Boundary Composition in Lead Registrant Dossier

Substance:	molybdenum sulfide (MoS2), roasted
EC Number	289-178-0
Type of substance:	UVCB

Name of boundary composition:	"Boundary composition: molybdenum sulfide (MoS2), roasted"
State / form:	solid: particulate/powder
Description of composition:	Roasted Molybdenite Concentrate Methods of manufacture of substance: 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 550-750 °C with natural gas as fuel and a large excess of air as oxidant. The oxidation of MoS2 is an exothermic reaction: $2\ MoS_2 + 7\ O_2 \rightarrow 2\ MoO_3 + 4\ SO_2$ $MoS_2 + 6\ MoO_3 \rightarrow 7\ MoO_2 + 2\ SO_2$ $2\ MoO_2 + O_2 \rightarrow 2\ MoO_x$ 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 roasting process. That 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)

Degree of purity 100 % (w/w)

	typical	min	max							
	% (w/w)	% (w/w)	% (w/w)							
				Selected Substance References		**Impurities Relevant for C&L**	**Remarks**			
Constituents				EC number	CAS number					
molybdenum trioxide	ca. 80	>= 45	<= 96	215-204-7	1313-27-5		*Constituent relevant for hazard classification.*			
Mo suboxides / tetramolybdenum undecaoxide (Mo_4O_{11}, example)	ca .8	>= 2	<= 30	-	-		According to XRD-analysis, mainly Mo_4O_{11}, Mo_8O_{23}, Mo_9O_{26}			
Iron molybdates / Diiron(III) trimolybdenum(VI) dodecaoxide	ca. 4	>= 1	<= 15	-	-		Based on XRD analysis and/or expert judgement, expected to be present as $FeMoO_4$, Fe2(MoO_4)3, $Fe_3Mo_3O_{12}$.			
molybdenum dioxide	ca. 2	>= 0.2	<= 10	242-637-9	18868-43-4					
silicon dioxide	ca. 3	>= 1	<= 15	238-878-4	14808-60-7		Less than 1% present as respirable crystalline silica			
copper molybdate	ca. 2	>= 0	<= 16	237-378-3	13767-34-5		Based on XRD and SEM-EDX, Cu is present in RMC within mixed metal cation molybdates , or as copper molybdate $CuMoO_4$. No CuO or Cu_2O could be identified. The compounds in which copper is present have no impact on the classification.			
calcium molybdate	ca. 1	>= 0	<= 5	232-192-9	7789-82-4					
lead molybdate	ca. 0.05	>= 0	<= 0.45	233-459-2	10190-55-3		Based on XRD and SEM-EDX, Pb is present in RMC within mixed cation molybdates or as lead molybdate $PbMoO_4$.			
diarsenic trioxide	ca. 0.016	>= 0.001	<= 0.099	215-481-4	1327-53-3		Based on XRD and SEM-EDX , trace amounts of arsenic as substitutes for Mo in MoO_3 or MoO_4 positions, i.e. within molybdenum oxide or molybdate structures, since the presence of one distinct arsenic substance cannot be confirmed analytically at such low concentrations, the presence of As_2O_3 is assumed as a worstcase for classification purposes.			
ammonium molybdates (example: hexaammonium heptamolybdate dihydrate)	ca. 0	>= 0	<= 15	-	-		Typical concentration is zero in the powder form, and ca. 10% in briquette form. Based on expert judgement and/or XRD analysis, expected to be present as $(NH_4)_6.Mo_7O_{24}.4H_2O$; $(NH_4)_6.Mo_9O_{30}.5H_2O$; $(NH_4)_2Mo_4O_{13,}$ $NH_3(MoO_3)_3$.			
Impurities										
Not applicable. All substances in a UVCB substance are constituents, not impurities										
Additives										
Not applicable. All substances in a UVCB substance are constituents, not additives										