U.S. Environmental Protection Agency
Science Advisory Board
Radiation Advisory Committee (RAC)
Augmented for the Review of MARSSIM Revision 2

Summary Minutes for the Public Meeting held
January 11 – 14, 2021

Meeting Participants:

SAB RAC-Augmented for Review of MARSSIM Rev 2 Members*

Dr. Brant Ulsh, Chair	Mr. Earl Fordham	Dr. Robert Litman	Dr. Wei-Hsung Wang
Dr. Sally Amundson	Dr. Eric Goldin	Mr. Dennis Quinn	Dr. R. Craig Yoder
Dr. Roland Benke	Ms. Barbara Hamrick	Dr. Richard Smith	
Dr. Harry Cullings	Dr. Kenneth Inn	Dr. Daniel Stram	
Dr. Lawrence Dauer	Dr. Annie Kersting	Mr. Zoltan Szabo	
Dr. Timothy DeVol	Dr. Amy Kronenberg		

*For the full membership see Roster[i]

Designated Federal Officer:
Dr Diana Wong, Science Advisory Board Staff Office

Other Attendees
See Attachment A.

Meeting Summary:

The Science Advisory Board (SAB) Radiation Advisory Committee (RAC) augmented for the review of MARSSIM revision 2 (Public Comment Draft) (Committee), convened for a public meeting via virtual video format and teleconference.

MONDAY, JANUARY 11, 2021

Meeting was convened Monday, January 11, 2021 at 12:00 pm, Eastern Standard Time (EST), by Dr. Diana Wong.

Dr. Wong provided brief opening remarks regarding legal authority under which the committee was meeting, meeting logistics, ethics review of committee members, public participation, and purpose of the meeting.

Mr. Thomas Brennan, Director of the Science Advisory Board Staff Office (SABSO), made some brief remarks welcoming the committee, thanking the members, staff, the MARSSIM report writers, inter-government partners, Dr. Wong and the contractors supporting the meeting.

Dr. Ulsh, Chair of the Committee, thanked all participants, and provided a review of the agenda[ii] and invited members to introduce themselves.

All members present introduced themselves in alphabetical order as follows:
Dr. Amundson, Dr. Benke, Dr. Cullings, Dr. Dauer, Dr. DeVol, Mr. Fordham, Dr. Goldin, Ms. Hamrick, Dr. Inn, Dr. Kersting, Dr. Kronenberg, Dr. Litman, Mr. Quinn, Dr. Smith, Dr. Stram, Mr. Szabo, Dr. Wang, Dr. Yoder.

Opening remarks were provided by Ms. Lee Ann Veal, Director of the Radiation Protection Division, Office of Radiation and Indoor Air. Ms. Kathryn Snead, Acting Director of the Center for Radiological Emergency Management, Office of Radiation and Indoor Air, and the chair of the MARSSIM workgroup, gave an overview of the MARSSIM, Revision 2.

Ms. Snead's presentation[iii] is posted to the meeting website as a meeting material located at the following URL:
https://yosemite.epa.gov/sab/sabproduct.nsf//51480F8C7827E7A085258657008181D1/$File/marssimrev2saboverview_reviewed_011121.pdf

After the presentation, one of the panel members asked for clarity regarding the legal framework within which the document being reviewed exists. Ms. Snead explained that the intergovernmental workgroup is tasked with a technical task that aims to avoid making policy and that there is no legal authority behind the document being reviewed. It is a technical manual for conducting surveys that many agencies and departments use in various ways. The lines drawn "around" MARSSIM is guided by the thinking among workgroup members as to "decisions that can be made completely on their technical merits".

A question was asked regarding subsurface soils, based on input from a previous RAC review. Ms. Snead responded that the document was envisioned to include subsurface in site investigation when brought to the previous review by the SAB. However, the previous review indicated the scanning technique is only as good as it can scan down into whatever you are working with. So the workgroup has not come up with a good method that can prove, technically, that the below surface material meets criteria. So this is a problem that still needs work, and the intergovernmental workgroup is still working on it.

Another question was asked regarding the audience intended for the document. Ms. Snead responded that the document is envisioned for survey designers with knowledge of site, health physics, and statistics. In the manual is a paragraph that describes the individual the manual is aimed at. Ms. Snead appreciated the preliminary comments submitted by Committee members and is considering that there is still, perhaps too much specialized vocabulary included in the text. However, specific vocabulary is necessary given the technical nature. So further consideration may be warranted.

Another question was asked regarding how many sites are using the MARSSIM manual for site surveys. Ms. Snead indicated that no good aggregated statistics are available on that at this time because state implementation varies quite a bit. However, looking at records of training classes conducted in MARSSIM, EPA has trained over 1000 professionals. Other training facilities do even more. There are still not enough classes to fully meet demand. It appears the manual is widely used.

One panel member with experience using MARSSIM indicated the technical material is guide but few people use it in its entirety. However, pieces are constantly used especially when dealing with radionuclides. The manual is important and will continue to be used in the future to identify and resolve issues in conducting site surveys.

Dr. Cynthia Barr then presented Scenario B to the Committee.

At the conclusion of the presentations, Dr. Ulsh opened the floor to Committee members for general questions. Several clarifying questions regarding details on the slides were asked and answered.

The Committee concluded its discussion, broke at 2:00 pm EST and reconvened at 2:15 pm EST

Public comments
There were no public comments.

SAB Committee Discussion
The committee reconvened at 2:15 pm EST to begin deliberations of the charge questions.

Discussion of Charge Questions:

Charge Question 1.1. - whether the inclusion and proposed implementation of scan-only surveys is appropriate, adequate and clear

Ms. Snead read charge question 1.1 and the lead discussant (Dr. Benke) presented a summary of comments provided in advance by the Committee members (posted to meeting website). Committee members assigned to the question were then allowed opportunities to provide additional comments not included in the oral summary, or as provided in their individual preliminary comments[iv]. The Committee discussed validation and verification methods and concluded there will be cross cutting issues that need to be coordinated in the final written report across chapters and sections, and requested editorial help in ensuring this is done.

Charge Question 1.2. - the inclusion and proposed implementation of Scenario B

Dr. Ulsh began the discussion of charge question 1.2 at approximately 2:40 pm EST. Ms. Snead read the question and the lead discussant (Dr. Stram) provided a summary of the previously submitted, and posted, comments from the Committee members. Some observations were made regarding the difficulty of the material and its accompanying terminology, especially as that may be unfamiliar even to a statistician. Suggestions were discussed about specifics such as the "gray region" and definitions in the report being placed in an appendix or a glossary.

Scenario B was discussed and a comment was made about it being recommended when the derived concentration guideline level (DCGL) is close to zero. In this case, the relative shift is too small (approaches zero), and the sample size becomes infeasible (approaches infinity). However, other committee members suggested it may be better to make a stronger statement that Scenario A is perfectly fine, and Scenario B is more for when the DCGL is close to zero cases, and that it should be easy for regulators to accept the use of Scenario A without always having to justify not using Scenario B first. One committee member suggested there is too much subjectiveness regarding scenario selection, and this may put the study designer in the position of proving to regulator that Scenario A is not feasible. Discussion proceeded including how the DCGL is calculated (and that DCGL calculations are out of the scope for MARSSIM) and used and how regulatory requirements vary across states. Conclusion was that it is more natural to rely on Scenario A except when it is infeasible.

Methods for considering background variability were discussed. It was concluded that the methods to differentiate the survey unit from background are likely reasonable and accurate. Issues regarding control regions and reference regions were discussed with respect to variability. Details for consideration were referenced as being included in the preliminary comments submitted in advance and posted to the meeting website. The statistical tests (Kruskal-Wallis test and Chebyshev inequality for bounds) for detection of background variability were discussed.

The Committee unanimously concluded that the inclusion of Scenario B seems to be appropriate, as expressed during discussion, however the retrospective power calculations are inherently complex, terminology must be learned and understood, and the approach appears to be basically sound.

The Committee had no further comments or questions regarding the "methods" part of the charge question and moved onto discussing the inclusion and implementation of added requirements for retrospective power analysis and the Quantile Test while using Scenario B in the MARSSIM document.

One Committee member started the discussion by indicating that the statistical test is the fundamental question and brought up the issue that non-parametric statistical test may be the heart of the issues. Committee members agreed the language in the document is heavily geared toward a statistician and that less "jargon" might enhance the MARSSIM presentation. Also suggested is an inclusion of a fully worked example would help in comprehension by others not as well versed in non-parametric statistical methods. Reference was made to Chapter 13 in NUREG-1505(NRC, 1998), a document provided by the DFO to the Committee and posted the meeting website as meeting material. Suggestion was offered by one Committee member to perhaps include these kinds of necessary materials as an appendix to the MARSSIM document. Further comments amongst the Committee members included support for inclusion, including justifications for tests suggested for use, and to gather the disbursed points into a single place and consider whether separate section or appendix may offer better presentation in MARSSIM.

Charge Question 1.3. - Measurement Quality Objectives (MQO), calculation of measurement uncertainty and considerations of laboratory and field measurement

Dr. Ulsh began discussion of charge question 1.3, which Ms. Snead read to the meeting.

The lead discussant (Dr. Litman) indicated that 15 pages of notes had been submitted prior the meeting regarding this question and that the materials were posted to the meeting website. He indicated that the comments broke down into 4 main parts and went over each reading from notes.

The committee then walked through the 4 parts as indicated by the lead discussant. Dr. Ulsh asked if there were further comments regarding the MQOs. One Committee member commented that the Committee should indicate that the language of uncertainty being used should clearly describe measurement uncertainty. They went further and indicated it is important to understand the uncertainty of the measured values to compare properly and that the data quality objectives (DQO) need to be addressed to that discussion and there could be more enhancement of that in the MARSSIM document.

Dr. Ulsh invited the full Committee to provide additional comments, and nothing additional was brought forward.

Dr. Ulsh moved onto the next part of charge question 1.3, *the proposed calculation*, and asked if that is consistent with MQO. Discussants raised the following questions for discussion: What is the role of the lab in all of this? How do you carefully describe uncertainty? What is the role of lab measurements with respect to other information?
Another Committee member responded by discussing the lab needs to be told the MQO of the project and that the project team must communicate to the lab so the lab has the bounds of uncertainty they are trying to achieve and a good rule of thumb is that the lab uncertainty should be about 1/3 of scan instrument uncertainty so that the overall uncertainty (lab and sampling) contributes to overall analysis uncertainty of approximately 10%.

Another Committee member indicated measurement results are reported as-is without subtracting blanks or reference areas measurements first. A question was raised as to whether one can get the value with appropriate units that way. In addition he raised the point that if looking at the MDC as MQO and the MDC equation, it seems to be related to the square root of the background counts, so he wondered if that should be net counts, not just raw background counts, and if it is, then it may change how one views how to do the MDC and MQO, so he suggested the Committee look at that beyond prior comments already made.

An additional Committee member reiterated the importance in the MQO process to list out the type A and type B uncertainties, and in the type B to derive the estimate of the standard deviation, and have that guide further thinking on what the team was trying to do. He went on to indicate the corrections being made to the data during processing impacts uncertainty, so particularly when calibrating the team conducting the survey needs to know how this all works.

No additional comments were heard on this part (*1.3c*) of the question response.

Dr Ulsh then moved to the next part of question 1.3 (*1.3d*): *Is the method appropriate for both laboratory and field (including scan) measurements?* He opened discussion and invited comments from assigned discussants and then the full committee. A member of the full committee reiterated that coming up with a full list is the heart of the uncertainty analysis. He believed the lab has a fair view of the type A and type B uncertainty to deal with, but field measurement is where it becomes more difficult. He indicated that taking a "best guess" at the distributions to place on type B uncertainty going into the model is indicated and that somewhere in the document a discussion of the measurement model may be appropriate.

Another Committee member spoke up and indicated that in the question summary by the lead discussant that this section of the Committee report may be a good place to summarize in a table, though it may be a large table, and that might be a good addition to the MARSSIM report, but perhaps there might be a better place to put such a large table, so leave it to the team writing the report to consider that.

Dr. Ulsh then moved onto the last part of question 1.3 and there was some discussion regarding the wording of the question (MDC/MDA should be set at 10-50% of the action level) being disconnected from the MARSSIM document being reviewed. Ms. Snead indicated the statement most likely originated in a training class and indicated it would be reviewed and corrected if not included in Revision 2.

A Committee member indicated that further discussion of the "grey region" may be appropriate here.

An additional comment was made regarding some lack of clarity on which MDC calculation is used.

Dr. Ulsh offered another chance for anyone on the Committee to offer an additional thought or comment. Nothing was heard.

Dr. Ulsh indicated the end of the day's agenda had been reached. The meeting would not pick up agenda items currently scheduled for other days. The meeting would end prior to the scheduled ending time on the agenda.

Dr. Wong recessed day one of the meeting at approximately 3:48 pm EST.

TUESDAY, JANUARY 12, 2021

Dr. Wong reconvened the meeting for the second day at approximately 12:00 noon EST and called the roll. All members of the Panel were present except for Dr. Wall who was ill and unable to participate.

Dr. Ulsh, the Panel Chair, followed and thanked everyone for their participation. He briefly reviewed the agenda for today's meeting and noted that the discussion of the charge questions would not be in the order of the questions. Before continuing with the next question, he

suggested that the discussion begin with Dr. Richard Smith providing a short summary[v] of his responses to charge questions 1.2 and 1.3 which were discussed on the previous day.

Dr. Smith began by addressing two statistical issues, the quantile tests and retrospective power analysis. He stated that the description of the quantile test was clear, and the principal reference, Gilbert (1987), is correct. The EPA document does not explain how or when this test should be implemented. He then noted that no section is headed "retrospective power analysis" in the draft MARSSIM Revision document, however, there is a discussion of it on pages 8-47 and 8-48. The draft manual doesn't provide anything about when or how to use this procedure, or how to interpret the results. This should be clarified.

A discussion of charge question 1.3 about the proposed implementation of the of the concept of Measurement Quality Objectives (MQO) and measurement uncertainty ensued. Dr. Smith continued to explain that he was not able to find a section in the MARSSIM document that referenced MQOs. He then addressed the concept of systematic and random uncertainty stating that it was not well explained in the document, and an example would be helpful for users. He then discussed the section dealing with "statistical counting uncertainty" where Equation 6-17 is provided but no explanation about when this equation is applicable. He concluded that more information is needed to guard against their inappropriate use.

Finally, he commented on the "confidence intervals" discussion (Section 6.4.4). He stated that the discussion in this section was not useful and needs to be strengthened. Other panel members agreed with Dr. Smith's recommendations. Further, there was a suggestion that information from Section 6.4 should occur earlier in the document and be moved to Chapter 4. Others mentioned that the MQOs should use exact terminology as in the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) (NRC, 2004) to avoid confusion as to whether a statement of measurement uncertainty is referring to the standard uncertainty, combined uncertainty or expanded uncertainty. Also, the MQO should require a statement about whether the resultant uncertainties are Type A or Type B, and the means by which their quantitative parameters (estimates of the standard deviation) were derived.

Discussion of Charge Questions

Charge Question 1.5.- the use of MARSSIM surveys for addressing sites containing discrete radioactive particles (DRPs)

Dr. Yoder, the lead discussant for question 1.5, provided a brief summary of the team response. He agreed with the statement that the MARSSIM guidance for Elevated Measurement Comparison (EMC) process is inappropriate when DRPs are discovered but noted that it is not clear if the rule-of-thumb will achieve the intent to avoid using the MARSSIM guidance in some situations. The rule states it is not acceptable to use the MARSSIM EMC process when the distance to the detector is greater than three times the longest dimension of the area of elevated activity. However, the source detector distance and length of the elevated activity area required for the current rule-of-thumb may not be sufficiently determined.

Others commented DRPs have an extremely small size and contain enough activity that they generate impractical survey designs under MARSSIM. They suggested that the discussion of DRPs could be

enhanced by a description of the impact - if they are present. Then a detailed discussion of DRP detection capability would need to be included.

Additionally, Appendix Section O.5 is a verbatim repetition of Section 4.12.8. It is not clear that the Appendix section is needed if it simply repeats the text.

Charge Question 1.4. - survey requirements for areas of elevated activity.

Dr. Fordham, the lead discussant for question 1.4 provided a brief summary of the team response. He acknowledged that the discussion of survey requirements for areas of elevated activity is technically accurate, though perhaps could use more detail in the text to increase clarity. He added that Figure 5.6 describes the needed steps in sequence making the text easy to follow.

Most discussants endorsed maintaining the use of the unity rule. Others stated that using the unity rule for a single elevated primary area is a good selection, however, the unity rule for two or more elevated areas has a potential to cause an overly conservative (and potentially impossible) scenario. Some suggested that as the initial default position, it is preferable to one that is unreasonably relaxed and increases the likelihood of inappropriate site release.

There was also concern about using the unity rule to ensure total dose is within the release criteria because it may result in unnecessary effort and expense. A member noted that early remediation of multiple elevated areas will circumvent the need to use a complex unity formula with additional terms addressing individual elevated areas. Members suggested that additional real-life examples would be useful in demonstrating the concepts.

Charge Question 3.1.- the revised description of how to set the Lower Bound of the Grey Region (LBGR) and its likely effectiveness in encouraging users to rely on site-specific information for doing so (Chapter 4 and Section 5.3).

Dr. Cullings, the lead discussant for question 3.1, provided a brief summary of the team response. He noted that the LBGR is introduced as a quantity used in an example in Chapter 4 without being properly defined in advance. He stated that the central questions that arises are: What is the purpose of the LBGR? Why is it needed? Why in the examples provided is the LBGR "usually set" at the median concentration of the radionuclide? How can the median concentration of a radionuclide be known when a survey is first being designed without prior measurements and only limited historical information is available? This is not clear to a technically trained reader who is not deeply familiar with the MARSSIM process. Therefore, panel members suggested that more examples and better explanations were needed.

Charge Question 3.2. - avoiding the use of the term "area factor" to improve understandability of the elevated measurement comparison concept (Section 8.6.1).

Since Dr. Wall, the lead discussant for question 3.2, was not available, Dr. Dauer provided a brief summary of the team response.

Members agreed that the term "area factor" was adequately described in MARSSIM, Revision 1 and it is described in detail in Appendix O of Version 2, but not elsewhere. They concluded that using the ratio of the Elevated Measurement Comparison (EMC) release criteria to the wide-area

release criteria does emphasize the need for site-specific modeling or calculations. Members suggested that a figure could perhaps be added to enhance overall understanding.

Members also stated that the area factors table should be eliminated and noted that use of site-specific factors would be better. There are still several sections of the MARSSIM, Revision 2 draft that continue to utilize 'area factor' and thereby introduce some level of confusion. These sections (i.e., 5.3.5.1, and 5.3.8) should be revised. Also, the 'historical information on the use of area factors' in Appendix O does not seem to be necessary.

Some members also stated that the inclusion of a definition of area factor in the glossary adds to the confusion and it should be made very clear that this is referring to a historical definition (from earlier MARSSIM revisions).

Charge Question 3.3 - the effectiveness of the new organization of Chapter 4 (Considerations for Planning Surveys) to improve the understandability of the Chapter.

Dr. Hamrick, the lead discussant for question 3.3, provided a brief summary of the team response. She stated that the organization of Chapter 4, in the draft MARSSIM, Revision 2 is considerably improved over MARSSIM, Revision 1. She explained that moving detailed derivations and calculations to Appendix O improved the flow of the information in the Chapter; however additional work is needed. She suggested that details on survey types in Chapter 2 should be in Chapter 4. At a minimum, Figures 2.4-2.8 should be included or referenced in Section 4.3. Figures 4.1 and 4.2 should appear in reverse order and should not be separated by so much text; they should be discussed in the context of survey types in Section 4.3. Consideration should be given to moving Section 4.12 Examples to Appendix O as well as some of the details regarding the calculation of the various types of DCGLs in Section 4.5.3 to further improve flow.

Members noted that some terms are missing from the glossary, including: a) sample median, b) parametric tests, c) Student's t test, and the word "decision" should be included in the term "Type I and Type II errors" to be consistent with the glossary. Others noted that they had provided additional editorial comments for consideration.

After the discussion of charge question 3.3 ended, Dr. Yoder asked EPA representatives for a clarification about the concept of minimum detectable concentration (MDC) as it was presented in the draft MARSSIM Revision 2 document. Dr. Ulsh asked him to provide the question in writing so that a response could be generated by the MARSSIM team for discussion on the following day.

Other members asked about the preparation of summary slides for the final day of the meeting. Dr. Ulsh explained that 2 slides would suffice for most of the charge question and Dr. Wong added that it will depend on the complexity of the question. Dr. Wong also mentioned that further instructions would be provided in an email to lead discussants.

Recess

Dr. Wong recessed the meeting at approximately 2:50 pm EST.

WEDNESDAY, JANUARY 13, 2021

Dr. Wong reconvened the meeting for the third day of deliberations at approximately 12:00 noon EST and called the roll. All members of the Panel were present except for Dr. Wall who was ill and unable to participate.

Dr. Ulsh, the Panel Chair, followed and thanked everyone for their participation. He briefly reviewed the agenda for today's meeting and noted that the discussion of the charge question 3 would continue and then the panel would return to discuss charge question 2. He then asked EPA representatives to provide their response to a question posed by Dr. Yoder.

Dr. Yoder's question and EPA's response are available on the SAB website for this meeting. Briefly, Dr. Yoder requested clarification about a statement on page 6-7 of the draft MARSSIM document, lines 9-12 and 19-23. He noted that the minimum detectable concentration (MDC) is defined as the point when 95% of the measured values will exceed the critical level, L_C. making the MDC equal to L_D, the detection limit, as defined on line 7. He wanted to confirm this because the example provided was based on pure counting statistics and ignores other sources of measurement method uncertainty. He suggested that this may introduce more issues for consideration than what some of the examples provide.

The response[vi] from the MARSSIM Workgroup stated that it is correct that the values of L_D and MDC both correspond to the quantity of radioactive material that can be detected with a probability of 95% (i.e. result in a measurement of net activity above the critical level), but the units are different. They noted that there is an assumption in this derivation of MDC that the source of variability (uncertainty) in the final number is predominately from counting statistics. They acknowledged this may not always be true and suggested a way to improve the chapter, by first presenting the calculation of MDC in terms of the variability when no radioactive material is present, σ_B (as estimated through repeated measurements of blank samples), and then include MDC based on counting statistics as a special or limiting case.

After a short discussion of the response, Dr. Ulsh asked Dr. Quinn to introduce the discussion of charge question 3.4.

Charge question 3.4. - the effectiveness of moving derivations from Chapter 5 to Appendix O to improve the understandability of the Chapter.

Dr. Quinn, the lead discussant for question 3.4, provided a brief summary of the team response. He mentioned that there is general agreement that the change to Chapter 5 by moving derivations to Appendix O make it easier to read and clearer to understand. Members also suggested improvements, including, several locations where reference to Appendix O should be added, as well a number of editorial comments.

Charge Question 2.1 - whether the description of updated measurement methods and instrumentation information (Chapter 6 and Appendix H) is useful, appropriate and clear

Dr. DeVol, the lead discussant for question 2.1, provided a brief summary of the team response. He noted that the description of measurement methods and instrumentation information in Chapter 6 and Appendix H are generally useful and appropriate and clear. However, there are descriptions of concepts and operations that could be made clearer and more useful. The discussion of minimum detectable concentration (MDC) and detectability need to be made clear, and used consistently and concisely. MDC and detectability are not the same and therefore are not interchangeable. He suggested that Chapter 6 and MARSSIM Version 2 should be reviewed for the correct and consistent usage, of L_C, L_D, detectability, MDA, MDC and similarly related terms.

He also noted that the methods described in Chapter 6 have not all been uniformly modernized, e.g. Surveyor Minimum Detectable Count Rate **(**$MDCR_{surveyor}$**)**. He suggested that Chapter 6 should be revised, and concepts and terminology that are no longer used or needed should be removed. Others stated that Appendix H was scrubbed of obsolete and outdated instrumentation. A similar scrubbing should happen for Chapter 6. Also, more recent references should be cited. Members emphasized the need to properly cite references to technical information contained in Appendix H.

Members also suggested that proper calculation and propagation of uncertainty should be consistent with other guidance documents, such as NIST/ISO Guide to the Expression of Uncertainty in Measurement (NIST,1994 ; ISO, 2015). Additionally, Dr. DeVol mentioned that there are numerous editorial and specific comments in the detailed draft comments provided by panel members.

Charge Question 2.2. - whether the additional optional methodology for the use of Ranked Set Sampling (Appendix E) for hard-to-detect radionuclides is useful, appropriate and clear

Dr. Smith, the lead discussant for question 2.2, provided a brief summary of the team response. He used a set of slides to explain what the Ranked Set Sampling (RSS) method is. It is a method for constructing a random sample that potentially could considerably improve on simple random sampling (SRS) with some small additional effort. He explained that the idea is to use the rough measurements to help construct a better sample for the precise measurements and it works best when the rough and precise measurements are highly correlated. However, it can still improve on SRS even when they are not.

He noted that the description of the method is sound but may be more suited to a statistician than the general user. Others suggested that significant information and guidance on how to perform this type of assessment is missing, include cautionary text about when not to use it. Furthermore, there should be a clearer discussion of practical issues such as when you should use this method at all, what alternatives might be available (e.g. stratified sampling, regression estimator, ratio estimator), how the rough measurements should be determined and what sorts of correlations are needed to make the method useful. They also suggested that more detailed examples should be provided. In addition, members offered numerous technical comments and suggested edits

Charge Question 2.3- whether the new and additional examples provided in Chapter 5 are useful, appropriate and clear.

Dr. Goldin, the lead discussant for question 2.3, provided a brief summary of the team response. He explained that overall, the examples are useful and helpful for users to see how the MARSSIM guidance can be implemented for practical situations. However, the examples could use additional details. The guidance appears to assume that the user is proficient in sampling theory or experienced in the statistical models used in the examples. He reviewed the examples used in the guidance and noted that of the 11 examples that appear in Chapter 5, five are unchanged, four are modified (additional information), and two are new.

Members concluded that the new examples represented a significant improvement and are needed. The unchanged examples were mostly reformatted and are easier to read and understand. The modified examples included some additional information or steps or changes to data and are more informative. In summary, the examples in Chapter 5 are a marked improvement.

Members also noted that the section on characterization surveys provides limited guidance on the scoping of contamination in matrices other than soils (e.g., ground water, surface water and sediments). The examples about the use of the Wilcoxon Rank Sum (WRS) Test have been revised and are clearer in Revision 2 than in Revision 1. Some members suggested that a cautionary note about when not to use the WRS test would be helpful.

After the discussion of the charge questions concluded, members were reminded to prepare 2-3 slides to summarize the teams' major conclusions and recommendations. Dr. Wong added that more slides may be needed depending on the complexity of the question. Members were asked to send their slides to Dr. Wong so that the slides can be shown on the computer screen for panel deliberations on the last day

Dr. Wong recessed the meeting at approximately 1:30 pm EST.

THURSAY, JANUARY 14, 2021

Dr. Wong reconvened the meeting for the fourth day of deliberations at approximately 12:00 noon EST and called the roll. All members of the Panel were present except for Dr. Wall who was ill and unable to participate.

Dr. Ulsh offered the Committee the opportunity to ask questions or to offer follow up discussion on anything that had been covered previously. Nothing was heard from the committee.

Dr. Ulsh then indicated the Committee would go through the summary of response to charge questions based upon the deliberations and previously submitted Committee member written comments.

The lead discussants presented summary slides[vii] (found on the meeting website: https://yosemite.epa.gov/sab/SABPRODUCT.NSF/MeetingCal/B980A9D5DFD693618525860F005E465D?OpenDocument in the document entitled: *Compilation of Summary Slides on Draft Responses to Charge Questions. (PDF, 73 pp., 631,885 bytes)*

Dr. Benke presented the summary of deliberations on charge question 1.1. There was no additional comments or discussion.

Dr. Stram presented the summary slides of the deliberations for charge question 1.2. Regarding the question whether it is appropriate to recommend that Scenario B be used only for those situations where Scenario A is not feasible, 2 panel members stated that more leeway should be given in applying Scenario B when Scenario A is still feasible (so long as retrospective power analysis is done). They believed it is difficult to prove to the regulator that Scenario A is not feasible, and they objected the presumption that burden of proof shifts from user to regulator when Scenario B is utilized. Other panelists accepted that Scenario A should be the default, and Scenario B should only be used when DCGL is close to zero.

Several of the panelists engaged in further discussion of detailed statistical considerations. Agreement was reached that it is reasonable to recommend that Scenario A should be the default scenario except when the DCGL is close to zero. The suggestion among the committee, generally agreed to, is that in some situations, where the proposed residual radioactive material criterion is "close to zero", consideration of Scenario B may be driven by available field instrumentation and laboratory analyses to be performed. In other situations, consideration of Scenario B may be driven by the fact that the contaminant is also found in nature with high variability in the location to be surveyed. The panel requested that language indicating that Scenario B was not as desirable as Scenario A be dropped or modified.

Dr. Litman presented the summary slides for question 1.3 which had four parts.

Ms. Snead offered some clarification on her intentions regarding the charge question. She indicated that when she first put it together parts 1, 2, 3 and the first part of the 4th part were about measurement uncertainty and the rest was to look at the use of Minimum Quantifiable Concentration (MQC) and whether incorporating it to MARSSIM was needed or could the existing concept of MDC work sufficiently well.

Dr. Litman indicated that from his perspective MQC is not a parameter that has a lot of value, and he didn't believe it belonged in there. He invited others to comment. Other panelists spoke regarding the general point already made that the MDC is the preferred approach. Another panelist discussed the history, going back to the 1960's, and suggested that MQC may be fine too, depending on what is intended and MARSSIM has decided the MDC level is the approach.

Another panelist spoke from the perspective of a public health professional and put forward the opinion that detection in the field with follow up laboratory measurement approaches should aim to ensure well assured measurements are obtained. He went on to suggest using the MQC is way too high for this purpose.

The Committee went on to further discuss measurement uncertainty and the overall context for cumulative uncertainties. Ms. Snead indicated that further discussion in the MARSSIM interagency workgroup writing the manual will occur to clarify the approach and address the issues raised by the Committee.

Dr. Ulsh asked if there were any further comments or questions from Committee members. Nothing was heard. Dr. Ulsh then moved onto charge question 1.4.

Dr. Fordham presented the slides summarizing the committee position and response to question 1.4. Dr. Cullings offered the additional observation that applications with multiple radionuclides, as opposed to multiple elevated areas, suggests alternatives aimed at multiple areas and the inverse square rule may not be sufficient and suggested considering responses in that light. There were no further comments or questions on charge question 1.4.

Dr. Ulsh started the discussion of charge question 1.5. Dr. Yoder presented the summary slides and indicated the discussion in the draft document on DRPs was incomplete and very unique challenges and issues permeate throughout the steps for survey or site investigations. He indicated that more material would be beneficial and suggested that smaller sections may help in the presentations and that the information should be included in the manual no later than chapter 3 because having a known history of DRP will influence future surveys. .

Upon conclusion of the presentation of summary recommendations, Dr. Ulsh asked if there were any other comments or questions. Nothing was heard.

The meeting broke and reconvened at 2:00 pm EST. Dr. Ulsh asked for Dr. Inn to provide the summary response to question 2.1. Dr. Inn read from the summary slides posted to the meeting website. Dr. Ulsh asked if there were any further questions or comments on charge question 2.1 and nothing was heard. After the summary of charge question 2.1, Dr. Szabo indicated he had trouble coming off of mute and that he did have something to say on question 2.1. He added that more citations for radon equipment had been submitted and would be prudent to add and update in the MARSSIM manual. These updated and additional citations had been provided via email to Dr. Wong and the group agreed to consider adding them.

Dr. Smith provided the summary response to question 2.2 for the writing team. There was clarification that if the committee report indicates “one member” that should not immediately be construed to indicate dissent from the consensus. All may agree, however there may not have been discussion beyond the presentation or commenting of the “one member.” All generally agreed with this position for considering committee report text. No additional comments were made on question 2.2.

Dr. Ulsh initiated the summary discussion of charge question 2.3. Dr. Goldin provided the review of the summary slides, as presented. The only additional question was regarding consideration by the Committee members of additional examples. Dr. Goldin indicated their writing group did not come up with any others in this place. Dr. Ulsh asked if there were any further comments or questions and nothing was heard.

Dr. Ulsh moved the discussion to charge question 3.1. Dr. Cullings read the summary slides to the committee meeting. No further discussion or comments were heard upon conclusion of the summary.

Dr. Ulsh continued the discussion with charge question 3.2. Dr. Dauer presented the summary slides. Dr. Ulsh asked for comments or questions from the committee and nothing was heard.

Dr. Ulsh moved onto questions 3.3. Ms. Hamrick read the summary slides from the writing group based upon the deliberations. Dr. Ulsh asked if any further comments or questions and nothing was heard.

Dr. Ulsh continued the discussion and moved onto question 3.4. Dr. Quinn read the summary slide and indicated that the writing team generally agreed with suggested change by moving the derivation and that will help improve understandability of the section of the MARSSIM report being considered. He went further and noted some specific improvements and made suggestions regarding specific call outs to remind readers of the appendix material thus improved. No further comments or questions were heard from the committee regarding charge question 3.4.

Dr. Ulsh then asked the committee if there was anything else they had thought of to bring forward and mention or discuss. Dr. Yoder, in response, asked Ms. Snead if there was anything she would like to ask for clarification of the committee at this time.

Ms Snead indicated her gratitude for the deliberations and indicated that she viewed the discussion and recommendations to be clear, adequate, and really an excellent opportunity to listen and hear the full range of opinions and to witness the process of coming to agreement as to what to include in the Committee report. She indicated that she believes the recommendations will be reflected well in the report and looks forward to it.

In response to further inquiry by Dr. Ulsh, Dr. Inn brought up a question wondering if the Committee had considered how performance testing programs could help in the verification parts of what they have been concerned about. He provided an example regarding the performance of scan only instruments. He wondered if it might be a good idea to set up a test program to verify instruments and the working of the instruments on an ongoing basis?

Ms. Snead indicated that would fall upon the MARSSIM interagency workgroup to consider and it may be out of scope for this manual. She indicated it was worth considering.

The committee ended its deliberations and Dr. Wong presented the next steps for the committee.

Next Steps:

Dr. Wong indicated that the final product of the committee will be a report submitted to the chartered SAB for quality review. Upon conclusion of that review the chartered SAB will likely approve the report, perhaps with some modifications, and then submit the final product to the Administrator.

Dr. Wong provided some guidance on likely timeline from the conclusion of this virtual meeting to the submission of the final report by the SAB.

The first step indicated was to adjust the slides based upon today's deliberations, and they would be posted to the meeting website. She indicated that lead discussants make revisions, circulate to their writing teams, and then send the revised slides to Dr. Wong before Tuesday, January 19th.

Dr. Wong indicated individuals may revise their individual responses to charge questions if they choose to, and if so the revisions should be transmitted to Dr. Wong by February 1st. If a committee member wants to simply add more details, such as including more references for example, they may do so and that should also be provided by February 1st to Dr. Wong. Dr. Wong will compile the revisions and post to the meeting website.

Dr. Wong indicated that lead discussants are also the lead authors for the responses to the charge questions. She indicated a deadline of February 18th to complete the written responses to the questions, circulate amongst the writing team members and submit to Dr. Wong.

Dr Wong indicated that after she receives all of the written responses, she will assemble a first draft of the report. She will provide editing and formatting. She will provide an example for the writers to follow in a follow-up email.

She then indicated the report will be reviewed by the panel chair and when the chair and the DFO consider the report ready it will be posted to the website for public comment. The entire Committee will have an opportunity to review the entire report at this time and will be circulated to the entire Committee. The committee will review the entire report and will convene to deliberate on the final report. Dr. Wong will be contacting Committee members to determine availability and dates for a teleconference, preferably no later than June.

Dr. Wong indicated a goal of submitting to SAB for quality review and hopefully finalizing and sending to the Administrator by the end of September.

Dr. Wong went back and expanded that the follow- up teleconference is for the committee to deliberate on their report and reach concurrence. The report will likely be revised, and the Committee needs to reach concurrence on the revised report, which will be posted to the website for chartered SAB quality review.

She indicated that the quality review will probably be in July, to allow the chartered SAB to have a public meeting to conduct the review and take public comment. She indicated the quality review meeting is also a public meeting so Committee members can listen in and the chartered SAB will vote on their decision at the conclusion of the quality review. Dr. Wong indicated the best option to achieve as an outcome of the SAB review is minimum revision is needed, such that the report only has to be worked on by the panel chair and the chartered SAB chair.

She indicated that another outcome of the SAB vote may be, that if more extensive revisions are needed, she may invite some Committee members to address comments from the chartered SAB and revise the report. If this occurs the revised report will be reviewed by a select group of chartered SAB members and final approval by the SAB chair is needed before transmitting to the Administrator.

Another option the SAB has in voting is to reject the report and sent it back to the Committee for rework. However, Dr. Wong indicated that given the experts and committee efforts and quality, she is confident the report will achieve the best option.

Dr. Wong indicated, in response to Committee member question, that the drafts of sections of the report should be sent to Dr. Wong and Dr. Ulsh and in fact Dr. Wong should be copied in all correspondence amongst the writing teams. Individual revisions to individual comments need only go directly to Dr. Wong.

Dr. Wong committed to emailing the committee with the next steps and timing for those steps. She clarified that she will be providing the editorial oversight to ensure consistency where similar items are covered in several places.

Meeting adjourned

Dr. Wong adjourned the meeting at approximately 3:00 pm EST.

Respectfully Submitted and Certified as Accurate,

/s /	/s /
Diana Wong	Thomas Brennan
Designated Federal Officer	Director
	Science Advisory Board Staff Office

Date: April 7, 2021
Due to the 3/31/21 reset of the Science Advisory Board, these meeting minutes are certified as accurate by the SAB Staff Office Director who was present at the meeting.

NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by committee members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive consensus advice from the panel members. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.

REFERENCES

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Attachment A: Additional meeting participants in attendance or who requested the teleconference call-in number.

Name	Affiliation
Thomas Brennan	EPA
Khanna Johnston	EPA
Erik Abkemeier	DOD
Boby Abu-Eid	NRC
Amanda Anderson	DOE
Nidal Azzam	EPA
Cynthia Barr	NRC
Ramachandra Bhat	DOD
Stephanie Bush-Goddard	NRC
Julie Clements	DOD
Carlos Corredor	DOE
Gerald Falo	DOD
Derek Favret	DOE
Lino Fragoso	DOD
Mark Fuhrmann	NRC
Anthony Huffert	NRC
Eugene Jablonowski	EPA
Jennifer Mosser	EPA
Lyndsey Nguyen	EPA
Oleg Povetko	EPA
Wagnus Prioleau	EPA
Kathryn Snead	EPA
Lee Veal	EPA
Neil Keeney	DOD
Roger Fenner	TN Radiological Health
Kerstun Norman	NRC
Bryan Bloomer	EPA
Sue Shallal	EPA

Materials Cited:
The following meeting materials are available on the SAB website (http://www.epa.gov/sab) at the page for the January 11, 2021 meeting.

https://yosemite.epa.gov/sab/sabproduct.nsf/MeetingCal/B980A9D5DFD693618525860F005E465D?OpenDocument

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[i] Roster
[ii] Agenda
[iii] EPA Presentation - MARSSIM Revision 2 Introduction
[iv] Compilation of Preliminary Responses to Charge Questions
[v] Comments from Dr. Richard Smith on Charge Question 1.2 and 1.3
[vi] EPA Response to Dr. Yoder's question on MDC and Detection Limit
[vii] Compilation of Summary Slides on Draft Responses to Charge Questions