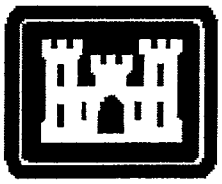
ADMINISTRATIVE RECORD
FOR THE MADISON SITE
MADISON, ILLINOIS

Community Relations-

Written Public Comments and Corresponding Responses to Comments



US Army Corps
of Engineers
St. Louis District

STATE OF ILLINOIS
DEPARTMENT OF NUCLEAR SAFETY
1035 OUTER PARK DRIVE • SPRINGFIELD, ILLINOIS 62704
217-785-9900 • 217-782-6133 (TDD)

George H. Ryan
Governor

Thomas W. Ortciger
Director

February 25, 2000

Ms. Sharon R. Cotner
FUSRAP Program Manager
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Ms. Cotner:

The Illinois Department of Nuclear Safety (Department) appreciates the opportunity to provide comments on the reports, "Remedial Investigation Report and Feasibility Study for the Madison Site" and "Proposed Plan for the Madison Site." The reports describe remediation alternatives and the proposed plan for the cleanup of residual uranium contamination at the Madison, Illinois site currently occupied by Spectrulite Consortium, Inc.

Cleanup of the Madison site is being pursued under the management of the Formerly Utilized Sites Remedial Action Program (FUSRAP.) The U. S. Corps of Engineers (Corps) has been authorized to implement this work under the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) pursuant to Public Law 106-60.

I have enclosed the Department's comments, and look forward to the Corps' response. If you have any questions, please contact Gary McCandless at (217) 782-1329.

Sincerely,

Joseph G. Klinger, Chief
Division of Radioactive Materials

cc: Paul Lake, IEPA
Spectrulite Consortium, Inc.

The following is the basis for the Department's determination, as quoted from DG-4006:

> *"... assume that current land uses in the area will be continued for the period of the dose assessment (1000 years). If a site-specific scenario or screening group will be used for structures, a description of the reasonable use of the structure after license termination for the projected lifetime of the structure should be provided. (If the lifetime cannot be estimated, 70 years, as used in the GEIS, may be used.)"*

The Corps must reassess potential worker dose, and conduct the required risk assessment for future-resident scenarios, including all inherent exposure pathways. Since the proposed remediation plan calls for the property to be released for unrestricted use, the Corps must demonstrate the long-term suitability and effectiveness of the proposed cleanup.

The "post demolition" segment of the required 1000-year dose assessment period should assume that the entirety of the structure's residual radioactivity is transferred to surficial soil after the building is demolished. The assumed "footprint" of the contaminated soil may consider scattering due to demolition and grading, but should not exceed 200% of the original contaminated area of the building (not the entire building.) RESRAD and DandD codes can then be used to model the estimated dose from all pathways. Surficial soil is defined as being the topmost 15 centimeters. MARSSIM does not address subsurface soil contamination beneath 15 centimeters. RESRAD is appropriate for modeling.

Assessment Methodology

The Corps has inappropriately and inadequately applied NRC guidance to set the cleanup criteria. The Corps applied dose conversion factors (DCFs) from NUREG-1640, *"Radiological Assessments for Clearance of Equipment and Materials From Nuclear Facilities,"* which is, in essence, a feasibility study. The goal of the modeling in NUREG-1640 is to produce estimates of potential radiation exposure to critical-group individuals engaging in specific scenarios describing the recycling of contaminated solid materials. The produced DCFs were modeled using Monte Carlo computer techniques, employing highly-variable parameters to describe material characteristics and "flow" -- parameters that were highly customized for specific individual exposure scenarios. The DCFs are invalid for scenarios that do not conform precisely to the modeled scenario; therefore, the DCFs are inappropriate for generic assessment of dose from remediation activities.

In NUREG-1640, the NRC acknowledges that:

1. the chosen assessment approach is a "specific" approach, that *"... is open to criticism that the chosen scenarios are too limited because they do not specifically represent other situations of interest,"*
2. *"... many individual parameters are required to describe the scenario details"*

"If other computer models are used to estimate the DCGL, the licensee should provide sufficient information to the NRC to allow review of the model, scenarios, and parameters."

The Corps should also note that some licensees misuse MARSSIM in their decommissioning analyses. The Department has not determined that the Corps has misapplied MARSSIM, however, to preclude any potential misapplication, the Department recommends familiarity with the limitations of MARSSIM. MARSSIM methodology is designed, not to establish remediation standards, but to statistically demonstrate, at the completion of remediation, that a site has been satisfactorily cleaned-up to established regulatory standards. Please note of the following quotes:

"Several issues related to releasing sites are beyond the scope of MARSSIM. These include translation of dose or risk standards into radionuclide specific concentrations." (MARSSIM, pg. 1-3.)

"Other contaminated media (e.g., sub-surface soil, building materials, ground water) and the release of contaminated components and equipment are also not addressed by MARSSIM." (MARSSIM, pg. 1-3.)

"Environmental pathway modeling and ecological endpoints in modeling are beyond the scope of MARSSIM." (MARSSIM, pg. 1-8.)

"The process described in MARSSIM begins with the premise that a release criterion has already been provided in terms of measurement quantity." (MARSSIM, pg. 2-2.)

"While the derivation of DCGLs is outside the scope of MARSSIM..." (MARSSIM, pg. 2-3.)

ALARA Analyses

The Corps contends that *"...[t]he difficult to access areas do not contribute to dose exceeding 25 mrem/yr"* (page 3-4, "Feasibility Study for the Madison Site.") This statement is suppositious, since the Corps has failed to adequately characterize the contamination in these areas, and has failed to perform adequate risk assessments that cover the scenarios and time periods required by the NRC.

The Department is also concerned that ALARA analyses could be misused to justify not cleaning all areas to comply with required radiological criteria. It is unclear whether the Corps has misapplied ALARA analyses. To preclude misapplication, the following summary of the NRC requirements is provided.

The requirements of the NRC rule, as well as the guidance in DG-4006, emphasize the distinction between (1) meeting the dose criteria and (2) meeting ALARA objectives. It is clearly stated in DG-4006 (page 22) that *"...a licensee must demonstrate that the dose*

regulatory requirements applicable when they were licensed by the NRC; they are presently required to comply solely with Illinois regulations.

The Corps' argument that Illinois termination and decommissioning *"... requirements must be identical to the standards of 10 CFR 20 Subpart E..."* is erroneous. The NRC has established the compatibility for this rule as Compatibility-C, not Compatibility-A, as stated by the Corps. Under Compatibility-C requirements, Agreement State regulations may be more restrictive than the NRC rules, but may not be less restrictive *(i.e., less protective.)*

Current NRC regulations do not apply to the Madison site. Illinois rules on radiological criteria for license termination are "relevant and appropriate since the activities conducted at the site and the resulting contamination are similar to those..." currently requiring an Illinois license. If the Corps disagrees with this as an historical argument, note that any similar current decontamination operations within the State of Illinois requires Department license authorization, since the possession, use and handling of radioactive material is involved. Illinois decontamination requirements are therefore "relevant and appropriate." *[See 32 Ill. Adm. Code, Sections 330.320(d)(1)(B), 330.320(d)(3) and 330.320(e) for the pertinent sections of this ARAR.]*

Source Term

The Department is encouraged that the Corps has collected additional samples to further characterize contaminated areas. The first step described in decommissioning guidance is the characterization of the radiactive contamination ("source term" or "source"), upon which all subsequent assessments are based. The Department has not been satisfied with the source characterization at the Spectrulite facility, due to the unvalidated assumptions of contamination levels at the upper tiers of the facility. The Department hopes that the Corps has now collected the samples necessary to demonstrate statistical representation of all contaminated areas. The Department is witholding a determination on this issue until the new sampling results and statistical analyses have been documented by the Corps.

SPECTRULITE CONSORTIUM INC.

618-452-5190

February 29, 2000

Sharon Cotner
U.S. Army Corps of Engineers
FUSRAP Project Office
9170 Latty Avenue
Berkeley, Missouri 63134

Dear Ms. Cotner:

Please find attached the Spectrulite Consortium Inc. and United Steelworkers Local 4804 comments regarding the Madison FUSRAP Site. Spectrulite and the Steelworkers are submitting concurrent comments to reflect the mutually inclusive nature of this issue to both parties. If there are any question please feel free to contact me at (618) 452-5190 EXT. 207.

Respectfully,

Craig Rathgeb
Environmental Engineer

SPECTRULITE CONSORTIUM INC.

Joint Comment of Spectrulite Consortium and the United Steelworkers Local 4804 to the United States Army Corp of Engineers regarding the Madison (Illinois) Formerly Utilized Sites Remedial Action Program

Spectrulite Consortium Inc. ("Spectrulite") and the United Steelworkers Local 4804 ("Steelworkers") are submitting these joint comments to the United States Army Corp of Engineers regarding the Madison (Illinois) Formerly Utilized Sites Remedial Action Program activities.

Before addressing the specifics of the chosen remediation plan, some general comments are appropriate with regard to the January 2000 *Remedial Investigation Report, and Feasibility Study for the Madison Site* (*"Report"*). First, Spectrulite and its employees strive to operate the facility in compliance with all laws and regulations applicable to it. Spectrulite and the Steelworkers work to act as responsible corporate citizens in all aspects of its operations.

Second, although the *Report* at page 1 intimates that Spectrulite is affiliated with Dow Chemical and/or Mallinckrodt Chemical, such is not the case. There is not now, nor has there ever been any affiliation between Spectrulite and those Companies. Further, Spectrulite never participated in any activity on behalf of the Atomic Energy Commission which gave rise to this program. Any statements to the contrary are incorrect.

Turning then to the chosen remedial option, Spectrulite and the Steelworkers agree with the assessment that there is no current risk to the general public regarding the conditions at the site. Although Spectrulite and the Steelworkers may disagree with the assumptions used to assess risk to utility workers, both agree that it is prudent to remove all of the remaining contamination at the Madison Site that poses a risk to worker health and safety. This option is the most appropriate to address any residual risk which may exist relative to AEC projects at the site, and remove any concerns regarding future activities, including future use or demolition and allow for the unrestricted use of the building by Spectrulite and any subsequent owners or

SPECTRULITE CONSORTIUM INC.

operators. Further, this option is most protective of the environment. In concept, Spectrulite and the Steelworkers are supportive of Alternative #4 of the Proposed Plan (Decontamination of Accessible Surfaces and Release of the Building) to remediate the facility structures, equipment, and other potential areas of contamination, to a degree that the facility shall be released for unrestricted use leaving Spectrulite Consortium Inc., or the facility's subsequent owners, and/or operators, with no liability associated with the contamination, no property easements, and with no other restrictions that limit the buildings use and maintenance. However, Spectrulite and the Steelworkers agree that the U.S. Army Corps of Engineers must expand the remediation to include the upper levels (monitors) of the building in order to remove the potential risk to Spectrulite employees presented by the AEC project contamination. Spectrulite and the Steelworkers disagree with USACE determination that the upper levels are inaccessible and therefore do not warrant remediation.

Spectrulite and the Steelworkers appreciate this opportunity to comment on this matter. As collateral participants and stakeholders, Spectrulite and the Steelworkers will cooperate with USACE, to the extent feasible, to affect a positive outcome for this project.

Sincerely,

Chris A. Barnes — Chris A. Barnes — 2-28-00
Chief Operating Officer — Date

Don Devany — Don Devany — 2/28/00
President, United Steelworkers Local 4804 — Date

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
9170 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

March 17, 2000

Formerly Utilized Sites Remedial Action Program

SUBJECT: Transmittal of USACE Responses to IDNS Comments on the Final Madison Site Remedial Investigation/Feasibility Study and Proposed Plan, January 2000

Mr. Gary McCandless, Head
LLW Licensing and Site Decommissioning
Illinois department of Nuclear Safety
1035 Outer Park Drive
Springfield, Illinois 62704

Dear Mr. McCandless:

Enclosed please find our responses to your comments dated February 25, 2000, on the Final Madison Site Remedial Investigation/Feasibility Study and Proposed Plan. These responses were extracted from the Responsiveness Summary section of the Record of Decision being developed for the site.

At your request, we are providing these responses prior to the scheduled public issuance (May 18, 2000) of the Record of Decision. These enclosed responses will still be considered draft until such time that they are published in the final Record of Decision for the Madison Site.

If you have any questions or comments concerning this plan, please contact Mr. Jim Moos at (314) 524-2069.

Sincerely,

Sharon R. Cotner
FUSRAP Program Manager

Enclosures
CC: Mr. Craig Rathgeb, Spectrulite Consortium, Inc.

Following are the responses to the Illinois Department of Nuclear Safety comments on the Madison Site RI/FS/PP. The official version of these comments and responses will be documented in the Responsiveness Summary of the forthcoming Record of Decision for this site.

Comment 1—The Department agrees with the U. S. Army Corps of Engineers (Corps) that removal of the contamination at the Madison facility is the only responsible remediation approach presented in the Remedial Investigation Report. However, the Corps has not demonstrated that the proposed scope of removal is protective of public health, as required by Department and NRC rules and guidance. The Department can not determine the adequacy of the proposed scope of removal, since the submitted dose/risk assessments are inadequate, inappropriate or incomplete.

Response 1— USACE has concluded that the dose/risk assessments presented in the RI/FS and supplemented by the analysis presented in this comment response are adequate and appropriate. The scope of the remedial action will result in a plant condition that is protective of the average member of the critical group (i.e., utility workers) and is in accordance with NRC rules and guidance.

Comment 2—The NRC's Draft Regulatory Guide DG-4006, Demonstrating Compliance with the Radiological Criteria for License Termination, provides guidance for a licensee to demonstrate that a site is suitable for release in accordance with the radiological release criteria in 10 CFR Part 20. DG-4006 describes the methods acceptable to the NRC for implementing the requirements in Subpart E, 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use." If the Corps considers the NRC rule and guidance to be ARAR, then the guidance in DG-4006 must be applied. The Corps has acknowledged an obligation to comply with the NRC rules and guidance, yet fails to implement the guidance as described in DG-4006.

Response 2—The FS references use of DG-4006 and NUREG-5512, among others, in developing the site assessments. USACE recognizes that all analyses do not follow default scenarios as defined in NUREG documents (and associated support documents). These default scenarios are neither fully reasonable nor appropriate for the Madison Site. All analyses are site specific. For example, the default building occupancy scenario used by the DandD code is not intended for exposure to overhead contamination on support beams located 7+ meters above the ground. USACE has concluded (using a conservative model) that a utility worker is the critical group and that this approach is consistent with NRC guidance.

Comment 3—The Corps has described risk assessments covering building use and worker exposure over a period of 25 years. DG-4006 (page 5) calls for a 70-year building-use period, with the remainder of the recommended 1000-year dose-assessment period being based on the assumption that the property is used by resident members of the public (e.g., after the building is demolished). The Corps has inadequately assessed the dose to the first critical group (workers) and has entirely ignored the second critical group (residents).

The Corps must reassess potential worker dose, and conduct the required risk assessment for future-resident scenarios, including all inherent exposure pathways. Since the proposed remediation plan calls for the property to be released for unrestricted use, the Corps must demonstrate the long-term suitability and effectiveness of the proposed cleanup.

The "post demolition" segment of the required 1000-year dose assessment period should assume that the entirety of the structure's residual radioactivity is transferred to surficial soil after the building is demolished. The assumed "footprint" of the contaminated soil may consider scattering due to demolition and grading, but should not exceed 200% of the original contaminated area of the building (not the entire building). RESRAD and DandD codes can then be used to model the estimated dose from all pathways. Surficial soil is defined as being the topmost 15 centimeters. MARSSIM does not address subsurface soil contamination beneath 15 centimeters. RESRAD is appropriate for modeling.

Response 3—IDNS is correct in stating that the default building life is 70 years as specified in DG-4006. The assumptions made for purposes of analysis in the RI/FS is that an individual could have a reasonable maximum exposure (RME) duration of 25 years which is commonly used and a widely accepted RME value for a commercial/industrial receptor. The RI/FS conservatively assumes that an individual works in the historical AEC-funded process areas for all of those 25 years performing the same duties. This use of the 25-year exposure duration has no impact on the final dose calculations. The 10 CFR Part 20, Subpart E limit is 25 mrem total effective dose equivalent (TEDE), which is based on assigning a lifetime dose from an intake in the year the intake is received. Additionally, Federal Guidance Report No. 11 dose conversion factors were used in the FS (pg. A-2 of the FS). These dose conversion factors are based on a 50-year committed effective dose equivalent. Therefore, all lifetime doses from intakes of radioactive material will be accounted for in the worker's 25 year exposure duration.

Also, it is USACE's position that this time frame applies to building use for the purposes of defining all reasonable building exposure scenarios (industrial, commercial, office, etc.) that are likely to occur within that time. The remaining use of the building is expected to be the current industrial scenario for a maximum duration of 25 years followed by demolition or dismantlement of the building. Since the facility is over 50 years old, the assumption of continued industrial use for 25 more years exceeds the useful life of 70 years recommended by DG-4006. In summary, the USACE has complied with the recommendations of DG-4006 concerning building use by evaluating an industrial exposure scenario for the remaining building life and evaluating scenarios for demolition and dismantlement after the building has exceeded its useful life.

The following USACE evaluation of the future resident scenario at 1000 years, including all inherent exposure pathways documents that a potential resident's exposure would be negligible both now and 1000 years into the future.

> Data show that the average total uranium concentration in dust on the difficult to access areas is 36 pCi/g and covers about 150 m^2 horizontal surface area (Class 1). The post-remedial Class 1 concentration in the lower areas could be a maximum

of 20 pCi/g total uranium in dust covering about 2800 m^2 horizontal surface area. The average total uranium concentration in dust the remaining areas (i.e., Class 2 areas) is 9.9 pCi/g covering about 1500 m^2 horizontal surface area. Using these concentrations and areas, the weighted average concentration in dust is calculated as follows:

$$[9.9 \text{ pCi/g} \times (1500/4450)] + [36 \text{ pCi/g} \times (150/4450)] + [20 \text{ pCi/g} \times (2800/4450)] = 17.1 \text{ pCi/g}$$

Based on characterization data, this dust material is 0.8 cm thick (before remediation) making the total volume of the material (0.008 m) × (4450 m^2) = 35.6 m^3. It was assumed this dust material was scraped from the overhead steel beams, spread over an area of approximately 10,000 m^2 (the RESRAD default), and tilled into the top 0.15 m (6 inches) of soil. The concentration is adjusted using these parameters as follows:

$$\text{Soil Concentration (pCi/g)} = 17.1 \text{ pCi/g} \times [35.6 \text{ m}^3 / (0.15 \text{ m} \times 10{,}000 \text{ m}^2)] = 0.40 \text{ pCi/g.}$$

This total uranium concentration would contribute negligibly to the natural uranium in soil of 1.8 pCi/g (adding approximately 0.19 pCi/g of U-238, 0.20 pCi/g of U-234, and 0.01 pCi/g of U-235). The resultant maximum dose modeled using RESRAD Version 5.95 and all the standard defaults with all pathways is 0.04 mrem at 1000 years. It should also be noted that the overhead horizontal surface is estimated to be about 20% of the original contaminated area of the building; therefore, the actual Class 1 and 2 areas in the building cover about (4450 m^2)/(0.2) = 22,250 m^2.

A copy of the RESRAD Summary Report is provided in Attachment 3.

Comment 4—The Corps has inappropriately and inadequately applied NRC guidance to set the cleanup criteria. The Corps applied dose conversion factors (DCFs) from NUREG-1640, *Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities*, which is, in essence, a feasibility study. The goal of the modeling in NUREG-1640 is to produce estimates of potential radiation exposure to critical-group individuals engaging in specific scenarios describing the recycling of contaminated solid materials. The produced DCFs were modeled using Monte Carlo computer techniques, employing highly-variable parameters to describe material characteristics and "flow" – parameters that were highly customized for specific individual exposure scenarios. The DCFs are invalid for scenarios that do not conform precisely to the modeled scenario; therefore, the DCFs are inappropriate for generic assessment of dose from remediation activities. Due to the extreme variability of parameters from one scenario to another, the DCFs provided in NUREG-1640 can be applied only under specific circumstances where the material characteristic and "flow" exactly match one of the scenarios described in the report. If a valid DCF is required for a different scenario, it must be derived by modifying the modeling characteristics. The Corps has not demonstrated the validity of generically using the DCFs as described in the proposal.

Response 4—NUREG-1640 was not used to estimate dose to the critical group. Appendix A of the FS (Page A-2) states "...incorporates generic modeling analysis guidance for NRC contained in NUREG/CR-5512..." and the "TEDEs were calculated using exposure-to-dose conversion factors from Federal Guidance Report 11...". Guidance from NUREG-5512 and dose conversion factors from FGR 11 were used to estimate the dose to the utility worker (a member of the critical group), a worker on the facility floor, and a remediation worker. Dose to a worker dismantling the building is modeled as a subset to the remediation worker and, therefore, also uses guidance from NUREG-5512 and FGR 11. Doses to other non-critical group receptors including demolition and steel recycle workers were also evaluated for completeness. The demolition and recycle workers were modeled using NUREG-1640 dose conversion factors and a simple scaling factor based on exposure time. Both scenarios are assumed to be recycle scenarios and are consistent with scenarios modeled in NUREG-1640. The actual worst case source term expected after remediation is 17.1 pCi/g, approximately 4 times below the modeled value. In summary, the models presented in the RI/FS overestimate dose and risks to account for uncertainties by using reasonable and appropriate, yet conservative, receptor assumptions.

NRC guidance identified by IDNS were used in the dose analysis, as appropriate, including NUREG-1640, NUREG-5849, NUREG-1575 (MARSSIM), NUREG-5512 and supporting documents, and NUREG-1507. DG-4006 was used to perform the ALARA analysis in Section 3 of the FS, but was not included in the references.

Comment 5—The Corps should also note that some licensees misuse MARSSIM in their decommissioning analyses. The Department has not determined that the Corps has misapplied MARSSIM, however, to preclude any potential misapplication, the Department recommends familiarity with the limitations of MARSSIM. MARSSIM methodology is designed, not to establish remediation standards, but to statistically demonstrate at the completion of the remediation that a site has been satisfactorily cleaned-up to established regulatory standards.

Response 5—Comment noted. The analysis in the RI/FS shows what the risk would be from some level of contamination. USACE used guidance from MARSSIM and NUREG-5849, where appropriate, to design the RI survey and did not intend for the RI to serve as the final status survey plan or a vehicle for presenting the final status survey. The final status survey plan detailing application of MARSSIM by USACE at the Madison Site was provided to IDNS in March 2000 for their review.

Comment 6—The Corps contends that " . . . [t]he difficult to access areas do not contribute to dose exceeding 25 mrem/yr" (page 3-4, Feasibility Study for the Madison Site.") This statement is suppositious, since the Corps has failed to adequately characterize the contamination in these areas, and has failed to perform adequate risk assessments that cover the scenarios and time periods required by the NRC.

Response 6—USACE completed a supplemental assessment on March 8, 2000 of the material in the Difficult to Access Areas. This assessment (see Attachment 1 – Dose Assessment for Difficult-to-Access Areas at the Madison Site) shows that the dose from the material in the

Difficult-to-Access Areas would be less than the ARAR dose criteria using reasonable and applicable exposure scenarios.

Comment 7—The Department is also concerned that ALARA analyses could be misused to justify not cleaning all areas to comply with required radiological criteria. It is unclear whether the Corps has misapplied ALARA analyses. Any reference to "remediation action(s)" in Section 3.1 (and its subsections) applies only to further ALARA remediation actions, not to the primary remediation actions required to meet the regulatory dose criteria of 10 CFR 20.1402 and 20.1403 (the subject of Regulatory Position 1, DG-4006, page 2).

Response 7—USACE believes it has used the ALARA analysis as intended. The analysis was used to justify that no further action is required. As noted in response to Comment No. 6, the dose from the material in the difficult to access areas is less than the ARAR dose criteria. See Attachment 2 – Madison Site ALARA Analysis, which demonstrates further action, is not required, as it would be prohibitively expensive in accordance with Section 3.4 of DG-4006.

Comment 8—Illinois rules regarding radiological criteria for license termination are "relevant and appropriate" since the activities conducted at the site and resulting contamination are similar to those currently requiring an Illinois license. Current NRC regulations do not apply to the Madison Site. Illinois rules on radiological criteria for license termination are "relevant and appropriate since the activities conducted at the site and the resulting contamination are similar to those . . ." currently requiring an Illinois license. If the Corps disagrees with this as an historical argument, note that any similar current decontamination operations with the State of Illinois requires Department license authorization, since the possession, use and handling of radioactive material is involved. Illinois decontamination requirements are therefore "relevant and appropriate."

Response 8—The NRC issues licenses to "receive title to, receive, possess, use, transfer, or deliver source and byproduct materials" in accordance with 10 CFR 40 for source materials (e.g., uranium) pursuant to the provisions of the Atomic Energy Act.

The NRC rules on radiological criteria for license termination, set forth at 10 CFR Part 20, Subpart E, Radiological Criteria for License Termination, establish dose criteria that are applicable when a licensee terminates its license. At Madison, possession and processing of uranium at the site was not performed under an NRC license, and thus the rule is not applicable. However, the provisions in 10 CFR 20 Subpart E are considered relevant and appropriate. Source material license requirements would have applied at Madison had it not been specifically exempted from such license requirements. This is particularly true given that the authority of the State of Illinois is derived from the NRC pursuant to "Agreement State" provisions authorized under the Atomic Energy Act (subsequent to the processing that occurred at Madison) and that all federal agencies must necessarily be licensed by the NRC rather than by Agreement States.

The dose criteria provisions under 10 CFR 20 Subpart E, indicate a site can be released for unrestricted use if the residual radioactivity would result in a dose of less that 25 mrem to the

average member of the critical group and the residual radioactivity has been reduced to ALARA levels.

The rules of the State of Illinois regarding radiological criteria for license termination, while not applicable, were carefully evaluated for relevancy and appropriateness. In evaluating the use of the State of Illinois regulations, two factors were considered: (1) the date when the State of Illinois was granted "Agreement State" status and (2) the compatibility of State regulations with NRC standards. First, the State of Illinois was granted "Agreement State" status by the NRC in the early 1980s pursuant to Section 274 (b) of the Atomic Energy Act. The State of Illinois subsequently promulgated regulations with standards for protection against radiation, 32 Ill. Adm. Code 340 et seq. pursuant to the Illinois Radiation Protection Act of 1990, 420 ILCS 40/16. This state regulation established standards for protection against radiation resulting from activities conducted pursuant to Agreement State licenses and product registrations issued by the Illinois Department of Nuclear Safety. These actions occurred a number of years after uranium processing was conducted at Madison. The site was never licensed by the State of Illinois for uranium. Secondly, Agreement States are now required to make their release standards compatible with the NRC' s. Illinois statutes have not, as yet, been updated to incorporate the provisions of 10 CFR 20 Subpart E and, therefore, are not currently compatible. The policy of the NRC, promulgated under the authority of Section 274 (j)(1) of the Atomic Energy Act, requires State standards for release limits be compatible with those of the Commission unless Federal statutes provide the State authority to adopt different standards. A deadline of three years from the promulgation of the NRC radiological criteria, which became effective on July 21, 1997, was established. Thus Illinois, which has not revised its standards to make them compatible with those of the Commission, should be in the process of doing so, with a final deadline of July 21, 2000. This response action will be performed at approximately the same time that the State standards are required to be changed and, therefore, while the State standards may be considered relevant, they are not considered to be appropriate for this response action. In the best professional judgment of USACE, it is inappropriate to alter the selected remedy on the basis of a state regulation that is in the process of being changed to conform to the NRC standard, and for which the legal deadline for such change will occur at almost the identical point in time that the remedial action will occur.

The contaminant of concern is processed natural uranium (i.e., chemically separated uranium with normal isotopic abundances). The State of Illinois does not have a generic guideline concentration for processed natural uranium in soil or dust. Existing Illinois surface contamination guidelines consist of total activity for alpha emitters of 1,000 dpm/100 cm sq., averaged over any one surface, and 5,000 dpm/100 cm sq., maximum, with removable activity guidelines of 33 dpm/100 cm sq., average, over any one surface, and 100 dpm/100 cm sq., maximum. These guidelines are corollary to NRC criteria in NRC Regulatory Guide 1.86 which are not legally promulgated standards and can not be imposed on Agreement States for implementation. Similarly, the corresponding Illinois Standards have not been fully promulgated and thus are not "relevant and appropriate" for processed natural uranium in soil or dust.

Comment 9—The Department is encouraged that the Corps has collected additional samples to further characterize contaminated areas. The first step described in decommissioning guidance is the characterization of the radioactive contamination ("source term" or "source"),

upon which all subsequent assessments are based. The Department has not been satisfied with the source characterization at the Madison facility, due to the invalidated assumptions of contamination levels at the upper tiers of the facility. The Department hopes that the Corps has now collected the samples necessary to demonstrate statistical representation of all contaminated areas. The Department is withholding a determination on this issue until the new sampling results and statistical analyses have been documented by the Corps.

Response 9—USACE has completed additional sampling and performed a supplemental risk assessment of the Difficult-to-Access Areas. The results of this assessment are enclosed. (Attachment 1).

ATTACHMENT 1

DOSE ASSESSMENT FOR DIFFICULT-TO-ACCESS AREAS

AT THE MADISON SITE

An Employee-Owned Company

To: Dennis Chambers/USACE St. Louis District Office
Jim Moos/USACE St. Louis District Office
From: David A. King/SAIC
Date: March 8, 2000
Re: Dose Assessment for Difficult to Access Areas at the Madison, Illinois Site

As requested, John Waddell completed a dose/risk assessment using the radio-analytical data collected on February 2, 2000 from the difficult to access areas of the Madison Site. Included in this new data are isotopic uranium results from seven sample locations. The sample locations were distributed in overhead structures above the area containing the uranium extrusion press, which is the area most likely to have elevated uranium concentrations. The purpose of this memorandum is to present both the data from the aforementioned sampling event and the assumptions and results from the dose/risk assessment.

ANALYTICAL RESULTS

Attachment A lists the preliminary analytical results as reported by the FUSRAP Analytical Laboratory. The data listed in Attachment A is preliminary; however it is not anticipated that the validation process will change the results. The larger of "REG", "SPLT" or "REPL" values under the *Sample Type* heading were conservatively used in dose/risk calculations. The dose/risk calculations were performed using only isotope-specific data, specifically U-234, U-235, and U-238. Gross alpha and gross beta results were not used in calculations. Concentration values were used in the dose/risk calculations as listed under the *Results* heading without consideration of standard error, or MDA. The data are summarized in Table 1 below, listing sample identification numbers, sample locations, isotopic concentrations, and total uranium concentrations.

The beam/sample locations presented in Table 1 are shown in Figure 1. Figure 1 is based on the hand-drawn map used by field personnel during the sampling event. Figure 1 is not drawn to scale, but does illustrate the distribution of sampling locations in relation to previous sampling events and the extrusion press. For a comparison to previous sampling locations and concentration results (from lower/accessible beams in the study area) see Figure 1-4 from the Feasibility Study (USACE 2000).

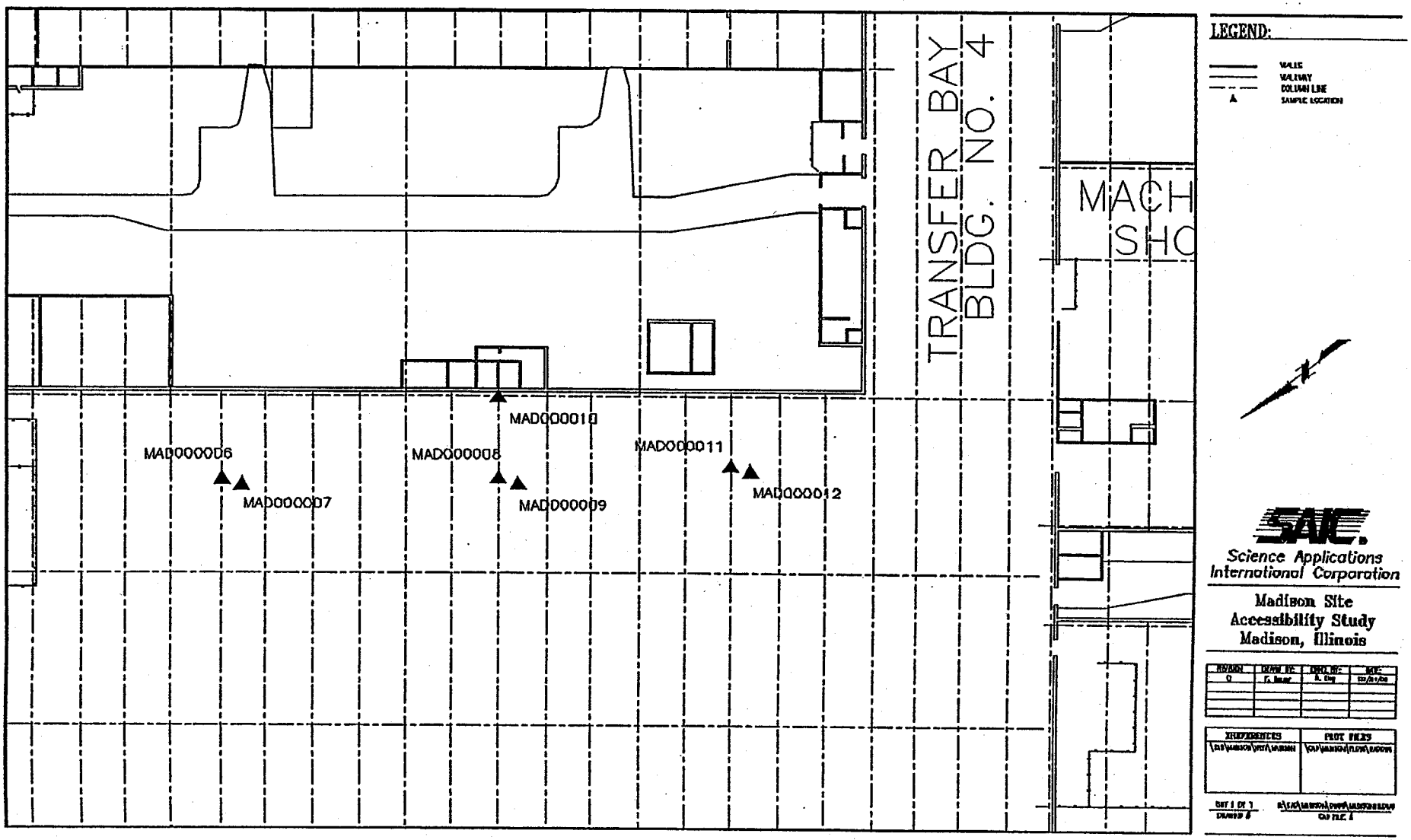


Figure 1. Approximate Sample Locations for Difficult to Access Areas

Table 1. Isotopic Uranium Results Summary Table

Sample ID	Beam/Sample Location	U-234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)	Total U [a] (pCi/g)
MAD00006	59-1	5.77	0.14	5.92	11.83
MAD00007	59-2	2.20	0.32	2.84	5.36
MAD00008	53-1	59.70	2.67	61.2	123.57
MAD00009	53-2	5.68	0.35	5.80	11.83
MAD00010	53-3	1.49	0.12	1.81	3.42
MAD00011	48-1	42.54	1.82	44.71	89.07
MAD00012	48-2	3.01	0.14	4.00	7.15
				Average =	36.0

[a] Sum of U-234, U-235 and U-238 results.

All values listed as reported by the analytical laboratory, with two digits to the right of the decimal.

DOSE ASSESSMENT METHODOLOGY

Appendix A from USACE 2000 presents the dose/risk assessment methodology for exposure to uranium contamination on the support beam and cross member surfaces in the study area. This assessment focuses on site workers on the facility floor, utility workers in the beams and trusses no higher than 36 ft above the floor, and remediation workers. The assessment also evaluates a building demolition worker, a building dismantlement worker, and a steel recycle worker exposed to uranium contaminants in the lower beams and trusses. The assessment does not address the difficult to access areas high (45 to 60 ft) above the facility floor. The omission of the higher areas occurred in part due to a lack of data and in part because there appears to be little reason for an individual to be exposed to potential contamination 45 to 60 ft above the facility floor.

Since USACE 2000 was issued, the USACE has collected samples from the higher areas. In addition, interviews with site workers have revealed that an individual spends no more than four hours per year in the difficult to access areas. Therefore, dose and risk estimates were performed using the following information:

1. The newly acquired data from the difficult to access areas;
2. The exposure frequency estimates for utility, demolition, dismantlement and steel recycle workers; and
3. The assessment methodology from Appendix A of the Feasibility Study (USACE 2000).

To estimate dose and risk from exposure to contaminants in the difficult to access areas, the estimates presented in USACE 2000 were scaled based on occupancy and contaminant concentrations. The scaling factors are explained below and are presented with dose plus risk results for each potential receptor.

Utility Worker

USACE 2000 reports a dose of 210 mrem/yr if the utility worker is exposed to an average concentration of 70.9 pCi/g total uranium. The average concentration in the difficult to access area (as presented in Table 1) is 36.0 pCi/g total uranium. All other things being the same, the utility workers dose would be adjusted by a factor of (36.0/70.9) when exposed only to the difficult to access areas. The 210 mrem/yr estimate also assumes the worker is exposed for 20 hr/yr. This exposure frequency is considered overly conservative for the difficult to access areas, whereas a 2 to 4 hr/yr frequency more closely represents central tendency and maximum exposure frequency and is supported by interviews with site workers. An exposure frequency scaling factor of 2/20 to 4/20 is therefore applied to adjust dose estimates. Using these factors, the dose to the utility worker while working in the difficult to access areas is estimated as follows:

$$\text{Dose (mrem/yr)} = (210 \text{ mrem/yr}) \times (36.0/70.9) \times (2/20) = 10.7 \approx 11 \text{ mrem/yr}$$

or

$$\text{Dose (mrem/yr)} = (210 \text{ mrem/yr}) \times (36.0/70.9) \times (4/20) = 21.3 \approx 21 \text{ mrem/yr}$$

Using the same method to adjust the original risk estimate of 5.3×10^{-4}, risk in the difficult to access areas are estimated to be 2.7×10^{-5} for a 2 hr/yr exposure or 5.4×10^{-5} for a 4 hr/yr exposure.

Demolition Worker

The demolition worker is intended to represent an individual who helps knock down the building. This individual would likely have little direct contact with contaminants on beams or trusses on any level. However, a dose estimate is presented in USACE 2000 assuming the average total uranium concentration is 70.9 pCi/g on all surfaces, which results in a dose of 0.03 mrem and a risk of 1.5×10^{-8}. For this assessment, it is assumed that the surfaces below the difficult to access areas are remediated to an average of 20 pCi/g (the site DCGL), which represents 95% of the total surface area. It is also assumed that the average concentration in the difficult to access areas is 36.0 pCi/g, which represents the remaining 5% of the total surface area. Using these conservative assumptions, the resulting average total uranium concentration is $[(20\times0.95) + (36\times0.05)] = 20.8$ pCi/g and the scaling factor is (20.8/70.9). The dose and risk estimates for the demolition worker are calculated as follows:

$$\text{Dose (mrem)} = 0.03 \text{ mrem } \{[(20\times0.95) + (36\times0.05)]/70.9\} = 0.03 \times (20.8/70.9) = 0.009 \text{ mrem}$$

and

$$\text{Risk (lifetime}^{-1}) = 1.5\times10^{-8} \times (20.8/70.9) = 4.4\times10^{-9}$$

These estimates demonstrate that the demolition worker would likely receive an insignificant dose and risk if exposed to the contaminants in the difficult to access areas.

Dismantlement Worker

The dismantlement worker is assumed to be similar to the remediation worker evaluated in USACE 2000 with two noted differences. First, the dismantlement worker is assumed to be exposed to an average of 20.8 pCi/g total uranium, as described above. Second, dismantlement worker is expected to have less direct contact with contaminated surfaces while disassembling (rather than decontaminating) the building. An exposure reduction of 25% is assumed for this assessment. Given that the remediation worker's estimated dose is 150 mrem, the dismantlement worker dose is estimated as follows:

$$\text{Dose (mrem/yr)} = 150 \text{ mrem} \times (0.25) \times (20.8/70.9) = 11 \text{ mrem}$$

Given that the work is performed over a one year period and using the dose-to-risk conversion factor of 5×10^{-7} per mrem (as used in USACE 2000), the risk to the dismantlement worker is estimated as follows:

$$\text{Risk (lifetime}^{-1}) = 11 \text{ mrem} \times 5\times10^{-7} \text{ mrem}^{-1} = 5.5\times10^{-6}$$

Steel Recycle Worker

The steel recycle worker in USACE 2000 is estimated to receive a dose of 0.91 mrem and have a lifetime risk of 4.6×10^{-7} when exposed to an average of 70.9 pCi/g of total uranium. This worker could handle metal beams and trusses in the scrap yard and could be exposed to contaminants from both the lower and difficult to access areas. Using the surface area fractions as described above and assuming that the lower surfaces are remediated to an average of 20 pCi/g, the steel recycle worker's dose and risk are estimated as follows:

$$\text{Dose (mrem/yr)} = 0.91 \text{ mrem} \times (20.8/70.9) = 0.27 \text{ mrem}$$

and

$$\text{Risk (lifetime}^{-1}) = 0.27 \text{ mrem} \times 5\times10^{-7} \text{ mrem}^{-1} = 1.4\times10^{-7}$$

As with the demolition worker, the steel recycle worker would likely receive an insignificant dose and risk if exposed to the contaminants in the difficult to access areas.

SUMMARY

The dose and risk assessment results using the data presented in Table 1 (and listed in the attachment) are shown below in Table 2. These estimates were calculated using scaling factors to adjust the dose and risk results from USACE 2000.

Table 2. Dose and Risk Estimates Using Data from the Difficult to Access Areas of the Madison Site

Receptor	Dose (mrem)	Risk [a] (lifetime^{-1})
Utility Worker [b]	11 to 21	3×10^{-5} to 5×10^{-5}
Demolition Worker	0.009	4×10^{-9}
Dismantlement Worker	11	6×10^{-6}
Steel Recycle Worker	0.27	1×10^{-7}

[a] All risk estimates rounded to one significant digit.
[b] Estimates for 2 and 4 hr/yr exposure frequencies are provided. Dose is yearly rate for utility worker (mrem/yr)

REFERENCES

USACE, 2000. *Remedial Investigation Report and Feasibility Study for the Madison Site, Madison, Illinois*, St. Louis District Office, January.

BC#LTSM011550

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George H. Ryan
Governor

Thomas W. Ortciger
Director

March 16, 2000

Michael R. Morrow, Colonel
U. S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Colonel Morrow:

I appreciate the Corps' solicitation of the views of the Illinois Department of Nuclear Safety (Department) during the review of the FUSRAP project in Madison, Illinois. As you may know, the Department has submitted comments (enclosed) at various times on the Remedial Investigation Report, Feasibility Study, and Proposed Plan for cleanup of the Madison Site. While we agree with the Corps that removal of contamination is the only responsible remediation approach, there remains a difference of opinion in the extent of the cleanup. Efforts have been made to address some of our comments, yet there remains a lack of commitment by the Corps to completely remediate all contaminated areas at the site.

The State of Illinois' position on this matter is clearly articulated in the Department's comments, and we urge you to reconsider them when finalizing your Record of Decision. Both the Department and the Corps have an obligation to the citizens of Illinois to ensure that the long-term effectiveness of the cleanup is protective of public health and the environment. This is true especially when one considers that the property will be released for unrestricted use in the future.

Any questions you may have can be addressed to me at 217/ 785-9868.

Sincerely,

Thomas W. Ortciger
Director

TWO:bac
Enclosures

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George H. Ryan
Governor

Thomas W. Ortciger
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February 25, 2000

Ms. Sharon R. Cotner
FUSRAP Program Manager
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Ms. Cotner:

The Illinois Department of Nuclear Safety (Department) appreciates the opportunity to provide comments on the reports, "Remedial Investigation Report and Feasibility Study for the Madison Site" and "Proposed Plan for the Madison Site." The reports describe remediation alternatives and the proposed plan for the cleanup of residual uranium contamination at the Madison, Illinois site currently occupied by Spectrulite Consortium, Inc.

Cleanup of the Madison site is being pursued under the management of the Formerly Utilized Sites Remedial Action Program (FUSRAP.) The U. S. Corps of Engineers (Corps) has been authorized to implement this work under the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) pursuant to Public Law 106-60.

I have enclosed the Department's comments, and look forward to the Corps' response. If you have any questions, please contact Gary McCandless at (217) 782-1329.

Sincerely,

Joseph G. Klinger, Chief
Division of Radioactive Materials

cc: Paul Lake, IEPA
Spectrulite Consortium, Inc.

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Illinois Department of Nuclear Safety

Comments on FUSRAP Project

February 25, 2000

"Remedial Investigation Report and Feasibility Study for the Madison Site"

and

"Proposed Plan for the Madison Site"

U. S. Army Corps of Engineers, St. Louis District

The Department agrees with the U. S. Army Corps of Engineers (Corps) that removal of the contamination at the Spectrulite facility is the only responsible remediation approach presented in the Remedial Investigation Report. However, the Corps has not demonstrated that the proposed scope of removal is protective of public health, as required by Department and NRC rules and guidance. The Department can not determine the adequacy of the proposed scope of removal, since the submitted dose/risk assessments are inadequate, inappropriate or incomplete.

The NRC's Draft Regulatory Guide, DG-4006, *"Demonstrating Compliance with the Radiological Criteria for License Termination,"* provides guidance for a licensee to demonstrate that a site is suitable for release in accordance with the radiological release criteria in 10 CFR Part 20. DG-4006 describes the methods acceptable to the NRC for implementing the requirements in Subpart E, 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use." If the Corps considers the NRC rule and guidance to be ARAR, then the guidance in DG-4006 must be applied. The Corps has acknowledged an obligation to comply with the NRC rules and guidance, yet fails to implement the guidance as described in DG-4006.

Inadequate Assessment

The Corps has described risk assessments covering building use and worker exposure over a period of 25 years. DG-4006 (page 5) calls for a 70-year building-use period, with the remainder of the recommended 1000-year dose-assessment period being based on the assumption that the property is used by resident members of the public (e.g., after the building is demolished.) The Corps has inadequately assessed the dose to the first critical group (workers) and has entirely ignored the second critical group (residents.)

The following is the basis for the Department's determination, as quoted from DG-4006:

> *"... assume that current land uses in the area will be continued for the period of the dose assessment (1000 years). If a site-specific scenario or screening group will be used for structures, a description of the reasonable use of the structure after license termination for the projected lifetime of the structure should be provided. (If the lifetime cannot be estimated, 70 years, as used in the GEIS, may be used.)"*

The Corps must reassess potential worker dose, and conduct the required risk assessment for future-resident scenarios, including all inherent exposure pathways. Since the proposed remediation plan calls for the property to be released for unrestricted use, the Corps must demonstrate the long-term suitability and effectiveness of the proposed cleanup.

The "post demolition" segment of the required 1000-year dose assessment period should assume that the entirety of the structure's residual radioactivity is transferred to surficial soil after the building is demolished. The assumed "footprint" of the contaminated soil may consider scattering due to demolition and grading, but should not exceed 200% of the original contaminated area of the building (not the entire building.) RESRAD and DandD codes can then be used to model the estimated dose from all pathways. Surficial soil is defined as being the topmost 15 centimeters. MARSSIM does not address subsurface soil contamination beneath 15 centimeters. RESRAD is appropriate for modeling.

Assessment Methodology

The Corps has inappropriately and inadequately applied NRC guidance to set the cleanup criteria. The Corps applied dose conversion factors (DCFs) from NUREG-1640, *"Radiological Assessments for Clearance of Equipment and Materials From Nuclear Facilities,"* which is, in essence, a feasibility study. The goal of the modeling in NUREG-1640 is to produce estimates of potential radiation exposure to critical-group individuals engaging in specific scenarios describing the recycling of contaminated solid materials. The produced DCFs were modeled using Monte Carlo computer techniques, employing highly-variable parameters to describe material characteristics and "flow" -- parameters that were highly customized for specific individual exposure scenarios. The DCFs are invalid for scenarios that do not conform precisely to the modeled scenario; therefore, the DCFs are inappropriate for generic assessment of dose from remediation activities.

In NUREG-1640, the NRC acknowledges that:

1. the chosen assessment approach is a "specific" approach, that *"... is open to criticism that the chosen scenarios are too limited because they do not specifically represent other situations of interest,"*
2. *"... many individual parameters are required to describe the scenario details"*

3. *"... [e]ach of the parameter values in the scenario must be defended as technically sound..."*
4. the scenario assessments do not employ a "generic" approach *"... that can be taken as representative of a wide range of possible exposure circumstances..."* and
5. the modeling *"... does not attempt to model the details of any specific, real-world situation."*

Due to the extreme variability of parameters from one scenario to another, the DCFs provided in NUREG-1640 can be applied only under specific circumstances where the material characteristics and "flow" exactly match one of the scenarios described in the report. If a valid DCF is required for a different scenario, it must be derived by modifying the modeling parameters to represent the actual proposed activity and material flow characteristics. The Corps has not demonstrated the validity of generically using the DCFs as described in the proposal.

Rather than using NUREG-1640 or any other inappropriate methodology, the Corps should use pertinent documents as identified in NRC decommissioning guidance:

NUREG/CR-5512 *"Residual Radioactive Contamination from Decommissioning -- Technical Basis for Translating Contamination Levels to Annual Effective Dose Equivalent"* (Describes acceptable methods to calculate DCGL values)

NUREG-1549 *"Decision Methods for Dose Assessment to Comply With Radiological Criteria for License Termination"* (Particularly relevant stepwise methodology for assessment decisions)

Draft Regulatory Guide DG-4006 *"Demonstrating Compliance with the Radiological Criteria for License Termination"* (Supersedes NUREG-1500)

NUREG-1575 *"Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)"*

NUREG-1505 *"A Nonparametric Statistical Methodology for the Design and Analysis of the Final Status Decommissioning Survey"*

While other methodologies are not expressly prohibited, the Corps should take note of the following admonitions from DG-4006:

"If DandD is used to estimate the DCGL, the licensee should provide to the NRC a copy of the report generated by DandD to verify the version of DandD that was used in the analysis. Information on site characterization should be provided to show that DandD is applicable for the site conditions."

"If other computer models are used to estimate the DCGL, the licensee should provide sufficient information to the NRC to allow review of the model, scenarios, and parameters."

The Corps should also note that some licensees misuse MARSSIM in their decommissioning analyses. The Department has not determined that the Corps has misapplied MARSSIM, however, to preclude any potential misapplication, the Department recommends familiarity with the limitations of MARSSIM. MARSSIM methodology is designed, not to establish remediation standards, but to statistically demonstrate, at the completion of remediation, that a site has been satisfactorily cleaned-up to established regulatory standards. Please note of the following quotes:

"Several issues related to releasing sites are beyond the scope of MARSSIM. These include translation of dose or risk standards into radionuclide specific concentrations." (MARSSIM, pg. 1-3.)

"Other contaminated media (e.g., sub-surface soil, building materials, ground water) and the release of contaminated components and equipment are also not addressed by MARSSIM." (MARSSIM, pg. 1-3.)

"Environmental pathway modeling and ecological endpoints in modeling are beyond the scope of MARSSIM." (MARSSIM, pg. 1-8.)

"The process described in MARSSIM begins with the premise that a release criterion has already been provided in terms of measurement quantity." (MARSSIM, pg. 2-2.)

"While the derivation of DCGLs is outside the scope of MARSSIM..." (MARSSIM, pg. 2-3.)

ALARA Analyses

The Corps contends that *"...[t]he difficult to access areas do not contribute to dose exceeding 25 mrem/yr"* (page 3-4, "Feasibility Study for the Madison Site.") This statement is suppositious, since the Corps has failed to adequately characterize the contamination in these areas, and has failed to perform adequate risk assessments that cover the scenarios and time periods required by the NRC.

The Department is also concerned that ALARA analyses could be misused to justify not cleaning all areas to comply with required radiological criteria. It is unclear whether the Corps has misapplied ALARA analyses. To preclude misapplication, the following summary of the NRC requirements is provided.

The requirements of the NRC rule, as well as the guidance in DG-4006, emphasize the distinction between (1) meeting the dose criteria and (2) meeting ALARA objectives. It is clearly stated in DG-4006 (page 22) that *"...a licensee must demonstrate that the dose*

criteria of Subpart E have been met and must demonstrate whether it is feasible to further reduce the levels of residual radioactivity to levels below those necessary to meet the dose criteria (i.e., to levels that are 'as low as reasonably achievable' (ALARA))." [underlined emphasis added]

DG-4006, Section 3.1 and its subsections address ALARA (the second requirement,) and may not be applied to demonstration of compliance with the dose criteria of Subpart E (the first requirement.) All of the 3.1 subsections apply only to evaluating further reductions below the release criteria. The subject ALARA formulae and methodologies may not be used to justify not complying with the regulatory release criteria. DG-4006 Regulatory Position 1, "DOSE MODELING," must be used for demonstrating compliance with the dose criteria of 10 CFR 20.1402 and 20.1403.

Any reference to "remediation action(s)" in Section 3.1 (and its subsections) applies only to further ALARA remediation actions, not to the primary remediation actions required to meet the regulatory dose criteria of 10 CFR 20.1402 and 20.1403 (the subject of Regulatory Position 1, DG-4006, page 2.)

DG-4006 "Regulatory Position" sections 3.2 *(Determination of "Net Public or Environmental Harm")*, 3.3 *(Demonstration of "Not Technically Achievable")* and 3.4 *(Demonstration of "Prohibitively Expensive")* all start with an explicit description of applicability to further reductions (i.e., further remediation actions.) These sections may not be applied to the primary remediation actions required to meet the regulatory dose criteria of 10 CFR 20.1402 and 20.1403.

ARAR

Illinois rules regarding radiological criteria for license termination are "relevant and appropriate" since the activities conducted at the site and resulting contamination are similar to those currently requiring an Illinois license.

The Corps argues that NRC rules on radiological criteria for license termination are *"relevant and appropriate since the activities conducted at the site and the resulting contamination are similar to those requiring an NRC license."* The Corps further opines that *"[s]ince the operations performed at the Madison Site occurred prior to [A]greement [S]tate status for Illinois, licensing, if applicable, would have been by the AEC/NRC."* This is accurate, just as is the argument that such a license would have been transferred to the State of Illinois in 1987-1988. If the facility had historically been licensed under NRC authority, and was not terminated since the site had not been decontaminated according to NRC requirements, the license would have been transferred to the State of Illinois, and Illinois regulations would apply from the transfer date to the present *(in reality, such licenses were so transferred.)* Illinois licensees are not required to comply with former

regulatory requirements applicable when they were licensed by the NRC; they are presently required to comply solely with Illinois regulations.

The Corps' argument that Illinois termination and decommissioning *"... requirements must be identical to the standards of 10 CFR 20 Subpart E..."* is erroneous. The NRC has established the compatibility for this rule as Compatibility-C, not Compatibility-A, as stated by the Corps. Under Compatibility-C requirements, Agreement State regulations may be more restrictive than the NRC rules, but may not be less restrictive *(i.e., less protective.)*

Current NRC regulations do not apply to the Madison site. Illinois rules on radiological criteria for license termination are "relevant and appropriate since the activities conducted at the site and the resulting contamination are similar to those..." currently requiring an Illinois license. If the Corps disagrees with this as an historical argument, note that any similar current decontamination operations within the State of Illinois requires Department license authorization, since the possession, use and handling of radioactive material is involved. Illinois decontamination requirements are therefore "relevant and appropriate." *[See 32 Ill. Adm. Code, Sections 330.320(d)(1)(B), 330.320(d)(3) and 330.320(e) for the pertinent sections of this ARAR.]*

Source Term

The Department is encouraged that the Corps has collected additional samples to further characterize contaminated areas. The first step described in decommissioning guidance is the characterization of the radiactive contamination ("source term" or "source"), upon which all subsequent assessments are based. The Department has not been satisfied with the source characterization at the Spectrulite facility, due to the unvalidated assumptions of contamination levels at the upper tiers of the facility. The Department hopes that the Corps has now collected the samples necessary to demonstrate statistical representation of all contaminated areas. The Department is witholding a determination on this issue until the new sampling results and statistical analyses have been documented by the Corps.

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Governor

Thomas W. Ortciger
Director

TO: U. S. Army Corps of Engineers, St. Louis District
FUSRAP Project Office

Due to hazardous weather, travel conditions prevent our attendance at the public meeting on Thursday, February 17, 2000 in Madison, Illinois. The meeting is sponsored by the U. S. Army Corps of Engineers, St. Louis District (Corps) to provide a forum for comments on the Remedial Investigation, Feasibility Study and Proposed Plan for cleanup of the Madison Site (Spectrulite Consortium, Inc.).

Following are the Illinois Department of Nuclear Safety (Department) oral comments on the Proposed Plan for the Madison Site:

1. The Department agrees with the Corps that removal of the contamination at the Spectrulite facility is the only responsible remediation approach in the "Remedial Investigation Report."

2. It is the Department's position that Illinois rules regarding radiological criteria for license termination are "relevant and appropriate" since the activities conducted at the site and resulting contamination are similar to those currently requiring an Illinois license. Any decontamination operation within the State of Illinois requires license authorization, since the possession, use and handling of radioactive material is involved.

3. The Corps has inappropriately and inadequately applied relevant NRC regulatory guidance to set the cleanup criteria and to establish the scope of the remediation.

4. The Corps should complete the required risk assessments for future-resident scenarios, including all inherent exposure pathways. Since the proposed remediation plan calls for the property to be released for unrestricted use, the Corps must demonstrate the long-term suitability and effectiveness of the plan.

5. The Department is encouraging the Corps to characterize all contaminated areas, and to complete appropriate technical analyses. The Department is striving to ensure that the Spectrulite remediation will be comprehensive, and that the cleanup standards will comply with State of Illinois regulations applicable to the release of property for unrestricted use.

6. The Department is preparing written comments on the Proposed Plan to submit during the public comment period.

Gary W. McCandless, P.E., Chief
Low Level Radioactive Waste Licensing &
Site Decommissioning Section
Division of Radioactive Materials
Office of Radiation Safety

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January 11, 2000

Ms. Sharon R. Cotner
FUSRAP Program Manager
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Ms. Cotner:

The Illinois Department of Nuclear Safety (Department) appreciates the opportunity to provide comments on the Regulatory Review Draft of the *Remedial Investigation Report, Feasibility Study, and Proposed Plan for the Madison Site*, dated December 1999. The report describes the investigation into remedial actions necessary to clean up residual uranium contamination associated with the Formerly Utilized Sites Remedial Action Program (FUSRAP) established by the U. S. Atomic Energy Commission, a predecessor of the U.S. Department of Energy. The U. S. Corps of Engineers (Corps) has been authorized to implement this work under the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) pursuant to Public Law 106-60. This Illinois site is presently occupied by Spectrulite Consortium, Inc. The Department offers the following comments:

1. The proposed Alternative 4 – Decontamination of Overhead Surfaces is the appropriate remedial action for the site. However, the report inappropriately applies "as low as reasonably achievable" (ALARA) as a justification to not address the contaminated areas at the high bay (45 to 60 ft.) levels. These higher levels should be decontaminated.

   NRC Draft Regulatory Guide DG-4006, *Demonstrating Compliance With Radiological Criteria for License Termination*, dated August 1998, indicates that "a licensee must demonstrate that the dose criteria...have been met and must demonstrate whether it is feasible to further reduce the levels of residual radioactivity to levels below those necessary to meet the dose criteria...(ALARA)". The Guide indicates that ALARA methods are used for determining when it is feasible to <u>further</u> (emphasis added) reduce concentrations of residual radioactivity to below the concentrations necessary to meet the dose criteria. ALARA analyses can not be used to eliminate contaminated areas from being remediated.

The upper levels represent nearly 50% of the contaminated areas. No data (characterization) has been collected in these areas and a basis for the assumption used to evaluate the cost and residual risk has not been demonstrated. The Department feels this area has not been adequately addressed and does not support the approach taken.

2. In regard to the future building demolition assessment, several modifications should be considered. The dose factors used were from the Concrete Recycle and Disposal scenario in NUREG 1640. The Department believes it would be more appropriate to use the Recycle of Steel Scrap dose factors in NUREG 1640 because after demolition the building material may be free released. These dose factors are nearly 14 times higher and will increase the total dose.

   The report also assumes a residual activity of 1000dpm/100cm^2 for the remediated accessible areas and this value is used in the building demolition risk assessment. There is no information in the report describing how this level will be demonstrated. The Department recommends that the final report on remedial action include a requirement to re-assess a post-remediation demolition scenario using measured values from the cleanup activities to confirm the residual risk of future building demolition.

   Other factors that should be considered involve the spread of contamination that will occur during post-remediation demolition from the contamination left on the upper areas. Additional structural materials are likely to be affected and at these residual activity levels, scrap yards will not accept these materials. Considering the current national issues being debated for release of slightly contaminated solids, the end result may be an overall increase in the volume of contaminated material to be disposed of as radioactive waste.

   Finally, the demolition risk assessment assumes that water sprays and respirators will be used during demolition activities. However, once the facility has been remediated and released for unrestricted use, these controls in all likelihood will not be employed when future demolition occurs. Worker doses beyond those estimated in the report will result.

3. The multi-agency radiation survey and site investigation manual (MARSSIM) approach is acceptable; however, there are several areas in the report where the Department believes MARSSIM guidance is being mis-applied. For example, all impacted areas are required to be separated into survey units (up to 100m^2 for structures), and each survey unit is evaluated to determine whether the average concentration in the survey unit as a whole is below the derived concentration guideline level (DCGL) and ALARA. The upper level contaminated beams will not be addressed in this manner under the proposed plan. The Department would like to review the remedial design and final survey plan to have an opportunity to address these issues with the Corps.

Ms. Sharon R. Cotner
U.S. Army Corps of Engineers
January 11, 2000

As an Agreement State, the Department has the authority to establish rules and regulations regarding the health and safety of the people of Illinois. The Department expects to adopt comparable standards to the NRC dose standard for decommissioning as defined in 10 CFR 20, Subpart E soon. NRC has adopted a level C capability designation for Subpart E that allows the Department to adopt a rule that achieves the same or better goal.

32 Ill. Adm. Code 330.320(d)(1)(B) requires that radioactive material licensees, prior to license termination, "Remove radioactive contamination to a level authorized in 32 Ill. Adm. Code 340.Appendix A, to the extent practicable." In addition, 32 Ill. Adm. Code 340.110(b) requires a licensee (or registrant) to maintain doses that are ALARA for workers and members of the public.

The Department expects all reasonable attempts be made to remediate all contaminated surfaces. Achieving the 32 Ill. Adm. Code.Appendix A guidance for radioactive cleanup projects in Illinois will ensure unrestricted release in the future.

I look forward to the Corps of Engineers' response to the above comments and a prudent cleanup effort at the Madison Site in Illinois. If you have specific questions, please contact Gary McCandless at (217) 782-1329.

Sincerely,

Joseph G. Klinger, Chief
Division of Radioactive Materials

cc: Paul Lake, IEPA
Spectrulite Consortium, Inc.

STATE OF ILLINOIS

DEPARTMENT OF NUCLEAR SAFETY

1035 OUTER PARK DRIVE • SPRINGFIELD, ILLINOIS 62704
217-785-9900 • 217-782-6133 (TDD)

George H. Ryan
Governor

Thomas W. Ortciger
Director

Illinois Department of Nuclear Safety
Division of Radioactive Materials
(217) 785-9926
Fax (217) 524-6417

NUMBER OF PAGES: 3
(Including fax cover)

To: Jim Moos/Lou Dell ORCO - USCOE
(314) 524-6044

From: Gary McCandless - IDNS

DATE: 3-28-2000

MESSAGE: FYI
Here is our RESEAD RUN. IT shows the peak dose is in the first year, and due to dispersion goes to "0" just over a 100 years. The 1000 yr spike is an artifact in the model and is not relevant.

recyclable

RESRAD, Version 5.95 T½ Limit = 1000 years File: Site2.RAD
Summary : RESRAD Default Parameters

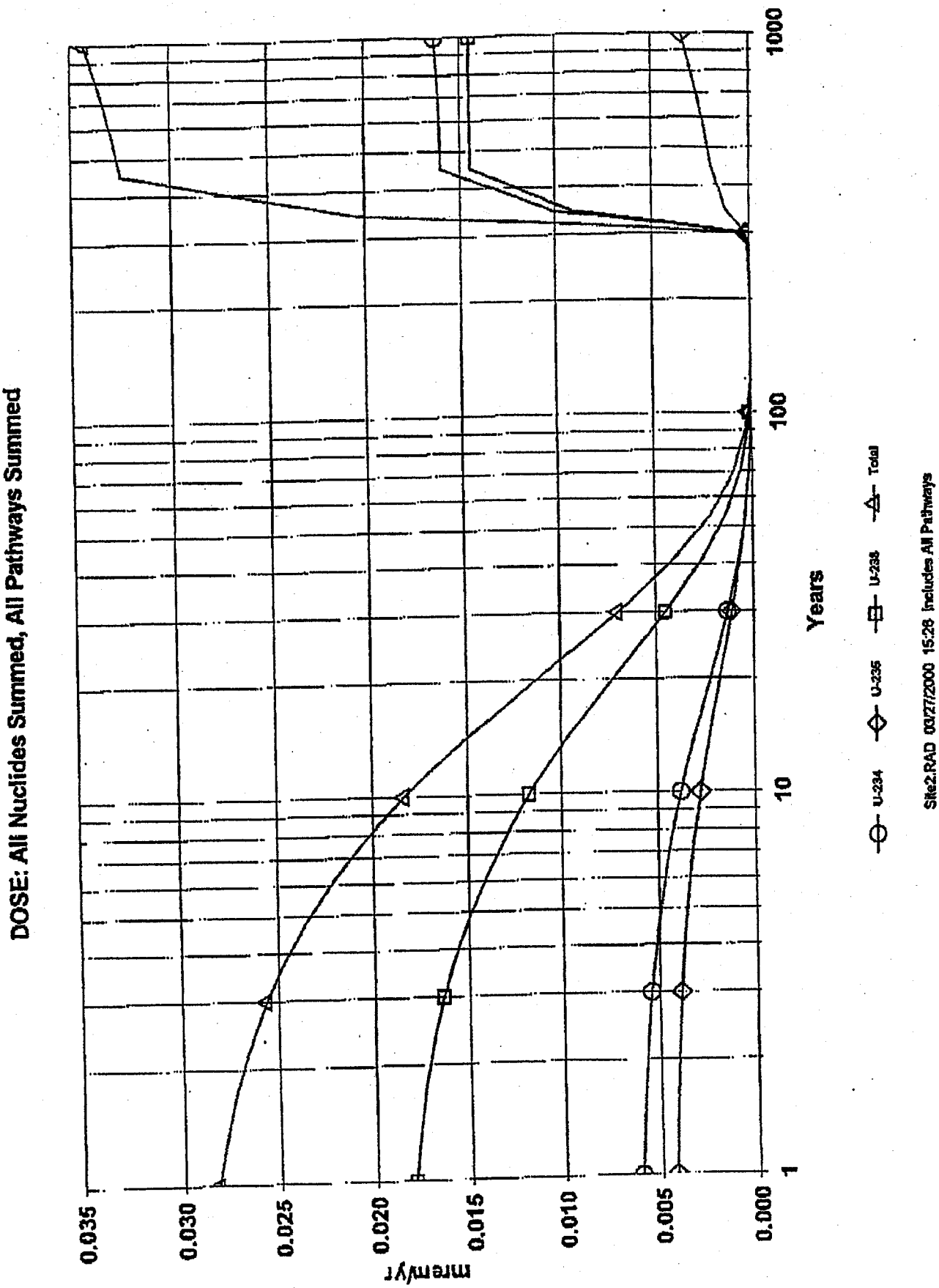
Contaminated Zone Dimensions	
Area:	10000.00 square meters
Thickness:	0.15 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g	
U-234	2.000E-01
U-235	1.000E-02
U-238	1.900E-01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.00
TDOSE(t):	2.963E-02	2.825E-02	2.567E-02	1.834E-02	6.965E-03	1.935E-04	2.310E-04	3.42
M(t):	9.876E-04	9.415E-04	8.555E-04	6.114E-04	2.322E-04	6.451E-06	7.700E-06	1.14

Maximum TDOSE(t): 3.427E-02 mrem/yr at t = 1.000E+03 years


DOSE: All Nuclides Summed, All Pathways Summed
mremyr
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
1000
100
10
1
Years
U-234
U-235
U-238
Total
Site2.RAD 03/27/2000 15:28 Includes All Pathways

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
9170 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

APR 13 2000

Formerly Utilized Sites Remedial Action Program

SUBJECT: Responses to Comments on the Remedial Investigation Report and Feasibility Study for the Madison Site

Mr. Thomas W. Orteiger, Director
Illinois Department of Nuclear Safety
1035 Outer Park Drive
Springfield, Illinois 62704

Dear Mr. Orteiger:

Thank you for your letter dated March 16, 2000, regarding the views of the Illinois Department of Nuclear Safety (IDNS) with respect to the Remedial Investigation Report/Feasibility Study and Proposed Plan for the Madison Site in Madison, Illinois.

The enclosed responses to IDNS comments regarding the extent of the remediation planned for the Madison Site fully consider the concerns expressed in your letter. These responses to comments were previously submitted to Mr. McCandless of IDNS. As presented in the responses to Mr. McCandless, our evaluation indicates that the residual uranium concentrations remaining in the difficult to access areas will not result in current or future unacceptable risks to human health and the environment. Thus, the U. S. Army Corps of Engineers, St. Louis District feels confident that the remedy proposed in the forthcoming Record of Decision ensures the long-term effectiveness of the remedial action is protective.

The St. Louis District appreciates the interest expressed by the IDNS in our efforts to evaluate and remediate the Madison Site. Please feel free to contact Ms. Sharon Cotner of my staff, at (314) 524-3212, if you have any further concerns regarding this matter.

Sincerely,

MICHAEL R. MORROW
Colonel, U.S. Army
District Engineer

Enclosure

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
9170 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

March 17, 2000

Formerly Utilized Sites Remedial Action Program

SUBJECT: Transmittal of USACE Responses to IDNS Comments on the Final Madison Site Remedial Investigation/Feasibility Study and Proposed Plan, January 2000

Mr. Gary McCandless, Head
LLW Licensing and Site Decommissioning
Illinois department of Nuclear Safety
1035 Outer Park Drive
Springfield, Illinois 62704

Dear Mr. McCandless:

Enclosed please find our responses to your comments dated February 25, 2000, on the Final Madison Site Remedial Investigation/Feasibility Study and Proposed Plan. These responses were extracted from the Responsiveness Summary section of the Record of Decision being developed for the site.

At your request, we are providing these responses prior to the scheduled public issuance (May 18, 2000) of the Record of Decision. These enclosed responses will still be considered draft until such time that they are published in the final Record of Decision for the Madison Site.

If you have any questions or comments concerning this plan, please contact Mr. Jim Moos at (314) 524-2069.

Sincerely,

Sharon R. Cotner
FUSRAP Program Manager

Enclosures
CC: Mr. Craig Rathgeb, Spectrulite Consortium, Inc.

Following are the responses to the Illinois Department of Nuclear Safety comments on the Madison Site RI/FS/PP. The official version of these comments and responses will be documented in the Responsiveness Summary of the forthcoming Record of Decision for this site.

Comment 1—The Department agrees with the U. S. Army Corps of Engineers (Corps) that removal of the contamination at the Madison facility is the only responsible remediation approach presented in the Remedial Investigation Report. However, the Corps has not demonstrated that the proposed scope of removal is protective of public health, as required by Department and NRC rules and guidance. The Department can not determine the adequacy of the proposed scope of removal, since the submitted dose/risk assessments are inadequate, inappropriate or incomplete.

Response 1— USACE has concluded that the dose/risk assessments presented in the RI/FS and supplemented by the analysis presented in this comment response are adequate and appropriate. The scope of the remedial action will result in a plant condition that is protective of the average member of the critical group (i.e., utility workers) and is in accordance with NRC rules and guidance.

Comment 2—The NRC's Draft Regulatory Guide DG-4006, Demonstrating Compliance with the Radiological Criteria for License Termination, provides guidance for a licensee to demonstrate that a site is suitable for release in accordance with the radiological release criteria in 10 CFR Part 20. DG-4006 describes the methods acceptable to the NRC for implementing the requirements in Subpart E, 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use." If the Corps considers the NRC rule and guidance to be ARAR, then the guidance in DG-4006 must be applied. The Corps has acknowledged an obligation to comply with the NRC rules and guidance, yet fails to implement the guidance as described in DG-4006.

Response 2—The FS references use of DG-4006 and NUREG-5512, among others, in developing the site assessments. USACE recognizes that all analyses do not follow default scenarios as defined in NUREG documents (and associated support documents). These default scenarios are neither fully reasonable nor appropriate for the Madison Site. All analyses are site specific. For example, the default building occupancy scenario used by the DandD code is not intended for exposure to overhead contamination on support beams located 7+ meters above the ground. USACE has concluded (using a conservative model) that a utility worker is the critical group and that this approach is consistent with NRC guidance.

Comment 3—The Corps has described risk assessments covering building use and worker exposure over a period of 25 years. DG-4006 (page 5) calls for a 70-year building-use period, with the remainder of the recommended 1000-year dose-assessment period being based on the assumption that the property is used by resident members of the public (e.g., after the building is demolished). The Corps has inadequately assessed the dose to the first critical group (workers) and has entirely ignored the second critical group (residents).

The Corps must reassess potential worker dose, and conduct the required risk assessment for future-resident scenarios, including all inherent exposure pathways. Since the proposed remediation plan calls for the property to be released for unrestricted use, the Corps must demonstrate the long-term suitability and effectiveness of the proposed cleanup.

The "post demolition" segment of the required 1000-year dose assessment period should assume that the entirety of the structure's residual radioactivity is transferred to surficial soil after the building is demolished. The assumed "footprint" of the contaminated soil may consider scattering due to demolition and grading, but should not exceed 200% of the original contaminated area of the building (not the entire building). RESRAD and DandD codes can then be used to model the estimated dose from all pathways. Surficial soil is defined as being the topmost 15 centimeters. MARSSIM does not address subsurface soil contamination beneath 15 centimeters. RESRAD is appropriate for modeling.

Response 3—IDNS is correct in stating that the default building life is 70 years as specified in DG-4006. The assumptions made for purposes of analysis in the RI/FS is that an individual could have a reasonable maximum exposure (RME) duration of 25 years which is commonly used and a widely accepted RME value for a commercial/industrial receptor. The RI/FS conservatively assumes that an individual works in the historical AEC-funded process areas for all of those 25 years performing the same duties. This use of the 25-year exposure duration has no impact on the final dose calculations. The 10 CFR Part 20, Subpart E limit is 25 mrem total effective dose equivalent (TEDE), which is based on assigning a lifetime dose from an intake in the year the intake is received. Additionally, Federal Guidance Report No. 11 dose conversion factors were used in the FS (pg. A-2 of the FS). These dose conversion factors are based on a 50-year committed effective dose equivalent. Therefore, all lifetime doses from intakes of radioactive material will be accounted for in the worker's 25 year exposure duration.

Also, it is USACE's position that this time frame applies to building use for the purposes of defining all reasonable building exposure scenarios (industrial, commercial, office, etc.) that are likely to occur within that time. The remaining use of the building is expected to be the current industrial scenario for a maximum duration of 25 years followed by demolition or dismantlement of the building. Since the facility is over 50 years old, the assumption of continued industrial use for 25 more years exceeds the useful life of 70 years recommended by DG-4006. In summary, the USACE has complied with the recommendations of DG-4006 concerning building use by evaluating an industrial exposure scenario for the remaining building life and evaluating scenarios for demolition and dismantlement after the building has exceeded its useful life.

The following USACE evaluation of the future resident scenario at 1000 years, including all inherent exposure pathways documents that a potential resident's exposure would be negligible both now and 1000 years into the future.

> Data show that the average total uranium concentration in dust on the difficult to access areas is 36 pCi/g and covers about 150 m^2 horizontal surface area (Class 1). The post-remedial Class 1 concentration in the lower areas could be a maximum

of 20 pCi/g total uranium in dust covering about 2800 m^2 horizontal surface area. The average total uranium concentration in dust the remaining areas (i.e., Class 2 areas) is 9.9 pCi/g covering about 1500 m^2 horizontal surface area. Using these concentrations and areas, the weighted average concentration in dust is calculated as follows:

$$[9.9 \text{ pCi/g} \times (1500/4450)] + [36 \text{ pCi/g} \times (150/4450)] + [20 \text{ pCi/g} \times (2800/4450)] = 17.1 \text{ pCi/g}$$

Based on characterization data, this dust material is 0.8 cm thick (before remediation) making the total volume of the material (0.008 m) × (4450 m^2) = 35.6 m^3. It was assumed this dust material was scraped from the overhead steel beams, spread over an area of approximately 10,000 m^2 (the RESRAD default), and tilled into the top 0.15 m (6 inches) of soil. The concentration is adjusted using these parameters as follows:

$$\text{Soil Concentration (pCi/g)} = 17.1 \text{ pCi/g} \times [35.6 \text{ m}^3 / (0.15 \text{ m} \times 10{,}000 \text{ m}^2)] = 0.40 \text{ pCi/g.}$$

This total uranium concentration would contribute negligibly to the natural uranium in soil of 1.8 pCi/g (adding approximately 0.19 pCi/g of U-238, 0.20 pCi/g of U-234, and 0.01 pCi/g of U-235). The resultant maximum dose modeled using RESRAD Version 5.95 and all the standard defaults with all pathways is 0.04 mrem at 1000 years. It should also be noted that the overhead horizontal surface is estimated to be about 20% of the original contaminated area of the building; therefore, the actual Class 1 and 2 areas in the building cover about (4450 m^2)/(0.2) = 22,250 m^2.

A copy of the RESRAD Summary Report is provided in Attachment 3.

Comment 4—The Corps has inappropriately and inadequately applied NRC guidance to set the cleanup criteria. The Corps applied dose conversion factors (DCFs) from NUREG-1640, *Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities*, which is, in essence, a feasibility study. The goal of the modeling in NUREG-1640 is to produce estimates of potential radiation exposure to critical-group individuals engaging in specific scenarios describing the recycling of contaminated solid materials. The produced DCFs were modeled using Monte Carlo computer techniques, employing highly-variable parameters to describe material characteristics and "flow" – parameters that were highly customized for specific individual exposure scenarios. The DCFs are invalid for scenarios that do not conform precisely to the modeled scenario; therefore, the DCFs are inappropriate for generic assessment of dose from remediation activities. Due to the extreme variability of parameters from one scenario to another, the DCFs provided in NUREG-1640 can be applied only under specific circumstances where the material characteristic and "flow" exactly match one of the scenarios described in the report. If a valid DCF is required for a different scenario, it must be derived by modifying the modeling characteristics. The Corps has not demonstrated the validity of generically using the DCFs as described in the proposal.

Response 4—NUREG-1640 was not used to estimate dose to the critical group. Appendix A of the FS (Page A-2) states "...incorporates generic modeling analysis guidance for NRC contained in NUREG/CR-5512..." and the "TEDEs were calculated using exposure-to-dose conversion factors from Federal Guidance Report 11...". Guidance from NUREG-5512 and dose conversion factors from FGR 11 were used to estimate the dose to the utility worker (a member of the critical group), a worker on the facility floor, and a remediation worker. Dose to a worker dismantling the building is modeled as a subset to the remediation worker and, therefore, also uses guidance from NUREG-5512 and FGR 11. Doses to other non-critical group receptors including demolition and steel recycle workers were also evaluated for completeness. The demolition and recycle workers were modeled using NUREG-1640 dose conversion factors and a simple scaling factor based on exposure time. Both scenarios are assumed to be recycle scenarios and are consistent with scenarios modeled in NUREG-1640. The actual worst case source term expected after remediation is 17.1 pCi/g, approximately 4 times below the modeled value. In summary, the models presented in the RI/FS overestimate dose and risks to account for uncertainties by using reasonable and appropriate, yet conservative, receptor assumptions.

NRC guidance identified by IDNS were used in the dose analysis, as appropriate, including NUREG-1640, NUREG-5849, NUREG-1575 (MARSSIM), NUREG-5512 and supporting documents, and NUREG-1507. DG-4006 was used to perform the ALARA analysis in Section 3 of the FS, but was not included in the references.

Comment 5—The Corps should also note that some licensees misuse MARSSIM in their decommissioning analyses. The Department has not determined that the Corps has misapplied MARSSIM, however, to preclude any potential misapplication, the Department recommends familiarity with the limitations of MARSSIM. MARSSIM methodology is designed, not to establish remediation standards, but to statistically demonstrate at the completion of the remediation that a site has been satisfactorily cleaned-up to established regulatory standards.

Response 5—Comment noted. The analysis in the RI/FS shows what the risk would be from some level of contamination. USACE used guidance from MARSSIM and NUREG-5849, where appropriate, to design the RI survey and did not intend for the RI to serve as the final status survey plan or a vehicle for presenting the final status survey. The final status survey plan detailing application of MARSSIM by USACE at the Madison Site was provided to IDNS in March 2000 for their review.

Comment 6—The Corps contends that " . . . [t]he difficult to access areas do not contribute to dose exceeding 25 mrem/yr" (page 3-4, Feasibility Study for the Madison Site.") This statement is suppositious, since the Corps has failed to adequately characterize the contamination in these areas, and has failed to perform adequate risk assessments that cover the scenarios and time periods required by the NRC.

Response 6—USACE completed a supplemental assessment on March 8, 2000 of the material in the Difficult to Access Areas. This assessment (see Attachment 1 – Dose Assessment for Difficult-to-Access Areas at the Madison Site) shows that the dose from the material in the

Difficult-to-Access Areas would be less than the ARAR dose criteria using reasonable and applicable exposure scenarios.

Comment 7—The Department is also concerned that ALARA analyses could be misused to justify not cleaning all areas to comply with required radiological criteria. It is unclear whether the Corps has misapplied ALARA analyses. Any reference to "remediation action(s)" in Section 3.1 (and its subsections) applies only to further ALARA remediation actions, not to the primary remediation actions required to meet the regulatory dose criteria of 10 CFR 20.1402 and 20.1403 (the subject of Regulatory Position 1, DG-4006, page 2).

Response 7—USACE believes it has used the ALARA analysis as intended. The analysis was used to justify that no further action is required. As noted in response to Comment No. 6, the dose from the material in the difficult to access areas is less than the ARAR dose criteria. See Attachment 2 – Madison Site ALARA Analysis, which demonstrates further action, is not required, as it would be prohibitively expensive in accordance with Section 3.4 of DG-4006.

Comment 8—Illinois rules regarding radiological criteria for license termination are "relevant and appropriate" since the activities conducted at the site and resulting contamination are similar to those currently requiring an Illinois license. Current NRC regulations do not apply to the Madison Site. Illinois rules on radiological criteria for license termination are "relevant and appropriate since the activities conducted at the site and the resulting contamination are similar to those . . ." currently requiring an Illinois license. If the Corps disagrees with this as an historical argument, note that any similar current decontamination operations with the State of Illinois requires Department license authorization, since the possession, use and handling of radioactive material is involved. Illinois decontamination requirements are therefore "relevant and appropriate."

Response 8—The NRC issues licenses to "receive title to, receive, possess, use, transfer, or deliver source and byproduct materials" in accordance with 10 CFR 40 for source materials (e.g., uranium) pursuant to the provisions of the Atomic Energy Act.

The NRC rules on radiological criteria for license termination, set forth at 10 CFR Part 20, Subpart E, Radiological Criteria for License Termination, establish dose criteria that are applicable when a licensee terminates its license. At Madison, possession and processing of uranium at the site was not performed under an NRC license, and thus the rule is not applicable. However, the provisions in 10 CFR 20 Subpart E are considered relevant and appropriate. Source material license requirements would have applied at Madison had it not been specifically exempted from such license requirements. This is particularly true given that the authority of the State of Illinois is derived from the NRC pursuant to "Agreement State" provisions authorized under the Atomic Energy Act (subsequent to the processing that occurred at Madison) and that all federal agencies must necessarily be licensed by the NRC rather than by Agreement States.

The dose criteria provisions under 10 CFR 20 Subpart E, indicate a site can be released for unrestricted use if the residual radioactivity would result in a dose of less that 25 mrem to the

average member of the critical group and the residual radioactivity has been reduced to ALARA levels.

The rules of the State of Illinois regarding radiological criteria for license termination, while not applicable, were carefully evaluated for relevancy and appropriateness. In evaluating the use of the State of Illinois regulations, two factors were considered: (1) the date when the State of Illinois was granted "Agreement State" status and (2) the compatibility of State regulations with NRC standards. First, the State of Illinois was granted "Agreement State" status by the NRC in the early 1980s pursuant to Section 274 (b) of the Atomic Energy Act. The State of Illinois subsequently promulgated regulations with standards for protection against radiation, 32 Ill. Adm. Code 340 et seq. pursuant to the Illinois Radiation Protection Act of 1990, 420 ILCS 40/16. This state regulation established standards for protection against radiation resulting from activities conducted pursuant to Agreement State licenses and product registrations issued by the Illinois Department of Nuclear Safety. These actions occurred a number of years after uranium processing was conducted at Madison. The site was never licensed by the State of Illinois for uranium. Secondly, Agreement States are now required to make their release standards compatible with the NRC' s. Illinois statutes have not, as yet, been updated to incorporate the provisions of 10 CFR 20 Subpart E and, therefore, are not currently compatible. The policy of the NRC, promulgated under the authority of Section 274 (j)(1) of the Atomic Energy Act, requires State standards for release limits be compatible with those of the Commission unless Federal statutes provide the State authority to adopt different standards. A deadline of three years from the promulgation of the NRC radiological criteria, which became effective on July 21, 1997, was established. Thus Illinois, which has not revised its-standards to make them compatible with those of the Commission, should be in the process of doing so, with a final deadline of July 21, 2000. This response action will be performed at approximately the same time that the State standards are required to be changed and, therefore, while the State standards may be considered relevant, they are not considered to be appropriate for this response action. In the best professional judgment of USACE, it is inappropriate to alter the selected remedy on the basis of a state regulation that is in the process of being changed to conform to the NRC standard, and for which the legal deadline for such change will occur at almost the identical point in time that the remedial action will occur.

The contaminant of concern is processed natural uranium (i.e., chemically separated uranium with normal isotopic abundances). The State of Illinois does not have a generic guideline concentration for processed natural uranium in soil or dust. Existing Illinois surface contamination guidelines consist of total activity for alpha emitters of 1,000 dpm/100 cm sq., averaged over any one surface, and 5,000 dpm/100 cm sq., maximum, with removable activity guidelines of 33 dpm/100 cm sq., average, over any one surface, and 100 dpm/100 cm sq., maximum. These guidelines are corollary to NRC criteria in NRC Regulatory Guide 1.86 which are not legally promulgated standards and can not be imposed on Agreement States for implementation. Similarly, the corresponding Illinois Standards have not been fully promulgated and thus are not "relevant and appropriate" for processed natural uranium in soil or dust.

Comment 9—The Department is encouraged that the Corps has collected additional samples to further characterize contaminated areas. The first step described in decommissioning guidance is the characterization of the radioactive contamination ("source term" or "source"),

upon which all subsequent assessments are based. The Department has not been satisfied with the source characterization at the Madison facility, due to the invalidated assumptions of contamination levels at the upper tiers of the facility. The Department hopes that the Corps has now collected the samples necessary to demonstrate statistical representation of all contaminated areas. The Department is withholding a determination on this issue until the new sampling results and statistical analyses have been documented by the Corps.

Response 9—USACE has completed additional sampling and performed a supplemental risk assessment of the Difficult-to-Access Areas. The results of this assessment are enclosed. (Attachment 1).

ATTACHMENT 1

DOSE ASSESSMENT FOR DIFFICULT-TO-ACCESS AREAS

AT THE MADISON SITE

An Employee-Owned Company

To: Dennis Chambers/USACE St. Louis District Office
Jim Moos/USACE St. Louis District Office
From: David A. King/SAIC
Date: March 8, 2000
Re: Dose Assessment for Difficult to Access Areas at the Madison, Illinois Site

As requested, John Waddell completed a dose/risk assessment using the radio-analytical data collected on February 2, 2000 from the difficult to access areas of the Madison Site. Included in this new data are isotopic uranium results from seven sample locations. The sample locations were distributed in overhead structures above the area containing the uranium extrusion press, which is the area most likely to have elevated uranium concentrations. The purpose of this memorandum is to present both the data from the aforementioned sampling event and the assumptions and results from the dose/risk assessment.

ANALYTICAL RESULTS

Attachment A lists the preliminary analytical results as reported by the FUSRAP Analytical Laboratory. The data listed in Attachment A is preliminary; however it is not anticipated that the validation process will change the results. The larger of "REG", "SPLT" or "REPL" values under the *Sample Type* heading were conservatively used in dose/risk calculations. The dose/risk calculations were performed using only isotope-specific data, specifically U-234, U-235, and U-238. Gross alpha and gross beta results were not used in calculations. Concentration values were used in the dose/risk calculations as listed under the *Results* heading without consideration of standard error, or MDA. The data are summarized in Table 1 below, listing sample identification numbers, sample locations, isotopic concentrations, and total uranium concentrations.

The beam/sample locations presented in Table 1 are shown in Figure 1. Figure 1 is based on the hand-drawn map used by field personnel during the sampling event. Figure 1 is not drawn to scale, but does illustrate the distribution of sampling locations in relation to previous sampling events and the extrusion press. For a comparison to previous sampling locations and concentration results (from lower/accessible beams in the study area) see Figure 1-4 from the Feasibility Study (USACE 2000).

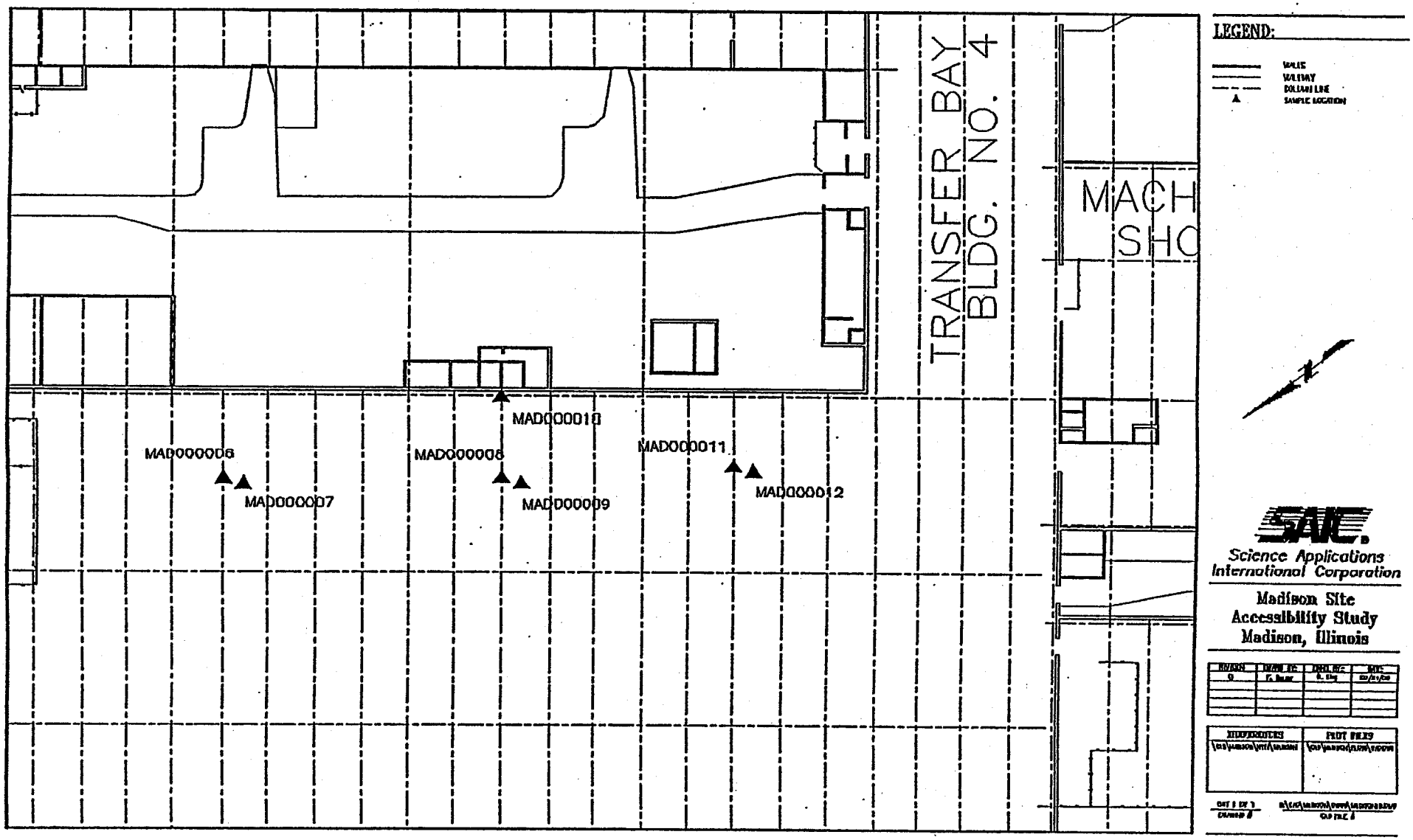


Figure 1. Approximate Sample Locations for Difficult to Access Areas

Table 1. Isotopic Uranium Results Summary Table

Sample ID	Beam/Sample Location	U-234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)	Total U [a] (pCi/g)
MAD00006	59-1	5.77	0.14	5.92	11.83
MAD00007	59-2	2.20	0.32	2.84	5.36
MAD00008	53-1	59.70	2.67	61.2	123.57
MAD00009	53-2	5.68	0.35	5.80	11.83
MAD00010	53-3	1.49	0.12	1.81	3.42
MAD00011	48-1	42.54	1.82	44.71	89.07
MAD00012	48-2	3.01	0.14	4.00	7.15
				Average =	36.0

[a] Sum of U-234, U-235 and U-238 results.

All values listed as reported by the analytical laboratory, with two digits to the right of the decimal.

DOSE ASSESSMENT METHODOLOGY

Appendix A from USACE 2000 presents the dose/risk assessment methodology for exposure to uranium contamination on the support beam and cross member surfaces in the study area. This assessment focuses on site workers on the facility floor, utility workers in the beams and trusses no higher than 36 ft above the floor, and remediation workers. The assessment also evaluates a building demolition worker, a building dismantlement worker, and a steel recycle worker exposed to uranium contaminants in the lower beams and trusses. The assessment does not address the difficult to access areas high (45 to 60 ft) above the facility floor. The omission of the higher areas occurred in part due to a lack of data and in part because there appears to be little reason for an individual to be exposed to potential contamination 45 to 60 ft above the facility floor.

Since USACE 2000 was issued, the USACE has collected samples from the higher areas. In addition, interviews with site workers have revealed that an individual spends no more than four hours per year in the difficult to access areas. Therefore, dose and risk estimates were performed using the following information:

1. The newly acquired data from the difficult to access areas;
2. The exposure frequency estimates for utility, demolition, dismantlement and steel recycle workers; and
3. The assessment methodology from Appendix A of the Feasibility Study (USACE 2000).

To estimate dose and risk from exposure to contaminants in the difficult to access areas, the estimates presented in USACE 2000 were scaled based on occupancy and contaminant concentrations. The scaling factors are explained below and are presented with dose plus risk results for each potential receptor.

Utility Worker

USACE 2000 reports a dose of 210 mrem/yr if the utility worker is exposed to an average concentration of 70.9 pCi/g total uranium. The average concentration in the difficult to access area (as presented in Table 1) is 36.0 pCi/g total uranium. All other things being the same, the utility workers dose would be adjusted by a factor of (36.0/70.9) when exposed only to the difficult to access areas. The 210 mrem/yr estimate also assumes the worker is exposed for 20 hr/yr. This exposure frequency is considered overly conservative for the difficult to access areas, whereas a 2 to 4 hr/yr frequency more closely represents central tendency and maximum exposure frequency and is supported by interviews with site workers. An exposure frequency scaling factor of 2/20 to 4/20 is therefore applied to adjust dose estimates. Using these factors, the dose to the utility worker while working in the difficult to access areas is estimated as follows:

$$\text{Dose (mrem/yr)} = (210 \text{ mrem/yr}) \times (36.0/70.9) \times (2/20) = 10.7 \approx 11 \text{ mrem/yr}$$

or

$$\text{Dose (mrem/yr)} = (210 \text{ mrem/yr}) \times (36.0/70.9) \times (4/20) = 21.3 \approx 21 \text{ mrem/yr}$$

Using the same method to adjust the original risk estimate of 5.3×10^{-4}, risk in the difficult to access areas are estimated to be 2.7×10^{-5} for a 2 hr/yr exposure or 5.4×10^{-5} for a 4 hr/yr exposure.

Demolition Worker

The demolition worker is intended to represent an individual who helps knock down the building. This individual would likely have little direct contact with contaminants on beams or trusses on any level. However, a dose estimate is presented in USACE 2000 assuming the average total uranium concentration is 70.9 pCi/g on all surfaces, which results in a dose of 0.03 mrem and a risk of 1.5×10^{-8}. For this assessment, it is assumed that the surfaces below the difficult to access areas are remediated to an average of 20 pCi/g (the site DCGL), which represents 95% of the total surface area. It is also assumed that the average concentration in the difficult to access areas is 36.0 pCi/g, which represents the remaining 5% of the total surface area. Using these conservative assumptions, the resulting average total uranium concentration is $[(20\times0.95) + (36\times0.05)] = 20.8$ pCi/g and the scaling factor is (20.8/70.9). The dose and risk estimates for the demolition worker are calculated as follows:

$$\text{Dose (mrem)} = 0.03 \text{ mrem } \{[(20\times0.95) + (36\times0.05)]/70.9\} = 0.03 \times (20.8/70.9) = 0.009 \text{ mrem}$$

and

$$\text{Risk (lifetime}^{-1}) = 1.5\times10^{-8} \times (20.8/70.9) = 4.4\times10^{-9}$$

These estimates demonstrate that the demolition worker would likely receive an insignificant dose and risk if exposed to the contaminants in the difficult to access areas.

Dismantlement Worker

The dismantlement worker is assumed to be similar to the remediation worker evaluated in USACE 2000 with two noted differences. First, the dismantlement worker is assumed to be exposed to an average of 20.8 pCi/g total uranium, as described above. Second, dismantlement worker is expected to have less direct contact with contaminated surfaces while disassembling (rather than decontaminating) the building. An exposure reduction of 25% is assumed for this assessment. Given that the remediation worker's estimated dose is 150 mrem, the dismantlement worker dose is estimated as follows:

$$\text{Dose (mrem/yr)} = 150 \text{ mrem} \times (0.25) \times (20.8/70.9) = 11 \text{ mrem}$$

Given that the work is performed over a one year period and using the dose-to-risk conversion factor of 5×10^{-7} per mrem (as used in USACE 2000), the risk to the dismantlement worker is estimated as follows:

$$\text{Risk (lifetime}^{-1}) = 11 \text{ mrem} \times 5\times10^{-7} \text{ mrem}^{-1} = 5.5\times10^{-6}$$

Steel Recycle Worker

The steel recycle worker in USACE 2000 is estimated to receive a dose of 0.91 mrem and have a lifetime risk of 4.6×10^{-7} when exposed to an average of 70.9 pCi/g of total uranium. This worker could handle metal beams and trusses in the scrap yard and could be exposed to contaminants from both the lower and difficult to access areas. Using the surface area fractions as described above and assuming that the lower surfaces are remediated to an average of 20 pCi/g, the steel recycle worker's dose and risk are estimated as follows:

$$\text{Dose (mrem/yr)} = 0.91 \text{ mrem} \times (20.8/70.9) = 0.27 \text{ mrem}$$

and

$$\text{Risk (lifetime}^{-1}) = 0.27 \text{ mrem} \times 5\times10^{-7} \text{ mrem}^{-1} = 1.4\times10^{-7}$$

As with the demolition worker, the steel recycle worker would likely receive an insignificant dose and risk if exposed to the contaminants in the difficult to access areas.

SUMMARY

The dose and risk assessment results using the data presented in Table 1 (and listed in the attachment) are shown below in Table 2. These estimates were calculated using scaling factors to adjust the dose and risk results from USACE 2000.

Table 2. Dose and Risk Estimates Using Data from the Difficult to Access Areas of the Madison Site

Receptor	Dose (mrem)	Risk [a] (lifetime^{-1})
Utility Worker [b]	11 to 21	3×10^{-5} to 5×10^{-5}
Demolition Worker	0.009	4×10^{-9}
Dismantlement Worker	11	6×10^{-6}
Steel Recycle Worker	0.27	1×10^{-7}

[a] All risk estimates rounded to one significant digit.
[b] Estimates for 2 and 4 hr/yr exposure frequencies are provided. Dose is yearly rate for utility worker (mrem/yr)

REFERENCES

USACE, 2000. *Remedial Investigation Report and Feasibility Study for the Madison Site, Madison, Illinois*, St. Louis District Office, January.