

PYRITE CONCENTRATE MATERIAL SAFETY DATA SHEET

ISSUED 16/06/14

SECTION 1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Identity: Mt Carlton Pyrite Concentrate

Manufacturer:
Evolution Mining
Mt Carlton Operations
PO Box 306
Bowen
QLD 4805

Supplier:
Evolution Mining
Level 30
175 Liverpool Street
Sydney
NSW 2000

MSDS Preparer:
Evolution Mining
Mt Carlton Operations
PO Box 306
Bowen
QLD 4805

Date of Last MSDS Revision/Edit: June 1, 2014

Product Use: Product is a complex mixture of minerals and used as a feedstock for metal smelters

The buyer assumes all risk in connection with the use of the material. Evolution Mining assumes no responsibility or liability in connection with the information supplied on this sheet or for any damage or injury caused by the material. The information contained in this material safety data sheet is developed from data supplied by commercial laboratories, and based on the best opinions and authoritative facts available at the time of issue but shall in no event be held to constitute or imply any warranty or understanding. No liability whatsoever can be accepted with regard to handling, processing or use of the product concerned which in all cases should be employed with due regard to relevant regulations or legislation.

Emergency Telephone Number: +61 7 4422 0113

SECTION 2. HAZARDS IDENTIFICATION

Classification of the Substance or Mixture: Non-Dangerous Goods according to the Model WHS Regulations and the ADG Code

Classification according to EC 1272 / 2008 (CLP / GHS):

Carcinogenicity
Reproductive Toxicity
STOT-RE, Specific Target Organ Toxicity – Repeated Exposure

Cat.2
Cat. 1A
Cat. 1

Labeling Pictogram:



SIGNAL WORD:

DANGER

Hazard Statements:

H351 – Suspected of causing cancer
 H360 – May damage fertility or the unborn child
 H373 – Causes damage to organs through prolonged or repeated exposure

Prevention Statements:

P260 - Do not breathe dust/fume/vapours/spray
 P285 - In case of inadequate ventilation wear respiratory protection.
 P281 – Use personal protective equipment as required.
 P270 - Do not eat, drink or smoke when using this product
 P264 - Wash hands thoroughly after handling
 P501 - Dispose of contents/containers in accordance with local regulation
 P273 – Avoid release to the environment
 P314 – Get medical advice/attention if you feel unwell

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

Pyrite Concentrate is a mineral product used in the production of metal and alloys. Mineral product comprising Pyrite with minor Silicates, Chalcopyrite, Enargite, Barium Sulfates, and Lead Sulfide.

Iron is present in the naturally occurring metal sulfide and oxides. Sulphur is present only on naturally occurring metal sulfide forms when shipped. These sulfide and oxide forms are variable in content. Toxicology data for these minerals pertains to the metal itself. Elements listed represent contents total within the various metal forms.

Ingredient Name	Chemical Formula	EC Number	CAS Number	Proportion (% by weight)
Pyrite, Iron Sulphide	FeS ₂		1309-36-0	25
Sphalerite, Zinc Sulphide	ZnS		12169-28-7	15 – 20
Silica Quartz	SiO ₂	238-878-4	14808-60-7	20
Chalcopyrite, Copper Sulphide	CuFeS ₂	603-441-2	1308-56-1	15
Galena, Lead Sulphide	PbS		51682-73-6	5 – 7
Enargite, Copper-Arsenic Sulphide	Cu ₃ AsS ₄			5
Barite	BaSO ₄		13462-86-7	5 – 7
Water	H ₂ O		7732-18-5	7 – 10

SECTION 4. FIRST AID MEASURES

Eye Contact: Flush with warm, running water, including under the eyelids, to remove dust particle(s). If irritation persists seek medical attention.

Skin Contact: Remove contaminated clothing and wash affected area with soap and warm water. Launder contaminated clothing before reuse. Seek medical attention if irritation develops or persists.

Inhalation: Remove victim from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Medical oxygen may be administered, if available, where breathing is difficult. If irritation persists or cough or other symptoms develop, seek medical attention.

Ingestion: If victim is conscious and can swallow, dilute stomach contents with 2-4 cupfuls of water or milk and induce vomiting. Seek medical attention and bring a copy of this MSDS. Never give anything by mouth to an unconscious person.

Most Important Symptoms and Effects: Symptoms and effects are generally associated with chronic exposures and not acute.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Product is not considered a fire or explosion hazard. However, concentrate will burn if strongly heated in a fire situation, releasing toxic and irritating sulphur dioxide gas (SO₂). Contact with strong acids will generate flammable and highly toxic hydrogen sulphide gas (H₂S). The ignition temperature of pyrite concentrate is approximately 700 – 800°C.

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: Toxic fumes of sulphur dioxide may result from combustion. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face piece mask.

Flashpoint and Method: Not Applicable

Upper and Lower Flammable Limit: Not Applicable

Auto ignition Temperature: Not Applicable

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid generating dust. Avoid contact with spilled material. Use personal protective equipment where inhalation or skin contact risk exists.

Environmental Precautions: Contain product and prevent contamination of soil and runoff into drains and waterways. Inform the relevant authorities in the case of spillage during transport.

Method of Cleaning up: Contain and recover concentrate and place product into designated labeled waste containers. Return recovered product for processing, if appropriate.

SECTION 7. STORAGE AND HANDLING

Precautions for Safe Handling: Avoid breathing dust. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands after handling and before eating, drinking, or smoking in appropriate designated areas only. Some sulphide concentrates may slowly oxidize in storage and generate sulphur dioxide as well as deplete the oxygen content of a confined space. The atmosphere within confined spaces containing concentrate must be tested before entry and the area thoroughly ventilated or self-contained breathing apparatus used, if conditions warrant.

Conditions for Safe Storage: Store in a cool, dry, well-ventilated area, removed from oxidising agents, acids and foodstuffs. If stored in bulk in an open environment, minimise dust generation by dampening with water or covering with a tarp or similar. Avoid getting wet as water content of concentrate is a critical factor. If stored in packages are adequately labeled and check regularly and inspect for spillages.

Product may be packaged into bulky bags and containerized for transport. Ensure bags are labelled and inspected in case of spillages. When stored in bulk in a sealed environment such as on ships, care must be taken as an oxygen deficient atmosphere may occur. Before entry, ventilate area well and ensure oxygen levels are acceptable and safe to enter. See PPE. Product may liquefy if shipped when moisture content in excess of their transportable limits. Avoid excessive heat. Avoid contact with acids, oxidizers and combustible materials. Minimize dust generation and accumulation.

Auto ignition: Some sulphide concentrates may oxidize and generate heat which accumulates in storage piles. If material is to be stored for an extended period, the temperature of piles should be monitored.

Means of Control: If heating of the concentrate is detected, the material should be sealed from air or oxygen in one of the following ways:

1. Leave the piles totally intact, do not open them up or try to spread them around.
2. Tamp or compact the surface of the piles.
3. Spray the pile with water. Resort to an organic binder only if needed because it can cause formation of hard lumps and subsequent problems for fluid bed roasting. Suggestions for organic binders include erospray 70A Binder, Coherex, Igepal CA-720 and lignin sulphonate, a pulp mill by-product.
4. For smaller piles, cover them with a tarp that will prevent exposure of the material to air.
5. If inside a building or ship's hold, keep all doors closed as much as possible.

SECTION 8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

Control Parameters:

Name	Reference	TWA mg/m ³	STEL mg/m ³
Lead	Safe Work Australia	0.15	N/a
Zinc Oxide Dust	Safe Work Australia	10	
Arsenic & soluble compounds (as As)	Safe Work Australia	0.05	
Iron Oxide Fume (as Fe)	Safe Work Australia	5	
Silica, Respirable silica	Safe Work Australia	0.1	
Respirable Dust	Safe Work Australia	3	

Exposure Controls: Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical extraction ventilation is recommended. Maintain dust levels below the recommended exposure standard.

Personal Protection: Coveralls or other work clothing, glasses or goggles, and gloves are recommended to prevent prolonged or repeated direct skin contact. Close-fitting safety goggles should be worn to prevent eye contact if excessive dust is generated or where any possibility exists that eye contact may occur. Workers should wash immediately when skin becomes contaminated and at the end of each work shift. Work clothing should be removed immediately if it becomes heavily contaminated and should be changed daily and laundered before reuse if there is reasonable probability that the clothing may be contaminated.

Respirators: Where zinc concentrate dust is generated and cannot be controlled to within acceptable levels by engineering means, wear a Class P2 (Particulate) respirator / dust mask. Where gases are generated, wear a Type BE (Inorganic and acid gas, sulphur dioxide) respirator or full face air-line in confined areas.



The recommendation for protective equipment contained within this MSDS is provided as a guide only. Factors such as method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

Recommended that a risk assessment is performed for the task to determine the appropriate controls.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Dark brown, fine-grained powder

Odour:

Weak organic odour from entrained xanthates

Physical State

Solid

pH:

Not Available

Vapour Pressure:

Not Applicable

Vapour Density:

Not Applicable

Boiling Point/Range:

Not Applicable

Freezing/Melting

Will burn first unless in an inert atmosphere

Specific Gravity:

2.65 (Bulk Sp. Gr. Comp)
1.7 (Bulk Sp. Gr. Uncomp)

Evaporation Rate:

Not Applicable

Coefficient of Water/Oil

Distribution:
Not Applicable

Odour Threshold:

Not Available

Solubility:

Essentially insoluble

Particle Size:

<75 µm, with 80% <35 µm

Percent Volatiles:

7% to 10% water

SECTION 10. STABILITY AND REACTIVITY

Reactivity: Screening tests have determined that this product is not corrosive to metals

Stability: Stable under recommended conditions of storage and containing 10% moisture. Product tested and found not to be classifiable as a self-heating substance. Avoid the product drying out as it may release toxic gases containing sulphur compounds.

Possibility of Hazardous Reactions: Polymerization will not occur.

Conditions to Avoid: Avoid heat and allowing the product to dry out in bulk storage, open flames and other ignition sources. Avoid adding water to bulk product in excess of the transportable moisture limit as it may cause the product to liquefy when shipped in bulk.

Incompatible Materials: Incompatible with acids and oxidising agents (eg. hypochlorites). Upon contact with acids, hydrogen sulphide, an extremely toxic gas, is evolved. Many sulphides react violently with oxidizers to evolve a strongly irritant gas, sulphur dioxide.

Hazardous Decomposition Products: May evolve toxic gases eg sulphur dioxide as well as metal oxides and lead compounds, when heated to decomposition. May release hydrogen sulphide gas on contact with strong acids.

SECTION 11. TOXICOLOGICAL INFORMATION

General: In the powder form in which this product is sold, the metals are present as sulphides which are relatively insoluble and poorly absorbed within the body. However high temperature operations such as oxy-acetylene cutting, electric arc welding or arc gouging on dust contaminated surfaces will generate metal oxide fume that also contains lead, arsenic and cadmium oxides. These oxides are soluble in body fluids and the particle size of the metal fumes is largely in the respirable size range which increases the potential of inhalation and deposition within the body. The primary route of exposure would be through inhalation of the metal oxide fumes.

The toxicological properties of this product in its entirety have not been fully investigated. The information contained in this MSDS, is therefore, based on technical and scientific literature about the constituent compounds.

Product is a mixture of various minerals sulphides and silica. Arsenic bio-accessibility tests were performed on the product and found that the mineralogy caused less than 10 % of the arsenic to be bio available.

Health Hazard classification has been based on the lead and quartz content. Lead sulphide has low solubility. However inorganic lead can accumulate in the body and affect the blood forming tissue as well as have reproductive effects on the unborn child. Lead is classified as a Toxic to Reproduction, Category 1.

Product contains iron and zinc sulphide compounds which have low solubility and limited health effects. Zinc is not classified using current EU criteria.

1. **Acute Toxicity:** Ingestion of the product may result in nausea, vomiting, abdominal pain and diarrhea.
2. **Skin Corrosion / Irritation:** Contact with dust may cause local irritation
3. **Serious Eye Damage / Irritation:** Contact with dust may cause local irritation, lacrimation, pain and redness.
4. **Respiratory or Skin Sensitization:** There is no evidence that the sparingly soluble minerals present in this product cause respiratory or skin sensitization.
5. **Germ Cell Mutagenicity:** Product is not considered to be mutagenic.
6. **Carcinogenicity:** Product has been classified as Category 2. IARC has listed lead as a Group 2A Carcinogen (Probable Carcinogen to Humans), however the EU does not list lead compounds as a human carcinogen. IARC has classified cadmium and certain cadmium compounds as a Group 1 Carcinogen (Carcinogenic to Humans) The EU lists classifies cadmium sulphide as a Category 1B Carcinogen. IARC has listed Arsenic and inorganic arsenic compounds as a Group 1 Carcinogen (Carcinogen to Humans), however the EU does not list arsenic compounds, with the exception of those specified elsewhere in the Annex as carcinogens. IARC has classified cadmium and certain cadmium compounds as a Group 1 Carcinogen (Carcinogenic to Humans).
7. **Reproductive Toxicity:** Product contains sufficient lead that the product is classified as having Reproductive Toxicity Category 1A. Chronic over exposure to lead compounds may cause adverse effects on male and female fertility, including adverse effects on sperm mobility. Prenatal exposure to lead compounds is also associated with adverse effects on neurobehavioral development in children.
8. **STOT – Single Exposure:** Not classified. Minerals present have been found to have low acute toxicity by ingestion, contact with skin and by inhalation, with no evidence of any local or systemic toxicity from such exposures.
9. **STOT Repeated Exposure:** Product is classified as Category 1 and is related to the presence of 20.5% of silica. Prolonged and/or massive exposure to respirable crystalline silica-containing dust may cause silicosis, a nodular pulmonary fibrosis caused by deposition in the lungs of fine respirable particles of crystalline silica.
10. **Aspiration Hazard:** The product is a solid and aspiration hazards are not expected to occur.

SECTION 12. ECOLOGICAL INFORMATION

General: Pyrite concentrate is insoluble in water and generally has low direct bio-availability. However, extended exposure in the aquatic and terrestrial environments can lead to the release of contained metals in bioavailable forms. These can cause detrimental environmental effects. The mobility of zinc and lead is media dependent. They can bind with inorganic and organic ligands, reducing their mobility and bioavailability in soil and water. Bioavailability is also controlled by other factors such as pH and hardness.

- 1. Toxicity:**
 - a. The 28 day Transformation / Dissolution test was performed and the product was found not to be classified as Aquatic Acute 1 or Aquatic Chronic 1 / 2, the criteria used for classification.
 - b. Under GHS protocols product was found to be Acute 2 / Chronic 3.
- 2. Persistence / Degradability:** Minerals are persistent in the environment. Biodegradation is not relevant for these minerals.
- 3. Bioaccumulation Potential:** Dissolved metal compounds (lead, zinc, copper, cadmium and arsenic) present have the potential to bio-accumulate.
- 4. Mobility in Soil:** Minerals are sparingly soluble and expected to be adsorbed onto soils and sediment. Mobility is low.
- 5. PBT and vPvB Assessment:** The PVT and vPvB criteria in Annex XIII of the REACH Regulations do not apply to inorganic substances.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste and spillages should be collected and recycled to recover the metals. Dispose of in accordance with relevant local legislation. Used large bulky bags should be disposed of in accordance with relevant local legislation.

SECTION 14. TRANSPORT INFORMATION

LAND TRANSPORT (ADG / ADR / RID / US DOT)

Transport Hazard Class	Not classified as Dangerous Good. None allocated.	UN Number	None allocated
UN Proper Shipping Name	None allocated	Hazchem Code	None allocated
Packing Group	None allocated	Special Precautions for User	None allocated
Environmental Hazards	None allocated		

SEA TRANSPORT (IMDG AND IMSBC CODE)

Transport Hazard Class	Not classified as Dangerous Good. None allocated.	UN Number	None allocated
Bulk Cargo Shipping Name	METAL SULPHIDE CONCENTRATES	Class	MHB
Substance Harmful to the Marine Environment (SHME)	Not classified	Group	A & B

AIR TRANSPORT (ICAO-TI / IATA-DGR)

Transport Hazard Class	Not classified as Dangerous Good. None allocated.	UN Number	None allocated
UN Proper Shipping Name	None allocated	Hazchem Code	None allocated
Packing Group	None allocated	Special Precautions for User	None allocated
Environmental hazards	None allocated		

SECTION 15. REGULATORY INFORMATION

Safety, Health and Environmental Regulations / Legislation:

Classification according to EC 1272 / 2008 (CLP / GHS):

Carcinogenicity	Cat.2
Reproductive Toxicity	Cat. 1A
STOT-RE, Specific Target Organ Toxicity – Repeated Exposure	Cat. 1

Hazard Statements

- H351 – Suspected of causing cancer
- H360 – May damage fertility or the unborn child
- H372 – Causes damage to organs through prolonged or repeated exposure

AICS

All chemicals listed on the Australian Inventory of Chemical Substances (AICS).

SECTION 16. OTHER INFORMATION

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