



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 22 2008

THE ADMINISTRATOR

Dr. M. Granger Morgan
Chair, Science Advisory Board
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Dr. Morgan:

Thank you for writing to transmit your recommendations and the report developed by the Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual Review Panel of the Science Advisory Board's Radiation Advisory Committee.

I appreciate the SAB's efforts to convene the MARSAME Review Panel and to complete a comprehensive, technical review of the *Draft Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual*, a technical document on radiological surveys of materials and equipment. I am pleased that the Panel found "the MARSAME manual to be an admirable cooperative and competently written effort," both in its technical merit and in the cooperation it represents among four federal agencies.

The enclosure summarizes the Agency's responses to your findings and recommendations. Many of your recommendations have already been implemented as the four federal agencies prepare to issue the MARSAME manual in final form.

Sincerely,

A handwritten signature in black ink, appearing to read "Stephen L. Johnson", written over the printed name.

Stephen L. Johnson

Enclosure

INTRODUCTION

Background

This document responds to recommendations provided by the Science Advisory Board (SAB) in their technical peer review of the draft "*Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual*," Draft Report for Comment, December 2006. The MARSAME manual is considered a supplement to the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), and a complementary document to the Multi-Agency Radiation Laboratory Analytical Protocols (MARLAP) manual. It was jointly developed by four federal agencies represented on the MARSSIM Workgroup: Department of Defense (Air Force, Army, and Navy), Department of Energy, Environmental Protection Agency, and Nuclear Regulatory Commission.

The Radiation Advisory Committee (RAC) of the SAB (augmented for this review) reviewed the draft manual, convened to hear presentations about and discuss recommendations for the manual on October 29-31, 2007, and held a series of teleconference calls October 9, 2007, December 21, 2007, and March 10, 2008 for further refinement of recommendations. A quality review of the Panel's April 24, 2008 draft report was conducted by the chartered SAB on May 29, 2008 in a public teleconference. The final report was issued on August 7, 2008.

Multi-Agency Nature of MARSAME

The MARSSIM Workgroup is governed by a charter that provides each federal agency equal weight in the decisions made by the workgroup. The charter indicates that the consensus of the agencies is required for all major workgroup products. The responses to the SAB detailed in this document therefore indicate the consensus of all four author agencies of MARSAME.

Additional Changes

In addition to responding to recommendations made by the SAB in their technical peer review, the MARSSIM Workgroup will be responding to recommendations received during the public review of MARSAME, conducted from January to May 2007. This will likely result in changes to the final MARSAME in addition to those detailed in the workgroup's responses below. The workgroup intends to review the draft final MARSAME document in October and November 2008. Additional changes may be recommended following this final review, which may modify some of the changes made in response to SAB recommendations.

DETAILED RESPONSES TO EPA SAB Review of Draft *MARSAME*

Charge Question 1: *The objective of the draft MARSAME is to provide an approach for planning, conducting, evaluating, and documenting environmental radiological surveys to determine the appropriate disposition for materials and equipment with a reasonable potential to contain radionuclide concentration(s) or radioactivity above background. Please comment on the technical acceptability of this approach and discuss how well the document accomplishes this objective.*

SAB Recommendation 1-1: Create a sub-section for the discussion that begins in Chapter 1, line 49, to present clearly the concept of simple alternatives to what may appear to the reader to be a major undertaking. Also, in lines 103-111 further define ‘release’ vs. ‘interdiction’ to clarify the distinction between the terms. Follow these paragraphs with sufficient detail and references to later chapters to assure the reader that when M&E is reasonably expected to have little or no radioactive contamination, it can be processed without excessive effort under the MARSAME system. One approach identified subsequently is applying standard operating procedures (SOP’s). Categorization as non-impacted or as class 3 M&E based on historical data also can lead to an appropriately simple process.

MARSSIM Workgroup Response: The workgroup will make lines 49-56 its own paragraph, and provide additional references to where MARSAME discusses SOPs and other simplifications to the process in this and subsequent sections. The workgroup will review the definitions of “interdiction” and “release” and make necessary changes to both the Glossary and existing Chapter 1, lines 103-111.

SAB Recommendation 1-2: Insert a sub-section in Chapter 1 and in appropriate subsequent chapters to consider various degrees of M&E decontamination as part of the available options associated with a MARSAME survey. Storage for radioactive decay can be an option for decontamination.

MARSSIM Workgroup Response: The workgroup will incorporate the clean-as-you-go concept (decontamination during the MARSAME survey) throughout the document; for Chapter 1, the workgroup will incorporate it into existing sections 1.4.3 and 1.4.4. The concept of storage for radioactive decay will be incorporated into existing section 6.8.2 on survey failure.

SAB Report Recommendation 1-3: Insert a paragraph after Chapter 1, line 196, to address use by persons less skilled professionally than defined in a preceding paragraph. Reference to Appendices B, C, and D, would be helpful for such persons. Adding an appendix that includes portions of the MARSSIM Roadmap and Chapters 1 and 2 could provide suitable background information without requiring that all of MARSSIM be read. Presentation of training courses for managers and other generalists with responsibility for MARSAME radiation surveys would be most helpful.

MARSSIM Workgroup Response: The workgroup will add a paragraph to Chapter 1 after line 196 on use by persons with less professional experience than that listed on line 187, and will develop and market training for managers and other decision-makers. The workgroup will not create a new appendix re-stating material found in MARSSIM, because MARSAME is considered a supplement to MARSSIM. The workgroup will, however, add language explaining that additional background information can be found in the MARSSIM Roadmap and Chapters 1 and 2.

Charge Question 1a: *Discuss the adequacy of the initial assessment process as provided in MARSAME Chapter 2, including the new concept of sentinel measurement (a biased measurement performed at a key location to provide information specific to the objectives of the Initial Assessment).*

Recommendation 1a-1: Add to the information sources in Chapter 2, lines 104 – 115, the files (inspection reports, incident analyses, and compliance history) maintained by currently and formerly involved regulatory agencies. Discussion with agency staffs, especially their inspectors, also could be fruitful.

MARSSIM Workgroup Response: The workgroup will include additional information sources as specified in the recommendation in existing Chapter 2, lines 104-155.

Recommendation 1a-2: The listing of complexity attributes in Table 2.1 could include Toxic Substances Control Act (TSCA) materials and hazardous waste.

MARSSIM Workgroup Response: The workgroup will change the fourth entry in Table 2.1, in the "Complexity" row, and the "Questions for Consideration" column to read: "Are there component materials that are inherently radioactive or regulated for their chemical properties(1)?", and add a footnote for (1) that reads: "For example, materials regulated under the Resource Conservation and Recovery Act (40 CFR 261) or the Toxic Substances Control Act (40 CFR 700-766)."

Recommendation 1a-3: In Chapter 1, lines 253 – 259, MARSAME should recognize that sentinel measurements are important because they may represent the entire historical record available for IA. Moreover, the measurements may have been so well planned that considering them "limited data" is misleading without a clear definition of terms. Sentinel measurements are particularly useful to evaluate assumptions based on process knowledge. In Chapter 2, lines 277 – 280, design of a preliminary survey for radioactive contaminants to fill knowledge gaps often depends on the availability of data from sentinel measurements. In some instances, the physical shape of the M&E may limit further survey to sentinel measurements. On the other hand, the MARSAME Manual draft, line 258, is correct in stating that sentinel measurements should not be used alone to justify categorization of M&E as non-impacted, especially when geometric or non-homogeneity limitations in radiation detection are suspected.

MARSSIM Workgroup Response: The workgroup intended for the term “limited” on line 256 to apply to “data collection,” meaning that sentinel measurements are a limited form of survey (e.g., the survey results cannot be used alone to justify a non-impacted decision). The SAB seems to be interpreting the term “limited” as applying to “data” and indicated that the term “limited data” was misleading. The workgroup will remove the term “limited” on line 256. This will not significantly change the meaning of the sentence as intended by the workgroup and will hopefully prevent future confusion amongst users.

Charge Question 1b: *Discuss the clarity of the guidance on developing decision rules, as provided in MARSAME Chapter 3.*

Recommendation 1b-1: The regulations or guidance for radionuclide clearance that define the action levels (AL) discussed in Chapter 3, lines 118 – 120, and listed in Appendix E should be sufficiently inclusive to apply to the usual M&E handled by users with regard to both non-fixed (removable) surface contamination and volumetric (distributed throughout the material) contamination. Tabulate or cite all other known pertinent regulations and guides for this purpose. To the non-fixed surface contamination regulations included in Table E.2 by DOE and Table E.3 by NRC, add the Department of Transportation regulation (U.S. DOT, 49CFR173.443), and guides by states such as New Jersey (State of New Jersey, 2007) and Nevada (State of Nevada, 2001). Include guidance for volumetric contamination clearance, summarized in Table 5.1 of NCRP (2002) from reports of national and international standard-setting groups.

MARSSIM Workgroup Response: The workgroup will only include in Appendix E those requirements approved for inclusion by the author agencies. However, the workgroup will insert "federal" after "some" in existing Chapter 3, line 118. In addition, the workgroup will insert the text, "National and International organizations have published recommendations for action levels (e.g. NCRP 2002, ANSI N13.12). These recommendations may be a useful source of action levels if approved by the appropriate authorities within the regulatory framework of particular sites or facilities."

Recommendation 1b-2: Information that guides decisions for radioactively contaminated M&E, listed in Chapter 3, lines 141 – 147, should include measurements of removable vs. fixed surface contamination to match the distinctions specified in Tables E.2 and E.3. Insert sub-sections that discuss the implications of planning for and responding to measurement of removable vs. fixed and surface vs. volumetric radioactive contamination and the subsequent disposition of M&E according to this categorization (see also RECOMMENDATIONS 2b-3 and 1d-3 for discussion of removable radioactive contaminants).

MARSSIM Workgroup Response: The measurement of removable radioactivity is related to the use of smears. The workgroup will review every Chapter in MARSAME and make changes where needed to reflect the new approach to smears. Thus far, the workgroup has identified several significant changes to the manual in reference to smear

samples: we will include smears as a sentinel measurement in existing Chapter 2; we will include the concept of smears as a method-based action level in existing Chapter 3, and the concept of a method-based survey design in existing Chapter 4; we will include smears as a sampling method and considerations for using smear samples in existing Chapter 5; and we will include the use of a smear sample as a sentinel measurement in an illustrative example in existing Chapter 7.

For existing Chapter 3, the workgroup will include "method-based" in the first box in Figure 3.1, and on page 3-7, put in parentheses after surficial "(fixed and removable)". The workgroup will insert a paragraph after line 92 that discusses method-based requirements or regulations and gives specific examples of action levels. The workgroup will change the title of section 3.3.2 from "Select the Most Restrictive Action Levels" to "Finalize Selection of Action Levels" and also make the change within the flow chart.

Recommendation 1b-3: Maintain the more general tone of MARSAME throughout Chapter 3 while moving detailed discussions of statistical aspects to a separate chapter (see also RECOMMENDATIONS 1c-1 and 2a-1). This approach could remove concerns such as why the Minimum Detectable Concentration (MDC) is recommended for the Measurement Quality Objective (MQO) in Chapter 3, lines 593 – 597, instead of the Minimum Quantifiable Concentration (MQC), and how item #1 differs from item #3 on lines 609 – 617.

EPA Response: The workgroup feels that the general tone of the guidance on statistical aspects in existing Chapter 3 is appropriate for the audience of the manual. Some knowledge and understanding of statistics and statistical matters is required for the user. However, the workgroup will prepare a new chapter on statistics after existing Chapter 6 and include text from Section 4.2, Sections 5.5-5.8, and Appendices F & G. Additional language will be added from SAB Review of Draft *"Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual"* Appendix A.

Charge Question 1c: *Discuss the adequacy of the survey design process, especially the clarity of new guidance on using Scenario B. and the acceptability of new scan-only and in-situ survey designs, as detailed in MARSAME Chapter 4.*

Recommendation 1c-1: In the organization of MARSAME, instead of the current mixture of general guidance about surveillance with detailed presentations of statistical matters, retain in each chapter only a brief and less detailed discussion of statistics. Collect the mathematical discussion in a separate chapter, as proposed above. Chapter 19, Measurement Statistics, in MARLAP should serve as example. The separation will serve both the specialist in statistics, who will appreciate the exposition in the newly added chapter, and readers with less training in statistics who can follow the general import of the MARSAME approach in the existing chapters.

MARSSIM Workgroup Response: The workgroup will summarize the sub-sections in Chapter 4.2 into smaller paragraphs and move the text in Chapter 4.2 into the new statistics chapter after Chapter 6. See response to Recommendation 1b-2 above.

Recommendation 1c-2: The MARSAME manual has emphasized disposition options that, after identification and segregation, lead directly to the disposition survey. Conditioning of the M&E, such as vacuuming, wiping down, chemical etching, and other forms of decontamination should be encouraged for meeting disposition options (see also RECOMMENDATION 1-2). Preliminary measurements are useful for this purpose. The MARSAME manual should provide more detail on these approaches and encourage them as an As Low As Reasonably Achievable (ALARA) policy.

MARSSIM Workgroup Response: The workgroup will incorporate the clean-as-you-go concept (decontamination during the MARSAME survey) throughout the document.

Charge Question 1d: *Discuss the usefulness of the case studies in illustrating new concepts and guidance, as provided in MARSAME Chapter 7.*

Recommendation 1d-1: Delete or replace the example for Standard Operating Procedure (SOP) use in Section 7.2. Given the good discussion in Section 3.10 for improving an SOP within the MARSAME framework, the example of applying SOP's at a nuclear power station appears to contribute little.

MARSSIM Workgroup Response: The workgroup will delete the illustrative example in existing Section 7.2.

Recommendation 1d-2: The example in Section 7.3 of mineral processing of concrete rubble is instructive, but the reader should be informed that many more measurement results than those listed in Table 7.3 are obtained under actual conditions and must be evaluated before making decisions. The radionuclide concentrations reported in Chapter 7, lines 213 – 214, should be confirmed as typical values or replaced by such values, because readers may apply them as default values. For the same reason, the AL taken from a U.S. Nuclear Regulatory Commission document (NUREG-1640; U.S. NRC, 2003) should be identified as a specific selection, not a general limit. Inserting boxes with interpretive comments would help the reader to understand the process used for illustration and the logic leading to the decisions.

MARSSIM Workgroup Response: The workgroup will add text after existing Table 7.3 to explain how the data are being used. Regarding the choice of the action level, the text will include the statement "in this illustrative example" and will change the term "stakeholders" to the "planning team."

Recommendation 1d-3: Insert an introductory statement to place in context the length of the 21-page example devoted in Section 7.4 to a simple baseline survey of a

rented front loader, to avoid discouraging the reader from applying it. This statement should explain that these details are needed to describe the survey process, but that the actual work is brief. This survey provides an opportunity to present the benefit of sentinel measurements and the comparison of removable with fixed surface contamination. An actual case history undoubtedly would show these and also contain a table of survey measurements.

MARSSIM Workgroup Response: The workgroup will include a header paragraph stating what portions of the MARSAME process are being demonstrated for each particular illustrative example. In addition, the use of a smear sample as a sentinel measurement will be incorporated into the illustrative example.

The MARSAME manual emphasizes the planning phase of a survey consistent with the Data Quality Objectives process, and therefore an extensive planning phase may be necessary, depending on the complexity of the material or equipment to be surveyed. Much of the 21-page illustrative example provides the details of this planning phase. While it is anticipated that the emphasis on planning will lead to a streamlined implementation phase, it is also possible that the actual survey selected may require significant time and resources. Therefore, the workgroup is hesitant to make any overarching comments concerning the amount of time that a MARSAME survey will require.

Recommendation 1d-4: Include in each of the illustrative example headings a statement that they are demonstrating the MARSAME process.

MARSSIM Workgroup Response: See response to Recommendation 1d-3 above.

Charge Question # 2: *The draft MARSAME, as a supplement to MARSSIM, adapts and adds to the statistical approaches of both MARSSIM and MARLAP for application to radiological surveys of materials and equipment. Please comment on the technical acceptability of the statistical methodology considered in MARSAME and note whether there are terminology or application assumptions that may cause confusion among the three documents.*

Charge Question # 2a: *Discuss the adequacy of the procedures outlined for determining measurement uncertainty, detectability, and quantifiability, as described in MARSAME, Chapter 5.*

Recommendation 2a-1: Enable the reader to understand the topics in Chapter 5 more clearly by separating the entire mathematically detailed statistical exposition in a chapter that could be entitled “Review of Experimental Design and Hypothesis Testing.” Appendix G can be included in this chapter. The chapter can be placed before Chapter 4. All sections currently in Chapters 4 – 6 that discuss generalized aspects of these topics, including measurement uncertainty, detectability, and quantifiability, can be kept in place; reference should be made to the technical discussions, equations, and tables in the new chapter.

MARSSIM Workgroup Response: The workgroup will prepare a new chapter after existing Chapter 6 and include text from Section 4.2, Sections 5.5-5.8, and Appendices F & G. Additional language will be added from SAB Review of Draft “*Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual*” Appendix A. The workgroup felt that locating the new chapter after existing Chapter 4 would result in breaking up the flow of the document as it follows the survey process, and decided instead to place the new chapter after existing Chapter 6.

For existing Chapter 5, the workgroup will replace sections and sub-sections 5.5-5.8 in the main document with paragraphs describing the general idea and step required, when to use it, limitations on using it, equations (and definitions of variables), and examples. The workgroup will replace challenging example 6 with an example using statistical software as opposed to a differential equation.

Recommendation 2a-2: Consider the comments made in Appendix A concerning the topics of experimental design, hypothesis testing, and the statistical aspects of uncertainty in preparing the separate chapter suggested above.

MARSSIM Workgroup Response: See response to Recommendation 2a-1 above.

Recommendation 2a-3: Move the discussion on setting MQOs, in Sections 5.5 thru 5.9, to Chapter 4 on Survey Design. Organize a summary or guide that focuses on the procedures for setting MQOs and for determining uncertainty, MDC, and MQC. The ability to set Measurement Quality Objectives (MQOs) is an important element of the MARSAME process, but the discussion involving the implementation of MQOs in the design of the three survey types may confuse the reader. Aspects of implementation are immersed in details defining, explaining, and deriving theoretical concepts.

MARSSIM Workgroup Response: See response to Recommendation 2a-1 above.

Charge Question # 2b: *Discuss the adequacy of the data assessment process, especially new assessment procedures associated with scan-only and in-situ survey designs, and the clarity of the information provided in Figures 6.3 and 6.4.*

Recommendation 2b-1: In Fig. 6.3 (See Figure 1 below, which reworks Fig. 6.3), clarify the distinction of a MARSSIM-type survey by moving “Start” to immediately above the decision point “Is the Survey Design Scan-only or *In situ*?” and then connecting this to an inserted decision diamond “Is the AL equal to zero or background?”. A “yes” leads to “Requires scenario B ...” and a “no” leads to “Disposition Decision Based on Mean”

MARSSIM Workgroup Response: The workgroup will make the recommended figure change to existing Figure 6.3.

Recommendation 2b-2: In Fig. 6.4 (See Figure 2 below, which reworks Fig. 6.4), for a more consistent presentation, insert a decision diamond after both “Perform the Sign Test” and “Perform the WRS Test” that says “Scenario A,” followed by a “yes” or “no” leading to the two “Scenario A” and “Scenario B” branches at both locations.

MARSSIM Workgroup Response: The workgroup will make the recommended figure change to existing Figure 6.4.

Recommendation 2b-3: To counteract the discomfort of Multi-agency working group members with the qualitative aspect of wipe tests, the MARSAME manual could recommend evaluations of the removable radionuclide fraction measured by wipe test for the surveyed M&E. These evaluations can include, for example, sequential smears at a given location at the M&E, or smears at adjoining locations performed with different material and pressure, by different persons, and for different radionuclides. Refer to State of Nevada (2001) and State of New Jersey (2007) for a description of the process, to Rademacher and Hubbell (2008) pp. 10, 16 for an application to radiological monitoring, and to U.S. EPA (2007a) for more general applications of the wipe test.

MARSSIM Workgroup Response: The workgroup acknowledges that the use of smears is required for demonstrating compliance with certain regulations, requirements, or license conditions, and the methods prescribed therein should be followed. Quality assurance and quality control procedures should be followed with all sampling and analysis techniques. Specific considerations for utilizing smear samples have been added in new section 5.9.1.3.

Recommendation 2b-4: Insert sub-sections in all chapters to address implementation and assessment of survey processes to distinguish between surface and volumetric contamination (i.e., measurement after surface cleaning or observing the effect of counting geometry) and between removable and fixed surface contamination (i.e., wipe test results compared to total surface activity). These types of contamination are described in Chapter 1, lines 127 – 152, but their implications should be considered throughout the MARSAME manual. Concerns in measuring volumetric contamination include characterizing non-uniformly distributed radionuclides and quantifying radionuclides that emit no gamma rays.

MARSSIM Workgroup Response: See response to Recommendation 1b-2 above.

Charge Question # 2c: *Discuss the usefulness of the case studies in illustrating the calculation of measurement uncertainty, detectability, and quantifiability as provided in MARSAME chapter 7.*

Recommendation 2c-1: Move the detailed derivations, including partial derivatives, identified above to the newly added separate chapter recommended for discussion of experimental design and hypothesis testing.

MARSSIM Workgroup Response: The workgroup will add text to the beginning of Section 7.3.6.4 that the following process is usually conducted through the use of statistical software that is commercially available; however, for the purposes of this illustrative example, this detailed solution is provided. The workgroup would prefer not to move portions of an illustrative example to a chapter on general theoretical statistical concepts. We believe that the illustrative examples should be complete and not split up into separate sections.

Recommendation 2c-2: Use illustrative examples to demonstrate any MARSAME guidance that the multi-agency work group considers difficult to follow. These may include approximating uncertainty (see Chapter 5), distinctions such as interdiction vs. release, and applying scenarios A vs. B.

MARSSIM Workgroup Response: See response to Recommendation 1d-3 above.

Recommendation 2c-3: Use Sections 7.4 and 7.5 to illustrate the benefit of wipe tests for determining removable radioactive surface contaminants. Experience suggests that the contaminant usually is in this form on M&E such as earth-moving equipment.

EPA Response: The workgroup will include an example of a smear as a sentinel measurement in existing Section 7.4.

Charge Question 3: *The draft MARSAME includes a preliminary section entitled Roadmap as well as seven appendices. The goal of the Roadmap is to assist the MARSAME user in assimilating the information in MARSAME and determining where important decisions need to be made on a project-specific basis. MARSAME also contains appendices providing additional information on the specific topics. Does the SAB have recommendations regarding the usefulness of these materials?*

Recommendation 3-1: Roadmap Figure 1 connects the MARSAME chapters in terms of the Data Life Cycle. Consider establishing an analogous connection with Roadmap Figures 2, 3, 5, 6, 7, and 8. At present, the only Roadmap figures connected to each other are Fig. 2, 3, and 4, and 7 with 8.

MARSSIM Workgroup Response: The workgroup will provide connecting information for all of the flowcharts in the final version of the document.

Recommendation 3-2: Consider assisting project managers by highlighting major operational decision points in the roadmaps.

MARSSIM Workgroup Response: The workgroup will provide flags that provide an indication of major decision points within the MARSAME process.

Recommendation 3-3: The roadmap should ensure that the primary components of the process are identified, their relationship to one another is depicted, and the boundaries of application are well-defined, in accord with the DQO process. Figure 3 provided below could be used in the MARSAME roadmap to illustrate application of the DQO process in the MARSAME manual. Realize also that the DQO process is iterative, so that, as in the case of MARSSIM, the MARSAME program should have the potential to improve and update the manual.

MARSSIM Workgroup Response: The workgroup will incorporate Figure 3 from SAB Review of Draft “*Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual*” into the Roadmap.

Recommendation 3-4: Indicate in the body of the text that Appendices B, C, and D are useful overviews of the environmental radiation background, sources of radionuclides, and radiation detection instruments, respectively, for managers and generalists; they may be too general for the experienced health physicist to whom the manual is addressed.

MARSSIM Workgroup Response: See response to Recommendation 1-3 above.

Recommendation 3-5: Insert a table with action level (AL) guidance for volumetric radionuclide contamination in Appendix E (see RECOMMENDATION 1b-1).

MARSSIM Workgroup Response: The workgroup will only include in Appendix E those requirements approved for inclusion by the author agencies. DOE requirements for release of property having residual radioactivity for volume contamination are found in Appendix E, Section E.1.3, with additional guidance in some of the materials referenced in E.1.4. The summary of NRC disposition criteria from current practices for the release of materials and equipment for volumetric radioactivity is found in Appendix E, Table E.3.

Recommendation 3-6: Either move Appendix G into the new chapter on experimental design and hypothesis testing or indicate its relation to that new chapter.

MARSSIM Workgroup Response: See response to Recommendation 2a-1 above.

Recommendation 3-7: Move the Glossary to the front to join the tables of acronyms and of symbols.

EPA Response: The MARSAME document provides glossary definitions of important terms in existing Chapter 1, and then a complete glossary in the back consistent with other similar guidance documents.

Recommendation 3-8: Expand the definition of ‘Interdiction’ in the glossary to clarify its application to receiving or disposing of M&E.

MARSSIM Workgroup Response: The workgroup will review the definitions of “interdiction” and “release” and make necessary changes to both the Glossary and existing Chapter 1, lines 103-111.

Recommendations Beyond the Charge:

Recommendation C-1: In Chapter 3, discuss in the recommended separate chapter on statistics any decisions leading to selecting the degree of confidence, embedded in the choice of significance level α and β values. Selection may be a matter of the acceptable uncertainty specified by the agency that sets the action level.

MARSSIM Workgroup Response: This guidance is found in Chapter 4.2.5; however, the workgroup will provide additional clarification in chapter 4 lines 183-189 by moving the first sentence, making the second sentence more iterative, and making the last sentence more understandable.

Recommendation C-2: In Chapter 2, discuss the impact of survey cost and needed skills, instruments, and time on the MARSAME effort. Brief projects obviously need different designs than lengthy ones. Discuss requirement and program for data retention, especially in long projects and when contractors are replaced.

MARSSIM Workgroup Response: The MARSAME document includes several sections on documentation of various portions of the disposition survey process, including existing sections 2.6, 4.5, 5.11, and 6.9. The workgroup will add text in Section 5.11 on data retention for large projects.

While a small lab, university, or simplified site may be considered a small or simple "facility", the difficulty of a MARSAME survey is determined not by the size of the facility, but by the specifics of the materials and equipment to be surveyed. While it may be possible to simplify steps within the Data Quality Objectives process, each step must be considered in order to develop a defensible survey. It is the concern of the workgroup that by simplifying the process too much one may lead to materials and equipment surveys that do not meet the design objectives for the survey.

Recommendation C-3: In Chapter 6, discuss the options to be considered and pursued when the plan proposed initially for M&E transfer is rejected because of the observed contaminant levels.

MARSSIM Workgroup Response: The workgroup will upgrade existing Section 6.8.2 to a more major section, and provide additional text description.

Recommendation C-4: Provide an additional Appendix that summarizes topics in MARSSIM and MARLAP that are important to the MARSAME manual but are insufficiently described in it, or at least give page references to the earlier documents. Such topics may include aspects of quality assurance (e.g., validation

and verification of results), data reliability affected by sample dimensions, measurement frequency, and detector characteristics. Consider also the effect of non-random variability in measurement (e.g., fluctuating geometry or monitor movement rate).

MARSSIM Workgroup Response: The workgroup does not want to reiterate information provided in MARSSIM and MARLAP, as MARSAME is a supplement to MARSSIM. However, the workgroup does want to provide section references to these earlier documents in the appropriate places to facilitate use by the reader (e.g., references to MARSSIM are found in the following existing sections: Roadmap, Chapter 1 (Sections 1, 2, 3, 4, and 6), Chapter 2 (Section 1, 2, and 3), Chapter 3 (Section 3, 6, 8, and 9), Chapter 4 (Section 1, 2, 3, and 4), Chapter 5 (Section 1, 3, 5, 8, 9, and 10), Chapter 6 (Section 2, 5, 6, 8, and 9), Chapter 7 (Section 1 and 3), Appendix D, Appendix G, and the Glossary. References to MARLAP are found in the following existing sections: Roadmap, Section 1.1, Section 1.4, Section 3.8, Section 4.2, Section 5.5, Section 5.6, Section 5.7, Section 5.8, Section 5.10, Section 6.2, Section 6.3, Appendix D, Appendix G, and the Glossary.) The workgroup will review the document for additional locations where section references to MARSSIM and MARLAP would be useful.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 22 2008

THE ADMINISTRATOR

Dr. Bernd Kahn
Chair, Radiation Advisory Committee
Science Advisory Board
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Dr. Kahn:

Thank you for writing to transmit the report developed by the Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual Review Panel of the Science Advisory Board's Radiation Advisory Committee on the *Draft Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual*.

I appreciate the SAB's efforts to convene the MARSAME Review Panel and to complete a comprehensive, technical review of the manual. I am pleased that the Panel found "the MARSAME manual to be an admirable cooperative and competently written effort," both in its technical merit and in the cooperation it represents among four federal agencies in addressing radiological surveys of materials and equipment.

The enclosure summarizes the Agency's responses to your findings and recommendations. Many of your recommendations have already been implemented as the four federal agencies prepare to issue the MARSAME manual in final form.

Sincerely,

A handwritten signature in black ink, appearing to read "Stephen L. Johnson", is written over the typed name.

Stephen L. Johnson

Enclosure

INTRODUCTION

Background

This document responds to recommendations provided by the Science Advisory Board (SAB) in their technical peer review of the draft "*Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual*," Draft Report for Comment, December 2006. The MARSAME manual is considered a supplement to the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), and a complementary document to the Multi-Agency Radiation Laboratory Analytical Protocols (MARLAP) manual. It was jointly developed by four federal agencies represented on the MARSSIM Workgroup: Department of Defense (Air Force, Army, and Navy), Department of Energy, Environmental Protection Agency, and Nuclear Regulatory Commission.

The Radiation Advisory Committee (RAC) of the SAB (augmented for this review) reviewed the draft manual, convened to hear presentations about and discuss recommendations for the manual on October 29-31, 2007, and held a series of teleconference calls October 9, 2007, December 21, 2007, and March 10, 2008 for further refinement of recommendations. A quality review of the Panel's April 24, 2008 draft report was conducted by the chartered SAB on May 29, 2008 in a public teleconference. The final report was issued on August 7, 2008.

Multi-Agency Nature of MARSAME

The MARSSIM Workgroup is governed by a charter that provides each federal agency equal weight in the decisions made by the workgroup. The charter indicates that the consensus of the agencies is required for all major workgroup products. The responses to the SAB detailed in this document therefore indicate the consensus of all four author agencies of MARSAME.

Additional Changes

In addition to responding to recommendations made by the SAB in their technical peer review, the MARSSIM Workgroup will be responding to recommendations received during the public review of MARSAME, conducted from January to May 2007. This will likely result in changes to the final MARSAME in addition to those detailed in the workgroup's responses below. The workgroup intends to review the draft final MARSAME document in October and November 2008. Additional changes may be recommended following this final review, which may modify some of the changes made in response to SAB recommendations.

DETAILED RESPONSES TO EPA SAB Review of Draft *MARSAME*

Charge Question 1: *The objective of the draft MARSAME is to provide an approach for planning, conducting, evaluating, and documenting environmental radiological surveys to determine the appropriate disposition for materials and equipment with a reasonable potential to contain radionuclide concentration(s) or radioactivity above background. Please comment on the technical acceptability of this approach and discuss how well the document accomplishes this objective.*

SAB Recommendation 1-1: Create a sub-section for the discussion that begins in Chapter 1, line 49, to present clearly the concept of simple alternatives to what may appear to the reader to be a major undertaking. Also, in lines 103-111 further define ‘release’ vs. ‘interdiction’ to clarify the distinction between the terms. Follow these paragraphs with sufficient detail and references to later chapters to assure the reader that when M&E is reasonably expected to have little or no radioactive contamination, it can be processed without excessive effort under the MARSAME system. One approach identified subsequently is applying standard operating procedures (SOP’s). Categorization as non-impacted or as class 3 M&E based on historical data also can lead to an appropriately simple process.

MARSSIM Workgroup Response: The workgroup will make lines 49-56 its own paragraph, and provide additional references to where MARSAME discusses SOPs and other simplifications to the process in this and subsequent sections. The workgroup will review the definitions of “interdiction” and “release” and make necessary changes to both the Glossary and existing Chapter 1, lines 103-111.

SAB Recommendation 1-2: Insert a sub-section in Chapter 1 and in appropriate subsequent chapters to consider various degrees of M&E decontamination as part of the available options associated with a MARSAME survey. Storage for radioactive decay can be an option for decontamination.

MARSSIM Workgroup Response: The workgroup will incorporate the clean-as-you-go concept (decontamination during the MARSAME survey) throughout the document; for Chapter 1, the workgroup will incorporate it into existing sections 1.4.3 and 1.4.4. The concept of storage for radioactive decay will be incorporated into existing section 6.8.2 on survey failure.

SAB Report Recommendation 1-3: Insert a paragraph after Chapter 1, line 196, to address use by persons less skilled professionally than defined in a preceding paragraph. Reference to Appendices B, C, and D, would be helpful for such persons. Adding an appendix that includes portions of the MARSSIM Roadmap and Chapters 1 and 2 could provide suitable background information without requiring that all of MARSSIM be read. Presentation of training courses for managers and other generalists with responsibility for MARSAME radiation surveys would be most helpful.

MARSSIM Workgroup Response: The workgroup will add a paragraph to Chapter 1 after line 196 on use by persons with less professional experience than that listed on line 187, and will develop and market training for managers and other decision-makers. The workgroup will not create a new appendix re-stating material found in MARSSIM, because MARSAME is considered a supplement to MARSSIM. The workgroup will, however, add language explaining that additional background information can be found in the MARSSIM Roadmap and Chapters 1 and 2.

Charge Question 1a: *Discuss the adequacy of the initial assessment process as provided in MARSAME Chapter 2, including the new concept of sentinel measurement (a biased measurement performed at a key location to provide information specific to the objectives of the Initial Assessment).*

Recommendation 1a-1: Add to the information sources in Chapter 2, lines 104 – 115, the files (inspection reports, incident analyses, and compliance history) maintained by currently and formerly involved regulatory agencies. Discussion with agency staffs, especially their inspectors, also could be fruitful.

MARSSIM Workgroup Response: The workgroup will include additional information sources as specified in the recommendation in existing Chapter 2, lines 104-155.

Recommendation 1a-2: The listing of complexity attributes in Table 2.1 could include Toxic Substances Control Act (TSCA) materials and hazardous waste.

MARSSIM Workgroup Response: The workgroup will change the fourth entry in Table 2.1, in the "Complexity" row, and the "Questions for Consideration" column to read: "Are there component materials that are inherently radioactive or regulated for their chemical properties(1)?", and add a footnote for (1) that reads: "For example, materials regulated under the Resource Conservation and Recovery Act (40 CFR 261) or the Toxic Substances Control Act (40 CFR 700-766)."

Recommendation 1a-3: In Chapter 1, lines 253 – 259, MARSAME should recognize that sentinel measurements are important because they may represent the entire historical record available for IA. Moreover, the measurements may have been so well planned that considering them "limited data" is misleading without a clear definition of terms. Sentinel measurements are particularly useful to evaluate assumptions based on process knowledge. In Chapter 2, lines 277 – 280, design of a preliminary survey for radioactive contaminants to fill knowledge gaps often depends on the availability of data from sentinel measurements. In some instances, the physical shape of the M&E may limit further survey to sentinel measurements. On the other hand, the MARSAME Manual draft, line 258, is correct in stating that sentinel measurements should not be used alone to justify categorization of M&E as non-impacted, especially when geometric or non-homogeneity limitations in radiation detection are suspected.

MARSSIM Workgroup Response: The workgroup intended for the term “limited” on line 256 to apply to “data collection,” meaning that sentinel measurements are a limited form of survey (e.g., the survey results cannot be used alone to justify a non-impacted decision). The SAB seems to be interpreting the term “limited” as applying to “data” and indicated that the term “limited data” was misleading. The workgroup will remove the term “limited” on line 256. This will not significantly change the meaning of the sentence as intended by the workgroup and will hopefully prevent future confusion amongst users.

Charge Question 1b: *Discuss the clarity of the guidance on developing decision rules, as provided in MARSAME Chapter 3.*

Recommendation 1b-1: The regulations or guidance for radionuclide clearance that define the action levels (AL) discussed in Chapter 3, lines 118 – 120, and listed in Appendix E should be sufficiently inclusive to apply to the usual M&E handled by users with regard to both non-fixed (removable) surface contamination and volumetric (distributed throughout the material) contamination. Tabulate or cite all other known pertinent regulations and guides for this purpose. To the non-fixed surface contamination regulations included in Table E.2 by DOE and Table E.3 by NRC, add the Department of Transportation regulation (U.S. DOT, 49CFR173.443), and guides by states such as New Jersey (State of New Jersey, 2007) and Nevada (State of Nevada, 2001). Include guidance for volumetric contamination clearance, summarized in Table 5.1 of NCRP (2002) from reports of national and international standard-setting groups.

MARSSIM Workgroup Response: The workgroup will only include in Appendix E those requirements approved for inclusion by the author agencies. However, the workgroup will insert "federal" after "some" in existing Chapter 3, line 118. In addition, the workgroup will insert the text, "National and International organizations have published recommendations for action levels (e.g. NCRP 2002, ANSI N13.12). These recommendations may be a useful source of action levels if approved by the appropriate authorities within the regulatory framework of particular sites or facilities."

Recommendation 1b-2: Information that guides decisions for radioactively contaminated M&E, listed in Chapter 3, lines 141 – 147, should include measurements of removable vs. fixed surface contamination to match the distinctions specified in Tables E.2 and E.3. Insert sub-sections that discuss the implications of planning for and responding to measurement of removable vs. fixed and surface vs. volumetric radioactive contamination and the subsequent disposition of M&E according to this categorization (see also RECOMMENDATIONS 2b-3 and 1d-3 for discussion of removable radioactive contaminants).

MARSSIM Workgroup Response: The measurement of removable radioactivity is related to the use of smears. The workgroup will review every Chapter in MARSAME and make changes where needed to reflect the new approach to smears. Thus far, the workgroup has identified several significant changes to the manual in reference to smear

samples: we will include smears as a sentinel measurement in existing Chapter 2; we will include the concept of smears as a method-based action level in existing Chapter 3, and the concept of a method-based survey design in existing Chapter 4; we will include smears as a sampling method and considerations for using smear samples in existing Chapter 5; and we will include the use of a smear sample as a sentinel measurement in an illustrative example in existing Chapter 7.

For existing Chapter 3, the workgroup will include "method-based" in the first box in Figure 3.1, and on page 3-7, put in parentheses after surficial "(fixed and removable)". The workgroup will insert a paragraph after line 92 that discusses method-based requirements or regulations and gives specific examples of action levels. The workgroup will change the title of section 3.3.2 from "Select the Most Restrictive Action Levels" to "Finalize Selection of Action Levels" and also make the change within the flow chart.

Recommendation 1b-3: Maintain the more general tone of MARSAME throughout Chapter 3 while moving detailed discussions of statistical aspects to a separate chapter (see also RECOMMENDATIONS 1c-1 and 2a-1). This approach could remove concerns such as why the Minimum Detectable Concentration (MDC) is recommended for the Measurement Quality Objective (MQO) in Chapter 3, lines 593 – 597, instead of the Minimum Quantifiable Concentration (MQC), and how item #1 differs from item #3 on lines 609 – 617.

EPA Response: The workgroup feels that the general tone of the guidance on statistical aspects in existing Chapter 3 is appropriate for the audience of the manual. Some knowledge and understanding of statistics and statistical matters is required for the user. However, the workgroup will prepare a new chapter on statistics after existing Chapter 6 and include text from Section 4.2, Sections 5.5-5.8, and Appendices F & G. Additional language will be added from SAB Review of Draft *"Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual"* Appendix A.

Charge Question 1c: *Discuss the adequacy of the survey design process, especially the clarity of new guidance on using Scenario B. and the acceptability of new scan-only and in-situ survey designs, as detailed in MARSAME Chapter 4.*

Recommendation 1c-1: In the organization of MARSAME, instead of the current mixture of general guidance about surveillance with detailed presentations of statistical matters, retain in each chapter only a brief and less detailed discussion of statistics. Collect the mathematical discussion in a separate chapter, as proposed above. Chapter 19, Measurement Statistics, in MARLAP should serve as example. The separation will serve both the specialist in statistics, who will appreciate the exposition in the newly added chapter, and readers with less training in statistics who can follow the general import of the MARSAME approach in the existing chapters.

MARSSIM Workgroup Response: The workgroup will summarize the sub-sections in Chapter 4.2 into smaller paragraphs and move the text in Chapter 4.2 into the new statistics chapter after Chapter 6. See response to Recommendation 1b-2 above.

Recommendation 1c-2: The MARSAME manual has emphasized disposition options that, after identification and segregation, lead directly to the disposition survey. Conditioning of the M&E, such as vacuuming, wiping down, chemical etching, and other forms of decontamination should be encouraged for meeting disposition options (see also RECOMMENDATION 1-2). Preliminary measurements are useful for this purpose. The MARSAME manual should provide more detail on these approaches and encourage them as an As Low As Reasonably Achievable (ALARA) policy.

MARSSIM Workgroup Response: The workgroup will incorporate the clean-as-you-go concept (decontamination during the MARSAME survey) throughout the document.

Charge Question 1d: *Discuss the usefulness of the case studies in illustrating new concepts and guidance, as provided in MARSAME Chapter 7.*

Recommendation 1d-1: Delete or replace the example for Standard Operating Procedure (SOP) use in Section 7.2. Given the good discussion in Section 3.10 for improving an SOP within the MARSAME framework, the example of applying SOP's at a nuclear power station appears to contribute little.

MARSSIM Workgroup Response: The workgroup will delete the illustrative example in existing Section 7.2.

Recommendation 1d-2: The example in Section 7.3 of mineral processing of concrete rubble is instructive, but the reader should be informed that many more measurement results than those listed in Table 7.3 are obtained under actual conditions and must be evaluated before making decisions. The radionuclide concentrations reported in Chapter 7, lines 213 – 214, should be confirmed as typical values or replaced by such values, because readers may apply them as default values. For the same reason, the AL taken from a U.S. Nuclear Regulatory Commission document (NUREG-1640; U.S. NRC, 2003) should be identified as a specific selection, not a general limit. Inserting boxes with interpretive comments would help the reader to understand the process used for illustration and the logic leading to the decisions.

MARSSIM Workgroup Response: The workgroup will add text after existing Table 7.3 to explain how the data are being used. Regarding the choice of the action level, the text will include the statement "in this illustrative example" and will change the term "stakeholders" to the "planning team."

Recommendation 1d-3: Insert an introductory statement to place in context the length of the 21-page example devoted in Section 7.4 to a simple baseline survey of a

rented front loader, to avoid discouraging the reader from applying it. This statement should explain that these details are needed to describe the survey process, but that the actual work is brief. This survey provides an opportunity to present the benefit of sentinel measurements and the comparison of removable with fixed surface contamination. An actual case history undoubtedly would show these and also contain a table of survey measurements.

MARSSIM Workgroup Response: The workgroup will include a header paragraph stating what portions of the MARSAME process are being demonstrated for each particular illustrative example. In addition, the use of a smear sample as a sentinel measurement will be incorporated into the illustrative example.

The MARSAME manual emphasizes the planning phase of a survey consistent with the Data Quality Objectives process, and therefore an extensive planning phase may be necessary, depending on the complexity of the material or equipment to be surveyed. Much of the 21-page illustrative example provides the details of this planning phase. While it is anticipated that the emphasis on planning will lead to a streamlined implementation phase, it is also possible that the actual survey selected may require significant time and resources. Therefore, the workgroup is hesitant to make any overarching comments concerning the amount of time that a MARSAME survey will require.

Recommendation 1d-4: Include in each of the illustrative example headings a statement that they are demonstrating the MARSAME process.

MARSSIM Workgroup Response: See response to Recommendation 1d-3 above.

Charge Question # 2: *The draft MARSAME, as a supplement to MARSSIM, adapts and adds to the statistical approaches of both MARSSIM and MARLAP for application to radiological surveys of materials and equipment. Please comment on the technical acceptability of the statistical methodology considered in MARSAME and note whether there are terminology or application assumptions that may cause confusion among the three documents.*

Charge Question # 2a: *Discuss the adequacy of the procedures outlined for determining measurement uncertainty, detectability, and quantifiability, as described in MARSAME, Chapter 5.*

Recommendation 2a-1: Enable the reader to understand the topics in Chapter 5 more clearly by separating the entire mathematically detailed statistical exposition in a chapter that could be entitled “Review of Experimental Design and Hypothesis Testing.” Appendix G can be included in this chapter. The chapter can be placed before Chapter 4. All sections currently in Chapters 4 – 6 that discuss generalized aspects of these topics, including measurement uncertainty, detectability, and quantifiability, can be kept in place; reference should be made to the technical discussions, equations, and tables in the new chapter.

MARSSIM Workgroup Response: The workgroup will prepare a new chapter after existing Chapter 6 and include text from Section 4.2, Sections 5.5-5.8, and Appendices F & G. Additional language will be added from SAB Review of Draft *“Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual”* Appendix A. The workgroup felt that locating the new chapter after existing Chapter 4 would result in breaking up the flow of the document as it follows the survey process, and decided instead to place the new chapter after existing Chapter 6.

For existing Chapter 5, the workgroup will replace sections and sub-sections 5.5-5.8 in the main document with paragraphs describing the general idea and step required, when to use it, limitations on using it, equations (and definitions of variables), and examples. The workgroup will replace challenging example 6 with an example using statistical software as opposed to a differential equation.

Recommendation 2a-2: Consider the comments made in Appendix A concerning the topics of experimental design, hypothesis testing, and the statistical aspects of uncertainty in preparing the separate chapter suggested above.

MARSSIM Workgroup Response: See response to Recommendation 2a-1 above.

Recommendation 2a-3: Move the discussion on setting MQOs, in Sections 5.5 thru 5.9, to Chapter 4 on Survey Design. Organize a summary or guide that focuses on the procedures for setting MQOs and for determining uncertainty, MDC, and MQC. The ability to set Measurement Quality Objectives (MQOs) is an important element of the MARSAME process, but the discussion involving the implementation of MQOs in the design of the three survey types may confuse the reader. Aspects of implementation are immersed in details defining, explaining, and deriving theoretical concepts.

MARSSIM Workgroup Response: See response to Recommendation 2a-1 above.

Charge Question # 2b: *Discuss the adequacy of the data assessment process, especially new assessment procedures associated with scan-only and in-situ survey designs, and the clarity of the information provided in Figures 6.3 and 6.4.*

Recommendation 2b-1: In Fig. 6.3 (See Figure 1 below, which reworks Fig. 6.3), clarify the distinction of a MARSSIM-type survey by moving “Start” to immediately above the decision point “Is the Survey Design Scan-only or *In situ*?” and then connecting this to an inserted decision diamond “Is the AL equal to zero or background?”. A “yes” leads to “Requires scenario B ...” and a “no” leads to “Disposition Decision Based on Mean”

MARSSIM Workgroup Response: The workgroup will make the recommended figure change to existing Figure 6.3.

Recommendation 2b-2: In Fig. 6.4 (See Figure 2 below, which reworks Fig. 6.4), for a more consistent presentation, insert a decision diamond after both “Perform the Sign Test” and “Perform the WRS Test” that says “Scenario A,” followed by a “yes” or “no” leading to the two “Scenario A” and “Scenario B” branches at both locations.

MARSSIM Workgroup Response: The workgroup will make the recommended figure change to existing Figure 6.4.

Recommendation 2b-3: To counteract the discomfort of Multi-agency working group members with the qualitative aspect of wipe tests, the MARSAME manual could recommend evaluations of the removable radionuclide fraction measured by wipe test for the surveyed M&E. These evaluations can include, for example, sequential smears at a given location at the M&E, or smears at adjoining locations performed with different material and pressure, by different persons, and for different radionuclides. Refer to State of Nevada (2001) and State of New Jersey (2007) for a description of the process, to Rademacher and Hubbell (2008) pp. 10, 16 for an application to radiological monitoring, and to U.S. EPA (2007a) for more general applications of the wipe test.

MARSSIM Workgroup Response: The workgroup acknowledges that the use of smears is required for demonstrating compliance with certain regulations, requirements, or license conditions, and the methods prescribed therein should be followed. Quality assurance and quality control procedures should be followed with all sampling and analysis techniques. Specific considerations for utilizing smear samples have been added in new section 5.9.1.3.

Recommendation 2b-4: Insert sub-sections in all chapters to address implementation and assessment of survey processes to distinguish between surface and volumetric contamination (i.e., measurement after surface cleaning or observing the effect of counting geometry) and between removable and fixed surface contamination (i.e., wipe test results compared to total surface activity). These types of contamination are described in Chapter 1, lines 127 – 152, but their implications should be considered throughout the MARSAME manual. Concerns in measuring volumetric contamination include characterizing non-uniformly distributed radionuclides and quantifying radionuclides that emit no gamma rays.

MARSSIM Workgroup Response: See response to Recommendation 1b-2 above.

Charge Question # 2c: *Discuss the usefulness of the case studies in illustrating the calculation of measurement uncertainty, detectability, and quantifiability as provided in MARSAME chapter 7.*

Recommendation 2c-1: Move the detailed derivations, including partial derivatives, identified above to the newly added separate chapter recommended for discussion of experimental design and hypothesis testing.

MARSSIM Workgroup Response: The workgroup will add text to the beginning of Section 7.3.6.4 that the following process is usually conducted through the use of statistical software that is commercially available; however, for the purposes of this illustrative example, this detailed solution is provided. The workgroup would prefer not to move portions of an illustrative example to a chapter on general theoretical statistical concepts. We believe that the illustrative examples should be complete and not split up into separate sections.

Recommendation 2c-2: Use illustrative examples to demonstrate any MARSAME guidance that the multi-agency work group considers difficult to follow. These may include approximating uncertainty (see Chapter 5), distinctions such as interdiction vs. release, and applying scenarios A vs. B.

MARSSIM Workgroup Response: See response to Recommendation 1d-3 above.

Recommendation 2c-3: Use Sections 7.4 and 7.5 to illustrate the benefit of wipe tests for determining removable radioactive surface contaminants. Experience suggests that the contaminant usually is in this form on M&E such as earth-moving equipment.

EPA Response: The workgroup will include an example of a smear as a sentinel measurement in existing Section 7.4.

Charge Question 3: *The draft MARSAME includes a preliminary section entitled Roadmap as well as seven appendices. The goal of the Roadmap is to assist the MARSAME user in assimilating the information in MARSAME and determining where important decisions need to be made on a project-specific basis. MARSAME also contains appendices providing additional information on the specific topics. Does the SAB have recommendations regarding the usefulness of these materials?*

Recommendation 3-1: Roadmap Figure 1 connects the MARSAME chapters in terms of the Data Life Cycle. Consider establishing an analogous connection with Roadmap Figures 2, 3, 5, 6, 7, and 8. At present, the only Roadmap figures connected to each other are Fig. 2, 3, and 4, and 7 with 8.

MARSSIM Workgroup Response: The workgroup will provide connecting information for all of the flowcharts in the final version of the document.

Recommendation 3-2: Consider assisting project managers by highlighting major operational decision points in the roadmaps.

MARSSIM Workgroup Response: The workgroup will provide flags that provide an indication of major decision points within the MARSAME process.

Recommendation 3-3: The roadmap should ensure that the primary components of the process are identified, their relationship to one another is depicted, and the boundaries of application are well-defined, in accord with the DQO process. Figure 3 provided below could be used in the MARSAME roadmap to illustrate application of the DQO process in the MARSAME manual. Realize also that the DQO process is iterative, so that, as in the case of MARSSIM, the MARSAME program should have the potential to improve and update the manual.

MARSSIM Workgroup Response: The workgroup will incorporate Figure 3 from SAB Review of Draft “*Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) Manual*” into the Roadmap.

Recommendation 3-4: Indicate in the body of the text that Appendices B, C, and D are useful overviews of the environmental radiation background, sources of radionuclides, and radiation detection instruments, respectively, for managers and generalists; they may be too general for the experienced health physicist to whom the manual is addressed.

MARSSIM Workgroup Response: See response to Recommendation 1-3 above.

Recommendation 3-5: Insert a table with action level (AL) guidance for volumetric radionuclide contamination in Appendix E (see RECOMMENDATION 1b-1).

MARSSIM Workgroup Response: The workgroup will only include in Appendix E those requirements approved for inclusion by the author agencies. DOE requirements for release of property having residual radioactivity for volume contamination are found in Appendix E, Section E.1.3, with additional guidance in some of the materials referenced in E.1.4. The summary of NRC disposition criteria from current practices for the release of materials and equipment for volumetric radioactivity is found in Appendix E, Table E.3.

Recommendation 3-6: Either move Appendix G into the new chapter on experimental design and hypothesis testing or indicate its relation to that new chapter.

MARSSIM Workgroup Response: See response to Recommendation 2a-1 above.

Recommendation 3-7: Move the Glossary to the front to join the tables of acronyms and of symbols.

EPA Response: The MARSAME document provides glossary definitions of important terms in existing Chapter 1, and then a complete glossary in the back consistent with other similar guidance documents.

Recommendation 3-8: Expand the definition of ‘Interdiction’ in the glossary to clarify its application to receiving or disposing of M&E.

MARSSIM Workgroup Response: The workgroup will review the definitions of “interdiction” and “release” and make necessary changes to both the Glossary and existing Chapter 1, lines 103-111.

Recommendations Beyond the Charge:

Recommendation C-1: In Chapter 3, discuss in the recommended separate chapter on statistics any decisions leading to selecting the degree of confidence, embedded in the choice of significance level α and β values. Selection may be a matter of the acceptable uncertainty specified by the agency that sets the action level.

MARSSIM Workgroup Response: This guidance is found in Chapter 4.2.5; however, the workgroup will provide additional clarification in chapter 4 lines 183-189 by moving the first sentence, making the second sentence more iterative, and making the last sentence more understandable.

Recommendation C-2: In Chapter 2, discuss the impact of survey cost and needed skills, instruments, and time on the MARSAME effort. Brief projects obviously need different designs than lengthy ones. Discuss requirement and program for data retention, especially in long projects and when contractors are replaced.

MARSSIM Workgroup Response: The MARSAME document includes several sections on documentation of various portions of the disposition survey process, including existing sections 2.6, 4.5, 5.11, and 6.9. The workgroup will add text in Section 5.11 on data retention for large projects.

While a small lab, university, or simplified site may be considered a small or simple "facility", the difficulty of a MARSAME survey is determined not by the size of the facility, but by the specifics of the materials and equipment to be surveyed. While it may be possible to simplify steps within the Data Quality Objectives process, each step must be considered in order to develop a defensible survey. It is the concern of the workgroup that by simplifying the process too much one may lead to materials and equipment surveys that do not meet the design objectives for the survey.

Recommendation C-3: In Chapter 6, discuss the options to be considered and pursued when the plan proposed initially for M&E transfer is rejected because of the observed contaminant levels.

MARSSIM Workgroup Response: The workgroup will upgrade existing Section 6.8.2 to a more major section, and provide additional text description.

Recommendation C-4: Provide an additional Appendix that summarizes topics in MARSSIM and MARLAP that are important to the MARSAME manual but are insufficiently described in it, or at least give page references to the earlier documents. Such topics may include aspects of quality assurance (e.g., validation

and verification of results), data reliability affected by sample dimensions, measurement frequency, and detector characteristics. Consider also the effect of non-random variability in measurement (e.g., fluctuating geometry or monitor movement rate).

MARSSIM Workgroup Response: The workgroup does not want to reiterate information provided in MARSSIM and MARLAP, as MARSAME is a supplement to MARSSIM. However, the workgroup does want to provide section references to these earlier documents in the appropriate places to facilitate use by the reader (e.g., references to MARSSIM are found in the following existing sections: Roadmap, Chapter 1 (Sections 1, 2, 3, 4, and 6), Chapter 2 (Section 1, 2, and 3), Chapter 3 (Section 3, 6, 8, and 9), Chapter 4 (Section 1, 2, 3, and 4), Chapter 5 (Section 1, 3, 5, 8, 9, and 10), Chapter 6 (Section 2, 5, 6, 8, and 9), Chapter 7 (Section 1 and 3), Appendix D, Appendix G, and the Glossary. References to MARLAP are found in the following existing sections: Roadmap, Section 1.1, Section 1.4, Section 3.8, Section 4.2, Section 5.5, Section 5.6, Section 5.7, Section 5.8, Section 5.10, Section 6.2, Section 6.3, Appendix D, Appendix G, and the Glossary.) The workgroup will review the document for additional locations where section references to MARSSIM and MARLAP would be useful.