Section 1. Material Identification
Ferric Chloride Solution (FeCl₃) Description: A solution of FeCl₃ in water derived by various methods; by the action of chlorine on ferrous sulfate or chloride; by the reaction of chlorine gas on red hot iron, obtained from spent steel pickling liquors; or as a by-product of titanium dioxide manufacture by the chlorine process. Also occurs in nature as the mineral molysite. Used in photoengraving, photography, purifying factory effluents and deodorizing sewage, manufacture of other iron salts, pigments, and inks, chlorination of silver and copper ores, as a catalyst in organic reactions, a mordant in dyeing and printing textiles, as an oxidizing agent in dye manufacture, and as a clinical reagent (for determining amino acids in urine).

Other Designations: CAS No. 7705-08-0, flores martis, iron (III) chloride, iron perchloride, iron sesquichloride, iron trichloride.

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

Cautions: Ferric chloride solution is irritating and corrosive to the eyes, skin, and mucous membranes.

Section 2. Ingredients and Occupational Exposure Limits
Ferric chloride solution, available in grades of 5 to 45%:
1991 OSHA PEL 8-hr TWA: 1 mg/m³ (soluble iron salts)
1990 NIOSH REL None established
1991-92 ACGIH TLV TWA: 1 mg/m³ (soluble iron salts)
1990 DFG (Germany) MAK None established

* See NIOSH, RTECS (LJ9100000), for additional reproductive and toxicity data.

Section 3. Physical Data
Boiling Point: ~223 °F (106 °C), 30%
Freezing Point: -58 °F (-50 °C), 30%
Vapor Pressure: 40 mm Hg at 95 °F (35 °C), 30%
Water Solubility: Soluble
Molecular Weight: 162.22

Appearance and Odor: Greenish-black solution which may have a slight hydrochloric acid odor.

Section 4. Fire and Explosion Data
Flash Point: Noncombustible
Autoignition Temperature: Noncombustible
LEL: None reported
UEL: None reported

Extinguishing Media: Because iron chloride is noncombustible, use extinguishing agents suitable for surrounding fire such as dry chemical, carbon dioxide (CO₂), water spray, and foam.

Unusual Fire or Explosion Hazards: Irritating hydrogen chloride fumes may form in fire.

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 will provide only limited protection. Apply cooling water to sides of tanks (to avoid crystallization of solution) until well after fire is out. Stay away from ends of tanks. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data
Stability/Polymerization: Ferric chloride solution is stable under cool temperatures (keep below average crystallization temperature (Sec. 3) for a particular percent solution) in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Solutions are corrosive to most metals except titanium and tantalum. Incompatible with allyl chloride, potassium, sodium, ethylene oxide, nylon, alkalis, and oxidizers.

Conditions to Avoid: Exposure to temperatures above the crystallization temperature and contact with incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of ferric chloride solution can produce toxic and irritating hydrogen chloride and chloride gas.

Section 6. Health Hazard Data
Carcinogenicity: The IARC(164) NTP(169) and OSHA(164) do not list ferric chloride solution as a carcinogen.

Summary of Risks: Ferric chloride solution is irritating and corrosive to the eyes, skin, and mucous membranes. Ingestion may cause kidney and liver damage. The estimated fatal dose in man for soluble ferric salts is 30 grams.

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

Target Organs: Eyes, skin, respiratory tract, liver, kidneys.

Primary Entry Routes: Inhalation, skin and eye contact, ingestion.

Continue on next page
Section 6. Health Hazard Data, continued

Acute Effects: Inhalation of vapors irritates the eyes, nose, and throat. Skin contact is irritating. Prolonged contact with the eyes has caused a local brown discoloration of the conjunctiva. Ingestion causes irritation of the mouth and stomach and possible abdominal pain, vomiting, diarrhea, rapid and weak pulse, and low blood pressure (symptoms appear within 10 to 60 minutes after ingestion). Cyanosis, secondary shock, coma have occurred from ingestion of iron salts. Type and degree of symptoms depend on the percentage of ferric chloride in solution.

Chronic Effects: None reported.

FIRST AID

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

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. 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 the poison control center advises otherwise, have that conscious and alert person drink 1 to 2 glasses of water, then induce vomiting. Standard bicarbonate solution or antacids may be all that is necessary after vomiting.

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

Note to Physicians: In severe cases of ingestion, the addition of 5 to 10 grams of deferoxamine may be helpful.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate area, deny entry, and stay upwind. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers. For large spills, dike far ahead of spill for later disposal or reclamation. Rinse spill area with sodium bicarbonate or soda ash solution. Spill may be neutralized with agricultural lime (slaked lime) or crushed limestone if landfill disposal is being considered. Follow applicable OSHA regulations (29 CFR 1910.120).

Ecotoxicity Values: Ferric chloride is harmful to aquatic life in very low concentrations. TLm Daphnia, 15 ppm/96 hr/fresh water; TLm mosquito fish, 74 ppm/96 hr; TLm minnow, 540 ppm/1.5 hr.

Disposal: Precipitate as the sulfide, adjusting pH to 7 to complete precipitation. Filter insolubles and dispose of in a hazardous waste site. Destroy excess sulfide with sodium hypochlorite and neutralize remaining solution before flushing down drain. 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
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311 (b)(4)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, soluble iron salts, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or splash-proof 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 NIOSH/MSHA-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: 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 repeated or prolonged skin contact. Polycarbonate and butyl rubber are recommended materials for PPG.

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

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from incompatibles (Sec. 5) and out of direct sunlight. Store small quantities in polyethylene bottles. Keep well closed. Discard solution if it becomes cloudy. If polyethylene is unavailable, store in glass bottles and refrigerate. Solution may leach alkali from the glass forming a yellow ferric oxide precipitate. Store large quantities in rubber lined steel tanks or fiberglass reinforced polyester tanks. Linings of FRP, PVC, or epoxy may be inserted into existing tanks and serve well if care is taken to prevent solution from entering space between the lining and the tank. Protect floors, walls, and equipment that are subject to solution splashes with corrosion-resistant coatings, rubber mats, etc.

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.

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

Transportation Data (49 CFR 172.101, 102)
DOT Shipping Name: Ferric chloride solution
DOT Hazard Class: Corrosive material
ID No.: UN2582
DOT Label: Corrosive
DOT Packaging Requirements: 173.244
DOT Packaging Grouping: Corrosive
IMO Shipping Name: Ferric chloride, solution
IMO Hazard Class: 8
IMO ID No.: UN2582
IMO Label: Corrosive
IMDG Shipping Grouping: Corrosive
IMDG Packaging Grouping: III

MSDS Collection References: 1, 73, 100, 101, 103, 124, 126, 127, 136, 153, 159, 162, 163, 164, 168
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