Environmental Protection Authority
Te Mana Rauhī Taiao

Memorandum

To:	Tipene Wilson, Dr Ngaire Phillips, Dr Derek Bolton
Copy to:	Milana Blakemore
From:	Lee Bailey, Ben Deeble
Date:	11 September 2020
Subject:	Reassessment of methyl bromide – responses to Direction and Minute WGT023

Purpose

1. In your Direction and Minute WGT023, the Decision-making Committee (DMC) directed Todoroski Air Sciences (TAS) to conduct air dispersion modelling to help with your deliberations on the reassessment of methyl bromide.
2. This memo sets out the response from TAS regarding when they would be able to complete the modelling.
3. TAS has a few clarification questions and suggestions for the DMC, which are also summarised in this memo.

Recommendation

4. The DMC are recommended to:

a.	**note** the contents of this memo
b.	**direct** how they wish TAS to proceed with the modelling.

Background

5. TAS has proposed a number of input parameters that are not exactly the same as those agreed in the three rounds of expert conferencing, though build on that with further information presented at the hearing. They have suggested that these proposals are peer reviewed prior to them commencing the modelling runs to reduce conflict later.
6. They have indicated that the number of possible combinations related to the fumigation types, fumigation rates, and recapture rates is over 8,000; and that to compile so many isopleth plots will take both a long time (effectively one to two work-years), and take a long time for you to review and absorb. They ask if the DMC had a smaller set of combinations with which you were most interested.

Input parameters

7. TAS has proposed to amend some of the input parameters that were used in the Sullivan Environmental Consulting (SEC) 2020 modelling, principally related to how the log stacks are modelled.

8. SEC used a single stack 25 m wide, by 25 m long, by 3 m high (25Wx25Lx3H) with a total volume of 1,875 m^3. TAS acknowledge that this is suitable if testing some wind conditions with a statistical approach.

9. In response to the feedback from Atmospheric Science Global (ASG) that TAS noted during the hearing, TAS proposes to use six separate stacks, 6Wx10Lx5H, per group with a combined volume of 1,800 m^3 instead. They consider that this is much closer to the actual pile shape, and is better when modelling all wind conditions. They then propose that combinations of one, three and six of such stack groups are vented in any particular hour in the model to give an indication of differing operations on ports.

10. This shape cannot be changed easily after the model has been set-up, and would require complete re-modelling to amend later. As such, TAS has asked for feedback on this proposal from the DMC, and suggested that operator feedback may be reasonable also.

11. In addition, TAS has indicated that some of the scenarios proposed to be modelled are not exactly as agreed by the expert conferencing or as modelled by SEC. The have made these amendments based on feedback they noted at the hearing, and to minimise modelling time.

12. They propose that their assumptions (See Appendix B) are shared with either the experts or the peer reviewer for their comment prior to the modelling commencing. The purpose of this would be to minimise any possible re-work should an expert / peer-reviewer disagree with any assumption.

13. There are three questions for the DMC as a result of this feedback:
    a. Do the DMC have any feedback for TAS on the approach they propose to model the log stacks?
    b. Does the DMC wish to consult with any party regarding these proposals, including but not necessarily limited to TAS's proposal of gaining operator feedback?
    c. Does the DMC wish for TAS to share their assumptions with any other modeller prior to them commencing the modelling work? And if yes, who would they like them to liaise with: the expert panel, or the peer-reviewer?

Isopleth plots

14. As noted above, TAS consider that is not appropriate to provide isopleth plots for all of the modelling combinations that are possible as a result of the direction in WGT023.

15. Instead they have proposed that around 30 different combinations would be suitable to be modelled and processed in a reasonable timeframe.

16. As a start, TAS has proposed a list of 14 combinations that they hope may be suitable to help your deliberations (see Appendix B).

17. TAS consider that they would be able to prepare any additional isopleth plots in as little as 30 minutes for the options modelled, if the DMC were to require these at a later date.

18. There are two questions for the DMC as a result of this feedback:
    a. Are the DMC comfortable with the approach that TAS are proposing?
    b. Are there any other combinations that you wish them to present?

Timing

19. TAS has indicated that the once the input parameters are agreed, it would take them approximately four weeks to conduct the modelling and provide a brief interpretative report.

Appendix A TAS's modelling assumptions

Parameter	For log stacks	For ship holds	TAS's comments
Model	CALPUFF version 7.3.1		Current model
CALMET weather files	2014 – 2016 CALMET data set from ASG		As agreed by experts
Treatment rates (g/m^3)	120	120	Standard target dose for various markets
	80	80	
	72	72	
	40	40	
Recapture rate (%)	30	0	The number of possible combinations of treatment, recapture, fraction of logs, # of logs, and ships is Over 8,064 (i.e. 4 log treatment x 8 recapture, x 3 fraction logs x 3 log numbers x 4 ship treatment x 7 ship recapture). For a single person to make isopleth plots for all combinations will take approx. 2,000 to 4,000 hours of work, or approx. 1-2 years of human effort. TAS can write a program to do this in say one month, but realistically making ~8,000 diagrams is not going to assist because it is just far too much to review and absorb. TAS suggest that DMC nominate approx. 30 combinations of logs and ships it may wish to see (1-2 days work to plot the isopleths). It takes approx. 15-30 minutes of human effort to provide isopleths for any new combination, as and when may be needed/ requested by DMC, e.g. to fill in any gaps that the 30 combinations don't answer. TAS can also add any missing treatment/ recapture as well, nominally 30 minutes effort is needed. Any of the green shaded values can be altered with nominally 30minutes effort. (The yellow shaded values cannot be altered after the model has run, the model must be re-run to change those values).
	40	50	
	50	60	
	60	70	
	70	80	
	80	99	
	99	-	

Parameter	For log stacks	For ship holds	TAS's comments
Fraction of logs with recapture (%)	100	100	Whilst amenable to a statistical/ Monte Carlo approach, to allow for best analysis of weather factors, TAS will assume fixed log/ ship position(s) and adjust the emission rate from ALL logs per the percentage. For example, for 50% of logs with a recapture rate of 30%, instead of having half the logs with recapture at 30% (and half with no recapture), TAS will have ALL the logs with a recapture rate of (50% x 30% =) 15%.
	75		
	50		
Receptors	125 x 125 m area with 12.5 m grid spacing near logs		No ring receptors, but overlay "ring" lines will be shown
	400 x 400 m area with 25 m grid spacing around logs/ship		
	1.6 km x1.6 km area with 50 m grid spacing		
	3 km x 3 km area with 100 m grid spacing, 200 m for rest of grid		
Sources	(per log stack*)	(Per ship hold)	
Length (m)	10	22	* Differs to SEC, responds to ASG critique. Cons: Increases the model run time approx. 6-fold. Pros: More accurate near to the log pile. SEC used a single 25Wx 25Lx 3H volume source (total 1,875m3), which is more-omni-direction re: wind conditions, i.e. better if testing some wind conditions per stat. approach. TAS propose a 6W x 60L x 5H volume source (total 1,800m3) made up of six separate 6W x 10L x 5H Volume sources, much closer to the actual pile shape. TAS use fixed locations and test all wind conditions. Both approaches have limitations, each pile shape perhaps better suited to its own approach. This shape cannot be changed easily; requires complete re-modelling. Ideal is ~ 10 sources but get excessive run time vs. small benefit.
Width (m)	6	22	
Height (m)	5	20.1	
Volume (m^3)	1,800	9,728	
Horizontal spread (m) sigma x	2.33	5.12	
Vertical spread (m) sigma z	1.16	4.67	

Parameter	For log stacks	For ship holds	TAS's comments
No. volume sources per stack/hold	6	1	
No. log stacks/ships	1, 3, 6	5	*All log stacks/ ship will be in a fixed location Assume either 1, 3 or 6 log stacks venting in an hour, assumed to be sufficient to cover the likely range of activity in any one place on the site within an hour. This does not deal with the whole site, rather it is focussed finding the right on-site buffer for workers or possibly nearby commercial receptors. For ships, the focus is about off-site and residential receptors being adequately protected.
No. ship holds	-	5	
No. log stacks in Zone 1	0	-	
No. log stacks in Zone 2	0	-	
No. log stacks in Zone 3	1, 3, 6	-	
No. log stacks in Zone 6	0	-	
Emissions (at each hour after ventilation)	% of initial dose emitted, per log stack	% of initial dose emitted, per ship hold	
0	50	21	Similar to SEC and experts recommendations. Ship emissions per hold staggered 2hrs, same profile.
1	1	18	
2	1	1	
3	0	1	

Parameter	For log stacks	For ship holds	TAS's comments
4	0	1	
5	0	1	
6	0	1	
7	0	1	
8	0	1	
9	0	1	
10	0	1	
11	0	1	
12	0	1	
13	0	0	
14	0	0	
15	0	0	
16	0	0	
17	0	0	
18	0	0	
19	0	0	
20	0	0	

Parameter	For log stacks	For ship holds	TAS's comments
21	0	0	
22	0	0	
23	0	0	
Results			
Averaging period (hour)	1		Per TEL period. (Ideally 5 to 10-minute model time step, but NOT proposed due to need for new CALMET input files and also 6 to 12 x longer run times (on top of 6 times longer for vol. sources).)
Percentile	99.9th		Per NZ guidelines
Conditions with greater impact	-		Analysis similar to diurnal profile for identifying worst hours to ventilate in, also other means to assess. Will model fixed source ventilating in every hour of the year (independently to other sources in the earlier or later hour) ie there are 24 separate models (actually 24 separate MB "species"), one for each hour of the day. TAS don't add the separate species together.
Buzzer zones	-		Nominally 30 isopleth diagrams, can add more at short notice, if and as needed by DMC.

Note: shading as provided by TAS

Appendix B TAS's proposed isopleth plots

Case Number	Case descriptor (if desired)	Log Treatment rate (g/m3)	Ship Treatment rate (g/m3)	Log stack recapture rate (%)	Ship recapture rate (%)	Fraction of logs with recapture	Number of log stacks ventilated in an area (per hour)
	Default Available variables (can be added to if desired, except # of log piles)	120	120	30%	0%	100%	1
		80	80	40%	50%	75%	3
		72	72	50%	60%	50%	6
		40	40	60%	70%		
				70%	80%		
				80%	90%		
				90%	99%		
				99%			
1	Worst case logs + ship	120	120	30	0	50	6
2	Worst case logs only	120	-	30	-	50	6
3	Worst case ship only	-	120	-	0	-	-
4	More likely high case L+S	72	72	30	0	50	6
5	More likely high case L	72	-	30	-	50	6
6	More likely high case S	-	72	-	0	-	-
7	Likely future high case L+S	72	72	60	0	50	6
8	Likely future high case L	72	-	60	-	50	6
9	Likely future high case S	-	72	-	0	-	-

Case Number	Case descriptor (if desired)	Log Treatment rate (g/m3)	Ship Treatment rate (g/m3)	Log stack recapture rate (%)	Ship recapture rate (%)	Fraction of logs with recapture	Number of log stacks ventilated in an area (per hour)
10	Likely future moderate case L+S	72	72	60	0	75	3
11	Likely future moderate case L	72	-	60	-	75	3
12	Logs buffer worst case 3 stacks/hr (adds to case 2, which is 6 stacks/hr)	120	-	30	-	50	3
13	Logs buffer worst case 1 stacks/hr	120	-	30	-	50	1
14	Ship only buffer low (adds to case 3 & 9)	-	40	-	0	-	-

Note: shading as provided by TAS