CHEMICAL SAFETY REPORT

Update 3: Submitted July 2021
(Replaces 2nd update submitted April 2016)

Substance Name: Molybdenum Dioxide
EC Number: 242-637-9
CAS Number: 18868-43-4
Registrant's Identity: Joint CSR submitted by the Lead Registrant MOLYMET Germany GmbH on behalf of all members of the joint submission MOCONJS-MODIOX. 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 to IUCLID Section 13. 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).

2. MANUFACTURE AND USES

Table 5. 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).

2.1. Manufacture

Table 6. Manufacture

	Manufacture
M-1	**Manufacture of molybdenum dioxide** Further description of manufacturing process: The following is a brief description of the typical manufacturing process for molybdenum dioxide. Other processes may be possible, which may lead to the same substance (”substance sameness”) despite using other raw materials and/or reactions. The usual production process for molybdenum dioxide starts with feedstock of pure molybdenum trioxide (EC 215-204-7), ammonium heptamolybdate (EC 234-320-9/234-722-4) or ammonium dimolybdate (EC 248-517-2). At temperatures between 400 to 700°C the raw material powder is reduced with hydrogen gas to produce molybdenum dioxide powder. If the feedstock is an ammoniated molybdate, the ammonia is separated off from the gas stream and recovered. Contributing activity/technique for the environment : **- ERC1: Manufacture of the substance** Contributing activity/technique for the workers : **- PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** **- PROC 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 15: Use as laboratory reagent** **- PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature. Industrial setting** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** Tonnage of substance for that use: tonnes/year Related assessment: use not assessed
M-2	**Manufacture of molybdenum dioxide in the catalyst industry** Further description of manufacturing process: Contributing activity/technique for the environment : **- ERC1: Manufacture of the substance** Contributing activity/technique for the workers : **- PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** **- PROC 2: Chemical production or refinery in closed continuous process with occasional**

	controlled exposure or processes with equivalent containment conditions **- PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 14: Tabletting, compression, extrusion, pelletisation, granulation** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** Tonnage of substance for that use: tonnes/year Related assessment: use not assessed

2.2. Identified uses

Table 7. Formulation

	Formulation
F-1	**Formulation of molybdenum dioxide** Further description of the use: Contributing activity/technique for the environment : **- ERC2: Formulation into mixture** **- ERC3: Formulation into solid matrix** Contributing activity/technique for the workers : **- PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 4: Chemical production where opportunity for exposure arises** **- PROC 5: Mixing or blending in batch processes** **- PROC 8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities [EU REACH]** **- PROC 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)** **- PROC 14: Tabletting, compression, extrusion, pelletisation, granulation** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** **Technical function of the substance:** no technical function Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such Related assessment: use not assessed

Table 8. Uses at industrial sites

	Uses at industrial sites
IW-1	**Intermediate use of molybdenum dioxide for the manufacture of molybdenum metal (by reduction)** Further description of the use: Molybdenum dioxide is considered as an intermediate since it is transformed to molybdenum metal by reduction. Contributing activity/technique for the environment : **- ERC6a: Use of intermediate** Contributing activity/technique for the workers : **- PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** **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)

	Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such Subsequent service life relevant for that use: no Remarks: Molybdenum dioxide is an intermediate as it is then reduced to molybdenum metal. Related assessment: use not assessed
IW-2	**Industrial use of molybdenum dioxide as a catalyst** Further description of the use: Contributing activity/technique for the environment : **- ERC4: Use of non-reactive processing aid at industrial site (no inclusion into or onto article)** **- ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)** Contributing activity/technique for the workers : **- PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** **- PROC 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities [EU REACH]** **- PROC 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** **Product Category used:** PC 20: Products such as ph-regulators, flocculants, precipitants, neutralisation agents **Sector of end use:** SU 8: Manufacture of bulk, large scale chemicals (including petroleum products); SU 9: Manufacture of fine chemicals **Technical function of the substance:** catalyst Tonnage of substance for that use: tonnes/year Substance supplied to that use: in a mixture Subsequent service life relevant for that use: no Related assessment: use not assessed
IW-3	**Intermediate use of molybdenum dioxide in alloy production** Further description of the use: Molybdenum dioxide is considered as an intermediate since it is transformed to molybdenum metal by reduction in the alloy production. Contributing activity/technique for the environment : **- ERC6a: Use of intermediate** Contributing activity/technique for the workers : **- PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** **- PROC 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 4: Chemical production where opportunity for exposure arises** **- PROC 5: Mixing or blending in batch processes** **- PROC 14: Tabletting, compression, extrusion, pelletisation, granulation** **- PROC 15: Use as laboratory reagent** **- PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature. Industrial setting**

	- PROC 23: Open processing and transfer operations with minerals/metals at elevated temperature **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** **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) Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such Subsequent service life relevant for that use: no Remarks: Molybdenum dioxide is an intermediate as it is reduced to molybdenum metal during alloy production. Related assessment: use not assessed
IW-4	**Industrial use of molybdenum dioxide in pigment production** Further description of the use: Contributing activity/technique for the environment : **- ERC5: Use at industrial site leading to inclusion into/onto article** Contributing activity/technique for the workers : **- PROC 4: Chemical production where opportunity for exposure arises** **- PROC 8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities [EU REACH]** **- PROC 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** **Product Category used:** PC 9a: Coatings and paints, thinners, paint removes; PC 9b: Fillers, putties, plasters, modelling clay; PC 0: Other: Pigment component **Technical function of the substance:** dye; pigment Tonnage of substance for that use: tonnes/year Substance supplied to that use: as such; in a mixture Subsequent service life relevant for that use: yes Link to the subsequent service life: Handling of molybdenum dioxide-coated/painted articles in professional settings.COPY; Service life of molybdenum dioxide-coated/painted articles used by consumers.COPY; Handling of molybdenum dioxide-coated/painted articles in industrial settings.COPY Related assessment: use not assessed
IW-5	**Intermediate use of molybdenum dioxide as catalyst precursor** Further description of the use: Contributing activity/technique for the environment : **- ERC6a: Use of intermediate** Contributing activity/technique for the workers : **- PROC 1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions** **- PROC 2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions** **- PROC 8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities [EU REACH]** **- PROC 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing)** **- PROC 26: Handling of solid inorganic substances at ambient temperature** **- PROC28: Manual maintenance (cleaning and repair) of machinery** **Product Category used:** PC 20: Products such as ph-regulators, flocculants, precipitants,

	neutralisation agents **Sector of end use:** SU 8: Manufacture of bulk, large scale chemicals (including petroleum products); SU 9: Manufacture of fine chemicals **Technical function of the substance:** intermediate (precursor) Tonnage of substance for that use: tonnes/year Substance supplied to that use: in a mixture Subsequent service life relevant for that use: no Related assessment: use not assessed

Table 9. Article service life

	Article service life
SL-2	**Handling of molybdenum dioxide-coated/painted articles in professional settings** Further description of the use: Article used by: workers Substance intended to be released from article: **Article category related to subsequent service life (AC):** AC 4: Stone, plaster, cement, glass and ceramic articles Contributing activity/technique for the environment: **- ERC10a: Widespread use of articles with low release (outdoor)** **- ERC11a: Widespread use of articles with low release (indoor)** Contributing activity/technique for consumers: Contributing activity/technique for the workers: **- PROC 21: Low energy manipulation of substances bound in materials and/or articles** **Technical function of the substance:** dye; pigment Tonnage of substance for that use: tonnes/year Related assessment: use not assessed
SL-1	**Handling of molybdenum dioxide-coated/painted articles in industrial settings** Further description of the use: Article used by: workers Substance intended to be released from article: **Article category related to subsequent service life (AC):** AC 4: Stone, plaster, cement, glass and ceramic articles Contributing activity/technique for the environment: **- ERC12c: Use of articles at industrial sites with low release** Contributing activity/technique for consumers: Contributing activity/technique for the workers: **- PROC 21: Low energy manipulation of substances bound in materials and/or articles** **Technical function of the substance:** dye; pigment Tonnage of substance for that use: tonnes/year Related assessment: use not assessed
SL-3	**Service life of molybdenum dioxide-coated/painted articles used by consumers** Further description of the use: Article used by: consumers Substance intended to be released from article: **Article category related to subsequent service life (AC):** Contributing activity/technique for the environment: **- ERC10a: Widespread use of articles with low release (outdoor)** **- ERC11a: Widespread use of articles with low release (indoor)** Contributing activity/technique for consumers: **- AC 4: Stone, plaster, cement, glass and ceramic articles** Contributing activity/technique for the workers: **Technical function of the substance:** dye; pigment Tonnage of substance for that use: tonnes/year Related assessment: use not assessed