Assessment of regulatory needs

Authority: European Chemicals Agency (ECHA)

Date: 11 May 2022

Group Name: Simple Molybdenum compounds

General structure: -

Revision history

Version	*Date*	*Description*
1.0	14/09/2022	

Substances within this group:

EC/List number	CAS number	Substance name	Molecular formula	Registration type (full, OSII or TII, NONS), highest tonnage band among all the registrations (t/y) [1]
215-204-7	1313-27-5	Molybdenum trioxide	MoO_3	Full, > 1000
215-263-9*	1317-33-5	Molybdenum disulphide	MoS_2	C&L notification
231-107-2	7439-98-7	Molybdenum	Mo	Full, > 1000
231-551-7	7631-95-0	Disodium molybdate	Na_2MoO_4	Full, 100-1000
231-970-5	7782-91-4	Molybdic acid	H_2MoO_4	Full, not (publicly) available
232-192-9	7789-82-4	Calcium molybdate	$CaMoO_4$	Full, 100-1000
234-722-4	12027-67-7	Hexaammonium heptamolybdate	$(NH_4)_6[Mo_7O_{24}]$	Full, 100-1000
235-115-7	12069-89-5	Dimolybdenum carbide	Mo_2C	Full, not (publicly) available
235-231-8	12136-78-6	Molybdenum disilicide	$MoSi_2$	Full, not (publicly) available
235-650-6	12411-64-2	Tetraammonium hexamolybdate**	$(NH_4)_4[Mo_8O_{26}]$	Full, 10-100
235-721-1	12612-50-9	Molybdenum sulfide	MoS_2	Full, 100-1000
236-031-3	13106-76-8	Ammonium molybdate(VI)	$(NH_4)_2MoO_4$	Full, not (publicly) available
236-599-2	13446-49-6	Dipotassium tetraoxomolybdate	K_2MoO_4	Full, not (publicly) available
237-377-8	13767-32-3	Molybdenum zinc tetraoxide	$ZnMoO_4$	Full, not (publicly) available
237-389-3	13769-81-8	Diiron trimolybdenum dodecaoxide	$Fe_2(MoO_4)_3$	Full, 10-100
238-034-5	14177-55-0	Molybdenum nickel tetraoxide	$NiMoO_4$	Full, not (publicly) available
242-637-9	18868-43-4	Molybdenum dioxide	MoO_2	Full, not (publicly) available
245-322-4	22914-58-5	Dimolybdenum trizinc nonaoxide	N/A	Full, not (publicly) available
248-517-2	27546-07-2	Diammonium dimolybdate	$(NH_4)_2[Mo_2O_7]$	Full, > 1000
289-178-0	86089-09-0	Molybdenum sulfide (MoS2), roasted	N/A	Full, > 1000
601-720-3	12054-85-2	azanium; molybdenum; oxygen(2-); hydrate	N/A	C&L notification
603-021-9	12501-45-0	Molybdate (Mo7O246-), ammonium (1:6)	N/A	Not registered
600-158-6	10102-40-6	Molybdate (MoO42-), sodium, hydrate (1:2:2), (T-4)-	N/A	C&L notification

* Registrations with EC number 235-721-1

** EC name is not correct. Correct name would be 'tetraammonium octamolybdate'.

[1] Note that the total aggregated tonnage band may be available on ECHA's webpage at https://echa.europa.eu/information-on-chemicals/registered-substances

This table contains also group members that are only notified under the CLP Regulation. However, the list is currently non-exhaustive. Should further regulatory risk management action on one or more substances in the group be considered, ECHA may make an additional search for related C&L notified substances to be included in the group and develop an assessment of regulatory needs for them.

Contents

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The author does not accept any liability with regard to the use that may be made of the information contained in this document. Usage of the information remains under the sole responsibility of the user. Statements made or information contained in the document are without prejudice to any further regulatory work that ECHA, the Member States or other regulatory agencies may initiate at a later stage. Assessment of regulatory needs and their conclusions are compiled on the basis of available information and may change in light of newly available information or further assessment.

Foreword

The purpose of the assessment of regulatory needs of a group of substances is to help authorities conclude on the most appropriate way to address the identified concerns for a group of substances or a single substance, i.e. the combination of the regulatory risk management instruments to be used and any intermediate steps, such as data generation, needed to initiate and introduce these regulatory measures.

An assessment of regulatory needs can conclude that regulatory risk management at EU level is required for a (group of) substance(s) (e.g. harmonised classification and labelling, Candidate List inclusion, restriction, other EU legislation) or that no regulatory action is required at EU level. While the assessment is done for a group of substances, the (no) need for regulatory action can be identified for the whole group, a subgroup or for single substance(s).

The assessment of regulatory needs is an important step under ECHA's Integrated Regulatory Strategy. However, it is not part of the formal processes defined in the legislation but aims to support them.

The assessment of regulatory needs can be applied to any group of substances or single substance, i.e., any type of hazards or uses and regardless of the previous regulatory history or lack of such. It can be done based on different level of information. A Member State or ECHA can carry out this case-by-case analysis. The starting point is available information in the REACH registrations and any other REACH and CLP information. However, more extensive set of information can be available, e.g. assessment done under REACH/CLP or other EU legislation, or can be generated in some cases (e.g. further hazard information under dossier evaluation). Uncertainties associated to the level of information used should be reflected in the documentation. It will be revisited when necessary. For example, after further information is generated and the hazard has been clarified or when new insights on uses are available. It can be revisited by the same or another authority.

The responsibility for the content of this assessment rests with the authority that developed it. It is possible that other authorities do not have the same view and may develop further assessment of regulatory needs. The assessment of regulatory needs does not yet initiate any regulatory process but any authority can consequently do so and should indicate this by appropriate means, such as the Registry of Intentions.

For more information on Assessment of regulatory needs please consult ECHA website[2].

[2] https://echa.europa.eu/understanding-assessment-regulatory-needs

Glossary

CCH	Compliance Check
CLH	Harmonised classification and labelling
CMR	Carcinogenic, mutagenic and/or toxic to reproduction
DEv	Dossier evaluation
ED	Endocrine disruptor
NONS	Notified new substances
OEL	Occupational exposure limit
OSII or TII	On-site isolated intermediate or transported isolated intermediate
PBT/vPvB	Persistent, bioaccumulative and toxic/very persistent and very bioaccumulative
RMOA	Regulatory management options analysis
RRM	Regulatory risk management
SEv	Substance evaluation
STOT RE	Specific target organ toxicity, repeated exposure
SVHC	Substance of very high concern

1 Overview of the group

ECHA has grouped together molybdenum metal and simple molybdenum-containing substances: mainly well-defined inorganic salts, oxides, sulphides and carbide. The group consists of 19 substances with Full Registration (Substance registrations that include the full set of information required), three substances which have been only notified to the C&L inventory and one which has been only pre-registered. The registered substances are mono-constituent substances except molybdenum nickel tetraoxide (EC 238-034-5) and molybdenum sulfide (MoS2) roasted (EC 289-178-0), which are UVCBs. The substances in the group release molybdate ions $[MoO_4]^{2-}$ in water solutions at pH > 6.5.

The substances are used in a broad variety of sectors and applications such as Chemical Synthesis, Composite ceramics, Steel, metal & alloy, Polymer preparations & compounds, Lubricants, Metal surface treatment, Metal working fluids, Welding Consumables and flux, Printing, Leather treatment, Brake pads, Cleaning and maintenance material, Coolant/anti-freeze/anti-icing/heat transfer fluid, Micronutrient in fertilizers/feed additives, Biocides, Steam condensate treatment, Activated carbon impregnant, Tracers in mixtures, Water treatment chemicals.

For eight substances (EC 215-204-7, 231-107-2, 231-551-7, 232-192-9, 234-722-4, 235-115-7, 248-517-2, 237-377-8), there is a potential for exposure to industrial/professional workers, and/or consumers and release to the environment.

The other registered substances are only used in industrial settings (mainly as intermediate, or catalyst).

For four substances (EC 215-263-9, 600-158-6, 601-720-3, and 603-021-9), there is no use information as the substances were only C&L notified or pre-registered. It should nevertheless be noted that EC 215-263-9 is listed in Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food as well as in the Swiss Ordinance of the Federal Department of Home Affairs on materials and articles intended to come into contact with foodstuffs.

Via the EU Observatory for nanomaterials, we note that molybdenum sulfide (EC 235-721-1) is listed in the French nano inventory. This information is not reflected in the registration dossiers of that substance[3]. Consequently, there is uncertainty whether this substance is manufactured or imported in the European Union as nanoforms. The REACH Regulation (as amended by Regulation Commission Regulation (EU) 2018/1881) sets out explicit information requirements for nanoforms of substances. Manufacturers and importers of nanoforms should meet these specific information requirements as of 1 January 2020. However, as the

[3] By 3 May 2022

registration dossiers currently submitted on the substance do not cover any nanoforms, the present assessment relates only to non-nanoforms.

Note on the scope of ECHA's assessment of regulatory needs

Regarding hazards, the focus of ECHA's assessment is on CMR (carcinogenic, mutagenic and/or toxic to reproduction), sensitiser, ED (endocrine disruptor), PBT/vPvB or equivalent (e.g. substances being persistent, mobile and toxic), aquatic toxicity hazard endpoints and therefore only those are reflected in the table in section 3. This does not mean that the substances do not have other known or potential hazards. In some specific cases, where ECHA identifies a need for regulatory risk management action at EU level for other hazards (e.g. neurotoxicity, STOT RE), such additional hazards may be addressed in the assessment. An overview of classification is presented in Annex 1.

On the exposure side, ECHA is mainly using the information on uses reported in the registration dossiers (IUCLID) as a proxy for assessing the potential for exposure to humans and releases to the environment. The potential for release / exposure is generally considered high for "widespread" uses, i.e. professional and consumer uses and uses in articles. For these uses, normally happening at many places, the expected level of control is *à priori* considered limited. The chemical safety reports are not necessarily consulted and no quantitative exposure assessment is performed at this stage.

2 Justification for the no need for regulatory risk management action at EU level

Based on currently available information, there is no need for (further) EU regulatory risk management for EC 236-031-3 (Ammonium molybdate(VI)), EC 235-231-8 (Molybdenum disilicide) and EC 236-599-2 (Dipotassium tetraoxomolybdate), and the four substances not registered (EC 215-263-9, 600-158-6, 601-720-3, and 603-021-9) due to no or unlikely hazard that would lead to concern for the reported uses (limited industrial uses) for human health and the environment.

Based on ECHA's assessment of currently available hazard information, no potential hazards were identified for human health. These conclusions are based on negative results from *in vitro* genetic toxicity tests, together with the lack of adverse effects in screening studies and repeated dose toxicity studies, with the substances themselves or via read-across. These hazard conclusions are scientifically plausible, and acceptable for the registered substances releasing molybdate ions.

Regarding the environmental hazards, the PBT/vPvB criteria set in REACH Annex XIII would not apply as these substances are inorganic substances. In addition, the registered substances are not self- classified for aquatic toxicity, and this is supported by the information available in the registration dossiers.

For the four substances which are currently not registered (EC 215-263-9, 600-158-6, 601-720-3, and 603-021-9), data generation and potentially follow up actions will be re-considered when the assessment will be revisited if their registration status changes.

Based on currently available information, it is not possible to assess the need for regulatory risk management for all the remaining substances in the group as information on hazard is not sufficient to conclude on reproductive toxicity hazard for these substances.

All these substances have in common the release of MoO_4^{-2} ion (the molybdate ion) and use of a mutual set of source substances for read-across. Extrapolation of hazards within the group is plausible based on molybdate release.

ECHA considers that the data set available provides conflicting information, therefore the substances will be further assessed under CCH to assess data generation needs (e.g. on **reproductive toxicity**).

The available information does indicate a potential for **local carcinogenicity 2 via inhalation** for EC 215-204-7 (Molybdenum trioxide), EC 231-970-5 (Molybdic acid) and EC 289-178-0 (Molybdenum sulfide roasted). EC 215-204-7 (Molybdenum trioxide) and EC 289-178-0 (Molybdenum sulfide roasted, which is an UVCB with Molybdenum trioxide as the main constituent) react with water giving an acidic solution. EC 231-970-5 (Molybdic acid) is already an acid. Local effects via inhalation are likely to be due to the direct particles/aerosol interaction with the lung tissue. This is not the case for the other substances belonging to the Molybdate Releasing Subgroup substances and hence carcinogenicity is not suspected for the wider group.

While EC 215-204-7 (Molybdenum trioxide), and EC 289-178-0 (Molybdenum sulfide roasted) are classified by the registrants as Carc. 2, for EC 231-970-5 (Molybdic acid) the data on carcinogenicity from a read-across source substance is not reported by the registrant, and the substance is not self-classified as Carc.2.

Since the reported uses for these three substances are only industrial, a correct labelling as Carc. 2 should be sufficient to trigger necessary RMM in industrial settings. For EC 231-970-5, Industry should therefore update their registration dossiers with the carcinogenicity study on its structural analogue (EC 215-204-7), correct the classification and labelling information, and inform accordingly the users of this substances (via SDS update).

Regarding the **environmental** hazards, the PBT/vPvB criteria set in REACH Annex XIII would not apply as the substances in this group are inorganic substances.

It should be noted that **the absence of target organ toxicity** (STOT RE), and **environmental hazard** could not be concluded for EC 289-178-0 (Molybdenum sulfide roasted) due to the composition of this substance which is not properly addressed in the registration dossier.

With regard to the information on uses for these high tonnage substances, the registrants have reported industrial and widespread professional uses (e.g. welding, metal surface treatment, metal working fluids, lubricants, ink and coating, fertilisers…), as well as uses in few consumer applications (e.g. anti-freeze, fertilisers, welding). These substances are also present in various types of articles (essentially made of metals and ceramics).

There is a potential for release/exposure during these uses (I, P, C, A) based on the name of the uses. This potential will be assumed until proven otherwise by the registrants. There are indeed some **uncertainties** with regard to the presence and potential exposure/release of the substance from the uses as information on exposure or release information is not available in the CSRs (CSR part B is not provided).

Finally, for three substances in the group (EC 237-377-8, 238-034-5 and 245-322-4) additional environmental (and human) toxicity may be driven by other counterions than molybdenum, namely zinc and nickel. The assessment of these counterions is not within the scope of this assessment and will be covered elsewhere.

3 Conclusions and actions

The conclusions and actions proposed in the table below are based on the REACH and CLP information available at the time of the assessment by ECHA. The main source of information is the registration dossiers. Relevant public assessments may also be considered. When new information (e.g. on hazards through evaluation processes, or on uses) will become available, the document will be updated and conclusions and actions revisited

Table 1: Conclusions and actions

Subgroup name, EC number, substance name	Human Health Hazard	Environmental Hazard	Relevant use(s) & exposure potential	Last foreseen action	Action
236-031-3 235-231-8 236-599-2 215-263-9 600-158-6 601-720-3 603-021-9	No hazard or unlikely hazard	No hazard or unlikely hazard	Industrial uses only in chemical synthesis, and production of composite ceramics, frits and enamel. Main technical function: intermediate, catalyst	Currently no need for EU RRM Justification: low human health and environmental hazards, and limited industrial applications	No action
215-204-7 231-107-2 231-551-7 231-970-5 232-192-9	Inconclusive hazard for reproductive toxicity No hazard or unlikely hazard for local carcinogenicity via	No hazard or unlikely hazard	Industrial, widespread professional uses, and few consumer uses with some potential for exposure.	Currently not possible to assess the regulatory needs Justification: Need to wait for the outcome of the CCH	CCH

Subgroup name, EC number, substance name	Human Health Hazard	Environmental Hazard	Relevant use(s) & exposure potential	Last foreseen action	Action
234-722-4 235-115-7 235-650-6 235-721-1 237-389-3 242-637-9 248-517-2 289-178-0	inhalation except for substances which react with water giving an acidic solution: EC 215-204-7, EC 231-970-5, and EC 289-178-0		e.g. chemical synthesis, use in lubricant, metal working fluids, metal surface treatment, welding flux, coating, ink, anti-icing, micronutrients in fertilisers/feeds, flame retardant, respiratory cartridges….		
237-377-8 238-034-5 245-322-4	Human health toxicity may be driven by (an)other inorganic moiety(s)	Aquatic toxicity is driven by (an)other inorganic moiety(s)	Industrial, widespread professional uses, and few consumer uses with some potential for exposure reported for 237-377-8. Industrial use only for the other substances	Currently not possible to assess the regulatory needs Justification: assessment not within the scope of this assessment and will be covered elsewhere	No action

Annex 1: Overview of classifications

Data extracted on 30 August 2021

Table 2: Overview of classifications

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
215-204-7	1313-27-5	molybdenum trioxide	**Eye Irrit. 2 H319** **STOT SE 3 H335** **Carc. 2 H351**	Carc. 2 H351 Eye Irrit. 2 H319 STOT Single Exp. 3 H335, affected organs: Respiratory tract	STOT Single Exp. 3 H335, affected organs: Lungs and thorax and respiratory tract[1 out of 110] STOT Rep. Exp. 2 H373, affected organs: lungs, mucous membranes[1 out of 110] STOT Rep. Exp. 2 H373, affected organs: [2 out of 110] STOT Single Exp. 3 H335, affected organs: lung[1 out of 110] STOT Single Exp. 3 H335, affected organs: lungs, mucous membranes[1 out of 110] STOT Single Exp. 3 H335, affected organs: respiratory tract[1 out of 110] STOT Single Exp. 3 H335[2 out of 110] STOT Single Exp. 3 H335, affected organs: [88 out of 110] STOT Single Exp. 3 H335, affected organs: Repiratory tract[1 out of 110] Acute Tox. 3 H301[1 out of 110] Muta. 2 H341[1 out of 110] STOT Single Exp. 3 H335, affected organs: respiratory system[3 out of 110] STOT Single Exp. 3 H336, affected organs: Respiratory system, Central nervous system[2 out of 110] STOT Single Exp. 3 H335, affected organs: lungs[1 out of 110] STOT Single Exp. 3 H335, affected organs: polmoni[1 out of 110] Acute Tox. 4 H302[1 out of 110] STOT Single Exp. 3 H335, affected organs: Respiratory system[2 out of 110]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
215-263-9	1317-33-5	molybdenum disulphide	-	-	Eye Irrit. 2 H319[10 out of 132] STOT Single Exp. 3 H335, affected organs: respiratory tract, lungs[1 out of 132] STOT Single Exp. 3 H335[1 out of 132] Aquatic Chronic 4 H413[1 out of 132] Acute Tox. 4 H302[3 out of 132] Skin Irrit. 2 H315[7 out of 132] Carc. 2 H351[4 out of 132] STOT Single Exp. 3 H335, affected organs: respiratory system[3 out of 132] Acute Tox. 4 H332[23 out of 132] STOT Single Exp. 3 H335, affected organs: Respiratory tract[4 out of 132] STOT Single Exp. 3 H335, affected organs: respiratory tracts[1 out of 132]
231-107-2	7439-98-7	molybdenum	-	-	Repr. 2 H361, specific effect:Suspected of damaging fertility[13 out of 151] STOT Rep. Exp. 1 H372, affected organs: Blood system[2 out of 151] Flam. Solid 1 H228[14 out of 151] Flam. Solid 2 H228[2 out of 151] Aquatic Chronic 4 H413[2 out of 151] Eye Irrit. 2 H319[2 out of 151]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
231-551-7	7631-95-0	disodium molybdate	-	-	STOT Single Exp. 3 H335, affected organs: RESPIRATORY SYSTEM[1 out of 73] Muta. 2 H341[1 out of 73] Skin Sens. 1 H317[1 out of 73] Acute Tox. 4 H332[4 out of 73] Aquatic Chronic 3 H412[3 out of 73] STOT Single Exp. 3 H335, affected organs: [1 out of 73] STOT Single Exp. 3 H335, affected organs: bronchia[2 out of 73] STOT Single Exp. 3 H335, affected organs: Resp. Tract[1 out of 73] Carc. 2 H351[1 out of 73] STOT Single Exp. 3 H335, affected organs: rat[2 out of 73] STOT Single Exp. 3 H335, affected organs: Blood system, Bones and Respiratory system[1 out of 73] Skin Irrit. 2 H315[15 out of 73] STOT Single Exp. 3 H335, affected organs: lung[1 out of 73] Acute Tox. 4 H302[2 out of 73] Repr. 2 H361, specific effect:In rat 10 mg Mo/kg of diet as sodium molybdate impaired reproductive performance[1 out of 73] STOT Single Exp. 3 H335, affected organs: Resp Tract[1 out of 73] Eye Irrit. 2 H319[16 out of 73]
231-970-5	7782-91-4	molybdic acid	-	-	STOT Rep. Exp. 1 H372, affected organs: [1 out of 14] STOT Single Exp. 3 H335, affected organs: respiratory system[1 out of 14] Eye Irrit. 2 H319[12 out of 14] STOT Rep. Exp. 2 H373, affected organs: Damage to organs[1 out of 14] Skin Irrit. 2 H315[2 out of 14] Acute Tox. 4 H332[2 out of 14] STOT Single Exp. 3 H335, affected organs: lungs[2 out of 14] STOT Single Exp. 3 H335, affected organs: Respiratory system[2 out of 14] STOT Single Exp. 3 H335, affected organs: [3 out of 14]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
					STOT Rep. Exp. 2 H373, affected organs: [5 out of 14] STOT Single Exp. 3 H335, affected organs: lung[1 out of 14] Acute Tox. 4 H302[2 out of 14]
232-192-9	7789-82-4	calcium molybdate	-	-	STOT Single Exp. 3 H335, affected organs: Respiratory tract[2 out of 18] Acute Tox. 3 H301[2 out of 18] Skin Irrit. 2 H315[2 out of 18] Acute Tox. 3 H331[2 out of 18] Repr. 2 H361[1 out of 18] Carc. 2 H351[1 out of 18] Acute Tox. 3 H311[2 out of 18] Eye Irrit. 2 H319[2 out of 18]
234-722-4	12027-67-7	hexaammonium heptamolybdate	-	-	Eye Irrit. 2 H319[14 out of 42] Acute Tox. 4 H312[4 out of 42] STOT Single Exp. 3 H335, affected organs: respiratory system[4 out of 42] Skin Irrit. 2 H315[14 out of 42] STOT Single Exp. 3 H335, affected organs: [4 out of 42] Aquatic Chronic 3 H412[1 out of 42] Acute Tox. 4 H332[4 out of 42] Acute Tox. 4 H302[14 out of 42] STOT Single Exp. 3 H335, affected organs: lung[1 out of 42] STOT Single Exp. 3 H335[5 out of 42]
235-115-7	12069-89-5	dimolybdenum carbide	-	-	Aquatic Chronic 4 H413[1 out of 2]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
235-231-8	12136-78-6	molybdenum disilicide	-	-	Acute Tox. 4 H302[1 out of 3] Acute Tox. 4 H312[1 out of 3] Acute Tox. 4 H332[1 out of 3]
235-650-6	12411-64-2	tetraammonium hexamolybdate	-	-	-
235-721-1	12612-50-9	Molybdenum sulfide	-	-	-
236-031-3	13106-76-8	ammonium molybdate(VI)	-	Acute Tox. 4 H302	STOT Single Exp. 3 H335, affected organs: Respiratory Track[1 out of 24] Aquatic Chronic 4 H413[1 out of 24] Muta. 2 H341[1 out of 24] Skin Sens. 1 H317[4 out of 24] Aquatic Chronic 3 H412[2 out of 24] STOT Rep. Exp. 2 H373, affected organs: [1 out of 24] STOT Single Exp. 3 H335, affected organs: Respiratory tract irritation[1 out of 24] Skin Irrit. 2 H315[14 out of 24] STOT Single Exp. 3 H335, affected organs: lungs[3 out of 24] STOT Single Exp. 3 H335, affected organs: Respiratory tract[1 out of 24] STOT Single Exp. 3 H335, affected organs: respiratory system[1 out of 24] Eye Irrit. 2 H319[18 out of 24] STOT Single Exp. 3 H335, affected organs: [5 out of 24] Resp. Sens. 1 H334[4 out of 24] Carc. 2 H351[1 out of 24] STOT Single Exp. 3 H335, affected organs: Respiratory system[1 out of 24]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
236-599-2	13446-49-6	dipotassium tetraoxomolybdate	-	-	STOT Single Exp. 3 H335, affected organs: respiratiry tract[1 out of 12] Eye Irrit. 2 H319[5 out of 12] Skin Irrit. 2 H315[5 out of 12] STOT Single Exp. 3 H335, affected organs: [4 out of 12]
237-377-8	13767-32-3	molybdenum zinc tetraoxide	-	Eye Irrit. 2 H319 Aquatic Chronic 2 H411	STOT Single Exp. 3 H335, affected organs: [5 out of 8] Skin Irrit. 2 H315[6 out of 8] STOT Single Exp. 3 H335, affected organs: lung[1 out of 8] Aquatic Acute 1 H400[2 out of 8]
237-389-3	13769-81-8	diiron trimolybdenum dodecaoxide	-	-	-
238-034-5	14177-55-0	molybdenum nickel tetraoxide	**Skin Sens. 1 H317** **STOT RE 1 H372** **Carc. 1A H350i**	STOT Rep. Exp. 1 H372, affected organs: respiratory system STOT Rep. Exp. 1 H372, affected organs: respiratory tract, specific concentration: >=1 Aquatic Chronic 1 H410 Carc. 1A H350 Carc. 1A H351 Muta. 2 H340 Repr. 1B H360 Acute Tox. 4 H302 Resp. Sens. 1 H334 Skin Sens. 1 H317 Skin Sens. 1 H317, specific concentration: >=.01	STOT Rep. Exp. 1 H372, affected organs: Damage to organs[1 out of 6] STOT Rep. Exp. 1 H372, affected organs: respiratory tract[1 out of 6] Carc. 1B H350[1 out of 6] Aquatic Acute 1 H400[2 out of 6] Muta. 2 H341[2 out of 6] STOT Rep. Exp. 1 H372, affected organs: nicht bekannt[1 out of 6] STOT Rep. Exp. 1 H372, affected organs: [2 out of 6] Repr. 1B H360, specific effect:May damage the unborn child.[1 out of 6]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
242-637-9	18868-43-4	molybdenum dioxide	-	-	STOT Single Exp. 3 H335, affected organs: respiratory system[1 out of 18] Acute Tox. 4 H312[2 out of 18] Acute Tox. 4 H302[2 out of 18] STOT Single Exp. 3 H335, affected organs: organs[1 out of 18] Acute Tox. 4 H332[2 out of 18] Skin Irrit. 2 H315[1 out of 18] Eye Irrit. 2 H319[2 out of 18]
245-322-4	22914-58-5	dimolybdenum trizinc nonaoxide	-	Acute Tox. 4 H332 STOT Rep. Exp. 2 H373, affected organs: kidney Aquatic Acute 1 H400 Aquatic Chronic 2 H411	Aquatic Chronic 1 H410[4 out of 7]
248-517-2	27546-07-2	diammonium dimolybdate	-	-	-
289-178-0	86089-09-0	Molybdenum sulfide (MoS2), roasted	-	Carc. 2 H351	-
600-158-6	10102-40-6	600-158-6	-	-	Acute Tox. 4 H312[4 out of 23] Acute Tox. 4 H332[9 out of 23] Aquatic Chronic 3 H412[4 out of 23] STOT Single Exp. 3 H335, affected organs: Respiratory tract[1 out of 23] Skin Irrit. 2 H315[9 out of 23] Eye Irrit. 2 H319[9 out of 23] STOT Single Exp. 3 H335, affected organs: Respiratory system[1 out of 23] STOT Single Exp. 3 H335, affected organs: [4 out of 23] Acute Tox. 4 H302[8 out of 23] STOT Single Exp. 3 H335, affected organs: lungs[3 out of 23]

EC Number	CAS Number	Substance Name	Harmonised classification	classification in registrations	classification in C&L notifications(*)
601-720-3	12054-85-2	601-720-3	-	-	STOT Single Exp. 3 H335, affected organs: [1 out of 24] STOT Single Exp. 3 H335, affected organs: Respiratory system[4 out of 24] Acute Tox. 4 H302[5 out of 24] Skin Irrit. 2 H315[8 out of 24] Aquatic Chronic 4 H413[2 out of 24] Aquatic Chronic 3 H412[1 out of 24] Eye Irrit. 2 H319[8 out of 24] STOT Single Exp. 3 H335, affected organs: respiratory system[3 out of 24]

(*) the number in brackets indicates the number of notifications received. Each notification can represent a group of notifiers, therefore the number may differ from the C&L inventory which displays number of notifiers.

Annex 2: Overview of uses based on information available in registration dossiers

Data extracted on 6 September 2021

Table 3: Overview of uses based on information available in registration dossiers

Main types of applications structured by product or article types	215-204-7	231-970-5	289-178-0	231-107-2	231-551-7	232-192-9	234-722-4	235-115-7	235-650-6	235-721-1	237-389-3	242-637-9	248-517-2	235-231-8	236-031-3	236-599-2
Anti-corrosive processing aid					F, I	F, I	F, I									
Catalysts	F, I			F, I		F, I	F, I			I	F, I	I	F, I			F, I
Chemical Synthesis	I				I										I	
Composite ceramics, frits and enamels	F, I				F		F, I						F	I, **A**		
Intermediate	F, I	I			I		I			F, I		I				
Laboratory chemicals				P			I, **P**								I	
Polymer preparations & compounds					I	F, I	F, I									
Manufacture of starch and derived starch products									I							
Lubricants additives, lubricants and greases	I				F, I								F, I, **P, A**			
Metal surface treatment	I				I		I	I					F, I, **P, A**			
Metal working fluids								F								

Main types of applications structured by product or article types	215-204-7	231-970-5	289-178-0	231-107-2	231-551-7	232-192-9	234-722-4	235-115-7	235-650-6	235-721-1	237-389-3	242-637-9	248-517-2	235-231-8	236-031-3	236-599-2
Steel, metal & alloy	F, I		F, I	F, I, **P, A**		F, I	I	F, I, **A**				I	I			
Welding Consumables, and flux				F, I, **P, C, A**												
3D printing				F,**P**												
Coating, ink **laser** applications (on paper, plastic…)									F, I**, A**							
Coating, ink applications including thermal spray coating				I		I, **P, C, A**	I									
Pigments (in paints and coating)	I				F							I, **A**				
leather treatment					I											
Brake pads				F, **A**												
Cleaning and maintenance material					F											
Coolant/anti-freeze/anti-icing/heat transfer fluid (e.g. in refrigerators)					F, I, **P, C**											
Implants				**C, A**												

Main types of applications structured by product or article types	215-204-7	231-970-5	289-178-0	231-107-2	231-551-7	232-192-9	234-722-4	235-115-7	235-650-6	235-721-1	237-389-3	242-637-9	248-517-2	235-231-8	236-031-3	236-599-2
Micronutrient in fertilizers/feed additives	I				F, I, **P, C, A**		F, I, **P, A**						F, I, **P, C, A**			
Respirator cartridges							F, I, **P, A**									
Smoke suppressant/flame retardant							F, I		I, **A**							
Steam condensate treatment					I											
Activated carbon impregnant	I												F, I			
Tracers in mixtures					I											
Water treatment chemicals, inc. water softener	F, I				F, I, **P, C**											

F: formulation, I: industrial use, P: professional use, C: consumer use, A: article service life; P, C and A are highlighted in red to indicate widespread use with potential for exposure/release

In addition, the following uses were reported for the substances with a different counterion than molybdenum ion:

Table 4: Uses reported for the substances with a different counterion than molybdenum ion

Main types of applications structured by product or article types	237-377-8	238-034-5	245-322-4
Catalysts		I	
Intermediate		F, I	
Laboratory chemicals	F, I, **P**		
Polymer preparations & compounds	F, I, **P, C**		F, I, **A**
Metal surface treatment	F, I, **P, C**		
Coating, ink applications including thermal spray coating	F, I, **P, C, A**		
Biocides? (not registered as an active substance under the BPR)	F, I, **P, C**		

F: formulation, I: industrial use, P: professional use, C: consumer use, A: article service life; P, C and A are highlighted in red to indicate widespread use with potential for exposure/release

Annex 3: Overview of completed or ongoing regulatory risk management activities

Data extracted on 26 August 2021.

Table 5: Overview of completed or ongoing regulatory risk management activities

EC/List number	RMOA	Authorisation		Restriction*	CLH	Actions not under REACH/ CLP
		Candidate list	Annex XIV	Annex XVII	Annex VI (CLP)	
215-204-7	YES				YES	
234-722-4				YES		
235-650-6				YES		
236-031-3				YES		
238-034-5					YES	

*Some of the broad restriction entries in the Annex XVII of REACH are not represented in the overview, e.g. when the scope of the restriction is defined by its classification or the substance identification is broad (e.g. entries 3, 28-30 and 40).

There are no relevant completed or ongoing regulatory risk management activities for the other substances.