August 25, 2011

COMPENDIUM OF INDIVIDUAL COMMENTARIES BY THE SAB/RAC AUGMENTED FOR MARSISM CONSULTATION PERTAINING TO CONSIDERATIONS FOR MARSSIM REVISION 2

Developed following the teleconference consultation held on July 26 & 27, 2011.

Table of Contents

Dr. Susan M. Bailey …….2

Dr. Thomas B. Borak ……4

Dr. Gilles Y. Bussod …….7

Dr. Shih-Yew Chen …….. 13

Dr. Faith G. Davis …….17

Dr. June T. Fabryka-Martin ……..18

Dr. R. William Field …No Written Comments submitted……..

Dr. David G. Hoel …No Written Comments submitted…….

Dr. Janet A. Johnson ……..22

Dr. Bernd Kahn ……..28

Dr. Jonathan M. Links ……30

Dr. Paul J. Merges …….31

Dr. William F. Morgan …No Written Comments submitted……..

Mr. Bruce A. Napier ……..35

Dr. Dale L. Preston ……37

Dr. Daniel O. Stram ……...40

Dr. Chen Zhu …….43

Dr. Susan M. Bailey, Colorado State University, Fort Collins, CO:

RAC Consultation Letter for MARSSIM Revision 2. Susan Bailey (July 29, 2011)

Comments in response to the MARSSIM consultation of July 26 and 27, 2011 are provided below.

Charge Question 1: Applicability and appropriateness of the proposed changes.

1. *Updated treatment of measurement uncertainty:* Document needs to be in "user friendly" terms and approaches so that it is readily understandable and practical in the field. Incorporation of more detailed information (e.g., full uncertainty analysis for measurements, as in the calculation of Scan-MDCs) could be accomplished in an appendix format.

2. *Updated measurement methods:* Obvious that incorporating new technologies/approaches is necessary and desirable. An important aspect of this is to also incorporate the necessary training (and updates) required to successfully (and consistently) use the new technologies.

3. *Scenario B:* Agree that the current MARRSIM approach of describing both Scenario A and B but recommending use of Scenario A appears to be a safe (conservative) approach that does not need change. Again recognizing need to keep document as "user friendly" as possible is recommended.

4. *Increased emphasis on regulator interface during survey design:* Agree that discussion of current options for presenting the proposed cleanup plan to the regulator at appropriate points of interactions with request for guidance could be added if deemed necessary, but also that caution is called for.

5. *User comments (lessons learned):* Obviously should be done, again to make the document current, useful and "user friendly".

6. *Definition/terms consistent with related documents:* Obviously should be done to keep all three MAR-series documents consistent and to avoid confusion.

7. *Better discussion of "hotspots" and UMTRCA standards:* Agree that estimating external dose from 'hot spots' should be considered for updating MARSSIM.

Charge Question 2: Recommendations for additional changes or improvements.

There was excellent discussion and input regarding sub-surface contamination. I suggest both its consideration in MARSSIM, as well as clarification of its definition.

Charge Question 3: Relative priorities of the seven proposed changes.

Several of the seven changes seem obvious, straightforward matters of updating and consistency, and need to be addressed regardless. The required training to go along with updating and incorporating any new technologies should also be a priority.

Dr. Thomas B. Borak, Colorado State University, Fort Collins, CO:

Department of Environmental and Radiological Health Sciences

Colorado State University

Ft. Collins, CO

August 8, 2011

To: Jack Kooyoomjian

From: Thomas Borak

Subject: RAC MARSSIM Consultation

GENERAL COMMENTS:

While it is important to simplify operational guidance for persons on the ground, it is essential to include documentation that provides justification for a methodology as well as assumptions associated with the method that must be satisfied for the process to remain valid. Thus the format of a main operational section for MARSSIM together with detailed appendices should be preserved in any revision process.

Although the emphasis of the document is supposed to be derived from scientific principles, there are other issues (e.g., K. Snead; Bullet 4) that are more or less procedural rather than scientifically based. This does not diminish the importance of these issues. The Multiagency Task Force should decide if these items should embedded in the scientific sections (i.e., by incorporating them into flow charts), or perhaps placed in a Preface that includes guidance and suggestions for implementing these types of concerns.

MEASUREMENT UNCERTAINTY

Ultimately MARSSIM must be up-to-date in uncertainty analysis. This does not mean that every statistical approach has to be incorporated. However it is necessary to perform an evaluation of the new approaches, and determine which ones can provide improvements in satisfying the objectives without introducing measurement constraints or analyses that are difficult or impossible to implement in field applications.

MEASUREMENT METHODS

Ultimately MARSSIM must be up-to-date in detection and data acquisition capabilities. Many basic detection instruments have not overcome radiometric limitations but, microprocessor based signal processing, prompt storage and telemetry provide advances that can open the door to statistical approaches that may not have been within reach when MARSSIM was first published.

SCENARIO B

On strictly numerical principles, there are situations where Scenario A provides an advantage with respect to Type 1 errors and statistical power, and other situations where Scenario B provides an advantage. Most likely, the majority of the cases could be satisfied with either A or B. The emphases for, A, seems to be grounded in a regulatory preference for defining Type 2 errors as well as concerns that a "lazy sampling approach" could lead to false adoption of the null hypothesis. Descriptions of the two scenarios in Appendix "D" make no mention of this.

The solution could be to create scientifically based sample size restrictions to avoid the lazy syndrome whenever Scenario B is used, or restrict the use of Scenario B to only specialized situations where there is a clear advantage and discourage the use of Scenario B in all other situations. This is more or less a policy based recommendation.

LESSONS LEARNED

Perhaps these do not need to be listed as such. Some could be incorporated into flow charts or adjustments to the statistical processes for sampling and analysis. Those that are behavioral, such as experience with operator fatigue or policies backing up data, or training procedures etc., might have to be included in a preface mentioned above. One emphasis here should seek to identify situations where the objectives of MARSSIM were not successfully achieved either because of lack of understanding or inability to complete the required tasks.

DEFINITIONS

It is certainly desirable to have terms and definitions consistent throughout all Multiagency documents. Whereas this appears as "low hanging fruit", this exercise is more than cut and paste. Each document has a set of terms and definitions that are consistent with specific objectives and recommended methodologies. Simply transferring a term or definition from one document to another might create subtle changes with inadvertent consequences. The process should proceed with caution to avoid these pitfalls.

HOT SPOTS/NEAR SURFACE

It seems unlikely that any substantive revision to MARRSIM can avoid these issues. The complications could lead to an enormous explosion in the complexity of MARSSIM. Perhaps a solution is to select a few cases where the risks of releasing a contaminated entity are larger than other cases and develop sampling methodologies for these as a first approach.

Other Issues

TRAINING

Successful implementation of MARSSIM depends on the capabilities of managers and technicians who are given the responsibility of performing the specified tasks. The revised document

should clearly describe the general qualifications for personnel using the manual and provide guidance on how to locate and register for organized training sessions.

Priorities

I believe that this depends on whether the emphasis is on a thorough revision of the document or a collection of simple updates that could be published as an Addendum. It is pretty obvious which of the tasks could be completed in a short period of time with relatively little effort.

MARSSIM is a very important document with a legacy for providing guidance that cannot be obtained elsewhere in a single reference. My sentiment is that it is time to make a wholesale revision by addressing the scientific and operational issues that will serve the community of users for the next several decades. Making simple patches here and there will not be, for the long term, in best interests of the agencies or institutions that need to complete decommissioning or clean-up.

Dr. Gilles Y. Bussod, New England Research, Inc., White River Junction, VT:

NEW ENGLAND RESEARCH, INC.

August 19, 2011

Dr. K. Jack Kooyoomjian, Ph.D.
Designated Federal Officer
Radiation Advisory Committee
U.S. EPA Science Advisory Board (SAB)
Office of the EPA Administrator (1400R)
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Washington, DC 20460-0001

RE: Augmented SAB/RAC Consultation Comments on Proposed Updates and Changes to the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

Dear Jack,

Enclosed are some thoughts in response to the Memorandum of July 22, 2011 by Michael P. Flynn, Director, Office of Radiation and Indoor Air, requesting comments from the augmented Radiation Advisory Committee on proposed changes to the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

Specifically the EPA has requested that the RAC provide comments on the following Charge Questions:

(1) The MARSSIM Workgroup has proposed a number of significant changes to MARSSIM, which if implemented, will result in Revision 2 of the document.
- Please comment on the applicability and appropriateness of the proposed changes.

(2) Do you have any recommendations for additional changes or improvements?
- Please comment on why you believe that these additional changes are warranted.

(3) The list of changes proposed by the MARSSIM Workgroup represents the Workgroup's best judgment as to the highest priority changes, given limited resources for implementation.
- Please comment on the relative priorities of the seven proposed changes versus other identified or recommended changes.

The opinions expressed herein are the result of discussions that took place during the SAB Consultation Conference Call of July 26-27, 2011, and the review of the MARSSIM document and supplementary materials presented by members of the MARSSIM Workgroup as well as public comments transmitted to the RAC by the DFO.

CHARGE QUESTION 1. Applicability and Appropriateness of the Proposed Changes to MARSSIM.

In terms of the first issue, the MARSSIM approach of applying a sound statistical methodology to the assessment and remediation of potential radioactive-contaminated sites, is of great importance and value. The proposed revision of the MARSSIM document is both appropriate and timely, given its acceptance and use by many stakeholders and Agencies. The specific changes proposed by the MARSSIM Workgroup, are all valid and based on sound judgment though the importance and prioritization of each of the seven (7) proposed changes is questionable and seemingly influenced by "…limited resources for implementation."

Given the information provided, and the scientific and technical nature of this Consultation, the "limited resources" of the EPA and the other government agencies involved cannot be properly addressed. The recommendations and prioritization of potential changes to MARSSIM presented in this letter are therefore based on the perceived need(s) of the public and site managers, the relative importance of the proposed changes as they relate to these needs, and the perceived demands that these potential changes place on the limited resources of the end users.

The seven changes proposed and associated comments are included under the following topics:

1. An updated and expanded discussion of uncertainty and introduction of the latest scientific methodology to treatment of measurement uncertainty.

   Given the relative sophistication and success of the present MARSSIM approach, changes should only be implemented to the extent that they significantly improve the end users ability to evaluate a site and improve compliance. This requires that a revision to the statistical techniques currently used be "user friendly" and not represent an extra burden (time and costs) to the end user. Introducing additional statistical techniques should therefore be presented as providing additional flexibility in the use of MARSSIM with recommendations for addressing specific questions or adapting to different scenarios and settings.

2. Introduction and discussion of "new measurement methodologies". The goal is to update MARSSIM with procedures derived from the use of new technologies introduced since 1995 and Revision 1 of MARSSIM (2000). This includes additional survey methods and the use of "scan-only surveys" for specific cases, as used in MARSAME.

   The introduction of new measurement methodologies is highly desirable but should not be restricted to analytical procedures and scans. It should also include improvements in GPS-integrated hydrogeophysical and tomographic ER and EM methods, as well as the use of Ground Penetrating Radar (GPR) in assessing the extent of surface contamination and the presence of buried contaminated pipes, canisters and drums. More importantly near-surface samples and associated measurement methodologies should also be included in this discussion as most direct measurement techniques and scanning are potentially applicable to auger holes and pits associated with the sampling of the 'near-surface' and the assessment of homogeneity of the contaminant with depth. These steps that should greatly affect uncertainty determinations (see discussion below).

3. Recommendation of the use of an "alternate null hypothesis" (Scenario B) for Class 3 sites .

In circumstances where site-specific conditions (e.g., high variability in background, lack of appropriate detection techniques and sensitivity) may preclude the use of the null hypothesis, the issue of -"how to design a statistically rigorous test to defend against *false positives*?" - needs to be addressed.

Scenario A presently recommended in MARSSIM, assumes the survey unit is contaminated, whereas *Scenario B* proposes that a site activity is acceptable if indistinguishable from background and "safe" until proven otherwise. Recommending the use of the "null hypothesis" (*Scenario A*) is the most conservative and rigorous approach of the two and offers a greater margin of safety. Nevertheless in the case of some Class 3 sites, the use of an alternate null hypothesis (*Scenario B*) could be justified provided that its choice is based on a strong quantitative assessment of the data (extensive survey area and laboratory measurements of near surface core samples), and that the statistical treatment remains rigorous.

4. Regulator interaction with operator and/or managing organization of a site.

   This proposed change could facilitate transparency and the efficient implementation of MARSSIM. Conversely the implementation might be difficult and uneven and the risks to public safety are real if the interaction undermines regulatory compliance by diluting MARSSIM safeguards. MARSSIM protocols should be set and adhered to if this change is implemented, and the outcome should be evaluated quantitatively using the Website feedback from all parties, including the EPA.

5. Updating MARSSIM Website .

   This is a very favorable development since it allows for enhanced public access to EPA communications and training and provides a venue for public feedback, advice and comment.

6. Normalization of the terminology and nomenclature used in MARSSIM and MARSAME.

   Important and necessary.

7. Expanded discussion on areas of elevated measurements or "hotspots" and clean-up methodology.

   This is also of great interest particularly in the context of the Uranium Mill Tailings Radiation Control Act (UMTRCA) standards.

CHARGE QUESTION 2. Recommended Additional Change(s).

Do you have any recommendations for additional changes or improvements?

- Please comment on why you believe that these additional changes are warranted.

One of the most important and high priority changes that MARSSIM could implement and that would improve the document and provide the end user with better guidance and more flexibility, involves revisiting/improving the definition of "surface" as applied to contaminated soils, and provide strong guidance in the use of "near surface" soil samples in the Survey Plans.

In fact, throughout the MARSSIM document there appear to be conflicting statements on its use and recommendations with respect to the characterization of contaminated soils and the implementation of site surveys. Specifically, in Chapter 1 it is stated that " MARSSIM is a method for planning, implementing, assessing and making decisions about regulatory compliance at sites with radioactive

contaminants in surface soil and on building surfaces, but … does not apply to other contaminated media (e.g., sub-surface soil, building materials, groundwater) …"

The reasons given in MARSSIM for limiting the scope of the survey guidance to "contaminated surface soils and building surfaces" appear somewhat arbitrary, self-imposed and presently out-of-date, and can be easily discounted. Quoting from pages 1-3 and 1-4, these reasons include:

> *" (1) contamination is limited to these media for many sites following remediation, (2) since many sites have surface soil and building surface contamination as the leading source of contamination, existing computer models used for calculating the concentrations based on dose or risk generally consider only surface soils or building surfaces as a source term, and (3) MARSSIM was written in support of cleanup rulemaking efforts for which supporting data are mostly limited to contaminated surface soil and building surfaces."*

In addition "surface soils" are not clearly defined in MARSSIM and restricted mostly to the degree of scan penetration or to the top two (2) centimeters of the surface. This is physically unrealistic and not very defensible given that scanning is only one of many surveying techniques and MARSSIM also prescribes the use of soil samples and laboratory testing:

> *"MARSSIM recommends that soil cores be collected to determine the actual depth profile for the site. These soil cores may be collected during the characterization or remedial action support survey to establish a depth profile for planning a final status survey"(Section 6.4.1 Direct Measurements, p6-12).*

Geologically speaking, soils extend at least 5 to 8 inches (13 to 20 centimeters) below the surface [McGraw-Hill Dictionary of Scientific & Technical Terms, 6E, Copyright © 2003 by The McGraw-Hill Companies, Inc.] and the U.S. Department of Agriculture (USDA) defines the *Topsoil* or "A Horizon" as the upper, outermost layer of soil, usually the top 2 inches (5.1 cm) to 8 inches (20 cm) where the highest concentration of organic matter and microorganisms are found and where most of the Earth's biological soil activity occurs (U.S. Department of Agriculture (USDA), Soil Survey Division Staff (1993). "Soil Survey Manual." USDA Handbook 18. Chapter3).

In the context of survey soil sampling and the rigorous assessment of contaminant distribution and homogeneity within soils, site surveys commonly include sampling instruments such as shovels, augers and soil samplers that commonly sample the soil down to 18-30" (Slit-Spoon Sampler), or Shelby Tube (36-54" long). In cases where radioactive canisters, drums and buried equipment or pipes are involved, and may be a possible source of contamination themselves, backhoes, pits and trenches are also commonly used.

It follows that MARSSIM needs to adjust its definition and practices related to "surface soil" surveys to reflect the reality in the field and the scientific definition of soil strata. Given the presence of root systems and associated biota in soil Horizon A, it is difficult to imagine that the characterization of a spill for example does not involve the full examination of the root zone, where bio activity can redistribute contaminated surface soils at depth (i.e., bioturbation).

Furthermore it is quite easy to distinguish the characterization of the "near surface" soil layers from that of the "subsurface" where characterization and remediation studies involve many more resources to describe the vadose- and saturated-zones as well as perched and ground water systems.

This redefinition of surface soils is in keeping with the MARSSIM requirements for Class 1 Areas that have the greatest potential for contamination and therefore receive the highest degree of survey effort for the final status survey, including "site areas previously subjected to remedial actions, locations where leaks or spills are known to have occurred, former burial or disposal sites, waste storage sites and areas with contaminants in discrete solid pieces of material and high specific activity."(Chapter 2, p. 2-5)

It is understood that the incorporation of "near surface" samples into the statistical protocols recommended by MARSSIM require revisiting the models and methods used in MARSSIM. In fact nearly all techniques of direct measurement and scanning are potentially applicable to auger holes, pits or trenches and the knowledge of the contaminant distribution at depth (within the zone accessible by sampling) should greatly reduce the assumptions and uncertainty in the contaminant distribution profile and the fluence-to concentration correction (Chapter 6, Section 6.4.1: Direct Measurements):

> "*MARSSIM recommends that soil cores be collected to determine the actual depth profile for the site. These soil cores may be collected during the characterization or remedial action support survey to establish a depth profile for planning a final status survey. The cores may also be collected during the final status survey to verify the assumptions used to develop the fluence-to concentration correction. Outdoor Contaminants are commonly distributed within the surface soils."*

It is recommended that the guidance from MARSSIM refer at a minimum to the definition of *Surface* vs. *Subsurface* soils from the USEPA, Attachment B: *Soil Screening DQOs for Surface Soils and Subsurface Soils*:

(1) <u>Soil Screening DQOs for Surface Soils Using the MAX test:</u>

-Define the Study Boundaries

- Define population of interest: Surface soils (usually the top 2 centimeters, but may be deeper where activities could redistribute subsurface soils to the surface)

- Divide site into strata- Strata may be defined so that contaminant concentrations are likely to be relatively homogeneous within each stratum based on the CSM (Conceptual Site Model) and field measurements.

(2) <u>Soil screening DQOs for Subsurface Soils</u>:

-Specify the Study Boundaries

- Define population of interest: Subsurface soils

- Define scale of decision making: Sources (areas of contiguous soil contamination, defined by the area and depth of contamination or to the water table, whichever is more shallow).

- Subdivide site into decision units: Individual sources delineated (area and depth) using existing information or field measurements (several nearby sources may be combined into a single source).

In the context of the recommendations above, Sections 6.6.1 (Surface Activity) and 6.7.2 (Scanning Sensitivity) should be modified to include the use of soils samples, pits or holes, to characterize near surface strata and corresponding activity profiles, depth of contamination and radionuclide distribution. One might also modify the definition of *Physical Probe Area* to include a *Physical Probe Volume* term or an equivalent *Effective Probe Area* (also covered under Section 6.6.2 (Soil Radionuclide Concentration and Exposure Rates). One could also introduce another "stage of scanning" in addition to the discussion in Section 6.7.2 (Scanning Sensitivity), whereby the surface could be overturned with a shovel and scanned to see if the signal detection increases , decreases or remains unchanged with depth.

CHARGE QUESTION 3. Relative Priorities of the Proposed Changes.

Suggestions for the prioritization of changes to the MARSSIM document are in order of importance:

1. Introducing the definition of "surface" to include at a minimum "Horizon A" or top soil, defined locally as the root zone and or the depth of core sampling using auger techniques, pits or boreholes applied to contaminated soils. Provide strong guidance in the use of "near surface" soil samples in the Survey Plans and modify statistical treatment of data to include soil core samples and soil profile scans from field or laboratory measurements (New Topic).

2. Introduction of new measurement technologies, including sampling techniques for near surface samples (expanded Topic 2).

3. Updated and expanded discussion of uncertainty with emphasis on the inclusion of field core samples. I am not in favor of "scan-only surveys" outside of Class 3 Areas and specific cases (Modified Topic 1).

4. Expanded discussion on "hotspot" areas, UMTRCA and clean-up methodology (Topic 7).

5. Update of MARSSIM Website, public interface and training (Topic 5).

6. Normalization of terminology (Topic 6).

7. Scoping vs. Characterization Surveys (Topic 8).

8. Guidance on Hard-to-Scan Radionuclides (Topic 9).

In closing and regardless of the final prioritization accepted by the Workgroup, it is important to commend all involved in the effort to improve MARSSIM, and acknowledge the success of this multiagency approach. Thank you for the opportunity to contribute to this process.

Sincerely,

Gilles Y. Bussod
Principal Scientist
New England Research, Inc.

Dr. Shih-Yew Chen, Argonne National laboratory, Argonne, IL:

RAC Consultation Letter for MARSSIM Revision 2. S.Y. Chen response (August 16, 2011)

My responses arising from the MARSSIM consultation are given below.

Charge Question 1: Comment on the proposed changes

Topic 1: Updated Treatment of Measurement Uncertainty.

I agree with many that this is an important change, similar to what was recommended by the Health Physics Society.

Topic 2: Updated Measurement Methods.

I believe introducing scan-only surveys as a general approach is suitable only if the technology can provide necessary assurance for accuracy. The method could provide a timely survey of the contaminated areas. The scan-only technique has been proven to be appropriate for equipment survey in accord with MARSAME and may be expanded for cleanup purposes. The method may also consider integration of GPS information into automated area scanning.

Topic 3: Scenario B ("assumed to pass until proven otherwise")

I agree that both scenarios A & B need to be developed; this is particularly true when cleanup levels are to be close to background (there are cases when a cleanup is compelled by some regulators to be at the "background " levels).

Topic 4: Increased emphasis on regulator interface during design survey.

Since MARSSIM is a technical document, not sure how this can be factored into the consideration in the next revision, as no one can require users to compel such integration. My suggestion instead, is to develop a protocol (with a checklist) that is intended to answer the "certification" of using the MARSSIM approach. This means that the users can provide such a basis document when submitting to regulators for approval of the final status survey during the process.

Topic 5: User comment ("lessons learned"

The Work Group should modify the MARSSIM and maintain an effective website to allow convenient posting and accessing such advice, and enabling an online feedback /response system with the users.

Topic 6: Definitions/terms consistent with related document

It is a given that terminology and definitions should be made consistent throughout MARSSIM and its related documents. The Work Group should take steps to ensure such consistency.

Topic 7: Better discussion of "hotspots" and UMTRCA standards.

This area should be improved, with justification from running dose modeling such as the RESRAD code.

Charge Question 2: Recommendation for additional changes

1. **Reconsider the discarded ideas.** Each of the additional 12 items considered by the MARSSIM work Group should be retained for further consideration and justification. The issue on subsurface surveillance has been of keen interest to many, although it was realized that inclusion in current version may not be attainable. The related subject is on the definition of "subsurface" versus "surface". This subject should be further deliberated and justified if discarded from consideration.

2. **Develop a "roadmap" for graded approach.** Since the MARSSIM document offers a "graded approach" to surveillance, it thus begs to contain a user-friendly "roadmap" intended to guide the users.

3. **Use of Compositing Techniques for Soil Sampling.** MARSSIM is silent regarding the use of soil sample compositing techniques and their potential application for Final Status Survey purposes. Soil sample compositing techniques, if implemented correctly, have the potential for significantly improving the estimates of average concentrations for survey units ($DCGL_w$ compliance) and improving the detection of the presence of hot spots when for radionuclides that cannot be detected via traditional scans ($DCGL_{emc}$ compliance). The Revision 2 of MARSSIM should provide guidance on how these techniques might be used to support MARSSIM-based sampling and analysis plans.

4. **Intersection Between MARSSIM-Recommended Dose-Based DCGL Values and State or Federal Promulgated Values.** One of the significant sources of confusion observed in implementing MARSSIM occurs for sites where a review of Applicable or Relevant and Appropriate Requirements (ARARs) identifies promulgated standards for specific radionuclides that are not directly dose-based. The Revision 2 of MARSSIM would benefit from a discussion of these settings with suggestions for how best to integrate ARARs within a MARSSIM closure framework.

5. **Dose- versus Risk-Based Cleanup Standards.** Any site involving EPA oversight (particularly CERCLA-based closures) will typically involve cleanup standards that are risk-based, not dose-based. One of the points of conflict in an EPA risk-based cleanup environment is the lack of an "elevated measurement criteria" (EMC) concept. In fact, many risk assessors within EPA would take the position that an EMC concept has no place in a risk-based cleanup since exposure, by definition, occurs as an average over an exposure unit. In addition, CERCLA guidance includes the notion of an acceptable risk-based range of cleanup levels, rather than one set of DCGL values as described by MARSSIM. The Revision 2 of MARSSIM would benefit from a more detailed discussion of how MARSSIM should be implemented in a risk-based environment, and the role an EMC concept plays in that circumstance.

6. **The Definition of Surface Soils.** MARSSIM restricts its scope to surface soils, but does not define what surface soils are. In our experience, surface soils at individual sites have been defined as everything from the top 15 cm of soil to the top 1 m or more. The definition of surface soils is non-trivial and has significant dose modeling implications, particularly for sites with multiple radionuclides present, some of which might pose a direct exposure concern while others primarily ingestion concerns. The Revision 2 of MARSSIM would benefit from a discussion of surface soils definitions and the ramifications for dose modeling/FSS design.

7. **Derivation of Minimum Soil Sample Requirements Based on the Ability to Scan for $DCGL_{emc}$ Concerns.** MARSSIM provides a methodology for determining systematic sampling density requirements based on scan sensitivities, balancing the needs for $DCGL_w$ compliance demonstration with the need for $DCGL_{emc}$ identification. Unfortunately, this methodology fails to address settings/radionuclides such as Sr-90 and Tc-99 where there is currently no viable scanning option for soils. In this setting, the concept of a $DCGL_{emc}$ standard becomes problematic from a survey design perspective. The Revision 2 of MARSSIM would benefit from additional discussion providing guidance on how to address this situation.

8. **When is a FSS Process "MARSSIM Based"?** In our experience we have encountered a significant number of FSS plans described as consistent with MARSSIM developed by reputable consulting companies that showed a lack of understanding of basic MARSSIM concepts. It would be very useful if the Revision 2 of MARSSIM provided a checklist of key components characteristic of a MARSSIM-based plan (i.e., site-specific DCGLs, use of survey units definitions consistent with MARSSIM, use of WRS or Sign test for $DCGL_w$ compliance, etc.) that the developers of a MARSSIM FSS plan could use as an indication of how consistent their plan was with overall MARSSIM guidance, recognizing that site-specific needs at times might require deviation from one or more of the key MARSSIM components.

9. **Addressing Soil Piles.** Soil piles are a ubiquitous reality at sites undergoing closure. The Revision 2 of MARSSIM would benefit from a discussion of the options available for demonstrating that soil piles meet FSS requirements, freeing them for potential use as backfill material at sites.

10. **$DCGLM_{emc}$ Presence in Class 2 and 3 Areas.** MARSSIM currently limits the need to address $DCGL_{emc}$ concerns to Class 1 survey areas. While conceptually this makes sense, practically reality is different. In our experience across a broad range of sites, $DCGL_{emc}$ concerns are much more likely to be encountered in Class 2 and Class 3 areas during the FSS process. There are two simple reasons for this – remediation in Class 1 units often continues until the remaining exposed surface is near background levels, eliminating any "hot spots" that might have been there, and Class 2 and 3 area definitions are often based on limited characterization data that failed to identify very localized contamination present, subsequently discovered during FSS surveys. The recommendation is that Revision 2 of MARSSIM take these two realities into account.

11. **Guidance Re Characterization Surveys, and the Connection Between Life Cycle Planning and the FSS Process.** While MARSSIM in some sense covers the life cycle of data collection work at sites undergoing closure, in reality it provides extremely little detail about data collection activities leading up to the FSS process. This is unfortunate, because there really is (or at least should be) a very tight linkage between data collection that occurs prior to the FSS, and the FSS process itself. The Revision 2 of MARSSIM would benefit from a much more detailed discussion of life cycle data collection issues that includes supporting final status survey unit definitions, identifying (or eliminating) radionuclides of interest, re-using characterization data for FSS purposes, and sequencing activities at sites undergoing restoration.

12. **LBGR Definition and Description.** There is a fundamental technical issue with the way MARSSIM describes and handles the concept of the Lower Bound of the Grey Region. MARSSIM's approach is very much grounded in statistical theory and consequently neglects that fact that the LBGR actually is physically grounded in the average activity concentration present when an FSS data collection process begins. The unfortunate consequence of this is that consultants preparing FSS plans often treat the LBGR as a statistical parameter that can be adjusted to obtain desired sample numbers, rather than as a physical reality that should be estimated based on available data. The Revision 2 of MARSSIM would benefit from a reworking of its discussion of the LBGR that includes its relationship to the actual physical realities of survey units.

13. **Background Comparisons for No Impact Conclusions.** MARSSIM currently provides no well-described pathway for collecting data from a site to demonstrate no measurable impacts without first developing DCGL values. This is unfortunate and limits the application of MARSSIM when attempting to clear sites of contamination where some data is required to demonstrate no measurable environmental impacts.

14. **Technical Measurement Feasibility.** In its current form, MARSSIM provides no mechanism for checking that DCGL values are in fact technically measurable at reasonable cost. The Revision 2 of MARSSIM should include a discussion of the practical measurement/analytical considerations that accompany the implementation of DCGL values at sites, and provide guidance on appropriate actions when DCGL values are below practically measurable values.

<u>Charge Question 3:</u> Provide relative priority of the recommended changes

My suggestions for high-priority items to be considered in the MARSSIM revision on the basis of their importance to users, and the suggested ranking are accordingly:

#6, #1, #2, #5, #7, #3, and #2. Others listed in my response to Charge Question 2 above also warrant consideration.

Dr. Faith G. Davis, University of Illinois at Chicago, Chicago, IL:

MARSSIM Consultation Comments by Dr. Faith Davis (August 4, 2011)

Charge 1: Applicability and appropriateness of proposed changes

1. Updated treatment of measurement uncertainty: It seems to me that requiring incorporation of full uncertainty analysis for measurements in the field should only be done if there are clear goals to be achieved. It should probably not be done if the only goal is to bring the calculations in line with what is being done in more academic settings as in the field settings this effort may add quite a burden to the overall work being accomplished.
2. No comment
3. No comment
4. This seems practical in this setting
5. No comment
6. Consistency is always good
7. No comment

Charge 2: Recommendations for additional changes

No comments

Charge 3: Priorities of proposed changes

No comment

<u>Dr. June T. Fabryka-Martin, Los Alamos National Laboratory, Los Alamos, NM</u>:

Comments from June Fabryka-Martin (August 23, 2011)

Charge Question #1:

The MARSSIM Workgroup has proposed a number of significant changes to MARSSIM, which if implemented, will result in Revision 2 of the document. Please comment on the applicability and appropriateness of the proposed changes.

a) Item 3, Scenario B. I agree an updated treatment of this aspect is needed and appropriate. However, it may be worthwhile to point out explicitly some of the potential pitfalls of applying Scenario B. Consider recommending that use of Scenario B is applicable only to a limited number of conditions, e.g., Class 3 sites. Emphasize that one of the disadvantages of the Scenario B option is that the user may be "rewarded" for doing a sloppy job in conducting survey.

b) Item 4, Regulatory involvement.

    a. Consider encouraging regulators to include in permits, licenses, or other regulatory documents, those decision points at which their involvement or concurrence must be included, and provide some draft language for this purpose (e.g., akin to the Model Statement of Work in MARLAP).

    b. In MARSSIM (or in an associated MARSSIM training manual), consider including draft meeting agenda that spell out discussion items with the regulator at each stage of the survey, e.g.:

        i. Initial survey area classifications and reclassifications
        ii. Calculation of scan MDCs for various instruments
        iii. Calibration procedures
        iv. Technical justification for new survey approaches and instrumentation
        v. Implementation of DQO process
        vi. Degree of conservatism built into decision parameters
        vii. Risk-based decisions, priorities
        viii. Treatment of hot spots, e.g., best estimate of receptor dose
        ix. In-process inspections by regulator

c) I suggest including a reference or summary of the NRC Standard Review Plan (SRP) for Final Site Surveys (FSS).

d) Item 7, UMTRCA. During our telecon, Alexander Williams (DOE) raised a point that seems appropriate to address in an update to MARSSIM. Here is my understanding of his comment: UMTRCA standards are concentration-based and focus on the risk of radon in structures. Applicable standards in 40 CFR 192 are 5 pCi/g for a surface and 15 pCi/g below the surface (to depth of 15 cm). These standards legally apply only to abandoned mine tailings (Type I) and NRC-licensed sites (Type II). UMTRCA standards use an averaging area of 100 m^2 but MARSSIM guidance applies to much larger areas. Bottom line: MARSSIM should clarify how UMTRCA regulatory requirements can be met following MARSSIM guidance.

e) Item 7, hotspots. I support the concept of considering decisions that are based on the best estimate of receptor dose at hotspot(s). Note the importance of obtaining regulator buy-in for this approach early in the process (overlaps with item 4, regulatory involvement).

f) Item 9, Hard-to-scan radionuclides. Is this aspect already addressed to some extent in MARSAME in its discussion of volumetric contamination and difficult-to-measure areas?

Charge Question #2:

Do you have any recommendations for additional changes or improvements? Please comment on why you believe that these additional changes are warranted.

a) It might be useful to point the user to software codes that are available for some of the steps in planning a survey and interpreting the results, such as:

   - RESRAD-BUILD to obtain DCGL and area factors

   - Visual Sample Plan (VSP)

b) Consider expanding appendix A in MARSSIM to list references for case studies that provide real-world examples of applications of MARSSIM guidance, along with an abstract for each study that summarizes the problem being addressed and the aspects of MARSSIM that were applied in that case study. (Ask each federal and state agency in the MARSSIM Workgroup to submit 2-3 references for this purpose so as to obtain a wide spectrum of examples.)

c) Seek ways to minimize the need for continuous updates to each of the MAR documents. Attempting to catch up and ensure consistency in the guidance provided in all of the MAR documents is a daunting task. One way to minimize conflicting guidance would be to minimize overlap in the scopes of the guidance documents. For example, consider creating a new MAR document (MARSTAT?) to discuss common statistical approaches and detailed treatments. One of the tasks of such a document would be to reference, contrast, and reconcile statistical requirements & guidance from different federal agencies.

d) Appendices currently comprise half of the MARSSIM document. Because equipment and instrumentation are always evolving, consider simplifying Appendix H (equipment and instrumentation) to more generic descriptions, reducing its level of detail in this appendix to that used in MARSSAME, or making this appendix a separate standalone reference document.

e) In the MARSSIM roadmap, consider adding an additional step that provides for independent verification (performed by regulators):

   - Objectives of independent verification: (a) provide independent evaluation of final site conditions and validation of final survey procedures, results and documentation, (b) increase the probability of complete site remediation and documentation; and (c) enhance public credibility by providing a second look at the D&D process.

   - Implementation of independent verification (graded approach): May involve document reviews (at a minimum), confirmatory analyses of samples, independent verification of field surveys, or in-process inspections of MARSSIM final status surveys

   - Note advantages and disadvantages of “back-end” verification versus in-process verification.

f) From my admittedly biased perspective as a hydrogeologist, guidance for designing and conducting surveys and site investigations of the deep subsurface constitutes the most significant challenge and opportunity for the MARSSIM Workgroup to improve our (society's) management of radiological risks to the environment and human health. The development of multiagency guidance for deep subsurface media would be timely as well as appropriate. Groundwater monitoring for impacts from in-situ leaching (ISL) uranium operations would appear to be a good initial target topic because of its fast-growing importance, potential for irreversible degradation of an invaluable resource, and the regulatory roles involving several federal agencies that participate in the MARSSIM Workgroup (EPA, NRC, DOE, NRC, DoD).

g) In the near term, consider expanding the scope of MARSSIM to provide some guidance for the surveying and characterizing the deep subsurface. For example, using the roadmap and other process flowcharts in MARSSIM to organize the discussion, identify which aspects of MARSSIM are relevant to the deep subsurface and which ones are not, and why. Point the user to appropriate available guidance. Note, for example, problems with the assumption of homogeneity, complications of transport pathways (e.g., the significance of subsurface transport paths and rates may influenced strongly by temporally and spatially variable water levels). Risk-assessment models for deep subsurface environments are very different from those for near-surface, as are the appropriate types of input data and model parameters.

h) I noticed that item 2 (equipment & measurement methods updates for Chapter 6, 7, and Appendix H) on the Workgroup's list of possible updates did not make the Workgroup's cut. Consider cutting this appendix from MARSSIM, and creating a new MAR document, or.

i) MARSSIM training. Facilitate aggressive reaching out, esp to federal and state regulatory agencies. Include training in Power Point as MARSSIM appendix or separate Study Guide. Develop Web-based training or virtual live training sessions that allow offsite attendees. Support training sessions in which attendees bring laptop

j) MARSSIM Table 1.1. Provide more recognition of conditions for which MARSSIM is guidance may be inappropriate (or not applicable) and reasons why (e.g., the guidance may not be appropriate for deep subsurface investigations because the guidance focuses on 2-D surveys using scanning instrumentation). Provide references to where appropriate guidance can be found (e.g., EPA Unified Guidance for RCRA sites).

k) Consider providing a brief overview section that identifies significant updates in cited references and that summarizes any important changes to regulations or guidance since the previous edition of MARSSIM.

Charge Question #3:

The list of changes proposed by the MARSSIM Workgroup represents the Workgroup's best judgment as to the highest priority changes, given limited resources for implementation. Please comment on the relative priorities of the seven proposed changes versus other identified or recommended changes.

Quantitative and qualitative criteria for the MARSSIM Workgroup to consider as it prioritizes its list of proposed updates:

- Level of effort required to prepare initial draft; schedule (timeliness is important)
- Difficulty of getting timely buy-in from all Workgroup agencies
- Implications if update is not done

- Potential that update may discourage users, e.g., daunted by more complex statistical approaches that is technically more correct but beyond level of understanding of user; backfire
- Number of users requesting update (note that HPS represents large constituency)
- Number of users (or types of site investigations) likely to be affected/benefited by update
- Types of users affected/benefited by update (field personnel, regulators, public)
- Extent to which update has potential to reduce risk of making wrong decision
- Extent to which update has potential to reduce cost of implementation
- Reduction in misuse of MARSSIM guidance and approaches
- Streamlining MARSSIM guidance, don't keep adding on in lieu of restructuring
- Reputation of MARSSIM as providing reliable, complete, user-friendly, and relevant guidance
- Potential to limit the need to continually update MARSSIM. Focus on timeless guidance not subject to changes in regulations.
- Can update be documented via an alternative to a full-blown Revision 2 (e.g., via an errata sheet or supplement)?

Consider mentioning in the revised MARSSIM those updates which were not addressed and were either dismissed or left as open issues.

Dr. Janet A. Johnson, Tetra Tech, Carbondale, CO:

MARSSIM Rev 2 Consultation Matrix – Jan Johnson (August 17, 2011)

Issues	**Charge Question 1: The MARSSIM Workgroup has proposed a number of significant changes to MARSSIM which if implemented, will result in Revision 2 of the document. Please comments on the applicability and appropriateness of the proposed changes.**	**Charge Question 2: Do you have any recommendations for additional changes or improvements? Please comment on why you believe that these additional changes are warranted.**	**Charge Question 3: The list of changes proposed by the MARSSIM Workgroup represents the Workgroup's best judgment as to the highest priority changes, given limited resources for implementation. Please comment on the relative priorities of the seven proposed changes versus other identified or recommended changes.** Criteria for prioritizing changes: Consider advantages and disadvantages of making the changes: Difficulty of getting buy in Complexity beyond the understanding of users Number of users affected Potential of update to reduce potential for wrong decision Maintaining the reputation of MARSSIM How could the changes affect the ease of making additional updates
Updated treatment of measurement uncertainty	The treatment of uncertainty should be updated to meet the current state-of-the -art but to the extent possible should be understandable to the MARSSIM user .	The improvements should center around making the document useable for the individual in the field who will have to implement it. Updating the treatment of measurement uncertainty will only be beneficial if it is understandable to the user.	This should be a lower priority than updates to scan methodology and other field measurement techniques.
Updated measurement	Changes, or more appropriately,	It's important for MARSSIM to reflect the	This is the number one or number two priority in my

methods (not instruments) i.e., scanning with GPS	adaptations of existing measurement methods to take advantage of the new technologies should be included in the MARSSIM revision. However, not all sites will have access to the newest technologies so the old, tried and true methodologies should be given a bit of an update as well. While MARSSIM nominally addresses final status surveys, the GPS-scanning technique is very important in establishing background levels and variability at large area sites such as in-situ leach uranium recovery facilities that may cover more than 10,000 acres.	latest technology but not preclude the use of older methods that accomplish the objective. The statistical methods for determining uncertainty and MDC for the new methods need to be presented in a way that is going to be understandable by the end user who may not be a statistics expert.	opinion. New technologies such as GPS based scanning systems are already widely used in the field so MARSSIM Guidance needs to reflect this fact.
Scenario B (assumed to pass until proven otherwise)	Scenario B is already used when the DCGL is indistinguishable from background. It's more prominent incorporation into the MARSSIM revision would be advantageous. While MARSSIM does not address establishment of the DCGL, in its discussion of the use of Scenario B, guidance should be given on determining the consequence of declaring a dirty site clean at a specified level under Scenario B. This is an issue that is best negotiated with the regulator but it would be helpful if	More guidance on selection of Survey Units under Scenario B would be helpful. The problems with sites with highly variable backgrounds might be alleviated somewhat with judicious definition of survey units.	This is also a high priority. The impossibility of proving that a site meets the DCGL under Scenario A is a significant problem for sites where the background is highly variable and its range may encompass the DCGL.

	MARSSIM provided some guidance.		
Increased emphasis on regulator interface during survey design	This is essentially a "no brainer". While it's not a technical issue, consultation with the regulators "early and often" is a win for both the regulatory agency and the licensee. Guidance on this issue could be addressed as an Appendix without compromising the technical nature of the rest of the document.	If this section or appendix is added, it should give some hints on approaches that would be helpful and collaborative but would not cross the line between regulator and regulated community or cause a perception among members of the public that the relationship is too "cozy".	This is a moderate priority. It would be relatively easy to develop a one page appendix that would address the need for interaction between the regulator and the licensee.
User comments (lessons learned)	This would be a good addition to the web site but some effort should be made to screen comments that may be technically inaccurate.	No additional comment.	Moderate priority, but would appear to be relatively easy to accomplish.
Definitions/terms consistent with related documents	This is an obvious need to avoid confusion between and within agencies and with stakeholders.	No additional comment.	Relatively high priority
Better discussion of "hotspots" and UMTRCA standards	The discussion of "hot spots" could be improved. While MARSSIM does not address dose or risk calculation from hot spots per se, but that would be a reasonable addition. I'm not sure that inclusion of addressing the UMTRCA standards is necessary and perhaps could be addressed as an Appendix..	The principal concern with MARSSIM addressing UMTRCA is the potential for conflicting guidance. UMTRCA is quite well addressed in other NRC and EPA documents. If the working group does attempt to deal with MARSSIM it would be essential to include in the group at least one individual with a great deal of experience in all phases of uranium recovery operations as well as the existing regulatory structure and guidance. Individual agreement state issues with uranium recovery	Higher priority for "hot spots"; lower priority for UMTRCA standard discussion. Guidance for demonstrating compliance with UMTRCA standards is relatively well established in NUREG 1620 and other uranium-specific documents.

		operations would have to be considered as well to make sure the whole body of guidance and regulation is not rendered more confusing than it already is.	
Other Issues: Note-this are issues that were not included in the original seven proposed to the panel but were on the table with the working group at one time.			
Surveying multiple surfaces	*No comment*	*No comment*	*No comment*
Update equipment and measurement methods	*This was addressed in Issue #2 above*	*No comment*	*No comment*
Quality assurance – field QC measurement analogs	*No comment*	*No comment*	*No comment*
Historical site assessment vs initial assessment	*No comment*	*No comment*	*No comment*
Subsurface measurements	*This is a very important issue that needs to be addressed in spite of the technical difficulty of doing so. Definitions need to be clarified, i.e., near surface vs sub-surface. Developing a DCGL is significantly easier than establishing a survey methodology that will statistically demonstrate that the DCGL has been met. However, the need for such guidance is quite serious. The potential dose can be calculated relatively easily using established computer*		*This is a very high priority with the understanding that at this time the resources are not available to address this issue.*

	codes such as RESRAD. Proving that you have met the DCGL without actually excavating an entire site or making "swiss cheese" out of it with boreholes or backhoe pits is a challenge. While it is understandable that the funding is not available for a new multi-agency guidance document, perhaps MARSSIM could include an appendix with some ideas and references regarding the issue.		
Smears for building surfaces	*This should be addressed in MARSSIM, particularly for nuclides that can be quantified in a scan survey. However, the principles outlined in MARSAME can be applied or the MARSSIM user can be directed to MARSAME for guidance*	*No comment*	*Low priority since MARSAME addresses the issue of smears for equipment. Much of that information is transferable to building surfaces.*
Emergency response surveys for building surfaces and surface soils	*This is an important issue but does it belong in MARSSIM that is intended primarily for Final Status Surveys? This should be addressed in a separate emergency response guidance document.*	*No comment*	*Low priority because it should be addressed elsewhere.*
Scoping and Characterization	*No comment*	*No comment*	*No comment*
Hard to scan radionuclides	*This is also an important issue but perhaps should be addressed with instrumentation*	*No comment*	*No comment*

Checklist (Outline) for survey plan	*This would be a good addition to MARSSIM.*	*No comment*	*No comment*
Implementing sign test with background present	*Is there not already guidance in NUREGS for this?*	*No comment*	*No comment*
Additional illustrative examples using exception values	*No comment*	*No comment*	*No comment*
Update of instrumentation appendix	*This should be done at some time but it's not easy to keep a document like MARSSIM up to date with instrument changes and improvements that tend to come in spurts. Perhaps a periodic brief update on the web site would be in order*	*.No comment*	*No comment*

Dr. Bernd Kahn, Georgia Institute of Technology, Atlanta, GA:

RAC Consultation Letter for MARSSIM Revision 2. Bernd Kahn response (July 28, 2011)

My responses arising from the MARSSIM consultation are given below. Agency staff presented their request effectively, and I hope that the individual responses by the RAC augmented members will be useful to EPA-ORIA.

Charge Question 1:

Topic 1

Updating of uncertainty treatment (i.e., sampling and counting statistics) to conform to GUM is recommended to achieve consistent data treatment across government agencies. This upgrade should be accompanied by a presentation of this treatment in a form sufficiently simple to be applied in the field, a recommended computer program for applying it, and training courses.

Topic 2

Introducing scan-only surveys as a general approach is unsuitable because of the need for sample analysis to provide radionuclide concentration ground truth for soil, concrete, and similar material. The scan-only technique is usually appropriate for equipment survey in accord with MARSAME and can be applied in a limited way to some analogous MARSSIM cases, such as clearance of structure walls of sheet-metal.

Updating other methods is desirable: review of environmental radiation and radionuclide monitoring newly applied during the past 15 years should be performed and practices of interest should be cited to keep MARSSIM up to date. The integration of GPS information into automated area scanning was cited as example.

Topic 3

The current MARRSIM approach of describing both Scenario A and B but recommending use of Scenario A appears to be a safe (conservative) approach that does not need change. Scenario B could be used conservatively by requiring application of higher power. Application of Scenario A under certain conditions is not obvious but can be done with some conceptual ingenuity.

Topic 4

The decontamination organization can find regulator input useful at various points of the cleanup project; this can be supported in the introduction to MARSSIM by adding a discussion of current options for presenting the proposed cleanup plan to the appropriate regulator at suitable points of interactions with request for guidance. The Work Group needs to be careful, however, to avoid mixing regulatory policy with technical guidance, notably when changes in policy can undermine this guidance.

Topic 5

Because comments ('lessons learned') by past users can be immensely useful to subsequent users, the Work Group should modify the MARSSIM web site to allow convenient posting and accessing such advice, and making this opportunity known through training courses and other communication.

Topic 6

It goes without saying that terminology and definitions should be made consistent throughout MARSSIM and its related documents.

Topic 7

A recent citation to estimating external dose from 'hot spots' should be considered for updating treatment of this situation in MARSSIM.

A separate section of MARSSIM can be devoted to uranium (and thorium) milling and mining activities if the unique regulatory requirements are taken into account. The Work Group also needs to consider current application of UMTRCA standards beyond tailings piles to other situations of contamination by natural radionuclides; and that current in-situ uranium mining will have its own post-mining monitoring requirements.

Charge Question 2

Each of the other 12 items considered by the MARSSIM work Group has significant justification for inclusion in the revised MARSSIM document. At this time, none should be discarded without further evaluation (considering responses to this Consultation) relative to the 7 items listed above.

A particularly strong argument can be made for considering the item 'MARSSIM and the Sub-surface' because sub-surface contamination (radionuclides in soil and pipes just below the surface – i.e., about 5 – 30 cm below) is so commonly encountered in cleanup. Preparation of the long-considered additional document for surveys of radioactive contamination in the ground also should be begun. These two recommendations will require proposing distinctions in addressing surface, near-surface, and deeper contamination.

Charge Question 3

My suggestions for high-priority items to be considered in the MARSSIM revision on the basis of their importance to users are:

Item # 5; additional items considered #2, 3, 5, 6, 9, and 12.

Suggested items for the MARSSIM revision based on the desirability to achieve consistency are:

Items # 1, 6, and 7; additional items considered #8.

Further, any of the listed items and additional items that can be addressed in the MARSSIM revision without extensive effort and cost should be included.

Dr. Jonathan M. Links, Johns Hopkins University, Baltimore, MD:

Jonathan Links Commentary (July 27, 2011 12:31 PM)

Hi Folks:
I strongly endorse Gilles's proposal. I did a crosswalk between EPA's 7 points and the 6 points in the (excellent) HPS letter; here's what I found:

EPA #1 (updated treatment of measurement uncertainty) maps perfectly with HPS #1.
EPA #2 (updated measurement methods) maps perfectly with HPS #5.
EPA #3 (Scenario B treated as equal to A) has no corresponding HPS point.
EPA #4 (increased regulator interface) has no corresponding HPS point.
EPA #5 (user comments) has no corresponding HPS point.
EPA #6 (consistent MAR terminology) maps perfectly with HPS #2.
EPA #7 (hotspots and UMTRCA) maps perfectly with HPS #3.

Of major importance, the above means that there are two HPS points that are absent from the EPA points:
HPS #4 (scan-only surveys) - HPS wants the MARSAME concept applied to MARSSIM
HPS #6 (subsurface surveys) - HPS wants subsurface surveys added to MARSSIM, consistent with Giles's proposal

Regards,
Jon

Dr. Paul J. Merges, Environment & Radiation Specialists, Inc. , Loudonville, NY:

RAC CONSULTATION LETTER OF PAUL MERGES, PhD, ON THE CURRENT MARSSIM PROCESS AND CONSIDERATIONS FOR FUTURE IMPROVEMENTS TO IT (REVISION 2) (August 17, 2011)

Introduction:

These comments come from a different perspective than most of those of the other SAB/RAC MARSSIM Review Panel. I was a regulator who has been involved in federal and state radiation, and other waste, cleanups over many years - on federal, state, and private properties. I often interacted with the various affected parties including the other federal and state agencies, and the public. I've been extensively involved in radioactive waste disposal issues from writing laws and regulations to overseeing efforts of all 50 states in siting and regulating radioactive waste disposal sites, and the minimization of these wastes. I am a former chairman of the Conference of Radiation Control Program Directors, and was their first E-5 Radioactive Waste Committee chair. Thus, my comments herein are given from a "states perspective".

Good government is open government whenever it is possible without putting national security at risk. We are truly privileged to be provided an opportunity to offer comments to be considered before the federal agencies commence their review process of MARSSIM. Early input can only improve this open government review process.

MARSSIM:

The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) provides guidance to federal agencies, states, site owners, contractors, and other private entities on how to demonstrate that their cleanup is in compliance with the radiation dose or risk-based regulation, otherwise known as a release criterion. Also, it provides for documentation thereof. MARSSIM is not intended to establish that risk or dose-based regulation, but is a process for scientifically demonstrating that criterion has been met for a successful cleanup. MARSSIM is a demonstration guidance document, not a site specific field manual. It does provide for such documents to be added under its umbrella process. MARSSIM is one process, and is not mandatory on agencies, if they wish to choose another process. The MARSSIM process was developed to demonstrate compliance to a surface based release criterion, and does not currently have the capability of addressing subsurface contamination.

MARSSIM is unique. Four federal agencies with sometimes conflicting goals agreed to develop the MARSSIM process as an "umbrella process" for their radiological cleanups. MARSSIM is a framework for the overall radiation cleanup that can function as a Rosetta Stone equivalent for all levels of government (federal, state, and local), principal responsible parties (PRPs), involved agencies, National Labs, contractors, and the health physics community. It is also an understandable process for the international community. After fourteen years of use, it has a documented success record. The success of MARSSIM resulted in former Vice President Gore presenting the MARSSIM Work Group Team his Hammer Award on April 16, 1999. This award was based on the Team's efforts which resulted in preparing a document which brought these federal agencies together in reinventing government principles to work together in improving radiological cleanups and at less cost. The Award also praised the Team for developing training and helping multi-agencies in collaboration on such cleanups.

Pre-MARSSIM Cleanups:

It is important to remember why MARSSIM was developed. Radiologically contaminated sites were remediated prior to MARSSIM on various bases: site-by-site, PRP-by-PRP, regulatory agency-by-regulatory agency, and federal policy-by-federal policy. Cleanups took longer due to this inconsistent approach within federal and state agencies. This often resulted in radiological cleanups on adjacent or vicinity properties, which usually have priority, accumulating their wastes on the major contaminated site only to have that waste "sit there" because the "window of opportunity" which provided access to disposal sites was closed. That window was dependent on many issues, such as:

- the availability of a disposal site for some wastes
- the availability of funds to the PRP to pay for transport and disposal
- the "pedigree" of the wastes (LLRW, NORM, FUSRAP, 11(e)2, RCRA, TSCA, etc.)
- the region of the country, or state of origin
- a determination of applicable cleanup standards, regulations, policies, and appropriate or relevant and appropriate requirements (ARARs)
- whether all cognizant federal, state, and local agencies could agree on a cleanup process, characterization process, background determination, sampling process, "hot spot" determinations, statistical approaches, lab analyses, close out surveys, etc.

As a result of such issues, when cleanups finally occurred they left regulators with a sense of confused meditation on their optimum success; the PRPs with a larger financial burden; and the public with a distrust that a long-term solution would exist. Often the "window-of-opportunity" closed before a cleanup was completed, and wastes were placed in on-site storage to await future resolution. While many of these problems still exist, MARSSIM, and waste disposal at sites under current radioactive waste disposal laws, have improved the cleanup process. For most sites, our present process is much better than that which existed before MARSSIM.

CHARGE 1 - Comments on the seven proposed changes of the Work Group

Topic 1

Updated treatment of measurement uncertainty - no comments

Topic 2

Introducing scan-only surveys in MARSSIM to make it consistent with MARSAME - While scans are very useful in closeout surveys, they should not be used exclusively, but only in conjunction with soil sampling. It may not be reasonable to require samples of metals on heavy equipment and some building materials under MARSAME, but MARSSIM site closeout without sampling and lab analyses thereof is unreasonable. It is more accurate and less prone to result in missing residual radiological contamination.

Topic 3

Scenario B ("assumed to pass until proven otherwise") - A MARSSIM approach of describing both Scenario A and B, but recommending use of Scenario A is much preferred from the perspective of obtaining final regulatory agency sign-off that a cleanup was successful in meeting the Derived Concentration Guidance Levels. Scenario A is also more assuring to the public and regulators by

preventing the release of a site based on poor quality work of the remediation contractor or use of the wrong detection instruments or sample analyses.

A classic case of rewarding poor judgment or work could be when a poorly performed “scan only” survey was combined with Scenario B (“assumed to pass until proven otherwise”).

Topic 4

Increased emphasis on regulator interface during survey design - Experience has shown that PRPs need to keep regulators advised of developments in almost all aspects of remediation especially in establishing DCGLs, setting background or ubiquitous levels of radiation, survey design, sampling methods, lab analyses, site limitations, “hot spot” assessments, environmental documentation, and waste disposal. It is also important to remember that 1) staff of these agencies and PRPs change and therefore these contacts need to be updated periodically, 2) where multiple regulatory agencies oversee a cleanup, these agencies usually work together to provide for each ones regulations and laws being met, and 3) when the contractor or PRP seeks to remediate another site under a regulator’s pervue it speeds the process to have a good working relationship in place from a previous cleanup.

Topic 5

User comments (lessons learned, including Glossary review, updating references, and QA sections of MARSSIM added after final peer review, etc.) - All these items should be included in the review. MARSSIM is an umbrella process for agencies to add their agency specific processes or other optional cleanup processes, and issues related to a cleanups. The Work Group should review the variety of issues which are being proposed to modify MARSSIM and recommend an approach to the Administrator and SAB which provides for future modification of MARSSIM for a spectrum of options, from a simple errata sheet for typos and minor changes to a comprehensive analysis including SAB consultation and review for major modifications. The Work Group should discuss in this proposal for future MARSSIM amendments how this proposal would affect the “overall umbrella of MARSSIM.

Regarding lessons learned, MARSSIM should be revised to incorporate several case studies. These lessons should include input from the PRP/contractor and the regulatory agencies for the each cleanup.

Topic 6

Definitions/terms consistent with related documents - All MAR-series documents should have the same definition for terms used.

Topic 7

Better discussion of “hotspots” and UMTRCA standards - In preparing revisions to MARSSIM, it should be noted that regulatory agency confirmatory sampling will often seek biased samples from areas of elevated concentration (‘hot spots”), and not just follow a predetermined grid pattern. On sites where more than one radiological contaminant is of concern, elevated levels can vary by radionuclide, although this is less common than the contaminants being in relatively constant abundance.

UMTRCA standards, a concentration based threshold level, and other standards, risk or dose based, were considered beyond the scope of MARSSIM since they are set in law or regulations. They still are, and there is no apparent omission in MARSSIM, it is intentional. If UMTRCA standards are addressed in Revision 2, the dose from radon gas should also be considered.

CHARGE QUESTION 2

All items considered for Revision 2 by the MARSSIM Work Group have justification.

Additional items for consideration in revising/updating MARSSIM:

- Sub-surface characterization in support of radionuclide remediation still needs to be added to the MAR-series. Dose/risk analyses needs to be considered for residual contamination in the Vadose Zone and Zone of Saturation.

- The Road Maps and flow diagrams in MARSSIM are "very busy", especially for new users and occasional readers such as managers. In order to make MARSSIM more user friendly these maps and diagrams should start out with the very basic process and with a series of mylar overlays, add more comprehensive steps till the full map or diagram is presented.

- MARSSIM has a very statistical basis and many cleanups require state regulatory concurrence and oversight. Most state radiation regulatory programs do not have access to strong statistical expertise Therefore for cleanups being sponsored by a federal agency, the federal agency should be encouraged in MARSSIM to provide a "loaner" statistician from another federal agency to assist the state radiation program in its reviews of statistical input to the cleanup.

- On some large remediations, sampling grids are set at the beginning of the cleanup on the basis of existing surface topography only to have part of the grid deep in a whole with groundwater seepage, or on a sheer unstable soil wall, as remediation advances. While such situations maybe site specific, they do illustrate the need to keep regulatory staff appraised on a regular basis so confirmatory surveys/sampling can take place prior to filling the hole, even when there is a need to promptly stabilize a situation by filling the remediated area.

CHARGE QUESTION 3

Before priority setting is considered the basis of the priority needs to be established. For example, should priorities be based on purely scientific criteria, economic criteria, public acceptance criteria, or optimum criteria for the desired outcome? My preference for priority setting is establishing priorities based on a desired outcome that optimizes a cleanup to assure that a remediated site is actually cleaned up to ALARA levels. From highest to lowest with the understanding that my comments to Charge Question 1 are considered:

5, 6, 4, 1, 7, 2, 3

If Charge Question 2 is also considered, I would place my first three responses ahead of the seven proposals of the Work Group, and my fourth response last.

END

Mr. Bruce A. Napier, Pacific Northwest National Laboratory, Richland, WA:

Pacific Northwest

National Laboratory

August 15, 2011

K. Jack Kooyoomjian, Ph.D.
Designated Federal Officer
Radiation Advisory Committee
U.S. EPA Science Advisory Board (1400R)
Office of the EPA Administrator
1200 Pennsylvania Avenue, NW
Washington, DC 20460-0001

Dear Jack:

SAB/RAC Comments on Proposed Updates and Changes to the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

The Multi-Agency Radiological Site Survey Implementation Manual (MARSSIM) is a guide to conducting site characterization activities at radioactively contaminated sites. MARRSIM was jointly developed by the Departments of Defense and Energy, the Environmental Protection Agency, and the Nuclear Regulatory Commission to provide detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with regulations. The MARSSIM approach provides a statistical method for obtaining survey data and comparing them, on a pass-fail basis, to a dose- or risk-based release criterion.

The MARSSIM approach consists of

- A Data Quality Objectives (DQO) process for development of systematic planning and decision making;
- Conduct of an Historical Site Assessment, for obtaining site information and prior survey data (operations records);
- Survey Planning and Design, to planning a strategy for conducting a final status survey;
- Recommendations for field survey methods and types of instrumentation, for sampling, direct measurements, and wide-area scanning;
- Survey result interpretation guidance including Data Quality Assessment, data interpretation, and statistical tests; and
- Guidance on developing Quality Assurance Project Plans and performance-based Quality Control requirements.

This approach is very advantageous. It allows application in a wide variety of situations by different agencies and their contractors. As noted in National Council on Radiation Protection and Measurements report No. 146, *Approaches to Risk Management at Radioactively Contaminated Sites*, although there are

disagreements about final cleanup criteria between agencies, there are no apparent differences between the agencies in regard to methods of estimating concentrations of radionuclides in contaminated areas at a site, nor in comparing these concentrations to the dose- or risk-based criteria using the MARSSIM techniques.

The recent presentations to the EPA's Science Advisory Board Radiation Advisory Committee on possible enhancements to MARSSIM highlighted use of new measurement devices as one area for revision. This can only improve the usefulness of the report and should be followed up on. The new techniques essentially provide more of the same types of data and their application should not undermine the existing processes.

The suggested areas for revision also include new statistical analysis techniques. On my first exposure to MARSSIM, I was surprised to find relatively sophisticated statistical techniques that I had used in other applications. I understood the application and found it to be quite "user-friendly". My understanding of the proposed changes is that they address the uncertainties of the measurements, but may not substantially change the current approaches for showing compliance. A separate but related proposal to allow a second method of showing compliance appears to have potential benefits. The intended audience for the MARSSIM is users at various sites. Therefore, the main body of the current report is a procedure; the supporting rationale for various requirements and statistical techniques is presented in appendices. This approach should be retained. Any revisions to the statistical techniques should be well described in the appendices, but highly "proceduralized" in the body of the report.

The MARSSIM characterization activities apply only to 'surface' contamination (the techniques were developed for building surfaces). At nearly all decommissioning sites, there is also contamination of surface and subsurface soils. The MARSSIM techniques have been successfully adapted to surface soils at many locations. However, there is a need for guidance on sampling surface soils, as well as buried soils and materials. Because of the apparent disagreements between agencies on the appropriate approach for subsurface materials, this should probably be made into a separate manual in the Multi-Agency series. However, an appendix in the MARSSIM specifically addressing uses in surface and near-surface soil (and defining "surface" and "near surface") would be highly beneficial.

Overall, some of the proposed changes would be "additions" in that they provide additional methods for performing the same tasks. These should be the initial priorities because they can most likely be completed with all agencies in agreement. A few could be "structural" (e.g., addition of techniques for subsurface analysis); these are more problematic and could be addressed as additional separate documents in the Multi-Agency series.

Sincerely,

Bruce A. Napier

Staff Scientist

Energy and Environment Division

BAN

Dr. Dale L. Preston, Hirosoft International, Eureka, CA:

RAC Consultation Letter for MARSSIM Revision 2. Dale Preston response (August 16, 2011)

My responses arising from the MARSSIM consultation of held on the 26th and 27th of July 2011 are given below. I felt that since our role was not as well-defined as it should have been prior to the consultation and since, as it turned out, the request was rather vague it took me and at least some of the other RAC members a bit more time than it should have to understand our role and respond appropriately. The framing issues notwithstanding, the presentations from Dr. Snead and the MARSSIM working group and the ORIA staff were quite helpful and as the consultation progressed I gained a better understanding of what was expected of the RAC members.

Charge Question 1:

Topic 1

While the updating of uncertainty treatment (i.e., sampling and counting statistics) to conform to Guide to Uncertainty in Measurement (GUM) and related NIST guidance concerning the quantification an characterization of measurement uncertainty with the goal of achieving consistent data treatment across government agencies has much merit, I feel that this must be done with care since it will almost surely make the process of determining the magnitude of measurement uncertainty more complex (but, one hopes better). My impression is that the success of MARSSIM has, to a large extent, been derived from the fact that it lays out a simple practical approach to study design and the testing of relevant hypotheses. As the methods used to assess measurement uncertainty and the ways in which this uncertainty is described become more complex care must be taken to insure that the methods can be applied by field staff with little familiarity with Bayesian methods. This will require clear and careful presentation of what is involved in the new methods and providing robust, user-friendly tools for carrying out the necessary computations.

It is my impression that while it is planned to modify the methods used to characterize measurement uncertainty will change with the revision of MARSSIM, there are no plans for an explicit discussion of how these changes will (or should) impact the design of the field studies or the tests that are carried out to address the hypotheses if interest. I suggest that the MARSSIM revision provide some discussion of this issue.

Topic 2

I am not very knowledgeable of measurement methods, but I suspect that there have been significant improvements in measurement methods since the development of MASRSSIM and that the report should be updated to deal with these developments. However, the primary discussion related to this topic concerned whether or not “scan-only” surveys should be allowed as an alternative to the current approach which relies on direct measurements or a combination of area scans and direct measurements. I am quite skeptical about the ability scan only surveys to provide data of comparable quality to approaches that make use of at least some direct measurements of affected areas. I would suggest that scan-only surveys be allowed only when they can be convincingly demonstrated to provide data that is as good as that which can be obtained from direct measurements and that the chance of wrongly concluding that a site has been

cleaned up when it has not is no more than it would be in a well-designed study involving direct measurements.

I do not think that Scenario B should be taken as equal to Scenario A. Scenario A should be preferred in all but some clearly delineated and well justified exceptional situations. Furthermore studies being designed using Scenario B should have more stringent power requirements than would be used for studies designed using Scenario A.

Topic 3

In my view the emphasis on "Scenario A", in which a site is deemed to have been cleaned up only when one rejects a null hypothesis that the site is out of compliance in favor of the alternative that the site has been cleaned up to an acceptable level, is the good approach to the problem. My main concern with "Scenario B" (assumed to pass until proven otherwise), which involves testing the null hypothesis that a site is in compliance, is that studies are usually designed to offer more protection against false positives (incorrectly rejecting the null hypothesis) than false negatives (accepting the null hypothesis when it is in fact false), thus with Scenario B a poorly done study is more likely to result in deciding that erroneously concluding that site that is out of actually out of compliance is clean. During the teleconference this someone nicely described this as a "reward for ignorance" though one might also describe it as a reward for poor study design.

It was stated in the meeting that one reason that Scenario B is necessary is that there are situations in which it is not possible to reject scenario B null hypothesis (that is all tests have 0 power). I am quite skeptical of whether this statement is true, but if there are situations, which are certainly rare, in which it is true then these should spelled out in the report.

I would suggest that Scenario B only be allowed in limited and well defined situations with detailed site-specific justification. I also suggest that if Scenario B is used the study design involve higher power than is required for studies based on Scenario A.

Topic 4

I do not have any opinions on this issue

Topic 5

It is certainly wise to incorporate ideas / lessons learned by users into the revision of the guidelines. More importantly it is important to make sure that that there is location (e.g. a website or social media system) where users can easily make and examine comments and suggestions from other users or the Workgroup.

Topic 6

This strikes me as something that is relatively easy to do and should be done.

Topic 7

It was obvious that the dealing with hotspots is an topic of considerable interest and that there recent years have seen a considerable amount of work by Ablequist and others on issues related to the definition and remediation of hotspots. This is an important area for further development.

Charge Question 2

It seemed clear to me from the discussions and comments during the conference calls that issues related to subsurface clean-up are of much interest and quite important. It was also clear that there is currently nothing like MARSSIM for that addresses subsurface cleanup. While a full treatment of subsurface clean-up studies is probably beyond the scope of the working group, I feel that the issue should at least be highlighted in this MARSSIM revision and to the extent possible MARSSIM should include some discussion of the distinction between surface, near-surface, and deep subsurface and consider extension of the MARSSIM approach to near-surface contamination.

Charge Question 3

The seven areas for revision of MARSSIM suggested by the Workgroup all appear to be important. I would suggest that the subsurface issues are of high priority and be addressed to some extent in the process of revising MARSSIM. I also feel that since a major focus of the revision concerns updated treatment of measurement uncertainty and measurement methods, it is important to update the material on equipment and measurement methods to reflect the current state of technology (item 2 on the list of possible updates considered but not recommended by the Workgroup).

<u>Dr. Daniel O. Stram, University of Southern California, Los Angeles, CA:</u>

RAC Consultation Letter for MARSSIM Revision, Dan Stram (August 17, 2011)

My comments are focused on Charge question 1 (for selected topics) with a bit of commentary about Charge question 3.

Charge Question 1

Topics

Treatment of Measurement Uncertainty,

Treating measurement uncertainty is certainly an important issue, as is the key issue when it comes to study design (power estimation and sample size choice). It was difficult from the material provided to know exactly what the proposed changes will encompass so my comments below are fairly general

It strikes me that there are two possible areas that additional guidance could be provided.

1) Treatment of measurement uncertainty in the design phase of the study, as in sample size and power calculations
2) Treatment of measurement uncertainty in the analysis of the data.

It is possible that these can be dealt with separately, i.e. that study power and sample size calculations can utilize a more sophisticated approach to estimating the variability of estimates under the null and alternative hypotheses, but that in actual practice empirical estimates of variability are estimated "as usual" as in parametric testing of mean levels (t-tests), or are used implicitly when non-parametric tests are performed (Wilcoxon). This could be perfectly appropriate depending upon the design of the study, i.e. if repeated measurements are taken under the same conditions, and if each repeat can be regarded as independent estimates of the quantities of interest, then the variability of these estimates provides an estimate of uncertainty, without explicit reliance upon values used in the design phase. In this case errors in the estimate of measurement uncertainty in the design phase would yield inappropriate sample size or power calculations, but not lead to statistically inappropriate conclusions from the data analysis (at least under "Scenario A" as discussed below).

Another possibility is that too few (or no) repeated measurements can be taken in a particular situation, so that it is not possible to provide an empirical estimate of measurement variability in the course of data analysis. In this case tests may still be performed, but the interpretation of their significance is reliant on assumed rather than estimated measurement variability. For example it may be decided in the design phase that an estimate, X, of the concentration of a particular radionuclide analyzed with a certain method is normally distributed around the true concentration value and has a standard deviation equal to σ. In this case a Z-score for a test that a measurement is below a guidance level (GL) can be constructed then as $Z=(X-GL)/\sigma$, with Z assumed to be standard normal under the null hypothesis. In such situations it is especially important that very careful analysis of the measurement variability be undertaken. Uncertainty in the estimate of σ may need to be incorporated into the analysis (perhaps by specifying that Z be treated as coming from a T-distribution with some prescribed number of degrees of freedom). The normality assumption must be carefully assessed, and if this is inadequate then more complex methods both for

study design, and for analysis of the resulting data, would need to be devised. Similarly it may be that σ is dependent on the true value being estimated, which again would have implications on both study design and data interpretation. Here errors in estimating or in assessing the uncertainty of σ or in evaluating the normality assumption for X, could each have an impact on both sample size and power calculations in the design phase, and on the statistical validity of the conclusions of the data analysis.

Comments on "Scenario A" and "Scenario B".

When empirical data are available to estimate measurement uncertainty in the course of the data analysis, then under scenario A (when the null hypothesis states that the true value is at or above a GL), improper assessment of measurement uncertainty in the design phase, would have effects on study power but not on the results of the data analysis per say. Of course if power is over estimated then the results of the hypothesis test may be inconclusive (because the sample size was too small) and additional testing (beyond that originally planned) required to confidently reject the null hypothesis. Continuing a study because the results weren't significant at the first analysis time does influence the type I error rate of a study, stopping rules for clinical trials for example customarily reflect the number of times the data is going to be "looked at", and the number of "looks" taken affects the final assignment of the statistical significance of the results. In general however, the effects of miss-specifying measurement variability under Scenario A are smaller than under Scenario B (at least in an uncritical evaluation). This is because when the null hypothesis (as under Scenario B) is that there is no elevation in contamination, the probability of failing to reject the null hypothesis is equal to (1-power) of the study and this probability is not being properly controlled if an inadequate sample size is used. Since it is in the interest of the licensee to accept the null hypothesis of no elevation, loss of control of the power of the study provides (at least naively) a benefit to the licensee.

In order to limit such a "reward for ignorance" (or better "reward for poor power"), it is necessary to examine upper confidence limits in the data analysis, and judge whether these are reasonably tight (i.e. don't include unacceptable values). Because of the close relationship between confidence intervals and hypothesis tests formalizing this (i.e. developing statistical criteria so as to not accept the null hypothesis unless the confidence bounds exclude unacceptable values) involves essentially the same statistical thinking that goes into calculating power and sample size under Scenario B. Thus statistical design as well as analysis under either Scenario A and B will involve quite similar concepts when done carefully.

When empirical data (i.e. repeated independent observations) are not available to estimate uncertainty in the course of data analysis then the testing of the null hypotheses embodied in either Scenario A or Scenario B are greatly affected by the analysis of measurement variability undertaken at the design phase. It is very important that realistic assessments of measurement variability be provided, and as described above, the use of these assessments are be complicated by the need to deal with non-normality, incomplete assessment of measurement standard deviations (σ), etc.

Charge Question 3: Priorities

Listed in rough order priority

Updating measurement methods (topic 2) clearly is of high importance given the elapsed time since the previous iteration of MARSSIM

Better discussion of “hotspots” and UMTRCA standards (topic 7). Are these really the same topic? Clearly dealing with hotspots is important but difficult, and guidance is of great importance. I am not (yet) familiar enough with the UMTRCA standards to know their relevance to MARSSIM.

It seems that the main goal for updating the measurement uncertainty treatment (topic 1) is to bring this into correspondence with other relevant technical documents. My commentary on this topic above is not focused specially on correspondence issues. Changes should not solely be directed to correspondence issues, but rather to provide methods for appropriate analysis and study design, including designs of studies to be conducted under “Scenario B”. Ultimately Scenario B and A involve similar issues when designed and conducted carefully, in order to avoid (1) unplanned additional data acquisition under scenario A and (2) a “reward for ignorance” under scenario A. Proper control of power as well as type I error make design and analysis similar under both scenarios.

Regulator interface during survey design would be helpful, and may especially be needed for maintaining control of power under Scenario B. The goal of the technical report should be to cover most topics well enough so that general approaches are clear and that guidance from regulators is only required to deal with unusual rather than typical situations.

Aligning the definitions and terms to be consistent with other documents would seem to be of high priority.

User comments could be helpful in order to make this the report more approachable. It may also be helpful to provide something like a wiki page that could be designed specifically by and for users. More important however, is to see that response to useful user comments be incorporated into the revision directly.

Dr. Chen Zhu, Indiana University, Bloomington, IN:

MARSSIM Consultative Comments - Dr. Chen Zhu (August 11, 2011)

From: "Zhu, Chen"
To: Jack Kooyoomjian, Bernd Kahn
Cc: "Zhu, Chen"
Date: 08/11/2011 12:47 PM
Subject: RE: Reminder Individual Comments Due Weds. Aug 17, 2011 for MARSSIM Consultation

Jack,

Here are my comments.

Chen Zhu
Professor of Geological Sciences
& Public and Environmental Affairs
Indiana University

Re: Charge #2 Recommendations for additional changes or improvements;
As a hydrogeologist and geochemist, the area that I feel needs to be addressed is the connection or separation between surface (up to top six inch soil) and subsurface survey. The current scope of the MARSSIM does not include subsurface contaminants. I understand that this is not the MARSSIM charge, and blur the line of surface and subsurface can bootleg the completion of the product. However, the scientific basis needs to be addressed. Surface radiation scan or survey often requires the taking soil cores and materials otherwise for interpretation of radiation signals. It appears to me that MARSSIM needs (1) explicitly describe this possible connection and (2) to provide references and resources where the issues of connection between surface (top six inches) and subsurface are addressed if nothing beyond this point can be done.

- - - End of Commentary - - -