

Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS)

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Section 1 – Chemical Product and Company Identification

GHS Product Identifier: Nickel Alloy	MSDS Category: NL
Other means of identification: None	
Supplier's Details: ATI Allegheny Ludlum 100 River Road, Brackenridge, PA 15014	CAS Number: Mixture
Phone Number (s): 724-226-5980 (M-F, 9 a.m.-4:30 p.m. EST)	
Off-Hour Emergency Phone Number: 724-226-5555	CHEMTREC: 800-424-9300
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Section 2 - Hazards Identification

As sold, this product, **Nickel Alloy** (semi-finished steel products) is not hazardous according to the criteria specified in European Directives 67/548/EEC and 1999/45/EC. Under OSHA 29 CFR 1910.1200 Hazard Communication Standard, steel products are considered mixtures due to further processing which may produce dusts and or fumes. Refer to Section 3 and 8 for additional information. Refer to Section 11 for Toxicological Information.

Precautionary Statement/Emergency Overview: Odorless solid product in various forms, silver-gray color. This formed solid metal product poses little or no immediate health or fire hazards. Product may be coated - refer to appropriate coating MSDS for physical and health hazards. When product is subjected to welding, burning, melting, sawing, brazing, grinding, or other similar processes, potentially hazardous airborne particulate and fumes may be generated. These operations should be performed in well-ventilated areas, and if appropriate, respiratory protection and other PPE should be utilized based upon a PPE Assessment of the task(s) involved.

Section 3 – Composition/Information on Ingredients

Chemical Identity of Regulated Substances under 29 CFR 1910.1200 (Hazard Communication Standard):

Ingredient Name	EC Number	CAS Number	% weight
Nickel	231-111-4	7440-02-0	40-80
Chromium	231-157-5	7440-47-3	14-33
Cobalt	231-158-0	7440-48-4	0-21
Iron	231-096-4	7439-89-6	0-20
Molybdenum	231-107-2	7439-98-7	0-17
Columbium (Niobium)	231-113-5	7440-03-1	0-5.5
Aluminum	231-072-3	7429-90-5	0-5.0
Tungsten	231-143-9	7440-33-7	0 – 4.5
Tantalum	231-135-5	7440-25-7	0 – 4.2
Copper	231-159-6	7440-50-8	0-3.0
Titanium	231-142-3	7440-32-6	0-3.0
Manganese	231-105-1	7439-96-5	0-1.0
Silicon	231-130-8	7440-21-3	0-1.0

EC - European Community

CAS - Chemical Abstract Service

All commercial metals may contain small amounts of various elements in addition to those specified. These small quantities (less than 0.1%) frequently referred to as "trace" or "residual" elements, generally originate in the raw material used. These elements may include, but are not limited to the following: Arsenic, Boron, Cadmium, Calcium, Cobalt, Lead, Nitrogen, Phosphorous, Sulfur, Tin and Zirconium.

Section 4 - First Aid Measures

Description of necessary first aid measures:

- **Inhalation:** If large amounts of dusts, fumes, or particulates are generated, move person to fresh air. If symptoms develop, seek medical attention.
- **Eye Contact:** For contact with dusts or particulates, flush eyes with water for 15 minutes. Eye injuries from solid particles should be treated by a physician immediately.
- **Skin Contact:** For skin contact with dusts or powders, wash immediately with soap and water. Cuts or abrasions should be treated promptly with thorough cleansing of the affected area.
- **Ingestion:** No need for first aid is anticipated if material is swallowed, however if symptoms develop, seek medical attention. For Ingestion of Dusts: IF SWALLOWED: Call a poison center or Doctor/physician if you feel unwell. Rinse mouth.

Section 4 - First Aid Measures

Most important acute and chronic symptoms/effects:

Primary Entry Routes: Nickel Alloy (semi-finished steel products) products in their usual physical form do not present an inhalation, ingestion or contact hazard. However, operations such as burning, welding, sawing, brazing, machining and grinding may result in the following effects if exposures exceed recommended limits as listed in Section 8.

Target Organs: Respiratory system

Acute Effects:

- **Inhalation:** Excessive exposure to high concentrations of dust may cause irritation to the eyes, skin and mucous membranes of the upper respiratory tract. Excessive inhalation of fumes of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns from many metals can produce an acute reaction known as “metal fume fever”. Symptoms consist of chills and fever (very similar to and easily confused with flu symptoms), metallic taste in the mouth, dryness and irritation of the throat followed by weakness and muscle pain. The symptoms come on in a few hours after excessive exposures and usually last from 12 to 48 hours. Long-term effects from metal fume fever have not been noted. Freshly formed oxide fumes of manganese have been associated with causing metal fume fever. Inhalation of chromium compounds may cause upper respiratory tract irritation. Inhalation of silica dusts may result in silicosis. Nickel compounds are respiratory tract irritants.
- **Eye:** Excessive exposure to high concentrations of dust may cause irritation and/or sensitization to the eyes. Particles of iron or iron compounds, which become imbedded in the eye, may cause rust stains unless removed promptly. Molybdenum compounds are eye irritants.
- **Skin:** Repeated or prolonged contact with dusts may cause skin irritation or sensitization, possibly leading to dermatitis. Skin contact with metallic fumes and dusts may cause physical abrasion. Exposure to nickel may cause contact and atopic dermatitis and allergic sensitization. Molybdenum compounds are skin irritants.
- **Ingestion:** Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of dust may cause nausea or vomiting.

Acute Effects by component:

- **NICKEL:** Nickel may cause allergic skin sensitization.
- **CHROMIUM (as Hexavalent Chrome):** Hexavalent chrome causes damage to gastrointestinal tract, lung, severe skin burns and eye damage, serious eye damage, skin contact may cause an allergic skin reaction, inhalation may cause allergic or asthmatic symptoms or breathing difficulties.
- **COBALT:** May cause skin, eye and allergic skin reactions.
- **IRON:** Iron is harmful if swallowed, causes skin irritation, and causes eye irritation.
- **MOLYBDENUM:** Molybdenum causes skin and eye irritation.
- **COLUMBIUM (Niobium):** Niobium may cause skin irritation
- **ALUMINUM:** Not Reported/ Not Classified
- **TUNGSTEN :** May cause eye and Skin irritation due to the abrasive effect of the dust
- **TANTALUM:** May cause abrasive irritation to mucous membranes of the respiratory tract. May cause abrasive irritation to skin and eyes.
- **COPPER:** Copper may cause allergic skin reaction.
- **TITANIUM:** Not Reported/ Not classified
- **MANGANESE:** Manganese is harmful if swallowed.
- **SILICON:** May be harmful if swallowed

Chronic Effects by component:

- **NICKEL:** Exposure to nickel dusts and fumes can cause sensitization dermatitis, respiratory irritation, asthma, pulmonary fibrosis, edema and may cause nasal or lung cancer in humans. Causes damage to lungs through prolonged or repeated inhalation exposure. IARC lists nickel and certain nickel compounds as Group 2B carcinogens (sufficient animal data). ACGIH 2009 TLVs® and BEIs® lists insoluble nickel compounds as confirmed human carcinogens. Suspected of damaging the unborn child.
- **CHROMIUM:** The health hazards associated with exposure to chromium are dependent upon its oxidation state. The metal form (chromium as it exists in this product) is of very low toxicity. The hexavalent form is very toxic. Repeated or prolonged exposure to hexavalent chromium compounds may cause respiratory irritation, nosebleed, ulceration and perforation of the nasal septum. Industrial exposure to certain forms of hexavalent chromium has been related to an increased incidence of cancer. NTP (The National Toxicology Program) Fourth Annual report on Carcinogens cites “certain Chromium compounds” as human carcinogens. ACGIH has reviewed the toxicity data and concluded that chromium metal is not classifiable as a human carcinogen. Hexavalent chromium may cause genetic defects and is suspected of damaging the unborn child. Developmental toxicity in the mouse, suspected of damaging fertility or the unborn child.
- **COBALT:** Chronic exposure to cobalt metal, dust, or fume may cause respiratory or dermatologic signs and symptoms. Following skin sensitization, contact with cobalt causes eruptions of dermatitis increases and on frictional surfaces of the arms, legs, and neck. Chronic respiratory exposure results in reduced lung function, increased fibrotic changes on chest X-ray, production of scanty mucoid sputum, and shortness of breath.
- **IRON (as Iron Oxide):** Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in the development of a benign pneumoconiosis, called siderosis, which is observable as an X-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of ferric oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Iron oxide is listed as a Group 3 (not classifiable) carcinogen by IARC.

Section 4 - First Aid Measures (continued)

Chronic Effects by component (continued):

- **MOLYBDENUM:** Certain handling operations, such as burning and welding, may generate both insoluble molybdenum compounds (metal and molybdenum dioxide) and soluble molybdenum compounds (molybdenum trioxide). Molybdenum compounds generally exhibit a low order of toxicity with the trioxide the more toxic. However, some reports indicate that the dust of the molybdenum metal, molybdenum dioxide and molybdenum trioxide may cause eye, skin, nose and throat irritation in animals. Also has been reported to cause induction of tumors in experimental animals, suspected of causing cancer. Molybdenum oxide is suspected of causing cancer in humans.
- **COLUMBIUM (Niobium):** No reports of human intoxication. There is no evidence of a human health hazard due to inhalation. Can cause eye and skin irritation.
- **ALUMINUM:** Chronic inhalation of finely divided powder has been reported to cause pulmonary fibrosis and emphysema. Repeated skin contact has been associated with bleeding into the tissue, delayed hypersensitivity and granulomas. Chronic exposure to aluminum flake has been reported to cause pneumoconiosis in workers. Repeat oral exposure to aluminum results in decrements in neurobehavioral function and development.
- **TUNGSTEN:** Tungsten has been shown to act by antagonizing the action of the essential trace element, Molybdenum. Tungsten metal powder administered to animals has been shown in several studies as not totally inert. One study found that guinea pigs treated orally or intravenously with tungsten suffered from anorexia, colic, incoordination of movement, trembling, dyspnea and weight loss. Long industrial experience has indicated no pneumoconiosis to develop among workers exposed solely to tungsten or its insoluble compounds (at air concentrations of the order of 5 mg/m³). In NIOSH's criteria document, two Russian studies were cited which indicated and incidence of 9-11% pulmonary fibrosis among employees exposed to tungsten without cobalt co-exposure.
- **TANTALUM:** The passivity of Tantalum metal for biological tissues has been amply demonstrated by its longtime use in surgical procedures both in animals and man. No significant toxic effects have been associated with tantalum
- **COPPER:** Inhalation of high concentrations of freshly formed oxide fumes and dusts of copper can cause metal fume fever. Chronic inhalation of copper dust has caused, in animals, hemolysis of the red blood cells, deposition of hemofuscin in the liver and pancreas, injury to lung cells and gastrointestinal symptoms.
- **TITANIUM:** There is no evidence of a health hazard from inhalation of titanium dioxide at airborne concentrations below 10 mg/m³. Rats (but not mice) exposed to ultrafine TiO₂ particles at 10 mg/m³ developed lung tumors; probably results from inhibited particle clearance from lung. The toxicity of titanium dioxide has been found to be relatively inert. Eye contact with pure material can cause particulate irritation. Skin contact with titanium dusts may cause physical abrasion
- **MANGANESE:** Chronic exposure to high concentrations of manganese fumes and dusts may adversely affect the central nervous system with symptoms including languor, sleepiness, weakness, emotional disturbances, spastic gait, mask-like facial expression and paralysis. Animal studies indicate that manganese exposure may increase susceptibility to bacterial and viral infections. Occupational overexposure (Manganese) is a progressive, disabling neurological syndrome that typically begins with relatively mild symptoms and evolves to include altered gait, fine tremor, and sometimes psychiatric disturbances. May cause damage to lungs with repeated or prolonged exposure.
- **SILICON:** Silicon dusts are a low health risk by inhalation and should be treated as a nuisance dust. Eye contact with pure material can cause particulate irritation. Skin contact with silicon dusts may cause physical abrasion.

Long-term inhalation exposure to high concentrations (over-exposure) to pneumoconiotic agents may act synergistically with inhalation of oxides, fumes or dusts of this product to cause toxic effects.

Carcinogenicity: IARC, NTP, and OSHA do not list steel products as carcinogens. IARC identifies nickel and certain nickel compounds and welding fumes as Group 2B carcinogens that are possibly carcinogenic to humans. ACGIH lists insoluble nickel compounds as confirmed human carcinogens. IARC lists chromium metal and trivalent chromium compounds as Group 3 carcinogens, not classifiable as to their human carcinogenicity. Hexavalent chromium compounds are listed by IARC as Group 1 carcinogens that are carcinogenic to humans. NTP Fourth Annual report on Carcinogens cites "certain Chromium compounds" as human carcinogens. ACGIH has reviewed the toxicity data and concluded that chromium metal is not classifiable as a human carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Individuals with chronic respiratory disorders (i.e., asthma, chronic bronchitis, emphysema, etc.) may be adversely affected by any fume or airborne particulate matter exposure.

SARA Potential Hazard Categories: Immediate Acute Health Hazard; Delayed Chronic Health Hazard

Section 5 – Fire and Explosion Hazard Information

Suitable Extinguishing Media: Not applicable for solid product. Use extinguishers appropriate for surrounding materials. For fines, use a Type-D fire extinguisher or table salt to control small fires. Machining of nickel alloys will generate fine turnings, chips or dust. Warning: May Form Combustible (Explosive) Dust - Air Mixtures. Keep away from all ignition sources including heat, sparks, and flame. Keep container closed and grounded. Prevent dust accumulations to minimize explosion hazard.

Specific Hazards arising from the chemical: Not applicable for solid product.

Explosion hazard: Accumulated metal dust can be combustible. Avoid creating dust.

Special protective equipment and precautions for fire fighters: Self-contained MSHA/NIOSH approved respiratory protection and full protective clothing should be worn when fumes and/or smoke from fire are present. Heat and flames cause emittance of acrid smoke and fumes. Do not release runoff from fire control methods to sewers or waterways.

Section 6 - Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures: Not applicable to nickel alloy in solid state. For spills involving finely divided particles, clean-up personnel should be protected against contact with eyes and skin. Collect material in appropriate, labeled containers for recovery or disposal in accordance with federal, state, and local regulations.

Environmental precautions: Not applicable to steel in solid state. Follow applicable federal, state, and local regulations

Methods and materials for containment and clean up: Collect material in appropriate, labeled containers for recovery or disposal in accordance with federal, state, and local regulations. Follow applicable OSHA regulations (29 CFR 1910.120) and all other pertinent state and federal requirements.

Section 7 - Handling and Storage

Precautions for safe handling: Operations with the potential for generating concentrations above ½ the PEL of airborne particulates should be evaluated and controlled as necessary. Practice good housekeeping. Avoid breathing metal fumes and/or dust.

Conditions for safe storage, including any incompatibilities: Store away from acids and incompatible materials.

Section 8 - Exposure Controls / Personal Protection

Occupational Exposure Limits (OELs): This product in its physical form as sold does not present an inhalation, ingestion or contact hazard, nor would any of the following exposure data apply. However, operations such as high temperature (burning, welding), sawing, brazing, machining and grinding may produce fumes and/or particulates. The following exposure limits are offered as reference, for an experienced industrial hygienist to review.

Ingredients	OSHA PEL ¹	ACGIH TLV ²	NIOSH REL ³	IDLH ⁴
Nickel	1.0 mg/m ³ (as Ni metal & insoluble compounds)	1.5 mg/m ³ (as inhalable fraction ⁵ Ni metal) 0.2 mg/m ³ (as inhalable fraction Ni inorganic only insoluble and soluble compounds)	0.015 mg/m ³ (as Ni metal & insoluble and soluble compounds)	10 mg/m ³ (as Ni)
Chromium	0.5 mg/m ³ (as Cr II & III, inorganic compounds) 1.0 mg/m ³ (as Cr, metal) 0.005 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble) "AL" 0.0025 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble)	0.5 mg/m ³ (as Cr III, inorganic compounds) 0.5 mg/m ³ (as Cr, metal) 0.05 mg/m ³ (as Cr VI, inorganic compounds) 0.01 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble)	0.5 mg/m ³ (as Cr II & III, inorganic compounds) 0.5 mg/m ³ (as Cr, metal) 0.001 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble)	250 mg/m ³ (as Cr II & metal) 25 mg/m ³ (as Cr III) 15 mg/m ³ (as Cr VI)
Cobalt	0.1 mg/m ³	0.02 mg/m ³	0.5 mg/m ³	20 mg/m ³ (as Co)
Iron	10 mg/m ³ (as iron oxide fume)	5.0 mg/m ³ (as iron oxide dust and fume)	5.0 mg/m ³ (as iron oxide dust and fume)	2,500 mg Fe/m ³
Molybdenum	15 mg/m ³ (as total dust, PNOR) ⁶ 5.0 mg/m ³ (as respirable fraction, PNOR)	10 mg/m ³ (as Mo insoluble compounds, inhalable fraction) 3.0 mg/m ³ (as Mo insoluble compounds, respirable fraction) ⁷ 0.5 mg/m ³ (as Mo soluble compounds, respirable fraction)	NE	NE
Columbium	15 mg/m ³ , total dust (PNOR) 5.0 mg/m ³ , respirable fraction (PNOR)	10 mg/m ³ (as inhalable fraction, PNOS) ⁸ 3.0 mg/m ³ (as respirable fraction, PNOS)	NE	NE
Aluminum	15 mg/m ³ (as total dust, PNOR) 5.0 mg/m ³ (as respirable fraction, PNOR)	10 mg/m ³ (as metal dust) 5.0 mg/m ³ (as welding fume)	10 mg/m ³ (as total dust) 5.0 mg/m ³ (as respirable dust)	NE
Tungsten	NE	5.0 mg/m ³ 10 mg/m ³	5.0 mg/m ³ "STEL" 10 mg/m	NE
Tantalum	5.0 mg/m ³	5.0 mg/m ³	5.0 mg/m ³ "STEL" 10 mg/m ³	2,500 mg Ta/m ³
Copper	0.1 mg/m ³ (as fume, Cu) 1.0 mg/m ³ (as dusts & mists, Cu)	0.1 mg/m ³ (as fume) 1.0 mg/m ³ (as dusts & mists, Cu)	1.0 mg/m ³ (as dusts & mists)	100 mg Cu/m ³
Titanium	15 mg/m ³ (as TiO ₂ , total dust)	10 mg/m ³ (as TiO ₂)	LFC (as TiO ₂) ⁹	5,000 mg/m ³ (as TiO ₂)
Manganese	"C" 5.0 mg/m ³ (as Fume & Mn compounds)	0.2 mg/m ³	"C" 5.0 mg/m ³ 1.0 mg/m ³ (as fume) "STEL" 3.0 mg/m ³	500 mg Mn/m ³
Silicon	15 mg/m ³ (total dust, PNOR) 5.0 mg/m ³ (as respirable fraction, PNOR)	10 mg/m ³	10 mg/m ³ (as total dust) 5.0 mg/m ³ (as respirable dust)	NE

NE - None Established

Section 8 - Exposure Controls / Personal Protection (continued)

Notes:

1. OSHA PELs (Permissible Exposure Limits) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A ("C") designation denotes a Ceiling Limit, which should not be exceeded during any part of the working exposure unless otherwise noted. A Short Term Exposure Limit (STEL) is defined as a 15-minute exposure, which should not be exceeded at any time during a workday.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. ACGIH TLVs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
3. The National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL): Compendium of Policy and Statements. NIOSH, Cincinnati, OH (1992). NIOSH is the federal agency designated to conduct research relative to occupational safety and health. As is the case with ACGIH TLVs, NIOSH RELs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
4. The "immediately dangerous to life or health air concentration values (IDLHs)" are used by NIOSH as part of the respirator selection criteria and were first developed in the mid-1970's by NIOSH. The Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs) is a compilation of the rationale and sources of information used by NIOSH during the original determination of 387 IDLHs and their subsequent review and revision in 1994.
5. Inhalable fraction. The concentration of inhalable particulate for the application of this TLV is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH 2009 TLVs® and BEIs® (Biological Exposure Indices) Appendix D, paragraph A.
6. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit of 15 mg/m³ for total dust and 5.0 mg/m³ for the respirable fraction (containing less than 1% crystalline silica).
7. Respirable fraction - The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH 2009 TLVs® and BEIs® Appendix D, paragraph C
8. PNOS (Particles Not Otherwise Specified). Inhalable fraction - The concentration of inhalable particulate for the application of this TLV is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs and BEIs Appendix D, paragraph A. Respirable fraction - The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs and BEIs Appendix D, paragraph C.
9. LFC – Lowest Feasible Concentration, Refer to Section 11, Toxicological Information

Appropriate Engineering Controls: Use engineering controls as appropriate to minimize exposure to metal fumes and dusts during handling operations. Provide general or local exhaust ventilation systems to minimize airborne concentrations. Local exhaust is necessary for use in enclosed or confined spaces. Provide sufficient general/local exhaust ventilation in pattern/volume to control inhalation exposures below current exposure limits.

Personal Protective Equipment (PPE)

- **Respiratory Protection:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use only a NIOSH-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. Concentration in air of the various contaminants determines the extent of respiratory protection needed. Half-face, negative-pressure, air-purifying respirator equipped with P100 filter is acceptable for concentrations up to 10 times the exposure limit. Full-face, negative-pressure, air-purifying respirator equipped with P100 filter is acceptable for concentrations up to 50 times the exposure limit. Protection by air-purifying negative-pressure and powered air respirators is limited. Use a positive-pressure-demand, full-face, supplied air respirator or self contained breathing apparatus (SCBA) for concentrations above 50 times the exposure limit. If exposure is above the IDLH (Immediately dangerous to life or health) for any of the constituents, or there is a possibility of an uncontrolled release or exposure levels are unknown, then use a positive-demand, full-face, supplied air respirator with escape bottle or SCBA.

Warning! Air-purifying respirators both negative-pressure, and powered-air do not protect workers in oxygen-deficient atmospheres.

Protective Clothing/Equipment:

- **Eyes:** Wear appropriate eye protection to prevent eye contact. For operations, which result in elevating the temperature of the product to or above its melting point or result in the generation of airborne particulates, use safety glasses or goggles to prevent eye contact. Contact lenses should not be worn where industrial exposures to this material are likely. Use safety glasses or goggles as required for welding, burning, sawing, brazing, grinding or machining operations.
- **Skin:** Wear appropriate personal protective clothing to prevent skin contact. Cut resistant gloves and sleeves should be worn when working with steel products. For operations, which result in elevating the temperature of the product to or above its melting point or result in the generation of airborne particulates, use protective clothing, and gloves to prevent skin contact. Protective gloves should be worn as required for welding, burning or handling operations.
- **Other protective equipment:** An eyewash fountain and deluge shower should be readily available in the work area when operations which could result in fumes and/or particulates are being performed.

Section 9 - Physical and Chemical Properties

Appearance and Odor: Silver-gray metallic solid form, odorless

Odor Threshold: NA

Vapor Pressure: Negligible

Vapor Density (Air=1): NA

Formula Weight: NA

Density: NA

Specific Gravity (H₂O=1, 60°F): 7-9

pH: NA

Flash Point (closed cup): NA

Water Solubility: Insoluble

Fat Solubility: NA

Other Solubilities: NA

Boiling Point: NIF for alloy product (Ni-5252/Cr-3992/Fe-5432 °F)

Viscosity: NA

Refractive Index: NA

Surface Tension: NA

% Volatile by volume: NA

Evaporation Rate: NA

Section 9 - Physical and Chemical Properties (continued)

Auto-ignition Temperature: NA	Freezing Point: NA
Decomposition Temperature: ND	Melting Point: : 2300-2600 °F
Partition Coefficient n-octanol/water: ND	UEL: NA
Flammability (solid, gas): Non-flammable	LEL: NA
Explosive Properties: ND	Oxidizing Properties: ND

NA - Not Applicable

ND - Not determined for product as a whole

Section 10 - Stability and Reactivity

Reactivity: Not Determined (ND) for product as a whole.

Stability: Nickel Alloy products are stable under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Will react with strong acids to form hydrogen. Iron oxide dusts in contact with calcium hypochlorite evolve oxygen and may cause an explosion.

Conditions to Avoid: Storage with strong acids or calcium hypochlorite








Hazardous Decomposition/Combustion Products: Thermal oxidative decomposition can produce fumes containing oxides of iron and manganese as well as other alloying elements.

Sensitivity to Mechanical Impact: ND

Sensitivity to Static Discharge: ND

Section 11 - Toxicological Information

Toxicological information has not been established for this product as sold. However, processing of this product in operations such as high temperature (burning, welding), sawing, brazing, machining and grinding may produce fumes and/or particulates, which would result in the material being classified as hazardous under OSHA 29 CFR 1910.1200. The categories of Health Hazards as defined in "GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS (GHS), Third revised edition ST/SG/AC.10/30/Rev. 3" United Nations, New York and Geneva, 2009 have been evaluated and are listed below:

Potential Hazard	Hazard Category	Hazard Symbol	Signal Word	Hazard Statement
Acute Toxicity Hazard	5 ^a	No Symbol	Warning	May be harmful if swallowed
Skin Irritation	2 ^b		Warning	Causes skin irritation
Eye Damage/ Irritation	2B ^c	No Symbol	Warning	Causes eye irritation
Skin Sensitization	1 ^d		Warning	May cause an allergic skin reaction
Germ Cell Mutagenicity	2 ^f		Warning	Suspected of causing genetic defects
Carcinogenicity	2 ^g		Warning	Suspected of causing cancer
Toxic Reproduction	2 ^h		Warning	Suspected of damaging the unborn child
Specific Target Organ Systemic Toxicity (STOST) following Single Exposure	3 ⁱ		Warning	May cause respiratory irritation
STOST following Repeated Exposure	1 ^j		Danger	Causes damage to lungs through prolonged or repeated inhalation exposure. Causes damage to the central nervous system.

Notes:

- a. No LC₅₀ or LD₅₀ has been established for Nickel Alloy (semi-finished steel products). The following data has been determined for the components:
- **Nickel:** LD₅₀ > 9000 mg/kg (Oral/Rat); LC₅₀ > 10.2 mg/l (Inhalation/Rat)
 - **Chromium (as Cr^{+VI}):** LD₅₀ = 80 mg/kg (Oral/Rat)
 - **Cobalt:** LD₅₀ = 6170-8610 mg/kg (Oral/Rat)
 - **Iron:** LD₅₀ = 1060 mg/kg (Oral/ Rat)
 - **Manganese:** Mn single oral exposures, LD₅₀ ranged from 275 to 804 mg/kg body weight per day for manganese chloride in different rat strains
 - **Silicon:** LD₅₀ = 3160 mg/kg (Oral/Rat); and as **Silicon Dioxide:** LD₅₀ > 15,000 mg/kg (Oral/Rat) ; LD₅₀ > 5000 mg/kg (Dermal/Rat); LC₅₀ > 0.69 mg/l/4hr (Inhalation/Rat)

Section 11 - Toxicological Information (continued)

b. No **Skin (Dermal) Irritation** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following Skin (Dermal) Irritation information was found for the components:

- **Nickel:** Slight irritation only in rabbits
- **Cobalt:** Irritating to skin of humans; mild severity specified
- **Chromium (as Cr^{+VI}):** Corrosive. Human skin sensitizer
- **Iron:** Causes skin irritation
- **Molybdenum:** Irritating
- **Columbium (Niobium):** May cause skin irritation
- **Tungsten:** Skin contact may cause irritation due to abrasive action of the dust
- **Tantalum:** May cause abrasive irritation to skin

c. No **Eye Irritation** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following Eye Irritation information was found for the components:

- **Nickel:** Slight eye irritation from particulate abrasion only.
- **Cobalt:** Irritating to skin of humans; mild severity specified
- **Chromium (as Cr^{+VI}):** Corrosive
- **Iron, Molybdenum:** Causes eye irritation
- **Tungsten:** Eye contact may cause irritation due to abrasive action of the dust
- **Silicon:** Slight eye irritation in rabbit protocol
- **Tantalum:** may cause abrasive irritation to eyes.

d. No **Skin (Dermal) Sensitization** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following Skin (Dermal) Sensitization information was found for the components:

- **Nickel:** Human skin sensitizer
- **Copper, Chromium (as Cr^{+VI}):** May cause allergic skin reaction
- **Cobalt:** May cause sensitization by skin contact
- **Copper:** It is reported that copper may induce allergic contact dermatitis in susceptible individuals,

e. No **Respiratory Sensitization** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following Respiratory Sensitization information was found for the components:

- **Chromium (as Cr^{+VI}):** Occupational asthma reported in workers
- **Cobalt:** May cause sensitization by inhalation

f. No **Germ Cell Mutagenicity** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following Mutagenicity and Genotoxicity information was found for the components:

- **Nickel:** Positive results *in vitro* and *in vivo* but insufficient data for classification
- **Chromium (as Cr^{+VI}):** Positive in *in vitro* and *in vivo* assays including cell transformation *in vitro* and dominant lethal *in vivo*
- **Cobalt:** Cobalt metal has been reported to be genotoxic in human blood cells in culture.
- **Iron:** Some positive and negative findings *in vitro*
- **Aluminum:** Not mutagenic *in vitro*; but has marginal effects *in vivo*

g. **Carcinogenicity:** IARC, NTP, and OSHA do not list **Nickel Alloy** (semi-finished steel products) as a carcinogen. The following Carcinogenicity information was found for the components:

- **Welding Fumes,** IARC Group 2B carcinogen, a mixture that is possibly carcinogenic to humans.
- **Nickel and certain nickel compounds** - IARC Group 2B carcinogens that are possibly carcinogenic to humans. Insoluble nickel compounds - ACGIH confirmed human carcinogen. Nickel - EURAR Insufficient evidence to conclude carcinogenic potential in animals or humans; suspect carcinogen classification Category 2 Suspected of causing cancer. Nickel Oxide – HSDB listed as Category 1a, may cause cancer. Human data in which exposure to nickel refinery dust caused lung and nasal tumors.
- **Chromium metal and trivalent chromium compounds** - IARC Group 3 carcinogens, not classifiable as to their human carcinogenicity. Hexavalent chromium compounds - IARC as Group 1 carcinogens, carcinogenic to humans. Chromium metal - ACGIH not classifiable as a human carcinogen. NTP Fourth Annual report on Carcinogens cites “certain Chromium compounds” as human carcinogens.

h. No **Toxic Reproduction** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following Toxic Reproduction information was found for the components:

- **Nickel:** Oral administration to experimental animals caused fetotoxicity.
- **Hexavalent Chromium:** Developmental toxicity in the mouse.
- **Aluminum:** May cause delay in development of neurobehavioral indices.

i. No **Specific Target Organ Systemic Toxicity (STOST) following a Single Exposure** data available for **Nickel Alloy** (semi-finished steel products) as a mixture. The following STOST following a Single Exposure data was found for the components:

- **Cobalt, Iron and Molybdenum:** May cause respiratory irritation.
- **Tantalum:** May cause abrasive irritation to mucus membranes of the respiratory tract.

j. No **Specific Target Organ Systemic Toxicity (STOST) following Repeated Exposure** data was available for **Nickel Alloy** (semi-finished steel products) as a whole. The following STOST following Repeated Exposure data was found for the components:

- **Nickel:** Rats exposed to Nickel by inhalation at 1 mg/m³ for 90 days developed lung inflammation, hyperplasia and fibrosis.
- **Hexavalent Chrome:** Inflammation of lung, skin irritation and ulceration with repeat exposures in workers.
- **Cobalt:** Occupational exposure to cobalt containing dusts can cause fibrotic changes in the lung and precipitate asthma.
- **Manganese:** Neurobehavioral alterations in worker populations with Mn and MnO including: speed and coordination of motor function are especially impaired.
- **Aluminum:** Chronic exposure to aluminum flake has been reported to cause pneumoconiosis in workers. Repeat oral exposure to aluminum results in decrements in neurobehavioral function and development.

Section 11 - Toxicological Information (continued)

The above toxicity information was determined from available scientific sources to illustrate the prevailing posture of the scientific community. The scientific resources includes: The American Conference of Governmental Industrial Hygienist (ACGIH) Documentation of the Threshold Limit Values (TLVs) and Biological Exposure indices (BEIs) with Other Worldwide Occupational Exposure Values 2009, The International Agency for Research on Cancer (IARC), The National Toxicology Program (NTP) updated documentation, the World Health Organization (WHO) and other available resources, the International Uniform Chemical Information Database (IUCLID), European Union Risk Assessment Report (EU-RAR), Concise International Chemical Assessment Documents (CICAD), European Union Scientific Committee for Occupational Exposure Limits (EU-SCOEL), Agency for Toxic Substances and Disease Registry (ATSDR), Hazardous Substance Data Bank (HSDB), and International Programme on Chemical Safety (IPCS).

Section 12 - Ecological Information

Hazard Category: Not Reported

Hazard Symbol: No Symbol

Signal Word: No Signal Word

Hazard Statement: No Hazard Statement

Ecotoxicity: No data available for the product, **Nickel Alloy** (semi-finished steel products) as a whole. However, individual components of the product have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife as follows:

- **Hexavalent Chrome:** EC₅₀ and LD₅₀ to algae and invertebrates < 1 mg.
- **Aluminum:** LC₅₀> 100 mg/l for fish and algae

Mobility: No data available for the product, **Nickel Alloy** (semi-finished steel products) as a whole. However, individual components of the product have been found to be absorbed by plants from soil.

Persistence & Degradability: No Data Available

Bioaccumulative Potential: No Data Available

Note: The listing of regulations relating to an ATI product may not be complete and should not be solely relied upon for all regulatory compliance responsibilities.

Section 13 - Disposal Considerations

Disposal: This material is considered to be a solid waste, not a hazardous waste. Follow applicable Federal, state, and local regulations for disposal of solid waste. Do not release into sewers or waterways. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations.

Container Cleaning and Disposal: Follow applicable federal, state and local regulations. Observe safe handling precautions. European Waste Catalogue (EWC): 16-01-17 (ferrous metals), 12-01-99 (wastes not otherwise specified), 16 03 (off specification batches and unused products), or 15 01 04 (metallic packaging).

Please note this information is for Nickel Alloy in its original form. Any alterations can void this information.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

US Department of Transportation (DOT) under 49 CFR 172 does not regulate **Nickel Alloy** (semi-finished steel products) as a hazardous material. All federal, state, and local laws and regulations that apply to the transport of this type of material must be adhered to.

Shipping Name: Not Applicable (NA) Shipping Symbols: NA Hazard Class: NA UN No.: Not applicable Packing Group: NA DOT/ IMO Label: NA Special Provisions (172.102): NA	Packaging Authorizations a) Exceptions: NA b) Group: NA c) Authorization: NA	Quantity Limitations a) Passenger, Aircraft, or Railcar: NA b) Cargo Aircraft Only: NA Vessel Stowage Requirements a) Vessel Stowage: NA b) Other: NA DOT Reportable Quantities: NA
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The International Maritime Dangerous Goods (IMDG) and the Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) classification, packaging and shipping requirements follow the US DOT Hazardous Materials Regulation.

ADR – Regulations Concerning the International Carriage of Dangerous Goods by Road does not regulate **Nickel Alloy** (semi-finished steel products) as a hazardous material.

Shipping Name: Not Applicable (NA) Classification Code: NA UN No.: Not applicable Packing Group: NA ADR Label: NA Special Provisions: NA Limited Quantities: NA	Packaging a) Packing Instructions: NA b) Special Packing Provisions: NA c) Mixed Packing Provisions: NA	Portable Tanks & Bulk Containers a) Instructions: NA b) Special Provisions: NA
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Section 14 - Transport Information (continued)

IATA – International Air Transport Association (IATA) does not regulate **Nickel Alloy** (semi-finished steel products) as a hazardous material.

Shipping Name: Not Applicable (NA) Class/Division: NA Hazard Label (s): NA UN No.: NA Packing Group: NA Excepted Quantities (EQ): NA	Passenger & Cargo Aircraft Limited Quantity (EQ)		Cargo Aircraft Only Pkg Inst: NA	Special Provisions: NA ERG Code: NA
	Pkg Inst: NA Max Net Qty/Pkg: NA	Pkg Inst: NA Max Net Qty/Pkg: NA	Max Net Qty/Pkg: NA	

Pkg Inst – Packing Instructions Max Net Qty/Pkg – Maximum Net Quantity per Package ERG – Emergency Response Drill Code

Transport Dangerous Goods (TDG) classification: **Nickel Alloy** (semi-finished steel products) does not have a TDG classification.

Section 15 - Regulatory Information

Regulatory Information: *The following listing of regulations relating to an ATI Allegheny Ludlum product may not be complete and should not be solely relied upon for all regulatory compliance responsibilities.*

This product and/or its constituents are subject to the following regulations:

OSHA Regulations: Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-2, Z-3): The product, **Nickel Alloy** (semi-finished steel products) as a whole is not listed. However, individual components of the product are listed: Refer to Section 8, Exposure RCRA, Controls and Personal Protection

EPA Regulations: Nickel Alloy (semi-finished steel products) is not listed as a whole. However, individual components of the product are listed:

Components	Regulations
Nickel	CAA, CWA, SARA 313, CERCLA, SDWA, RCRA
Chromium	CAA, CWA, SARA 313, SDWA, CERCLA, RCRA
Cobalt	SARA 313
Iron	SDWA
Molybdenum	SDWA
Aluminum	SWDA, SARA 313
Copper	CWA, CERCLA, SDWA, SARA 313
Manganese	SARA 313, CAA, CERCLA, SDWA

SARA Potential Hazard Categories: Immediate Acute Health Hazard; Delayed Chronic Health Hazard

Regulations Key:

- CAA Clean Air Act (42 USC Sec. 7412; 40 CFR Part 61 [As of: 8/18/06])
- CERCLA Comprehensive Environmental Response, Compensation and Liability Act (42 USC secs. 9601(14), 9603(a); 40 CFR Sec. 302.4, Table 302.4, Table 302.4 and App. A)
- CWA Clean Water Act (33 USC Secs. 1311; 1314(b), (c), (e), (g); 136(b), (c); 137(b), (c) [as of 8/2/06])
- RCRA Resource Conservation Recovery Act (42 USC Sec. 6921; 40 CFR Part 261 App VIII)
- SARA Superfund Amendments and Reauthorization Title III Section 302 Extremely Hazardous Substances (42 USC secs. 11023, 13106; 40 CFR Sec. 372.65) and Section 313 Toxic Chemicals (42 USC secs. 11023, 13106; 40 CFR sec. 372.65 [as of 6/30/05])
- TSCA Toxic Substance Control Act (15 U.S.C. s/s 2601 et seq. [1976])
- SDWA Safe Drinking Water Act (42 U.S.C. s/s 300f et seq. [1974])

Section 313 Supplier Notification: This product, **Nickel Alloy** (semi-finished steel products) contains the following toxic chemicals subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372:

CAS #	Chemical Name	Max Percent by Weight
7440-02-0	Nickel	80
7440-47-3	Chromium	33
7440-48-4	Cobalt	21
7429-90-5	Aluminum	5
7440-50-8	Copper	3
7439-96-5	Manganese	1

This information should be included in all MSDSs that are copied and distributed for this material.

State Regulations: The product, **Nickel Alloy** (semi-finished steel products) as a whole is not listed in any state regulations. However, individual components of the product are listed in various state regulations:

Pennsylvania Right to Know: Contains regulated material in the following categories:

- Hazardous Substances: Chromium, Nickel, Manganese, Copper, Molybdenum, Tantalum, Tungsten, Aluminum, and Silicon
- Environmental Hazards: Cobalt, Aluminum (dust and Fume), Nickel, Tantalum Manganese, Copper, and Chromium
- Special Hazard Substances: Chromium, Nickel and Iron

California Prop. 65: The product, **Nickel Alloy** (semi-finished steel products) may possibly contain metallic elements known to the State of California to cause cancer or reproductive toxicity. These include cobalt, chromium and nickel.

Section 15 - Regulatory Information (continued)

State Regulations (continued):

New Jersey: Contains regulated material in the following categories:

- Special Health Hazard Substances: Manganese, Nickel, and Chromium
- Hazardous Substance List: Iron Oxide (fume), Silicon, Cobalt, Titanium, Molybdenum, Tantalum, Tungsten, Aluminum (dust and fume), Chromium, Nickel, Manganese, and Copper
- Environmental Hazards: Nickel, Aluminum, Cobalt, Chromium compounds and Tungsten

Minnesota: Iron Oxide (fume) Silicon, Copper, Cobalt, Molybdenum, Nickel (elemental, soluble, and insoluble compounds), Aluminum (dust and fume), Chromium (metal), and Manganese (elemental and compounds)

Massachusetts: Aluminum (dust and fume), Silicon (dust), Iron, Nickel, Copper, Chromium (compounds), Manganese, Molybdenum, Cobalt, Tantalum, and Tungsten

Other Regulations:

WHMIS Classification (Canadian): Nickel Alloy (semi-finished steel products) is not listed as a whole. However individual components are listed.

Ingredients	WHMIS Classification
Nickel	D2B
Cobalt	D2A, D2B
Iron	B4, D2B
Copper	D2B, B4
Manganese	B4, D2A
Molybdenum	B4, D2B
Silicon	B4
Titanium	D26

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Section 16 – Other Information

Hazardous Material Identification System (HMIS) Classification

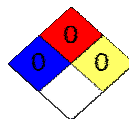
Health Hazard	0
Fire Hazard	0
Physical Hazard	0

HEALTH = 0, No significant risk to health.

FIRE = 0, Materials that will not burn

PHYSICAL HAZARDS = 0, Materials that are normally stable, even under fire conditions, and will not react with water, polymerize, decompose, condense, or self-react. Non-explosives

National Fire Protection Association (NFPA)



HEALTH = 0, No hazard beyond that of ordinary combustible materials.

FIRE = 0, Materials that will not burn

INSTABILITY = 0, Normally stable, even under fire exposure conditions, and are not reactive with water.

ABBREVIATIONS/ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists	NIF	No Information Found
BEIs	Biological Exposure Indices	NIOSH	National Institute for Occupational Safety and Health
CAS	Chemical Abstracts Service	NTP	National Toxicology Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	ORC	Organization Resources Counselors
CFR	Code of Federal Regulations	OSHA	Occupational Safety and Health Administration
CNS	Central Nervous System	PEL	Permissible Exposure Limit
GI, GIT	Gastro-Intestinal, Gastro-Intestinal Tract	PNOR	Particulate Not Otherwise Regulated
HMIS	Hazardous Materials Identification System	PNOC	Particulate Not Otherwise Classified
IARC	International Agency for Research on Cancer	PPE	Personal Protective Equipment
LC50	Median Lethal Concentration	ppm	parts per million
LD50	Median Lethal Dose	RCRA	Resource Conservation and Recovery Act
LD_{Lo}	Lowest Dose to have killed animals or humans	RTECS	Registry of Toxic Effects of Chemical Substances
LEL	Lower Explosive Limit	SARA	Superfund Amendment and Reauthorization Act
µg/m³	microgram per cubic meter of air	SCBA	Self-contained Breathing Apparatus
mg/m³	milligram per cubic meter of air	STEL	Short-term Exposure Limit
mppcf	million particles per cubic foot	TLV	Threshold Limit Value
MSDS	Material Safety Data Sheet	TWA	Time-weighted Average
MSHA	Mine Safety and Health Administration	UEL	Upper Explosive Limit
NFPA	National Fire Protection Association		

Section 16 - Other Information (continued)

DISCLAIMER: All information, recommendations, and suggestions appearing herein concerning the product are based upon data believed to be reliable. It is the user's responsibility to determine the safety, toxicity, and suitability for their own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied is made by AM Health and Safety, Inc. (acting consultant) and ATI Allegheny Ludlum as to the effects of such use, the results to be obtained, or the safety and toxicity of the product, nor does AM H&S or ATI Allegheny Ludlum assume any liability arising out of use by others of the product referred to herein. AMH&S and ATI Allegheny Ludlum shall not in any event be liable for special, incidental or consequential damages in connection with this MSDS. This MSDS is not intended as a license to operate under, or recommendation to infringe on, any patents. Appropriate warnings and safe handling procedures should be provided to handlers and users.

This information is not intended to serve as a complete regulatory compliance document. This information is offered as a guide to the MSDS user. No guarantees can be made whether the user will be in complete or correct compliance with all applicable regulations when this MSDS is used. It is the user's responsibility to comply with all federal, state, and local regulations.

NOTE: The percent composition in Section 3 reflects the range that is possible within this GROUP of products. These are not the technical specifications for a particular product.

PREPARED BY: AM Health and Safety, Inc. (acting consultant)

REVISION NO.: 1

APPROVAL DATE: 12/15/11

MFR. CONTACT: M.R. Shirey (724-226-5980)

SUPERSEDES MSDS DATED: 12-15-07

WEBSITE: www.alleghenyludlum.com or www.ATIMetals.com

Note: This MSDS supersedes all prior MSDSs issued by ATI Allegheny Ludlum.