



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

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OFFICE OF
AIR AND RADIATION

Dr. Joan M. Daisey
Chair
Office of the Science Advisory Board
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Dr. Daisey:

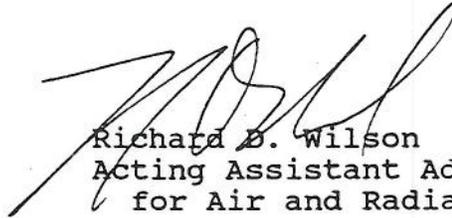
Thank you for the Radiation Advisory Committee's (RAC) report on the Review of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), EPA-SAB-RAC-97-008, dated September 30, 1997.

I would like to commend the MARSSIM Review Subcommittee for the highly professional and expedient effort it put into the MARSSIM review. Thanks in part to the responsiveness and support of the Subcommittee, MARSSIM will be completed on schedule. I would also like to commend the Subcommittee for accommodating a multi-agency review that involved four federal agencies.

I am pleased that the Subcommittee was impressed with the collaborative effort of this multi-agency workgroup. Their success in coming to consensus on the many complex issues addressed in the manual provides a model for future multi-agency efforts. The multi-agency workgroup appreciates the Subcommittee's comments and believes that the resulting changes in MARSSIM have been responsive to those comments. I have outlined the steps taken in response to your comments in the enclosure. We will provide the revised report to you as soon as it is finalized.

Thank you for helping us enhance the field of environmental protection by improving the area of environmental measurements in the Agency and among government agencies. We appreciate your invaluable assistance.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'R. D. Wilson', written over the typed name.

Richard D. Wilson
Acting Assistant Administrator
for Air and Radiation

Enclosure

Enclosure

Agency Responses to the Radiation Advisory Committee's
Recommendations on MARSSIM

Recommendation (a): In general, the Subcommittee found that MARSSIM is nearly a finished product. The multi-agency team is commended for its work in addressing the many complex issues involved, resulting in the compilation of an exceptionally well-prepared reference which is technically sound and which will be a useful tool for guiding final status surveys. The document provides generally consistent and explicit guidance for planning and conducting radiation surveys for the decommissioning of radiologically contaminated sites.

Agency Response: The MARSSIM workgroup appreciates this comment from the Subcommittee and wishes to thank them for their consideration.

Recommendation (b): MARSSIM should discuss its rationale for limiting its scope to guidance for contaminated surface soils and building surfaces. Furthermore, it should more clearly state that radioactive contamination of subsurface soil, surface water, and ground water are explicitly excluded from its coverage. The document should include some discussion of why these particular media were not included, the potential for incorrect decisions if they are not evaluated and the plans, if any, to cover them in the future. Also, MARSSIM should discuss the extent to which it is necessary to evaluate scenarios under which subsurface contamination might be expected to contribute to surface contamination in the future, and how this affects the decision of whether the site meets release criteria.

Agency Response: A table was added and changes were made to the text to clarify the scope. The text has been modified to state that MARSSIM's focus is on surface soil and building surfaces after remediation, which qualifies the scope and explains why subsurface contamination is not included. Models and methods currently used for calculating contaminant concentration for cleanup based on dose or risk generally are focused on surface soil and building surface source terms. Consideration of the impact on other media besides surface soil and building surfaces is addressed, in part, in the current MARSSIM. Further changes may be made if future revisions of the document are developed.

Recommendation (c): Description of field measurement method, instruments, and operating procedures in MARSSIM are technically sound but incomplete. Some additions, clarifications, and corrections are noted in our report. MARSSIM should provide guidance for the development of standardized procedures, including a list of considerations for designing site-specific surface-soil sampling and preparation methods so as to ensure that samples will be representative of the materials of concern

in deriving the derived concentration guideline levels (DCGLs) for the site.

Agency Response: The MARSSIM workgroup agrees with the Subcommittee's recommendation and has made the appropriate additions, clarifications and corrections throughout the text to address the committee's concerns.

Recommendation (d): Descriptions of the selection and operation of radiation detection instruments for laboratory analyses are technically sound and represent standard practice but may not be state-of-the-art. MARSSIM should standardize the level of detail used in its presentation of this material and should also provide information on the planned scope and current status of plans to prepare a manual on Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP). MARLAP may be a more appropriate forum than MARSSIM in which to provide more thorough in-depth guidance to the user on the selection and operation of laboratory instrumentation.

Agency Response: The MARSSIM workgroup has edited the text to standardize the level of detail used in the presentation of the selection and operation of instrumentation. The workgroup agrees with the Subcommittee with respect to the MARLAP being the more appropriate forum for a more detailed presentation of the selection and operation of laboratory instrumentation. The MARSSIM workgroup has been working together with the MARLAP workgroup in a coordinated effort regarding this comment.

Recommendation (e): The Subcommittee believes that it is critically important that the assumptions and procedures used in MARSSIM to make comparisons with the DCGLs match those used in defining the DCGLs. For example, if a DCGL for soil is derived from a dose limit or risk criterion by assuming that a receptor ranges over a certain area on a random basis, then the same area should be used for spatial averaging in the MARSSIM statistical analyses. Such averaging is usually performed from the standpoint of potential human receptors. The manual should note that different spatial and temporal scales of averaging will be necessary if dose- and risk-based criteria are applied to components of the ecosystem other than humans for derivation of a DCGL. This recommendation assumes that the DCGL is derived in a manner appropriate for characterizing human and/or ecological exposures likely to occur at the site under investigation.

Agency Response: The MARSSIM workgroup agrees with the Subcommittee and has added text to the document which emphasizes the recommendation. While ecological exposure endpoints are outside the scope of MARSSIM, the MARSSIM workgroup believes that the principles in MARSSIM could still be applied. In addition, the discussion on assessing survey data has been expanded to

include this concern. While the development of DCGLs is outside the scope of MARSSIM, it is stated in the manual that the survey design should be consistent with the modeling assumptions. To emphasize this recommendation, statements have been added in appropriate places throughout the manual cautioning the user about the modeling assumptions.

Recommendation Report (f): Although MARSSIM is applicable to the majority of contaminated sites, there appear to be cases that MARSSIM, as currently written, would have trouble assessing. These include: 1) cases dealing with the release of sites that had been contaminated with naturally occurring radionuclides and in which the DCGL is contained within the ambient (background) analyte variability, and 2) cases in which a reference background cannot be established. The Subcommittee recommends that future revisions of MARSSIM provide guidance to the user regarding appropriate choices when such conditions are encountered. For example, the null hypothesis might be redefined to be that the distribution of site radioactivity is not different from that at the reference site or than ambient radioactivity in general.

Agency Response: The text has been modified to advise the user to recognize these as unique, site-specific cases requiring attention beyond the scope of MARSSIM.

Recommendation (g): MARSSIM properly warns the user that the DCGL is not free of error and that the uncertainty associated with this quantity may be considerable if derived using generic assumptions and parameter values. However, its discussion of this issue is relegated to an appendix. This important aspect, together with an expanded discussion of its implication for the release decision, needs to be disclosed more prominently in the text of the main document. It is clearly undesirable to design a survey around a DCGL that may not be relevant to the actual conditions at a site, such that actual exposures, doses, and risks would be largely different than those used to derive the generic DCGL. Consequently, MARSSIM should more strongly encourage the user to examine critically the assumptions made in any model used to derive DCGLs for a site in order to determine whether application of site-specific information and parameters would result in significant modifications to the proposed DCGL, or whether development of a site specific model would be warranted in order to obtain a DCGL that is more relevant to the human and ecological exposure conditions prevailing at the site.

Agency Response: The MARSSIM workgroup agrees with the Subcommittee's recommendation and has added a main text reference to Appendix D, where the uncertainty in DCGLs is discussed in more detail.

Recommendation (h): In MARSSIM, the preferred null hypothesis is that a survey unit is not ready for release and the information gathered must be sufficient, with a high degree of confidence, to accept the alternative hypothesis (i.e., that the unit meets the release criteria). Furthermore, MARSSIM discusses in detail two non-parametric procedures, the Wilcoxon Rank-Sum test and the Sign test, for testing this hypothesis. However, MARSSIM allows more flexibility in defining the null hypothesis and in choosing statistical analysis methods to test that hypothesis than may be readily apparent to most readers. The existence of this flexibility needs to be more clearly stated and the criteria for selecting among potential applicable tests need to be described.

Agency Response: As recommended by the Subcommittee, the text has been modified to more clearly present the flexibility of MARSSIM and a discussion of bootstrapping and Bayesian analysis (two techniques suggested by the Subcommittee) have been included.

Recommendation (i): MARSSIM's discussion about the mean and median should be revised in order to ensure that the correct statistical parameter is used to compare concentrations in the survey area to those in the reference area. The target statistic for any exposure assessment should be the arithmetic mean concentration for a defined area, together with the uncertainty associated with the estimate of the mean. For a normally distributed population, the mean and the median are identical in value. However when the distribution of sample evidence is moderately to highly skewed then non-parametric statistical techniques cannot be used to determine the uncertainty associated with the estimate of the arithmetic mean, and the median of such a sample set will underestimate the true arithmetic mean of surface contamination. The majority of soil sampling programs usually reveal highly skewed distributions. Therefore, the Wilcoxon Rank-Sum test and the Sign test, which are appropriate for testing differences in median concentrations, may not be appropriate to test for differences in mean concentrations.

Agency Response: As recommended, the MARSSIM workgroup has modified the text to clarify that the mean is the appropriate parameter for exposure assessments and to further address skewed distributions. A condensed version of the text modification follows:

The Wilcoxon Rank Sum (WRS) test and Sign test are used in MARSSIM to detect a uniform shift in the mean of a distribution of measurements. When the underlying measurement distribution is symmetric, the mean is equal to the median. The assumption of symmetry is less restrictive than that of normality, since a normal distribution is itself symmetric.

Without assuming symmetry in the measurement distribution, the WRS and Sign tests generally produce the correct decisions more often even when the assumption of symmetry is violated than the commonly used Student's t-test, which assumes normality in addition to symmetry of the distribution.

The Elevated Measurement Comparison (EMC) is used, in addition to the WRS and Sign tests, to guard against extremes of asymmetry. When the underlying data distribution is highly skewed, it is often because there are a few high measurements. Since the EMC is used to evaluate these high measurements, the difference between using the median and the mean as a measure of the degree to which uniform residual radioactivity remains in a survey unit diminishes in importance.

Recommendation (j): The guidance provided in MARSSIM may introduce an additional measure of conservatism in the process of setting and determining compliance with radiation cleanup standards, compounding the conservatism already likely to occur in developing default DCGLs. Release decisions may be biased correspondingly. MARSSIM should include a qualitative summary of any biases that may result from its assumptions and policy choices, and recommend that the planning team be similarly revealing when developing a site specific survey design.

Agency Response: The MARSSIM workgroup understands the Subcommittee's concerns regarding compounding conservatism. While the DCGL determination and uncertainty is outside the scope of MARSSIM, Appendix D does discuss this important interface issue. In addition, in response to the subcommittee's concerns, text was added that provides a reference to EPA's Guidance for Data Quality Assessment (EPA QA/G-9) regarding considerations for selecting a particular null hypothesis. A copy of this document was provided to the Subcommittee as a reference for their review of MARSSIM.

Recommendation (k): (Note: The Subcommittee provided the following preface to this comment ... "we offer the following comment on an issue that was outside the scope of our charge but that we felt was important to bring to your attention.") DCGLs are critical for determining the acceptability of residual levels of radioactivity remaining after a site has been remediated. The Subcommittee suggests that the various approaches proposed for derivation of DCGLs (not the individual site-specific DCGLs) be reviewed and evaluated. This evaluation can be performed by an interagency group and by the EPA/SAB. This evaluation should focus on the strengths and weaknesses of current methodologies, and opportunities to refine generic DCGLs with improved site-specific models and data. This review is important but outside the current scope of the SAB/RAC review of MARSSIM *per se*.

Agency Response: The derivation of the various approaches to DCGLs is currently outside the scope of the MARSSIM. There is ongoing work in this important area which the Agency will take into consideration in future revisions of the MARSSIM document. This emerging work could be reviewed and evaluated using an approach similar to the current review of MARSSIM.