CHEMICAL SAFETY REPORT

Update 5: Submitted July 2021

(Replaces: 4th update June 2020; 3rd update June 2016; 2nd Update July 2015; 1st Update 2013 & Original 2010)

Substance Name: Molybdenum Sulfide (MoS2), roasted
EC Number: 289-178-0
CAS Number: 86089-09-0
Registrant's Identity: Joint CSR submitted by the Lead Registrant (Molymet Belgium) on behalf of all members of the joint submission MOCONJS-RMC. Document prepared by the IMOA REACH Molybdenum Consortium (MoCon)

See also the ***2014 OECD Highly Soluble Molybdenum Salts Mutual Acceptance of Data (MAD) dataset (containing primarily sodium molybdate data used for read-across in many instances in this CSR),*** which is attached in IUCLID Section 13.2. The afore-mentioned MAD status data is:

1) likewise contained in the relevant individual sections within this CSR
2) also downloadable from the OECD website at:

http://webnet.oecd.org/HPV/UI/SIDS_Details.aspx?id=5c88d62f-4401-4cad-b521-521a4bd710f3

Several supporting documents/reports are to be considered together with the CSR. They are referenced in the CSR, and are attached in the technical registration dossier in IUCLID section 13.2:

- MoCon read-across concept/justification for human health hazards
- MoCon read-across concept/justification for environmental hazards
- Speciation of molybdenum compounds in water: UV spectra (in support of the above)
- DNEL derivation report
- Background document – Environmental Effects Assessments (updated July 2021)
- Background document – Environmental Fate properties (updated May 2021)
- Background document – Regional / ambient monitoring data (water, soil, sediment)
- OECD SIDS Initial Assessment Profile (SIAP), containing the dataset with MAD status
- List of assessors (list of professionals that contributed to the registration dossier).

- Indirect exposure assessment for Roasted Molybdenite Concentrate (RMC)
- Methodology paper describing the methodology applied in the occupational exposure scenarios for the substance

The **"Exposure Scenarios"**, i.e. chapters 9+10 of Part B of the CSR are also provided as a separate document that is attached to IUCLID section 13.1.

2. MANUFACTURE AND USES

Table 4. Quantities (in tonnes/year)

Year	Tonnages (tonnes per year)
-	For confidentiality reasons the data on manufactured or imported **quantities per registrant are not provided in this joint CSR**, but are instead provided by each individual registrant of this substance in their technical registration dossier (section 3.2 in IUCLID). **Total tonnage on the EU market:** Eurostat data enables assessment the total tonnage of this substance Roasted Molybdenite Concentrate (RMC) in the EU market. RMC can be directly imported (Eurostat product code 26131000). And RMC is produced in the EU by roasting the imported molybdenite ore concentrate (Eurostat product code 26139000). There is no mining of the ore in the EU. Almost all imported ore concentrate is converted to RMC by roasting. Therefore, the tonnage of RMC manufactured in the EU can be estimated from the imported tonnage of the ore concentrate. Details for the years 2011-2018 are presented in tabular format (manually inserted CSR table 2.1, attached in IUCLID as pdf in section 13.2).

Quantities of RMC manufactured in and imported into the EU, tonnes per year

Source for import data: Eurostat, NET IMPORT EU28
Data compiled by the International Molybdenum Association (IMoA)

		2011	2012	2013	2014	2015	2016	2017	2018
RMC direct import into EU (Eurostat product code 26131000)	A	41319	32464	32481	31798	41436	37237	32731	33717
import of molybdenite ore concentrate into EU (product code 26139000)	B	37467	48375	45221	56909	50483	40246	57737	54652
estimated RMC manufacture from roasting the ore concentrate*	C=B*0.825	30910	39910	37308	46950	41648	33203	47633	45088
Total RMC tonnage (import+manufacture)	A+C	**72229**	**72373**	**69788**	**78748**	**83084**	**70440**	**80364**	**78805**

* Molybdenite concentrate has an average 6% (w/w) content of water and oil and there is a concentration factor due to the chemical reactions of the roasting of about 1.14. This gives a weight reduction factor during roasting of 17.5%

2.1. Manufacture

Table 5. Manufacture

	Manufacture
M-1	**Manufacture of RMC** Further description of manufacturing process: The production process of the UVCB substance Molybdenum sulfide (MoS2), roasted, CAS-number 86089-09-0 (also called Roasted Molybdenite Concentrate or RMC) is an oxidation of molybdenum sulfide ores (MoS2) that contain 30-59 % Mo, and the following minor constituents Cu, Pb and As that can be relevant for hazard classification. The process takes place in a multiple-hearth furnace at a temperature of 550-1000 °C with natural gas as fuel and a large excess of air as oxidant. The oxidation of MoS2 is an exothermic reaction: 2 MoS2 + 7 O2 -> 2 MoO3 + 4 SO2 MoS2 + 6 MoO3 -> 7 MoO2 + 2 SO2 2 MoO2 + O2 -> 2 MoOx The multiple hearth or Herreshoff furnace consists of a tower that contains 8 to 18 annular shaped

	refractory brick hearths arranged vertically and enclosed in a cylindrical, refractory-lined steel shell. Material is usually fed to the outside of the top hearth of the furnace and is moved to the center of this hearth by rabble arms where it falls to the center of the second hearth. The material flow on the second hearth is from the center out where it falls to the outside of the third hearth. This zigzag flow is repeated until the roasted material is discharged. The rabble arms are attached to a central, vertical rotating tube which is air cooled. Gas burners are provided at various points in the furnace depending on the combustion characteristics of the material. Molybdenum sulfide (MoS2), roasted, CAS-number 86089-09-0 (also called Roasted Molybdenite Concentrate or RMC) is the end product of the installation. The final product is crushed and sieved to less than 4 mm, and pneumatically transported to the storage silo. From there it can be briquetted, packaged and sold, or it can be used as feedstock to produce ferromolybdenum. The above-described well-known roasting process is also described in the European BREF Non Ferrous Metals Industries (version December 2001, §2.6.1.3. p 86). Contributing activity/technique for the environment : **- Manufacture of RMC (ERC1)** Contributing activity/technique for the workers : **- Roasting (PROC 22)** **- Mechanical treatment of massive object (PROC 24)** **- Briquetting (PROC 14)** **- Quality control (PROC 15)** **- Handling and packaging of solid substance (PROC 9; PROC 26)** **- Wet cleaning (PROC28)** **- Removal of dust (PROC28)** use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant Tonnage of substance for that use: tonnes/year Related assessment: use assessed in a joint CSR

2.2. Identified uses

Table 6. Uses at industrial sites

	Uses at industrial sites
IW-1	**Intermediate use of RMC in steel and alloy production** Further description of the use: In the steel and alloy industries RMC is an intermediate in the sense that it is converted into metallic molybdenum within the steel/alloy matrix, where it primarily enhances the corrosion resistance properties of the steel/alloy. Contributing activity/technique for the environment : **- Intermediate use of RMC in steel and alloy production (ERC6a)** Contributing activity/technique for the workers : **- Raw material handling (PROC 9; PROC 26)** **- Mixing, blending (PROC 4; PROC 5)** **- Quality control (PROC 15)** **- Steel and alloy production in batch process (PROC 1; PROC 2; PROC 3; PROC 4)** **- Steel and alloy production by melting (PROC 22)** **- Wet cleaning (PROC28)** **- Removal of dust (PROC28)** **Product Category used:** PC 7: Base metals and alloys **Sector of end use:** SU 14: Manufacture of basic metals, including alloys

	Technical function of the substance: intermediate (precursor) use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such Subsequent service life relevant for that use: no Related assessment: use assessed in a joint CSR
IW-2	**Intermediate use of RMC in ferromolybdenum production** Further description of the use: In the ferromolybdenum industries RMC is an intermediate in the sense that it is converted into metallic molybdenum and alloy with iron to manufacture ferromolybdenum, where it primarily enhances the corrosion resistance properties of ferromolybdenum. Contributing activity/technique for the environment : **- Intermediate use of RMC in ferromolybdenum production (ERC6a)** Contributing activity/technique for the workers : **- Raw material handling (PROC 9; PROC 26)** **- Mixing, blending (PROC 4; PROC 5)** **- Quality control (PROC 15)** **- FeMo production in batch process (PROC 1; PROC 2; PROC 3; PROC 4)** **- FeMo production by melting (PROC 22)** **- Wet cleaning (PROC28)** **- Removal of dust (PROC28)** **Product Category used:** PC 7: Base metals and alloys **Sector of end use:** SU 14: Manufacture of basic metals, including alloys **Technical function of the substance:** intermediate (precursor) use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such Subsequent service life relevant for that use: no Related assessment: use assessed in a joint CSR
IW-3	**Production of Molybdenum chemicals** Further description of the use: Contributing activity/technique for the environment : **- Production of Molybdenum chemicals (ERC6a)** Contributing activity/technique for the workers : **- Raw material handling (PROC 26)** **- Closed batch process (PROC 3)** **- Wet cleaning (PROC28)** **- Removal of dust (PROC28)** **Sector of end use:** SU 9: Manufacture of fine chemicals **Technical function of the substance:** intermediate (precursor) use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such Subsequent service life relevant for that use: no Related assessment: use assessed in a joint CSR