INTERNATIONAL URANIUM (USA) CORPORATION

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June 28, 2001

VIA EXPRESS COURIER
Mr. Melvin Leach, Director
Fuel Cycle Licensing Branch
Mail Stop T-8A33
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Reference: Annual Safety and Environmental Review Panel Report for July 1, 2000 - June 30, 2001
White Mesa Uranium Mill - Blanding, Utah
International Uranium (USA) Corporation
NRC Source Materials License No. SUA-1358
Docket No. 40-8681

Dear Mr. Leach:

This letter transmits International Uranium (USA) Corporation's ("IUSA's") Safety and Environmental Review Panel ("SERP") Report for the period from July 1, 2000 to June 30, 2001. This annual SERP Report is provided pursuant to License Condition 9.4 (D) of Source Materials License Number SUA-1358.

In addition to summarizing SERP evaluations, including the safety and environmental review of each such evaluation performed during the reporting period, this Report transmits change pages to the Operations Plan and/or Reclamation Plan of the approved license application, as applicable, to reflect changes made in accordance with License Condition 9.4.

NMSS01Public

Should you have any questions regarding the information provided, please do not hesitate to contact me at (303) 389-4131.

Sincerely,

Michelle R. Rehmann
Environmental Manager

cc: Ron E. Berg
William N. Deal
David C. Frydenlund
Ron F. Hochstein
R. William von Till, U.S. Nuclear Regulatory Commission
Charles Cain, U.S. Nuclear Regulatory Commission, Region IV
Scott Clow, Ute Mountain Ute Tribe
William J. Sinclair, Utah Department of Environmental Quality

2000 ANNUAL REPORT

White Mesa Uranium Mill Safety and Environmental Review Panel Evaluations Performed July 1, 2000 to June 30, 2001

Prepared by:

International Uranium (USA) Corporation
for
White Mesa Uranium Mill
License No. SUA-1358
Docket No. 40-8681

June 28, 2001

Submitted to:

U.S. Nuclear Regulatory Commission
Fuel Cycle Licensing Branch
Office of Nuclear Material Safety and Safeguards
2 White Flint North
11535 Rockville Pike
Rockville, MD 20852-2738

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1.0 INTRODUCTION

U.S. Nuclear Regulatory Commission (NRC) Source Materials License No. SUA-1358 for the White Mesa Uranium Mill (the "Mill") contains a number of performance-based license conditions. License Condition 9.4 allows International Uranium (USA) Corporation (IUSA) to make changes in the facility, process, or procedures as presented in the approved license application or to conduct tests or experiments not presented in the application, under certain specified conditions. If, however, the specified conditions are not met, the licensee is required to file an amendment application with NRC. IUSA's Safety and Environmental Review Panel (SERP) makes these determinations.

This Annual SERP Report for the period from July 1, 2000 to June 30, 2001 is provided pursuant to License Condition 9.4 (D) of the Mill's Source Materials License. In addition to summarizing SERP evaluations, including the safety and environmental review of each such evaluation performed during the reporting period, this Report transmits change pages to the Operations Plan and/or Reclamation Plan of the approved license application, as applicable, to reflect changes made in accordance with License Condition 9.4.

During the reporting period, nine separate SERP evaluations were conducted and completed. Each SERP evaluation and review was conducted and documented in accordance with SERP procedures set forth in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2.

2.0 DESCRIPTION AND SUMMARY OF THE SAFETY AND ENVIRONMENTAL EVALUATION OF EACH CHANGE, TEST OR EXPERIMENT

The following subsections describe and summarize the SERP evaluation of each change, test or experiment performed during the reporting period, pursuant to License Condition 9.4 of License No. SUA-1358.

In accordance with License Condition 9.4 (C), SERP membership during the reporting period consisted, at a minimum, of the following three individuals:

1. One member of the SERP had expertise in management and was responsible for managerial and financial approval changes. During this reporting period, this individual was the President or a Vice President;

2. One member had expertise in operations and/or construction and had responsibility for implementing any operational changes. During this reporting period, this person was the Mill Manager; and

3. As in prior years, for this reporting period, one member was the corporate manager of environmental health and safety, with the responsibility of assuring changes conform to radiation safety and environmental requirements.

Additional members served in selected SERPs, as appropriate, to address technical aspects such as health physics, groundwater hydrology, surface-water hydrology, specific earth sciences, and other technical disciplines or legal areas.

During the reporting period, depending upon requirements of the matter under consideration, the SERP consisted of individuals from the following list:

- William N. Deal – Manager, White Mesa Mill
- Ron F. Hochstein – President and Chief Executive Officer
- Michelle R. Rehmann – Environmental Manager
- David C. Frydenlund – Vice President and General Counsel
- Ron E. Berg – Radiation Safety Officer, White Mesa Mill
- Jo Ann S. Tischler – Chemical Engineer, Consultant

The Mill's approved SERP Standard Operating Procedure (SOP) dated June 10, 1997 identifies: (1) the membership of the SERP; (2) the general procedure to be followed in reviewing potential changes, tests, and/or experiments against the provisions of the performance-based license condition; and (3) the documentation required. The SERP followed the SOP as it performed each SERP evaluation, to ensure that each result was consistent with the following three criteria:

(1) The change, test or experiment did not conflict with any requirement specifically stated in the Mill license, and did not impair IUSA's ability to meet all applicable NRC regulations.. (referred to hereafter as Criterion 1)

(2) There would be no degradation in the essential safety or environmental commitments in the license application, or provided by the approved reclamation plan. (referred to hereafter as Criterion 2)

(3) The change, test or experiment was consistent with the conclusions of actions analyzed and selected in the Environmental Assessment (EA) dated February 1997. (referred to hereafter as Criterion 3)

2.1 SERP 00/01-01 - July 19, 2000

2.1.1 Description of the Change, Test, or Experiment

The SERP met on Monday, April 3, 2000 in accordance with SERP procedures in White Mesa Mill SOP PBL-1, Rev. No. R-2, to consider the following three issues:

(1) Review of the IUSA organization chart updated on June 15, 2000

(2) Review of the revised Intermodal Container ("IMC") SOP

(3) Revision of Table 1 in the April 3, 2000 revision of the Sampling and Analysis Plan ("SAP") for confirmatory sampling of Ashland 1 material to address one analyte detected in IT Corporation ("IT") confirmatory sampling, and one analyte detected in Mill sampling, that were not previously included in Table 1 of the April 3, 2000 revision of the SAP

2.1.2 Summary of SERP Evaluation and Conclusions

With respect to item (1) listed in Section 2.1.1 above, the SERP evaluated whether or not the updated organization charts satisfy Criterion 1 and noted that they would, because the organization is adequate to meet all the roles required in the March 1997 license, and to maintain the functions required for compliance with NRC regulations.

The SERP then found that the updated organization charts would meet Criterion 2 because the organization charts are consistent with those provided to NRC in the license renewal application, in that all the environmental, safety, and management roles identified in the license renewal application organization chart are covered in the current organization. In particular, staffing for all the environmental, safety and management activities identified in the license renewal application was determined to be covered in the current organization. The organization was also found to be sufficient to meet the requirements of the reclamation plan.

The SERP with respect to Criterion 3, found that the organization charts are consistent with the EA, in that staffing for all the environmental, safety and management activities identified in the EA is covered in the current organization.

The foregoing SERP evaluation resulted in the following conclusions and recommendations regarding issue (1) identified above in Section 2.1.1:

- The updates to the organization chart met the standards set forth in the SERP SOP for approval.

- As the current organization charts were sufficiently generic to cover both standby and operating conditions, it was not necessary to maintain two different sets of organization charts.

- The current organization was adequate to address all the roles required by NRC as reflected in the Mill's license and the EA of February 1997.

- Although the charts were modified to better represent the current corporate and Mill operational staffing, the changes to the organization charts were still consistent with the roles reflected in the license renewal application and current license, and did not require a license amendment.

The SERP evaluation resulted in the following conclusion regarding item (2) under Section 2.1.1 above:

- The IMC SOP would undergo another revision prior to formal SERP review. The SERP did not finalize the IMC SOP during this meeting (see SERP 00/01-02, below, for completion of this item in a separate SERP).

With respect to Item (3) under Section 2.1.1 above, the SERP evaluation of this issue in light of Criterion 1 found that modifying the SAP is consistent with the license. The license requires that IUSA review analytical results to determine that no RCRA listed hazardous waste is included in material to be processed. Addition of these analytes to the SAP Table was in conformance with the license requirement that the Mill not accept RCRA listed hazardous waste, and addition of these analytes would not impair IUSA's ability to meet all applicable regulations.

With respect to Criterion 2, revision to the SAP Table 1 would be in conformance with the license application commitment that IUSA would have a Sampling and Analysis Plan and program in place for shipments received from Ashland 1. The objective of that commitment in the license application was to ensure that IUSA will only process materials that conform to environmental commitments made in the license amendment application. Therefore, addition of these compounds to the SAP Table 1 would not create any degradation of the essential safety or environmental commitments in the license application, or provided by the approved reclamation plan. The SERP also evaluated safety in terms of unloading requirements and handling properties of the material based on a review by an independent chemical expert, and was advised that:

- The materials could not generate a vapor concentration sufficient to require respiratory protective equipment for vapors;

- Current worker personal protective equipment was sufficient for protection from skin exposure;

- The materials would be safely compatible with all chemicals which they will contact in the Mill; and

- The materials would not affect the Reclamation Plan for the Mill.

During the SERP evaluation with respect to Criterion 3, the SERP noted that the primary environmental impacts evaluated in the EA of February, 1997 were based on the tailings containing large volumes of organics, such as kerosene and alcohol; large volumes of acid solutions; and smaller volumes of process chemicals. The EA assumed that the Mill was designed to manage such chemicals in significantly greater quantities than these trace levels being added to the SAP, which may not even actually arrive at the Mill due to volatilization.

Therefore, the SERP evaluation resulted in the following conclusions and recommendations regarding revision of the SAP Table 1 (item 3 under Section 2.1.1 above):

- The revisions to the SAP Table 1 met the standards set forth in the SERP SOP for approval.

- One additional compound reported in IT sampling—propylene chloride, and one additional compound identified in Mill sampling – di-n-octyl phthalate, were determined to not be RCRA listed hazardous waste.

- The chemical engineering consultant reported that the presence of these compounds presented no additional environmental, health or safety impacts or additional handling requirements.

- Acceptance of materials containing these compounds, as well as those already identified in the April 7, 2000 SAP, is in conformance with the environmental commitments in license amendment 10, in compliance with all NRC requirements applicable to the Mill, and consistent with the conclusions of the EA dated February, 1997.

- Therefore, Table 1 of the SAP would be revised to include these compounds, as identified in the J.A. Tischler memorandum of July 11, 2000.

2.2 SERP 00/01-02 - July 24, 2000

2.2.1 Description of Change, Test, or Experiment

The SERP met on Friday, July 21, 2000, and reconvened on Monday, July 24, 2000 in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance to consider the following issue:

> Review of a draft final Standard Operating Procedure (SOP) for Intermodal Container Acceptance, Handling and Release, and approval of the final revision based on comments given by the SERP.

2.2.2 Summary of SERP Evaluation and Conclusions

With respect to Criterion 1, the SERP evaluation noted that the IMC SOP is consistent with the license, because the license requires that the Mill have SOPs to support and implement operations defined by the license and supporting documents. This SOP would (1) prevent inadvertent acceptance of IMC's not properly destined for the Mill; and (2) ensure that IMCs released from the Mill meet the proper release criteria. Therefore, rather than impairing IUSA's ability to meet all applicable regulations, that ability is enhanced by this SOP.

In evaluating this change relative to Criterion 2, the SERP found that the IMC SOP has specific language about operations involving unloading IMCs, so it further enhances safety in that area.

Finally, with respect to Criterion 3, the SERP observed that the purpose of the IMC SOP is to ensure that IUSA accepts, handles, and releases IMCs in accordance with the license, applicable regulations, and the approved reclamation plan. The IMC SOP is therefore expected to produce no environmental impacts beyond those assessed in the EA dated February 1997, and is consistent with the conclusions regarding actions analyzed in the EA.

As a result of the SERP evaluation summarized above, the SERP conclusions and recommendations regarding the IMC SOP were as follows:

- The IMC SOP met the standards set forth in the SERP SOP for approval.
- In accordance with the SERP SOP and Guidance, the IMC SOP was approved for usage at the Mill.
- Future modifications of the SOP would be brought to the SERP for approval.

2.3 SERP 00/01-03 - August 3, 2000

2.3.1 Description of Change, Test, or Experiment

The SERP met on Thursday, August 3, 2000 in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance to consider the following issue:

> Revision No. 2 of the White Mesa Mill Groundwater Monitoring Plan and Standard Operating Procedures for Quarterly POC Monitoring

2.3.2 Summary of SERP Evaluation and Conclusions

In evaluating this revised SOP relative to Criterion 1, the SERP found that revision of the Plan and SOP is consistent with the license, for the following reasons. The renewal license, issued by the NRC in 1997, incorporated, among other things, the approved Point of Compliance (POC) monitoring program (for which an application had been submitted by the licensee in 1994). The Plan and SOPs were inspected by an NRC Hydrogeologist during the NRC inspection of July 25-27, who had commented after inspecting the Plan and SOPs that the Mill's groundwater sampling program was generally good, but that the procedures could use more detail in describing purging volumes and methodology. IUSA committed to incorporating these suggestions and forwarding information on this action to the NRC. The technical additions to the SOP were minor, and were consistent with having an SOP in place that conforms with the license, because the license requires that the licensee implement "a groundwater detection monitoring program to ensure compliance to 10 CFR Part 40, Appendix A" that is in accordance with the report entitled, "Points of Compliance, White Mesa Uranium Mill" with modifications as listed under License Condition 11.3 A, B, and C. This revision was consistent with LC 11.3 and would not, therefore, impair IUSA's ability to meet all applicable regulations.

In addition, the revision did not make any substantive changes in terms of monitoring locations or parameters, and the SERP found that the revision, therefore, met Criterion 2 in that it would not create any degradation of the essential safety or environmental commitments in the license application, or provided by the approved reclamation plan.

Finally, the SERP evaluated the revision relative to Criterion 3, noting that this revision is consistent with the conclusions of actions analyzed in the EA in that it makes no changes in the areas of:

1. POC wells to be monitored;

2. Analyses to be performed (the "analytical parameters");

3. Statistical data analysis to be used in interpreting the data;

4. Continued monitoring for uranium; or

5. Monitoring of the leak detection system as per the EA, and subsequent amendments.

As a result, the SERP found that the revised documentation activities for purge volumes and purge methodology were expected to produce no environmental impacts beyond those assessed in the EA dated February 1997.

The SERP therefore concluded that:

- The Groundwater Monitoring Plan and SOP revisions met the standards set forth in the SERP SOP for approval; and

- The revised Plan and SOP would be implemented.

2.4 SERP 00/01-04 - September 25, 2000

2.4.1 Description of Change, Test, or Experiment

The SERP met on September 25, 2000, in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance to consider the following issue:

> Complete the review and approval process for a Standard Operating Procedure (SOP) for Determination of Available Tailings Capacity, (the "Tailings Capacity Evaluation SOP") in accordance with Amendments 14 and 15 to the Mill License

2.4.2 Summary of SERP Evaluation and Conclusions

The SERP discussed the following reasons why Criterion 1 would be met: First, License Condition 10.14 of Amendment 14 to the Mill License states:

> "Prior to the licensee receiving materials from the Linde FUSRAP site, the licensee must make a determination that adequate tailings space is available for the tailings produced from the processing of this material. Such determination shall be made based on a SERP approved internal procedure. Design changes to the cells or the reclamation plan require the licensee to submit an amendment request for NRC review and approval".

Second, License Condition 9.11 of Amendment 15 to the Mill License states the following requirement:

> "The final reclamation shall be in accordance with the May, 1999, Reclamation Plan Revision 2.0, Attachment A submitted n June 22, 1999, and Revision 3.0 submitted on July 7, 2000, and July 17, 2000. Prior to the placement of alternate feed material, the licensee shall determine that adequate cell space is available for that additional material. This determination shall be made by a SERP approved procedure."

The SERP next found that the SOP would be in conformance with IUSA's commitments, which were considered by the NRC in issuing License Amendment 15, in that this SOP would be used only to make a determination that adequate tailings space is available for tailings produced from the processing of materials, and would not involve design changes to the cells or the reclamation plan. Therefore, it is in conformance with IUSA's commitments in the license application and provided by the approved reclamation plan, and would be consistent with Criterion 2.

With regard to Criterion 3, this SOP would ensure that tailings cells detailed in the EA are adequate in terms of capacity, and would therefore be consistent with the conclusions of actions analyzed in the EA.

As a result of the above evaluation, the SERP reached the following conclusions:

- The Tailings Capacity Evaluation SOP met the standards set forth in the SERP SOP for approval.
- The Tailings Capacity Evaluation SOP, SOP No. PBL-3, Rev. No. R-0, was approved for usage at the Mill.
- Future modifications of the SOP would be brought to the SERP for approval.

2.5 SERP 00/01-05 – January 12, 2001

2.5.1 Description of Change, Test, or Experiment

The SERP met on Friday, January 12, 2001, in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance, to consider SERP No. 00/01-05, regarding the following issue:

> Revision No. IUSA-1 of the White Mesa Mill Radiation Protection Manual and Standard Operating Procedures (SOPs)

2.5.2 Summary of SERP Evaluation and Conclusions

The SERP found that these SOPs are consistent with the license, in that the license requires that the Mill have SOPs to support and implement operations defined by the license and supporting documents. The improvements and updates in these SOPs would enhance IUSA's ability to comply with the license and NRC regulations. Therefore, Criterion 1 was met.

With respect to Criterion 2, the SERP commented that the SOP revisions incorporated updates or enhancements to ensure that the SOPs, while being technically adequate, also reflect current equipment, instruments, and practices. Also, all reviews necessary to ensure that any change, if made, would be equally as protective as a previous approach, were included in the review package. These reviews gave the SERP reasonable assurance that these revisions would be consistent with Criterion 2.

The SERP then determined that Criterion 3 was satisfied in that these revisions include improvements to existing SOPs, and were expected to produce no environmental impacts beyond those assessed in the EA dated February 1997. In addition, the Mill's NRC License Condition No. 9.6 requires that:

> "Standard operating procedures shall be established and followed for all operational process activities involving radioactive materials that are handled, processed, or stored. SOPs for operational activities shall enumerate pertinent radiation safety practices to be followed. Additionally , written procedures shall be established for non-operational activities to include in-plant and environmental monitoring, bioassay analyses, and instrument calibrations. An up-to-date copy of each written procedure shall be kept in the mill area to which it applies.
>
> All written procedures for both operational and non-operational activities shall be reviewed and approved in writing by the radiation safety officer (RSO) before implementation and whenever a change in procedure is proposed to ensure that proper radiation protection principles are being applied. In addition, the RSO shall perform a documented review or all existing operating procedures at least annually."

The February 1997 EA authorizes the licensee to "make changes in the procedures presented in the application" so long as those changes meet the three criteria detailed in the EA and in License Condition 9.4(B). The SERP found that the revisions to the RPM SOPs met all of these criteria. The SERP noted that these changes were also necessary to ensure that SOPs are established and followed for all non-operational activities, in this case radiation protection activities; and that they are up-to-date. In performing this update, the SOPs for radiation protection were also reviewed and approved by the Radiation Safety Officer (RSO) to ensure that proper radiation protection principles were being applied, and they had received an annual review by the RSO.

As a result of the described evaluation above, the SERP conclusions and recommendations regarding the Radiation Protection SOPs were as follows:

- The proposed revisions to the Radiation Protection SOPs met the standards set forth in the SERP SOP for approval.
- The Radiation Protection SOPs, SOP Numbers PBL-RP-1, -2, -3, and –4, Rev. No. IUSA-1, were approved for usage at the Mill.
- Future modifications of the RPM will be brought to the SERP for approval.
- The ALARA Committee, meeting quarterly to consider any issues relating to SOPs, would discuss these SOPs with the Mill Radiation Staff once per year to ensure that they are current and up to date; in addition, performance of these SOPs will be one of the subjects of the annual ALARA audit.
- A separate VPL SOP will be prepared, for review and approval by the SERP, before the next time VPL is shipped from the Mill.

2.6 SERP 00/01-06 - November 17, 2000

2.6.1 Description of Change, Test, or Experiment

The SERP met on Friday, November 17, 2000, in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance to consider the following issue:

> Review of a revised (Revision R-1) Standard Operating Procedure (SOP) for Intermodal Container Acceptance, Handling and Release, and approval of such revision based on comments given by the SERP.

2.6.2 Summary of SERP Evaluation and Conclusions

The SERP discussed the reasons that Criterion 1 would be met, as follows. The IMC SOP would be consistent with the license, in that the license requires that the Mill have SOPs to support and implement operations defined by the license and supporting documents. This SOP would continue

to: (1) prevent inadvertent acceptance of IMC's not properly destined for the Mill; and (2) ensure that IMCs released from the Mill meet the proper release criteria. However, in addition, this SOP contained added actions to correct minor weaknesses in the previous SOP, which were identified during a significant storm event. Therefore, rather than impairing IUSA's ability to meet all applicable regulations, that ability was enhanced by the further improvements proposed in this SOP.

Criterion 2 was evaluated and found to be met for two primary reasons: First, the IMC SOP was in conformance with the license application commitment that IUSA would accept IMCs of material, properly handle such IMCs, and release them according to the appropriate release criteria; second, the IMC SOP also retained specific language about operations involving unloading IMCs, and therefore enhanced safety in that area.

With respect to Criterion 3, the SERP found that the revision represented a further improvement of the previous Revision No. 0 of this SOP, and would not introduce any activities that would be inconsistent with the EA.

The SERP conclusions and recommendations regarding Revision No. 1.0 of the IMC SOP were, as a result, as follows:

- Revision No. 1.0 of the IMC SOP met the standards set forth in the SERP SOP for approval.
- The revised IMC SOP was approved for usage at the Mill.
- Future modifications of the SOP would be brought to the SERP for approval.

2.7 SERP 00/01-07 - December 15, 2000

2.7.1 Description of Change, Test, or Experiment

The SERP met on Friday, December 15, 2000, in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance to consider the following issue:

> Complete the review and approval process for a Calibration Function Check SOP, prepared in response to an NOV

2.7.2 Summary of SERP Evaluation and Conclusions

The SERP discussed the bases for consistency with Criterion 1 as follows: The SOP is consistent with the license, in that the license requires that the Mill have SOPs to support and implement operations defined by the license and supporting documents. Moreover, this is an improvement of the SOP. An NRC inspector felt that additional language specifying the steps used to perform these function checks should be added to our SOP, and IUSA committed to adding such language. Therefore, rather than impairing IUSA's ability to meet all applicable regulations, that ability was enhanced by this SOP.

The SOP text improvements also were found to meet Criterion 2, because they were in conformance with IUSA's commitment to ensure that calibrations are performed in a consistent manner, which can be documented.

Criterion 3 was determined to be met, as well, because as an improvement being made to an existing SOP, at the recommendation of an NRC inspector, the SOP was expected to produce no environmental impacts beyond those assessed in the EA dated February 1997, and was therefore consistent with the conclusions regarding actions analyzed in the EA.

The SERP conclusions and recommendations regarding the Calibration Function Check SOP were as follows:

- The revised Calibration Function Check SOP met the standards set forth in the SERP SOP for approval.

- In accordance with the SERP SOP and Guidance, and with the revisions discussed during the SERP meeting on December 15, 2000, the Calibration Function Check SOP, SOP No. PBL-T-1, Rev. No. R-0, was approved for usage at the Mill.

- Future modifications of the SOP will be brought to the SERP for approval.

2.8 SERP 00/01-08 - March 21, 2001

2.8.1 Description of Change, Test, or Experiment

The SERP met on Wednesday, March 21, 2001, in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance, to consider SERP No. 00/01-06, regarding the following items:

(1) Standard Operating Procedure (SOP) for Clearance of Linde Material Intermodal Containers

(2) Revised SOP for Intermodal Container Acceptance, Handling and Release

2.8.2 Summary of SERP Evaluation and Conclusions

For Item 1 identified in Section 2.8.1 above, the SERP found that this SOP does not conflict with any requirement specifically stated in the license. As directed by the AC, this SOP specific to the Linde Material will improve IUSA's ability to document the administrative review of Linde data. Therefore, Criterion 1 was met.

Criterion 2 was also met, the SERP noted, because the intent of the SOP was to ensure that the Mill will not receive any material from Linde that would either not conform with the RMPR or contain

listed hazardous waste. By accomplishing these goals, the SOP would enhance, rather than reduce, IUSA's ability to meet license and regulatory commitments.

Criterion 3 was also found to be satisfied relative to the fact that the EA concludes that 11e.(2) waste is placed in the tailings. This SOP was therefore consistent with the conclusions regarding actions analyzed in the EA, because it ensures that IUSA will have documentation in place demonstrating that the Linde Material the Mill receives and processes will result in 11e.(2) waste containing no listed hazardous waste.

The SERP conclusions and recommendations regarding the Standard Operating Procedure (SOP) for Clearance of Linde Material Intermodal Containers were as follows:

- Subject to minor revisions detailed below, revised SOP PBL-4 met the standards set forth in the SERP SOP for approval.
- In accordance with the SERP SOP and Guidance, SOP PBL-4 was approved for usage at the Mill, subject to incorporation of revisions discussed and indicated on the draft attached to the SERP Report 00/01-07.
- Future modifications of SOP PBL-4 would be brought to the SERP for approval.
- The ALARA Committee, meeting quarterly to consider any issues relating to SOPs, would discuss this SOP with the Mill Radiation Staff once per year to ensure that it is current and up to date.

The SERP then evaluated Item 2 in Section 2.8.1 above, the revised SOP for Intermodal Container Acceptance, Handling and Release. The SERP found that reviewing this SOP, as IUSA's ALARA Committee had requested, and also updating it to allow it to better reflect the Mill's most current practices, would be consistent with Criterion 1. That is, it would not conflict with any requirement specifically stated in the license, nor would it impair IUSA's ability to meet all applicable NRC regulations. Rather, the improvements and updates in this SOP would enhance IUSA's ability to comply with the Mill's NRC license and with NRC regulations.

The SERP then noted that the revisions to the SOP would not create any degradation in the essential safety or environmental commitments in the license application, or provided by the approved reclamation plan, and were therefore consistent with Criterion 2. Based on an extensive database, it was demonstrated by the Mill Radiation Safety Officer that the scanning of IMC tops yielded results indicating no contamination on these areas. However, personnel tasked with scanning the tops were at a significantly greater risk of accidents such as falling. Therefore, based on ALARA considerations, safety to personnel was improved, with no degradation in the essential safety or environmental commitments as set forth in Criterion 2.

With respect to Criterion 3, the SERP noted that the Mill conducts both in-plant safety <u>and</u> radiation safety programs. Section 4.7 of the EA states that "The licensee's operation is based on good safety practices and procedures". In proposing the revised IMC top scanning found in the SOP revision,

the RSO had noted that the scanning database demonstrates that the IMC tops do not show contamination. He had weighed any possible benefit of scanning the tops more frequently against the occupational safety risk to workers having to perform the scans. Based upon these data, the RSO had made an informed judgement that fewer scans, with QA scans performed to ensure no change to the trend observed, were reasonable and ALARA. Therefore, this revised SOP was expected to produce no environmental impacts beyond those assessed in the EA dated February 1997, and would be consistent with the conclusions of actions analyzed in the EA.

The SERP conclusions and recommendations regarding the Intermodal Container Acceptance, Handling and Release were as follows:

- Subject to minor revisions detailed below, revised SOP PBL-2 met the standards set forth in the SERP SOP for approval.

- In accordance with the SERP SOP and Guidance, SOP PBL-2, Rev. 2, was approved for usage at the Mill, subject to incorporation of the revisions discussed by the SERP and shown on the SERP review copy attached to SERP Report 00/01-07.

- Future modifications of SOP PBL-2 would be brought to the SERP for approval.

- The ALARA Committee, meeting quarterly to consider any issues relating to SOPs, would discuss this SOP with the Mill Radiation Staff once per year to ensure that it is current and up to date; in addition, performance of this SOPs would be one of the subjects of the annual ALARA audit.

2.9 SERP 00/01-09 - March 30, 2001

2.9.1 Description of Change, Test, or Experiment

The SERP met on Friday, March 30, 2001, in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance, to consider SERP No. 00/01-09, regarding the following items:

(1) Revision No. 1 of SOP PBL-RP-1, Section 1 of the Radiation Protection Manual being revised to IUSA-2, (the second revision made by IUSA).

(2) Revision No. IUSA-1 of Revision 1, dated 12/98, to Appendix E, White Mesa Mill Tailings Management System (Sections 3.1-3.4) and Appendices.

2.9.2 Summary of SERP Evaluation and Conclusions

The SERP first considered item 1 listed in Section 2.9.1 above, Revision No. 1 of SOP PBL-RP-1, Section 1 of the Radiation Protection Manual, as follows.

The SERP found Criterion 1 to have been met for the following reasons. First, the revisions to the Radiation Protection Manual were made in response to specific ALARA Committee requests; and, to enhance compatibility with current technologies. In particular, these updates contain improved methods for monitoring for personal exposure by using the most current technology. Therefore, rather than impairing IUSA's ability to meet all applicable regulations, that ability is enhanced by these SOPs. In addition, Criteria 2 and 3 were met in that these improvements to the SOPs would meet the standards for each of these criteria.

In considering item 2 listed in Section 2.9.1 above, Revision No. IUSA-1 of Revision 1, dated 12/98, to Appendix E of the White Mesa Mill Tailings Management System (Sections 3.1-3.4) and Appendices, the SERP observed that in general, the draft revisions to the Mill Tailings Management System sections were made for one of three reasons: (1) they were made in response to specific ALARA Committee requests; (2) they were made to update the SOPs; or (3) they were made to more clearly set forth procedures needed to meet current license requirements. The SERP also noted that these SOPs:

- Were based on (1) the previous SOPs contained in the License Application copied from the NRC Public Document Room (1991 revision) and (2) a copy of the License Application from the Mill (1993 revision); and

- Were updated to more clearly set forth procedures for inspecting and monitoring the tailings management systems at the Mill.

- Added an SOP regarding the freeboard calculation for Cell 3 as per License Condition 10.3, amended as of September 15, 2000.

Commenting that the existing SOPs were not sufficiently detailed in certain areas, the SERP found that Criterion 1 would be met because, rather than impairing IUSA's ability to meet all applicable regulations, that ability would be enhanced by these revisions to the SOPs.

With respect to Criterion 2, the SERP found that these SOP revisions were consistent with IUSA's overall ALARA commitment to continuously review and improve it's ability to meet safety and environmental commitments by systematically seeking ways to update the Mill's SOPs through the ALARA Committee review process. Also, for any revisions or updates, all reviews necessary to ensure that any change, if made, would be equally as protective as a previous approach, were included in the review comment notes attached that were be retained as part of SERP Report 00/01-09. These reviews were meant to give the SERP reasonable assurance that these revisions would not create any degradation in the essential safety or environmental commitments in the license application, or provided by the approved reclamation plan.

Finally, as improvements to existing SOPs, these revised SOPs were expected to produce no environmental impacts beyond those assessed in the EA dated February 1997; therefore, Criterion 3 was also satisfied.

The SERP conclusions and recommendations regarding Revision No. 1 of SOP PBL-RP-1, Section 1 of the Radiation Protection Manual being revised to IUSA-2, (the second revision made by IUSA); and (B) Revision No. IUSA-1 of Revision 1, dated 12/98, to Appendix E, White Mesa Mill Tailings Management System (Sections 3.1-3.4) and Appendices; were as follows:

- The subject SOP revisions met the standards set forth in the SERP SOP for approval.
- The SOP revisions did not conflict with any requirement specifically stated in the license, or impair IUSA's ability to meet all applicable NRC regulations. Both of the sets of SOP revisions described in items (1) and (2) of section 2.9.2 were in conformance with IUSA's license commitments.
- These SOP revisions were consistent with IUSA's overall ALARA commitment to continuously review and improve its ability to meet safety and environmental commitments by systematically seeking ways to update and improve the Mill's SOPs through the ALARA Committee review process.
- The subject revisions were approved for usage at the Mill, subject to incorporation of revisions discussed.
- Future modifications of the subject SOPs would be brought to the SERP for approval.
- The ALARA Committee, meeting quarterly to consider any issues relating to SOPs, would discuss these SOPs with the Mill Radiation Staff once per year to ensure that they are current and up to date.

3.0 Summary and Conclusions:

During the reporting period, nine separate SERP evaluations were conducted and completed in accordance with SERP procedures in White Mesa Mill Standard Operating Procedure PBL-1, Rev. No. R-2, and the SERP Guidance. SERP evaluations detailed above ensured that each approved action met the criteria stated in License Condition 9.4 (B). Records of each SERP evaluation and action are documented in individual SERP Reports retained at the Mill for review and inspection, in accordance with requirements in the Mill license.

INTERNATIONAL URANIUM (USA) CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 628 7798 (main) • 303 389 4125 (fax)

June 15, 2000

VIA OVERNIGHT MAIL

Mr. Philip Ting, Chief
Fuel Cycle Licensing Branch
Division of Fuel Cycle Safety and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North, Mail Stop T-7J9
11545 Rockville Pike
Rockville, MD 20852

Re: Source Material License No. SUA-1358

Dear Mr. Ting:

Enclosed are copies of updated organization charts for International Uranium (USA) Corporation's White Mesa Uranium Mill and corporate office. The organization structures depicted reflect recent staffing changes, but otherwise are essentially unchanged from those previously submitted to the U.S. Nuclear Regulatory Commission.

Should you have any questions regarding these charts, I can be reached at (303) 389-4153.

Sincerely,

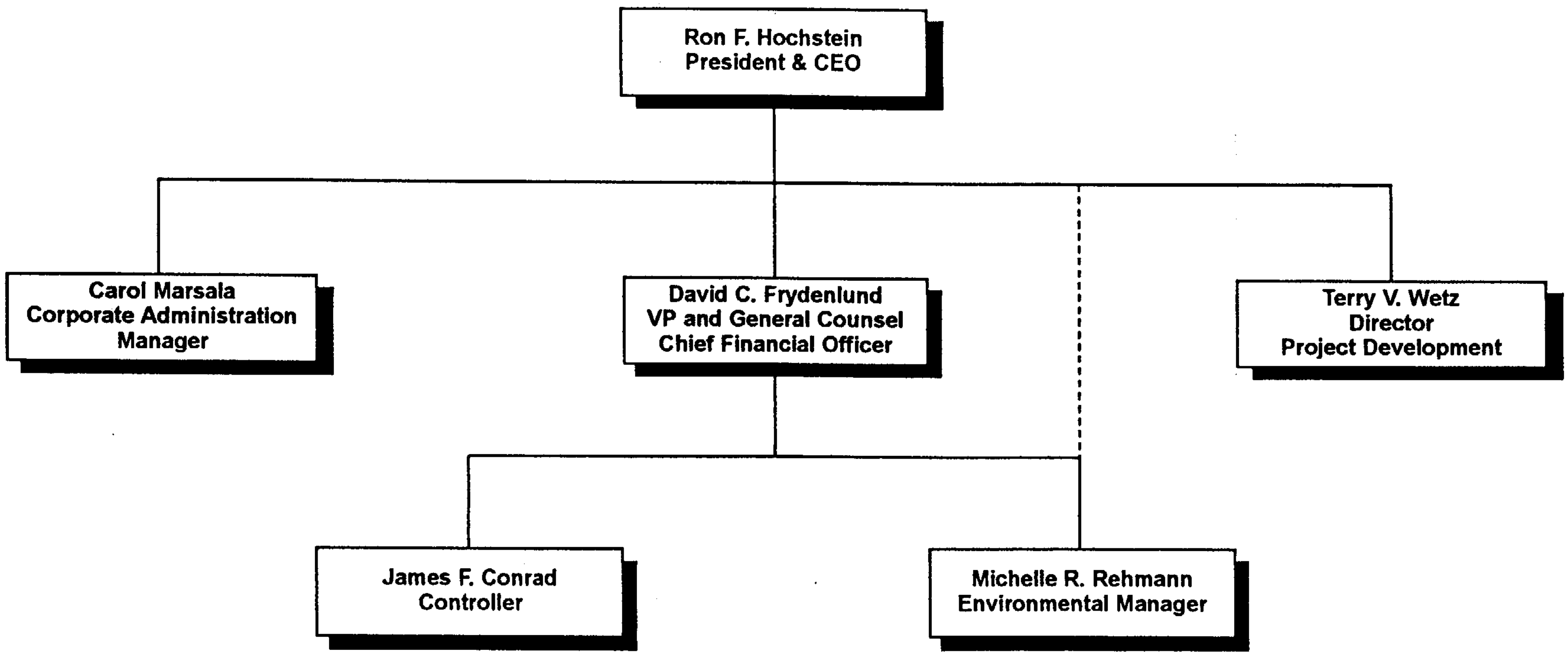
Ron F. Hochstein
President and Chief Executive Officer

Enclosures

cc: William von Till, U.S. NRC
Ron E. Berg
William N. Deal
David C. Frydenlund
Michelle R. Rehmann

International Uranium (USA) Corporation

Organization Chart



GROUND WATER MONITORING PLAN AND STANDARD OPERATING PROCEDURES FOR QUARTERLY POC MONITORING

International Uranium (USA) Corporation
P.O. Box 809
Blanding, UT 84511

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APPENDIX E

GROUND WATER MONITORING PLAN AND STANDARD OPERATING PROCEDURES

PART I <u>GROUND WATER MONITORING PLAN</u>

1.0 GROUND WATER MONITORING

This Groundwater Monitoring Plan is applicable to quarterly groundwater sampling of Point of Compliance ("POC") parameters as required by the Mill's current NRC license conditions. Per the license requirements, ground water is sampled on a quarterly basis for water surface elevations and analysis of radionuclides and chemical parameters. The active monitoring wells for the quarterly POC program are MW-5, MW-11, MW-12, MW-14, MW-15, and MW-17. Quarterly ground water samples are tested for the following parameters: U-Nat, nickel, potassium, and chloride.

2.0 QUALITY ASSURANCE

Quality assurance for ground water monitoring consists of QC samples submitted with each set of samples. The QC samples consist of 1 duplicate, 1 spike, 1 equipment rinsate, and 1 blank.

PART II <u>GROUND WATER STANDARD OPERATING PROCEDURES</u>

<u>STANDARD OPERATING PROCEDURE NO. 1.0 - GROUND WATER SAMPLING PROCEDURE AND MEASUREMENT OF FIELD PARAMETERS</u>

1.0 EQUIPMENT

Ground water monitor wells consist of narrow diameter PVC cased wells. Equipment used for ground water sampling program is as follows:

1.1 SAMPLING EQUIPMENT

1. 1.8 inch O.D. air-driven sampling pump, or equivalent
2. 150 psi air compressor and ancillary equipment, or equivalent
3. pH meter and probe
4. Temperature, level, and conductivity meter with probe

5. 0.45 micron filters
6. Field preservation chemicals – HNO_3
7. Five gallon calibrated sample bucket
8. Stopwatch
9. Polyethylene sample containers
10. Distilled water

1.2 EQUIPMENT FOR MEASUREMENT OF PHREATIC ELEVATIONS

Measurement of phreatic elevations is accomplished by using the following water level equipment:

1. YSI Model 3000 temperature, and conductivity meter with probe or equivalent

2.0 MONITORING METHODOLOGY

2.1 Phreatic Elevations – Quarterly

Phreatic elevations are determined in each monitoring well prior to sampling by using a water level indicator meter. Field logbooks are maintained listing depth to water from top of casings. Readings are taken by lowering the sensor into the casing until the electrical sensor contact shows that a conductive liquid has been reached. The distance from the point of contact to a known one-foot interval marker on the wire is determined using a tape measure in inches, or the scale provided on the back of the T-L-C meter in tenths of a foot. Data is recorded as Depth to Water, to the nearest tenth of a foot. This information is maintained in the logbooks and on computer files.

There are no action levels associated with a monitor well phreatic elevation.

2.2 Ground Water Quality

Ground water quality is monitored on a quarterly basis. The perched zone monitoring wells at the White Mesa Mill are located in a low-yield

formation. During any sampling event, some or all of the perched zone wells may be incapable of yielding two casing volumes of purge water. The sampler will attempt to evacuate two casing volumes, following procedures for calculating flow rate and flow volumes detailed below in Subsection 2.3. A minimum of three measurements of field parameters (pH, conductivity, and temperature) will also be taken during well purging. These will be recorded on the Field Worksheet. If the well yields two casing volumes the individual performing the sampling should immediately test for pH, temperature and specific conductance and collect the samples at once.

If the well cannot yield two casing volumes, the individual performing sampling should evacuate the well to dryness once. Approximately 24 hours later, after water level is again measured and recorded, the first sample should be tested for pH, temperature, and specific conductance. Samples should then be collected and containerized. The well is to be retested for pH, temperature, and specific conductance after sampling as a measure of purge efficiency and as a check on the stability of the water samples over time.

When the well water has reached equilibrium, the sample bucket is rinsed with the water stream. The flow is passed into a five gallon sample bucket then through a filtration unit utilizing a 0.45 micron membrane filter.

2.3 Field Sampling Procedure for Monitoring Wells:

1. Remove casing cap and check water level in well by lowering the electrical water level probe until a conductance reading is measured.

2. Record water level in Monitoring Well logbook. Record the water level, casing volume (see step 3 below), depth of water in the well (h) and other data required in Attachment 1. This may also be recorded in the well logbook

3. Determine the casing volume (V), where V = 0.653*h, for a 4" casing volume and V = .367*h for a 3" casing.

4. Lower field pump into well, making sure to keep pump at least five feet from the bottom of the well.

   Evacuate two casing volumes (if possible). Casing volumes are calculated using the formula in step (3) above, and recorded on the

Field Worksheet. Record the starting and ending time of well volume evacuation on the Field Worksheet. Determine pump flow rate (Q) by measuring the number of seconds (s) required to fill to the one-gallon mark in the calibrated bucket, and then dividing the number of seconds by 60, to obtain the flow rate in gallons per minute (gpm). With the flow rate, calculate how long it will take, at the given flow rate (in gpm) to evacuate the number of gallons contained in two casing volumes (2V). Record this in the "pumping rate" section of the Field Worksheet. If the well cannot yield two casing volumes, evacuate well to dryness, note the number of gallons evacuated on the Field Worksheet, and wait 24 hours before performing step 5.

After two casing volumes have been evacuated or 24 hours after a low yield well has been evacuated, the following steps are to be performed. If 24 hours have passsed, measure and record water level in the well before proceeding with the following steps.

5. Rinse all used probes with distilled water.

6. Rinse new filter with distilled water.

7. Rinse sample containers with filtered water.

8. Place a new 0.45 micron filter on sample tubing. Be careful not to contaminate filters by handling them with dirty fingers or gloves.

9. Pump sample through filtration unit, and into sample container, after letting the first 100 ml be used to rinse the sample container and be discarded.

10. Rinse lid of sample container after container is filled with filtered water, and tighten lid onto container.

11. Identify and label the sample container with:

    a. Project/facility
    b. Date and time of sample
    c. Any preservation method utilized
    d. Sampler's initials
    e. Filtered or unfiltered
    f. Sample location

12. Place sample in cooler.

    Upon returning to the office, the samples must be stored in a refrigerator at approximately 4° C until transferred to the analytical laboratory.

13. Before leaving the sampling location, thoroughly document the sampling event in the field logbook, by recording the items required in Steps 3 of SOP No. 2, Sample Handling, Documentation, and Analysis. Water levels are to be recorded in the well logbook. The Field Worksheet (Attachment 1) is also to be completed as field data are gathered at each well. The Field Worksheet provides data to show that the well was properly purged prior to sampling. These data and any other significant features or conditions observed during the sampling event must be recorded on the Field Worksheet.

14. Remove pump from well and replace the casing cap on well. Lock the well.

15. Rinse pump thoroughly with distilled water before sampling next well.

2.4 Field Data

Field data is retained on file or on computer for review. This information is compared to the analytical results of sampling for Quality Assurance and correctness.

2.5 Sample Transportation

Samples are catalogued at the White Mesa Mill office and sent to the Analytical Laboratory with the appropriate Chain of Custody sheets attached. Samples are transported via sealed containers by postal or contract services. Laboratory chain of custody procedures will be followed.

3.0 CALIBRATION

3.1 Phreatic Measurements

Equipment used in phreatic measurements are checked for calibration quarterly.

3.2 Water Quality

Probe and meter function including temperature, pH and conductivity are calibrated prior to each use by using known pH solutions and conductivity standards. Temperature is checked comparatively by using a thermometer.

4.0 RECORD KEEPING

Data will be logged onto Field Worksheets. (See Attachment 1.) Once all the data for the quarter (all wells) is completed, the data from the Field Worksheets is typed into a computer file. The Field Worksheets are retained at the Mill. Certificates of analysis and computer worksheets are maintained as a backup file for this information Data entered into the computer file will include well I.D., sample date, well phreatic elevations, field analytical data, and all laboratory analytical data.

5.0 MONITORING LOCATIONS AND FREQUENCY

Monitor wells are monitored quarterly for phreatic elevation, radionuclide and chemical analyte constituents. Water samples are collected from the following monitor wells: MW-5, MW-11, MW-12, MW-14, MW-15 and MW-17.

6.0 ANALYSIS PROCEDURE

Analytical procedures utilized by the contract laboratory are in accordance with their respective established quality assurance and quality control programs. The analytical determinations of each well sample are as follows: Chloride, nickel, potassium and uranium.

7.0 QUALITY ASSURANCE METHODOLOGY

7.1 Well Contamination

Well contamination from external surface factors, is controlled by installation of a cap over the surface casing and cementing the surface section of the drill hole. Wells have surface covers of mild steel with a lockable cap cover. Environmental staff have access to the key series locking the wells.

Subsurface well stagnation, for pumped wells, is reduced by pumping the wells until the temperature, pH, and conductivity levels of water samples become consistent. This verifies that the aquifer zone water is being drawn into the well and is a representative sample.

7.2 Phreatic Elevations

Monitoring of phreatic elevations is controlled by comparing historical field log data to actual measurement depth. This serves as a check of the field measurements.

7.3 Water Quality

Quality assurance of water sample collection, sample handling, and preservation is maintained by following procedures established in the White Mesa Mill ground water quality assurance plan. Observation of technician performance is monitored on a periodic basis to ensure compliance with this procedure. Blind duplicates of at least one well per quarter are submitted to the analytical laboratory to monitor field and laboratory quality assurance performance. Deviations exceeding ten percent (10%) result in analytical and field procedure review.

STANDARD OPERATING PROCEDURE NO. 2.0 – SAMPLE HANDLING, DOCUMENTATION, AND ANALYSIS

1.0 SAMPLE LABELING

All sample labels must be filled out in ink and numbered. The date, time, sampler's initials, and the sample location will be identified on each sample. The following information will be contained on the label: (1) project/facility, (2) date and time of sample collection, (3) sampler's initials, (4) filtered or unfiltered, (5) preservatives, and (6) sample location.

2.0 SAMPLE HANDLING AND SHIPPING

Sample containers will be placed and packaged in large plastic coolers. Samples will be stored at four degrees Celsius. Samples will then be transported via these sealed containers by postal contract services to the contract analytical laboratory.

Chain-of-Custody reports will be placed inside a resealable bag and taped to the inside lid. Seals will be placed on outside of packaging.

3.0 SAMPLE DOCUMENTATION AND TRACKING

Documentation of observations and data from sampling provide important information about the sampling process and provide a permanent record for sampling activities. All observations and sampling data will be recorded in waterproof ink in a bound field logbook with consecutively numbered pages.

STANDARD OPERATING PROCEDURE NO. 3.0 – DATA VALIDATION

1.0 DATA VALIDATION AND REVIEW

1.1 Data Qualifiers

Laboratory analyses will be reviewed by the Environmental Coordinator and/or staff. Quality control samples provide a comparative basis for analysis fundamental to this review process. Rejected data will not be usable for any purpose.

1.2 Required Contents of Laboratory Analytical Data Packages

The contract laboratory will prepare and retain all analytical and QC documentation. The laboratory will provide hard copy information in each data package submitted in accordance with QA objectives for the Surface Water QA Project Plan: COC forms cover sheets with comments, narrative, samples analyzed, reporting limits and LLD values for analytes, and analytical results of QC samples. The data reduction and laboratory review will be documented, signed, and dated by the analyst.

2.0 DATA VALIDATION PROCEDURE

Ten percent of the data will be subjected to a complete data validation using appropriate scientific methods and guidance from U. S. NRC Regulatory Guides 4.14 and 4.15. A minimum of reported results of one or more analytes for ten percent of the samples will be recalculated from the raw data and checked for transcription order. The laboratory's data validation specialist will be responsible in part for validating the analytical data.

3.0 CORRECTIVE ACTION

Corrective action will be taken for any noted deficiency in laboratory data. QA/QC problems will be brought to the immediate attention of the environmental coordinator and or staff. Appropriate response measures will be taken with regard to these problems.

Appropriate attachments and forms are maintained by the Environmental Department in accordance with record keeping policies of the White Mesa Mill.

TABLE 1

SUMMARY GROUND WATER MONITORING PROGRAM

MONITOR SITES

Monitor Wells No. MW-5, MW-11, MW-12, MW-14, MW-15 and MW-17, (QA/QC samples)

FIELD REQUIREMENTS

Depth of well in feet to nearest tenth of a foot.
Water temperature in degrees Celsius (°C)
pH in pH units, to two decimal places.
Specific conductance in umhos at temperature.

LAB REQUIREMENTS

Quarterly Samples

* Chlorides
Nickel (mg/l)
Potassium (mg/l)
** U-nat (uCi/ml)
U-nat LLD (uCi/ml)

ATTACHMENT 1

FIELD DATA WORKSHEET FOR GROUND WATER

Location______________________________

Date/Sampler
Name and initials__________________________

pH Buffer 7.0__________________________

pH Buffer 4.0__________________________

Specific Conductance_________uMHOS/cm

Well Depth______________________________

Depth to Water _______________________

Casing Volume (V) 4" Well:__________(.653h)
3" Well:__________(.367h)

Conductivity (avg)______________________

pH of Water (avg)________________________

Temperature (avg)______________________

Time:

Conductivity__________________________

pH__________________________________

Temperature__________________________

Time:

Conductivity______________________________

pH_____________________________________

Temperature______________________________

Time:

Conductivity__________________________

pH__________________________________

Temperature__________________________

Time:

Conductivity______________________________

pH_____________________________________

Temperature______________________________

Pumping Rate Calculation

Flow Rate (Q), in gpm.
S/60 = = ________________________

Time to evacuate two casing volumes (2V)
T = 2V/Q = ______________________________

Comments ____
____
____
____
____
____

1.0 RADIATION MONITORING – PERSONNEL

This section contains the following procedures for radiation monitoring: (1) airborne particulates (2) alpha surveys (3) beta/gamma surveys and (4) urinalysis surveys.

1.1 Airborne Particulates

Sampling for personnel exposure to airborne particulate radionuclides, other than for Radon progeny, will be done utilizing two distinct sampling protocols. The sampling protocols include usage of (1) personnel breathing zone samplers and (2) ambient air high volume samplers.

Specific standard operating procedures for these two collection methods are described in Section 1.1.2 and 1.1.3 below.

1.1.1 Frequency

For work with the potential to cause airborne radiation doses to site personnel, the frequency and type of air sampling to be conducted is determined from measured air concentrations. The air sampling program for work with airborne radioactive materials is:

0.01 DAC – 0.1 DAC	Quarterly or monthly <u>area air sampling</u> and/or bioassay measurements
> 0.1 DAC	Continuous sampling is appropriate if concentrations are likely to exceed 0.10 DAC averaged over 40 hours or longer.

The RSO will determine the exact frequency of area air sampling and/or bioassay measurements. He will also determine how many workers in a group of workers performing similar jobs are to be equipped with breathing zone air samplers and how often they are to wear the samplers. Higher airborne concentrations warrant more frequent use of area air samplers, bioassay measurements, and breathing zone air samplers. Area air samplers may be used where documentation exists showing the sample is equivalent to a breathing zone sample. Breathing zone samples taken within one foot of the worker's head are considered representative without further documentation. Breathing zone air samplers are preferred under work conditions of higher airborne concentrations. Regulatory Guide 8.25, Table 1.1.1-1 (which follows)

provides additional guidance for the RSO in designing and implementing air sampling programs for specific jobs.

Table 1.1.1-1 below contains breathing zone and area air sampling to be performed based on estimated intakes and airborne concentrations.

Table 1.1.1-1
Air Sampling Recommendations Based on Estimated Intakes and Airborne Concentrations

Worker's Estimated Annual Intake as a Fraction of ALI	Estimated Airborne Concentrations as a Fraction of DAC	Air Sampling Recommendations
< 0.1	< 0.01	Air sampling is generally not necessary. However, monthly or quarterly grab samples or some other measurement may be appropriate to confirm that airborne levels are indeed low.
	> 0.01	Some air sampling is appropriate. Intermittent or grab samples are appropriate near the lower end of the range. Continuous sampling is appropriate if concentrations are likely to exceed 0.1 DAC averaged over 40 hours or longer.
> 0.1	< 0.3	Monitoring of intake by air sampling or bioassay is required by 10 CFR 20.1502(b).
	> 0.3	A demonstration that the air samples are representative of the breathing zone is appropriate if (1) intakes of record will be based on air sampling and (2) concentrations are likely to exceed 0.3 DAC averaged over 40 hours (i.e., intake more than 12 DAC-hours in a week).
Any annual intake	> 1	Air samples should be analyzed before work resumes the next day when potential intakes may exceed 40 DAC-hours in 1 week. When work is done in shifts, results should be available before the next shift ends. (Credit may be taken for protection factors if a respiratory protection program is in place.)
	> 5	Continuous air monitoring should be provided if there is a potential for intakes to exceed 40 DAC-

		hours in 1 day. (Credit may be taken for protection factors if a respiratory protection program is in place.)

1.1.2 Airborne Particulate – Breathing Zone Sampler

1.1.2.1 General

Breathing zone samplers (MSA pumps and accessory kits) or equivalent are used to determine airborne exposure to uranium while individuals are performing specific jobs. The units consist of a portable low volume pump that attaches to the individuals belt, tygon tubing and filter holder that is attached to the individuals lapel or shirt collar. The unit monitors airborne uranium in a person's breathing zone. Pumps must be recharged after 6 to 8 hours of use.

1.1.2.2 Applicability

1. Breathing zone samples are required for all calciner maintenance activities.
2. Breathing zone samples are required at least quarterly during routine operating and maintenance tasks on representative individuals performing these tasks.
3. When radiation work permits are issued in which airborne concentrations may exceed 25% of 10CFR20 limits.
4. Weekly for yellowcake operations.
5. Additional breathing zone samples at the discretion of the RSO.

1.1.2.3 Procedure

The procedure for collecting a breathing zone sample is the following:

1. Secure the breathing zone sampler, which has been charged and loaded with a filter paper from the radiation department.

2. Secure the pump to the worker's belt and the filter holder to the shirt collar or lapel. Try to secure pump tubing to minimize restriction of motion.

3. Turn pump on (record the time pump was turned on) and continue monitoring until the work being monitored is completed and the worker no longer is in the exposure area. Record the time at which the job is complete.

4. Return the pump and accessories to the RSO, who will remove the filter paper for analysis. Be sure to indicate accurately the total time taken by the work being monitored.

5. Analysis of filter samples will be performed using a sensitive alpha detector. The procedure is as follows: (1) Count a background sample for ten minutes. (2) Place the breathing zone sample in the instrument and count the sample again for ten minutes. Divide the sample count by ten to obtain the count rate in cpm. (3) Divide the background count by ten to obtain the background count rate in cpm. (4) Subtract the background count rate from the sample count rate and record all data on the Breathing Zone sampling analysis form, a copy of which is attached.

6. Record the total hours of exposure that are being assigned to the employee on the Employee Exposure form, which is maintained in personnel folders. Be sure to consider protection factors permitted by respirator use if the employee was also wearing respiratory protection during the job.

7. The number of DAC hours assigned is calculated with the formula:

$$\text{DAC hours of exposure} = \frac{\text{Measured air concentration}}{(\text{DAC})(\text{PF})} \times \text{Total hours of exposure}$$

where,

DAC = Derived Air Concentration (for uranium; 10 CFR Part 20, Appendix B)

PF = protection factor for respirator use. If no respiratory protection was used,

PF = 1.

The measured air concentration must be in uCi/cc.

1.1.2.4 Calibration

Calibration of the breathing zone samplers will be performed before use as per the primary calibration method Bubble Tube Calibration described in Section 3.2.1.

1.1.2.5 Equipment – Breathing Zone Sampler

The equipment used for breathing zone samples consists of:

1. Personal sampling pumps

2. Gelman 37 mm Delrin filter holders, or equivalent
3. Gelman 37 mm type A/E glass fiber filters, or equivalent
4. Kurz Model 543 air mass flow meter, or equivalent

1.1.2.6 Data Record

Data maintained on file includes:

1. Time on and off for each sample pump.
2. Sampling location(s).
3. Individual's name, identification number, etc.
4. Date and sample number.

Sample count rate is determined by using a sensitive gross alpha detector and used to calculate air sample concentration and employee exposure.

1.1.2.7 Calculations

The airborne concentration in uCi/cc is equal to the sample count rate minus the background count rate in cpm divided by the instrument alpha efficiency, the sample flow rate in cc/minute, the sample time in minutes and a conversion factor converting dpm to uCi.

The calculation is:

Equation Number 1:

$$\text{Airborne concentration} = \frac{\text{(Count Rate)}}{\text{(Time)}(\langle\text{eff})\text{(conversion factor)}\text{(Flow Rate)}}$$

$$\text{i.e. } \frac{\text{uCi}}{\text{cc}} = \frac{(\text{cpm-Bkg})\ 1\ \text{uCi} \quad (1) \quad (1)}{(\langle\text{eff})(2.22\text{x}10^{6}\text{dpm})(\text{cc/min})(\text{min})}$$

where ⟨eff = cpm/dpm for counting instruments
cpm = counts/min
dpm = disintegrations/min
conversion factor 1 uci = $2.22\text{x}10^{6}$ dpm
Flow Rate = cc/min
Collection time = min

Once the airborne concentration has been calculated it is possible to calculate personnel exposure in microcuries (uCi). Personnel exposure is determined for an individual who is working in an area at a known air concentration (uCi/cc) for a given amount of time (hours) breathing the area air at an assumed rate. The breathing rate for standard man (Handbook of Radiological Health) is 1.20 cubic meters per hour (m^3/hr).

The calculation for personnel exposure is:

Equation Number 2:

Exposure uCi = (uCi/cc)(1.20m^3/hr)(hours of exposure)(conversion rate)

Where uCi/cc = air concentration from Equation 1

1.20 m^3/hr = breathing rate for standard man (ICRP)
hours of exposure = hours
conversion factor = 10^6cc/m^3

It is also possible to determine the percent or fraction of the Derived Air Concentration (DAC) for a particular radionuclide using the information obtained from the exposure calculation and dividing this value by the regulatory limit DAC listed in 10 CFR Part 20.

% DAC = uCi of exposure/uCi limit 10 CFR Part 20

For the Radionuclide Natural Uranium (U-Nat) the DAC limits from 10 CFR Part 20 for insoluble Class Y compounds are as follows:

Weekly 1.0×10^{-3} uCi/week
Quarterly 1.25×10^{-2} uCi/Qt
Yearly 5.0×10^{-2} uCi/yr

1.1.2.8 ALARA/Quality Control

The Radiation Safety Officer reviews each monitored result and initiates action if levels exceed 25% of 10 CFR 20 limits. At a minimum, ten percent (10%) of the air samples collected in a given quarter will be recounted using the same instrument or using a different instrument and these results will be compared to the original sample results. Deviations exceeding 30% of the original sample results will be reviewed by the RSO and the samples will be recounted again until the sample results are determined to be consistent. Additional QA samples consisting of spiked air samples, duplicate samples and blank samples will be submitted to the radiation department for counting. This will be based on ten percent (10%) of the number of samples collected during a quarter. The

sample results will be compared to the spiked values, duplicate values, or blank (background) values of the prepared sample. Deviations exceeding 30% of the determined spiked, duplicate or blank value will be recounted. If no resolution of the deviation exceeding 30% is made the QA samples preparation will be repeated. Periodic reviews by the Radiation Safety Officer and the audit committee will be made and documented to ensure quality maintenance and ALARA control.

1.1.3 Airborne Particulates – Airborne Uranium High Volume Sampling

Grab air sampling involves passing a representative sample of air through a filter paper disc via an air pump for the purpose of determining the concentration of uranium in breathing air at that location. Although the process is only measuring airborne concentrations at a specific place and at a specific time, the results can often be used to represent average concentration in a general area. A high volume sample pump will be used for this purpose. Samples will be analyzed as per standard gross alpha analysis procedures using a sensitive alpha detector.

1.1.3.1 Frequency and Locations

Area uranium dust monitoring frequency is monthly for the locations shown on the accompanying exposure time sheet. Areas BA-10 and BA-12 are soluble uranium exposure areas. These areas are areas where the uranium compounds that are produced are soluble in lung fluids and are comparatively quickly eliminated from the body. All the other areas are insoluble exposure areas. Insoluble uranium areas are areas where the uranium compounds are not readily soluble in lung fluids and are retained by the body to a higher degree. Temperature of drying operations has a significant impact on solubility of uranium compounds. High drying temperatures produce insoluble uranium compounds. Area uranium dust monitoring, during production periods, is weekly in the designated yellowcake production areas. Monitoring increases to weekly in other monitored areas with the observance of levels exceeding 25% of 10 CFR 20 limits and reverts to monthly upon a continued observance of levels below 25% of 10 CFR 20 limits as determined by the Radiation Safety Officer.

The RSO will designate those areas involved in area monitoring during non-production periods. Non-production period monitoring becomes effective one month following the cessation of production.

Annually, the licensee shall collect, during mill operations, a set of air samples covering eight hours of sampling, at a high collection flow rate (i.e., greater than or equal to 40 liters per minute), in routinely or frequently occupied areas of the mill. These samples

shall be analyzed for gross alpha. In addition, with each change in mill feed material or at least annually, the licensee shall analyze the mill feed or production product for U-Nat, Ra-226 and Pb-210 and use the analysis and results to assess the fundamental constituent composition of air sample particulates.

Whenever grab sampling results indicate that concentrations in work locations exceed 25% of the applicable value in 10 CFR Part 20, Appendix B, time weighted exposures of employees who have worked at these locations shall be computed. Calculations will reveal an individual's exposure in DAC hours. This value shall be assigned to the worker and logged onto the worker's "Employee Exposure to Airborne Radionuclides" form. This form is in Section 4. Whenever special air sampling programs (as required for cleanup, maintenance, decontamination incidents, etc.) reveal that an employee has been exposed to airborne radioactive material, the calculated value shall also be entered on the individual's exposure form.

1.1.3.2 Sampling Procedure

Monitoring equipment will be capable of obtaining an air sample flow rate of at least 40 liters per minute for one hour or longer. Equipment utilized will be:

1. Eberline RAS-1 or
2. Scientific Industries Model H25004, or
3. Equivalent

Filter media will have a maximum of 0.8 micron pore diameter. Equipment is calibrated prior to each usage.

1.1.3.3 Sampling Procedure

The following principles used for the collection of area grab samples must be considered when collecting a sample in order to obtain a representative air concentration that workers may be exposed to during their assigned work tasks.

1. The locations selected for sampling should be representative of exposures to employees working in the area.

2. For special air sampling, the sampling period should represent the conditions during the entire period of exposure. This may involve sampling during the entire exposure period.

3. For routine sampling, the sampling period must be sufficient to ensure a minimum flow rate of 40 liters per minute for at least 60 minutes.

4. Sample filters will be analyzed for gross alpha using a sensitive alpha detector.

5. Grab sampling procedures may be supplemented by use of Breathing Zone Samples for special jobs or non-routine situations.

Steps for collection of area airborne grab samples are as follows:

1. A high volume pump will be used for sample collection.

2. Check sample pump calibration.

3. Locate sampler at designated site. Insert a clean filter, using tweezers, into the filter holder on the sampler. Do not contaminate the filter. Log starts time and mill operating conditions at the site.

4. Collect a sample for a minimum of 60 minutes at a flow rate of 40 liters per minute.

5. After sampling is completed, carefully remove the filter, using tweezers, from the filter holder and place it in a clean glassine envelope, or in the plastic casing furnished with the filter.

6. Log all sample data on the log sheet.
   A. Sample location and number (also on the envelope).
   B. Time on, time off and date.
   C. Mill operating conditions at the site.
   D. Sampler's initials.

7. Analyze for gross alpha

1.1.3.4 Calculations

Perform calculations as described in Section 1.1.2.7.

1.1.3.5 Records

Logs of all samples taken are filed in the Radiation Safety Officer's files. Data are used to calculate radiation exposures as described in Section 4.0.

1.1.3.6 Quality Assurance

Calibration checks on each air sampler, prior to field use, ensure accurate airflow volumes. Use of tweezers and new filter storage containers minimizes contamination potential. Field logging of data during sampling and logging of identifying data on sampled filter containers minimizes sample transposition. Quality control samples will be analyzed as described in Section 1.1.2.8

Review of data by the RSO and by the Audit Committee further assures quality maintenance.

Code	Location/Description
BA-1	Ore Scale House
BA-2	Ore Storage
BA-7	SAG Mill Area
BA-7A	SAG Mill Control Room (radon only)
BA-8	Leach Tank Area
BA-9	Washing Circuit CCD Thickeners
BA-10	Solvent Extraction Building/Stripping Section
BA-11	Solvent Extraction Building/Control Room
BA-12	Yellowcake Precipitation & Wet Storage Area
BA-12A	Yellowcake Dryer Enclosure
BA-13	Yellowcake Drying and Packaging Area
BA-13A	Yellowcake Packaging Enclosure
BA-14	Packaged Yellowcake Storage Room
BA-15	Metallurgical Laboratory Sample Preparation Room
BA-16	Lunch Area
BA-17	Change Room
BA-18	Administrative Building
BA-19	Warehouse
BA-20	Maintenance Shop
BA-21	Boiler
BA-22	Vanadium Panel
BA-22A	Vanadium Dryer
BA-23	Vanadium Belt Screen

1.2 Alpha Surveys

1.2.1 Restricted Area

The restricted area is defined as:

1. The property area within the chain link fence surrounding the mill property and the area enclosed to the north and east of the facility by the posted restricted area fence.

2. The active tailings and liquid waste disposal areas.

All personnel who enter the restricted area will monitor themselves each time they leave the restricted area and at the end of their shift. The Radiation Department will review the monitoring information. All personnel exiting the restricted area must initial a record of their monitoring activity.

1.2.2 Instrumentation

The instrumentation utilized for personnel alpha scanning is listed in Appendix 1 at the end of this manual. Personnel alpha survey instruments are located at the exits from the restricted area.

1.2.3 Monitoring Procedures

The monitoring procedure includes the following steps:

1. The alarm rate meter is adjusted within the range of 500 to 750 dpm/100 cm^2 to ensure a margin of 250 dpm/100 cm^2 due to the low efficiency of this instrumentation.

2. An individual monitors himself by slowly passing the detector over their hands, clothing and shoes, including the shoe bottoms, at a distance from the surface of approximately ¼ inch. An area that is suspected of possessing any contamination (i.e. hands, boots, visible spotting/stain on clothing etc.) should be carefully monitored by placing the detector directly on the surface and note the measurement.

3. Should an alarm be set off indicating the presence of contamination, the individual should:

   A. Resurvey himself to verify the contamination.

   B. If contamination is present the individual must wash the affected area and again resurvey himself to ensure the contamination has been removed.

4. If the decontamination efforts by the individual are not successful, then the Radiation Safety personnel will be contacted to assess the situation. Further decontamination may be required.

5. If an individual's clothing cannot be successfully decontaminated, he/she must obtain clothing from the warehouse to use and must launder the personal clothing in the laundry room.

6. Individual surveys are to be logged and initialed.

1.2.4 Training

All employees will be trained on the proper scanning procedures and techniques.

1.2.5 Records

Log sheets will be collected daily and filed by the Radiation staff. Records will be retained at the mill. Contamination incidents will result in a written record, which is maintained on file.

1.2.6 Limits/ALARA

Contamination limits for personnel scans are set at 1,000 dpm/100 square centimeters. Records will be reviewed by the Radiation Safety Officer to maintain levels noted as low as reasonable achievable.

1.2.7 Quality Assurance

A random check of an individual's scanning technique provides quality assurance of the monitoring procedures. Daily function checks using calibrated sources assures instrumentation performance. Periodic review by the Radiation Safety Officer and the audit committee document and ensure quality control and ALARA maintenance.

1.3 Beta-gamma Surveys

Site employees working within the restricted area will be required to wear a personal monitoring device (such as a TLD, LUXEL badge or other NVLAP approved device which has been approved by the RSO and the SERP) during their work period. The

personal monitoring devices are normally issued to each employee quarterly; however, during pregnancy or if the radiological potential for exposure to an individual is anticipated to be elevated and requires quick assessment the badges may be issued monthly.

1.3.1 Monitoring Procedures

The monitoring procedures consist of:

1. Personnel issued personal monitoring devices will wear the device on the trunk (torso) of the body or visibly on the exterior of their hard hat. The personal monitoring device records beta/gamma radiation as well as other forms of penetrating radiation such as x-rays. A personal monitoring device is an exposure record of an individual's personal exposure to radiation while on the job. Therefore, personal monitoring devices are to remain at the Mill in the personal possession of each individual, in a locker or other secure area. All exposure records obtained by a personal monitoring device which are not consistent with the exposure rates of work tasks or work location measurements made throughout the Mill will be evaluated by the RSO. This evaluation will result in an investigation by the RSO and a written explanation of the findings. These written records will be maintained at the Mill.

2. Personal monitoring devices will be issued at a minimum quarterly and will be exchanged by the Radiation Safety Department. Missing or lost badges will be reported to management.

3. Female employees that become pregnant and continue to work during the course of their pregnancy will be placed on a monthly personal monitoring device exchange during this period. NRC Regulation Guide 8.13 provides guidelines to be followed during pregnancy and is made part of this procedure.

<u>Section summary</u>:

1. All employees working in the restricted area of the mill will be required to wear a personal monitoring device (such as a TLD, LUXEL badge or other NVLAP approved device which has been approved by the RSO and the SERP).

2. During off-shift hours, the monitoring device will remain at the Mill in an individual's personal locker or other secure location.

3. If the device is accidentally taken off-site or the badge is lost or damaged or there are other circumstances the employee knows of that would not be representative of their

personal exposure the circumstances must be reported to the Radiation Protection Department.

4. Badges will be worn on the trunk (torso) of the body or visibly on the exterior of their hard hats.

5. Monitoring devices will be issued at a minimum quarterly. Exception to this will be according to NRC Regulation Guide 8.13 – Pre-natal Exposures, and at the discretion of the RSO.

1.3.2 Records

The Radiation Protection Department will maintain all occupational exposure records in the departmental files:

1. Occupational exposure records are a part of an individual's health record and, as such, will be considered private information.

2. An individual may examine his/her exposure record upon request.

3. An employee terminating his/her employment with International Uranium (USA) Corporation may request a copy of his/her occupational exposure records.

4. The Radiation Protection Department on the signature of the employee will request prior occupational exposure records.

5. Occupational exposure records will be made available to authorized company or regulatory personnel.

1.3.3 Quality Assurance

Periodic reviews by the Radiation Safety Officer and the ALARA audit committee document and ensure quality control and maintenance of conditions ALARA.

1.4 Urinalysis Surveys

1.4.1 Frequency

Urinalyses will be performed on those employees that are a) exposed to airborne yellowcake or involved in maintenance tasks during which yellowcake dust may be

produced, or b) routinely exposed to airborne uranium ore dust. Baseline urinalyses will be performed prior to initial work assignments. Urinalyses will usually be performed on employees who have been working on assignments that require a Radiation Work Permit, and always on any individual that may have been exposed to airborne uranium or ore dust concentrations that exceed the 25% of the DAC level.

Urine samples will be collected from employees who have worked in yellowcake packaging, yellowcake precipitation, grind area (SAG Mill), ore feed, sample plant, scale house, and the sample preparation room every two weeks during production periods. Samples will be collected from all other employees monthly during production periods. During non-production periods, bi-weekly samples will be collected if individual exposures are expected to exceed 25% of the DAC value otherwise samples will be collected from all employees quarterly. Non-routine urinalyses will be used to determine if an over-exposure occurred for those individuals who have been exposed to yellowcake or ore dust in concentrations that would exceed 25% of the DAC value for uranium and, usually, for those employees who have worked under the guidelines of a Radiation Work Permit.

1.4.2 Specimen Collection

Clean, disposable sample cups with lids will be provided to each employee that will be required to submit a urine specimen. The containers will be picked up at the security shack as the individual enters the restricted area.

The container, filled with specimen, will be returned to the security shack prior to reporting to work. The name of the employee and the date of collection will be indicated on the specimen cup.

A valid sample must be collected at least 40 hours, but not more than 96 hours, after the most recent occupancy of the employee's work area (after two days, but not more than four days off).

The specimen should be collected prior to reporting to the individual's work location. To prevent contamination, the hands should be carefully washed prior to voiding.

Under unusual circumstances where specimens cannot be collected in this manner, the worker will shower immediately prior to voiding.

1.4.3 Sample Preparation

Equipment required:

Disposable centrifuge tubes with lids – 15 ml
10 ml pipette
5 ul pipette
10 ul pipette
Disposable tips for the above pipettes
Spiking solution – 0.03 or 0.02 g/l of uranium in de-ionized water

After the specimens are received, they will be stored in a refrigerator until they are prepared for analysis.

Sample preparation will be done in an area decontaminated to less than 25 dpm alpha (removable) 100 cm^2 prior to preparation of samples. All of the equipment that is used in sample preparation will be clean and maintained in such condition.

A log will be prepared and the following information will be kept for each urinalysis performed:

Sample identification number
Name of employee submitting the specimen
Employee's Social Security Number
Date of sample collection
Date the sample was sent to the laboratory
Date the results were received
Results of the urinalysis in ug/l
Indication of any spike used in ug/l

The centrifuge tubes will be marked with a sample identification number. 10 milliliters of urine will then be pipetted into the centrifuge tube using the pipette device. (To prevent contamination, a new tip must be used for each specimen.) After each step of the procedure, the proper entry must be made in the logbook.

The samples that are to be spiked for quality assurance purposes will then be prepared. The spikes will be introduced into the sample with 5 ul or 10 ul pipettes. A new tip must be used with each spike. With the standard spike solution (0.03 g/l of U), a 5 ul spike will result in a 15 ug/l concentration for the 10 ml sample; the 10 ul spike will give 30 ug/l). The proper entry must be made in the logbook for each sample spiked.

1.4.4 Quality Assurance

To assure reliability and reproducibility of results, at least 25% of the samples that are submitted for analysis will be used for quality assurance purposes. These samples will

consist of spikes, duplicates, and blanks (samples collected from individuals known to have no lung or systemic uranium burden).

Spiked samples will be prepared as stated under sample preparation of this procedure.

Duplicates will be identical samples of the same specimen and/or spikes of identical concentrations.

To assure reliability of the in-house analytical procedure, 10% of the samples will be sent to a contractor laboratory for analysis. These samples will contain quality assurance items designed to provide intra-laboratory comparisons.

1.4.5 Analyses

After preparation has been completed, the QA samples are securely packaged as soon as practicable and sent to the contract laboratory for analysis.

The samples that are to be analyzed in-house will be placed in the chemistry laboratory's refrigerator until the analysis can be completed. A copy of the in-house analytical procedure is described in Section 1.4.7.6.

Urinalysis results must be completed and reported to the Radiation Safety Department within seven days of the sample collection. The contract laboratory should report any results that exceed 35 ug/1 by telephone.

If any of the results obtained for the quality assurance control samples are in error by a ± 30%, the analysis will be repeated.

1.4.6 Corrective Actions

As soon as the analytical results are received, they are entered in the logbook and the entries are checked for correctness and completeness.

Corrective actions will be taken when the urinary uranium concentration falls within the limits listed in Table 1(attached).

The information must be placed in the individual employee's exposure file and maintained as directed by the NRC.

1.4.7 Determination of Uranium in Urine

Urine samples are collected on a routine basis from mill employees as required in Regulatory Guide 8.22. Disposable collection cups and sample vials are used. These can be disposed of after the lab report is returned to the Radiation Department unless re-analysis is needed to confirm results.

After the samples are collected as outlined in Guide 8.22, they are identified to the lab by collection date and number. The Radiation Department prepares the samples by shaking the capped collection cup and pipetting 10 ml of the sample into a graduated disposable 15 ml screw cap vial. Sample number also identifies the vial.

Spiked samples are prepared by adding known concentrations of uranium to samples as outlined in Guide 8.22.

The capped vials are submitted to the lab for analysis. The lab report is returned to the Radiation Department with results reported as micrograms/liter of uranium. The Radiation Department is notified immediately of any sample with a concentration greater than 35 micrograms/liter of uranium. The Radiation Department should compute the error on the control spiked samples and advise the lab if the results are more than ± 30% of the known values.

1.4.7.1 Equipment List

1. Specimen collection cups with disposable lids (VWR No. 15708-711 or equivalent)
2. Screw cap, disposable, graduated 15 ml centrifuge tubes (Corning No. 25310 or equivalent)
3. Micro-pipettes 1 each 5, 5 each 10 microliters (Oxford Model 7000 or equivalent) 20 ml Scintillation Vials
4. Disposable micro-pipette tips for micro-pipettes (Oxford No. 910A or equivalent)
5. Lab Oven
6. Hot Plate
7. Fume Hood
8. Ultrasonic Cleaner
9. ICP-MS
10. Forceps with curved tips

1.4.7.2 Reagent List

1. 1% to 2% Nitric Acid
2. Concentrated Nitric Acid
3. Perchloric Acid, Concentrated 70%

4. Wetting Agent
5. 1,000 ug/ml Uranium Stock Solution, certified vendor prepared
6. Dilutions of the above stock solution, replaced bi-annually. Used for QA/QC.
7. Appropriate Cleaning Solution for Ultrasonic Cleaner

Ensure that all reagents used are within their expiration dates listed on each reagent package, if applicable.

1.4.7.3 Premise

A portion of urine is digested in the presence of a strong oxidizer, and the sample is heated at 550 degrees Celsius for ½ hour to destroy all organics and insure proper oxidation state of any uranium present to allow the uranium to solubilize in a dilute matrix mix.

1.4.7.4 Safety Precautions

1 Follow laboratory guidelines when working with acids.

2. Utilize all appropriate PPE.

3. All digestions must be done under a working fume hood.

4. Working with perchloric acid in the presence of organic material can be hazardous. Do not overheat to dryness. Excess nitric acid is required to insure all organic material is destroyed prior to perchloric phase of digestion.

1.4.7.5 Sample Preparation Procedure

1. Compare sample numbering with bioassay result sheet to insure order and eliminate discrepancies.

2. To 20 ml scintillation vials, add 5 mls instrument grade concentrated nitric acid and 1 ml concentrated perchloric acid.

3. Maintaining sample order of left to right, front to back, lowest sample number to highest sample number in the set, add 5 ml to 10 ml of sample to the scintillation vial.

4. Swirl the vial and place on hot plate, again maintaining the above stated sample order. Hot plate should be set to allow sample to cook down for approximately 2 hours prior to perchloric phase of digestion.

5. Cook samples down to perchloric salts. If there is any brown color left in the sample, repeat digestion. It is important that wet ashing of sample is complete to insure oxidation of the uranium.

6. Place the samples in oven at 550°C for at least ½ hour.

7. Remove samples from the oven, allow to cool and add 10 ml of 1% or 2% nitric acid that has 0.2% wetting agent to the samples.

8. Heat the samples to digest salts.

9. Analyze using procedure on the ICP-MS described in section 1.4.7.6.

1.4.7.6 ICP-MS Procedures

Special considerations: Because of the high salt content of the samples, it is necessary to clean the skimmer and sampler cones after each use.

1. Turn the argon on at the tank and set the delivery pressure at 80 pounds per square inch (psi).

2. The ICP-MS is in a continuous standby mode because it is necessary to maintain a vacuum on the detector. To move from the standby mode to the operating mode press the **ON** button.

3. There are two turbo vacuum pumps that need to come up to speed prior to operating the ICP-MS. While waiting for the pumps, purge the interface area with argon by pressing the + and – buttons. The argon light will come on while the argon is purging. It is a good idea to purge at least 3 times.

4. Turn on the exhaust fan and the water supply to the ICP-MS. The water supply has to have a delivery pressure of 70 psi. It may be necessary to change the filters on the water supply in order to achieve sufficient water supply pressure. The ICP-MS will not operate below this pressure.

5. Turn on the computer and enter the Spectro program.

6. Press the **START** button to start the ignition sequence. The ignition step is 60 seconds. At 10 seconds the vacuum pump for the interface starts. If the exhaust fan is not on, the plasma will shut off a few seconds after ignition.

7. After the plasma ignites, the electronics go through a check loop. Avoid any input to the computer during this time.

8. Under the instrument window in the generator parameters turn the pump on and set the nebulizer flow to the appropriate amount determined from previous set up operations.

9. Under Utilities, select the Scan Manager window. From this window, select the time scan that has previously been set up for your operation.

10. Using the instrument settings, adjust or verify that the Rh line is about 3×10^5 counts. Close and exit Scan Manager.

11. Under Measure, select Quantitative and then Bioanalysis.

12. After entering this window under Function, select Standardize Method and follow prompts. After verifying standardization values are close to previous operation, begin sample analysis.

13. Because of the nature of the sample, it is necessary to aspirate a blank in between each sample. After 5 to 7 samples, the blank needs to be aspirated for a sufficient time to clean the salt build up.

14. To begin sample analysis, press F2 or click the Start button at the bottom left side of the window. Record the value and move to the next sample.

15. After the last sample, exit window and aspirate the blank long enough to clean the lines and chambers.

16. Allow the pump to run long enough without aqueous uptake to void all lines and chambers.

17. Turn the pump off and relax lines off of pump.

18. Push the STOP button to go back to the standby mode.

19. After 5 to 10 minutes turn off the water supply, exhaust fan and argon.

All bioassay samples need to be analyzed three (3) working days from receipt in the laboratory. Samples are extremely susceptible to contamination. Precautions should be taken to minimize traffic and fugitive dust while samples are digesting.

Volume additions are made with an auto-pipette for which the calibration has been checked.

1.5 In-vivo Monitoring

In-vivo body counting for lung burdens of U-natural and U-235 will not be routinely conducted. Monitoring will be conducted at the discretion of the Radiation Safety Officer in consultation with IUC management should potential exposure to an individual warrant.

2.0 RADIATION MONITORING – AREA

2.1 Airborne Particulates – High Volume Airborne Uranium Area Air Sampling

Area air sampling involves passing a representative sample of air through a filter paper disc via an air pump for the purpose of determining the concentration of uranium in breathing air at that location. Although the process is only measuring airborne concentrations at a specific place and at a specific time, the results can often be used to represent average concentration in a general area. A high volume sampler or similar high volume pump will be used for this purpose. Samples will be analyzed as per standard gross alpha analysis procedures using a sensitive alpha detector.

2.1.1 Equipment

Monitoring equipment will be capable of obtaining an air sample flow rate of 40 lpm or greater for one hour or longer. A variety of equipment may be used for area air sampling, however normally the equipment used is:

1. Eberline RAS-1, or equivalent

Filter media will have a maximum of 0.8 micron pore diameter. Equipment is calibrated prior to each usage as per Section 3.6 of this manual.

2.1.2 Frequency/Locations

Area uranium dust monitoring frequency is monthly for the locations shown on the accompanying exposure time sheet. Areas BA-10 and BA-12 are soluble uranium exposure areas. These areas are areas where the uranium compounds that are produced are soluble in lung fluids and are comparatively quickly eliminated from the body. All the other areas are insoluble exposure areas. Insoluble uranium areas are areas where the uranium compounds are not readily soluble in lung fluids and are retained by the body to a higher degree. Temperature of drying operations has a significant impact on solubility of uranium compounds. High drying temperatures produce insoluble uranium compounds. Area uranium dust monitoring, during production periods, is weekly in the designated yellowcake production areas. Monitoring increases to weekly in other monitored areas with the observance of levels exceeding 25% of 10 CFR 20 limits and reverts to monthly upon a continued observance of levels below 25% of 10 CFR 20 limits as determined by the Radiation Safety Officer.

The RSO will designate those areas involved in area monitoring during non-production periods. Non-production period monitoring becomes effective one month following the cessation of production.

Annually, the licensee shall collect, during mill operations, a set of air samples covering eight hours of sampling, at a high collection flow rate (i.e., greater than or equal to 40 liters per minute), in routinely or frequently occupied areas of the mill. These samples shall be analyzed for gross alpha. In addition, with each change in mill feed material or at least annually, the licensee shall analyze the mill feed of production product for U-Nat, Ra-226 and PB-210 and use the analysis and results to assess the fundamental constituent composition of air sample particulates.

Whenever grab sampling results indicate that concentrations in work locations exceed 25% of the applicable value in 10 CFR Part 20, Appendix B, time weighted exposures of employees who have worked at these locations shall be computed. Calculations will reveal an individual's exposure in DAC hours. This value shall be assigned to the worker and logged onto the worker's "Employee Exposure to Airborne Radionuclides" form. Whenever special air sampling programs (as required for cleanup, maintenance, decontamination incidents, etc.) reveal that an employee has been exposed to airborne radioactive material, the calculated value shall also be entered on the individual's exposure form.

2.1.3 Sampling Procedures

1. A RAS-1 or similar high volume pump shall be used for area grab sampling. Insure the pump has been recently calibrated within the past month.

2. The locations selected for area air samples should be representative of exposures to employees working in the area.

3. For routine sampling, the sampling period should be for a minimum collection duration of 60 minutes at a flow of 40 lpm or greater.

4. Insert a clean filter into the filter holder on the sampler. Note start time of pump and record unusual mill operating conditions if they exist.

   A. Stop sample collection and note time. Normally, an automatic timer is connected to the sampler and a 1 hour sample collection time is used.

6. Remove the filter from the sampler and place in a clean glassine envelope or the package supplied by the manufacturer for delivery to the Radiation Department.

7. Count the sample by gross alpha counting techniques and enter the result and sampling information into the record.

2.1.4 Calculations

Perform calculations as specified in Section 4.0.

2.1.5 Records

Logs of all samples taken are filed in the Radiation Protection Officer's files. Data is utilized to calculate radiation exposures as specified in Section 4.0.

2.1.6 Quality Assurance

Calibration checks on each air sampler are made at least monthly to ensure accurate airflow volumes are being collected. Usage of tweezers and new filter storage containers minimizes contamination potential. Field logging of data during sampling and logging of identifying data on sampled filter containers minimizes sample transposition. Samples may periodically be submitted for chemical analysis and a comparison of these results to the radiometric measurements will be made.

Review of data by the Radiation Safety Officer and by the ALARA audit committee further assure quality maintenance.

Table 2.1.6-1
Airborne Radiation Sample Locations

Code	Location/Description
BA1	Ore Scalehouse
BA2	Ore Storage
BA7	SAG Mill Area
BA7A	SAG Mill Control Room (radon only)
BA8	Leach Tank Area
BA9	Washing Circuit CCD Thickness
BA10	Solvent Extraction Building/Stripping Section
BA11	Solvent Extraction Building/Control Room
BA12	Yellowcake Precipitation & West Storage Area
BA12A	Yellowcake Dryer Enclosure
BA13	Yellowcake Drying & Packaging Area
BA13A	Yellowcake Packaging Enclosure
BA14	Packaged Yellowcake Storage Room
BA15	Metallurgical Laboratory Sample Preparation Room
BA16	Lunch Area
BA17	Change Room
BA18	Administrative Building
BA19	Warehouse
BA20	Maintenance Shop
BA21	Boiler
BA22	Vanadium Panel
BA22A	Vanadium Dryer
BA23	Vanadium Belt Screen

2.2 Radon Progeny

2.2.1 Definitions

A. Working Level:

(Exposure level, not a dose rate) The exposure to 1.3E + 05 MEV of alpha energy or the potential alpha energy in one liter of standard air containing 100 pCi each of RaA (Polonium-218), RaB (Lead-214), RaC (Bismuth-214), and RaC prime (Polonium-214).

B. Kusnetz Method:

Method of radon progeny measurement and calculation based upon a 10 liter sample and at least 40 minutes decay time before counting.

2.2.2 Equipment

The equipment utilized consists of the following or appropriate equivalent:

1. Portable personal sampler
2. Gelman 25 mm filter holder with end cap
3. Gelman Type A/E 25 mm diameter glass fiber filters
4. Counter-Scaler – Eberline MS-3 with SPA-1 probe or equivalent

2.2.3 Frequency/Location

Radon progeny samples are obtained monthly at those locations included for area particulate uranium monitoring during production periods. Monitoring is increased to weekly upon observance of levels exceeding 25% of 10 CFR 20 limits. Monitoring is reduced to monthly upon the continued observance of levels below 25% of 10 CFR 20 limits. During non-production periods, monitoring is done monthly for only those locations occupied by personnel where exposures may have the potential of exceeding 25% of 10 CFR 20 limits. The Radiation Safety Officer shall so designate those areas to be monitored during non-production periods.

2.2.4 Procedures

The procedures to be utilized are as follows:

1. Assemble filter trains.

2. Ensure pump batteries are fully charged.

3. Calibrate pump (see Section 3.5).

4. Attached filter trains at sample locations; disconnect end plug.

5. Collect sample for five minutes at 4.0 lpm.

6. Collect sample in the breathing zone of the employee.

7. Log sample site, time started, time stopped, and filter pump number prior to leaving each site on the field log notebook.

8. Samples are counted between 40 minutes and 90 minutes after collection using sensitive alpha detector.

9. Check the calibration and function check information to ensure the detector is calibrated and operating.

10. If the calibration check correlates, proceed with sample analysis.

11. Radon progeny samples are normally counted for three minutes, however any sample count time may be selected for counting.

12. Run background detector count prior to running sampled filters.

13. After counting, calculate working levels.

Equation:

$$\frac{(\text{CPM - BKg})}{(\alpha\text{eff})\ (20\ \text{liters})\ (\text{Time Factor})} = \text{W.L.}$$

Where: CPM – sample count per minute
BKg – counter-detector background count per minute

Efficiency α: The efficiency of the counting system
(See Section 3.2.3.3)

Time Factor: Values determined from Kusnetz method
(See attached Table 2.2)

W.L. = Working Levels

TABLE 2.2.4-1
Time Factors

Min.	Factor	Min.	Factor
40	150	71	89
41	148	72	87
42	146	73	85
44	142	75	83
45	140	76	82
46	138	77	81
47	136	78	78
48	134	79	76
49	132	80	75
50	130	81	74
51	128	82	73
52	126	83	71
53	124	84	69
54	122	85	68
55	120	86	66
56	118	87	65
57	116	88	63
58	114	89	61
59	112	90	60
60	110		
61	108		
62	106		
63	104		
64	102		
65	100		
66	98		
67	96		
68	94		
69	92		
70	90		

2.2.5 Exposure Calculations

The personnel exposure calculations are a job-weighted average of those areas and concentrations that an individual is exposed to. The procedure is:

1. Determine areas and durations (hrs.) each individual worked during the period (month and quarter).

2. Determine monitored concentrations (W.L.) for each area so noted.

3. The multiplication of the hours worked in each area by the area concentration (W.L.) noted is added to the result for each area involved in the period.

4. The result is the Working Level Hours exposed (WLH) for the period.

5. The working level hours (WLH) divided by 173 (30 CFR 57.5-40 note); or hours per month gives the working level months (WLM) exposure. (The limit is 4 working level months exposure per year.)

6. If calculated per quarter, the working level hours summed for the quarter are divided by 519 (173 X 3) to obtain the working level quarter exposure.

See Section 4.0 for details on how to perform exposure calculations and maintain the exposure records.

2.2.6 Records

Data records, which are filed in the radiation protection files, include:

1. Sample location
2. Date and time of sample
3. Time on and off of sample pump
4. Counts per minute of sample
5. Elapsed time after sampling
6. Background detector count
7. Appropriate Kusnetz time factor
8. Working level
9. Sampler identification

Employee exposure records include:

1. Month monitored
2. Areas and duration worked
3. Employee identification
4. Concentrations (W.L.) observed
5. Calculated W.L.M.'s

2.2.7 Quality Assurance

Calibration checks each month assure proper calibration of the counting equipment. Documented semi-annual calibrations of the counting equipment using certified alpha calibration and pulse meter sources ensure proper calibration of the equipment over the anticipated ranges. The air sampling system has documented calibration prior to each use, ensuring sampling the appropriate air volumes. Duplicate counts of select data may be counted to assure instrument precision. Field documentation is maintained for each sample during monitoring. This methodology provides assurance in data quality.

Review of data by the Radiation Protection Officer and the Audit Committee further assures quality maintenance.

2.3 Alpha Surveys

2.3.1 Equipment

Equipment to be utilized in area alpha surveys are shown in Appendix 1. Pre-use function checks will be performed on all radiation survey equipment as specified in Section 3.1.2.3.2.

2.3.2 Frequency/Locations

2.3.2.1 Respirators

Respirators are monitored following cleaning and re-assembly of each respirator as specified in section 2.3.3.1 below.

2.3.2.2 Area Surveys

Fixed and removable alpha surveys are made at those general locations on the Table 2.3.2.2-1, "Alpha Area Survey Locations." Surveys are completed weekly during production periods. During non-production periods, only those areas designated by the Radiation Safety Officer as authorized lunchroom/break areas are monitored.

Table 2.3.2.2-1
White Mesa Mill
Alpha Area Survey Locations

Scale House Table
Warehouse Office Desks
Maintenance Office Desks
Change Room Lunch Tables
Maintenance Lunchroom Tables
Mill Office Lunchroom Tables
Metallurgical Laboratory Desks
Chemical Laboratory Desks
Administrative Break Room Counter
Administrative Office Desks

2.3.3 Procedures

2.3.3.1 Respirators

Respirators are monitored utilizing a sensitive alpha meter such as a Ludlum Model 3 meter with a 43-2 detector or other equivalent radiological instruments. As an example, the 43-2 detector's active surface area is 11.6 square centimeters. Metered readings are adjusted from x dpm per 11.6 square centimeters to y dpm per 100 square centimeters. Each cleaned respirator is monitored inside the face seal with the detector located ¼ inch from the respirator surface. Readings exceeding 100 dpm/100 square centimeters result in re-cleaning or discarding the respirator. Respirator cleaning and monitoring is a function of the radiation protection staff assigned to this duty. The detector's surface and performance is checked prior to each use period.

2.3.3.2 Total Alpha Surveys

Alpha surveys for fixed alpha contamination are performed using a variety of alpha detecting instruments. Each instrument is checked using a calibrated alpha source for proper function and operation prior to use, as described in Section 3.1.2.3.2. Instruments used for this survey are listed in Appendix 1. Adjustments to the surface area being measured using a particular detectors surface area to the commonly used unit of dpm per 100 square centimeters must be made. For instance, the surface area of a Ludlum Model 177 with a 43-1 detector is $75cm^2$; the Eberline ESP-1 with an AC-3 detector has a surface area of $59cm^2$. Therefore when converting a measurement to a useful commonly used unit of $dpm/100cm^2$, a multiplying area factor must be applied to the measurement. For the Ludlum instrument with a 43-1 detector of $75cm^2$ surface this is accomplished by

multiplying the value by 1.33 (i.e. $100cm^2$ divided by $75cm^2$). For an ESP-1 with a detector surface of $59cm^2$ the actual measured value must be multiplied by 1.70, again the $100cm^2$ divided by $59cm^2$ for the detector's surface area.

The procedures are:

1. Turn the meter on and check the meter battery condition.

2. Check alpha detector mylar surface for pinholes, etc. Replace if necessary and repeat calibration.

3. As specified in Section 3.1.2.3.2, perform a function calibration check using calibrated alpha source.

4. If check is acceptable, proceed with monitoring.

5. At each designated site, monitor designated surfaces, table tops, etc., holding within ¼ inch of the surface.

6. Record data, location, cpm/cm^2 monitored on data sheet.

7. At the conclusion of the survey, transpose results to the file log, correcting to dpm/100 cm^2, using correction for detector's surface area and cpm/dpm conversion factor.

2.3.3.3 Removable Alpha Surveys

The Ludlum Model 2200 scaler with 43-17 detector, or a variety of other sensitive alpha detection instruments such as Model 2929 or equivalent, counts wipe samples collected during removable alpha surveys. Glass fiber filters, sized to fit the detector sample slot, are utilized as the wipe medium. A template having a 100 square centimeter surface area maybe used to standardize the surface area wiped.

The procedure is:

1. Perform function check calibration of the scaler/detector. Ensure that this measurement is within ± 10% of the value obtained from the calibration laboratory.

2. If so proceed with the survey and counting.

3. Obtain clean filters and clean envelopes for filter storage.

4. At a location to be surveyed, remove the filter from the envelope and wipe the surface covering approximately 100cm^2. This is easily accomplished by making a "S" shaped smear for approximately 10 inches using normal swipes (approximately 2.5 cm diameter).

5. Record on envelope the date and location of the sample.

6. Upon returning to counting lab, place an unused filter in the counting unit for at least 1 minute and obtain a background count rate.

7. Repeat procedure for each used filter, extracting filter from envelope, immediately prior to counting, using tweezers and placing in the detector slot with the wiped surface facing the detector, and count for at least 1 minute.

8. Convert results from cpm/filter to dpm/filter (100 cm^2 wiped) after subtracting the blank background count.

9. Record on the alpha survey form the following information:

   A. Sample location and conditions
   B. Sample date
   C. Sampler identification
   D. Wipe count dpm/100 cm^2

10. Discard the filters and envelopes

2.3.4 Action Limits

2.3.4.1 Respirators

Levels greater than 100 dpm/100 cm squared require re-cleaning or discarding of a respirator.

2.3.4.2 Fixed Alpha Surveys

Levels greater than 1,000 dpm/100 cm squared require remedial action by management. ALARA criterion ensures that the Radiation Safety Officer takes action where he deems necessary to maintain levels as low as reasonably achievable.

2.3.4.3 Removable Alpha Surveys

Levels greater than 1,000 dpm/100 cm squared require remedial action and decontamination. ALARA criteria ensures that the Radiation Safety Officer takes action where he deems necessary to maintain levels as low as reasonably achievable.

2.3.5 Records

Records of fixed and removable alpha surveys are maintained in the radiation protection office files. Records include:

1. Sample location/conditions
2. Sample date
3. Sampler identification
4. Fixed alpha determination – dpm/100 cm^2
5. Removable alpha determination – dpm/100 cm^2
6. Remedial action taken, where necessary

2.3.6 Quality Assurance

Calibration function checks of detector performance and visual observation of detector surfaces prior to each survey ensures counting reliability and consistency. Usage of clean containers and tweezers minimizes contamination of wipe samples. Field logs of sample I.D.'s on sample containers minimizes transposition of samples. Data review by the Radiation Safety Officer and by the Audit Committee further assures quality maintenance.

2.4 Beta-gamma Surveys

2.4.1 Equipment

Beta/Gamma surveying instruments used for beta-gamma surveys are listed in Appendix 1 and the sources used are listed in Appendix 2.

Some instruments read directly in MREM/hour while others read in CPM (with a conversion to MREM/hour). The model 44-6 detector has a removable beta shield allowing discrimination between beta and gamma contributions. Each instrument has a manufactures user's manual which describes the function, use and capability of each instrument. These manuals must be understood before surveying proceeds. Calibration

of Beta/Gamma and functional checks are performed using calibrated CS-137 or SR-Y 90 sources

2.4.2 Frequency/Locations

The sites noted on the accompanying table are monitored on a monthly basis by of the radiation protection staff during production periods. During non-production periods, only areas routinely occupied by personnel are monitored as designated by the Radiation Safety Officer.

2.4.3 Procedures

The monitoring procedures are:

1. Check meter battery condition.

2. Check detector using a check source.

3. If the calibration function check indicates that the instrument is operating within calibration specifications, proceed with monitoring.

4. Survey each designated location on Table 2.4.3-1 and record in the field log:

   A. Site location/condition
   B. Date
   C. Instrument used
   D. Sampler's initials
   E. Meter reading (beta + gamma)
   F. Meter reading (gamma)

5. Upon returning to the office, record the mr/hr reading into a permanent file which is maintained for beta-gamma exposure evaluation.

Table 2.4.3-1
Beta-gamma Survey Locations

Identification Number	Description of Possible Source of Area of Exposure	Distance from Source in Cm
WM-1	Mill Feed Hopper & Transfer Chute	1
WM-2	SAG Mill Intake-Feed Chute	1
WM-3	Screens-Area Floor Between Screen	1
WM-4	Leach Operator's Desk	1
WM-5	Leach Tank Vent #3	1
WM-6	Leach Tank #3 – Wall	1
WM-7	CCD Thickeners	1
WM-8	Pumphouse Tailings Discharge	1
WM-9	Oxidant Makeup Room-Sump Pump	1
WM-10	Shift Foreman's Office-Work Desk	1
WM-11	Sand Filters-Top Deck #1 Filter	1
WM-12	Precipitation Tanks #1 Tank; Wall	1
WM-13	Precipitation Section "Lab Bench"	1
WM-14	Precipitation Vent	1
WM-15	Yellowcake Thickener #1; Wall	1
WM-16	Centrifuge Discharge-Chute Wall	1
WM-17	Yellowcake Thickener #2; Wall	1
WM-18	Yellowcake Packaging Room	1
WM-19	Yellowcake Dryer	1
WM-20	Yellowcake Dust Collector	1
WM-21	SX Uranium Mixer #1 Extractor	1
WM-22	SX Uranium Mixer #1 Stripping	1
WM-23	SX Vanadium Mixer #1 Stripping	1
WM-24	Vanadium Dryer	1
WM-25	Mill Laboratory Fume Hood	1
WM-26	Chemical Laboratory Work Area	1
WM-27	Metallurgical Laboratory Work Area	1
WM-28	Lunchroom Eating Area	1
WM-29	Lunchroom Wash Area	1
WM-30	Maintenance Shop – Work Area	1
WM-31	Maintenance Shop – Rubber Coating	1
WM-32	Tailings Impoundment Discharge	1
WM-33	Tailings Impoundment Dike 1	1
WM-34	Tailings Impoundment Dike 2	1
WM-35	Tailings Impoundment Dike 3	1
WM-36	Scalehouse	1
WM-37	Tailings Impoundment Dike 4	1

Note: *WM = White Mesa Radiation*

2.4.4 Action Levels

The ALARA concept is utilized in action levels. Responses include operative cleaning of the area or isolation of the source. The Radiation Safety Department will ensure levels ALARA.

2.4.5 Records

Records maintained in the radiation protection office files include:

1. Date monitored
2. Site location/condition
3. Instrument used
4. Sampler's initials
5. Beta/Gamma level, mr/hr
6. Remedial action taken, if necessary

2.4.6 Quality Assurance

Quality of data is maintained with routine calibration and individual function checks of meter performance. Personnel utilizing equipment are trained in its usage. Records of the operational checks and calibrations are maintained in the files. The Radiation Safety Officer routinely reviews the data and the Audit Committee periodically analyzes the performance of the management of the monitoring and administrative programs.

2.5 This section, which previously describe procedures for sealed source surveys, has been deleted and left intentionally blank.

2.6 Equipment Release Surveys

2.6.1 Policy

Materials leaving a restricted area going to unrestricted areas for usage must meet requirements of NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated May 1987).

All material originating within the restricted area will be considered contaminated until checked by the Radiation Safety Department. All managers who desire to ship or release material from the facility will inform the Radiation Safety Officer of their desires. The

Radiation Safety Officer has the authority to deny release of materials exceeding NRC guidance for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use" (dated May, 1987). No equipment or materials will be released without documented release by the Radiation Safety Officer or his designee.

2.6.2 Limits

The release limits for unrestricted use of equipment and materials is contained in the NRC guidance listed above in Section 2.6.1 and are summarized as follows:

Limits for Alpha emissions for U-Nat and its daughter products are:

Average	5,000 dpm/100 cm^2
Maximum	15,000 dpm/100 cm^2
Removable	1,000 dpm/100 cm^2

Limits for Beta-gamma emissions (measured at a distance of one centimeter) for Beta/Gamma emitting radioisotopes are:

Average	0.2 mr/hr or 5,000 dpm/100 cm^2
Maximum	1.0 mr/hr or 15,000 dpm/100 cm^2

2.6.3 Equipment

Radiological survey instruments are listed in Appendix 1.

2.6.4 Procedures

Upon notification that materials are requested for release, the Radiation Safety Department shall inspect and survey the material. Surveys include fixed and removable alpha surveys and beta-gamma surveys. An equipment inspection and release form is to be prepared and signed by the Radiation Safety Officer or his designee. Any material released from the mill will be accompanied with the appropriate release form. If contamination exceeds levels found in NRC guidance "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use", dated May, 1987, then decontamination must proceed at the direction of the Radiation Safety Officer. If the material cannot be decontaminated, then it will not be released.

2.6.5 Records

Documented records for each released item are filed in the Radiation Safety Department files.

2.6.6 Quality Assurance

The Radiation Safety Officer and the Audit Committee periodically review the policy and documented release forms to ensure policy and regulatory compliance.

2.7 Product Shipment Surveys

2.7.1 Policy

The Radiation Safety Department, prior to shipment release, will survey product shipments from the facility. Product shipments include uranium concentrate and solid vanadium products.

The Radiation Safety Department is to be notified in advance of each shipment. The shipment will not be released prior to the Radiation Safety Department's authorization.

2.7.2 Equipment

Equipment used for product shipment surveys is the same as equipment used for material release surveys and is listed in Appendices 1 and 2.

2.7.3 Frequency

All barrels are fixed alpha and gamma scanned prior to shipment. A minimum of 25 percent of the barrels consigned are also wipe tested.

2.7.4 Procedures – Solid Vanadium Shipments

The procedure to be followed for solid vanadium shipments are:

1. Inspect each product barrel that makes up the consigned shipment for leaks, holes in the barrels, cleanliness, etc.

2. Barrels requiring repair shall be repaired prior to the radiation survey.

3. Perform a beta-gamma survey of each barrel. The release limit for beta-gamma contamination is an average of 0.2 mrad/hr at 1 cm and a maximum of 1.0 mrad/hr at 1 cm.

4. Perform a fixed alpha survey of each barrel. The release limits for fixed alpha radiation contamination is an average of 5,000 dpm/100 cm^2 and a maximum of 15,000 dpm/100 cm^2. Any barrel that exceeds 1,000 dpm/100 cm^2 fixed alpha contamination requires a removable alpha smear/wipe test to be performed.

5. Perform a removable alpha survey on any barrel exceeding 1,000 dpm/100 cm^2 fixed alpha contamination. The release limit for removable alpha contamination is 1,000 dpm/100 cm^2. Perform a smear/wipe test and analyze filters for removable alpha on 25% of the barrels at a minimum, and perform a smear/wipe test and analyze the filters for removable alpha on any barrels that exceed 1,000 dpm/100 cm^2 fixed contamination.

6. Any barrels with visible contamination are to be cleaned prior to release.

2.7.5 Procedures – Uranium Concentrate Shipments

The procedures for exclusive use uranium concentrate shipments are:

1. Inspect each product barrel that makes up the consigned shipment for leaks, holes in the barrels, cleanliness, etc.

2. Barrels requiring repair shall be repaired prior to the radiation survey.

3. Perform a fixed alpha survey of each barrel. The release limits for fixed alpha radiation contamination is an average of 5,000 dpm/100 cm^2 and a maximum of 15,000 dpm/100 cm^2. Any barrel that exceeds 1,000 dpm/100 cm^2 fixed alpha contamination requires a removable alpha smear/wipe test to be performed.

4. Perform a removable alpha survey of each barrel exceeding 1,000 dpm/100 cm^2 fixed alpha contamination. The release limit for removable alpha radiation contamination is 1,000 dpm/100 cm^2. Perform a smear/wipe test and analyze filters for removable alpha on 25% of the barrels at a minimum, and perform a smear/wipe test and analyze filters for removable alpha on any barrels that exceed 1,000 dpm/100 cm^2 fixed contamination.

5. Perform a dose rate survey of the loaded trailer and truck to determine if the external radiation levels exceed the limits as specified in 49 CFR 173.443. The dose rate limits are as follows: 200 mr/hr on trailer surface, 10 mr/hr six feet from the trailer, and 2 mr/hr in any normally occupied space in the cab of the truck.

6. Any barrels with visible contamination are to be cleaned prior to release.

7. Survey the truck prior to loading to ensure that the truck is essentially free of contamination. Survey at random locations.

8. After truck loading, gamma survey the truck to ensure compliance with 49 CFR 173.441 (b)(1).

9. Document inspection (see form attached).

10. Ensure driver has and understands Driver/Carrier instructions for use in case of an accident. (For uranium shipments only). See Uranium Concentrate Transport Response Manual.

2.7.5 Records

The attached form serves as a record of shipment and is retained in the Radiation Protection files.

2.7.6 Quality Assurance

Periodic reviews of transport forms and policies by the Radiation Safety Officer and the Audit Committee ensures quality assurance for product shipment surveys.

3.0 EQUIPMENT/CALIBRATION

All radiation detection instruments used at the White Mesa Mill are sent to a qualified independent laboratory for calibration every six months. If necessary, Radiation Safety Staff can use the procedures outlined in Section 3.1.1 below to verify calibration.

3.1 Counters/Detectors

3.1.1 General

All radiation detectors require determination of detector optimal voltage performance or plateau operating point. The graph of voltage applied to a detector versus detector response is referred to as a plateau curve. The plateau curve typically has two rapidly sloping sections and a stable, flat region. The optimal operating point is typically located at the beginning of the flat, or flatter, section of the graph. The plateau curve is specific for a particular detector and its accompanying readout, or measuring meter, and may vary over time depending upon electronic component condition.

The equipment used to determine detector plateau curves includes:

1. Appropriate radiation sources
2. Electrostatic voltmeter
3. Radiation detecting instrument
4. Graph paper
5. Manufacturer's technical manual

The procedure is:

1. Ensure instrument batteries are fresh or fully charged, if applicable.

2. Turn the instrument on.

3. Adjust the instrument voltage control starting at voltage of 600 using electrostatic voltmeter to monitor voltage setting.

4. Expose detector to a radiation source applicable to the type of detector and in the appropriate setting.

5. Record voltage and instrument response for each adjustment of voltage applied; increments of 50 volts are adequate.

6. Repeat steps 4 and 5 until instrument response rapidly increases versus voltage level. At this point, the detector is approaching potential differentials across the electrode that may damage the detector.

7. Graph instrument response versus voltage applied.

8. Set equipment high voltage control to the optimum operating point. Record on graph voltage selected.

9. Retain graph with calibration records.

3.1.2 Alpha Monitors

Alpha particles travel very short distances in the air due to their high ionization ability – typically ¼ to ½ inch. Due to this limitation, alpha monitoring must be done at a distance of ¼ inch or less between the detector face and the source. Alpha monitoring, to be consistent, requires ensuring a consistent distance be utilized between the detector face and the source. Alpha detectors read out in counts per minute (cpm). A correlation relationship, known as the efficiency factor, between the meter response and the actual disintegration rate of the source is used to determine actual calibration of the meter.

Radioactivity is measured in curies (Ci), which, by definition, is 3.7×10^{10} disintegrations per second (dps), or 2.2×10^{12} disintegrations per minute (dpm). Another measurement unit is the Becquerel, or one dps. Alpha radiation is usually monitored as dpm, per surface area measured.

3.1.2.1 Alpha Sources

The alpha sources are calibrated sources from the manufacture with a known disintegration rate. They are used for quantifying instrument efficiency.

3.1.2.2 Equipment

Radiation survey equipment used at the Mill for alpha surveys are listed in Appendices 1 and 2.

3.1.2.3 Calibration

3.1.2.3.1 Frequency

The frequency of calibration is specified in individual instrument user's manuals and manufacture's specifications.

During production periods, the following frequencies are observed for calibration and function checks of radiation detection instruments:

	Type	Calibration Frequency	Function Checks
1.	Employee scans	6 month	5 days/week
2.	Radon progeny	6 month	each use
3.	Respirator checks	6 month	each use
4.	Area fixed scans	6 month	Daily or each use
5.	Area wipe scans	6 month	Daily or each use

During non-production periods, the following frequencies are observed:

	Type	Calibration Frequency	Function Checks
1.	Employee scans	6 month	bi-monthly
2.	Radon progeny	6 month	each use
3.	Respirator checks	6 month	each use
4.	Area fixed scans	6 month	Daily or each use
5.	Area wipe scans	6 month	Daily or each use

3.1.2.3.2 Function Checks

Calibration function checks are required prior to use of radiation detection instruments used at the White Mesa Mill for the purpose of verifying that the instruments are operating at the same efficiency as when they were calibrated by the calibration laboratory (i.e., within +/-10%). Function checks are also used for purposes beyond verifying calibration. Namely, to verify repeatability, reliability, and comparability of an instrument's measurements, from one period to another. By performing function checks for extended time periods, or on a larger sample size, these goals are met.

Function checks involve two basic elements:

(1) Calibration laboratory efficiency is compared to the instrument's efficiency on the date of the function check; and

(2) The function check is verified with a check source having similar isotopic composition as the one that was used by the calibration laboratory to calibrate the instrument.

Function checks are made for all types of radiation survey instruments. The basic principle in performing a function check is measuring the radiation field using a survey instrument against a known amount of radiation from a calibrated source. These measurements are made for the specific type of radiation occurring. For example, when performing a beta/gamma survey, the instrument function check is performed using a beta/gamma check source, such as a (SrY)-90. When performing an alpha survey, use an alpha check source, such as Th-230 or Pu-239 for performing the function check.

3.1.2.3.2.1 Documentation

Function checks are documented one of the two Calibration Check Forms (See Attachment A, copy of forms to be used, attached) for each specific instrument. They will be maintained in the instrument's' calibration and maintenance file.

3.1.2.3.2.2 Reference

A number of radiation detection instruments are used at the Mill. An Instrument Users Manual for each instrument is maintained in the calibration files, together with calibration documentation. The Users Manuals are to be considered the primary reference for operating a particular instrument. This Standard Operating Procedure (SOP) is not intended to replace the Users Manual, but rather to supplement the Manual by providing steps to be performed for function checks. Before operating an instrument, personnel should read the Users Manual and become familiar with the instrument's operation, capabilities, and special features. Personnel will also receive on the job training on each instrument.

3.1.2.3.2.3 PROCEDURE – Beta/Gamma Instruments

The following steps will be used for function checks on Beta/Gamma Instruments:

1. Turn the instrument on and place the calibrated beta/gamma (SR-Y)-90 check source on the face of the detector.

2. Let the reading stabilize to a constant value.

3. Record this value in cpm.

4. Divide this value by the known activity on the check source. This is the efficiency of the instrument and detector.

5. Compare this efficiency to the efficiency obtained from the calibration laboratory. If the efficiency comparison is within ±10% deviation the instrument needs is calibrated if not the instrument needs to be recalibrated.

6. If this efficiency comparison is within ±10% deviation the instrument is in calibration.

7. Proceed with monitoring activities.

3.1.2.3.2.4 PROCEDURE – Alpha Counters/Alpha Scalers

The following steps will be used for function checks for alpha counters and alpha scaler instruments.

1. Turn the instrument on and place a calibrated alpha check source in the detector holder on or the face of the detector.

2. Count the source for 1 minute and record this value in cpm.

3. Repeat step 2 four more times.

4. Average the five readings and divide the average in cpm by the know activity on the alpha source. This is the efficiency of the instrument and detector.

5. Compare this efficiency with the efficiency obtained from the calibration lab. If the efficiency comparison is within ±10% deviation the instrument needs is calibrated if not the instrument needs to be recalibrated.

6. If this efficiency comparison is within ±10% deviation the instrument is in calibration.

7. Proceed with monitoring activities.

3.1.2.3.2.5 PROCEDURE – ESP-1

There are special performance consideration when using the Eberline Smart Portable (ESP-1) instrument with an Eberline AC-# alpha detector, because the ESP-1 contains a

microcomputer to perform its internal calculations. The value obtained during a measurement event will be converted to 100% and displayed as such, once the user has adjusted the calibration constant (CC), which is a special feature of the ESP-1. Adjusting the CC of the ESP-1 in no way changes the laboratory calibration performed on the instruments. The calibration constant is set to a value of "one" at the laboratory and calibration proceeds as detailed by the manufacturer specifications.

The following steps will be used for function checks for the ESP-1.

1. Turn the instrument on and set the calibration constant (CC) to 1.00. This is the setting the calibration laboratory uses for performing calibration of the instruments.

2. Place a calibrated alpha check source on the face of the detector and count the source for one minute and record this value in cpm.

3. Repeat step 2 four more times.

4. Average the five readings in cpm and divide by the known activity of the alpha check source. Note: use an alpha check source which is the same radioisotope, i.e.) Th-230 or Pu-239 or one of equivalent energy emission for this procedure. The instrument efficiency is now established.

5. Compare the efficiency to the value obtained from the calibration lab. If the efficiency comparison is within ±10% deviation the instrument is calibrated; if not the instrument requires recalibration.

6. Set the calibration constant (CC) to the efficiency value obtained in step 4. For instance if the efficiency value is 20% from step 4 change the CC from 1.00 to 0.20. This setting changes the calibration constant to the efficiency of the detector, by introducing a multiplier into the microprocessor. Then, individual measurements are obtained at a 100% level.

7. Place a calibrated alpha check source on the detector and take five readings. Average the five readings and divide this value by the known activity of the check source. This value should be 100% ±5% of the known activity of the check source. If it is not within this range (100%±5%) readjust the CC (fine tune) slightly and count the source five times and average. Compare the average value to the check source keeping in mind you want to be within 100± 5.0% of the total activity of the check source. Continue this step until that objective is achieved. The instrument is not only in calibration as observed by step 5; it is now functionally capable of measuring at 100% efficiency. Proceed with use.

3.1.2.3.3 Calibration Procedures

All radiation detection instruments used at the White Mesa Mill are sent to a qualified offsite laboratory every six months for calibration. However, if additional onsite calibration is required the calibration procedures are:

1. Set the detector high voltage at the prior determined operating point using an electrostatic voltmeter.

2. For counter/scalers (radon progeny/wipes), close the detector, without source present, obtain a reading for a set time. This is a background reading.

3. Place a calibrated source for the type of radiation being measured in the source holder and obtain reading.

4. Observe the counts per minute for both the background and the source.

5. Subtract the cpm value of background from the cpm value of the source to obtain the net cpm.

6. Divide the net cpm value by the known dpm of the source. This is the percentage efficiency of the instrument system for this energy source.

7. By dividing 100 by this efficiency, an efficiency factor is obtained.

8. Dpm equals the cpm divided by the efficiency of the instrument detector system:

Note: *1 curie = 2.22 E + 12 dpm*
1 microcurie = 2.22 E + 6 dpm
1 picocurie = 2.22 dpm

3.1.3 Beta-gamma Monitors

3.1.3.1 Equipment

Equipment utilized for beta-gamma monitoring is listed in Appendices 1 and 2.

3.1.3.2 Calibration

All beta-gamma survey instruments are sent out every six months for calibration. Additional calibration, if necessary, may be performed on site using techniques described

in Reg. Guide 8.30, Appendix C – Beta Calibration of Survey Instruments for calibration performed by a qualified calibration laboratory using the indicated source as listed in Appendix 2.

3.1.4 Gamma Monitors

3.1.4.1 Equipment

Instruments for Gamma measurements are listed on the White Mesa Mill Radiation Survey Equipment List (Appendix 1).

3.1.4.2 Calibration

Independent calibration service laboratories perform calibration every six months. Meters are calibrated to Cesium-137 or other radioisotopes as suggested by the calibration laboratory or manufacturer. Most calibration service laboratories calibrate Beta/Gamma instruments electronically in accordance with their standard calibration procedures. However, electronic calibration basically consists of the steps described in Section 3.1.5 of this manual.

3.1.5 Electronic Calibration

As a general rule, all instruments will be sent out every six months for calibration. If, however, additional calibration becomes necessary, then the steps listed below will be followed. No form for this procedure. If this procedure is used, record values described below on a calibration log sheet.

1. Connect survey instrument to be calibrated to the model 500.

2. Turn both instruments on.

3. Record high voltage reading on model 500.

4. Set cpm and the range multiplier on the model 500 to the desired meter deflection. The model 500 frequency controls consist of the three-digit readout, range selector, coarse tuning know, and the fine tuning knob. The three-digit readout is in cpm times the frequency multiplier.

5. Calibrating survey instruments in cpm:

   A. Set model 500 frequency to value that will provide a ¾ meter deflection on the survey instrument's highest count scale. Set pulse height/amplitude to twice instrument input sensitivity.

   B. Adjust the range calibration potentiometer on the survey meter to provide correct reading record.

   C. De-code model 500 frequency to next lower value; then do the same for the survey instrument.

   D. Adjust the range calibration potentiometer for correct reading on survey instrument. Record readings.

   E. Repeat process until all ranges have been calibrated at ¾ meter deflection. Record readings.

   F. Return to highest count scale on survey meter.

   G. Set model 500 for ¼ scale deflection readings.

   H. Survey instrument should read within ± 10% of model 500 frequency. Record readings.

      1) If readings are outside of the tolerance, re-calibrate for ¾ meter deflection.

      2) Tap instrument meter lightly to check for sticky meter. Meter tolerance is ± 3% from the initial readings to the final reading.

   I. Decode M 500 to next lower scale. Check survey instruments for ¼ scale reading. Record.

6. Record input sensitivity.

   A. Select the most sensitive amplitude range 0-5 mv on the model 500.

   B. Observe meter on survey instrument.

   C. Increase pulse amplitude, switching to next higher range, if necessary, until the rate meter indicates a stable reading (i.e., further increase of pulse amplitude does not cause an increase in meter reading). Now, decrease pulse height until the

survey instrument meter reading drops 15 ± 5%. Record this pulse height as the instrument sensitivity.

D. If your instrument has a gain or threshold control to set instrument sensitivity, set pulse height on the model 500 to desired sensitivity level. Now adjust your instrument threshold or gain control until the rate meter reading is within 85 ± 5% of its stable reading value (see step C). Record the pulse height as instrument sensitivity.

7. Calibrating survey instrument to cps.

   A. Set frequency in model 500. Divide model 500 readings by 60 to convert to counts per second.

   B. Repeat calibration steps as in item 5 above.

3.1.5.1 Frequency of Calibration

If electronic calibration is performed using the above method by the Radiation Safety Department, the model 500 pulse generator will be sent out for calibration on an annual basis.

3.2 Personnel Air Samplers

The calibration procedure for personnel air samplers involves primary and secondary calibration procedures. Samplers will be calibrated prior to each use by either of two methodologies: bubble tube or mass flow determinations. Air samplers may be calibrated to standard air conditions.

3.2.1 Bubble Tube Calibration Method

The Bubble Tube Calibration Method is a primary calibration method and does not require corrections to or from standard conditions for temperature and pressure. Personal air samplers are calibrated for the flow rate for the sampling being performed, typically 2-4 liters per minute.

The equipment utilized is as follows:

1. Burette – 1,000 ml capacity, 10 ml divisions
2. Support, iron, rectangular base, with rod
3. Burette clamps – 2

4. Soap solution, dish
5. Tubing, Gelman filter holder, filter media (0.8 micron glass fiber Gelman type A/E)
6. Stopwatch
7. Small screwdriver
8. Sample pump

The procedures utilized are:

1. Assemble a filter train – place a filter in an in-line filter. Attach two lengths of tubing to each connector of the in-line filter holder.

2. Make sure the Burette is clean. Clamp the 1,000 ml Burette upside down on the ring stand with the Burette clamps.

3. Attach the pump to be calibrated to one end of the filter train, connect the other end of the filter train to the small end of the 1,000 ml Burette, as per Figure 1.

4. Check all tubing connections for air tightness.

5. Pour approximately ½ inch (12 mm) of soap solution into the dish.

6. Start the pump.

7. Raise the dish up under the Burette opening, and then immediately lower the dish. This should cause a film of soap to form over the Burette opening (i.e., a bubble). Repeat this procedure until the film (bubble) will travel up the inverted Burette the length of the graduation marks on the Burette without breaking.

8. When the film (bubble) has wetted the Burette inside and will travel the entire length of the graduated area of the Burette, proceed with the actual calibration run.

9. Quickly form three bubbles and start the stopwatch when the middle bubble is at the bottom graduation line (actually the 1,000 ml mark, but for purposes here, it will be called the "zero" line).

10. Time the travel of the bubble from the zero line to the top line of the graduated distance (0 ml). Since the capacity of the Burette is 1,000 ml (1.0 liter), then the volume of air that is displaced above the bubble (i.e., needed to raise the bubble) is 1.0 liter. Stopping the stopwatch at the top mark is the time elapsed for the pump to accomplish this. The rate of rise of the bubble through the apparatus is the flow rate of air being pulled by the pump.

11. Increase or decrease the pump collection rate by adjusting the appropriate screw or knob designed for this purpose.

12. Set the pump flow collection rate to the desired valued usually between 2 and 4 liters per minute for low volume collection pumps and between 30 and 80 liters per minute for high volume collection pumps.

3.2.2 Mass Flow Method

Mass flow meters are manufactured equipment designed to measure air collection flow rates for a variety of purposes. Mass flow meters may be subject to temperature and pressure corrections of air movement depending on whether they are calibrated/manufactured for standard conditions.

Utilizing an air mass flow meter, traceable to NBS, the airflow rate of pumps can be quickly adjusted to correct standard flow rate conditions. However, the mass flow meter must be calibrated annually using a primary calibration method.

The equipment consists of the following:

1. Kurz air mass flow model 543 or equivalent
2. Suitable filter head adapter connections
3. Filter heads with filter media
4. Pump to be calibrated

Note: The meter is calibrated directly in standard air conditions – 25° C., 29.82" Hg.

The procedures utilized are:

1. Ensure pump batteries are fully charged.

2. Ensure flow meter batteries are fully charged.

3. Assemble filter train.

4. Connect (with a suitable adapter) the Kurz probe onto the filter train. Ensure an airtight seal with tape, if necessary.

5. Set the meter function switch to the highest range: 40 std liters per minute.

6. Turn the pump on.

7. Select appropriate range on the meter. (Do not allow meter needle to be forcibly pegged.)

8. Adjust the pump flow rate as necessary to desired flow rate. Allow the meter to stabilize before adjustment of the pump.

9. Meter reads directly in standard air conditions, correcting for temperature and barometric pressure.

Pump is now calibrated. Low volume pumps are set at 2 to 4 lpm.

3.3 Air Samplers Area

The calibration procedure for area air samplers involves one of the following procedures; Kurz Mass Flow, Wet Test Gas Meter or Bubble Tube Method.

3.3.1 Kurz Mass Flow Method

Repeat procedures discussed in 3.2.2 – except – airflow rate is adjusted to 40 slpm and samplers utilized are:

1. Eberline RAS-1
2. Scientific Industries Model H25004
3. Equivalent

3.3.2 Wet Test Gas Meter Method

The wet test gas meter method utilizes a Precision Scientific wet test meter rated at one cubic foot per revolution of the main dial. This method is used to calibrate the Kurz air mass flow meter in addition to direct calibration of the area air samplers.

The procedures are:

1. Attached coupling to sampler filter assembly; secure it with tape.

2. Connect wet test meter hose to coupling.

3. Check water level of wet test meter. The needle should be on slightly above the water level.

4. Check the thermometer temperature of the wet test meter. Record this on the calibration sheet. Assume that the wet and dry bulb temperatures are the same.

5. Turn on the sampler. Check the west test meter's manometer reading. This reading is obtained by adding the left and right column values. (A typical reading might be .3). Log these values for each ball height on the "Static pressure … H_2O" column.

6. For the following sampler approximate settings, pull one cubic foot of air through the wet test meter and record the time (in seconds) for each: 20, 30, 40, and 50 lpm.

Sampler Calibration Procedures – Calculations and Equations

1. To convert the static pressure (of the manometer attached to the wet test meter) from inches of water to inches of mercury, divide the number of inches to water by 13.6. Example: 0.4/13.6-0.02941176" Hg

2. To compute the actual flow rate ("Q rate act. lpm"), first divide the number of cubic feet by the number of seconds. Example: 1 $ft.^3$/90 sec = .01111 $ft.^3$/awx. Convert the cubic feet to liters. The conversion factor is 28.317. Example: .01111 $ft.^3$/sec x 28.317 L $ft.^3$ = .3146 L/sec. Multiply this by 60 to convert from seconds to minutes. Example: .3146 L/sec x 60 sec = 1888 L/m or 18.88 lpm.

3. Using the "Vapor Pressures of Water" chart, find the vapor pressure inside the wet test meter by matching the wet bulb temperature with the corresponding vapor pressure. This number is the vapor pressure at the standard wet bulb (Pvpstw).

4. Find the vapor pressure at dewpoint using this formula: Pv dewpoint = Pvpstw = 0.0003613 (td-tw) Bp (Where +d = dry bulb temp; tw = wet bulb temp; bp = barometric pressure in inches of mercury.) Assume that the dry bulb temperature and the wet bulb temperature are the same, so the difference between them will always be zero. Thus, Pv dewpoint will equal Pvpstw.

5. Determine the actual air density (D act) with this formula:

$$D\ act = \frac{1.327}{td + 459.67}\ [(Pg\text{-}Sp) - 0.378\ (Pv\ dewpoint)]$$

(Where td - dry bulb temp in degrees F.; Bp = barometric pressure in inches of mercury; Sp = static pressure of wet test meter in inches of mercury.)

Example:

D act = $\frac{1.327}{70.5 + 459.67}$ [(24,8031 - 0.02941176) - 0.378 (.875)]

= $\frac{1.327}{530.17}$ (24,773688 - 0.33075)

= (0.00250297) (24.442938)

D act = 0.06117996

Log this in "Air Density lbs/ft^3" column of log sheet.

6. Find the flow rate of the sampler at standard conditions (Q std) using this formula:

$$Q\ std = Q\ act \quad \frac{D\ act}{D\ std}$$

(Where D std = .075 lbs/ft^3)

(i.e., Q std = 18.88 $\frac{(0.06117996)}{0.075}$

= 18.88 (0.8157328)

= 15.40

Q std = 15.40 (write this down for each position in the Q 0.075 column)

3.3.3 Bubble Tube Method

Refer to Section 3.2.1 to perform this method.

4.0 EXPOSURE CALCULATIONS AND RECORD MAINTENANCE

4.1 Personnel Exposure Calculations

4.1.1 DAC for Mixtures

Both uranium ore and uranium mill tailings consist of a mixture of radionuclides each with their individual DAC's. The DAC for a mixture is as follows:

Ore prior to chemical separation of the uranium from the ore.

6E-11 uCi of gross alpha from U-238, U-234, Th-230, and Ra-226 per ml of air, or
3E-11 uCi of natural uranium per ml of air

Tailings when the identity of each radionuclide is known but the concentration of one or more of the radionuclides in the mixture is not known.

6E-12 uCi/ml = DAC for Th-230

Tailings when the identity and concentration of each radionuclide is known. The DAC for the mixture is calculated by the following (see Regulatory Guide 8.30, page 2).

$$DAC_m = \left[\frac{f_1}{DAC_1} + \frac{f_2}{DAC_2} + \ldots + \frac{f_n}{DAC_n} \right]$$

where DAC_m = DAC for the mixture of radionuclides 1 through n.

DAC_1 = DAC for the first radionuclide in the mixture.

DAC_n = DAC for the n^{th}, the last, radionuclide in the mixture.

f_1 = Fraction of alpha activity from the first radionuclide in the mixture.

f_n = Fraction of alpha activity from radionuclide n in the mixture.

For example:

Ra-226	80 pCi/g	DAC = 3E - 10 uCi/ml
Th-230	20 pCi/g	DAC = 2E - 12 uCi/ml

$$DAC_m = \left[\frac{\frac{80}{100}}{3E\text{-}10} + \frac{\frac{20}{100}}{2E\text{-}12} \right]^{-1}$$

$$= \left[2.67E9 + 1.00E11 \right]^{-1}$$

$$= \frac{1}{1.0E11}$$

$$= 9.7E\text{-}12 \frac{uCi}{ml}$$

4.1.2 Sampling Time

Calculate the sampling time required to detect 10% of the DAC by solving for sampling time in the following equation:

$$\frac{LLD}{(\text{Sampling Time})\ (\text{Flow Rate of Sampler})} = 0.1\ DAC$$

For example:

To detect 10% of the DAC for U-nat, a 40 lpm air sampler would have to operate 57 minutes, assuming the sample counter has a lower level of detection of 10 dpm above background, i.e.:

$$\frac{(10\ \text{DPM})\left(\frac{\text{pCi}}{2.22\ \text{DPM}}\right)\left(\frac{\text{E-6 uCi}}{\text{pCi}}\right)}{(\text{X min.})\left(\frac{40\ \text{lit}}{\text{min.}}\right)\left(\frac{10^{3}\text{ml}}{\text{lit}}\right)} = 2\text{E-12}\ \frac{\text{uCi}}{\text{ml}}$$

X = 56.8 minutes

4.1.3 Dose Calculations (10 CFR 20.1201-20.1202)

1. Analytical results of airborne particulate samples may be obtained in several different units that need to be converted into mg soluble natural uranium to determine the weekly exposures and into uCi-hr/ml or WL-hr to determine annual exposures. The following table presents a summary of the conversions that may be necessary. The first row of the table presents the operations to be performed in the conversions. Enter the measured weight or activity, the sampler flow rate, the sampling time, and the exposure time into the first four columns. Divide the values in column 1 by the values in column 2 and column 3, and then multiply by the values in columns 4 and 5 to obtain the units in column 6, or:

$$\frac{(\text{Column 1})\ (\text{Column 4})\ (\text{Column 5})}{(\text{Column 2})\ (\text{Column 3})} = \text{Column 6}$$

UNIT CONVERSION TABLE

1	2	3	4	5	6
OPERATION	DIVIDE	DIVIDE	MULTIPLY	MULTIPLY	ANSWER
MEASURED VALUE	SAMPLER FLOW RATE	SAMPLING TIME	EXPOSURE TIME	CONSTANT	ANSWER
ug soluble U-natural	L/min	min	hrs	1.2	mg soluble U-natural
pCi soluble U-natural	L/min	min	hrs	1.77	mg soluble U-natural
pCi gross alpha	L/min	min	hrs	E-9	UCi-hrs / ML
ug U-nat	L/min	min	hrs	6.77E-10	UCi-hrs / ML
uCi / mL Radon	---	---	hrs	E7	WL-hrs

For example:

$$\frac{(10\ \text{ug Soluble U-nat})\ (10\ \text{hrs})\ (1.2)}{(2\ \text{L/min})\ (30\ \text{min})} = 2\ \text{mg Soluble U-nat}$$

See notes for a description of the unit conversions.

2. The table on the following page is divided into four quadrants. Different quadrants are for soluble uranium, insoluble uranium, tailings dust, and radon. Select the proper quadrant for the type of airborne particulate being sampled. Enter the area, particulate concentration, and hours of exposure in the labeled columns of the selected quadrant.

3. The protection factors are whole numbers, e.g., 10, 50, 1,000. Divide 1 by the protection factor and enter the quotient in the fourth column of each quadrant, e.g., for a protection factor of 1,000, enter 1/1,000 or 0.001 in the column. The 1/PF values are unit-less.

4. Enter the product of the airborne concentration, the hours of exposure, the time, and 1/PF in the fifth column of each quadrant. Add these values and enter the total at the bottom of the column.

5. On the dose calculations form which follows, enter the total for <u>Soluble Uranium</u> in the equation and calculate the corresponding mg. If a value exceeds 10 mg, an over-exposure may have occurred. If verified by a high uranium in urine results, an over-exposure has probably occurred and needs to be reported to the NRC.

6. Enter the totals for <u>Soluble Uranium, Insoluble Uranium, Tailings Dust,</u> and <u>Radon</u> in their respective equations. Perform the indicated calculations, add the fractions together, and record as the subtotal. (Use the DAC for Th-230 or the DAC for tailings dust to determine the contribution of tailings dust to the subtotal.) If a subtotal exceeds 1, an over-exposure may have occurred. If verified by a high uranium in urine result, an over-exposure has probably occurred and needs to be reported to the NRC.

7. Enter the TLD determinations of whole body dose as the <u>Deep Dose Equivalent</u> on the form. If the Deep Dose Equivalent exceeds 5 rems, an over-exposure may have occurred and needs to be reported to the NRC.

8. If the Deep Dose Equivalent exceeds 0.5 rem <u>and</u> the subtotal exceeds 0.1, calculate the <u>Total Effective Dose Equivalent</u> by adding the Deep Dose Equivalent to the product of 5 rems times the subtotal and enter on the form. If the total effective dose equivalent exceeds 5 rems, an over-exposure may have occurred and may have to be reported to the NRC.

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

Name ____________ Soc. Sec. No. ____________ Co. I.D. No. ____________ Week ______ Year ______

AREA	SOL. U uCi/ML	HR	1/PF	uCi-HR/ML	AREA	INSOL. U uCi/ML	HR	1/PF	uCi-HR/ML
TOTAL	---	---	---		TOTAL	---	---	---	---
AREA	TAILINGS DUST uCi/ML	HR	1/PF	uCi-HR/ML	AREA	RADON WL	HR	1/PF	WL-HR
TOTAL	---	---	---		TOTAL	---	---	---	

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

Name	Soc. Sec. No.	Co. I.D. No.	Week	Year

Weekly Soluble Uranium $\frac{(\text{uCi-hr})\ (1.77E9)}{(\text{mL})}$ = ____________ mg

Limit 10 mg

Annual Soluble Uranium $\frac{(\quad \text{uCi-hr}) / \text{mL}}{(2000\ \text{hr})\ (5E\text{-}10)}$ = ____________

Annual Insoluble Uranium $\frac{(\quad \text{uCi-hr}) / \text{mL}}{(2000\ \text{hr})\ (2E\text{-}11)}$ = ____________

Annual Tailings Dust $\frac{(\quad \text{uCi-hr}) / \text{mL}}{(2000\ \text{hr})\ (\quad *)}$ = ____________

* = DAC for Th-230 = 6E-12;
or = DAC for tailings dust.

Annual Radon with Daughters Present $\frac{(\quad \text{WL-hr})}{(2000\ \text{hr})\ (0.33\ \text{WL})}$ = ____________

Subtotal ____________

Limit 1

Deep Dose Equivalent = TLD Whole Body Dose in rem = ____________ rem

Limit 5 rem

If the Deep Dose Equivalent is > 0.5 rem
and
the Subtotal is > 0.1, then

Total Effective Dose Equivalent = Deep Dose Equivalent + Committed Effective Dose Equivalent

= (rem) + (5 rem) (Subtotal) = ____________ rem

Limit 5 rem

DOSE CALCULATIONS (10 CFR 20.1201 + 20.1202)

Notes:

1. PF = Respiratory Protection Factor.

2. The 10 mg soluble uranium per week limit in 10 CFR Part 20.1201 is more restrictive than the (40 hour) (DAC) limit for natural uranium, thus compliance is based on 10 mg per week.

3. The conversion of uCi-hr/mL to mg natural uranium is the product of:

   (air concentration) (hours of exposure) (breathing rate for light work) (conversion of minutes to hours) (specific activity of natural uranium) (conversion of ug to mg) which is:

   $$\left(\frac{\text{uCi-hr}}{\text{mL}}\right)\left(\frac{\text{2E4 mL}}{\text{min}}\right)\left(\frac{\text{60 min}}{\text{hr}}\right)\left(\frac{\text{ug}}{\text{6.77E-7 uCi}}\right)\left(\frac{\text{E-3 mg}}{\text{ug}}\right) =$$

   $$\left(\frac{\text{uCi-hr}}{\text{mL}}\right)(1.77\text{E}9) = \text{mg U natural}$$

   Thus to obtain mg natural uranium, multiply the uCi-hr/mL by 1.77E9.

4. Soluble Uranium DAC (Class D) = 5E-10 uCi/mL
   Insoluble Uranium DAC (Class Y) = 2E-11 uCi/mL
   Thorium-230 DAC (Class Y) = 6E-12 uCi/mL
   Radon with Daughters DAC = 3E-8 uCi/mL = 0.33 WL
   Tailings Dust DAC is a Site Specific Value = uCi/mL

5. Description of unit conversions:

   a. ug soluble U-nat → mg soluble U-nat

   $$\left(\frac{\text{ug}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-3 mg}}{\text{ug}}\right)\left(\frac{\text{60 min}}{\text{hr}}\right)(\text{hr exposure}) =$$

   $$\left(\frac{\text{ug}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})(1.2) = \text{mg soluble U-nat.}$$

b. pCi soluble U-nat → mg soluble U-nat

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-9 mCi}}{\text{pCi}}\right)\left(\frac{\text{mg}}{\text{6.77E-7 mCi}}\right)\left(\frac{\text{2E4 mL}}{\text{min}}\right) \rightarrow$$

$$\left(\frac{\text{60 min}}{\text{hr}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})(1.77) = \text{mg soluble U-nat.}$$

c. pCi gross alpha → uCi-hr

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E-3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{E-6 uCi}}{\text{pCi}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{pCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})(\text{E-9}) = \frac{\text{uCi-hr}}{\text{mL}}$$

d. ug U-nat → $\frac{\text{uCi- hr}}{\text{mL}}$

$$\left(\frac{\text{ug}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})\left(\frac{\text{E3 mL}}{\text{L}}\right)}\right)\left(\frac{\text{6.77E-7 uCi}}{\text{ug}}\right)(\text{hr exposure}) =$$

$$\left(\frac{\text{uCi}}{\left(\frac{\text{L}}{\text{min}}\right)(\text{min sampler})}\right)(\text{hr exposure})(\text{6.77E-10}) = \frac{\text{uCi-hr}}{\text{mL}}$$

e. $\frac{\text{uCi}}{\text{mL}}$ of Radon-222 → WL

$$\left(\frac{\text{uCi}}{\text{mL}}\right)\left(\frac{\text{E6 pCi}}{\text{uCi}}\right)\left(\frac{\text{E3 mL}}{\text{L}}\right)\left(\frac{\text{L-WL}}{\text{E2 pCi}}\right) =$$

$$\left(\frac{\text{uCi}}{\text{mL}}\right)(\text{E7}) = \text{WL}$$

4.2 Personnel Exposure Files

International Uranium (USA) Corporation will generate and maintain individual exposure records for each employee that works at the White Mesa Mill. The record system will be designed to meet the specifications of the Federal Code of Regulations 10 CFR Part 20.

When an employee is hired, a file will be generated specifically for that individual. All records that are to be in the radiation exposure file will be maintained during the term of employment. When the employee terminates, all records will be preserved until the Nuclear Regulatory Commission authorizes their disposition.

Personnel exposure records will be maintained at the mill site and will be accessible only to the employee and the Radiation Protection staff. No copy of the exposure history will be furnished to anyone outside of the Radiation Protection Department without a signed consent form from the employee.

Contents of the exposure file:

Each personnel exposure file will contain the following records:

1. Information Sheet – Each information sheet will include the following information:

   A. Employee's full name
   B. Birth date
   C. Social Security number
   D. Date of hire
   E. Date of termination

2. Record of Urinalyses – A multiple entry log of all urinalyses conducted at this work site will include the following information:

   A. Employee's full name
   B. Social Security number
   C. Sample dates
   D. Sample identification number
   E. Concentration of uranium in ug/l
   F. An entry for any quality assurance "spikes" entered in ug/l

3. Internal personnel Exposure Records – These will be calculated and prepared using the forms above or by the computer and the printout will be used as the permanent record in the exposure file. The internal exposure records will contain the following information:

   A. Employee's full name
   B. Social Security number
   C. Birth date
   D. Exposure to airborne uranium expressed in both uCi and percent MPC
   E. Any breathing zone samples collected for airborne uranium to be expressed in uCi
   F. Radon daughters expressed in working levels (WL) and period of exposure (date)

4. External Exposure Record (TLD, Dosimeter) – The date received from the Dosimeter contractor will be posted to the Dosimeter record in the exposure file. The following information will be included on the Dosimeter record:

   A. Employee's full name
   B. Birth date
   C. Social Security number
   D. Period of exposure (dates)
   E. Exposure in millirems (MR) for a given period
   F. Total accumulated exposure while at the White Mesa Mill
   G. Identification number of the Dosimeter badge

5. Record of Exposure from Previous Employment (NRC form 4 or similar) – A record of occupational exposures that occurred prior to employment at the mill must be obtained for each employee. If no such exposure record is available, the employee must sign a statement to that affect. If previous exposure records were kept, a copy must be secured and placed in the individual's file.

6. Reports of Over-exposure – If an individual has been found to be over-exposed, the Radiation Safety Officer will draft a letter of explanation. The report will explain the circumstances and/or reasons for the over-exposure. It will also state any actions taken to correct the problem or to prevent future over-exposures. The report must be placed in the individual's exposure file.

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

Overview

The tailings management system consists of an inspection program that focuses on the four constructed tailings cells and those areas in the immediate vicinity. The inspection program outlines the proper procedure for conducting tailings inspections and for recording observations, especially those of particular concern. The scope of the inspections is broad and includes the following technical areas: geotechnical, structural, hydraulic, and electrical/mechanical. The program includes a monthly managerial review and sets forth the format for the standard monthly report covering the tailings areas. Below is a brief listing of the inspections to be performed. Each inspection will be elaborated on in later sections.

I. Introduction

The tailings management system is designed as a systematic program for constant surveillance and documentation of the integrity of the tailings impoundment system including dike stability, liner integrity, and transport systems. The scope of the surveillance program includes geotechnical, structural, hydraulic and electrical/mechanical evaluations of the operations. The program also includes comprehensive usage of protocols, documentation, management and engineering reviews of the surveillance program and impoundment systems performance.

The protocols detail training programs for surveillance personnel, inspection requirements and frequencies, performance evaluation requirements and technical evaluation report format and content.

The surveillance program includes daily, weekly, monthly, quarterly and annual documented inspections and monitoring of the tailing impoundments and ancillary structures, such as diversion structures and transport pipeline integrity. Annual technical stability and integrity evaluations are performed by qualified professional engineers to ensure continued performance of the system. These evaluations are submitted to and reviewed by both the U.S. NRC and the State of Utah Dam Safety Engineer.

In addition, the program monitors and evaluates the performance of liquid evaporation systems, fugitive dust control generation and waterfowl and burrowing animal habitations.

1. Daily Tailings Inspection

The daily inspections are conducted Monday through Friday, by the Environmental Department and shift foremen are responsible for performing these inspections on the weekend. During Mill operation, the Shift Foreman will perform an inspection once per shift, paying close attention to the discharges from the pipelines. The Environmental Department will also perform an inspection once a day. The utility person will perform an inspection twice a shift during Mill operation.

2. Weekly Tailings Inspection

Weekly tailings inspections are to be conducted by the Environmental Department and include checking each cell's leak detection system.

3. Monthly Tailings Inspection

Monthly tailings inspections are to be performed on the tails collection system. These inspections can be made no sooner than 14 days since the last monthly inspection and can be conducted concurrently with the quarterly tailings inspection when applicable. The monthly tailings inspection will be conducted by the Radiation Safety Officer or his designee from the Environmental Department.

4. Quarterly Tailings Inspection

The quarterly tailings inspection is to be performed approximately every three months. The quarterly inspections can be made no sooner than 30 days since the previous quarterly inspection was performed. The Radiation Safety Officer or his designee from the Environmental Department will conduct the quarterly tailings inspections.

5. Monthly Tailings Reports

Monthly tailings reports are compiled each month and cover the previous month's activities. The report consists of a summary of the observations and corrective actions taken around the tailings area during the previous month. The report includes all daily inspections, weekly inspections, a monthly inspection, and possibly a quarterly inspection.

6. Movement Monitors

A movement monitor survey is to be conducted by a licensed surveyor annually during the month of June. The movement monitor survey consists of surveying monitors along dikes 3 and 4 to detect any possible settlement or movement of the dikes. The movement monitor survey data is included in the *Annual Technical Evaluation.*

7. Annual Technical Evaluation

The *Annual Technical Evaluation* consists of an annual tailings inspection conducted by a registered PE and review of the year's tailings inspections and monthly tailings reports. Also included in the report is the movement monitor survey. The report summarizes the year's tailings activities and makes recommendations for improvement to the conditions of the tailings cells and dikes. This report must be submitted to the U.S. NRC by September 1. A copy of this report is also sent to the State of Utah to:

Directing Dam Safety Engineer
State of Utah, Natural Resources
1636 West North Temple, Suite 220
Salt Lake City, Utah 84116-3156

All inspections should be performed as specified above. However, inspections will also need to be conducted after any significant storm or significant natural or man-made event occurs. Inspections are elaborated on in Sections II through VI.

II. Daily Tailings Inspection

On a daily basis, including weekends, all areas connected with the four tailings cells will be patrolled. Observations will be made of the current condition of each cell, noting any corrective action that needs to be taken. These observations will be recorded on the *Daily Inspection Data Form* (a copy of which is attached in Appendix B).

The Environmental Technician is responsible for performing the daily tailings inspections, except on weekends when designated individuals with training will perform the weekend tailings inspections. The Radiation Safety Officer may designate other individuals to perform the daily tailings inspection. Furthermore, when the Mill is operating, the utility person and Shift Foreman patrol the tailings area. The utility person will patrol twice per shift while the shift supervisor will patrol once per shift. These designated individuals must

have Tailings Management System training. This training will include a training pack explaining the procedure for performing the inspection and addressing inspection items to be observed. Each individual designated to become an inspector will be trained according to Appendix A. In addition, each individual after reviewing the training pack will sign a certification form, indicating that training has been received relative to his/her duties as an inspector. Inspectors until relieved by the Environmental Technician or Radiation Safety Officer will have the authority to direct resources during tailings emergencies.

Appendix A provides an inspection checklist, tailings cells map, and space to record observations, especially those of immediate concern and those requiring corrective action. The inspector will place a check by all inspection items that appear to be operating properly. Those items where conditions of potential concern are observed should be marked with an "X". A note should accompany the "X" specifying what the concern is and what corrective measures will be taken. This observation of concern should be noted on the form until the problem has been remedied. The date that corrective action was taken should be noted as well. Areas to be inspected include the following: Cell 1-I, 2, 3, and 4A, Dikes 1-I, 2, 3, 4A-S, and 4A-W, wind movement of tailings, dust minimization, spray evaporation, Cell 2 spillway, Cell 3 and 4A liquid pools and associated liquid return equipment, cell leak detection systems if the pumps are running, and the wildlife ponds for avifauna.

On every Monday's tailings inspection an estimate of the of percentage of the tailings beach surface subject to wind movement for cells 2 and 3 will be made when the wind speed exceeds 25 mph. Also, included on Monday's tailing inspections will be percentage estimates of solutions, cover areas, and tailings sands for Cells 3 and 4A. When the Mill is operating, flow estimates will need to be determined on a daily basis for the following items: active tailings slurry, pond return and SX lines, and overspray for evaporation purposes. In addition, slurry and SX discharge points need to be indicated on the tailings cells map included in the *Daily Inspection Data Form.*

Daily inspections of the tailings lines are required to be performed when the Mill is operating. There are three lines to be inspected: tailings slurry lines from CCD to the active tailings cell, SX raffinate lines that can discharge into any of the tailings area and the pond return line from the tailings area to the Mill.

Operational features of the tailings area are checked for conditions of potential concern. The following items require visual inspection during the daily tailings inspection:

1. Tailings slurry and SX raffinate transport systems from the Mill to the active disposal cell(s).

2. Evaporation of Cell 1-I.

3. Cell 2.

4. Cell 3.

5. Cell 4A.

6. Dike structures including dikes 1-I, 2, 3, 4A-S, and 4A-W.

7. The Cell 2 spillway, Cell 3 and Cell 4A liquid pools and associated liquid return equipment.

8. Presence of wildlife and/or domesticated animals in the tailings area.

9. Spray evaporation pumps and lines.

10. Dust minimization.

    Dust minimization will be evaluated on a daily basis in cells containing tailings sand. During tailings inspection, general surface conditions will be evaluated for the following: 1) areas of tailings subject to blowing and/or wind movement, 2) liquid pool size, 3) areas not subject to blowing and/or wind movement, expressed as a percentage of the total cell area. The evaluations will be reviewed on a weekly basis and will be used to direct dust minimization activities.

11. Daily qualitative estimates of pond elevations in Cells 1-I, 3, and 4A.

12. Locations of slurry and SX discharge within the active cells.

13. An estimate of flow for active tailings slurry and SX line(s).

14. An estimate of flow in the solution return line(s).

15. An estimate of flow in the dust control/spray evaporation system(s).

16. Daily measurements of the liquid level in Cell 4A's leak detection system, while leakage is present. Daily measurements in the other LDS sumps will be made when

warranted by changes in the solution level of the respective leak detection system.

The trigger for further action when evaluating the measurements in any of the leak detection systems is a gain of more than 12 inches in 24 hours. If this observation is made, the Mill Manager should be notified immediately and the leak detection system pump started. Whenever the leak detection system pump operating the flow meter reading, the date and the time will be recorded on the Daily Tails Inspection Form. This data will be used in accordance with License Condition 11.3.B through 11.3.E to determine whether or not the flow rate into the leak detection system is in excess of the License Condition.

Items 1, 12, 13, and 14 are to be done only when the Mill is operating. When the Mill is down, these items cannot be performed.

III. Weekly Tailings Inspection

Weekly tailings inspections will be conducted on a weekly basis during the regular work week by the environmental staff. Inspection items include the following:

1) A check to ensure that the dump sign is in place in cell 2,
2) An evaluation of wind movement of tailings or dusting and control measures taken if needed,
3) The leak detection systems for each of the cells to determine whether they are wet or dry. If marked wet, the liquid levels need to be measured and reported.
4) The conductivity of the liquid in Cell 2 leak detection.

Elevations in Cells 2 and 3 uses survey equipment that is accurate to 0.1 feet, while elevations in Cell 4A are more of an estimate and are accurate to only 0.5 feet. When the liquid elevation reaches 5586 feet in Cell 4A, survey equipment will be used to determine the liquid elevation.

In addition, the weekly inspection should summarize all activities concerning the tailings area for that particular week. An example of the weekly tailings inspection form is provided in Appendix B.

IV. Monthly Tailings Inspection

Monthly tailings inspections will be performed by the Radiation Safety Officer or his designee from the Environmental Department at or near the first of every month when possible. Monthly inspections are to be performed no sooner than 14 days since the last

monthly tailings inspection. The following items are to be inspected: slurry pipeline at certain key locations during operation of the Mill; inspection of diversion ditches 1, 2, 3, and diversion berm 2, Mill and facilities area sedimentation pond, remarks, and overspray dust minimization evaluation if applicable.

When the Mill is operating, the slurry pipeline will be inspected at key locations to determine pipe wear. Pipe thickness will be measured using an ultrasonic device by either the environmental staff or other trained designees. The critical points of the pipe include bends, slope changes, valves, and junctions, which are critical to dike stability. These locations to be monitored will be determined by the Radiation Safety Officer or his designee from the Environmental Department during the Mill run. The diversion ditches are also to be monitored for sloughing, erosion, undesirable vegetation, and obstruction of flow. Diversion berm 2 should be checked for stability and signs of distress. In addition, activities around the Mill and facilities area sedimentation pond should be summarized for the month. A section is included for remarks in which recommendations can be made or observations of concern can be documented. Another area on the inspection form is an evaluation of overspray minimization if applicable. This entails ensuring that the overspray system is functioning properly. In the event that overspray is carried more than 50 feet from the cell, the overspray system should be immediately shut-off. The monthly inspection should also summarize the weekly and daily tailings inspections for the specific month. An example of a monthly tailings inspection form is included in Appendix B.

V. Quarterly Tailings Inspection

Quarterly inspections are to be performed every three months. For every calendar year, four quarterly inspections should be performed. A quarterly inspection should be performed no sooner than 30 days since the previous quarterly inspection was performed. Items covered on the inspection form include the following: Embankment inspection, Operations/Maintenance review, post-construction changes, and a summary.

The embankment inspection involves a visual inspection of the crest, slope and toe of each dike for movement, seepage, severe erosion, subsidence, shrinkage cracks, and exposed liner.

If any of these conditions are noted, these conditions and corrective measures taken should be documented in the inspection form. Operations/Maintenance reviews consist of reviewing Operations and Maintenance activities pertaining to the tailings area on a quarterly basis. Post-construction changes consist of changes or modifications made to the tailings area. The summary will include all major activities or observations noted around the tailings area on a quarterly basis as well. An example of a quarterly tailings inspection form is provided

in Appendix B.

VI. Monthly Tailings Report

The reports are composed at the beginning of every month and summarize the previous month's activities around the tailings area. The report is submitted to the Radiation Safety Officer for review. The Mill Manager will review the report as well before the report is filed in the Mill Central File. The report will contain a summary of observations of concern noted on the daily and weekly tailings inspections. Corrective measures taken during the month will be documented along with the observations where appropriate. All daily and weekly tailings inspection forms will be attached to the report. A monthly inspection form will also be attached. Quarterly inspection forms will accompany the report when applicable. The report will be signed and dated by the preparer in addition to the Radiation Safety Officer and the Mill Manager.

VII. Movement Monitors

Surveying of movement monitors is to be conducted during the month of June every year. Movement monitors consist of various monitor points along dikes 3-S, 4A-W, and 4A-S. These monitor points are marked with rebar and are surveyed on an annual basis. The data resulting from these measurements is used in determining whether any settlement or movement of the dikes occurred during the past year. The data generated from this survey is reviewed and incorporated into the *Annual Technical Evaluation Report* of the tailings management system.

VII Annual Evaluations

1. Annual Technical Evaluation

An annual technical evaluation of the tailings management system is performed by a registered professional engineer (PE), who has experience and training in the area of geotechnical aspects of retention structures. The technical evaluation includes an on-site inspection of the tailings management system and a thorough review of all tailings records for the past year.

All tailings cells and corresponding dikes will be inspected for signs of erosion, subsidence, shrinkage, and seepage. The drainage ditches will be inspected to evaluate surface water control structures.

1. From a survey of the Cell, the pool surface will be determined.

2. An estimate of the maximum tons of dry tailings to be generated during the next 12 months will be made. This estimate is multiplied by 1.5, a factor of safety, to yield the Maximum Mill Production.

3. The Maximum Mill Production is divided by the number of tons required to reduce the pool size by one acre and then subtracted from the pool surface (determined in Step 1), yielding the Reduced Pool Area.

4. The PMP Flood Volume Requirement, as per the January 10, 1990 Drainage Report, is 123.4 acre feet. The PMP Flood Volume Requirement is divided by the Reduced Pool Area to determine the PMP Freeboard Level.

5. The Wave Run Up of 0.78 feet (as specified in the January 10, 1990 Drainage Report) is added to the PMP Freeboard Level to determine the Total Required Freeboard.

The calculation of the Total Required Freeboard for Cell 3 will be calculated annually and the calculation sheet filed in the Mill Central File.

APPENDIX A

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

TAILINGS INSPECTOR TRAINING

This document provides the training necessary for qualifying management-designated individuals for conducting daily tailings inspections. Training information is presented by the Radiation Safety Officer or designee from the Environmental Department. Daily tailings inspections are conducted in accordance with the White Mesa Mill's Material License SUA-1358. Inspections will be performed on a daily basis. Furthermore, the Radiation Safety Officer or designee from the Environmental Department is responsible for performing monthly and quarterly tailings inspections. Tailings inspection forms will be included in the monthly tailings inspection reports, which summarize the conditions, activities, and areas of concern regarding the tailings areas.

Notifications:

The inspector is required to record whether all inspection items are normal (satisfactory, requiring no action) or that conditions of potential concern exist (requiring action). A "check" mark indicates no action required. If conditions of potential concern exist, the inspector should note the condition, mark "X" in the area the condition pertains to, and specify the corrective action to be taken. If an observable concern is made, it should be noted on the tailings report until the corrective action is taken and the concern is remedied. The dates of all corrective actions should be noted on the reports as well.

Any major catastrophic events or conditions pertaining to the tailings area should be reported immediately to the Mill Manager or the Radiation Safety Officer, one of who will notify Corporate Management. If dam failure occurs, notify your supervisor and the Mill Manager immediately. The Mill Manager will then notify Corporate Management and the U. S. NRC (301-316-5100), MSHA (303-231-5465), and the State of Utah, Division of Dam Safety (801-538-7200).

Inspections:

All areas of the tailings disposal system are routinely patrolled and visible observations are to be noted on a daily tailings inspection form. Refer to Appendix B for an example of the tailings inspection form. The inspection form consists of three pages and is summarized as follows:

1. Tailings Slurry Transport System:

The slurry pipeline is to be inspected for leaks, damage, and sharp bends. The pipeline joints are to be monitored for leaks, and loose connections. The pipeline supports are to be inspected for damage and loss of support. Valves are also to be inspected particularly for leaks, blocked valves, and closed valves. Points of discharge need to be inspected for improper location and orientation.

2. Operational Systems:

Operating systems including water levels, beach liners, and covered areas are items to be inspected and noted on the daily inspection forms. Sudden changes in water levels previously observed or water levels exceeding the operating level of a pond are potential areas of concern and should be noted. Beach areas that are observed as having cracks, severe erosion or cavities are also items that require investigation and notation on daily forms. Exposed liner or absence of cover from erosion are potential items of concern for ponds and covered areas. These should also be noted on the daily inspection form.

Cells 1, 3 and 4A solution levels are to be monitored closely for conditions nearing maximum operating level and for large changes in the water level since the last inspection. All pumping activities affecting the water level will be documented. Extra attention needs to be given for Cell 2 and 3 beaches. In Cells 1 and 3, the PVC liner needs to be monitored closely for exposed liner, especially after storm events. It is important to cover exposed liner immediately as exposure to sunlight will cause degradation of the PVC liner. Small areas of exposed liner should be covered by hand. Large sections of exposed liner will require the use of heavy equipment

In addition, the HPDE liner in Cell 4A needs to be monitored and checked frequently for small tears, cracks, and holes along the seams and the liner in general. When such conditions are noted, the location and the number of these abrasions should be brought to the immediate attention of the Radiation Safety Officer.

These conditions are considered serious and require immediate action. After these conditions have been noted to the Radiation Safety Officer, a work order will be written by the Radiation Safety Officer and turned into the Maintenance Department. All such repairs should be noted in the report and should contain the start and finish date of the repairs.

3. **Dikes and Embankments:**

Inspection items include the slopes and the crests of each dike. For slopes, areas of concern are sloughs or sliding cracks, bulges, subsidence, severe erosion, moist areas, and areas of seepage outbreak. For crests, areas of concern are cracks, subsidence, and severe erosion. When any of these conditions are noted, an "X" mark should be placed in the section marked for that dike.

In addition, the dikes should be inspected closely for mice holes and more importantly for prairie dog holes, as the prairie dogs are likely to burrow in deep, possibly to the liner. In particular, dike 3, dike 4A-S, and dike 4A-W should be inspected closely for all items above. If any of these conditions exist, the inspection report should be marked accordingly.

4. **Flow Rates:**

Presence of all flows in and out of the cells should be noted. Flow rates are to be estimated in gallons per minute (GPM). Rates need to be determined for slurry lines, pond return, SX-tails, and the spray system. During non-operational modes, the flow rate column should be marked as "0". The same holds true when the spray system is not utilized.

5. **Physical Inspection of Slurry Line(s):**

A physical inspection of all slurry lines has to be made every 4 hours during operation of the mill. If possible, the inspection should include observation of the entire discharge line and discharge spill point into the cell. If "fill to elevation" flags are in place, the tailings and build-up is to be monitored and controlled so as to not cover the flags.

6. **Dust Control:**

Dusting and wind movement of tailings should be noted for Cells 2, 3, and 4A. Other observations to be noted include a brief description of present weather conditions, and a record of any precipitation received. Any dusting or wind movement of tailings should be documented. In addition, an estimate should be made for wind speed at the time of the observed dusting or wind movement of tailings.

The Environmental Department measures precipitation on a daily basis. Daily measurements should be made as near to 8:00 a.m. as possible every day. Weekend measurements will be taken by the Shifter as close to 8:00 a.m. as possible. All snow or ice should be melted before

a reading is taken.

7. Observations of Potential Concern:

All observations of concern during the inspection should be noted in this section. Corrective action should follow each area of concern noted. All work orders issued, contacts, or notifications made should be noted in this section as well. It is important to document all these items in order to assure that the tailings management system records are complete and accurate.

8. Map of Tailings Cells:

The last section of the inspection involves drawing, as accurately as possible, the following items where applicable.

1. Cover area
2. Beach/tailing sands area
3. Solution as it exists
4. Pump lines
5. Activities around tailings cell (i.e. hauling trash to the dump, liner repairs, etc.)
6. Slurry discharge when operating
7. Over spray system when operating

9. Safety Rules:

All safety rules applicable to the mill are applicable when in the tailings area. These rules meet the required MSHA regulations for the tailings area. Please pay particular notice to the following rules:

1. The posted speed limit for the tailings area is 15 mph and should not be exceeded.
2. No food or drink is permitted in the area.
3. All personnel entering the tailings area must have access to a two-way radio.
4. Horseplay is not permitted at any time.
5. Only those specifically authorized may operate motor vehicles in the restricted area.
6. When road conditions are muddy or slick, a four-wheel drive vehicle is required in the area.
7. Any work performed in which there is a danger of falling or slipping in the cell will require the use of a safety belt or harness with attended life line and an approved life jacket. A portable eyewash must be present on site as well.
8. Anytime the boat is used to perform any work; an approved life jacket and goggles must

be worn at all times. There must also be an approved safety watch with a two-way hand-held radio on shore. A portable eyewash must be present on site as well.

10. Preservation of Wildlife:

Every effort should be made to prevent wildlife and domesticated animals from entering the tailings area. All wildlife observed should be reported on the Wildlife Report Worksheet during each shift. Waterfowl seen near the tailings cells should be discouraged from landing by the use of noisemakers.

11. Certification:

Following the review of this document and on-site instruction on the tailings system inspection program, designated individuals will be certified to perform daily tailings inspections. Certification is authorized by the Radiation Safety Officer. Refer to the Certification Form, Appendix C. This form should be signed and dated only after a thorough review of the tailings information previously presented. The form will then be signed by the Radiation Safety Officer and filed.

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

DUST MINIMIZATION

1. **Operational Procedure for Dust Minimization:**

In an effort to keep wind movement of tailings sand to a minimum, the following dust minimization procedures will be utilized.

1.1. When blowing tailings sand or dusting is observed on Cell 3 beaches, the spray system should be operated until a crystal crust develops on the sands surface. The spray lines will be moved as necessary. As soon as the crystal surface develops, the spray system will be shut off. The Radiation Safety Officer along with the Mill Foreman and Shift Foreman will be responsible for the operational decisions regarding dust minimization. The spray lines require periodic cleaning because they tend to crystallize over a period of time. The spray system should be operated if there is evidence of excessive blowing sands indicating surface crust deformation or otherwise on an as needed basis.

1.2. During times of strong winds, the Radiation Safety Officer will ensure that no spray is being carried out of the cells. If spray is leaving the confines of the cell, all spraying will cease immediately.

1.3. Additional snow fencing and straw bales will be assembled to form windbreaks, as needed on Cell 3 beaches.

1.4. As 11e.(2) by product material is placed in Cell 3, interim cover can be advanced in an effort to minimize dusting on Cell 3.

The effectiveness of the above methods will be documented on the weekly tailings inspection form. Documentation will include observed wind movement of tailings sand, if any, and the steps taken the preceding week for dust control. Wind movement of tailings sand is noted on every daily inspection form along with an estimate of the percentage of dusting from Cells 2 and 3. The areas of blowing dust will be noted as well on Monday's daily inspection form.

2. Procedure: Tailings Dust Control System:

There are five methods of control of blowing tailings dust: Spraying raffinate solution, creating wind breaks with straw bales and snow fencing, flooding with slurry, using chemical stabilization agents and covering with interim cover. During operation of the mill, Cell 2 will not require any dust control measures since the cell consists of cover area and a slimes area. In addition to these areas, cover will be advancing along the slimes area as the disposal of waste at the Cell 2 dump expands. This advancement of cover will also reduce the amount of exposed tailings sand on Cell 2's surface; thereby eliminating the need for dust control measures. If dusting is observed on Cell 2, similar dust control measures to those implemented for Cell 3 will be taken. The entire control activities will be focused on Cell 3 beaches unless the above conditions are modified.

At present, there are four general areas in Cell 3:

1. The pond.

2. The 11e.(2) by product material disposal area.

3. The cover area.

4. The tailings beaches.

The area of concern regarding dusting is the tailings beaches. These beaches will need to be sprayed in order to minimize dusting. The sprays should continue until a crust develops on the tailings surface. Once a crust develops, the spray system can be shut down.

Another method of dust control for Cell 3 beaches is the use of straw bales and snow fencing, which are used as wind breaks. These breaks should extend at least three feet above the existing sands and should be extended in lines to form barriers. These windbreaks will be monitored daily and repaired or replaced as needed.

The use of interim cover as a means of dust control in Cell 3 beaches will be utilized only in the area in which the 11e.(2) by product materials are placed, or in areas of Cell 3 where the tailings sand is up to final grade and is dewatered sufficiently enough to support the use of equipment for placement of the interim cover. As the material is placed, the cover can be advanced; thus, reducing the amount of tailings sand subject to

dusting.

Once the mill is operating and tailings is deposited in Cell 3, the area where tailings sand is deposited becomes inaccessible to equipment. After a period of two to three weeks, the sand surface will be stable enough to walk or work on. Tailings will be deposited through two lines until the sands are at the final deposition elevation. At this time, the lines will be moved to another area.

3. Procedure: Dust Minimization for Ore Stockpiles:

Dusting from the ore stockpiles have not been observed to be a problem as a hard crust has developed, which has inhibited dusting. The primary dust control techniques will utilize water application to the roadways on an as needed basis. If dusting is observed while transferring ore to the Grizzly from either roadways or stockpiles, water applications will be applied to minimize dusting. The number of applications, time of application, and location of application is documented and kept on file in the Radiation Office. Weekly inspections of the stockpile area are conducted to evaluate the effectiveness of dust control measures.

WHITE MESA MILL TAILINGS MANAGEMENT SYSTEM

TAILINGS LINE DETECTION

1. Procedure: Tailings Line Rupture Detection System

The following method detects line rupture of a tails line at the White Mesa Mill.

There are four major pipelines that transport solution and slurry from the Mill to the tailings Cells and from the tailings Cells back to the Mill. One six inch line and one eight inch line transport slurry from the Mill to impoundment Cell 3. One eight inch line transports tails solution from the solvent extraction process to impoundment Cell I-I. Solution is returned back to the mill in a pond return line from either Cell I-I or Cell 3.

Each of the above mentioned lines will have separate sensing systems that will be tied into a common alarm system. Each line will have a sensor at its discharge to determine the flow condition in the line. There will be a total of four (4) sensors.

The type of sensors will be a conductivity detection device, which will detect the presence or absence of material in the pipe. They will be positioned at high points in the line so that a "no flow" condition will not produce a high conductivity reading. If they were positioned at a low point in the line, the material would always present a false reading.

A time delay device will be incorporated in both tailings slurry lines that will activate the alarm after approximately 30 seconds of no flow condition, or a time determined by operational practice. This is necessary because of surges in the tailings slurry lines. It is not anticipated that delay devices will be necessary for the pond return line or SX tails line. The rupture detection alarm will be both optical and auditory, and will activate in the Central Control Room. An alarm indicator will be installed in the Central Control Room along with an "on-off" switch so that the Shift Foreman will have immediate control over the pond return pump.

The Central Control Room will have an alarm panel that will show lights corresponding to the different lines. The lines not in use will be shown as "no flow" conditions by the lights. When a line goes from a "flow" to a "no flow" condition, an alarm horn unique to the tailings system will sound and the corresponding light to the line will then blink intermittently. The Shift Foreman can then acknowledge the alarm. This will turn off the horn, but the light will

APPENDIX B

DAILY INSPEC ON DATA

Inspector:____________________
Date:____________________
Accompanied by:____________________
Time:____________________

Any Item not "ok" must be documented. A check mark = OK, X = Action Required.

I. TAILINGS SLURRY TRANSPORT SYSTEM

Inspection Items	Condition of Potential Concern	Cell 1-I	Cell 2	Cell 3	Cell 4A
* Slurry Pipeline	Leaks, Damage, Blockage, Sharp Bends				
* Pipeline Joints	Leaks, Loose Connections				
* Pipeline Supports	Damage, Loss of Support				
* Valves	Leaks, Blocked, Closed				
* Point(s) of Discharge	Improper Location or Orientation				

I. OPERATIONAL SYSTEMS

Inspection Items	Conditions of Potential Concern	Cell 1-I	Cell 2	Cell 3	Cell 4A
* Water Level	Greater Than Operating Level, Large Change Since Previous Inspection				
* Beach	Cracks, Severe Erosion, Subsidence				
* Liner and Cover	Erosion of Cover, Exposure of Liner				

II. DIKES AND EMBANKMENTS

Inspection Items	Conditions of Potential Concern	Dike 1-I	Dike 1-IA	Dike 2	Dike 3	Dike 4A-S	Dike 4A-W
* Slopes	Sloughs or Sliding Cracks, Bulges, Subsidence, Severe Erosion, Moist Areas, Areas of Seepage Outbreak						
* Crest	Cracks, Subsidence, Severe Erosion						

V. FLOW RATES

	Slurry Line(s)	Pond Return	S-X Tails	Spray System
* GPM				

. PHYSICAL INSPECTION OF SLURRY LINE(S)

* Walked to Discharge Point ______Yes______No
* Observed Entire Discharge Line ______Yes______No

Inspector:____________________
Date:____________________

VI. DUST CONTROL

	Cell 2	Cell 3	Cell 4A
* Dusting			
* Wind Movement of Tailings			

Precipitation:__________ inches liquid
General Meteorological Conditions:

VII. DAILY LEAK DETECTION CHECK

* Leak Detection System Under Cell____ Checked. _____Wet_____Dry

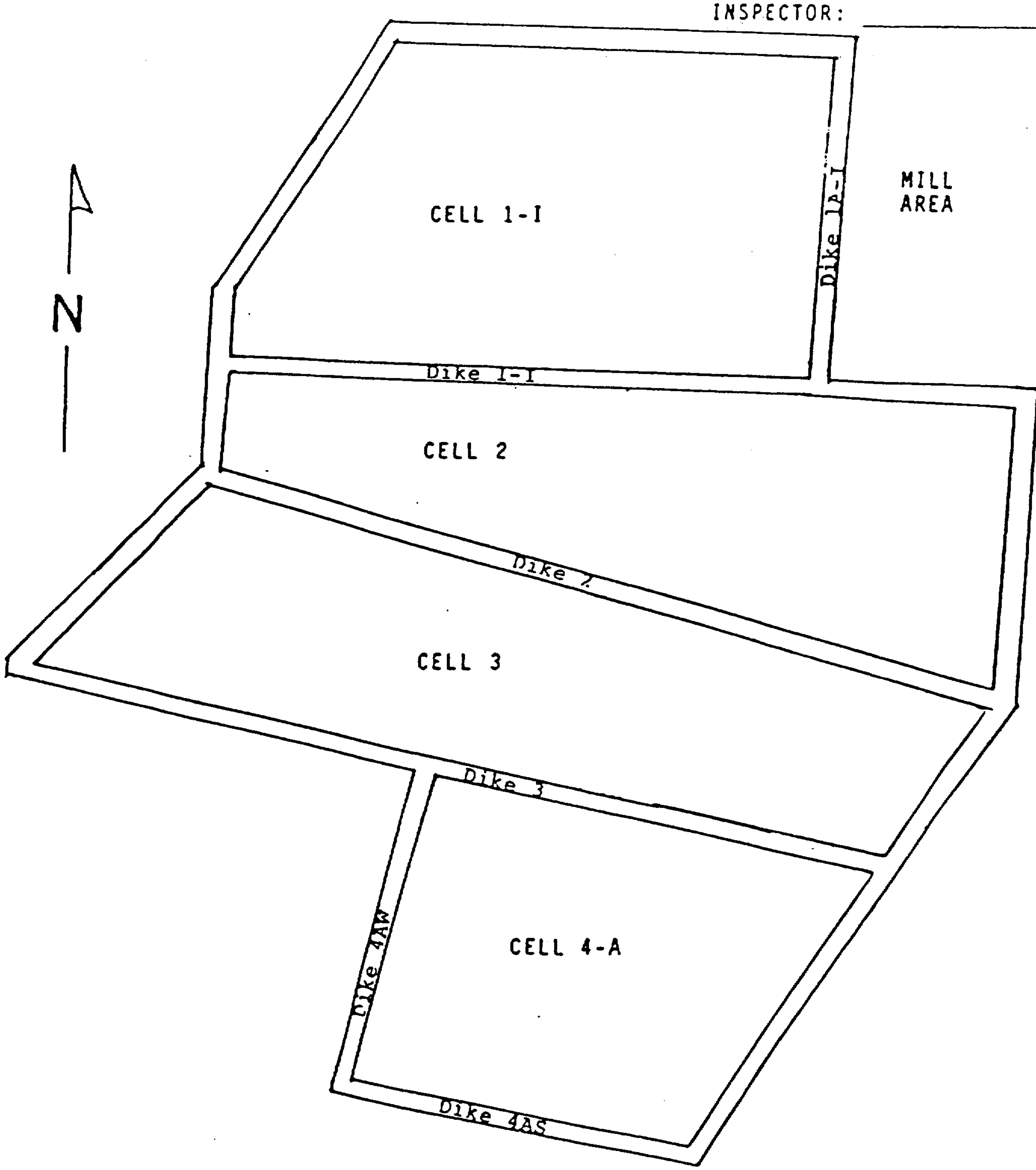
Initial level____________
Final level ____________
Gallons pumped __________

VIII. Observations of Potential Concern	Action Required

DAILY INSPECTION REPORT
TAILINGS SLURRY DISCHARGE LOCATION

DATE: ____________________

INSPECTOR: ____________________



Appendix C
Certification Form

Date:_________________________

Name:_________________________

I have read the document titled "Tailings Management System , White Mesa Mill Tailings Inspector Training " and have received on-site instruction at the tailings system. This instruction included documentation of daily tailings inspections, analysis of potential problems (dike failures, unusual flows), notification procedures and safety.

____

Signature

I certify that the above-named person is qualified to perform the daily inspection of the tailings system at White Mesa Mill..

____

Environmental Coordinator

Tailings System Supervisor

International Uranium Corporation
Weekly Tailings Inspection

Date: ____________ Inspectors: ____________

1. Pond Elevations (msl, ft)

Cell 1: ____________
Cell 3: ____________

2. Underdrain Liquid Levels

Cell 1: ____________

Cell 2: ____________ μohms
____________ Feet to liquid
____________ Gallons Pumped

Cell 3: ____________

Cell 4A: ____________ Beginning Level
____________ Ending Level
____________ Gallons Pumped

3. Settlement Monitors (msl, ft)

Cell 2 W1: ____________
Cell 2 W2: ____________
Cell 2 W3: ____________
Cell 2 W4: ____________
Cell 2W7-C: ____________
Cell 4A-Toe: ____________

Cell 2W3-S: ____________
Cell 2E1-N: ____________
Cell 2E1-1S: ____________
Cell 2E1-2S: ____________
Cell 2 East: ____________

Cell 3-1N: ____________
Cell 3-1C: ____________
Cell 3-1S: ____________
Cell 3-2N: ____________
Cell 2W5-N: ____________

4. Tailings Area Inspection (Note dispersal of blowing tailings): ____________

5. Control Methods Implemented: ____________

6. Remarks: ____________

7. Contaminated Waste Dump: ____________

Inspector ______________________
Date ______________________

WHITE MESA PROCEDURES MANUAL

Quarterly Inspection Data

1. Embankment Inspection: ______________________

2. Operations/Maintenance Review: ______________________

3. Post-construction Changes: ______________________

4. Summary: ______________________

DAILY INSPECTION ..TA

Inspector: ____________________
Date: ____________________
Accompanied by: ____________________
Time: ____________________

* Item not "ok" must be documented. A check mark = OK, X = Action Required.

I. TAILINGS SLURRY TRANSPORT SYSTEM

Inspection Items	Condition of Potential Concern	Cell 1-I	Cell 2	Cell 3	Cell 4A
• Slurry Pipeline	Leaks, Damage, Blockage, Sharp Bends				
• Pipeline Joints	Leaks, Loose Connections				
• Pipeline Supports	Damage, Loss of Support				
• Valves	Leaks, Blocked, Closed				
• Point(s) of Discharge	Improper Location or Orientation				

OPERATIONAL SYSTEMS

Inspection Items	Conditions of Potential Concern	Cell 1-I	Cell 2	Cell 3	Cell 4A
• Water Level	Greater Than Operating Level, Large Change Since Previous Inspection				
• Beach	Cracks, Severe Erosion, Subsidence				
• Liner and Cover	Erosion of Cover, Exposure of Liner				

DIKES AND EMBANKMENTS

Inspection Items	Conditions of Potential Concern	Dike 1-I	Dike 1-IA	Dike 2	Dike 3	Dike 4A-S	Dike 4A W
• Slopes	Sloughs or Sliding Cracks, Bulges, Subsidence, Severe Erosion, Moist Areas, Areas of Seepage Outbreak						
• Crest	Cracks, Subsidence, Severe Erosion						

FLOW RATES	Slurry Line(s)	Pond Return	S-X Tails	Spray System
• GPM				

PHYSICAL INSPECTION OF SLURRY LINE(S)

• Walked to Discharge Point ______Yes______No

• Observed Entire Discharge Line ______Yes______No

Inspector:____________________
Date:____________________

ST CONTROL	Cell 2	Cell 3	Cell 4A
Dusting			
Wind Movement of Tailings			

ecipitation:__________ inches liquid
neral Meteorological Conditions:

DAILY LEAK DETECTION CHECK

Leak Detection System Under Cell____ Checked. _____Wet_____Dry   Initial level____________
Final level ____________
Gallons pumped ____________

Observations of Potential Concern	Action Required

DATE: ____________

INSPECTOR: ____________