

# Radiator Repair

1985

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A Safety Support Pamphlet



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RADIATOR REPAIR

A SAFETY SUPPORT PACKET

## Industrial Safety Fact Sheet

SUBJECT: Accident Prevention in Radiator Repair Operations

1. The National Safety Council estimates the value of goods and services each worker must produce to offset the cost of work injuries is \$350. In 1985 work injuries in the United States cost \$37.3 billion. According to the National Health Interview Survey, more than 13 percent of all accidents occurred in industrial places. This equates to approximately 9 million injuries per year.
2. Injuries, death, and disability are the results of accidents. Costs combined with worker pain, disability, and loss of life emphasize the importance of accident prevention on all levels of industrial maintenance operations.
3. Accidents from PMCS, removing caps from hot radiators, organizational radiator servicing, and DS/GS radiator repair operations are numerous and can occur at any level. Most accidents are caused by improper materials handling, lack of knowledge and training, failure to use protective equipment when handling acids, and many others.
4. Use of protective equipment, proper training in all radiator procedures, use of technical manuals and manufacturers equipment instructions, awareness of hazardous materials used, compliance with safety and OSHA requirements, teamwork, and individual awareness are necessary for effective control of unnecessary accidents, injury, and death.
5. Good judgment and proper supervision of subordinates are instrumental in accident prevention. Incidents of back injuries from improper lifting, exposure from failure to use the proper type of protective equipment or poor maintenance of equipment, eye and skin burns from improper soldering or welding operations can be avoided by controlling hazardous conditions, educating workers, and by following established guidelines. No one can prevent accidents like you can!

## Tailgate Sessions

### Short Safety Briefings for Radiator Repair Personnel

What is a tailgate session? Tailgate sessions got their name from employees sitting on the tailgate of a truck while receiving a short safety briefing for an upcoming job.

The use of this type training for maintenance personnel has obvious advantages:

- . It shows safe performance is one of the work standards.
- . It allows sharing of safety information about upcoming jobs.
- . It can be done with minimal planning during nonpeak work hours.
- . It shows supervisory support of safe activities.
- . It can be keyed to specific individuals or work groups without requiring entire unit participation.
- . It lends authenticity to the safety program by keying on the job at hand and therefore avoids generalization.
- . It raises safety awareness level of personnel.

### Implementation

- . Identify topics that are pertinent to the unit's maintenance activities (see list of additional tailgate topics for recommendations).
- . Develop hip-pocket tailgate sessions on selected topics.
- . Distribute tailgate sessions to supervisors and discuss when and where they are to be used (sessions are included in this kit).
- . Have individuals from the command group or element occasionally conduct tailgate sessions to reiterate and reinforce their concern for safety.
- . Continually revise and update the tailgate sessions to ensure applicability.

## RADIATOR FLOW TESTING

When handling recently turned in radiators, workers should be careful to minimize exposure to antifreeze (ethylene glycol) that may be trapped or leaking out of a radiator.

Radiator cleaning has three purposes: to restore perfect radiation, to facilitate soldering, and to remove obstruction to water circulation. Various chemical salts and dirt found in the water of different locations and grease and oil find their way into the cooling system. These elements clog the circulation and overheat the engine. Before the radiator is cleaned, it is generally flow tested to determine the extent of obstruction.

When performing flow testing operations, workers should be careful when adjusting the flow rate. If you accidentally push the lever too far, or input too much pressure, water may shoot out of the top of the radiator. This water may contain diluted antifreeze and dirt particles which may be irritating to the eyes.

## RADIATOR PRESSURE FLUSHING

Pressure flushing forces water by air pressure (approximately 5 psi) through the water passages of the radiator core. This is generally performed in two ways: direct flushing (water is forced through from top to bottom) and reverse flushing. The same equipment is used in both operations - water pressure, air pressure, a flushing gun, and occasionally, a solvent or cleaner. These methods are generally used to clean out radiators that are not too badly clogged.

Air pressure hoses should always be used at the acceptable psi for the job. Horseplay and too much air pressure can cause injury. Additionally, workers should be aware of the hazards of all cleaning solvents and materials used within their job in order to minimize unnecessary injury. Manufacturers instructions should be followed.

Any required protective equipment should be worn. It is always a good idea to wear safety shoes, gloves, aprons, and goggles for several reasons. Safety shoes keep the worker from slipping on wet floors or injuring feet if something falls on the foot. Goggles keep water, cleaning solvents, and dirt from entering the eye. Gloves and aprons not only protect the skin from substances that may cause irritation but keep the workers from getting their clothing wet.

## BOILING OUT RADIATORS

If pressure flushing is not successful in removing radiator obstructions, the radiators are generally boiled to remove trapped dirt and sediment. Another stage of the process involves cleaning the outside of the radiator with air and water pressure to clean off bugs, dirt, and other debris. Safety goggles and face shields should be utilized to prevent these materials from entering the eye. The interior of the radiator is back flushed with air pressure and water.

The cleaning solution in which the radiator is boiled may be a commercial or Federally procured chemical. Manufacturers instructions should be followed when using all cleaning chemicals. Protective equipment used should be appropriate for the particular solvent used. Safety goggles and face shields will prevent foreign materials from entering the eyes. Clothing should be appropriate to minimize skin exposure to chemicals. Protective gloves will protect the hand from solvent irritation and possible injury from sharp edges on the radiator. Special tools should be used to lift radiators out of boiling vats and personnel should never touch hot radiators or lean against boiler units.

## RADIATOR ACID BATHS

Most facilities use this method instead of the previously mentioned boiling process. Large vats or dip tanks are filled with heated sodium hydroxide, an extremely corrosive material. This solution removes old paint, sludge, and other radiator obstructions. Workers performing this operation are required to wear safety goggles, face shields, rubber gloves, rubber aprons, and are required to have immediate access to eyewash and deluge shower facilities. The vats or dip tanks should have ventilation sufficient to remove the vapors. Respirators are also required when handling the powder form or in areas of high vapor.

Tongs and other tools are to be used in handling and removing heated radiators from the tank. These dip tanks are also required to have such items as automatic cover closing devices and must be constructed in accordance with certain OSHA criteria for dip tanks. Other OSHA requirements depend upon the size of the tank.

Tank locations should be away from sources of heat, spark, and open flame. Tank lids should always be closed when not in use and only authorized and trained personnel should be allowed access to this operation.

## TESTING AND REPAIRING RADIATOR LEAKS

The usual method for leak testing radiators is to fill the radiator with air and place it in a tank of water. Bubbles coming from the radiator indicate leaking areas. Sometimes water conditioners are added to the water to help detect the presence of leaks or to neutralize ethylene glycol (antifreeze) residue.

As mentioned previously, workers must be aware of all chemicals used in their operation to include cleaning and water conditioning materials. Protective equipment must be suitable to protect the worker from hazards. Protective goggles, gloves, and other items of protective equipment are always a good idea to prevent skin exposure and prevent chemicals of any kind from entering the eyes. Even if chemicals used are not hazardous, certain allergic reactions and cuts may still be prevented from use of protective equipment.

## RADIATOR DISASSEMBLY

Radiator disassembly is performed in a variety of ways. The usual method involves heating certain areas of the side members with a heating torch to melt solder holding the pieces together. Sometimes air is used to blow away the pieces of molten solder. When performing this operation, goggles or face shields should be worn to prevent molten solder from entering the eye. Additionally, precautions should be taken to prevent this hot solder from being blown on other people. Gloves should be worn to prevent burns to the hands when handling hot metal and to prevent accidental cuts or jagged metal edges during handling. Protective equipment can't protect you if it isn't used. Accidents always seem to happen the one time the worker forgets to use it.

Appropriate tools should be used to remove parts such as the filler neck and baffle plate. Slip joint pliers and other appropriate tools should be used carefully and maintained to prevent slippage and injury.

## REPAIRING RADIATOR LEAKS

The most common methods of patching radiator leaks is through soldering and welding. During the soldering process, old solder is heated and removed and the seam is then flushed with muriatic acid. The acid is then heated until it boils on the surface in order to remove all dirt and oxides which prevent good solder bonding. The hazards of this process are not only the heating of metal but the handling of acids, heating of acids, and the blowing away of residual acid with an air hose. Protective equipment should protect the worker from hot metal and molten solder, but most importantly, contact with the acid. Precautions must prevent the acid from being blown at other workers.

Welding and brazing operations should be accomplished in a well-ventilated area by trained personnel who are attired in the proper protective equipment for their type of operation, to include eye protection. Welding areas should be located away from flammable vapor areas.

Solder, brazing flux, and other items are used during routine operations. Workers should be aware of the hazards of each material used. Safety data sheets are required to be maintained on all chemical items used in the operation. Brazing flux, certain types of solder, etc., contain materials that give off vapors during the heating process. Workers must be adequately protected against inhaling vapors.

REMEMBER: ACCIDENTS ALWAYS HAPPEN TO THE OTHER GUY. TO EVERYONE ELSE, YOU ARE THE OTHER GUY. NO ONE CAN PREVENT ACCIDENTS LIKE YOU CAN!

## List of Additional Tailgate Topics

Inspection of Lifting Devices IAW TB 43-0142

Submitting DA Form 2028 on TM

Submitting QDR/EIR On Equipment and Tools

Unit SOP Requirements (DA Pam 750-35)

First Aid

Necessity for Inspection of Components

Fire Prevention

When and When Not To Improvise

Using TMs—How to Get, Use, Change (DA Pam 25-30)

Ground Guides In and Around Motor Pool, Track Park, and Maintenance Shop

Prejob Checks

After Job Checklists

How to Inspect Tools

Protective Equipment

Material Hazards

## Radiator Safety Checklist

1. Are hazardous materials safety data sheets available on all chemicals used in the operation? (29 CFR 1910.1200)
2. Are these data sheets readily available to workers? (29 CFR 1910.1200)
3. Are deluge showers and emergency eyewashes available in acid tank area? (29 CFR 1910.151(c))
4. Is protective clothing; i.e., face shield/chemical goggles, safety shoes, gloves, aprons, provided and worn? (29 CFR 1910.132(a))
5. Are written SOPs governing the selection and proper use of respirators available? (29 CFR 1910.134(b)(1))
6. Are respirators selected on the basis of hazards to which the worker is exposed? (29 CFR 1910.134(b)(2))
7. Are the users instructed and trained in the proper use of respirators and their limitations? (29 CFR 1910.134(b)(3))
8. Are respirators thoroughly cleaned and disinfected after each use. (29 CFR 1910.134(b)(5)); TB Med 502, para 2-8)
9. Are personnel who use respirators given a physical examination to determine if they are physically able to perform the work and use this equipment? (29 CFR 1910.134(b)(10))
10. Are personnel given proper instruction and training concerning potential dangers associated with their daily task? (29 CFR 1910.94(d)(9))
11. Are personnel given proper protective clothing in accordance with the hazard involved? (29 CFR 1910.94(d)(9))
12. Have personnel been properly trained for use of the PPCE provided? (29 CFR 1910.94(d)(9))
13. Are fire extinguishers maintained and in a designated area at all times? (29 CFR 1910.108(g)(1))
14. Is the work area kept in a clean and orderly condition? (29 CFR 1910.22(a))
15. Are color code markings used properly? (29 CFR 1910.144 and AR 385-30)

16. In the use of cleaning solvents, because of their possible flammability and toxicity, are manufacturers' instructions for use and precautions followed?  
(29 CFR 1910.252(f)(11))
17. Are dip tanks (containing combustibles and flammables) constructed of noncombustible material and are the supports made of heavy metal, reinforced concrete, or masonry? (29 CFR 1910.108(c)(1))
18. Are dip tanks (containing combustibles and flammables) in excess of 150 gallons in capacity equipped with at least a 3-inch overflow pipe leading to an outside area? (29 CFR 1910.108(c)(2)(i and ii))
19. Are dip tanks (containing combustibles and flammables) in excess of 500 gallons equipped with bottom drains at least 3 inches in diameter which may be automatically or manually drained from a safe distance in the event of fire?  
(29 CFR 1910.108(c)(3))
20. Do dip tanks in excess of 150 gallons (combustibles and flammables) capacity have automatic fire extinguishing facilities? (29 CFR 1910.108(c)(5))
21. When combustible or flammable dip tank solvents are heated by artificial means or by dipping of heated parts, is the temperature kept at least 50 degrees below the solvent flashpoint temperature? (29 CFR 1910.108(c)(7))
22. When using flammable solvents, are sources of heat, spark, and flame kept away from the vapor area? (29 CFR 1910.108(c)(7)(e))
23. Is combustible debris removed from the dip tank area and are solvent soaked rags disposed of in approved metal waste cans? (29 CFR 1910.108(f)(1 and 2))
24. Are solvent waste cans mentioned above emptied daily?  
(29 CFR 1910.108(f)(2))
25. Are periodic inspections made on dip tank, dip tank covers, pipes and drains, electrical wiring, ventilation, and fire extinguishing equipment in and around the dip tank area? (29 CFR 1910.108(f)(3))
26. Is smoking prohibited in the vapor area of the dip tank and is the area posted as such? (29 CFR 1910.108(f)(4))
27. Are dip tank covers constructed of noncombustible or tin-clad material and do covers have automatic/manual closing devices in the event of fire? (29 CFR 1910.108(g)(6)(i and ii))
28. When using compressed air for cleaning purposes, is the pressure reduced to less than 30 psi and are chip guarding and protective goggles/equipment used?  
(29 CFR 1910.242(b))

29. Are procedures and protective equipment monitored by an industrial hygienist to ensure adequate worker protection? (29 CFR 1910.1000)

30. Are the dip tank covers kept closed when not in use? (29 CFR 1910.108(g)(6)(iv))

HAZARDOUS MATERIALS  
USED IN RADIATOR  
REPAIR AND MAINTENANCE OPERATIONS

This listing details some typical chemical materials used by maintenance facilities to repair and maintain radiators. Due to the number of chemicals used within the Army, it is not possible to list all of them. Items having a Federal Stock Number (FSN) can be located in the DOD Hazardous Materials Microfiche 6050.5-LR (can be ordered on 12 series publications requisition) in order to evaluate hazards, storage, and personal protective equipment requirements. If the material does not meet the description on the microfiche, is omitted from the microfiche, or is a local purchase item, hazardous materials safety data sheets should be obtained from the procurement source or manufacturer.

Safety data sheets are required to be maintained on all potentially hazardous chemicals used in the operation. These are to be accessible to all workers or within 1 hour of supervisor notification. This is required by 29 CFR 1910.1200. These data sheets are to be used by the supervisor to make informed decisions concerning hazards, equipment, protective gear, and storage to ensure compliance with Federal standards.

## Sodium Hydroxide

Hazard class: Corrosive.

Safety precautions: Avoid contact with aluminum, strong acids, and many organic chemicals. A byproduct of reaction with materials, such as aluminum, results in emission of flammable hydrogen gas. This material is one of the most caustic alkalies used in industry. It is more corrosive to tissue because it combines with tissue proteins and fats to form gelatinous burns that are deep and painful.

Effects of overexposure:

- a. Skin/eyes: Extremely corrosive and causes serious burns.
- b. Ingestion: Vomiting, prostration, collapse, constrictive scarring.
- c. Inhalation: Severe respiratory tract damage.

Protective equipment: Keep containers tightly closed and avoid damaging them. Workers should wear chemical-proof goggles, rubber boots, rubber gloves, and an approved dust mask respirator. Eyewash, deluge shower facilities, and adequate ventilation are also required.

First aid: Contact medical assistance at once.

- a. Eyes: Flush with plenty of water for 15 minutes.
- b. Skin: Wash area with plenty of water. If clothing is contaminated, remove clothing.
- c. Inhalation: Remove from exposure and call a medical doctor.
- d. Ingestion: Give water or milk, then diluted vinegar or fruit juice. Do not induce vomiting.

Spill cleanup and disposal: Sweep up and recontainerize small spills. Remaining chemical should be neutralized with diluted acid. Do not add water. Considerable heat is generated when caustic soda and water are mixed. Boiling and spattering of caustic solution may result. Dispose of wastes in accordance with applicable Federal regulations. Do not dump into sewers, drainage, or water systems.

Ethylene Glycol  
(Antifreeze)

Hazard class; Not regulated, but considered moderately hazardous.

Safety precautions: Keep away from strong oxidizing agents. Some forms may ignite in air at 775 degrees F. Keep containers closed to prevent moisture from entering.

Effects of overexposure:

- a. Skin/eyes: Irritation/pain/some case of corneal damage.
- b. Inhaling: Dizziness, headache, pulmonary edema.
- c. Ingestion: Nausea, vomiting, coma, death.

Protective equipment: Mechanical ventilation is needed in areas where high concentrations of vapors exceed allowable limits. In extreme cases, an air supplied mask respirator is needed. In areas where spills are likely, a shower and eyewash facility are required. All workers should wear protective safety goggles. Rubber gloves and clean clothing should be used when directly handling small amounts of the chemical. Personnel should always wash up before eating, smoking, etc.

First aid: Contact medical assistance.

- a. Skin/eyes: Remove contaminated clothing and wash skin with plenty of water. Eyes should be thoroughly flushed with plenty of water.
- b. Ingestion: Induce vomiting. Continue to induce vomiting until vomit is clear.
- c. Inhalation: Get worker to fresh air. Perform CPR, if needed.

Spills and disposal: Ventilate area of spill. Workers should wear protective clothing to suit the situation. Small spills can be cleaned up by using rubber gloves for protection. Wastes should be collected in a suitable container for reclamation purposes. Bulk wastes should never be dumped into sewage or drainage systems.

Black Lacquer Paint  
(Often used to paint repaired radiators)

Hazard class: None listed for transportation.

Item name: Vinyl Toluene Alkyd Enamel.

Safety precautions: Avoid exposure to heat, sunlight, spark, and open flame. Avoid prolonged exposure to vapor and mist. Store in an approved paint storage area.

Effects of overexposure: Inhalation of vapors can cause headache, dizziness, stupor, and vomiting. Intentional misuse by deliberately concentrating and inhaling vapors can be harmful or fatal.

Protective equipment: Ventilation should be adequate to minimize inhalation of vapors. In areas of extreme vapor concentration, a self-contained breathing apparatus may be needed. Generally, use of protective gloves is optional. Protective goggles are required. Clothing should be appropriate to minimize skin exposure.

First aid: Contact medical assistance.

- a. Eyes/skin: Flush with water for at least 15 minutes. Remove contaminated clothing and wash before reuse.
- b. Ingestion: Do not induce vomiting. Contact medics.
- c. Inhalation: Move to fresh air. Perform CPR, if needed.

Spills/disposal: Ventilate area, absorb with inert material, and place in authorized container. Do not flush into sewage system. Do not incinerate aerosol cans, place in trash compacters, or puncture the can.

Olive Drab Vinyl Alkyd Paint  
(Often used in painting repaired radiators)

Hazard class: None listed for transportation.

Safety precautions: Avoid contact with strong oxidizing agents, heat, sparks, and open flame. Do not store in areas above 120 degrees F. Store in approved paint storage areas and keep away from sunlight.

Effects of overexposure: Inhalation can cause irritation, dizziness, weakness, fatigue, nausea, headache, and possible unconsciousness.

Protective equipment: Rubber gloves, protective solvent resistant goggles, and proper ventilation are necessary. In areas where vapor concentration is above allowable limits, an approved supplied-air respirator is required. (For additional conditions and requirements in spray painting, see Table G-1, Technical Guide No. 144, Guidelines for Controlling Health Hazards in Painting Operations, U. S. Army Environmental Hygiene Agency. DASG-PSP-O, Aug 87.) Clothing should be appropriate to minimize skin exposure.

First aid: Contact medical assistance.

a. Inhalation: Move affected worker to fresh air and administer oxygen, if necessary.

b. Ingestion: Do not induce vomiting.

c. Skin/eyes: Flush area with large amounts of water and remove contaminated clothing. Flush eyes with water for at least 15 minutes.

Spills/disposal: Spills may be cleaned up with paper, floor absorbent or other absorbent material. The material should then be placed in a closed metal can away from sources of ignition. Do not puncture or incinerate aerosol cans. Dispose of IAW local, state, and Federal toxic substance regulations.

Olive Drab Flat Paint (Contains Lead)  
(Sometimes used in painting radiators)

Hazard class: None listed for transportation.

Safety precautions: Avoid contact with strong oxidizing agents and sources of heat, sparks, and open flame. Store in approved paint/flammable storage areas.

Effects of overexposure: Excessive inhalation of vapors can cause dizziness, weakness, nausea, headache, and unconsciousness.

Protective clothing: Mechanical and local ventilation must be adequate to keep vapors below allowable limits. When vapor concentrations are excessive, an approved supplied-air respirator is required. (For additional conditions and requirements in spray painting, see Table G-1, Technical Guide No. 144, Guidelines for Controlling Health Hazards in Painting Operations, U. S. Army Environmental Hygiene Agency. DASG-PSP-O, Aug 87.) During normal operations protective gloves, protective goggles, and clothing suitable to minimize skin exposure are required.

First aid: Contact medical assistance.

- a. Ingestion: Do not induce vomiting. Contact medics immediately.
- b. Eyes/skin: Flush with water.
- c. Inhalation: Move affected worker to fresh air and administer oxygen, if required.

Spills/disposal: Absorb small spills with paper, floor absorbent, or other similar materials and place in a closed metal container away from sources of ignition. Do not incinerate aerosol cans and do not dump wastes into drainage or sewage system. Paint collected on absorbent material will be disposed of IAW Federal, state, and local toxic substance regulations.

## Rosin Core Solder

Hazard class: Not required.

Effects of overexposure: Mucous membrane and skin irritation.

Safety precautions: Avoid breathing fumes when soldering.

Protective equipment: Use adequate ventilation and avoid breathing fumes.

First aid: Move victim from contaminated area to fresh air.

Spills/disposal: Flux may be wiped away with alcohol and a sponge.

## Acid Core Solder

Hazard class: Not regulated.

Effects of overexposure: Mucous membrane, skin irritation, dizziness, and headache result from inhaling vapors while soldering.

Safety precautions: Avoid breathing fumes when soldering.

Protective equipment: Use adequate ventilation and avoid breathing fumes.

First aid: Move victim from contaminated area to fresh air.

Spills/disposal: Flux may be wiped away with alcohol and a sponge.

Muriatic Acid  
(Hydrochloric acid)

Hazard class: Corrosive material.

Safety precautions: Keep container tightly capped and do not store in direct sunlight or near sources of heat. Avoid contact with poisons, metals (aluminum), strong bases, and steel magnesium. Contact with these items causes a reaction, with explosive hydrogen gas a byproduct.

Effect of overexposure:

- a. Skin and eye burns.
- b. Nose and throat irritation. Even at low concentrations, slow deterioration of the respiratory system can occur.
- c. Pulmonary edema and laryngeal spasm.

Protective equipment: Local exhaust and a mechanical fume hood vent are needed and in cases of extreme vapor concentration, an approved industrial gas canister for HCL absorption. Rubber gloves, rubber aprons, boots, goggles and/or face shield are also required.

First aid: Contact medical assistance immediately.

- a. Inhalation: Move to fresh air and give CPR, if needed.
- b. Eyes: Flush with water for at least 15 minutes.
- c. Skin: Flush with water for at least 15 minutes. Be sure to remove contaminated clothing and wash before reusing.
- d. Ingestion: Do not induce vomiting. Give milk, milk of magnesia, or egg whites beaten with water.

Spills/disposal: Cover contaminated surface with soda ash and slaked lime mixture. Be sure ample ventilation is available. Disposal should comply with applicable Federal, state, and local regulations.

Tin Quick  
(Commercial product used in radiator repair)

Hazard class: None.

Safety precautions: The material itself is not the danger. The hazard results from exposure to fumes when burning the material. Decomposition byproducts are ammonia, hydrogen chloride and zinc oxide. This material also contains lead.

Effects of overexposure: Causes burns. Fumes are irritating to eyes and respiratory passages. Possible injury from lead.

Protective equipment: Ventilation should be adequate to minimize exposure to fumes. Additionally, rubber gloves and chemical safety goggles should be used.

Spills/disposal: Sweep up and put into a chemical waste container. Dispose of as a solid chemical waste.

NAME OF OFFICE \_\_\_\_\_

STANDING OPERATING PROCEDURE NO. \_\_\_\_\_

DATE \_\_\_\_\_

### Radiator Repair Operations

1. Purpose. To establish safe operating procedures and assign responsibilities to cover radiator repair and maintenance operations.
2. Applicability. This procedure applies to the cleaning, repair, maintenance of radiators, and handling, storing, and use of corrosive solvents/dip tanks.
3. Responsibility. The immediate supervisor is responsible for:
  - a. Application and enforcement of this procedure.
  - b. Ensuring that only qualified personnel are permitted to engage in these operations.
  - c. Ensuring that the building leader and subordinates are thoroughly briefed regarding qualified personnel being allowed to engage in these operations.
4. Location of operations. Building \_\_\_\_\_.
5. Material limits. The amount of corrosive solvents and dip tanks in use will be limited to the number and quantity needed to perform a safe and efficient operation.
6. Personnel limits. The number of personnel exposed to corrosive and radiator repair operations will be the minimum required to safely perform the operation.
7. Safety requirements. Industrial requirements include those below.
  - a. Hazardous materials data sheets will be obtained from manufacturer and/or hazardous materials microfiche. Chemical solvents without this information will not be used until this information is procured and coordination with the industrial hygienist has been accomplished.
  - b. Personnel will be aware of and trained in the hazards of all chemicals and solvents used to include personnel protective equipment maintenance and requirements.
  - c. Smoking, spark, and open flame will not be permitted in any solvent storage or dip tank area. Welding operations will not be present any closer than 20-feet outside the vapor area.
  - d. Industrial hygienist will monitor work exposure and suitability of protective equipment.

e. Dip tanks, grounding systems, electrical systems, and storage facilities will be periodically inspected to ensure safe operation and OSHA compliance. Deficiencies will be corrected as soon as possible.

f. Rags contaminated with flammable or corrosive solvents will be disposed of in approved metal cans which are emptied daily.

g. Personnel will be trained in fire prevention techniques and proper methods for cleaning up spills and solvent disposal. Waste solvents will not be dumped into sewage or drainage systems.

h. Adequate and approved ventilation, eyewashes, showers, and other equipment will be available as required and tested.

8. Corrosive solvent dip tank operations/radiator repair.

a. All eating and smoking is prohibited in the solvent/dip tank area. Personnel will practice acceptable levels of personal hygiene after handling these materials.

b. Protective equipment will be used and maintained.

c. The least hazardous material that will accomplish the job will be used.

d. Personnel will be well trained in safe procedures, fire prevention, and the hazards of each solvent used in the operation.

e. Corrosive solvents and paints will be stored in approved cabinets or in outside storage sheds designated for this purpose. Unneeded solvents and paints will not be kept in the workplace.

f. Dip tank covers will be kept closed when not in use.

g. Only approved methods of chemical disposal will be authorized.

h. Personnel will exercise caution in soldering, cleaning, and pressure testing to prevent injury.

9. Posting. After this sample SOP has been developed and approved by the concerned command, a copy should be posted in an area accessible to all employees.

SUBMITTED BY: \_\_\_\_\_

RECOMMENDING APPROVAL: \_\_\_\_\_

APPROVED: \_\_\_\_\_

**RADIATOR REPAIR MATERIALS**

**SAFETY BRIEFINGS**

**FOR USE BY THE SUPERVISOR**

## ETHYLENE GLYCOL

Ethylene glycol is a colorless, odorless liquid that is slightly heavier than water. It is a major constituent of antifreeze which also contains dyes and anticorrosion additives. We use (large/small) quantities, as in antifreeze. If taken internally, through breathing or swallowing, it has a number of harmful effects on the nervous system. Your internal organs can also be injured, even fatally, by a heavy overexposure. Generally, however, the material is only moderately hazardous. Skin absorption is not much of a problem, though glycol may cause irritation. As usual, getting it in your eyes causes pain and injury.

If long-term skin contact with liquid is anticipated, as in cleaning up a spill, rubber gloves should be used. When pouring a large amount of ethylene glycol, wear splash-proof goggles or a face shield. In normal use, a respirator is not needed, but good room ventilation is necessary. Ordinary clean work clothes are adequate protection for the skin.

Any case of obvious poisoning requires medical treatment. When a coworker shows any unusual, drunk-like behavior help him to fresh air. A safety shower or at least an eyewash fountain is needed in areas where splashes can occur.

Storage is no special problem. Ethylene glycol will burn in a fire, but it is not easily ignited. Oxidizing materials like acids or lye should be kept away. The material absorbs water so it should be kept tightly capped in a cool, dry place. You can fight a small fire involving ethylene glycol with CO<sub>2</sub> or dry-chemical extinguishers. Small spills can be soaked up and then hosed down, but large spills should be kept away from natural waterways. Call the engineers if you can't contain the spill immediately. When the spill is in an enclosed area, the cleanup crew will need a respirator.

MURIATIC ACID  
(HYDROCHLORIC ACID)

We handle hydrochloric acid in \_\_\_\_\_ concentrations as a \_\_\_\_\_. It is a hazardous chemical at any strength since it presents both health and disaster risks. The liquid is often colorless, but its odor is distinctive enough to give a good warning of its presence.

Contact with the acid or the acid vapor, whether through the lungs, mouth, or body surface, results in quick damage. Your eyes are particularly vulnerable. At very low vapor concentrations, slow deterioration of the breathing passages may occur. The damage remains at the area that contacts the acid, rather than affecting your whole system.

Vapors and mists of hydrochloric acids are controlled through engineering methods. When forced air ventilation cannot be employed, approved respiratory protection is used. Face shields or chemical-proof goggles will protect your eyes. Rubber gloves and other chemical resistant clothing keep acid off the skin.

In case of swallowing, call for medical help immediately. The medics will know what to administer and will have the materials on hand. Put plenty of water on a skin or eye splash, and keep soaking the injured area until help arrives.

Hydrochloric acid itself is not a fire hazard, but it can complicate fire-fighting efforts. If containers of the acid are exposed to a fire, do not try to extinguish it with a hand-held water extinguisher. It releases explosive gas when it is in contact with many metals and other materials. Therefore, hydrochloric acid should be stored by itself in well-protected containers. Avoid oxidizing materials in particular. In case of a spill, do what you can to contain and limit the damage, but do not expose yourself or others to the risk of burns or dangerous vapors. Call the Spill Control Office at the Engineers.

## SODIUM HYDROXIDE, FLAKE AND PELLET

This lesson discusses sodium hydroxide in its solid, flake, and pellet form. Most precautions also apply to the material when it is procured in liquid solutions. Sodium hydroxide is the familiar household lye, the stuff your grandmother used in making soap. We use (amount) of this strong caustic monthly as a (purpose). Sodium hydroxide presents a considerable hazard to our people and to the facility.

A strong, corrosive action on the skin, respiratory tract, and especially the eyes is the major health threat. It would be very unusual for someone to swallow the stuff as a solid or strong liquid concentration. Dust from handling dry material turns to a dangerous caustic when it hits moist tissues like the eyes or throat. Chemical-proof goggles and rubber skin protection, such as gloves or apron, are required. An approved respirator will be issued to you if you need it. No protective equipment will do you any good if you do not wear it.

Someone who is splashed with sodium hydroxide should be treated like a man on fire. Get the material off the body as fast as possible. Flush with lots of water, and keep flushing until medical help arrives. If the air is contaminated get the victim to fresh air.

Several precautions must be followed in storing sodium hydroxide. The material must be kept dry since it gives off great amounts of heat when it comes in contact with small volumes of water. Sodium hydroxide also reacts with oxidizers, acids, all kinds of flammables, and many metals. Heat and explosive gases are the usual result. It seems odd, after warning you to keep sodium hydroxide dry, but water is the firefighting agent used on a sodium hydroxide fire because the fire truck can put a large volume of water on a small amount of material. Do not try to soak down 100 pounds of sodium hydroxide with a 5-gallon extinguisher.

Small spills can be cleaned up according to the SOP. In case of a large spill, contain it, call for help from the Engineer's Environmental Protection and Energy Section. If the sodium hydroxide is spilled, assume that it is going to give off harmful and explosive gases. Shut down spark-producing equipment and keep nonessential people out of the area.

POSTER IDEA

SAMPLE JOB SAFETY  
BREAKDOWN SHEETS

These Sample Job Safety Breakdown Sheets may be used to prepare similar analysis of local operations. Although modification is necessary to suit individual needs, the samples provide a workable method of safety evaluation and job/task analysis.

JOB SAFETY BREAKDOWN SHEET  
SAMPLE

INSTRUCTION UNIT:	OPERATION:	JOB:
STEPS	KEY POINTS	SAFETY INSTRUCTIONS
Clean and Repair Radiators	Radiator Cleaning and Repairing	Cleaning and repairing radiators
1. Check equipment	a. Proper tools	In good condition.
	b. Steam equipment	Check daily.
	c. Work area	No unauthorized persons in shop.
	d. Wet floors	Watch for slippery floors.
	e. Soap mixture	Make proper mix.
	f. Proper protection	Wear gloves, aprons, eye and face protection, and safety toe boots.
2. Cleaning radiators	a. Cooker	Be very careful, wear proper protection, contains paint stripper.
	b. Steaming	Burns, watch for blowbacks.
	c. Strains	Lift properly.
	d. Kind of radiators	Watch for sharp edges.
3. Repair radiators	a. Work area	Often wet and slippery.
	b. Handling	Watch for sharp edges. Secure on table properly.
	c. Acid and tinning compound	Good ventilation.
	d. Work area	Well lighted.
	e. Torch	Watch for burns.
	f. Radiator lift	Weekly maintenance.
	g. Cleanliness of shop	All personnel will be responsible.

**JOB SAFETY BREAKDOWN SHEET  
SAMPLE**

INSTRUCTION UNIT:  M110, M578 Rubber Fuel	OPERATION:  Rubber Repair	JOB:  Auto Radiator Repairer Tank Bladders
STEPS	KEY POINTS	SAFETY INSTRUCTIONS
1. Protective equipment	a. Wear face shield or goggles, safety shoes, and safety glasses	Wear safety glasses and safety shoes at all times. Wear face shield or goggles while grinding and while mixing and applying rubber cement.
	b. Use approved disposable dust respirators	Wear respirators while grinding.
	c. Gloves	Wear gloves while mixing and applying rubber cement.
2. Equipment	a. Curing irons	Make sure curing irons are in proper working order.
	b. Safety Mixing Applying Grinding Eyewash	Avoid contact with skin and eyes. Avoid prolonged breathing. Mixing, applying, and curing will be done in a well-ventilated, no smoking area. Make sure eyewash in vicinity of operation is working.
3. Cleanup	a. Personal	Wash before eating and at conclusion of operations.
	b. Work area	Keep work area clean.
	c. Safety instructions	Food and beverages are not to be stored or consumed in the area.