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**RECOMMENDATION ON OPENING OF BEACHES AROUND THE UMHLANGA ESTUARY:
REVIEW OF ANALYTICAL RESULTS FROM V&M ANALYTICAL TOXICOLOGICAL
LABORATORY SERVICES (PTY) LTD AS REFLECTED IN REPORT NO. 210902 VM24719
DATED 2 SEPTEMBER 2021**

Beach sediments, sea water, estuarine sediments and estuarine water were collected by Nicolette Forbes, the managing director of MER on 17 and 18 August 2021 and submitted to V&M Analytical Toxicological Laboratories (Pty) Ltd (V&M ATLS) on 20 August 2021 for broad spectrum pesticide trace analysis. The beach sediments and sea water samples were collected from the same sites where previous samples were collected from and which were analyzed by a different laboratory. A previous assessment that I drafted in consultation with Prof Mary Gulumian on 24 August 2021 on the risk for people using the beaches for recreation and surfing in the sea water indicated that the risk for people was completely negligible; that assessment must be read as pre-amble to this assessment and my resultant recommendation on the opening (or limited opening) of the beaches for leisure and surfing.

The only pesticides (insecticide, fungicides, and herbicides) that were detected at trace levels or quantifiable levels were –

1. Tebuthiuron which is a systemic soil herbicide of the urea group of herbicides.
 - a. It has an acute oral mammal toxicity (worst case scenario) $LD_{50} = >200$ mg/kg for cats. Note that the norm for human toxicity is the LD_{50} value for rats which is 387 for female rats. A person on 60 kg body mass need to ingest 12.0 grams of Tebuthiuron to reach the LD_{50} value. The tebuthiuron concentrations that were measured were between 168 ng/ml (168 ug/l or 0.168 mg/l) and 807 ng/ml (807 ug/l or 0.807 mg/l). The highest concentration of tebuthiuron (807 ng/ml) was measured in the estuary water whereas the B1S and B2S sea water samples that were collected due south of the estuary mouth only showed traces of tebuthiuron below the Limit of Quantification (LOQ). Even at the highest measured concentration in the estuary, it poses no risk to people; a person would have to ingest 247 litres estuary water to reach the LD_{50} value.
 - b. The acute dermal toxicity for mammals is $LD_{50} > 5,000$ mg/kg for rabbits. This is of no toxicological concern to people.
 - c. The Lowest Observed Effect Level (LOEL) for chronic intake of tebuthiuron for mammals is 80 mg/kg body mass per day which is a daily intake of 4.8 grams of tebuthiuron for a person with a body mass of 60 kg. This means a person would have to ingest 5,948 litres of estuary water daily for at least two years to show adverse health effects.

- d. From an ecological perspective (in terms of all animal life) the highest quantified concentration of tebuthiuron (0.807 mg/ml) in the estuary is not at a level of concern for fish (LC_{50} (96 hrs) = 112 mg/l bluegill sunfish which is practically non-toxic to fish) or *Daphnia* (LC_{50} (96 hrs) = 297 mg/l which is non-toxic to *Daphnia*), but it is highly toxic at the highest concentration to algae (*Selenastrum* LC_{50} = 0.05 mg/l) and duckweed (*Lemna gibba* LC_{50} = 0.135 mg/l). Acute oral toxicity for birds is moderate (LD_{50} > 500 mg/kg) but at the highest quantified concentration, the risk for birds in the estuary is extremely low. The acute LC_{50} of Tebuthiuron for pink shrimp is 62 mg/l (slightly toxic) while chronic LOEL for fathead minnow is 18 mg/l over 24 days (slightly toxic). This concentration is 22.3 times higher than the highest quantified concentration of tebuthiuron in the Umhlanga estuary (refer to Annex 1 for more details about Tebuthiuron toxicity and risks).
2. Picloram which is a selective systemic herbicide of the pyridinecarboxylic acid group of herbicides that can be absorbed by leaves and roots.
 - a. The acute oral toxicity is more than 5,000 mg/kg for mammals and birds and since the substance was only found at trace level in the estuary water and sediments, it is of no human health concern for beach use and surfing.
 - b. It is moderately toxic to fish (acute LC_{50} (96 hrs) = 5.5 mg/l for trout) and slightly toxic to *Daphnia* (LC_{50} (96 hrs) = 34.4 mg/l) and moderately toxic to pink shrimps (LC_{50} (96 hrs) = 10.3 mg/l), but only slightly toxic to algae (*Selenastrum* LC_{50} = 36.9 mg/l).
 - c. Picloram was detected only as traces below the LOQ and therefore the risk to aquatic organisms is extremely low. The very low levels can probably be attributed to its rapid photodegradation in water (DT_{50} < 3 days).
 3. Metolachlor is a selective herbicide of the chloroacetamide group of herbicides that prevents germination of certain grass and broad-leaved weeds.
 - a. The acute oral toxicity of metolachlor is LD_{50} = 1,063 mg/kg (female rats). The concentration of metolachlor was between <30 ng/ml and 107 ng/l. At the highest quantified level of 107 ng/l (107 ug/l or 0.107 mg/l) the risk for people is extremely low and requires oral ingestion by a 60 kg person of thousands of litres of estuarine water. It was not detected in the beach sediments or sea water. It therefore poses no risk for people to use the beach or surf in the sea water.
 - b. The acute oral toxicity for birds is lower than for human beings at LD_{50} > 2,150 mg/kg while chronic exposure at >10,000 mg/kg in food over 8 days showed no effects on bobwhite quail and mallard ducks. Metolachlor is present in to low a concentration to pose any risk to birds.
 - c. Metolachlor is moderately toxic to fish (acute LC_{50} (96 hrs) = 3.96 mg/l for rainbow trout) and slightly toxic to *Daphnia* (LC_{50} (48 hrs) = 25 mg/l) and moderately toxic to pink shrimps (LC_{50} (96 hrs) = 10.3 mg/l). It showed high toxicity for Eastern oysters *Crassostrea virginica* (LC_{50} (96 hrs) = 1.6 mg/l) and the No Observed

Adverse Effect Concentration (NOAEC) for the mysid shrimp *Mysidopsis bahia* was 0.13 mg/l. It is highly toxic to algae (*Scenedesmus subspicatus* LC₅₀ = 0.1 mg/l).

4. Acetamiprid is a systemic insecticide of the neonicotinoid group of insecticides. It only detected as traces below the LOQ in the estuarine sediments and thus poses no risk to people using the beaches or surfing. Its toxicity for fish is practically non-toxic (LC₅₀ > 100 mg/l) while for *Daphnia* in direct exposure (ingestion) it is slightly toxic (EC₅₀ (48 hrs) = 49.8 mg/l) but over 24-hour period the LC₅₀ > 200 mg/l which makes it practically non-toxic to *Daphnia*. It is also practically non-toxic to algae E_rC₅₀ > 98.3 mg/l (E_rC₅₀ is a measure of reduction in growth rate of an organism). It is moderately toxic to duckweed (LC₅₀ (14 days) = 1 mg/l) and is expected to be moderately to slightly toxic to other floating aquatic plants also.
5. Pesticides of acute and chronic human health concern such as carbofuran (acute), methomyl (acute), chlorpyrifos (acute and chronic), dichlorvos (acute), oxamyl (acute) and terbufos (acute) were not detected in the analysis.
6. Arsenic concentrations in sea water and beach sediments. **PLEASE READ THE REPORT THAT WAS SUBMITTED ON 24 AUGUST 2021 AS BACKGROUND TO THIS ASSESSMENT OF THE ARSENIC (MSMA) CONCENTRATIONS.**
 - a. The concentration of arsenic expressed as MSMA, or elemental arsenic as reported by V&M ATLS is lower in both beach sediments and sea water:
 - i. Beach sediments: highest MSMA concentration recorded in samples collected on 28 July 2021 was 20.6 mg/kg and highest MSMA concentration recorded in samples collected on 17 and 18 August 2021 was 3.038 mg/ml. This is a significant reduction in the beach sediment MSMA contamination.
 - ii. Sea water: highest MSMA concentration in samples collected on 28 July 2021 was 0.0177 mg/l and highest MSMA concentration recorded in samples collected on 17 and 18 August 2021 was 0.0108 mg/l. This is a slight reduction in the sea water MSMA concentration.
 - b. The concentration of MSMA in both the earlier samples from 28 July 2021 and those of 17 and 18 August 2021 of not of acute or chronic human health concern. Explanations are offered in the tables as attached to this report.
7. **Recommendation on opening of beaches for recreational use and surfing.**
 - a. It is recommended that the regulatory authorities can consider the opening of beaches for recreational use and surfing, provided that –
 - i. An exclusion zone of 1 km south and 1 km north of the Umhlanga estuary mouth remains closed for recreational use and surfing.
 - ii. Harvesting of any live or dead marine vertebrate or invertebrate organisms remains forbidden.

- iii. Activities of the KZN Sharks Board may continue as normal even in the sea directly facing the Umhlanga estuary mouth because the arsenic concentration in the sea water is too low to be of any health concern.

- b. This recommendation is based on critical evaluation of the toxicity data that were provided by independent toxicology analytical laboratories and doing an assessment on arsenic (MSMA and es elemental arsenic) and pesticides of human and environmental health concern.

I trust that you will find this in order.

Sincerely,



DR GERHARD H VERDOORN
DIRECTOR: GRIFFON POISON INFORMATION CENTRE