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May 30, 2018

Mike LaFranzo
Senior Health Physicist
Region III – Division of Nuclear Materials and Safety
U.S. Nuclear Regulatory Commission
2443 Warrenville Road
Lisle, IL 60532

Re: Request for Alternate Disposal of Licensed Radioactive Waste - License No. 24-00513-32, Docket No 030-02278

Dear Mr. LaFranzo:

Per 10 CFR 20.2002, the University of Missouri (MU) requests approval to dispose of conforming radioactive wastes from the Pickard Hall Decommissioning Project at the US Ecology EPA-permitted RCRA Subtitle C landfill in Grandview, Idaho (USEI).

In the early 1900's the basement of Pickard Hall, located at 405 S. Ninth Street in Columbia MO, was used for separation of radium-226 from uranium ores and research with thorium-232 daughters (specifically Ra-228 as a potential substitute for Ra-226). Additionally, the purified materials may have been used in other areas of the building. As a result of these historical operations, Pickard Hall is impacted by legacy radioactive materials on building structures and in soils around (and potentially under) the building.

Licensed source material disposal at the USEI site requires NRC approval under 10 CFR 20.2002; however, Ra-226 does not require alternate disposal approval because the Energy Policy Act of 2005 (EPAct) approved disposal of the newly added byproduct materials using pre-existing methods. From Federal Register Vol. 72, No. 189 dated Monday, October 1, 2007 Page 55880:
"Notwithstanding the previously mentioned provisions for the NRC or Agreement State licensing of the disposal facility for the newly added byproduct material, Section 651(e)(3) of the EPAct does not affect the authority of any entity to dispose of the newly added byproduct material at a disposal facility in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act. This means that Federal and State solid or hazardous waste laws can continue to be used as an authority to permit disposal of this newly added byproduct material. Disposal

solutions already in place to allow disposal of the newly added byproduct material are unaffected by the EPAct. To implement this provision of the EPAct, the NRC is changing its regulations in 10 CFR Part 20 to redefine Waste to allow disposal of the newly added byproduct material in the NRC-regulated disposal facilities or in a disposal facility permitted under Federal or State solid or hazardous waste laws."

MU conducted a radiological assessment in several phases from 2009 to 2011. The assessment results indicate that the nuclides of concern are Ra-226, U-238, Th-232 and their progeny. Since the usage of radioactive materials, the building was renovated such that most of the original surfaces have been covered. MU has submitted a Site Characterization Plan (SCP) to the NRC that is designed to fully characterize the site and collect the information necessary to develop a Decommissioning Plan (DP). Characterization will require the removal of building materials such as sheetrock, plaster, concrete, etc. to make the original surfaces available for surface contamination measurements.

Characterization and remediation activities will generate radioactive waste that must be disposed. As part of characterization, it is expected that up to 90 cubic yards of contaminated building material (such as wood, plaster, brick, and insulation) and 60 cubic yards of soil, concrete, and piping will require disposal. As part of the overall decommissioning, it is expected that up to another 350 cubic yards of similar materials will require disposal. Based on radiological measurements collected on available surfaces and evaluation of surface exposure rates on covered surfaces, MU believes the decommissioning wastes can be managed to meet the USEI waste acceptance criteria (WAC).

MU conducted a radiological assessment to estimate the extent and magnitude of residual radioactivity to support decommissioning planning, and to evaluate radiological exposures to building occupants and visitors. The assessment was an iterative process that was performed from December 2009 to October 2011 over six separate mobilizations (ML102800311, ML102800322, ML102800330, ML102800336, ML102800398, ML102800412, ML102800427, ML102800430, ML102800436, ML102800441, ML102800450, ML102800452, ML102800455, ML102800458, ML102800463, ML102800467, and ML102800563). MU surveyed accessible portions of the entire building including the basement, first floor, second floor, the attic, the roof, steam tunnel feeder, and outside grounds. Surveys consisted of the following types of measurements:

- indoor surface scans for alpha and beta emissions using gas flow proportional detectors (100% of accessible surfaces < 2 m height)
- indoor surface scans for gamma emissions using a 2" x 2" sodium iodide detector at a

distance of 10 cm (100% of accessible surfaces < 2 m height)

- indoor large area wipes for alpha and beta removable activity (100% of accessible floor surfaces)
- at locations of elevated activity identified during indoor scans:
- static measurements for alpha and beta total surface activity
- static measurements for gamma emissions at a distance of 10 cm
- external dose rate measurements at a 1 meter distance
- disc smears for alpha and beta removable activity
- solid samples of concrete surfaces for gamma spectroscopy analysis (a subset of samples was also analyzed by alpha spectroscopy analysis)
- solid samples of contaminated brick ventilation shafts and wood flooring in the attic
- Global positioning system (GPS) correlated gamma scans of outdoor areas
- surface soil samples for gamma spectroscopy analysis (a subset of samples was also analyzed by alpha spectroscopy analysis)
- sampling for airborne radioactivity

Selected locations of highest surface exposure rate were uncovered to allow surface contamination measurements, after making surface contamination measurements the surface contamination was scraped away and collected for laboratory analysis by gamma spectroscopy and alpha spectroscopy (U and Th). The highest activity concentrations of the scrapings were 1,998 pCi/g Ra-226, 257 pCi/g Th-232, and 59 pCi/g U-238. MU believes that these radiological measurements represent the highest radioactivity concentrations on building structural surfaces. The highest soil sample results were an order of magnitude lower.

USEI is regulated by the Idaho Department of Environmental Quality (IDEQ). Idaho regulations and the USEI RCRA permit provide for the acceptance of this material with the appropriate NRC exemptions. USEI is permitted to dispose certain federally-exempted radioactive materials, including materials meeting the definition of "unimportant quantities of source material" per 10 CFR40.13(a). USEI routinely disposes of large quantities of similar materials in accordance with the permit.

MU requests NRC approval for disposal of up to 500 CY of wastes conforming to the USEI Permit WAC. Wastes will be generated and managed to achieve packages that conform to the USEI WAC. Should material be identified that could cause a shipment to exceed the USEI WAC, those material will be segregated for disposal at an appropriately licensed Low Level Radioactive Waste disposal facility.

Exposure assessments for materials with similar concentrations of source material have been completed by the NRC in NUREG 1717, "Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials" to support exemption from licensing. These assessments bound the impacts of the disposal procedures requested in that the NUREG 1717 assessments analyze exposures from uncontrolled public use of the materials. Additional exposure assessments have been completed by USEI and approved as part of the permitting process. A summary of the USEI safety assessment is attached.

Wastes will be handled in a controlled manner by trained individuals to ensure doses to workers and the public are maintained ALARA. Work at Pickard Hall will be performed under the MU broad scope radioactive materials license in accordance with NRC-approved license amendments and Plans. Wastes will be packaged at the Pickard Hall site by qualified radiation workers in compliance with a radioactive materials license, transported directly to USEI according to US DOT requirements using properly licensed/permitted carriers and transport vehicles, and received/handled by USEI according to the provisions of their Permit. No other facilities will be affected by these disposal procedures.

MU believes that the material from the Pickard Hall Decommissioning Project qualifies for alternate disposal at that Idaho facility since the material in question will comply with the USEI WAC, result in a small dose to members of the public, and complies with USEI site operational and post closure requirements which limits the dose to maximally exposed individuals (MEI).

If you have any questions, please do not hesitate to contact me at (573) 882-7018.

Sincerely,

Felicity Beckfield, MS, CHP
Radiation Safety Officer

cc: Todd Houts, Director, MU Environmental Health & Safety

Enclosure: Appendix A: US Ecology Idaho Exempt Materials Safety Assessment
Appendix B: US Ecology Idaho Radiological Waste Acceptance Criteria

Appendix A:
US Ecology Idaho Exempt Materials Safety Assessment

Exempt Radiological Materials Procedures

Safety Assessment

The Model

The RESRAD model is a publicly available performance assessment model that allows estimation of potential radiation doses to hypothetical individuals from radioactive materials disposed below ground surface. The reference case used in previous safety assessments by US Ecology Inc. (USEI) models doses from all pathways including direct exposure, inhalation, and ingestion, through a number of pathways that describe the movement of water, vapor and gases in the environment. This simple and conservative case had been used since it was effective at demonstrating compliance in previous USEI submittals. These very conservative models demonstrated that compliance with all permit and regulatory requirements would be achieved. As noted in the RESRAD manual:

"The models and input parameters described in this manual and incorporated into RESRAD have been chosen so as to be realistic but reasonably conservative, and the calculated doses corresponding to guideline values of the radionuclide concentrations are expected to be reasonably conservative estimates (overestimates) of the actual doses." [1]

The RESRAD model currently incorporated into the USEI permit relies predominantly on very conservative default parameters and exposure scenarios to demonstrate compliance. This "very conservative case" approach produces hypothetical dose estimates that significantly overstate what might actually occur. A more site specific description of the physical geology, hydrology and human use parameters (home construction, water use, etc) will, for example, provide a more meaningful evaluation of potential for hypothetical doses under the RESRAD resident farmer scenario.

With the safety assessment presented in this document, USEI proposes to use the same RESRAD model employing more realistic, site specific parameters. The same 15 mrem per year radiation exposure standard for the general public set forth in IDAPA 58, Title 01, Chapter 10 and used in the current model is employed. In addition, USEI has retained the services of Mr. Eric Lappala, P.E., to develop the site-specific RESRAD parameters and evaluate the contaminated zone for this safety assessment. Mr. Lappala's report draws heavily upon existing site hydrogeological investigations performed during the course of permitting and site development. The Lappala report is appended to and

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[1] User's Manual for RESRAD Version 6 ANL/EAD-4 by C. Yu, A.J. Zielen, J.-J. Cheng, D.J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo III,* W.A. Williams,* and H. Peterson* Environmental Assessment Division Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439 July 2001

incorporated as a part of this safety assessment. Mr. Lappala's credentials are attached to his report.

USEI believes that these improvements based on site-specific hydrogeologic information better represent the site's behavior and the selected RESRAD parameter values better represent potential exposure scenarios. The use of site-specific information and more realistic exposure scenarios is encouraged in the RESRAD Version 6 documentation. As noted on page *xi* of the preface regarding this latest version of the RESRAD model:

"These improvements have increased RESRAD's capabilities and flexibility and enabled users to interact with the code more easily. With the improvements, the code has become more realistic in terms of the models and default parameters it uses."

Site-specific RESRAD improvements reflected in this safety assessment are as follows:

1. Refine the contaminated soil, vadose and saturated zone models to better reflect actual site conditions,

2. Refine the radon gas scenario to better reflect house construction practices consistent with construction practices in the local area,

3. Refine the aquatic (surface pond) pathway as a route of exposure to potentially exposed individuals,

4. Add additional radionuclides (e.g. fission and activation products) to provide a basis for inclusion of limits in the permit's Waste Acceptance Criteria for specified byproduct material subject to potential case by case exemptions.

5. Provide a basis for expanding the Environmental Monitoring and Occupational Monitoring Program for select radiological constituents.

USEI proposes that the improved, more site-specific RESRAD model be incorporated into its permit for purposes of evaluating future case-by-case proposals to accept source or byproduct material that has been exempted from regulation for disposal purposes by the U.S. Nuclear Regulatory Commission or its Agreement States. Acceptance of such exempt material is presently provided for in existing Idaho regulations and the permit.

Contaminated Soil, Vadose and Saturated Zone Models

The site-specific hydrogeologic properties and conditions used in the RESRAD analysis were determined using extensive site-specific information available from the many characterization reports previously submitted to the Idaho Department. This is the same information used to support the existing, recently renewed RCRA permit for the USEI facility. Specifically, hydrogeologic conditions in both the vadose and saturated zones from these reports were used to develop the necessary input parameters for RESRAD.

Site-specific conditions in the waste disposal cell needed for the RESRAD analysis were determined using information on potentially anticipated waste streams regarding waste forms, volumes, concentrations of radionuclides, co-disposed waste forms and volumes, waste emplacement and stabilization methods, and waste cover operations.

A reference case RESRAD analysis was performed using the site specific vadose zone, saturated zone, and waste cell conditions. Waste cell conditions were conservatively modeled by only taking credit for the three foot compacted natural clay liner employed at the facility. No credit is taken in the assessment for containment provided by the dual synthetic liner and leachate collection system also required as a condition of USEI's permit.

Sensitivity analyses was performed to determine the parameters for which the estimated dose was the most sensitive. These parameters are the distribution coefficient (K_D for ^{14}C, the quantity of ^{14}C in the anticipated waste stream, the RESRAD "b" parameter used of the contaminated zone (b_{CZ}), and the saturated conductivity of the contaminated zone ($Ksat_{CZ}$).

Revised Radon Pathway

RESRAD code's default radon gas scenario is not consistent with home construction practices in the rural communities of Idaho surrounding to the USEI facility. It is conservative to assume that a home would be built on disposal cells. Since deed restrictions would prevent this activity, it is most likely that no construction of any type will occur on top of closed disposal units. USEI proposes to revise the RESRAD model's default radon gas pathway scenario by replacing the assumption that houses with basements are constructed into closed trenches with the assumption that "at grade" construction is used. The city engineer for Mountain Home, ID, has indicated that the majority of homes built in this area (greater than 90% of homes built in the more populated but nearby Mountain Home area) are either slab on grade or pier on beam with a ventilated crawl space[2]. This change in model assumptions is consistent with RESRAD guidance to use site-specific data. Accordingly, USEI's revised performance assessment models a house built on a slab directly above the waste disposal zone on top of the disposal trench. By changing the parameter for depth of a hypothetical home the foundation to 0 (slab on ground surface) from the default value of –1 meter depth, the radon emanation rate better reflects a realistic radon flux for the type of house construction common in the area. The maximum annual hypothetical dose calculated from this improved radon scenario and using the assumed concentrations requested in the Exempt Radiological Manual Procedures (ERMP) is 2.7 mrem in year 1,000.

New Radionuclides Added to the Model

[2] Personal communication with City Engineer, Mtn. Home, Idaho.

In USEI's permit modification of December 2001, a table of materials and items exempted by the U.S. Nuclear Regulatory Commission (USNRC) was included in the Waste Acceptance Criteria ("WAC"). This table includes generally exempted items and devices that contained small amounts of radionuclides not specifically listed in the USEI WAC. These additional radionuclides have short half-lives, large partitioning coefficients (K_d's) or both. They would decay to insignificant levels before reaching ground water and were previously determined by the Department to be acceptable for disposal. The RESRAD analysis provided in this documentation confirmed that these radionuclides do not contribute substantively to the hypothetical dose to a resident farmer and conform to all regulatory requirements.

USEI currently provides an annual update to the assessment of disposed radiological materials. The annual reports are cumulative so that with the receipt of a radionuclide its contribution to the inventory is properly accounted for.

USEI anticipates seeking case-by-case concurrence to accept specified NRC and Agreement State exempt byproduct material containing predominantly fission and activation product radionuclides in low concentrations. Two common examples of fission and activation products are ^{137}Cs and ^{60}Co respectively. These exempt byproduct materials may also contain very small concentrations of transuranic radionuclides in physical forms similar to materials currently being received. These waste forms will include soils, concrete and building debris and similar decommissioning wastes. These wastes are expected to contain measured or analytically derived concentrations in the range of tens of pCi per gram or less of fission and activation products, and less than 0.1 pCi per gram of transuranic radionuclides. This is consistent with the doses per unit intake (inhalation and ingestions) for fission and activation product radionuclides versus transuranic radionuclides and is taken into account in the RESRAD analysis. These levels also consider the requirements for protection of workers during operations as discussed in the expanded operational monitoring program below. Worker exposures are expected to be consistent with USNRC guidance for disposal of exempt materials[3].

Expanded Environmental Monitoring Program

To provide added confidence that the facility is safely isolating radioactive constituents from the biosphere, the permit modification is proposed to expand the required environmental monitoring program as follows:

Gamma spectroscopic analysis will be performed for all air, water and soil samples in addition to the current suite that consists of isotopic alpha spectroscopy for uranium and thorium radionuclides, analyses for radium, gross beta and gross alpha activity. Analysis for ^{239}Pu and ^{241}Am will be added to those radionuclides assessed using alpha spectroscopy. They will serve as the indicator radionuclide for other transuranic radionuclides as shown in Table 3-1.

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[3] Nureg 1757, v.1, rev.1, Consolidated Decommissioning Guidance- Decommissioning Guidance for Materials Licensees, Final Report, pp. 15-25, US Nuclear Regulatory Commission, Office of Nuclear Materials Safety and Safeguards, Washington, DC, September 2003.

Expanded Occupational Exposure Monitoring Program

USEI is currently required, under worker protection regulations, to monitor its employees for exposure to external sources of radiation using whole body dosimeters. The current method for monitoring for potential external radiation exposure *(thermo luminescent dosimeters)* is the accepted method for monitoring for doses from radioactive materials in both current and proposed wastes. Therefore, no change to the external monitoring program is considered necessary.

Alpha emitting radionuclides including transuranic alpha emitters can contribute to internal exposure if inhaled but are not significant sources of external radiation exposure. The occupational air sampling program will be expanded consistent with environmental air monitoring to include analysis for gamma-emitting radionuclides. Analysis for ^{239}Pu and ^{241}Am will also be included in the suite of analyses employed for occupational air sampling to provide sufficient assurance that transuranic radionuclides are not present in quantities sufficient to cause any internal dose of consequence.

No change is required for the contamination control program as the proposed exempt wastes will be composed of radionuclides that emit the same types of radiation that are currently monitored. The additional radionuclides will be monitored using the same equipment and procedures currently in place with the same detection limits applying. USEI's current counting equipment meets the standard of practice in routine monitoring procedures for counting swipe samples that potentially contain alpha, beta and gamma-emitting radionuclides.

Model Summary Reports

A copy of the proposed RESRAD and the current RESRAD model summary reports are included with this safety assessment for comparison.

Based upon the upgraded RESRAD model, the maximum post-closure dose has been reduced from 13.5 mrem/yr in year 1000 to 9.8 mrem/yr in year 326.

Revised Waste Acceptance Criteria

A driving principle in the development of the revised WAC has been that the hypothetical dose to the general public and USEI employees not be increased significantly above background. Further, USEI experience has shown that these wastes can be safely received, offloaded, and disposed in accordance with all permit and regulatory requirements. This principle has been reinforced by the NRC's requirements that any materials exempted from regulation for purposes of disposal would not cause a dose of more than "a few mrem" to any individual involved in packaging, transporting and

disposing of the materials[4] Finally, USEI's proposed WAC modification retains the overall limit of 2,000 pCi/gm for the sum of the concentrations of all radionuclides in a given waste stream.
By using a concentration limit of 25 pCi/g for fission and activation product radionuclides, USEI can assure that potential doses to employees and to the general public from the receipt, processing and disposal of those radionuclides will remain within the NRC guidelines of "a few mrem". These concentrations would result in a dose to the workers approximately 3 orders of magnitude below the allowable dose for occupational exposure, assuming the individuals worked in this airborne concentration without respiratory protection for a full 2000-hour work year. Additionally, USEI workers are required to wear respirators while working in areas where waste is loaded or unloaded. These respirators provide an additional reduction in the amount of material workers could inhale by at least a factor of 10. Doses to members of the general public from the transport and disposal of these materials can also be demonstrated to be a factor of ten times less than that allowed by the U.S. Nuclear Regulatory Commission.

^{3}H (tritium), a radioisotope of hydrogen, produces only a small amount of dose per unit activity if inhaled or ingested. As shown in the RESRAD report, a concentration of tritium of 1000 pCi/g throughout the mass of the contaminated zone will produce a maximum hypothetical dose of 3.5×10^{-4} mrem per year. In addition, tritium's relatively short half-life of 12.5 years allows for substantial decay to occur before the model conservatively introduces it to the upper saturated zone. Since tritium is a radioisotope of hydrogen, it travels with water as it moves through the vadose zone. Based upon the USEI site's characteristics as modeled, water is transported to the upper saturated zone in approximately 220 years. This allows tritium to undergo 17.6 half-lives by the time it reaches that zone. In this time the concentration of tritium has been reduced to 5×10^{-4} % of its original concentration. As can be seen in the RESRAD analysis, the remaining tritium contributes an insignificant portion to the hypothetical post-closure dose. For this reason the WAC for tritium is proposed at 1000 pCi/g for byproduct material wastes.

Limits already in the WAC for the naturally occurring alpha emitting radionuclides are not proposed to change. The concentration limits for the transuranic radionuclides is proposed to be 0.1 pCi/g. USEI believes that in most instances, any transuranic radionuclides it receives will be as a minor radiological contaminant in other radiologically contaminated waste. The proposed limit for transuranic radionuclides is consistent with this expectation. At the level of 0.1 pCi/g, potential worker doses from the transuranic radionuclides are expected to be approximately one-thousandth of the allowable limit prescribed by the NRC and at least one tenth the allowable limit for dose to members of the general public. In the revised model, transuranic radionuclides contribute no post-closure dose within the model time frame of 1000 years. The maximum dose from transuranic radionuclides occurs about year 5000 and is approximately 3.6×10^{-8} mrem/yr.

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[4] Nureg 1757, v.1, rev.1, Consolidated Decommissioning Guidance- Decommissioning Guidance for Materials Licensees, Final Report, pp. 15-25, US Nuclear Regulatory Commission, Office of Nuclear Materials Safety and Safeguards, Washington, DC, September 2003.

Because an unanticipated radionuclide may be considered for disposal at the site, USEI proposes to amend the WAC to allow for the disposal of any particular radionuclide based upon a satisfactory demonstration that its disposal will not substantively increase the post closure dose, or cause a dose to site workers or members of the general public of more than "a few mrem". USEI seeks a permit modification to use the RESRAD analysis described in this safety assessment for that limited purpose. The demonstration shall be conditioned as described below conducted in the following manner:

1. The material must be exempted by the US Nuclear Regulatory Commission or its Agreement State, and if diffuse, shall meet the appropriate concentration limitation for the type of emission, i.e., fission and activation products, transuranic, etc.

2. The material shall be evaluated using realistic scenarios to assess hypothetical doses to site employees and members of the general public to assure they are consistent with the results reported here. Results below one-thousandth the annual occupational dose limit or one tenth the annual dose limit for members of the general public respectively will be viewed to be consistent. Materials otherwise conforming to all permit requirements and meeting this criterion will qualify for disposal.

3. If a published K_d is not obtainable, decay of the radionuclide(s) will be used and the K_d assumed to be zero to determine its concentration at the time the model predicts the material would reach ground water.

4. If at the time the material is predicted to reach ground water, its concentration, based on its half-life, is less than 0.1 pCi/g then it will be considered acceptable for disposal.

5. Any additional radionuclides accepted using this methodology will be included in the exempt waste annual report for the year it was disposed.

Corrections

In order to correct two errors, USEI proposed to change the wording in Table 4 for exemption 10 CFR 40.13(b) by removing the wording "<2000 pCi/g source material and progeny", which does not appear in the exemption and replacing it with the words "as set forth in exemption". Also in row one of Table 1, the ppm for natural uranium will be corrected to 422 from 211. This corrects a calculational error. Additionally, Section C.3.2 of the WAP was modified to clarify the annual assessment report requirements as well as adding a requirement to provide an annual summary report of environmental monitoring activities. Finally, the nomenclature to describe radionuclides was modified so that a common format utilizing the industry accepted practice of using superscripts (^{238}U vs. _U-238).

Appendix B:
US Ecology Idaho Radiological Waste Acceptance Criteria

When a waste shipment arrives on-site for treatment, storage, or disposal, a determination has usually been made by the generator that the waste is either:

- Excluded as a solid waste under IDAPA 58.01.05.005 {40 CFR § 261.4(a)};
- A listed hazardous waste, as defined in Subpart D of IDAPA 58.01.05.005 {40 CFR Part 261};
- A characteristic hazardous waste, as defined in Subpart C of IDAPA 58.01.05.005 {40 CFR Part 261};
- A solid waste, which is not hazardous waste, as defined by IDAPA 58.01.05.005 {40 CFR § 261.4(b)}; and
- A Corrective Action Management Unit (CAMU)-eligible waste, as defined by IDAPA 58.01.05.008 {40 CFR 264.552(a)(1) & (2)

C.3 Waste Acceptance Criteria

C.3.1 Pre-acceptance Review

The pre-acceptance protocol has been designed to ensure that only hazardous and radioactive material that can be properly and safely stored, treated and/or disposed of by USEI are approved for receipt at the facility. A two-step approach is taken by USEI. The first step is the chemical and/or radiological and physical characterization of the candidate waste stream by the generator. The second step is the pre-acceptance evaluation performed by USEI to determine the acceptability of the waste for receipt at the facility. Figure C.2 presents a logic diagram of the pre-acceptance protocol that is utilized at the facility.

C.3.2 Radioactive Material Waste Acceptance Criteria

The following waste acceptance criteria are established for accepting radiological contaminated waste material that is not regulated under the Atomic Energy Act of 1954 ("AEA"), as amended. This may be accomplished by the following regulatory mechanisms; use of a general or specific exemption from regulation by the Nuclear Regulatory Commission (NRC) or an Agreement State; a Release from Radiological Control declaration by the Department of Energy (DOE); or a determination that 91(b) radioactive material is no longer regulated by the Department of Defense (DoD). Material may also be accepted if it is not regulated or licensed by the NRC or Agreement State or has been authorized for disposal by the IDEQ and is within the numeric waste acceptance criteria. Waste acceptance criteria are consistent with these restrictions.

The following five tables establish types and concentrations of radioactive materials that may be accepted. These tables are based on categories and types of radioactive material not regulated by the NRC, an Agreement State, the DOE, or the DoD for alternate disposal. The criteria are consistent with these restrictions and detailed analyses set forth in *Waste Acceptance Criteria and Justification for FUSRAP Material*, prepared by Radiation Safety Associates, Inc. (RSA) as subsequently refined, expanded and updated in *Waste Acceptance Criteria and Justification for Radioactive Material*, prepared by USEI.

Material may be accepted if the material has been specifically exempted from regulation by rule, order, license, license condition, letter of interpretation, or specific authorization under the following conditions: Thirty (30) days prior to intended shipment of such materials to the facility, USEI shall notify IDEQ of its intent to accept such material and submit information describing the material's physical, radiological, and/or chemical properties, impact on the facility radioactive materials performance assessment, and the

basis for determining that the material does not require disposal at a facility licensed under the AEA. The IDEQ will have 30 days from receipt of this notification to reject USEI's determination or require further information and review. No response by IDEQ within thirty (30) days following receipt of such notice shall constitute concurrence. IDEQ concurrence is not required for generally exempted material as set forth in Table C-4a.

Based on categories of waste described in the waste acceptance criteria, the concentration of the various radionuclides in the conveyance (e.g., rail car gondola, other container etc.) shall not exceed the concentration limits established in the WAC without the specific written approval of the IDEQ unless generally exempted as set forth in Table C-4a. Radiological surveys will be performed as outlined in Exempt Radiological Materials Procedure-01 (ERMP-01) to verify compliance with the WAC. If individual "pockets" of activity are detected indicating the limits may be exceeded, the RSO or RPS shall investigate the discrepancy and estimate the extent or volume of the material with the potentially elevated radiation levels. The RPS or RSO shall then make a determination on the compliance of the entire conveyance load with the appropriate WAC limits. If the conveyance is determined not to meet the limits, USEI will notify IDEQ's RCRA Program Manager within 24 hours of a concentration based exceedance of the facility WAC to evaluate and discuss management options. The findings and resolution actions shall then be documented and submitted to the IDEQ.

The radioactive material waste acceptance criteria, when used in conjunction with an effective radiation monitoring and protection program as defined in the USEI *Radioactive Material Health and Safety Plan* and *Exempt Radioactive Materials Procedures* provides adequate protection of human health and the environment. Included within this manual are requirements for USEI to submit a written summary report of all radioactive material waste receipts showing volumes and radionuclide concentrations and total activities disposed at the USEI site on a quarterly basis. The 4th quarter report of each year will also include an updated analysis of the cumulative impact on the facility performance assessment based upon the previous year's waste receipt.

These criteria and procedures are designed to assure that the highest potential dose to a worker handling radioactive material at USEI shall not exceed 400 mrem/year TEDE dose, and that no member of the public is calculated to receive a potential post closure dose exceeding 15 mrem/year TEDE dose, from the USEI program. TEDE is defined as the "Total Effective Dose Equivalent", which equals the sum of external and internal exposures. The public dose limit during operation activities is limited to 100 mrem/yr TEDE dose. An annual summary report of environmental monitoring results will be submitted to IDEQ by June 1st for the preceding year.

Materials that have a radioactive component that meets the criteria described in Tables C-1 through C-4c and are RCRA regulated material will be managed as described within this WAP for the RCRA regulated constituents.

Table C-1: Unimportant Quantities of Source Material Uniformly Dispersed* in Soil or Other Media**

	Status of Equilibrium	Maximum Concentration of Source Material	Sum of Concentrations Parent(s) and all progeny present
a	Natural uranium in equilibrium with progeny	<500 ppm / 167 pCi/g (^{238}U activity)	≤ 3000 pCi/g
	Refined natural uranium	<500 ppm / 167 pCi/g (^{238}U activity)	≤ 2000 pCi/g
	Depleted Uranium	<500 ppm / 169 pCi/g	≤ 2000 pCi/g
b	Natural thorium	<500 ppm / 55 pCi/g (^{232}Th activity)	≤ 2000 pCi/g
	^{230}Th (with no progeny)	0.1 ppm / ≤2000 pCi/g	
	Any mixture of Thorium and Uranium	Sum of ratios ≤ 1****	≤2000 pCi/g

*Refined Uranium includes ^{238}U, ^{235}U, ^{234}U; ^{234}Th, ^{234m}Pa, ^{231}Th

Table C-2: Naturally Occurring Radioactive Material Other Than Uranium and Thorium Uniformly Dispersed* in Soil or Other Media**

	Status of Equilibrium	Maximum Concentration of Parent Nuclide	Sum of Concentrations of Parent and All Progeny Present
a	^{226}Ra or ^{228}Ra with progeny in bulk form [1]	500 pCi/g	≤ 4500 pCi/g
b	^{226}Ra or ^{228}Ra with progeny in reinforced IP-1 containers [1]	1500 pCi/g	≤ 13,500 pCi/g
c	^{210}Pb with progeny(Bi & ^{210}Po)	1500 pCi/g	≤ 4500 pCi/g
	^{40}K	818 pCi/g	N/A
	Any other NORM		≤ 3000 pCi/g

[1] Any material containing ^{226}Ra greater than 222 pCi/g shall be disposed at least 6 meters from the external point on the completed cell.

Table C-3: Particle Accelerator Produced Radioactive Material

Acceptable Material	Activity or Concentration
Any particle accelerator produced radionuclide.	All materials shall be packaged in accordance with USDOT packaging requirements. Any packages containing iodine or volatile radionuclides will have lids or covers sealed to the container with gaskets. Contamination levels on the surface of the packages shall not exceed those allowed at point of receipt by USDOT rules. Gamma or x-ray radiation levels may not exceed 10 millirem per hour anywhere on the surface of the package. All packages received shall be directly disposed in the active cell. All containers shall be certified to be 90% full.

*Average over conveyance or container. The use of the phrase "over the conveyance or container" is meant to reflect the variability on the generator side. The concentration limit is the primary acceptance criteria.

**Unless otherwise authorized by IDEQ, other Media does not include radioactively contaminated liquid (except for incidental liquids in materials). See radioactive contaminated liquid definition (definition section of Part B permit).

*** $\frac{\text{Conc. of U in sample}}{\text{Allowable conc. of U}} + \frac{\text{Conc. of Th in Sample}}{\text{Allowable conc. of Th}} \leq 1$

Table C-4a: NRC Exempted Products, Devices or Items

Exemption 10 CFR Part*	Product, Device or Item	Isotope, Activity or Concentration
30.15	As listed in the regulation	Various isotopes and activities as set forth in 30.15
30.14, 30.18	Other materials, products or devices specifically exempted from regulation by rule, order, license, license condition, concurrence, or letter of interpretation	Radionuclides in concentrations consistent with the exemption
30.19	Self-luminous products containing tritium, ^{85}Kr, ^{3}H or ^{147}Pm	Activity by Manufacturing license
30.20	Gas and aerosol detectors for protection of life and property from fire	Isotope and activity by Manufacturing license
30.21	Capsules containing ^{14}C urea for *in vivo* diagnosis of humans	^{14}C, one µCi per capsule
31.12	General License for certain items and self-luminous products containing Radium 226	As set forth in 31.12 and see #4 under Additional information below
40.13(a)	Unimportant quantity of source material: see Table C-1	≤0.05% by weight source material
40.13(b)	Unrefined and unprocessed ore containing source material	As set forth in rule
40.13(c)(1)	Source material in incandescent gas mantles, vacuum tubes, welding rods, electric lamps for illumination	Thorium and uranium, various amounts or concentrations, see rules
40.13(c)(2)	(i)Source material in glazed ceramic tableware (ii)Piezoelectric ceramic (iii) Glassware not including glass brick, pane glass, ceramic tile, or other glass or ceramic used in construction	≤20% by weight ≤2% by weight ≤10% by weight
40.13(c)(3)	Photographic film, negatives or prints	Uranium or Thorium
40.13(c)(4)	Finished product or part fabricated of or containing tungsten or magnesium-thorium alloys. Cannot treat or process chemically, metallurgically, or physically.	≤4% by weight thorium content.
40.13(c)(5)	Uranium contained in counterweights installed in aircraft, rockets, projectiles and missiles or stored or handled in connection with installation or removal of such counterweights.	Per stated conditions in rule.
40.13(c)(6)	Uranium used as shielding in shipping containers if conspicuously and legibly impressed with legend "CAUTION RADIOACTIVE SHIELDING – URANIUM" and uranium incased in at least 1/8 inch thick steel or fire resistant metal.	Depleted Uranium
40.13(c)(7)	Thorium contained in finished optical lenses	≤30% by weight thorium, per conditions in rule.
40.13(c)(8)	Thorium contained in any finished aircraft engine part containing nickel-thoria alloy.	≤4% by weight thorium, per conditions in rule.

Table C-4b: Materials Specifically Exempted by the NRC or NRC Agreement State

Exemption	Materials	Isotope, Activity or Concentration*
10 CFR 30.11**	Byproduct material including production particle accelerator material exempted from NRC or Agreement State regulation by rule, order, license, license condition or letter of interpretation may be accepted as determined by specific NRC or Agreement State exemption.***	Byproduct material at concentrations consistent with the exemption
10 CFR 40.14**	Source material exempted from NRC or Agreement State regulation by rule, order, license, license condition or letter of interpretation may be accepted as determined by specific NRC or Agreement State exemption.***	Source material at concentrations consistent with the exemption.
10 CFR 70.17	Special Nuclear Material (SNM) exempted from NRC regulation by rule, order, license, license condition or letter of interpretation may be accepted as determined by specific NRC or Agreement State exemption.***	SNM at concentrations consistent with the exemption.

*Sum of all isotopes up to a maximum concentration of 3,000 pCi/gm.

** Alternate disposals authorized by Agreement States also require an NRC exemption for the purposes of disposal in the State of Idaho.

*** Similar material not regulated or licensed by the NRC may also be accepted. Sum of all isotopes up to a maximum concentration of 3,000 pCi/gm. IDEQ shall be notified prior to the receipt of Special Nuclear Material not regulated or licensed by the NRC.

Table C-4c Material Released by Other Government Agencies

Exemption	Materials	Isotope, Activity or Concentration*
US DOE	Radioactive materials that have been released or cleared from radiological control	Radioactive materials at concentrations consistent with the Release**
US DoD	Radioactive materials determined not to be regulated under the AEA under authority granted to the DoD in Section 91(b) of the AEA of 1954, as amended	Radioactive materials at concentrations consistent with the Authorization**

*Sum or all isotopes up to a maximum of 3,000 pCi/gm.

**May include byproduct materials, source materials and special nuclear material as defined in the AEA of 1954 as amended. NORM and Particle Accelerator Produced Radioactive Material may also be accepted under Tables C.2 and C.3, as part of these Releases and Authorizations.

Additional Information for USEI's Waste Analysis Plan

1. US Ecology Idaho, Inc. (USEI) may receive contaminated materials or other materials as described in Tables C-1 - C-4b above. USEI may not accept for disposal any material that by its possession would require USEI to have a radioactive material license from the Nuclear Regulatory Commission (NRC).

2. Unless approved in advance by USEI and IDEQ, average activity concentrations may not exceed those concentrations enumerated in Tables C-1 and C-2. Additionally, for Tables C-1 and C-2, individual pockets of material may exceed the WAC for the radionuclides present as long as the average concentration of all radionuclides within the package or conveyance remains at or below the WAC and the highest dose rate measured on the outside of the unshielded package or conveyance does not exceed those action levels enumerated in ERMP-01.

3. Other items, devices or materials listed in Table C-4a, which are exempted in accordance with 10 CFR Parts 30, 40 or equivalent Agreement State regulations or 10 CFR Part 70 may be accepted at or below the activities (per device or item) or concentrations specified in those exemptions.

4. 10CFR20.2008 authorizes disposal of certain byproduct material as defined in Section 11.e(3) and 11.e(4) of the Atomic Energy Act, as amended, at disposal facilities authorized to dispose of such material in accordance with any Federal or State solid or hazardous waste law, as authorized under the Energy Policy Act of 2005.

5. The generator of particle accelerator produced waste must specify that the waste meets applicable acceptance criteria.

6. In accordance with permit requirements, notification of any exceedance of the WAC will be provided to the RCRA Program Manager within 24 hours, in accordance with the permit.

C.4 Sampling Methodology

Sampling is performed by the generator and/or their representatives to make the initial waste determination and/or by USEI to identify incoming waste shipments. Waste generators are referred to IDAPA 58.01.05.005 {40 CFR Part 261}, Appendix I, II and III for sampling procedures. IDAPA 58.01.05.005 {40 CFR Part 261, Appendix I, II and III} describes sampling and analysis method selection procedures generators should consult when determining the specific sample analysis situation. Sampling is usually conducted as described in EPA document SW-846.
The sampling strategy employed for a given WAP activity is dependent on the nature of the waste being sampled, the type of container/vehicle in which it has been shipped, or the type of hazardous waste management unit in which the waste resides. Hazardous waste is received at the facility in various containers/vehicles including, but not limited to, bulk tanks, end dump trucks, drums, and boxes. Inside the facility, hazardous wastes are contained in landfills, surface impoundments, tanks, waste bins, containers, and other hazardous waste management units. Access to the container/vehicle or hazardous waste management unit influences sampling strategy.

This section presents sampling methodologies to be utilized by USEI personnel when collecting representative samples for analysis pursuant to IDAPA 58.01.05.008 {40 CFR §§264.13(a), 264.13(b), and 264.13(c)}.

The waste shipment is inspected, sampled, and/or analyzed to ensure it matches the overall identity of the waste designated on the accompanying manifest (or shipping paper) and the pre-acceptance paperwork (WPF, etc.). If examination indicates strata in the waste, then each layer may be composited in proportion to its estimated volume or analyzed separately.

The sampling equipment and procedures described in this WAP represent USEI's recommended sampling protocol for general types of waste materials and containment. Specific waste materials or shipments may require different sampling techniques as outlined in the Waste Analysis at Facilities That Generate, Treat, Store, and Dispose of Hazardous Wastes: A Guidance Manual, USEPA OSWER 9938.4-03, April 1994. Therefore, deviations from the recommended protocol do not constitute violations of acceptable sampling practices or conditions of this WAP. USEI personnel follow the QA/QC procedures outlined in Section C.10 when collecting samples for characterization.

C.4.1 Sampling Materials

At a minimum, the methodologies utilized for specific materials correspond to those referenced in IDAPA 58.01.05.005 {40 CFR Part 261, Appendix I}. The types of sampling methods and the most common equipment utilized for different materials are presented in the following table

Pavon, Sandy

From: Tomczak, Tammy
Sent: Monday, June 04, 2018 4:00 PM
To: Montoya, Brenda; Pavon, Sandy
Cc: Sandrik, Lauren; Song, Taehoon
Subject: FW: RE: University of Missouri - 24-00513-32 - Request for Alternate Disposal of Licensed Radioactive Waste
Attachments: 2018-5-30 - Request for Alternate Disposal of Licensed Material.pdf

Hi all,

Can you please add the attached into ADAMS? I will come pick-up the document when it's ready.

Thank you ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺

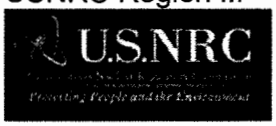
Tammy

From: LaFranzo, Michael
Sent: Monday, June 04, 2018 3:11 PM
To: Tomczak, Tammy <Tammy.Tomczak@nrc.gov>
Subject: FW: RE: University of Missouri - 24-00513-32 - Request for Alternate Disposal of Licensed Radioactive Waste

Hi Tammy,

Attached is a request from the University of Missouri asking for an Alternate Disposal license amendment. MCID will need a mail control number to process this amendment; other than the information attached, what do you need?

Michael LaFranzo
Senior Health Physicist
USNRC Region III



From: Beckfield, Felicity J. [mailto:BeckfieldFJ@missouri.edu]
Sent: Thursday, May 31, 2018 9:13 AM
To: LaFranzo, Michael <Michael.LaFranzo@nrc.gov>
Cc: Houts, Todd A. <houtst@missouri.edu>
Subject: [External_Sender] RE: University of Missouri - 24-00513-32 - Request for Alternate Disposal of Licensed Radioactive Waste

Mike-

My apologies, the first email didn't go through because the file size of the request was too large. This version is a smaller file size and should go through. Please see attached.

Sincerely,

Felicity

From: Beckfield, Felicity J.
Sent: Thursday, May 31, 2018 8:30 AM
To: 'LaFranzo, Michael' <Michael.LaFranzo@nrc.gov>
Cc: Houts, Todd A. (houtst@missouri.edu) <houtst@missouri.edu>
Subject: University of Missouri - 24-00513-32 - Request for Alternate Disposal of Licensed Radioactive Waste

Hi Mike-

As promised, please see our attached 10 CFR 20.2002 Request for Alternate Disposal of Licensed Radioactive Waste for our Pickard Hall project. If you have any questions, please let me know.

Sincerely,

Felicity Beckfield, MS, CHP, RT(R)(CT)
Radiation Safety Officer
University of Missouri
Environmental Health and Safety
180 General Services Building
Columbia, MO 65211
E-mail: beckfieldfj@missouri.edu
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