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Safety Data Sheet

RMMG-1

1 – MATERIAL AND COMPANY IDENTIFICATION

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| CRM code | RMMG-1 |
| CRM name | Mining Waste (Jarosite) |
| Product intended use | This certified reference material (CRM) is intended for use in calibration of a measurement system, assessment of a measurement procedure, quality control and value assignment to materials with similar matrices. An RMMG-1 unit consists of around 80 g of material packaged in eight vacuum sealed PET+aluminum+PE lined sachets, containing a minimum of 10 g of material each. |
| Producer information | Center for Mineral Technology - CETEM Certified Reference Material Program - PMRC Av. Pedro Calmon, 900 – Ilha da Cidade Universitária 21941-908 – Rio de Janeiro – RJ Brazil Telephone / Fax: 55 21 3865-7310 / 55 21 2290-9196 E-mail: pmrc@cetem.gov.br Website: http://www.cetem.gov.br/crm |

2 – HAZARDS IDENTIFICATION

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| Classification: | |
| ▪ Physical hazard | Not classified. |
| ▪ Health hazard | Not classified. |
| Label elements: | Not applicable. |
| ▪ Symbol | No symbol or pictogram. |
| ▪ Signal word | No signal word. |
| ▪ Hazard statement(s) | Not applicable. |
| ▪ Precautionary statement(s) | Not applicable. |
| ▪ Hazards not otherwise classified | Not applicable. |
| ▪ Ingredients with unknown acute toxicity | Not applicable. |

3 – COMPOSITION AND INFORMATION ON INGREDIENTS

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| Substance/Mixture | Jarosite |
| Other designation | Residue generated in a primary zinc plant. |
| Components | Quartz, gypsum, calcite and minerals from the amphibole, alunite and hydrotalcite supergroups/groups, probably close to hornblende, jarosite and hydrowoodwardite, respectively. Gypsum, calcite, jarosite and hydrowoodwardite are likely synthetic phases precipitated from metallurgical residues rather than minerals whereas quartz and hornblende might be refractory minerals withstanding the ore's processing. |
| CAS N° | Not applicable. |

The Certificate of Analysis reports the concentrations of the individual constituents as elements. The elements are not freely available in the material as sold. The health and safety information provided in this SDS are for jarosite residue not for its individual constituents. This material does not contain free crystalline silica, quartz; silicon is present but in form of silicates.

4 – FIRST AID MEASURES

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| Description of first aid measures: | |
| ▪ Inhalation | If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention. |
| ▪ Skin contact | Wash skin with soap and water. |
| ▪ Eye contact | Flush eyes with water for at least 15 minutes. If necessary, seek medical attention. |
| ▪ Ingestion | If adverse effects occur after ingestion, seek medical treatment. |
| Most important symptoms and effects, acute and delayed | Exposure may cause mechanical irritation. |
| Indication of any immediate medical attention and special treatment needed, if necessary | If any of the above symptoms are present, seek medical attention if needed. |

5 – FIRE FIGHTING MEASURES

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| Fire and explosion hazards | Negligible fire hazard. Avoid generating dust. The material is not flammable, explosive or combustible. |
| Extinguishing media | Regular dry chemical, carbon dioxide, water in the form of mist, regular foam. Never use direct water jet on fire. |
| Specific hazards arising from the chemical | None listed. |
| Special protective equipment and precautions for fire-fighters | Avoid inhalation of material or combustion byproducts. Wear full protective clothing and a self-contained breathing apparatus. |

6 – ACCIDENTAL RELEASE MEASURES

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| Personal precautions, protective equipment and emergency procedures | Any accumulated material on surfaces should be removed and properly disposed of. Use suitable personal protective equipment (see section 8). |
| Measures for environmental protection | Keep out of water supplies and sewers. |
| Methods and materials for containment and clean up | Collect spilled material in appropriate container for disposal. Keep unnecessary people away, isolate hazard area and deny entry. |

7 – HANDLING AND STORAGE

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| Safe handling precautions | Minimize dust generation and accumulation on surfaces. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Use suitable personal protective equipment (see section 8) Avoid contact with incompatible materials (see section 10). |
| Storage | The material must be stored in its original package, at room temperature in a clean and dry place. The bottle must be opened only during sampling and kept in a desiccator under vacuum or vacuum sealed in a laminated aluminum foil pouch to minimize oxidation and moisture absorption. |

8 – EXPOSURE CONTROLS AND PERSONAL PROTECTION

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| Exposure limits | No occupational exposure limits have been established for jarosite. This material is a particulate matter and adequate inhalation/respiratory protection should be used to minimize exposure. The exposure limits for Particulates Not Otherwise Regulated (PNOR) are applicable. OSHA (PEL) 15 mg/m ³ (TWA, total particulates not otherwise regulated); 5 mg/m ³ (TWA, respirable particulates not otherwise regulated). |
| Engineering controls | Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits. |
| Personal equipment | Wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material. |

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| Respiratory protection | If workspace conditions warrant respirator, wear adequate respirators against dust when handling the material. |
| Eye/face protection | Wear safety goggles with face shields. An eye wash station should be readily available near areas of use. |
| Skin and body protection | Personal protective equipment for the body should be selected on the task being performed and the risks involved. Chemical-resistant gloves should be worn at all times when handling chemicals. |
| 9 – PHYSICAL AND CHEMICAL PROPERTIES | |
| Appearance | Powder / pale brown color. |
| Odor | Odorless. |
| pH | Not applicable. |
| Melting point / freezing point (°C) | Not available. |
| Initial boiling point and boiling range | Not applicable. |
| Flash point (°C) | Not available. |
| Evaporation rate | Not applicable. |
| Flammability | Not flammable. |
| Explosive limits (% volume) | Not available. |
| Vapor pressure | Not available. |
| Vapor density (air=1) | Not available. |
| Density (specific gravity) | 2.67 g/cm ³ |
| Solubility in water at 20°C | Soluble. |
| Partition coefficient (n-octanol/water) | Not available. |
| Autoignition temperature | Not available. |
| Thermal decomposition | >400 °C |
| Viscosity (cP) | Not applicable. |
| Radioactivity | Not available. |
| Nominal particle size | <0.075mm. |
| 10 – STABILITY AND REACTIVITY | |
| Reactivity | Non-reactive. |
| Chemical stability | Stable at normal temperatures and pressure. |
| Possible hazardous reactions | None listed. |
| Conditions to avoid | Avoid generating dust. Avoid heat, flames, sparks, and other sources of ignitions. Avoid contact with incompatible materials. |
| Incompatible materials | Flammable products (solvents, oils and greases), acid vapors and chemical fumes. |
| Hazardous products of decomposition | Thermal decomposition will produce carbon dioxide. |
| 11 – TOXICOLOGICAL INFORMATION | |
| Route of exposure | Inhalation and skin. |
| Symptoms related to the physical, chemical and toxicological characteristics | May aggravate respiratory disorders. |
| Potential health effects (acute, chronic and delayed): | |
| ▪ Inhalation | Irritation and difficulty breathing. |

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| ▪ Skin contact | May cause mechanical irritation. |
| ▪ Eye contact | May cause irritation or eye damage. |
| ▪ Ingestion | No data available on significant adverse effects. |

Numerical measures of toxicity:

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| ▪ Acute toxicity | Not classified, no data available. |
| ▪ Skin corrosion / irritation | Not classified, no data available. |
| ▪ Serious eye damage / eye irritation | Not classified, no data available. |
| ▪ Respiratory sensitization | Not classified, no data available. |
| ▪ Skin sensitization | Not classified, no data available. |
| ▪ Germ cell mutagenicity | Not classified, no data available. |
| ▪ Carcinogenicity | Not classified, no data available. |
| ▪ Listed as a carcinogen / potential carcinogen | Not listed. |
| ▪ Reproductive toxicity | Not classified, no data available. |
| ▪ Specific target organ toxicity, single exposure | Not classified, no data available. |
| ▪ Specific target organ toxicity, repeated exposure | Not classified, no data available. |
| ▪ Aspiration hazard | Not applicable. |

12 – ECOLOGICAL INFORMATION

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| Ecotoxicity Data | No data available. |
| Persistence and degradability | No data available. |
| Bioaccumulation potential | No data available. |
| Mobility in soil | No data available. |
| Other adverse effects | No data available. |

13 – DISPOSAL CONSIDERATIONS

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| Waste disposal | Dispose of waste in accordance with local, state and federal regulations. |
| Disposal of empty packages | The empty package, after clean, may be recycled. |

14 – TRANSPORT INFORMATION

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| Transportation requirements | The material is not regulated by national or foreign transportation requirements. The product is not classified as dangerous for transportation. |
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15 – REGULATORY INFORMATION

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| Specific regulations | Not applicable. |
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16 – ADDITIONAL INFORMATION

This SDS was prepared according to ABNT NBR 14725-4:2014 – Chemicals – Information about safety, health and environment. Part 4: Safety Data Sheet (SDS) for chemicals; and on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) – 6^a ed.: UNO, 2015.

Key and Legend: CAS – Chemical Abstracts Service.

Disclaimer: This SDS provides information based on the current level of knowledge only for use in assessing the hazardous nature of the material and safety measures. The certified values for this material are given in the Certificate of Analysis.

Users of RMMG-1 certified reference material should ensure that the SDS in their possession is current. This can be accomplished by contacting CETEM: (55 21) 3865-7310, fax (55 21) 2290-9196, e-mail pmrc@cetem.gov.br; or downloading it from the website <http://www.cetem.gov.br/mrc>.