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REGULATIONS for SNORT LIQUID-PROPELLED SLEDS

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SAFETY REGULATIONS FOR
SNORT LIQUID-PROPELLED SLEDS

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SAFETY REGS LIQUID-PROPELLED SLEDS

FORWARD

The safety rules and regulations set forth in this manual prescribe methods and practices for insuring continuity of production, safeguarding personnel, and preventing property damage.

The mandatory requirements and advisory provisions set forth in this manual apply to the Supersonic Track Division and the WDC facility, where the Test Department is charged with the responsibility for safety.

Federal contractors and visitors are required to conduct their activities in accordance with these prescribed and posted regulations. Any recommended deviation from prescribed methods are required to be submitted in writing.

JAMES P. JUDIN
Head, Supersonic Track Division

Approved by
J. D. DeSAMTO
Test Department Safety Director

SAFETY REGS LIQUID-PROPELLED SLEDS

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SAFETY RECS LIQUID-PROPELLED SLEBS

MIXING JPX

1. Personnel limits shall be posted to restrict the number of persons in the area at one time to four (two operators and two transients).

2. Protective clothing consisting of Greylite coveralls, hood, boots, special handling gloves and respiratory protection must be worn by all personnel in the storage area when mixing operations are in progress. Respiratory protection must consist of either air line fed hood, Scott Air-Pac, or Chemox breathing apparatus.

3. All equipment must be earth grounded prior to loading or mixing, and above-ground continuity must be established between each piece of equipment before loading.

4. The Baker flag must be raised prior to loading or mixing operations.

5. JPX contact with air must be kept to a minimum by flushing all containers with dry nitrogen and maintaining a blanket of nitrogen throughout the mixing and transfer processes. Containers must be completely free of water prior to transferring UDMH or JPX. (See Appendix A for a discussion of the Characteristics and Properties of Fuels.)

6. Always put JP-4 into the mixing containing before the UDMH.

7. The fuel will be mixed by the operating crew in accordance with the operating manual for the SNORT Liquid Engine.

8. Care must be taken to relieve any pressure that may have developed by slowly loosening the plugs on the drums of UDMH.

9. All empty drums of UDMH must be flushed thoroughly with water and steamed to remove the last traces of UDMH. If steaming is impractical, a gallon or so of water must be left in the drum after washing.

10. All empty drums of JPX must be flushed with dry nitrogen.

11. In case of spillage the area must be washed down with water. In the event JPX or UDMH splashes on the protective clothing, this clothing must be washed under the shower immediately and

SAFETY REGS LIQUID-HANDLED SILKS

again prior to removing protective clothing in order to prevent contact with chemicals. Contaminated clothing must not be worn again until checked by the Safety Division.

12. Foam-type extinguishers should never be used on JPX or UDMH fires.

MIXING ANILINE AND FURFURAL

1. Personnel limits shall be posted to restrict the number of persons in the area at one time to four (two operators and two transients).

2. Protective clothing consisting of Greylite coveralls, hood, boots, special handling gloves, and respiratory protection must be worn by all personnel in the storage area when mixing operations are in progress. Respiratory protection must consist of either air line fed hood, Scott Air-Pac, or Chemox breathing apparatus.

3. All equipment must be grounded prior to loading and mixing, and above-ground continuity must be established between each piece of equipment before loading.

4. The Baker flag must be raised prior to loading or mixing.

5. Aniline and furfural must be mixed and transferred only in a clean and closed system.

6. Only equipment necessary for the handling and transferring of aniline and furfural will be allowed in the area. Empty containers must be removed from the area.

7. All containers that have been used for furfural or aniline must be flushed thoroughly with water until all traces of the liquid propellants have been removed before being moved to the storage area.

8. In case of spillage, the area must be washed down with water immediately.

9. If clothing becomes contaminated, the personnel with the contaminated clothing must leave the area after the clothing has been washed off under the shower, and remove the clothing. This clothing must not be worn again until checked by the Safety Division.

SAFETY REGS LIQUID-PROPELLED SLEDS

LOADING OF NITRIC ACID TRAILER

1. Personnel limits shall be posted to restrict the number of persons in the area at one time to six (four operators and two transients).
2. Protective clothing, consisting of Greylite coveralls, hood, boots, polyethylene gloves, and respiratory protection must be worn by all personnel in the loading area where loading or unloading operations are in progress. Respiratory protection must consist of either air line fed hood, Scott Air-Pac, or Chemox breathing apparatus.
3. All equipment must be grounded prior to unloading or loading sled, and above-ground continuity must be established between each piece of equipment before loading or unloading.
4. The Baker flag must be raised prior to loading or unloading.
5. Inspection of the area must be made prior to loading or unloading, and all material not required for the operations must be removed to prevent contamination or reaction if the acid is spilled. (See Appendix B for further discussion of oxidizers.)
6. Care must be taken to relieve any pressure that may have developed by slowly loosening the plugs on the drums of acid.
7. Never use pressure to empty the drums of acid.
8. All empty drums of acid must be flushed thoroughly with water until all traces have been removed. Empty drums must be removed to the storage area.
9. Splashing or spillage of nitric acid, resulting in contamination of the area, must be washed down with large quantities of water and neutralized by spreading lime over the area.
10. In the event the protective clothing has been contaminated by the acid, this clothing must be washed off under the personnel safety shower immediately. Personnel with contaminated clothing must leave the area and remove the clothing. Do not enter the area until new clothing is procured. Contaminated clothing must not be worn again until checked by the Safety Division.

SAFETY REGS LIQUID-PROPELLED SLEDS

LOADING OF MISSILE AT LAUNCHING AREA

GENERAL

1. Personnel limits shall be posted to restrict the number of persons in the area at one time to six (four operators and two transients).
2. Protective clothing, consisting of Greylite coveralls, hood, boots, and respiratory protection must be worn by all personnel in the area designated by signs. In addition, special polyethylene gloves will be worn when transferring acid, JPX, or fural and aniline. Respiratory protection must be used, consisting of either an air line red hood, Scott Air-Pac, or Chemox breathing apparatus.
3. All equipment must be earth grounded prior to loading, and above-ground continuity must be established between each piece of equipment before loading.
4. The Baker flags in the breech area must be raised just prior to bringing fuel into the area.
5. All equipment used for transferring liquid propellants must be clean, and must be used only for the designated fuel or oxidizer.
6. The deluge system will be controlled from the blockhouse. This system will be turned on immediately if a fire starts at the breech or if a line or tank ruptures.
7. Accidental spillage or splashes occurring on protective clothing must be handled as described in trailer loading regulations.

SPECIFIC PROCEDURE

Liquid Loading Procedure

Call for the Slug.

1. Personnel transporting the slug must wear coveralls and rubber gloves.
2. Vehicles transporting the slug shall carry red flags and chemical signs.

SAFETY REGS LIQUID-PROPELLED SLEDS

Service Slug.

1. Personnel in coveralls and rubber gloves make connections of the slug container to the liquid sled.
2. Personnel in complete Greylite suits load the slug by gravity flow and disconnect the connections.
3. Personnel in coveralls and rubber gloves remove the empty slug container from the breech area.

Call for JPX.

1. Personnel transporting the JPX will wear coveralls and rubber gloves.
2. Vehicles pulling the JPX trailer shall carry red flags and chemical signs.

Service JPX.

1. Personnel in coveralls and rubber gloves will position trailer and make up the connections to the liquid sled.
2. Personnel in Greylite suits will pump the JPX into the sled and disconnect the connections.
3. Personnel in coveralls and rubber gloves shall remove the JPX trailer from the breech area.

Call for IRFNA(Inhibited Red Fuming Nitric Acid).

1. Personnel transporting IRFNA will wear coveralls and green acid gloves.
2. Vehicles pulling the acid trailer shall carry red flags and chemical signs.

Service IRFNA.

1. Personnel in complete Greylite suits shall make the necessary connections, pump the acid and remove the connections.
2. Personnel in coveralls and green acid gloves shall remove the acid trailer from the breech area.

SAFETY REGS LIQUID-PROPELLED SLEDS

Pre-Charging Checks.

Only personnel wearing coveralls and rubber or acid gloves may make the pre-charge checks.

General Loading Preparations.

1. Clear the breech area of all non-operative personnel.
2. Install decontamination trough and initiate the flow of water.
3. Install and check the operation of the two showers.
4. Install and put the garden hose (with water flowing from it) into the trough.
5. Install and check the operation of air lines to Greylite suits.
6. Install and have ready emergency breathing apparatus in the blockhouse. Have a man ready to go to the breech if necessary.
7. Have a fire truck and corpsman in standby.
8. Close all SNORT access gates and clear out all non-operative personnel in an area 200 ft radius from the breech.
9. Limit the number of vehicles in the breech area to one plus the necessary number to haul the liquid propellant.

Post Firing Operation.

1. Check the telemetering records for evidence of track shut-down.
2. Wait 15 minutes before approaching sled, to allow afterburn to burn out and acid cloud to disperse.
3. Approach sled with complete Greylite protection.
4. Disarm sled.
5. Unload acid into trailer with complete Greylite protection.
6. Unload JPX into trailer with complete Greylite protection.

SAFETY REGS LIQUID-PROPELLED SLEDS

7. Remove liquid sled to Assembly Building.
8. No smoking will be allowed near the sled at any time.

MISFIRES

1. Personnel must not approach the launching area until ten minutes after the sled accumulators and tanks have been completely vented to atmosphere.

2. Minor repair may be made without unloading the liquid propellant from the engine with the Range Engineer's permission. Only the Range Engineer or his designated representative will give this order.

3. Major repair will require the unloading of the liquid propellant. Remove the oxidizer first. Wash the sled and missile down with water, if it is felt that any splashes or spillage of the nitric acid has occurred.

4. Remove the oxidizer and flush the containers with nitrogen gas. The area must be washed down if any spillage or splashes occur.

5. A water truck must be available for immediate use at all firings in case a flame out or rupture occurs downrange. The same precaution will be observed as in a misfire, and the water trucks must be available for immediate washing down of the area.

Appendix A

CHARACTERISTICS AND PROPERTIES OF FUELS

JP-4

Characteristics. JP-4 is a blend of gasoline and kerosene with a closed cup flash point at 30° F at 0.8% to 6.2% in air. The vapors of this fuel are heavy and will roll along the ground a great distance before dissipating--therefore, keep the containers covered.

Behavior in Fire. JP-4 will burn, releasing flammable vapors which self-propagate the flame in the presence of air or oxygen.

Action of Detonators on Material. JP-4 is insensitive to mechanical shock. However, if the container is ruptured by detonation the escaping fuel may form a mist which would be highly flammable and/or explosive.

Effect of Storage. JP-4 is comparatively non-hygroscopic but should not be stored with oxidizing materials, because this will increase the fire and explosive hazard of the material.

Transferring. In transferring JP-4 from one container to another the containers must be grounded to each other and then to an earth ground. These containers must be clearly marked to show what they contain.

Fire. In case of fire, use water in the form of fog, never in a solid stream--this only spreads the fire. Other methods may be used such as foam, CO₂, or chemical.

UDMH AND JPX

Characteristics. Unsym-dimethylhydrazine, referred to as UDMH and known as JPX when mixed with JP-4, is a corrosive fuming liquid which is highly flammable and explosive when mixed with air. The vapors of this material are toxic and have a sharp ammoniacal or fishy odor.

Health Hazard. Exposure to moderate or heavy concentrations of the fumes produce irritation of the nose and throat, and an itching and burning sensation of the eyes. Mild concentrations of the vapors are not evident at the time of inhalation but the ill effects appear three to four hours later. This fact makes it very

SAFETY REGS LIQUID-PROPELLED SLEDS

important that all precautions in handling the fuel be observed and personnel protective clothing worn.

Behavior in Fire. UDMH and JPX burn evenly and smoothly in normal atmosphere but will evolve hydrogen which may react explosively with oxygen.

Action of Detonators on Material. A detonation test on hydrazine showed that it cannot be exploded by a No. 8 blasting cap and resists mechanical shock.

Effect of Storage. UDMH is presently shipped in 55-gallon drums, fabricated of Type 304 stainless steel. The drums are fitted with Teflon gaskets and are nitrogen padded. It is recommended that drums of UDMH remain sealed, just as received, pending need for transfer of their contents. The drums must be stored on end with the bung (plug) on top to prevent leakage around the threads. Periodic inspection should be made, and if any leaks are discovered transfer the material into good drums.

Transferring. If the drum is to be emptied in a single operation, venting during withdrawal can be done simply by returning the drum to a horizontal position with the discharge connection in the end opening and loosening or removing the plug from the side opening. The empty drum must be steam cleaned thoroughly. If it is not possible to steam clean the drum, flush it with water, leaving one gallon of water in the drum and replacing the plugs.

If the drum of UDMH is partially emptied, the vapor space must be covered with an atmosphere of nitrogen. The receiver for UDMH, such as the tank trailer containing JP-4, must be blanketed with nitrogen to eliminate the explosive hazard, and all equipment grounded. All containers of UDMH or JPX must be clearly marked to indicate what they contain. Personnel protective clothing must be worn.

Fire. In case of fire, use water in the form of fog, never in a solid stream--this only spreads the fire. Carbon dioxide (CO₂) is also effective in fighting UDMH and JPX fires. Chemical foams are not recommended since UDMH seems to deactivate the foam by forming a crust and rapidly destabilizing the foam. Personnel protective equipment, listed below, must be worn.

Personnel Protection. In performing all operations involving the handling or transferring of UDMH or JPX, complete Greylite suit with hood, boots, and red acid handling gloves must be worn. The use of respiratory protection is mandatory when operating at

SAFETY REGS LIQUID-PROPELLED SLEDS

pressures above standard atmosphere. This may be by air line fed hood, Chemox breathing apparatus, or Scott Air-Pac.

Decontamination. All leaks, spillage or unburned UDMH and/or JPX must immediately be washed down with water to reduce the fire and health hazard.

First Aid. (a) Contaminated skin should be washed immediately with large amounts of fresh water, followed by an application of 3% boric acid paste. (b) A contaminated eye should be washed out immediately with boric acid solution using an eye cup. (c) Personnel overcome by toxic fumes should be removed immediately from the contaminated area to fresh air. Give artificial respiration if needed and use an ammonia capsule if unconscious. Call an ambulance immediately (phone 7-2911).

ANILINE

Characteristics. Aniline is a colorless oily liquid which rapidly turns brown when exposed to light. It is flammable, toxic, and noncorrosive. It is used with acid to aid in propulsion, and has a flash point of 168° F (closed cup).

Health Hazard. Aniline is toxic. Ill effects can be caused by inhalation of the fumes or vapors, by ingestion, and absorption through the skin. More than five parts of aniline vapors per million parts of air per working day is likely to produce chronic aniline poisoning.

Symptoms. (a) Intoxication, weakness and prostration, coldness and numbness of the skin, blueness of the lips, and decrease in the powers of perception. In addition, there is frequently shortness of breath, and in some instances cessation of breathing and death.

(b) The chronic form of poisoning, as a result of repeated exposures to mild concentrations, is headaches, digestive disturbances, and ringing in the ears.

(c) More severe forms of chronic poisoning generally show weakness in the limbs, disturbances of senses, rapid pulse rate and often blueness of the skin, and difficult labored breathing.

Behavior in Fire. Aniline will burn in normal atmosphere, and this rate increases when in contact with oxidizers.

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Action of Detonators on Material. Aniline is not sensitive to mechanical shock. Information concerning the effect of detonators is not available at this time.

Effect of Storage. Aniline is quite stable and will remain usable for a long period of time, if properly stored out of the sun's rays. It will freeze at 22° F and should be protected accordingly. Due to its fire properties and personnel hazards, periodic inspections should be made of the storage area to discover any leaks in the containers.

Transferring. Aniline should be transferred in a clean, and preferably closed, system. Aniline must not be permitted to come near any oxidizers, and all equipment, containers, and receivers must be grounded. Empty containers must be flushed out with water and stored in a prescribed area. During the transfer operation, personnel protective clothing must be worn.

Fire. In case of fire, use water in the form of fog, never in a solid stream--this only spreads the fire. Chemical or foam may also be used to fight aniline fires.

Personnel Protection. In performing all operations involving the handling or transferring of aniline, complete Greylite suit with hood, boots, and red acid handling gloves must be worn. The use of respiratory protection is mandatory when operating at pressures above standard atmosphere. This may be by air line fed hood, Scott Air-Pac, or Chemox breathing apparatus.

Decontamination. All leaks, spillage, or unburned aniline must be immediately washed down with water to reduce the fire and health hazard.

First Aid. (a) Contaminated skin should be washed immediately with large amounts of fresh water, followed by an application of 5% acetic acid solution.

(b) A contaminated eye should be washed out immediately with boric acid solution using an eye cup.

(c) A contaminated ear should be washed with 3% acetic acid solution.

(d) Personnel overcome by toxic fumes should be removed immediately from the contaminated area to fresh air. Give the individual artificial respiration if needed and use an ammonia capsule if he is unconscious. Call an ambulance immediately (phone 7-2911).

FURFURAL ALCOHOL

Characteristics. Furfural alcohol is a straw yellow to dark amber liquid which is flammable and has a brine-like odor. It is used with acid to aid in propulsion and has a flash point of 167° F (closed cup).

Health Hazard. Furfural alcohol is not classed as a toxic, but is a local skin irritant if allowed to remain in contact with the skin.

Behavior in Fire. Furfural alcohol will burn like kerosene, and this rate increases when in contact with oxidizers.

Action of Detonators on Material. Furfural alcohol cannot be detonated.

Effect of Storage. Furfural alcohol is quite stable in a closed container, but may darken with age. Closed vessels containing furfural alcohol at temperatures above 162.5° F will have an explosive mixture of vapor and air over the liquid. Due to its fire property, periodic inspection should be made of the storage area to check for any leaks in the containers.

Transferring. Furfural alcohol should be transferred in a clean system and must not be allowed to come in contact with any oxidizer. Due to its fire property, all equipment must be grounded. Empty containers must be flushed out with water and stored in a prescribed area. During the transfer operations, personnel protective clothing must be worn.

Fire. In case of fire, use water in the form of fog, never in a solid stream--this only spreads the fire. Foam or CO₂ extinguishers may be used to fight furfural alcohol fires.

Personnel Protection. In handling furfural alcohol, acid goggles and red acid handling gloves must be worn. If personnel are not equipped with Greylite suits for handling other acids or fuels and are handling only furfural alcohol, the use of flame-proof coveralls is sufficient.

Decontamination. All leaks, spillage, or unburned furfural alcohol must be washed down immediately with water to reduce the fire hazard.

First Aid. Remove contaminated clothing and wash contaminated skin with fresh water immediately.

SAFETY DATA SHEET LIQUID-PROPELLED MISSILES

Appendix B

CHARACTERISTICS AND PROPERTIES OF CHEMICALS

NITRIC ACID

Characteristics. These acids are liquid, varying in color from water white to reddish brown, depending upon the amount of dissolved nitrogen oxides. White fuming acid becomes amber to brown upon exposure to light. Nitric acid vapors have a sweet to acrid odor and are harmful to human life. It does not burn but is a strong oxidizer, which, when in contact with wood or certain organic materials, may cause a fire.

Health Hazard. Nitric acid vapors are extremely toxic and will produce burns on any of the body tissues with which it comes in contact. Nitric acid, in addition, when contaminated with any organic material, many metals, and oxygen, produces toxic vapors or gases called oxides of nitrogen.

Symptoms. (a) Skin contact with concentrated solutions of nitric acid for any appreciable period of time results in severe burns. Death of tissues may result, with clotting of the blood vessels and subsequent scarring and deformity.

(b) Contamination of an eye with nitric acid may result in a severe burn and destruction of the tissues of the eye, with subsequent blindness.

(c) Inhalation of nitric acid fumes will cause destruction of the tissues in the mouth, nose, throat, respiratory passages, and lungs. The inhalation effect of the oxides of nitrogen are most important, as acute fatal poisoning can be produced with little or no warning to the victim at the time. Several hours after the exposure, a sensation of choking and a spasmodic cough develop. There is a feeling of burning in the chest, accompanied by difficulty in getting the air in and out of the lungs. In severe cases, the above symptoms are increased in intensity together with the accumulation of fluid in the lungs, and the development of pneumonia, the latter frequently being fatal. In other instances, inhalation of oxides of nitrogen presents a distinctly different appearance--one type causes sudden death from respiratory failure; another type produces marked lowering of the blood pressure, accompanied by a feeling of faintness, dizziness, loss of consciousness, and frequently terminates fatally. Inhalation of mild concentrations of oxides of nitrogen over a long period of time can produce yet

another type of poisoning. It is characterized by wearing down and decay of the teeth, dilatation of the lungs, chronic irritation of the breathing passage, a slow pulse rate, and lowering of the blood pressure. In addition, ulceration of the membranes of the nose and mouth are frequently encountered.

Behavior in Fire. When heated, nitric acid will evolve poisonous fumes and actively supports combustion.

Action of Detonators on Material. Nitric acid cannot be detonated. However, in contact with organic material or ammonia, explosive compounds may be formed.

Effect of Storage. (a) Nitric acid has an appreciable vapor pressure which increases with the amount of dissolved nitrogen oxide, thus the storage containers should be protected from the direct rays of the sun. Upon exposure to light, nitric acid decomposes slightly to water and nitrogen oxide, and white fuming acid will change in color from amber to brown. Under normal storage conditions, nitric acid is stable and can be stored for long periods of time.

(b) Mixed acid may form a heavy sludge when stored in steel containers, and this sludge, if present in too large a quantity, may introduce difficulties in using the acid as an oxidizer for propellant systems. Care must be taken in choosing containers because certain metals react violently with nitric acid. Aluminum and stainless steel are applicable in the storage of certain types of nitric acid.

(c) When nitric acid is stored in drums, the following regulations apply:

1. Store with the plug up to prevent leakage.
2. Keep the drums out of the sun.
3. Relieve internal pressure when the drums are received and at least weekly thereafter, by slowly loosening plug. Retighten the plug immediately. During the summer months it is necessary to relieve the pressure twice weekly.
4. Never use pressure to empty the drums.
5. The storage area must be kept clear of all combustible and organic material.
6. Spillage must be washed down immediately and neutralized with lime.

GREYLYTE LIQUID-PROPYLENE GLASS

Transfer. Use manual pumps of corrosion-resistant material for the transfer of nitric acid. Pipelines should be of suitable corrosion-resistant material. Special care must be observed to prevent the use of valves, gages, or fittings of metals that react with nitric acid. Threaded fittings should be avoided where possible and flanged joints used instead. The flanged joints should be provided with shields to protect against leaks and splashes resulting from gasket failures. Never use pressure to transfer acid from the drums. On completion of transfer, the empty drums must be washed out before being returned, and the plugs replaced.

CAUTION: (a) Nitric acid and mixed acids are soluble in water in all proportions. The large amount of heat released when these acids dissolve in water may cause spattering and the evolution of fumes unless precautions are taken to allow time for heat dissipation.

(b) Only approved handling equipment and tools should be used with nitric acid, as certain vinyl compounds will react explosively with nitric acid.

(c) All equipment that has been exposed to nitric acid must be washed with fresh water.

(d) Avoid rough handling or striking of the containers containing nitric acid to prevent puncture and rupture.

(e) Personnel protection equipment must be used at all times while handling nitric acid.

Fire. Nitric acid does not burn by itself, but will when combined with wood or certain organic materials, and these materials will feed the fire. The nitric acid, acting as an oxidizer, will release heat and poisonous fumes; therefore, great care must be used in fighting these fires. Water in the form of fog should be used, and personnel protection equipment is necessary.

Personnel Protection. In performing all operations involving the handling or transfer of nitric acid, complete Greylite suit with hood, boots, and green acid handling gloves must be worn. The use of respiratory protection is necessary. This may be by air line fed hood, Scott Air-Pac, or Chemox breathing apparatus.

Decontamination. In case of spillage or deposits of unburned nitric acid, wash down the area with large amounts of fresh water and then neutralize by spreading lime over the area.

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First Aid. (a) Contaminated skin must be thoroughly washed with fresh water, followed by an application of a saturated solution of sodium bicarbonate.

(b) A contaminated eye must be flushed promptly and copiously with fresh, cool water, or 2% solution of sodium bicarbonate, whichever can be reached first, the latter being preferable.

(c) Individuals showing evidence of exposure to nitric acid fumes, or oxides of nitrogen, must be removed immediately from the area of concentration, and, if necessary, given artificial respiration.

(d) In all cases of exposure or contact with nitric acid, obtain medical attention immediately.

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1 Code 3001, Associate Head, Test Department
2 Code 30037, Editorial Branch, Test Department
1 Code 301, Head, Project Engineering Division
1 Code 303, Head, Assessment Division
1 Code 304, Head, Instrument Development Division
1 Code 305, Head, Projectile Range Division
1 Code 306, Head, Instrument Operations Division
10 Code 307, Head, Supersonic Track Division
30 Code 3072, Head, Track Operations Branch
3 Code 308, Head, Missile Range Division
1 Code 35, Head, Aviation Ordnance Department
1 Code 40, Head, Weapons Development Department
1 Code 4013, Head, Propulsion Research Branch
1 Code 45, Head, Propellants and Explosives Department
1 Code 50, Head, Research Department
1 Code 55, Head, Engineering Department
1 Code 75, Head, Technical Information Department
1 Code 751, Head, Publishing Division
1 Code 7522, Head, Development Branch
4 Code 753, Head, Technical Library
1 Code P80962, Head, Pasadena Annex Library
5 Code 8580, Head, Safety Division

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