, nor are they listed in the NTP annual report on carcinogens

The Ensign-Bickford company

MATERIAL SAFETY DATA SHEET

Page 1 of 6

SECTION I

Manufacturer's Name:

The Ensign-Bickford Company

Emergency Telephone No:

(203) 658-4411
(203) 843-2276

Trade Name and Synonyms: PRIMADET® NONELECTRIC DETONATORS, EZDET, EZTL™ DETONATORS, TLBB, MSC, SLMS/SLHD, LEAD-IN-LINES

Address:

660 Hopmeadow St., Simsbury, CT 06070

Cage Code:

152-B-059/060
92-C-207/409/413
152-C-04;08;17;26;40-43;46
152-C-78;80;90

EBCo Product Code:

NMS, NLP, NEZ, EZTL,
TLBB, MSC, SLMS/SLHD,
L-I-L

SECTION II - HAZARDOUS INGREDIENTS

Ingredient:	C.A.S. No.	OSHA PEL	ACGIH TLV
PENTAERYTHRITOL TETRANITRATE (PETN)	78-11-5	None	None
LEAD AZIDE	13424-46-9	0.05mg(Pb)/m^3	.05mg(Pb)/m^3
RED LEAD	1314-41-6	.05mg(Pb)/m^3	.05mg(Pb)m^3
BARIUM CHROMATE	10294-40-3	1mg/m^3	0.01mg/m^3 (Insoluble Cr VI) compounds
POTASSIUM PERCHLORATE	7778-74-7	None	None
OTTAWA SILICA	61790-53-2	6mg/m^3	2mg/m^3 (silca, fume)

LEAD CHROMATE	7758-97-6	1 mg/10m ³ (ceiling)	0.01mg/m³ (Insoluble Cr VI) compounds
SELENIUM	7782-49-2	0.2 mg/m³	0.2 mg/m³
MOLYBDENUM	7439-98-7	15 mg/m³	10 mg/m³
TUNGSTEN	7440-33-7	None	5 mg/m³
ALUMINUM	7429-9-5	15mg/m³ (dust) 5mg/m³(resp. frac.)	10mg/m³
LEAD	7439-92-1	.05 mg/m³	.05mg/m³
SILICON	7440-21-3	15 mg/m³ (total dust) 5mg/m³ (respirable dust)	10 mg/m³

SECTION III - PHYSICAL DATA

Boiling Point:

Lead Chromate:	Decomposes
Selenium:	690° C
Molybdenum:	4825° C
Tungsten:	5900° C
Aluminum:	2450° C
Lead:	1740° C

Vapor Pressure:

Molybdenum:	1mm @ 3102° C
Aluminum:	1mm @ 1284° C
Lead:	1mm @ 973° C

Specific Gravity:

PETN @	1.773
Potassium Perchlorate@	2.52
Lead Chromate@	6.3
Selenium@	4.81-4.26
Molybdenum@	10.28
Tungsten@	19.3 @ 20
Aluminum@	2.70
Lead@	11.34
Barium Chromate@	4.50

Percent Volatile:

N/A

Vapor Density:
N/A

Evaporation Rate:
N/A

Solubility in Water:

PETN:	No
Lead Azide:	Very Slight
Potassium Perchlorate:	Yes
Lead Chromate:	No or Slight
Molybdenum:	No
Aluminum:	No
Lead:	No
Barium Chromate:	No

Melting Point:

PETN:	140° C
Potassium Perchlorate:	Decomp. at 400° C
Lead Chromate:	920° C
Molybdenum:	2622° C
Tungsten:	3410° C
Aluminum:	660° C
Lead:	327.43° C

Appearance and Odor:
Aluminum shell containing appox. 100mg of lead azide and 400-800mg of Pentaerythritol Tetranitrate (PETN) with Shock Tube (plastic) containing a dust of HMX and Aluminum powder.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point:
N/A

Explosive Limits:
LEL:N/A UEL:N/A

Extinguishing Media: Do not fight fires involving explosives. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Special Fire Fighting Procedures: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. ISOLATE THE AREA. EVACUATE PERSONNEL TO A SAFE PLACE. EXPLOSIVE DETONATION CAN OCCUR.

Unusual Fire and Explosion Hazards: May detonate if exposed to shock, heat, impact, sparks or friction. Nitrogen, Oxides, Carbon Monoxide and Carbon Dioxide are released when this product is burned.

Auto Ignition Temperature: PETN 190°

SECTION V – ROUTES OF ENTRY/EFFECTS OF OVEREXPOSURE

Threshold Limit Value:	Product is fully contained and presents low risk of skin contact, ingestion, or inhalation of chemical constituents during normal handling. Personnel could be exposed to by-products during functional detonation of the unit and post clean-up.
Eye Contact:	Dust can irritate, corneal injury may result. Flush immediately with running water for at least 15 minutes. Seek medical attention.
Skin Contact:	Irritation and Eczema may result. If exposure occurs, wash thoroughly with soap and water. If skin irritation occurs seek medical attention.
Inhalation:	Breathing dust can cause nasal and respiratory irritation and lowering of blood pressure. PETN can lower blood pressure. PETN is a vasodilator. Lead exposure at high levels can cause acute or chronic symptoms which can range from eye and skin irritation to permanent brain damage, vomiting, convulsions. ACGIH classifies lead as an "Animal Carcinigen" and insoluble chromium VI compounds as "Confirmed Human Carcinogens". Seek medical attention.
Ingestion:	See Inhalation.

SECTION VI – EMERGENCY FIRST AID PROCEDURES

	Emergency and First Aid Procedures
Eye Contact:	Flush using running water for 15 minutes. If irritation persists, seek medical attention.
Skin Contact:	Wash thoroughly with soap and water. If skin irritation occurs, seek medical attention.
Inhalation:	Remove victim to fresh air. If not breathing administer artificial respiration. Seek medical attention.
Ingestion:	Seek medical attention.

SECTION VII - REACTIVITY DATA

Stability:	Stable, but improper handling can result in accidental detonation.
Conditions To Avoid:	Heat, shock, friction, impact, static charge.
Incompatibility:	Incompatible with acids, alkalis.
Hazardous Decomp Products:	Detonation will produced Nitrogen, Oxides, Carbon Dioxide and Carbon Monoxide. Airborne particulates, including the metals in Section II, may be released.
Hazardous Polymerization:	Will not occur.

SECTION VIII - SPILLS OR LEAK PROCEDURES

Steps To Be Taken In Case Material Is Released Or Spilled:	Review Fire and Explosive Hazards and Safety Precautions before Proceeding with Clean-Up. Use appropriate Personal Protective Equipment during clean-up. Isolate the spill area; removing all sources of ignition from the location. Carefully collect the spilled material and place in a (Velostat) conductive bag. Contamination of this material with sand, grit, or dirt will render material more sensitive to detonation. If safe separate material that is not contaminated from contaminated material. "Loose" powder spills should be wetted down and cleaned using a damp rag or sponge. Store all collected material in a secure area, to await proper disposal. Detonators contain Lead Azide; in the event of any spill of loose powder, such as from a broken cap all spilled material should be treated with Cerric Ammonium Nitrate killing solution (10%). This will chemically decompose the Lead Azide, but the PETN and pyrotechnic will remain reactive, and all residue materials must be assumed to be explosive - contaminated until proper waste disposal of the reactive material (see below) is complete. Only qualified personnel should perform any clean-up and disposal of material.

Waste Disposal Method: Waste detonators are classified as a hazardous waste with the characteristic of reactivity, EPA Hazardous Waste Number of D003; see CFR 40 Section 261. Any such waste should be handled and stored in accordance with local, state and federal regulations. The current preferred method of waste treatment for waste detonators is detonation in a confined chamber. The open (unconfined) detonation of waste detonators may result in the release of lead particulate. Open burning of detonators is likely to result in detonation, and is not recommended. Any treatment of waste detonators must be performed by qualified personnel and at licensed facilities.

SECTION IX - SPECIAL PROTECTION INFORMATION

Respiratory Protection: See page 4, Inhalation. A dual cartridge negative pressure respirator with high efficiency dust, mist and fume cartridges should be worn if exposure is found to be between 50 and 500 micrograms (Pb) per cubic meter of air (ug/m^3). Powered air purifying respirators or other higher forms of respiratory protection should be worn if exposure levels exceed 500 ug/m^3.

Ventilation: Product is intended for outside use and in underground mines. Ventilation should be provided if used in underground mines or if any special testing is to be performed indoor.

Protective Gloves: Not required for normal use. Protective gloves should be worn during post clean-up operations.

Eye Protection:: Safety glasses

SECTION IX - REACTIVITY DATA

Precautions To Be Taken In Handling And Storing: Transportation and storage must be in accordance with Federal, State and Local Regulations. Store away from sparks or other ignition sources. Avoid heat , shock and impact.

Other Precautions: Refer to Manufacturer's Instructions and Warnings supplied with product.

SARA 313 Information: Manufactured unit contains Aluminum, Barium compounds, Chromium compounds, Lead and Selenium which fall under the reporting requirements of SARA Title III; Section 313.

Last Data Sheet Revision: 05/05/94

APPENDIX 8

General Ordnance Characterization for Kaho'olawe Island

GENERAL ORDNANCE CHARACTERIZATION

Over the last fourty years the Island of Kaho'olawe has been subjected to every type of military ordnance in the inventory with the exception of nuclear and chemical weapons. Inherent to all service ordnance is a "dud ratio", a failure of a portion of the ordnance to function as designed. Duds result from manufacturing defects or errors in deployment which do not allow for the normal arming and/or functioning of the ordnance. It is estimated that tens of thousands of dud munitions have accumulated on Kaho'olawe Island. The dud rate most commonly used is in the area of 2 - 3% of all ordnance delivered.

Dud ordnance range in size from 20mm projectiles to general purpose bombs in excess of 1000 pounds. All dud ordnance on the island was delivered as designed and should have functioned. Unfortunately there were no sterilization features designed into these munitions. Each piece of dud ordnance now presents the same hazard to personnel as it did the moment it impacted the island without exploding. If an ordnance item did not function upon impact, it may require only the smallest disturbance to function. Deterioration of metal components over a long period of time may increase the sensitivity of a fuzing system and therefore increase the risk of unintended detonation. Dud ordnance must be treated with the utmost respect and must be considered ready to function.

The various types of ordnance, explosive weight, and type of fuzing found on Kaho'olawe Island by UXO specialists in the past are as follows:

Bombs

Bombs found on Kaho'olawe Island range from 2 lbs to 2000 lbs. There are various types of bombs including general purpose, anti-personnel, fuel-air-explosive and fire bombs (napalm). The explosive components could weigh as much as 1000 lbs or as little as 1/2 lb. The fuzing incorporated in these bombs also varies. Typical fuzing systems used include: impact, cocked striker, piezo electric, all ways acting, time delay, and variable time (radar) fuzes, many of which incorporate anti-disturbance features. Bombs found during surface sweep activities include:

Name	Exp Weight	Type Fuzing
2000 lb SAP bomb	1000 lbs	Impact Cocked Striker Impact Delay
2000 lb LDGP Bomb/MK 84	1000 lbs	Impact Cocked Striker Impact Delay VT
1000 lb LDGP Bomb/MK 83	500 lbs	Impact Cocked Striker Impact Delay VT

500 lb LDGP Bomb/MK 82	200 lbs	Impact Cocked Striker Impact Delay VT
250 lb LDGP Bomb/MK 81	100 lbs	Impact Cocked Striker Impact Delay VT
FAE Bombs	75 lbs E.O.	Mech Time Piezo Electric
40 lb Frag Bomb	23 lbs	Impact
Butterfly Bomblets	1/2 lb	Impact Anti-Disturbance Long Delay
Fire Bombs	705 lbs Napalm	All-Ways Acting (WP Igniters)
Baseball Type Bomblets	1/4 lb	Anti-Disturbance (Anti-Personnel)

Projectiles

Projectiles found range from aircraft launched 20mm to shipboard fired 16 inch projectiles. Explosive weights range from .017 lbs in the 20mm to 153 lbs in the 16 inch. White phosphorous (WP) projectiles have also been found on Island. Fuzing systems include: Impact (cocked-striker) tail or nose, mechanical time, powder train time, piezo electric and all-ways acting fuzes.

In addition, 81 mm mortar projectiles which contain 4.3 lbs of white phosphorous pyrotechnic mixture have been found. The fuzing of mortar rounds consist of impact or mechanical time systems. Projectiles found during surface sweeps include:

Name	Exp Weight	Fuzing Type
20mm projectiles	.01710 lbs	Impact Impact Self Destruct Impact (Cocked-Striker)
40mm projectiles	.1726 lbs	Impact Impact Self Destruct
3"/50 projectiles	1.6645 lbs	Impact Mech

Time
VT

5"/38 projectiles	10 lbs	Impact Impact (Cocked-Striker) (Tail and Nose)
5"/54 projectiles	8 lbs	Impact Mech Time
106mm projectile (heat)	2.79 lbs	Impact
105mm projectile	7.760 lbs	Piezo Electric Impact Mech Time
8" projectiles	21.58 lbs	Impact Mech Time
16" projectile	153 lbs	Impact
81mm mortar	4.3 lbs	Impact Mech Time Powder Time
60mm mortar	5 lbs 1 lb WP	Impact Mech Time Powder Time

Rockets

A variety of rockets including 7.2 inch rocket thrown depth charges, 2.75 inch and 5 inch aircraft launched rockets, and 5 inch shipboard launched barrage rockets have been found during surface sweeps. Explosive weights range from 2.3 lbs to 33.7 lbs.

Name	Exp Weight	Fuzing Type
2.75" rocket	2.3 lbs	Impact VT
66mm LAW	1.5 lbs	Impact Piezo
3.5" Bazooka	3 lbs	Impact
5" HVAR rocket	20 lbs	Impact VT

5" Zuni rocket	20 lbs	Impact VT
4.5" Barrage rocket	8 lbs	Mech Time Powder Time
4.2" Rocket Thrown Depth Charge	15 lbs	All-ways acting Hydrostatic
7.2" Rocket Thrown Depth Charge	33 lbs	All-ways acting Hydrostatic

Guided Missiles

Guided missiles used on Kaho'olawe include air launched items with warheads up to 250 lbs and man-portable ground launched with 10 lb warheads.

Name	Exp Weight	Fuzing Type
Tow Surface Attack	10 lbs	Impact
Dragon Anti-Tank	6 lbs	Impact
AGM-12 Bullpup	250 lbs	Impact VT
AGM-45 Shrike	55 lbs	Impact VT

Flares

Flares found on Kaho'olawe Island include aircraft dropped illuminating charges with 17.627 lbs of illuminating compound inside. The fuzing is usually powder train time or mechanical time. The 5 inch star projectile is also found on the island with the same fuzing as mentioned previously.

Name	Exp Weight	Fuzing Type
MC 24 Aircraft Illuminating Flare	17 lbs	Mech Time Powder Time
MK 45 Aircraft Illuminating Flare	17 lbs	Powder Time
5 Inch Projectile (Star)	6 lbs	Powder Time Mech Time

APPENDIX 9
NAVFAC Accident Reporting Guidelines

PTTULYUW RULSSGG8591 2901320-UUUU--RHHMMCS.
ZNR UUUUU
R 171320Z OCT 94 ZYB PSN 115306F16
FM COMNAVFACENGCOM ALEXANDRIA VA//40K//
TO AIG ONE ONE ONE THREE EIGHT//00/09K//
AIG ONE ONE ONE THREE NINE//00/09K//
INFO RUCBCLF/CINCLANTFLT NORFOLK VA//N4433//
RHHMHAH/CINCPACFLT PEARL HARBOR HI//N466//
RUCTPOA/CNET PENSACOLA FL//JJJ//
RULSNAA/COMNAVAIRSYSCOM WASHINGTON DC//09F2//
RULSSEA/COMNAVSEASYSCOM WASHINGTON DC//223-2//
RULSSPA/COMSPAWARSYSCOM WASHINGTON DC//
RUENMED/BUMED WASHINGTON DC//242//
RUENAAA/CNO WASHINGTON DC//N454//
RUEANEA/CDRUSACE WASHINGTON DC//CESO//
BT
UNCLAS

09K
A

MSGID/GENADMIN/NAVFACENGCOM 40K/OCT//
SUBJ/REPORTING CONTRACTOR ACCIDENTS//
REF/A/DOC/FED ACQUISITION REG/-//
REF/B/DOC/29CFR1926/-//
REF/C/DOC/EM385-1-1/-//

NARR/REF A REQUIRES THE USE OF THE ARMY CORPS OF ENGINEERS (USACE) MANUAL FOR CONSTRUCTION PROJECTS. REF B ARE THE OSHA CONSTRUCTION SAFETY STANDARDS. REF C IS THE USACE (DOD) CONSTRUCTION SAFETY STANDARDS.//

RMKS/1. THIS MESSAGE IS INTENDED TO CLARIFY NAVFAC'S POLICY ON INVESTIGATIONS OF MISHAPS AND IMPLEMENTATION OF THE OSHA REVISED SERIOUS MISHAP CRITERIA FOR CONTRACTOR RELATED ACCIDENTS.

2. AS CONSTRUCTION AGENT FOR THE US NAVY, NAVFAC PROVIDES CONSTRUCTION SAFETY POLICY AND GUIDANCE IAW OSHA POLICY. OVER THE PAST THREE YEARS, NAVY CONTRACTORS HAVE EXPERIENCED A NUMBER OF SIGNIFICANT MISHAPS WHICH HAVE NOT BEEN REPORTED IN A TIMELY OR SUFFICIENT MANNER. REFERENCE C REQUIRES ACCIDENTS TO BE INVESTIGATED, REPORTED, AND ANALYZED IN DEPTH TO IDENTIFY ALL CAUSES.

3. AS A RESULT OF THE NAVFAC CONSTRUCTION WORKING GROUP MEETING 21-23 JUNE 1994, THE FOLLOWING PROCESS WAS AGREED UPON FOR IMPLEMENTATION:

A. TIER ONE - SERIOUS CONTRACTOR MISHAPS - ANY CONTRACTOR ACCIDENT INVOLVING A FATALITY OR THE HOSPITALIZATION OF 3 OR MORE WORKERS MUST BE REPORTED, BY THE CONTRACTOR, TO OSHA AND THE RESPONSIBLE CONTRACTING OFFICER WITHIN 8 HOURS. THE ACTIVITY WITH CONTRACT OVERSIGHT RESPONSIBILITY SHALL APPOINT A QUALIFIED SAFETY AND HEALTH PROFESSIONAL (EFD/EFA/PWC/CBC) TO INVESTIGATE AND PROVIDE A COMPLETE REPORT TO NAVFACHQ WITHIN 30 DAYS.

B. TIER TWO - SIGNIFICANT CONTRACTOR MISHAPS - ANY CONTRACTOR MISHAP WHICH INVOLVES:

1) FALLS OF 4 FEET OR GREATER WHICH RESULTED IN A LOST TIME INJURY OR PROPERTY DAMAGE OF $10K OR GREATER.

2) ELECTRICAL MISHAPS WHICH RESULTED IN A LOST TIME; PROPERTY DAMAGE OF $10K OR GREATER; FIRE DEPARTMENT OR EMERGENCY MEDICAL TREATMENT (EMT) ASSISTANCE.

3) CONFINED SPACE MISHAPS WHICH RESULTED IN A LOST TIME; PROPERTY DAMAGE OF $10K OR GREATER; FIRE DEPARTMENT OR EMT ASSISTANCE.

4) DIVING MISHAPS WHICH RESULTED IN A LOST TIME; PROPERTY DAMAGE OF $10K OR GREATER; FIRE DEPARTMENT OR EMT ASSISTANCE.

5) CRANE MISHAPS WHICH RESULTED IN A LOST TIME; PROPERTY DAMAGE OF $10K OR GREATER.

[illegible]

6) TRENCHING/ENTRAPMENT MISHAPS WHICH INVOLVED A DEPTH OF FOUR FEET OR GREATER AND RESULTED IN A LOST TIME DUE TO UNSTABLE SOIL, ANGLE OF REPOSE, ESCAPE ROUTES, ETC.

7) HAZARDOUS MATERIAL/WASTE MISHAPS WHICH RESULTED IN LOST TIME, FIRE OR EXPLOSION OR $10K CLEANUP COSTS.

8) EQUIPMENT MISHAPS WHICH RESULTED IN A LOST TIME; PROPERTY DAMAGE OF $10K OR GREATER INVOLVING MOTORIZED EQUIPMENT, TAR KETTLES, BACKHOES, COMPRESSORS, OR LIFTS.

9) FIRE MISHAPS WHICH RESULTED IN LOST TIME; PROPERTY DAMAGE OF $10K OR GREATER.

10) ANY MISHAP WHICH RESULTED IN A LESSON LEARNED THAT MAY AFFECT GOVERNMENT CONTRACTS OR AFFECT A NEW OSHA STANDARD.

ALL SIGNIFICANT CONTRACTOR MISHAPS SHALL BE REPORTED BY THE CONTRACTOR TO THE CONTRACTING OFFICER WITH CONTRACT OVERSIGHT RESPONSIBILITY WITHIN 24 HOURS AND INVESTIGATED BY AN APPROVED QUALIFIED ACCIDENT INVESTIGATOR. A QUALIFIED ACCIDENT INVESTIGATOR MUST HAVE SUCCESSFULLY COMPLETED A NAVFAC APPROVED ACCIDENT INVESTIGATION COURSE. REPORTS SHALL BE PROVIDED TO NAVFACHQ, VIA THE RESPONSIBLE (EFD/EFA/PWC/CBC) WITHIN 30 DAYS.

C. TIER THREE - GENERAL CONTRACTOR MISHAPS - ANY MISHAP NOT MEETING THE ABOVE DEFINITIONS OF SERIOUS OR SIGNIFICANT MISHAPS. GENERAL MISHAPS SHALL BE INVESTIGATED BY THE CONTRACTOR AND A REPORT PROVIDED TO THE CONTRACTING OFFICER WITHIN FIVE WORKING DAYS.

4. SPECIFIC PROCEDURES WILL BE FORTHCOMING AND WILL BE INCLUDED IN NEXT REVISION OF NAVFACINST 5100.11.

5. NAVFACENGCOM POC'S ARE CRAIG SCHILDER (FAC-40K) DSN 221-0435 AND SHELIA DAVIDSON (FAC40K4) DSN 564-5193.//

BT
#8591
NNNN
DLVR:PWC PEARL HARBOR HI(1)...ACT
CF(1)...ACT FOR PACNAVFACENGCOM PEAR(10)
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505(1) 09P(1) 09B(1) 09A(1) 09(1) 04(1) 02(1) 01(1) 00(1)
RTD:000-000/COPIES: