September 14, 2020

Follow-up to the 2011 DMMP Clarification paper, Marine Sediment Quality Screening Levels: Adopting RSET Marine SLs for Use in DMMP

Prepared by the DMMP agencies

INTRODUCTION

In 2011, DMMP proposed adopting the Regional Sediment Evaluation Team (RSET) Marine Screening Levels (SLs) for evaluating the suitability of dredged material for in-water disposal (DMMP 2011). The proposal considered selected compounds for which RSET and DMMP guidelines differed prior to 2011 Table 1 and Table 2. "Group 1" compounds were on the DMMP's list of chemicals of concern (COC), but not on the RSET list (Table 1). "Group 2" compounds were considered marine COCs for evaluation of dredged material by both DMMP and RSET, but different SLs were used (Table 2).

Group 1 compounds were dropped from the DMMP COC list for evaluation of project dredged material, but remained on the COC list for monitoring of DMMP disposal sites. Group 2 compounds were set equal to RSET marine SLs.

Table 1. Group 1 compounds - Deleted from DMMP COC List in 2011.

Chemical	DMMP Marine SL (dry weight)	RSET Marine SL (dry weight)
Metals (mg/kg)		
Nickel	140	---
Chlorinated Hydrocarbons (µg/kg)		
1,3-Dichlorobenzene	170	---
Volatile Organic Compounds (µg/kg)		
Trichloroethene	160	---
Tetrachloroethene	57	---
Ethylbenzene	10	---
Total Xylenes	40	---
Miscellaneous Extractables (µg/kg)		
Hexachloroethane	1400	---
Pesticides/PCBs (µg/kg)		
gamma-BHC (Lindane)	10	---

Table 2. Group 2 compounds - Set equal to RSET SLs in 2011. Shaded compounds are discussed below.

Chemical	Former DMMP Marine SL (dry weight)	RSET Marine SL (dry weight)
Metals (mg/kg)		
Chromium	267 (BT*)	260
Miscellaneous Extractables (µg/kg)		
Hexachlorobutadiene	29	11
Pesticides (µg/kg)		
p,p'-DDD	---	16
p,p'-DDE	---	9
p,p'-DDT	---	12
Total DDT (sum of 4,4') DDX)	6.9	---
Aldrin	10	9.5
Chlordane (total)	10	2.8
Dieldrin	10	1.9
Heptachlor	10	1.5

*BT = bioaccumulation trigger; before 2011, there was no SL for chromium

The 2011 paper recognized that it would take time for analytical labs to lower the practical quantitation limits (PQLs) to meet the new SLs for four specific Group 2 chemicals: hexachlorobutadiene, total chlordane, dieldrin, and heptachlor (shaded in Table 2). The DMMP committed to using Best Professional Judgment (BPJ) as needed to interpret data in cases where laboratory PQLs did not meet the new DMMP SLs.

This paper is intended to follow-up on the potential laboratory issues identified in 2011 and to evaluate the impact the new SLs have had on DMMP project characterizations and suitability determinations. The questions addressed here include:

1. Have analytical laboratories been able to meet the lower SLs?
2. In cases where non-detect exceedances (NDEs) fell between the new and old SLs, what kind of additional testing was undertaken, and what did it show?
3. In cases where project PQLs could not be lowered below SLs, what steps were taken programmatically to evaluate material?

In addition, the DMMP proposes to make these clarifications:

1. Recommend continued use of the new SLs for hexachlorobutadiene, total chlordane, dieldrin, and heptachlor as well as continued BPJ on either detected or undetected exceedances.
2. Remove Group 1 compounds from the DMMP disposal site monitoring list**.**

DATA REVIEW AND IMPACT ASSESSMENT

1. Have analytical laboratories been able to meet the lower SLs?

To evaluate this question, all sediment chemistry data for hexachlorobutadiene, total chlordane, dieldrin, and heptachlor from all DMMP projects since 2011 were compiled and reviewed for the occurrence and handling of NDEs. NDEs occur when the laboratory is unable to achieve a sufficiently low reporting limit (when PQL or MDL exceeds SL) and the reported non-detect result exceeds the DMMP SL. Data were evaluated for 612 samples representing 74 projects from June 2011 through December 2019.

The analysis found that the % of samples with NDEs exceeding the new SLs has generally decreased since 2011 (Table 3) reflecting a concurrent drop in the reporting limits (either PQL or MDL, as reported by project) for these four chemicals. Despite the improved analytical method sensitivity the labs have been able to achieve, there are still some instances where NDEs exceed the new, lower SLs. This is a limitation of the low resolution gas chromatograph with electron capture detector (GC/ECD) pesticides method, which is affected by co-extracted interferences (i.e., PCBs, etc.).

Table 3. Analysis of NDEs of four target chemicals before and after DMMP 2011 clarification.

DY	# projects	# samples	# samples with NDE > new SL	% samples w/ NDE > new SL
2011-2012, pre-clarification	8	50	25	50%
2012 post-clarification	10	75	26	35%
2013	8	61	8	13%
2014	10	77	38	49%
2015	9	62	8	13%
2016	8	89	14	16%
2017	6	60	3	5%
2018	6	59	2	3%
2019	6	27	5	19%
2020	11	102	11	11%

2. **In cases where NDEs fell between the new and old SLs, what kind of additional testing was undertaken, and what did it show?**

When an NDE occurs, the DMMP requires additional information to be able to make a suitability determination for the material. Typically, this would mean bioassays, but could also include re-analysis by the laboratory to obtain lower PQLs via additional cleanup steps or a different analytical method (i.e., High Resolution Gas Chromatography/High Resolution Mass Spectrometry [HRGC/HRMS], or MS/MS). Three projects had NDEs greater than the SLs and chose to re-test using HRGC/HRMS analysis to lower MDLs and/or PQLs. Out of 19 samples re-tested, 11 samples had MDLs and/or PQLs, below the SL. In one case (Kenmore Federal Navigation Channel with 8 samples), results of follow-up HRGC/HRMS testing resulted in detected concentrations that were above SLs.

Some projects/samples in Table 3 that had NDEs for one or more of the 4 COCs also had other compounds that exceeded the SLs. In these instances, the applicant chose to conduct bioassay testing or bring the material to an upland disposal facility.

3. **In cases where NDEs were above SLs, with no further testing, what steps were taken to programmatically evaluate material?**

When bioassays or HRGC/HRMS testing could not be performed, the DMMP used BPJ to make regulatory decisions on samples that had NDEs. Several factors were considered when applying BPJ including the magnitude of NDE, concentrations of other COCs, grain size distribution, total organic carbon content, historical data from the project area, and potential sources in the vicinity. Table 4 provides a summary of projects where BPJ was used to determine that no further testing was required. BPJ will not always result in a no further testing decision; it may result in the decision to consider the material unsuitable for disposal without further characterization.

Table 4. Samples with BPJ suitability applied to NDE for target compounds.

DY	# projects	# samples	# BPJ
2011-2012, prior to clarification	8	50	14
2012 post-clarification	10	75	3
2013	8	61	6
2014	10	77	7
2015	9	62	0
2016	8	89	1
2017	6	60	2
2018	6	59	0
2019	6	27	0
2020	11	102	2

PROPOSED ACTIONS

1. **DMMP will continue to use the 2011 marine SLs for hexachlorobutadiene, total chlordane, dieldrin, and heptachlor.**

Labs were able to lower the reporting limits for most cases once the new guidance was in place. Labs must continue to strive to achieve reporting limits below the SLs, and the following approaches should be considered if PQLs are above the SL:

- Re-analyze[i] with additional cleanup protocols to remove matrix interferences

- Report results down to the Method Detection Limit (MDL); or,
- Utilize alternative analytical methods. Alternative analytical methods that are less prone to matrix interferences include[ii]:
    - EPA method 1699: Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS
    - Organochlorine pesticides by isotope dilution GC/MS/MS

If the above options are unable to produce suitable reporting limits, or are not feasible due to cost or size of the project, the DMMP will continue to consider BPJ.

2. **Group 1 compounds (nickel, 1,3-dichlorobenzene, VOCs (trichloroethene, tetrachloroethene, ethylbenzene, and total xylenes), hexachloroethane, and lindane) will be dropped from the DMMP disposal site monitoring list.**

These compounds have never been found (detected or undetected) above the previously existing screening levels. This includes during the 2013 monitoring of Elliott Bay, the disposal site with the highest potential to have elevated chemicals of concern.

REFERENCES:

DMMP, 2011. DMMP Clarification Paper: Marine Sediment Quality Screening Levels: Adopting RSET Marine SLs for Use in DMMP". Prepared by Laura Inouye for the DMMP agencies. June 20, 2011.

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[i] Meeting bioassay holding times (56-days post sample collection) can be an issue if multiple rounds of testing are needed to bring reporting limits below SLs. Approaches to meeting holding times should be discussed with the DMMP agencies and may include shorter laboratory turn-around times or the use of an alternative pesticide method up front in project testing.

[ii] Analytical methods are consistently changing, and more sensitive and/or accurate methods may be available. Check with laboratories for updates.