

**From:** Rebecca Tadessee <sup>-NMSS</sup>  
**To:** Amy Snyder; Claudia Craig; Stewart Brown } NMSS  
**Date:** 03/04/2002 2:22PM  
**Subject:** License condition and evaluation of subsurface soil

Per the recommendation of the February 25, 2002 meeting with DCB, EPAP and Research staff and management a license condition has been developed. In support to the license condition there are several questions that needs to be addressed.

Attached you will find the proposed license condition and the additional information that will be needed to resolve the subsurface issue.

Thanks  
 Rebecca Tadesse

**CC:** Christopher McKenney; Mark Thaggard } NMSS

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### License Conditions

For all portions of the site with subsurface residual radioactivity, the licensee shall demonstrate prior to the conduct of Final Status Survey, that the following issues have been adequately addressed:

- A. Confirm that the assumption of the contaminated area and the thickness will not exceed a 10,000 m<sup>2</sup> and 1 m in depths of the source term.
- B. Confirm that the spatial variability of the subsurface residual radioactivity distribution is commensurate with conceptual model used to derive the site specific DCGL;
- C. Any subsurface soil volumes characterized by concentrations above the established investigation level will be evaluated and/or remediated for ALARA considerations; and
- D. The process of averaging radionuclide soil concentrations over the entire subsurface soil volume has not resulted in a significant underestimate of the potential dose from portions of the site characterized by concentration above established investigation level.

In support to the above licensee conditions, the following questions needs to be addressed :

1. A clear distinction needs to be made on the sampling methods. All sampling planned according to MARSSIM methodology must be made on a random start and systematic approach, regardless of the classification (A, B, C, which is assumed to be equivalent to the concept used for Class 1, 2, and 3 areas). Not doing so violates the assumption of unbiased measurements used to develop the MARSSIM statistical tests. The use of biased sampling is acceptable as long as the basis is provided using HSA information, site characterization data, and professional judgment. However, the MARSSIM statistical tests cannot be applied to the set of biased results. **Item D**
2. The MARSSIM statistical tests (WRS or Sign) on subsurface soil sample results should be performed for each data set representing a single soil layer (at 1, 2, and 3-meter depth) and then in the aggregate by pooling all results as one data set in determining whether the survey unit meets the DCGL. **Items C and D**
3. The discussion on the number of subsurface soil samples taken in Class A, B, and C areas needs to provide the basis for the specified number of samples, i.e., 31 locations times each one-meter depth interval from the surface to bedrock for a total of 93 samples. For example, the basis for the number of samples needs to state whether it is based on the "central limit theorem," or founded on MARSSIM methodology addressing the LBGR, shift, sigma for the expected contaminants, and Type I and II decision error rates. Similarly, the discussion should outline conditions on biased sampling locations and sampling density using current information. The discussion should identify a preliminary number of bias samples taking into account contamination depth profiles of

the areas being considered using HSA information, site characterization data, and professional judgment. **Item D**

4. The proposed sampling method should define the investigational level and what type of follow-up actions will be taken if the investigation level is exceeded. The investigation level should be set at some fraction of the surface or Groundwater DCGLs. **Item C and D**
5. The discussion needs to define the conditions that set the size of subsurface areas for each Class A, B, and C survey unit identified in the LTP. The discussion should identify whether the size of the areas is based on ground water or subsurface soil concentrations, dose model in deriving DCGLs, known locations of plume fronts for expected radionuclide contaminants, or area-weighted average based on known depths of contaminants. **Item D**
6. The proposed sampling method should acknowledge and commit to consider a triangular sampling grid, as it is better suited than a square grid in identifying areas of elevated contamination and in fitting site conditions. **Items C and D**

**The following areas need to be addressed in order to make the proposed sampling methodology acceptable:**

1. The proposed approach refers to both subsurface soil sampling "or" measurements interchangeably, without stating conditions when sampling or measurements will be conducted. The use of "well logging" needs to be elaborated upon as to its method, instrumentation, investigational levels, etc. These aspects need to be explained since the associated survey methods and DQOs are expected to be quite different than those used for surface measurements.
2. For its implementation, the sampling method should discuss how "refusals" and poor core or split-spoon "recovery" will be addressed. If refusal is encountered during drilling, there must be some provisions specifying the conditions for relocating the drill rig to a new nearby location and still meet the intent of MARSSIM. In addressing sample recovery, the method must specify the conditions (minimum percent recovery required) that would void the sample and require that a new core be obtained. Without such a provision, situations may be encountered where a core sample with poor recovery might be used to characterize radionuclide concentrations over the full 1-m depth. For example, a soil sample may only characterize a 10-cm soil segment, but yet the results might be interpreted as the mean concentration over the full 1-m depth. The sampling method needs to address this possibility and how it will be dealt procedurally in the field.
3. Clarify that during sampling the horizontal extent will also be considered. Also the investigational criteria as to what the delta will be in between measurements needs to be explained both in text and figure.
4. Justify why 5% is adequate for analyzing Hard to Detect radionuclides when the most of the contamination of concern is Sr-90. Also clarify if the horizontal and vertical investigation would include the Hard to Detect radionuclides.

**From:** Amy Snyder  
**To:** Stewart Brown  
**Date:** 03/05/2002 4:36PM  
**Subject:** Fwd: License condition and evaluation of subsurface soil

In preparation for tomorrow's meeting on this topic, I reviewed the subject email. See attached file- my questions/ comments are in yellow highlight. (sub35.wpd). I have incorporated my suggestions- (most of which have been shared with Rebecca last week) based on my current understanding. I have a lot of questions -which I hope can be answered tomorrow.

Sincerely,  
Amy Snyder

**CC:** Christopher McKenney; Claudia Craig; Mark Thaggard; Rebecca Tadessee

License Conditions

For all portions of the site with subsurface residual radioactivity, the licensee shall demonstrate prior to the conduct of Final Status Survey, that the following issues have been adequately addressed:

Why is only subsurface residual radioactivity being called out, when no other media is fully characterized yet?

- A. Confirm that the assumption of the contaminated area and the thickness will not exceed a 10,000 m<sup>2</sup> and 1 m in depths of the source term . (If the DCGLs for surface soil are applicable to subsurface soil now, then I believe this is a characterization issue - what remains at the time of final status survey (technically - at the time of license termination). ;
- B. Confirm that the spatial variability of the subsurface residual radioactivity distribution is commensurate with conceptual model used to derive the site specific DCGL (I believe that EPAB said that the surface soil DCGLs are applicable to the subsurface soil now- this is a characterization issue - what remains at the time of final status survey (technically - at the time of license termination);
- C. Any subsurface soil volumes characterized by concentrations above the established investigation level (established investigation level - should this go in a license condition?) will be evaluated and/or remediated for ALARA considerations (- investigation level for surface soil is a scanning measurement. If the subsurface is remediated (contaminated soil excavated, then I would see it would be appropriate to scan the excavation surface and use the DCGL<sub>emc</sub> before backfill. This would do two things 1) "chasing of the contamination" 2) indicate when the licensee can stop digging vertically and horizontally. what remains the time of final status survey (technically - at the time of license termination). In addition, I believe that the GEIS already covers ALARA for soil remediation; and
- C. The process of averaging radionuclide soil concentrations over the entire subsurface soil volume has not resulted in a significant underestimate of the potential dose from portions of the site characterized by concentration above established investigation level. (This is a characterization and data evaluation issue. If the present model applies, then the way I understand it is that the concentration over the volume is of importance.)

Please see my draft SER discussion on characterization below- I believe they will address A,B, C and D above:

The licensee plans to develop more extensive characterization efforts and expand information collected from its initial characterization efforts. Concurrent with site characterization and the conceptualization of the site, decommissioning activities are taking place. In Section 5.3 and Section 5.9 of the LTP, the licensee has committed to produce documented and detailed

radiological survey plans, using the DQO process; and associated data evaluation reports produced from subsequent RSSI surveys (e.g., operational, characterization, and remedial action support surveys). This documentation and supporting data will be available for NRC review. Characterization is not complete until the model used to determine the DCGLs does not change. Therefore, NRC expects that the licensee will provide documentation for each survey area before FSS implementation that clearly demonstrates that each survey area was fully characterized, the classification of the survey unit is appropriate, contamination was removed, as appropriate, and the model used for determining DCGLs remains appropriate for final status survey.

The staff will review the licensee's characterization (RSSI survey) plans and associated reports to: 1) assess whether the licensee has demonstrated that the full nature and extent of the site has been (radiologically) characterized; 2) assess whether the licensee demonstrated on a statistical basis that the characterization data are sufficiently representative of the waste and contaminated environmental media; 3) determine whether the licensee has demonstrated whether the characterization results are sufficient to support evaluation of reasonable decommissioning approaches; and 4) assess whether the licensee adequately used characterization data in the FSS design. If the staff finds that the licensee's characterization is not adequate, then the NRC will document its findings in a inspection report and pursue follow-on corrective action. In conclusion, the licensee's continuing efforts to finalize the site characterization will be a focus of future NRC inspections (announced and unannounced) to ensure that all activities comply with NRC requirements.

**In support to the above licensee conditions, the following questions needs to be addressed :**

1. A clear distinction needs to be made on the sampling methods. All sampling planned according to MARSSIM methodology (is CY using MARSSIM methodology? I thought the statistics that are used- dictates such conditions. CY has stated in the LTP that they want to remain open to other statistically methods and if they want to pursue them CY will prepare a technical basis document for NRC approval ( Section 1.5 of the LTP- NRC approval is necessary.) must be made on a random start and systematic approach, regardless of the classification (A, B, C, which is assumed to be equivalent to the concept used for Class 1, 2, and 3 areas). Not doing so violates the assumption of unbiased measurements used to develop the MARSSIM statistical tests. The use of biased sampling is acceptable as long as the basis is provided using HSA information, site characterization data, and professional judgment. However, the MARSSIM statistical tests cannot be applied to the set of biased results. **Item D** NRC should ask the licensee what statistics it plans on using and then how it will establish sampling locations.
2. The MARSSIM statistical tests (WRS or Sign) on subsurface soil sample results should be performed for each data set representing a single soil layer (at 1, 2, and 3-meter depth) and then in the aggregate by pooling all results as one data set in determining whether the survey unit meets the DCGL. **Items C and D** (Again, I think the model for surface soil -which I believe the modelers said is okay to use for subsurface is dependent on the volume concentration.- why would this matter if NRC reviews the characterization data and finds it adequate and also finds the model adequate?

3. The discussion on the number of subsurface soil samples taken in Class A, B, and C areas needs to provide the basis for the specified number of samples, i.e., 31 locations times each one-meter depth interval from the surface to bedrock for a total of 93 samples. For example, the basis for the number of samples needs to state whether it is based on the "central limit theorem," or founded on MARSSIM methodology addressing the LBGR, shift, sigma for the expected contaminants, and Type I and II decision error rates. (Agree- The licensee has committed to use the DQO process for site characterization and RSSI surveys. This should also apply to subsurface sampling. The licensee should provide the basis for the number of samples (31, etc) and the associated DQOs- which should be documented- especially for FSS.) NRC should ask the licensee to provide the basis for the number of samples and this information can be explained or referenced in the LTP. My feeling is that the number of samples should be statistically based.) Similarly, the discussion should outline conditions on biased sampling locations and sampling density using current information. The discussion should identify a preliminary number of bias samples taking into account contamination depth profiles of the areas being considered using HSA information, site characterization data, and professional judgment. (This information should go into a sampling and analysis project plan not a LTP or Program level plan. Characterization plans are based on scoping surveys and biased sampling according to MARSSIM.)  
**Item D**
4. The proposed sampling method should define the investigational level and what type of follow-up actions will be taken if the investigation level is exceeded . The investigation level should be set at some fraction of the surface or Groundwater DCGLs. **Item C and D** (see my comment above under 2)
5. The discussion needs to define the conditions that set the size of subsurface areas for each Class A, B, and C survey unit identified in the LTP. The discussion should identified whether the size of the areas is based on ground water or subsurface soil concentrations, dose model in deriving DCGLs, known locations of plume fronts for expected radionuclide contaminants, or area-weighted average based on known depths of contaminants. **Item D** (NRC should ask the licensee to provide a basis for the size of the units- at minimum I believe that the characterization and post remediation data (if applicable) must be evaluated so that the results are statistically significant)
6. The proposed sampling method should acknowledge and commit to consider a triangular sampling grid, as it is better suited than a square grid in identifying areas of elevated contamination and in fitting site conditions. **Items C and D**

Concurrent with site characterization and the conceptualization of the site, decommissioning activities are taking place. Meaning they plan on cleaning up as they go along. They could go and remove the major areas of subsurface contamination. Get post remediation data of the excavation area before they back fill and then write a sampling and analysis plan for characterization - that may be appropriate for the final status survey. That is why I believe it is important to review for acceptability- the characterization data (if the licensee gives it to NRC after the FSS-then the risk is on the licensee.) The area of particular concern - subsurface area in the RCA where the 3 tanks leaked. MARSSIM states in Section 5.5.2.4 that a systematic sampling grid may be either triangular or square. The triangular grid is generally more efficient for locating small areas of elevated activity (In reading page D-23 of MARSSIM - It appears to me

that is largely based on surface scanning- I have not read the EPA reference document yet- so I am not sure. Appendix D MARSSIM includes a brief discussion on the efficiency of triangular and square grids for locating areas of elevated activity. A more detailed discussion is provided by EPA (EPA 1994b). Therefore, I do not think that using a square grid or a triangular grid is important considering the CY will be decommissioning concurrent with site characterization.

**The following areas need to be addressed in order to make the proposed sampling methodology acceptable:**

1. The proposed approach refers to both subsurface soil sampling "or" measurements interchangeably, without stating conditions when sampling or measurements will be conducted. The use of "well logging" needs to be elaborated upon as to its method, instrumentation, investigational levels, etc. These aspects need to be explained since the associated survey methods and DQOs (assumes DQOs are to be used -see my comment under 3 above) are expected to be quite different than those used for surface measurements. (Agree)
2. For its implementation, the sampling method should discuss how "refusals" and poor core or split-spoon "recovery" will be addressed. If refusal is encountered during drilling, there must be some provisions specifying the conditions for relocating the drill rig to a new nearby location and still meet the intent of MARSSIM. In addressing sample recovery, the method must specify the conditions (minimum percent recovery required) that would void the sample and require that a new core be obtained. Without such a provision, situations may be encountered where a core sample with poor recovery might be used to characterize radionuclide concentrations over the full 1-m depth. For example, a soil sample may only characterize a 10-cm soil segment, but yet the results might be interpreted as the mean concentration over the full 1-m depth. The sampling method needs to address this possibility and how it will be dealt procedurally in the field. For any medium, not just for subsurface samples, this should be addressed regarding placement of sampling grid and sampling points to depth of sampling points. I believe this concept can be addressed in the LTP in general provided it is detailed in specific sampling and analysis plans and reflected and documented in the DQO process.
3. Clarify that during sampling the horizontal extent will also be considered. This should be clarified and the basis for horizontal sampling- the licensee said they were going to do this. Also the investigational criteria as to what the delta will be in between measurements needs to be explained both in text and figure (detailed specifics- like a figure should go in a sampling and analysis plan not a LTP.)
4. Justify why 5% is adequate for analyzing Hard to Detect radionuclides when the most of the contamination of concern is Sr-90. Also clarify if the horizontal and vertical investigation would include the Hard to Detect radionuclides. (Agree- 5% is not consistent with MARSSIM- I will ask the Licensee this concerning other types of sampling. MARSSIM recommends at least 10%.)