11 Test the container for the presence of flammable vapors, preferably with a combustible gas indicator Test for toxic contaminants and for oxygen sufficiency if personnel are to enter

12 Make similar tests just before welding repair operations are performed If the operations extend over an appreciable period of time, make repeated tests

Precautions for employee protection during container cleaning operations include

1 Wear head and eye protection, rubber gloves, boots, and aprons when handling steam, hot water, and caustic solutions When handling dry caustic soda or soda ash, wear approved respiratory protective equipment, long sleeves, and gloves

2 To handle hot drums, wear asbestos hand pads or gloves Steam irons or other hot surfaces which may be touched should be insulated or otherwise guarded

3 Dispose of residue in a safe manner. In each instance, the method of disposal should be checked for hazards

4. If a vessel must be entered, wear respiratory protective equipment approved for the exposure and a safety harness with attached lifeline tended by a helper who is similarly equipped and stationed outside the vessel

Many containers which have held combustible or explosive material present special problems Detailed information can be secured from the manufacturer of such materials For gasometers or gasholders for natural or manufactured gas, the American Gas Association should be consulted

For cleaning and gas-freeing of tanks, bunkers, or compartments on board ship, refer to NFPA Standard No 306, *Control of Gas Hazards on Vessels To Be Repaired*

Personal Protection

Respiratory protection

During welding and cutting operations, toxic gases, fumes, and dusts may be evolved, depending on the type of electrode used, the base metal being welded or cut, and whether or not the base metal is coated with such materials as tar, paint, lead, or zinc Gases—the oxides of nitrogen, carbon monoxide, ozone—and metallic dusts and fumes may, in varying degrees, present inhalation hazards if adequate respiratory protection is not provided

American National Standard Z49 1, *Safety in Welding and Cutting*, gives specifications for local exhaust systems, general ventilation, and health protection of workers on various types of welding and cutting The following discussion is based on this standard, which should be consulted for further information

In open-air welding or cutting or in large, well-ventilated areas, where clean carbon steel is welded or cut with bare or coated carbon-steel electrodes and without inert-gas shielding, minimum health hazards exist

In confined areas, such as tanks, pressure vessels, and holds of ships, local exhaust or general ventilation systems should be provided to maintain concentrations of toxic gases, fumes, or dusts below maximum allowable concentrations (MAC) as defined in American National Standard Z37 Series "Maximal Acceptable Concentrations of Toxic Dust and Gases," or below threshold limit values (TLV) specified by the American Conference of Governmental *Industrial Hygienists* For a complete discussion, see Chapters 37 and 38, "Industrial Hygiene" and "Industrial Toxicology"

If gases, dusts, and fumes cannot be kept below the TLV because work is intermittent or for other reasons, welders should wear respiratory protective equipment approved for the exposure by NIOSH Where oxygen is also deficient, self-contained breathing apparatus or hose masks with blowers are necessary

Coatings, fluxes, and base metals. When welding or cutting involves coatings or fluxes containing base metals that contain elements such as zinc, fluorine, beryllium, lead, or cadmium, and their compounds, local exhaust removal or general ventilation should be provided to maintain the concentration of any toxic fume generated below the MAC or TLV Outdoor welding and cutting involving lead,