Ladish Co., Inc.

MATERIAL SAFETY DATA SHEET

MSDS NO. 1521
ISSUED JULY 28, 1995
REVISED JANUARY 29, 2001

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATIONSECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATIONSECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATIONSECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Carbon Steel and Low Alloy
CHEMICAL NAME: Steel

CORPORATE FACILITY:
Ladish Co., Inc.
Cudahy Forgings Division
P. O. Box 8902
5481 S. Packard Avenue
Cudahy, WI 53110-8902

INFORMATION AND NORMAL BUSINESS HOURS:
Corporate Facility, AP&OH Department, (414) 747-3521

EMERGENCY PHONE NUMBERS:

Corporate Plant Security	(414) 747-3514
Chemtrec	(800) 424-9300

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTSSECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTSSECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTSSECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	Typical Wt. %	OSHA-PEL (mg/m^3)	ACGIH TLV (mg/m^3)	LD50/LC50 Species Route
Carbon	7440-44-0	0 - 1.5	Not established	Not established	No information
#Chromium*	7440-47-3	0 - 14	0.5 Cr II & Cr III compounds 1 Metal	0.5 Metal, Cr II & Cr III compounds	No information
#Cobalt	7440-48-4	0 - 9.5	0.05 Metal, dust, fume	0.2 Metal dust, fume	6.17 gm/kg, rat/oral
Iron	1309-37-1	0 - 99.5	10 Fe_2O_3 dust, fume	5 Fe_2O_3 dust, fume	5.4 gm/kg, mouse/oral
#Manganese	7439-96-5	0 - 1	5 Compounds ceiling 1 Fume TWA 3 Fume STEL	5 Dust & compounds 1 Fume	9.0 gm/kg, rat/oral
Molybdenum	7439-98-7	0 - 5.5	10 Total insoluble dust 5 Soluble compounds & respirable insoluble	10 Insoluble 5 Soluble	No information
#Nickel	7440-02-0	0 - 19	1 Metal & insoluble compounds 0.1 Soluble compounds	1 Metal & insoluble compounds 0.1 Soluble compounds	No information
Silicon	7440-21-3	0 - 1.8	10 Total dust 5 Respirable	10	No information
Tungsten	7440-33-7	0 - 3.5	5 TWA insoluble compounds 10 STEL insoluble compounds 1 TWA soluble compounds 3 STEL soluble compounds	5 TWA insoluble compounds 10 STEL insoluble compounds 1 TWA soluble compounds 3 STEL soluble compounds	2 gm/kg, unreported
#Vanadium	1314-62-1	0 - 1.5	0.5 V_2O_5 dust 0.1 V_2O_5 fume	0.05 V_2O_5 dust, fume	0.13 gm/kg, mouse/oral

The chromium contained in this product is in the elemental form.
#SARA reportable - See Section 12, Regulatory Information.

SECTION 3 - HAZARDS IDENTIFICATIONSECTION 3 - HAZARDS IDENTIFICATIONSECTION 3 - HAZARDS IDENTIFICATIONSECTION 3 - HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS: Carbon steel and low alloy forgings in their usual physical form do not pose a health hazard. However, when subjected to welding, burning, grinding, cutting, abrasive blasting, heat treatment, pickling, etching, or similar operations, potentially hazardous fumes or dusts may be emitted. The following is a list of fumes or dusts that may be generated from this product and the health effects associated with overexposure to them.

CHROMIUM (Cr): Chromium metal and its divalent and trivalent compounds are of low toxicity. Adverse reactions on the skin may include dermatitis for a Cr-sensitive individual. Long-term excessive inhalation exposure to ferro-chromium alloys may cause lung changes in workers exposed to these alloys. Exposure to chromium metal does not give rise to pulmonary fibrosis or pneumoconiosis. Chromium metal, unlike hexavalent chromium (Chromium VI), has not been linked to an increased risk of cancer.

COBALT (Co): Cobalt has been reported as causing hypersensitization type dermatitis in individuals who are susceptible. Industrial exposures, possibly combined with small amounts of silica, are reported capable of producing serious pneumoconiosis which is initially of an insidious nature. Overexposure to cobalt can cause chronic interstitial pneumonitis. Wheezing may be considered evidence of hypersensitivity.

IRON (Fe): Inhalation of iron oxide fumes may cause an apparent benign pneumoconiosis which is called siderosis. This disease is reported not to be disabling, but makes X-ray determination of other lung conditions difficult. No physical impairment of lung function has been linked to siderosis. Iron dust can cause conjunctivitis, choroiditis, retinitis, and siderosis of tissues. Continued exposure to concentrations above 30 mg/m^3 can cause chronic bronchitis.

IRON OXIDE (Fe_2O_3): Long-term excessive inhalation exposure to iron oxide fume or dust has been associated with a benign lung condition known as siderosis. No physical impairment of lung function has been linked to siderosis.

MANGANESE (Mn): The central nervous system is the chief site of chronic manganese poisoning. Chronic manganese poisoning (more likely to occur after at least one or two years of prolonged or repeated exposures) is not a fatal disease, although it is extremely disabling. Early symptoms may include weakness in lower extremities, sleepiness, salivation, nervousness, and apathy. In more advanced stages, severe facial expression and uncontrollable laughter may occur. Freshly formed manganese fume has caused fever and chill similar to metal fume fever. Manganese has a high toxicity via the intraperitoneal and inhalation routes.

MOLYBDENUM (Mo): Molybdenum is generally considered to exhibit a low order of toxicity; however, soluble compounds (molybdenum trioxide) are more toxic via intraperitoneal and subcutaneous routes. Molybdenum trioxide may produce irritation of the eyes, nose, and throat. In animals, soluble Mo compounds have also caused weight loss, diarrhea, loss of coordination, pneumoconiosis, breathing difficulties, anemia, and colic. Pneumoconiosis with X-ray findings and subjective symptoms has been observed in a small number of workers exposed to metallic molybdenum and Mo trioxide; however, no physical impairment of lung function has been linked to this condition. Gout and hepatotoxicity have also been recorded due to molybdenum exposure.

NICKEL (Ni): The most common ailment arising from contact with nickel or its compounds is an allergic dermatitis known as "nickel itch" which usually occurs when the skin is moist. Generally nickel and most salts of nickel do not cause systemic poisoning. IARC and NTP have determined that there is limited evidence that nickel and certain nickel compounds may be human carcinogens. Several nickel compounds are carcinogenic to laboratory animals and have been linked to an increased incidence of cancer of the lungs and nasal passages. Nickel can cause neoplasma via inhalation, subcutaneous, implantation, and intraperitoneal modes of exposure routes.

SILICON (Si): Silicon is considered to be a nuisance particulate by the American Conference of Governmental Industrial Hygienists (ACGIH).

TUNGSTEN (W): Tungsten metal and insoluble tungsten compounds are generally considered to have a low toxicity, but have produced lung changes in experimental animals. Recent studies have failed to indicate any serious toxic effect following the inhalation or ingestion of various tungsten compounds, although heavy exposure to dust or the ingestion of large amounts of the soluble compounds produces a certain rate of mortality in experimental animals.

VANADIUM (V): Vanadium may act as an irritant to the conjunctivae and respiratory tract. Eye symptoms may include excessive tearing and a burning sensation. Excessive inhalation exposures, even after brief periods, may result in inflammation of the nasal passages, sore throat, cough, tracheitis, bronchitis, wheezing, and chest pain. Excessive long-term or repeated exposures may result in more severe effects such as pulmonary edema, pneumonia, chronic bronchitis, and recurring episodes of labored breathing. Workers exposed to excessive levels of vanadium often show a greenish discoloration of the tongue.

CARCINOGENICITY: Chromium is listed in the Annual Report on carcinogens, as prepared by the National Toxicology Program (NTP), and also by the International Agency for Research on Cancer (IARC) as a carcinogen. Nickel is also listed by the IARC as a probable carcinogen and by the NTP as a suspect carcinogen.

PRIMARY ROUTES OF ENTRY: Inhalation, skin contact

MEDICAL CONDITIONS POSSIBLY AGGRAVATED: Individuals with chronic diseases or disorders of the respiratory system should consult a physician regarding workplace exposure to ingredients.

ADDITIONAL OR MISCELLANEOUS INFORMATION: Nonmetallic coatings may be applied (often at the customer's request) to the surface of our products. These are usually classified as protective coatings or lubricants. The possible presence of coatings on our products should be recognized and considered when evaluating potential employee health hazards and exposures during welding or other dust/fume generating activities. Material Safety Data Sheets for specific coatings are available upon request.

SECTION 4 - FIRST AID MEASURESSECTION 4 - FIRST AID MEASURESSECTION 4 - FIRST AID MEASURESSECTION 4 - FIRST AID MEASURES

INHALATION: For breathing difficulty caused by inhalation of dust or fume, move individual to fresh air and administer oxygen as necessary. If breathing has stopped, perform artificial respiration. Obtain medical attention at once.
SKIN: Skin cuts and abrasions can be treated by standard first aid. If skin irritation develops, remove contaminated clothing and wash contaminated skin with water for five minutes. If irritation persists, obtain medical assistance.

EYES: In case of contact with dust or powder, immediately flush eyes with large amounts of water for fifteen minutes, occasionally lifting the lower and upper lids. If irritation persists, obtain medical assistance. Contact lenses are not recommended if working with metal dusts and powders.

INGESTION: Although not expected in an industrial setting, swallowing metal powder or dust can be treated by having individual swallow large quantities of water and attempting to induce vomiting if conscious. Obtain medical assistance at once.

SECTION 5 - FIRE FIGHTING MEASURESSECTION 5 - FIRE FIGHTING MEASURESSECTION 5 - FIRE FIGHTING MEASURESSECTION 5 - FIRE FIGHTING MEASURES

FLASH POINT (°F)/METHOD USED. Not applicable

FLAMMABLE LIMITS (% VOL): Not applicable

LEL: Not applicable

UEL: Not applicable

EXTINGUISHING MEDIA: Carbon and low alloys themselves present negligible fire and explosion hazards. A moderate fire and explosion hazard may exist due to contamination or when material is finely divided and exposed to heat or flames. Use fire fighting methods that are appropriate for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTIONS: Use powdered graphite, dolomite, dry sand, or other Class D type extinguishing agents for fires involving metal.

UNUSUAL FIRE AND EXPLOSION HAZARDS: High concentrations of dust may present an explosion hazard under rare favoring conditions of particle size, dispersion, and strong ignition source. Good housekeeping and adequate ventilation are recommended.

SECTION 6 - ACCIDENTAL RELEASE MEASURESSECTION 6 - ACCIDENTAL RELEASE MEASURESSECTION 6 - ACCIDENTAL RELEASE MEASURESSECTION 6 - ACCIDENTAL RELEASE MEASURES

STEPS TO TAKE IF MATERIAL IS RELEASED OR SPILLED: In solid form, this material poses no special clean-up procedures. If alloy dusts or powder must be removed, use vacuuming or wet sweeping techniques to prevent heavy concentrations of airborne dust.

WASTE DISPOSAL METHOD: Various state regulations may require specific labeling, packing, storage, transportation, and disposal procedures. If potential for a spill or release of metal powders or dusts may exist, follow an appropriate emergency spill response plan consistent with local, state, and federal regulations.

SECTION 7 - HANDLING AND STORAGESECTION 7 - HANDLING AND STORAGESECTION 7 - HANDLING AND STORAGESECTION 7 - HANDLING AND STORAGE

WORK PRACTICES: Use lifting and working devices, e.g., crane, hoist, etc. within related capacities and in accordance with manufacturers' instructions when handling these products. Should be handled in ways to minimize generation of airborne dust and fume

ADDITIONAL INFORMATION: Nonmetallic coatings., i.e., lubricants, rust preventive oils, paints, epoxies, and laminates, etc. may be applied (generally at the customer's request) to the surface of these products. The possible presence of these coatings should be recognized and considered when evaluating potential employee health hazards and exposures during handling and welding or other dust/fume generating activities.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTIONSECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTIONSECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTIONSECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING CONTROLS (VENTILATION, ETC.): Provide ventilation sufficient to maintain exposure levels below the applicable exposure limits.

When airborne emissions may occur due to further processing: (1) avoid breathing dust and fume, (2) evaluate potential employee exposure, (3) minimize penetration of airborne emissions, (4) maintain surfaces free as practical of accumulated material, (5) use protective clothing as specified by an industrial hygienist or safety professional where exposure levels may be excessive, (6) do not smoke in work area, (7) wash hands before eating, drinking or smoking and after handling, (8) change contaminated clothing before leaving work premises.

Removal of surface coatings should be considered prior to welding or other fume generating activities.

EYE PROTECTION: Use safety glasses and/or other protective eyewear as specified by a safety professional where risk of eye injury is present.

SKIN PROTECTION: Not anticipated to pose a significant skin hazard. Use gloves (i.e., cotton or leather) and/or protective clothing (i.e., Tyvek, cotton) as specified by an industrial hygienist or safety professional where exposure levels are excessive.

RESPIRATORY PROTECTION: When engineering controls are not feasible or sufficient to lower exposure levels below the applicable exposure limit, use a NIOSH-approved respirator which protects against dust or fume as specified by an industrial hygienist or qualified

safety professional in accordance with manufacturer instructions and use limitations.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIESSECTION 9 - PHYSICAL AND CHEMICAL PROPERTIESSECTION 9 - PHYSICAL AND CHEMICAL PROPERTIESSECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless solid with grey-black metallic lustre, becoming reddish brown with oxidation

MELTING POINT: Range of 2600-2800°F, depending on specific alloy composition

VAPOR PRESSURE (mmHg at 20°C): Not applicable

VAPOR DENSITY (Air=1): Not applicable

PERCENT VOLATILE BY VOLUME: Not applicable

DENSITY (lb/cu.in.): 0.28 - 0.29, depending on specific alloy composition

EVAPORATION RATE (Ethyl Ether=1): Not applicable

BOILING POINT: Not applicable

SOLUBILITY IN WATER: Not soluble

SPECIFIC GRAVITY: Approximately 7 - 8, depending on specific alloy composition

PH: Not applicable

SECTION 10 - STABILITY AND REACTIVITYSECTION 10 - STABILITY AND REACTIVITYSECTION 10 - STABILITY AND REACTIVITYSECTION 10 - STABILITY AND REACTIVITY

STABILITY (CONDITIONS TO AVOID): Material is stable at room temperature under normal storage and handling conditions.

INCOMPATIBILITY (MATERIALS TO AVOID): Contact of powder with strong acids or oxidizers may form flammable and explosive hydrogen gas or oxide fumes.

HAZARDOUS DECOMPOSITION PRODUCTS: Metal fumes and certain noxious gases, such as CO, may be produced during welding or burning operations. Refer to Sections 3 and 8 for additional information.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11 - TRANSPORT INFORMATIONSECTION 11 - TRANSPORT INFORMATIONSECTION 11 - TRANSPORT INFORMATIONSECTION 11 - TRANSPORT INFORMATION

DOT TRANSPORTATION DATA (49 CFR 172.101):

HAZARDOUS MATERIAL PROPER SHIPPING NAME: Not listed

HAZARD CLASS: Not listed

IDENTIFICATION NUMBER: Not listed

SECTION 12 - REGULATORY INFORMATIONSECTION 12 - REGULATORY INFORMATIONSECTION 12 - REGULATORY INFORMATIONSECTION 12 - REGULATORY INFORMATION

EPA REGULATIONS:

RCRA HAZARDOUS WASTE NUMBER: Not listed (40 CFR 261.33)

SARA/TITLE III HAZARD CATEGORIES: Under applicable definitions, this material may meet the criteria for delayed (chronic) health hazard category.

SARA 313 INFORMATION: This product contains chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and 40 CFR Part 372 (see Section 3; the # symbol denotes chemicals subject to these reporting requirements). Please also note that if you repackage or otherwise redistribute this product to industrial customers, SARA 313 requires that a notice be sent to those customers.

SECTION 13 - SPECIAL PRECAUTIONSSECTION 13 - SPECIAL PRECAUTIONSSECTION 13 - SPECIAL PRECAUTIONSSECTION 13 - SPECIAL PRECAUTIONS

During welding, precautions should be taken for airborne contaminants and noxious gases that may originate from components of the welding rod. Of special concern are silica or silicates, fluorides, copper, manganese, carbon monoxide and nitrogen oxides. Arc and sparks generated when welding with this product could be a source of ignition for combustible and flammable materials.

SECTION 14 - OTHER INFORMATIONSECTION 14 - OTHER INFORMATIONSECTION 14 - OTHER INFORMATIONSECTION 14 - OTHER INFORMATION

Original Date of Preparation: 11/10/85
Previous Revision Date: 04/16/89
Latest Revision Date: 01/29/01

The information contained herein is based on current knowledge and experience; no responsibility is accepted that the information is sufficient or correct in all cases. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use and disposal of these materials, the safety and health of employees and customers, and the protection of the environment.