

**Supplementary material**

**Derivation of ecological standards for risk assessment of molybdate in soil**

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**Table S1. Published information on the toxicity of Mo to soil organisms**

Reference	Test substance	Species	Endpoint	Soil	Toxicity threshold	Rationale for not including in effects assessment
Plant studies						
Yanni, 1990 <sup>[1]</sup>	Na <sub>2</sub> MoO <sub>4</sub>	<i>Glycine max</i>	Seed yield at harvest (112 days after Mo application)	Clay-loamy alluvial soil from Egypt (pH 8, 0.84 % org. C, 54 % clay)	NOEC: ≥4 mg Mo kg <sup>-1</sup> (nominal dose)	Surface application of sodium molybdate solution, no mixing into soil; only unbounded NOEC values; no measured Mo concentrations
De Iorio et al., 1998 <sup>[2]</sup>	Na <sub>2</sub> MoO <sub>4</sub>	<i>Elytrigia elongata</i>	Shoot yield (180 days after sowing)	Halomorphic soil from Argentina (typic Natraquoll, pH 7.1, 1.32 % org. C)	NOEC: ≥1 mg Mo kg <sup>-1</sup> (nominal dose)	Soil not relevant for Europe, insufficient information reported on methods and results; unbounded values; no measured Mo concentrations
Kevresan et al., 2001 <sup>[3]</sup>	Na <sub>2</sub> MoO <sub>4</sub>	<i>Pisum sativum</i>	Root and shoot yield (12–16 days after Mo application)	Calcareous chernozem (pH 8.1, 2.5 % org. C)	NOEC: 0.001 mg Mo kg <sup>-1</sup> (root, nominal dose) NOEC: 0.1 mg Mo kg <sup>-1</sup> (shoot, nominal dose)	Surface application of sodium molybdate solution, no mixing into soil; two orders of magnitude between doses tested; no measured Mo concentrations
Invertebrate studies						
No relevant literature data on the effect of Mo on terrestrial invertebrates were identified						
Microbial studies						
Yanni, 1990 <sup>[1]</sup>	Na <sub>2</sub> MoO <sub>4</sub>	<i>Bradyrhizobium japonicum</i>	Nodulation	Clay-loamy alluvial soil from Egypt (pH 8, 0.84 % org. C, 54 % clay)	NOEC: ≥4 mg Mo kg <sup>-1</sup> (nominal dose)	Surface application of sodium molybdate solution, no mixing into soil; only unbounded NOEC values; no measured Mo concentrations
Akerblom et al., 2007 <sup>[4]</sup>	MoCl <sub>5</sub>	Native biomass	Basal respiration; microbial community structure	Mor layer of forest soil from Sweden	EC <sub>10</sub> : 75 mg Mo kg <sup>-1</sup> ; NOEC: 7 mg Mo kg <sup>-1</sup>	No information reported on characteristics of the soil used; one order of magnitude between doses tested

Reference	Test substance	Species	Endpoint	Soil	Toxicity threshold	Rationale for not including in effects assessment
Tabatabai, 1977 <sup>[5]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Urease activity	Six soils from North America (pH 5.1–7.8, 1.5–5.5 % org. C, 17–42 % clay)	4–16 % inhibition at 480 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations
Juma and Tabatabai, 1977 <sup>[6]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Phosphatase activity	Three soils from North America (pH 5.8–7.8, 2.6–5.5 % org. C, 23–34 % clay)	22–93 % inhibition at 2400 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations
Liang and Tabatabai, 1977 <sup>[7]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Nitrogen mineralisation	Four soils from North America (pH 5.8–7.8, 2.6–5.5 % org. C, 23–45 % clay)	10–54 % inhibition at 480 mg Mo kg <sup>-1</sup> (nominal dose)	Only one single dose tested; no measured Mo concentrations
Liang and Tabatabai, 1978 <sup>[8]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Nitrification	Three soils from North America (pH 5.8–7.8, 2.6–5.5 % org. C, 23–34 % clay)	39–74 % inhibition at 480 mg Mo kg <sup>-1</sup> (nominal dose)	Only one single dose tested; no measured Mo concentrations
Al-Khafaji and Tabatabai, 1979 <sup>[9]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Arylsulphatase activity	Four soils from North America (pH 6.2–7.6, 2.7–5.3 % org. C, 26–34 % clay)	14–79 % inhibition at 2400 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations
Frankenberger and Tabatabai, 1981 <sup>[10]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Amidase activity	Three soils from North America (pH 5.6–7.6, 2.6–4.7 % org. C, 28–34 % clay)	2–4 % inhibition at 480 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations

Reference	Test substance	Species	Endpoint	Soil	Toxicity threshold	Rationale for not including in effects assessment
Stott et al., 1985 <sup>[11]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Pyrophosphatase activity	Three soils from North America (pH 4.6–7.0, 2.0–5.3 % org. C, 24–36 % clay)	19–62 % inhibition at 50 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations
Ueda et al., 1988 <sup>[12]</sup>	Na <sub>2</sub> MoO <sub>4</sub>	Native biomass	Nitrification and ammonification	Alluvial loamy soil (pH 7.15, 0.48 % org. C, 18 % clay)	NOEC: ≥466 mg Mo kg <sup>-1</sup> (nominal dose)	No information on statistics, unbounded values; no measured Mo concentrations
Fu and Tabatabai, 1989 <sup>[13]</sup>	Na <sub>2</sub> MoO <sub>4</sub>	Native biomass	Nitrate reductase	Three soils from North America (pH 6.7–7.8, 3.0–5.6 % Org. C, 10–36 % clay)	0–26 % inhibition at 240 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations
Arshad and Frankenberger, 1991 <sup>[14]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	Ethylene production	pH 5.8, 2.6 % Org. C,	NOEC: 0.5 mg Mo kg <sup>-1</sup> (nominal dose)	Tests do not appear to be reproducible; no measured Mo concentrations
Frankenberger and Tabatabai, 1991 <sup>[15]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	L-glutaminase activity	Three soils from North America (pH 5.6–7.6, 2.6–4.7 % org. C, 28–34 % clay)	5–6 % inhibition at 480 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations
Frankenberger and Tabatabai, 1991 <sup>[16]</sup>	H <sub>2</sub> MoO <sub>4</sub>	Native biomass	L-asparaginase activity	Three soils from North America (pH 5.6–7.6, 2.6–4.7 % org. C, 28–34 % clay)	3–6 % inhibition at 480 mg Mo kg <sup>-1</sup> (nominal dose)	Only one or two doses tested; buffered pH during the exposure; measurement of extracellular enzymatic activity considered less relevant for microbial toxicity; no measured Mo concentrations

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