

INTERPRETATION OF ACUTE AND CHRONIC TOXICITY OF ARSENIC PESTICIDES FOR BEACHES AND SEA														
							Samples collected on 17 and 18 August 2021 and analysed by V&M ATLS							
							Report compiled by Dr Gerhard H Verdoorn							
							02-Sep-21							
							Beach sediments							
Substance	Conc.	B1S	B2S	B3S	B4S	B5S	B6S	B7S		B1N	B2N	B3N	B4N	
Arsenic elemental	ug/g	0.38	ND	0.50	0.21	0.32	0.62	0.48		*	0.21	0.22	0.34	
Arsenic as MSMA	ug/g	1.862	ND	2.45	1.029	1.568	3.038	2.352		*	1.029	1.078	1.666	
Arsenic elemental	mg/kg	0.38	ND	0.50	0.21	0.32	0.62	0.48		*	0.21	0.22	0.34	
Arsenic as MSMA	mg/kg	1.862	ND	2.45	1.029	1.568	3.038	2.352		*	1.029	1.078	1.666	
<b>ND = not detected</b>														
							Sea water							
	Conc.	B1S	B2S	B3S	B4S	B5S	B6S	B7S		B1N	B2N	B3N	B4N	
Arsenic elemental	ng/ml	2.0	2.0	2.2	2.1	2.1	1.9	1.8		*	2.0	2.1	2.0	
Arsenic as MSMA	ng/ml	9.8	9.8	10.78	10.29	10.29	9.31	8.82		*	9.8	10.29	9.8	
Arsenic elemental	ug/l	0.002	0.002	0.0022	0.0021	0.0021	0.0019	0.0018		*	0.002	0.0021	0.002	
Arsenic as MSMA	mg/l	0.0098	0.0098	0.0108	0.0103	0.0103	0.0093	0.0088		*	0.0098	0.0103	0.0098	
<b>Figures in red and bold are the highest quantities recorded</b>														
										*	<b>Site inaccessible at the time</b>			
<b>Interpretation of analytical results for acute human exposure based on acute oral intake of beach sand (sediments) or sea water</b>														
Acute oral toxicity of pure elemental arsenic for human beings								LD <sub>50</sub> (human being) =		median value of 13 mg/kg but ranges				
Acute oral toxicity of pure MSMA for human beings								LD <sub>50</sub> (male rats) =		900 mg/kg (used as the norm for hum				
<b>Acute exposure to MSMA by oral intake of beach sediments and sea water</b>														
<b>Ingestion of sub-lethal to lethal dosages of MSMA by oral ingestion of beach sand</b>														
A person of 60 kg body mass (weight) requires at least 900 X 60 = 54,000 mg of MSMA to reach the LD <sub>50</sub> value of MSMA for acute oral intake														
Beach sediments contain a maximum of (calcutated) 3.038 mg/kg MSMA														
which means a person will have to ingest 54,000/22.5 = 17,775 kg of beach sand or 17.8 tonnes to ingest the LD <sub>50</sub> quantity of MS														
It is impossible for such a scenario to materialise														

<b>Ingestion of sub-lethal to lethal dosages of MSMA by oral ingestion of sea water</b>												
A person of 60 kg body mass (weight) requires at least $900 \times 60 = 54,000$ mg of MSMA to reach the LD <sub>50</sub> value of MSMA for acute oral intake												
Sea water contains a (calculated) maximum of 0.0108 mg/l MSMA												
which means a person will have to ingest $54,000/0.0108 = 5$ million litres of sea water to ingest the LD <sub>50</sub> quantity of MSMA												
It is impossible for such a scenario to materialise												
<b>Chronic exposure by oral intake of beach sediments and sea water that is contaminated by MSMA</b>												
Allowed Daily Intake (ADI) or RfD (standard reference dose) of MSMA for human beings is 0.01 mg/kg body mass per day												
A person of 60 kg body mass can thus safely ingest 0.6 mg MSMA per day without the risk of observable health effects, while the No Observed Effect for mice over a 2 year exposure period was determined to be 3.2 mg/kg body mass which means even if ingesting 320 times the human ADI, the mice showed no signs of chronic toxicity symptoms. This can be attributed to the very high water solubility of MSMA in water (1.4 kg/l).												
A person of 60 kg body mass must therefore ingest more than 30 gram beach sand per day to or drink more than 3.5 litres sea water per day reach t												
<b>Acute dermal exposure to MSMA by contact with beach sediments and sea water</b>												
Reported acute dermal toxicity of MSMA for white rabbits: acute dermal LD <sub>50</sub> (24 hrs) = 2,000 to 4,000 mg/kg body mass (assume worst case of 2,000)												
A person of 60 kg requires $60 \times 2,000 = 120,000$ mg dermal exposure over a 24 hr period to reach the acute dermal LD <sub>50</sub> of MSMA												
120,000 mg equals $120,000/3.038 = 39,500$ kg contaminated beach sand												
120,000 mg equals $120,000/0.0108 > 11$ million litres of contaminated sea water												
<b>Chronic dermal exposure to MSMA by contact with beach sediment and sea water</b>												
Reported chronic dermal toxicity of MSMA for white rabbits: chronic dermal LD <sub>50</sub> (24 days) = 102 mg/kg body mass												
A person of 60 kg requires over a 24 day period to be exposed to $60 \times 102 = 6,102$ mg MSMA per day to reach the chronic dermal LD <sub>50</sub> fo MSMA												
6,102 mg equals $6,102/22.5 = 2,009$ kg beach sand direct exposure per day												
6,102 mg equals $6,102/0.0177 = 565,000$ litres of sea water direct exposure per day												
<b>MSMA versus elemental arsenic</b>												
Elemental arsenic is acutely highly toxic to human beings with a median LD <sub>50</sub> of 13 mg/kg compared the MSMA acute oral LD <sub>50</sub> of 900 mg/kg												
Elemental arsenic is also chronically much more toxic than MSMA with severe adverse health effects recorded at a median oral intake of 0.5 mg/kg b												
<b>There is currently no evidence that the MSMA has been reduced to elemental arsenic and we can therefore only work on the toxicity data of MSM</b>												

<b>WATER</b>				
<b>B5N</b>	<b>B6N</b>	<b>B7N</b>	<b>B8N</b>	<b>B9N</b>
0.35	0.32	0.23	0.25	0.31
1.715	1.568	1.127	1.225	1.519
0.35	0.32	0.23	0.25	0.31
1.715	1.568	1.127	1.225	1.519
<b>B5N</b>	<b>B6N</b>	<b>B7N</b>	<b>B8N</b>	<b>B9N</b>
2.0	1.9	1.9	1.9	1.8
9.8	9.31	9.31	9.31	8.82
0.002	0.0019	0.0019	0.0019	0.0018
0.0098	0.0093	0.0093	0.0093	0.0088
<b>of sampling</b>				
from 2 mg/kg to 20 mg/kg				
(an beings)				
<b>MA</b>				

