EnergySolutions Services, Inc.

Attachment 3

MMO License Renewal Document

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I. METAL MELT OPERATIONS RENEWAL APPLICATION

Energy*Solutions* Services, Inc. (ES) requests authorization of the activities discussed herein to be performed the Metal Melt Facility (MMF), the Parcel 4 (P4) facility, and the Radioactive Materials Solutions (RMS) facility, collectively referred to herein as the Metal Melt Operations (MMO) facilities, with the radioactive materials authorized source list and use as outlined in Appendix A. This compilation of currently licensed activities consolidates all of the prior amendments and current activities related to the Bear Creek Facility (also referred to in this document as the site) Radioactive Material License R-73016 to present a more concise description of the activities that are to be relicensed.

ES may also receive, possess, and use any radioactive material distributed under a general licensed, issued by the U.S. Nuclear Regulatory Commission (NRC), or another Agreement State, without being specifically referenced in the radioactive materials authorized source list as outlined in Appendix A.

The MMO facilities occupy the western end of the Bear Creek Operations (BCO) facility on Bear Creek road approximately one mile due south of the Heritage Industrial Site, approximately two miles northeast of the former Breeder Reactor Site, four miles from Oak Ridge National Laboratory (ORNL), and approximately 11 miles from downtown Oak Ridge. The BCO facility is bounded on the north by Watts Bar Reservation Boundary and Bear Creek road and on the south by Grassy Creek, which joins the Clinch River. The BCO facility is on approximately 94 acres of land located in the Clinch River Industrial Park. The park was developed and zoned by the City of Oak Ridge for businesses that handle radioactive and/or hazardous materials. The Clinch River Industrial Park is surrounded on three sides by the Department of Energy (DOE) Reservation and Tennessee Valley Authority (TVA) on the water side. The Industrial Park is located south and west of the City of Oak Ridge in Roane County and is northwest of the City of Knoxville.

Highway 58 and Highway 95, both of which connect directly with Interstate Highway 40, service Bear Creek road. The BCO facility is situated in Bear Creek Valley between Pine Ridge to the north and Chestnut Ridge to the south. The Clinch River is less than one mile west of the facility processing operations. The elevation of the land starts at 805 feet and descends to 750 feet at the Grassy Creek. The facility buildings are at a nominal elevation of 780 feet, which is 30 feet above the 100 year flood plain for TVA. Approximately 36 acres of the facility is used for buildings, parking, and storage areas.

The BCO facility is primarily licensed for operations within the facility buildings and for waste storage with the exception of radiation protection and environmental monitoring. Because of this, the renewal application is organized to address the radiation protection, environmental aspects and general operations first and then focuses on the specific processing activities within the MMO facilities.

The licensed areas and process buildings are within a secured area (restricted area) protected by an 6 foot (ft) security fence topped with three strands of barbed wire with a 24-hour a day, 7 days a week, state-certified, security force. The security force guards are trained in accordance with ES policies and procedures for safety to include radiological and non-radiological. There are three gated vehicle entries to the facility; however, typically only one gate is open at any one time as directed visually by the security guard via cameras/monitors. These vehicle gates provide large truck/equipment gate access to the facility. Separate entries are provided for personnel via a

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turn-style type gate with key entry, through the security guard house, or via a lift gate equipped with a badge reader. All individuals desiring facility access must have a current security badge issued by ES or be under visitor escort access controls and require site orientation training and radiation monitoring. Certain areas within the restricted area and process buildings are maintained and posted as contamination control zones (CCZ) which have further restrictions on entry and exit as discussed in the Radiation Safety Guide (RSG), which is a licensed controlled document.

II. RADIATION PROTECTION

The ES comprehensive radiation safety program addresses all aspects of the operations at the facility to include other ES Tennessee facilities. The program is operated under the direction of the Radiation Safety Officer (RSO) and all radiological activities are controlled by the RSG. As a result of this, the descriptions of processes herein do not have specific details on each activity involved in the process since many of the activities are covered within the RSG, e.g., the activity of opening packages or containers involves an assessment of the radiological potential presented by the contents of the package which is covered by implementing procedures and a Radiation Work Permit (RWP) developed pursuant to the RSG, Section 9.

A. Personnel Radiation Protection

Operations that take place in the processing complex are performed in accordance with the provisions of a RWP. Personnel radiation exposures are monitored through the use of both TLDs (other approved devices may be used) and direct reading dosimeters (DRDs), per Section 6 of the RSG. Records of exposure are reviewed frequently and personnel exposure is closely managed as an element of an active ALARA program. All radiation detection and measurement instruments will be calibrated and maintained in accordance with the instrumentation program described in the RSG.

B. Contamination Control and Monitoring

An RWP establishes the radiological controls necessary to perform an operation safely and consistent with the ALARA concept. The RWP describes the requirements for protective clothing, respiratory protective equipment, dosimetry, and radiological monitoring. In addition, the RWP includes any special instructions, precautions, workstation set-up, mock-up training (if necessary), etc. Contamination levels are monitored following the opening of shipping containers. Contamination controls are practiced in accordance with the RSG and applicable implementing procedures.

C. Airborne Radioactivity Control and Monitoring

Within the processing complex, process and engineering controls are implemented to minimize airborne radioactive materials. Although routine airborne radioactivity levels are normally much less than 25% of the DAC, personnel may be provided with respiratory protective equipment, as deemed necessary by Radiation Protection.

Airborne radioactivity levels are determined by collecting air samples. When performed, these air sampler(s) are located in areas where the highest potential for airborne radioactivity may exist, in worker breathing zones, or at other locations deemed appropriate by Radiation Protection. In addition to portable air sampling, continuous air monitors (CAM) are located in the process complex to continuously measure airborne

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concentrations to alert Radiation Protection if and when there is an unexpected airborne concentration that may exceed the administrative limits. Operability (sensitivity) of the CAM is a function of area background and the specific radionuclides anticipated to be present; its use may be supplemented or replaced by fixed station air sampling at a frequency determined by Radiation Protection.

III. RADIOLOGICAL ENVIRONMENTAL MONITORING

Routine radiation surveys are performed by specific procedures to monitor the exposure rates along the entire perimeter of the facility. At several marked and numbered locations, exposure rates are recorded and summed for review and comparison with the quarterly (at least) TLD (other radiation exposure detection devices may be utilized in the future) exposure records. In addition, TLDs are strategically located around the perimeter of the outermost fence line. The TLDs are positioned inward towards the site and are exchanged and read at least quarterly. In the event that exposure rates change due to new or relocated operations or storage areas, TLDs will be added or moved around the facility perimeter as needed per the direction of the RSO. A background dosimeter is located at a nearby non-nuclear facility location. Section 15.7 of the RSG defines the ambient radiation monitoring program for the facility where the maximum annual unrestricted area boundary dose, as measured by TLDs[1] shall not exceed 500 millirem (mrem) in a year (yr)—which is based on 100 mrem/yr with application of an occupancy factor (OF) of 20 percent.

The occupancy time for a member of the public is based on 8,766 hours (hrs) in a year, with the notion that they would not conceivably be present at the fenceline more than 1,800 hrs per year or 20 percent of the time. The 1,800 hrs (20 percent OF) is derived considering that a member of the public's work time per year is 2,080 hrs with a combination of 280 hours of vacation, sick leave, training, and administrative time. This OF applies to the effective dose equivalent (EDE) and committed effective dose equivalent (CEDE) respectively when calculating total effective dose equivalent (TEDE) for compliance per 0400-20-05-.61(2)(a) using the equations below.

$$TEDE_c(<100\ mrem/yr) = EDE_c + CEDE_c \qquad \text{(Equation 1)}$$

$$EDE_c = EDE_m \cdot OF \qquad \text{(Equation 2)}$$

$$CEDE_c = (Stack\ Conc_m \cdot DCF_c \cdot W_m) \cdot OF \qquad \text{(Equation 3)}$$

Where:
- c = calculated value
- m = measured value
- OF = occupancy factor, 0.20 (20%)
- $Stack\ Conc_m$ = stack concentration, μCi/ml
- DCF_c = Dose Conversion Factor, using RHS 8-30 Table II, Col. 1, ICRP 68, or FGR 11 per the direction of the RSO
- W_m = prominent wind direction fraction

Stack emissions from air sampling are used for the measurement for effluent concentrations and fenceline TLDs are used for the measurement of external radiation to ensure that ES is in compliance to the dose limits of 0400-20-05-.60 per 0400-20-05-.61(2)(a).

[1] Based on technology advances, ES may use an equivalent NVLAP-approved dosimeter, corrected for background and transit dose for the measurement of dose for occupational workers and/or unrestricted area boundaries.

Note that 0400-20-05-0.61, RHS 8-30, Table II, Col. 1 may be used in the DCF_c.

Routine samples of soil are collected and analyzed quarterly from locations of potential concentration (run-off), directly off paved areas used for storage of radioactive material, and water samples are collected from the creek and tributaries, downstream of the facility at least quarterly. Storm water drain sediments and water (when available) are collected and analyzed at least quarterly. The BCO Storm Water and Spill Contingency flow for the site is outlined in Figure 1.

ES performs routine surveys for contamination of the normal process complex entrances/exits, paved parking and storage areas, and unloading areas. Also, ES collects representative sweepings from the processing areas at a frequency determined by the RSO based on process operations (typically quarterly) to detect buildup of radioactivity that may not be detected by normal swipe techniques.

When pavement from financially assured process or storage areas is removed or repaired the concrete or asphalt and foundation soil/material will be assessed for release or disposal as per the RSG, Section 13.8.

Offices for support staff directly associated with processing operations are routinely surveyed per site procedures (typically weekly) or more frequently if determined by the RSO. Also associated with the facility is the administrative office complex area northeast of the MMF Building. This facility is routinely monitored at least annually.

IV. RADIOACTIVE MATERIAL MANAGEMENT AND STORAGE

ES is primarily a processing facility; however, there are instances where BCO may store radioactive material for purposes other than staging for processing, inspection, on-site use, or consolidation prior to transport of radioactive material as waste for disposal. An example of this is the interim storage of radioactive materials for decay and/or characterization stored in RMS. Storage of radioactive material will be in specifically designated areas. Storage of reusable radioactive material and equipment that is owned by ES and others, which is not subject to the 365-day limit, may take place at the site, e.g., 5 year interim storage at RMS. Some storage occurs within the buildings on-site and will be addressed within the discussion provided for each MMO facility.

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Containers used for outside storage of radioactive material must be capable of withstanding environmental conditions. Poly "supersacks" and similar Industrial Packaging are not suitable for extended outdoor storage. Such packages containing radioactive material may be stored outside for periods up to 60 days. After 60 days, the material must be moved inside or repackaged in a container suitable for outside storage. Wooden containers are not considered suitable for long-term outside storage. Materials received in wooden containers may remain outside for a period not to exceed 15 days, provided the containers are covered with a waterproof tarp to prevent the infiltration of rainwater. After 15 days the material must be moved inside or repackaged in a container suitable for outside storage. Painted metal ingots as finished product may be stored outside awaiting shipping. Some items may serve as their own shipping container. Items such as internally contaminated tanks, steam generators, etc. may be stored outside.

The financial assurance (FA) required by the Rules of Tennessee Department of Environment and Conservation, Chapter 0400-20-10, is based upon the bonded square footage of the facility that is used for radioactive material use, storage, and processing at a rate of $\$42/ft^2$. The total

available bonded square foot area for the BCO Facility is 490,800 ft^2 and applying the \$42/ ft^2 rate generates a product of FA equal to \$20,613,600 (which is a total area that applies to both facility licenses). Figure 2 displays the aerial view and the defined boundaries and square feet of the financial assurance area footprint for the BCO Facility.

Outside storage of Department of Transportation (DOT) Empty containers are only permitted in paved (asphalt or concrete) areas. Storage of DOT Empty containers on grass, dirt, or gravel is specifically prohibited.

ES Empty containers are permitted to be stored on any surface (e.g., paved, grass, dirt, or gravel) within any area of the facility that is routinely monitored by the environmental sampling program for radioactivity per Section 15 of the RSG.

Green Is Clean (GIC) Empty containers are assayed to be free of radioactive material and may be released for unrestricted use, and thus may be stored in any location within the facility or later released for unrestricted use. GIC containers that have contained radioactive material that did not meet the criteria for release (See TRML# R-73006); the container must be assayed clean via the GIC process prior to being declared a GIC Empty container.

Each designated outside storage area shall be equipped with identifiable markers (sign postings) at each corner to clearly identify the boundary. Inside storage areas will also be appropriately delineated. Container stacking limits by type are specified in the RSG. Within each building the specific criteria for inside storage may be separately constrained; however, small radioactive material packages (<100 lbs) may be placed on shelving as long as the shelf is rated to support the weight of the package(s).

The site has a common radioactive material storage plan and combined isotopic possession limit for this license and the Dry Active & Liquid Waste (DALW) license [TRML# R-73008]. Note that all process areas are identified in the facility drawings (Figure 2).

No radioactive material (excluding calibration and standardization sources) or radioactive waste (radioactive material that has no further use that is to be dispositioned for disposal) may be possessed under this license (to also include waste generated under the authority of this license), from the time of receipt acceptance until its transfer from the facility, for a period of time greater than 365 days. Exceptions to this constraint are listed as follows:

- Equipment or a product, specifically licensed or otherwise authorized, and stored on-site for future use: (1) at a location authorized by an ES TRML or (2) at a location where such equipment is authorized by the agency having jurisdiction.
- Radioactive material may be stored for up to 5 years from the time of receipt acceptance in the RMS facility.
- Up to 20,000 cubic feet (cf) of radioactive waste, stored on-site for an unlimited period of time. Radioactive waste stored on this unlimited time exception shall not include TRU (concentrations greater than 100 nCi/g of transuranics) or mixed waste (exhibits the characteristics outlined in 40CFR Part 261 Subpart C or which contain hazardous wastes listed in 40 CFR Part 261 Subpart D). The licensee shall maintain records of the receipt and storage of this material such that its volume and location are readily identifiable.

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- Lead and lead fabricated objects may be possessed for no more than 18 months from the initial date of receipt after it is determined to be material for casting into a beneficial reuse product due to final survey failure. All lead and lead fabricated objects will be subject inventory tracking of aged waste per the preceding paragraph, this bullet section, and the associated bulleted sections above.

A. Waste Attribution

Per 10 CRF 20 Appendix G, it is the intent of ES to maintain the originating generator's identity wherever feasible; however there are instances that low-level radioactive waste resulting from processing or decontamination activities where it cannot be easily separated into distinct batches attributable to the specific waste generators. This waste shall be attributable to ES, as applicable. Secondary waste (including, but not exclusive, floor sweepings, baghouse dust, HEPA filters, fly ash, mop water, scrubber salts, slag and anti-contamination clothing) that cannot be easily tracked back to a specific customer becomes ES residual waste. Because there is not a "date received from a customer" to associate with this waste, the date the waste is generated (defined below) becomes the date associated with the waste and such secondary waste is considered newly generated waste for tracking and aging purposes—a specific example is metal melt slag from a metal melt campaign. Note that in some limited instances (bulk processing or dedicated processing of a single customers waste) some of the very same wastes can be easily tracked and in that case remain the customer's waste with associated "date received" being the limiting aging date. For example, dedicated metal melt of only one generator's waste could lead to all the slag waste streams being attributed to the generator (even the HEPA filters, if clean at the start).

Where practical, for large campaigns secondary waste will be attributed to the waste generator. In the case of ES generated secondary waste the date of generation is the date the container being used for collection of the waste is considered full and is moved from the collection point to a queue for processing or disposal. For HEPA filters and bag house bags it would be the day they are removed from service. Equipment and/material damaged or deemed no longer useful will carry the date the determination was made to dispose as the equipment/material as waste. It should be noted that for long campaigns of one generator's waste while the waste may all be attributable to the original generator the date of generation may have to be determined as noted above otherwise HEPA filters and other long term contaminated items would have to be removed from service early to preclude their becoming aged waste.

B. Waste Tracking and Handling

ES will maintain records of all radioactive material received. The records will include at least: date shipped and received, radionuclides and quantities in shipment, verification and comparison of results (if conducted), date of processing, and disposition. The tracking database system has precision limit less than 27 picocuries (pCi) [one (1) Becquerel (Bq)]. Most of the radioactive material received is sorted prior to processing. The radioactive material sorted into smaller packages is referred to as "daughtering". All packages, whether received from customers or daughtered at the facility, will maintain their generator identification, contain a unique identifier, have package activity based upon either manifested or mass apportioned activity based upon the incoming container specific activity, dose to curie scaling, lab analysis and/or waste volume.

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Radioactive waste containers, packages, etc., that are to be stored on site cannot exceed the following stacking limits as outlined in the RSG.

Container Type	Stacking Limit
Drums	3 high
B-25 Boxes	3 high
B-12 Boxes	5 high
Sea-Land Containers	2 high
Any other strong tight container	10 feet nominal[1]

[1] Small radioactive material packages (<100 lbs) may be stored on interior shelving that is rated to support the weight of the package(s).

The outside storage areas shall be equipped with markers at each corner to clearly identify the boundary of the bonded storage area. In addition, the space between these markers can be either painted or otherwise marked to identify the storage area. The intent is to clearly status the waste and its location within a shift (typically 10 hours).

After processing and packaging is complete, the waste is stored on site, until transportation for disposal, return to customer, sale of a product, or other disposition is arranged. Prior to final departure the blocks and/or containers are staged in the loading area. The product and/or waste container is inspected for defects, surveyed for radiation and contamination, and any final labeling applied just prior to shipment. The vehicle and/or rail is inspected, and if acceptable, the product and/or containers are loaded and secured. Containers and vehicles and/or rails are marked, labeled, and placarded in accordance with DOT regulations, and a final inspection on the conveyance and load is performed. Just before departure, the responsible supervisor and the conveyance operator review the shipping papers, destination route, handling requirements, and emergency procedures. When the responsible supervisor is satisfied the shipment is proper and complies with applicable laws and safety practices and the driver is fully prepared, the shipment is released.

Complete and accurate records of the receipt and disposal of radioactive material will be maintained. Radioactive waste shall not be stored with non-radioactive waste. Written records of all radioactive waste shall be maintained until it has been determined by a suitable survey or radioassay that it has decay to releasable and/or background levels or until it has been shipped to an authorized recipient in accordance with the applicable regulations. The transfer of radioactive waste to a land disposal facility or a licensed waste handler shall be done in accordance with 0400-20-05.125. ES will not accept radioactive waste and/or items contaminated with licensable quantities of radioactive material or radioactive materials or items from licensable activities for repackaging, processing, refurbishing, storage pending disposal or disposal unless the shipper of such waste possesses a valid license for delivery issued pursuant to 0400-20-10.32.

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Except as specifically authorized by the Department, all radioactively contaminated metals which have been melted, formed, generated and cast as a result of metal melting (this includes lead operations) shall only be transferred to persons specifically licensed by the Department, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State to receive such material, or to an Agency of the Federal Government that has been exempted from licensing regulation by Federal Law. Metal products being shipped or metals or waste being returned to foreign customers must have appropriate export permits

from the US Nuclear Regulatory Commission and be specifically approved by the Department.

C. Contractual Obligations

ES will ensure that every contractual obligation related to radioactive materials will provide an option to return radioactive materials, processed or unprocessed, to the prior licensed facility or exempt possessor. This contract option will serve as written assurance that the facility shipping the radioactive material may accept return of the material processed or unprocessed. In addition, for states outside of the Southeast Compact the state or appropriate Compact must be a signatory to the Interregional Access Agreement of Waste Management or assurances shall be obtained from the appropriate state governor's office, the state radiation control program, and the appropriate Compact official, if any.

D. Trustworthiness and Reliability (T&R)

ES complies with the requirements described in Order EA-07-305 (the Order). Access lists, fingerprint data, and key lists are updated following identification new or retired personnel. Responsibility for maintenance of rosters of personnel approved as "Trustworthy and Reliable" (T&R) is consolidated under a single individual (also T&R) reporting to our Director of Security (approved as our T&R Official).

With regard to aggregation of sources for categorization, waste management operations per TEDOC 1344, Section 1.4, Scope, may be considered as out of the scope of T&R controls. ES waste operations with containers that meet the following criteria are excluded from aggregation considerations:

1. external exposure rate on the waste package <100 mR/hr, measured at 30 cm, or
2. the package is ≥1 ft^3, exterior volume, or
3. the package gross weight is ≥100 lbs.

Packages that exceed 100 mR/hr at 30 cm are subject to High Radiation Area controls, and are therefore stored in a locked or conspicuously barricaded storage facility within the Restricted Area, effectively providing double physical barriers to access. High Radiation Area controls dictate that material in process be continuously attended or visually monitored.

E. Emergency Response

Per 0400-20-10-.13(17), *Emergency Preparedness*, ES is providing as a part of this renewal package, our Integrated Emergency Response Plan (IRP). This is provided to meet these requirements in 0400-20-10-.13(17)a due to the increase in activity possession limits other than uranium and plutonium that could be equal to or exceed the values in Table RHS 7-2, *Quantities of Radioactive Materials Requiring the Consideration of the need for an Emergency Plan for Responding to a Release.* In addition, the BCO site would be authorized for 0400-20-10-.13(17)b,c for the possession of:

- uranium hexafluoride, in excess of 50 kilograms in a single container or 1000 kilograms total, and/or
- plutonium in excess of 2 curies in unsealed form or on foils or plated sources.

Also provided in the IRP booklet are the response letters with acknowledgment of emergency response from offsite response organizations who were provided a 60 day comment period prior to submittal of the IRP to TDRH for incorporation into this license per 0400-20-10-.13(17)e.

V. LABORATORY OPERATONS

ES maintains a radiochemistry laboratory (Lab) on the site located in the Administrative Building. The Lab has a full complement of sample preparation equipment such as balances, drying ovens, fume hood, hot plates, glassware, and chemicals. The lab currently has a Gamma Spectroscopy System operating numerous High Purity Germanium detectors. The Lab has Low Background Alpha/Beta Counters equipped with automatic sample changers. One Counter is normally reserved for Air Samples. A Liquid Scintillation Counter is available for low energy beta and alpha counting and a Whole Body Counter is used for *in vivo* Bioassay Monitoring. Laboratory samples include, but are not limited to, the following: Bioassay Samples, Environmental Stack Samples, fenceline Air Samples, In plant Air Samples, Environmental Soil and Water Samples, Free Release Characterizations, Sealand Surveys, Area Surveys, Sweeping Samples, Respirator Smears, etc. There are also a variety of samples generated by Operations, these include samples of: DAW materials, GIC materials, Hearth Ash, Fly Ash, Slag, Floor Sweeping Fines, Scrubber Salt, Baghouse Bags and Dust, Chemline Solution, Mop Water, Respirator Wash Water, etc. Analysis of customer waste samples (to evaluate acceptability for processing) is also performed.

The Lab has satellite areas located in the MMF where tests for RCRA constituents (TCLP analysis total solids) and the Incinerator Facility (separately licensed) where flash point analysis are performed. Analytic equipment includes an atomic absorption spectrometer and an ICP used for metals analysis. These satellite labs are within the RCA and all material/equipment transfers are handled appropriately.

All lab waste (except office/administrative waste and clean environmental samples) is assumed radioactive and is collected and stored appropriately, in addition, any hazardous waste is collected in a separate container and is sent to Special Waste Operations Group (SWOG) for treatment of the hazardous constituent. Non-hazardous waste is bar-coded and sent to sorting for processing. All liquid waste from the Lab, with the exception of urine which is disposed into the sanitary sewer, is collected in a liner located at the TCLP Lab in the MMF. A gamma spectroscopy and TCLP analysis is performed to determine the proper treatment for the waste. Non Health Physics/Monitoring samples that do not require TCLP analysis are returned to the generator. "Potentially clean" samples may be dispositioned via the GIC program.

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The standard calibration cycle for laboratory instruments is biannual. Normally ES calibrates its lab instruments using NIST (National Institute of Standards and Technology) traceable standards made into the appropriate geometries. The laboratory participates in blind quality control analysis, for example: sending duplicate samples to a vendor laboratory or purchase of blind samples.

Occasionally, ES may provide source leak test services for clients or for internal use. As such, potentially contaminated test samples (swipes) may be taken at the client's facility under the authority of their license, transported to ES, and counted in our radiochemistry laboratory. To assure safety and regulatory compliance, ES (or the client) will check all such samples before transporting them to assure that DOT regulations are met and that excessive activity is not

received in the laboratory. All leak test samples containing activity in excess of established removable contamination limits for unrestricted release will be disposed as radioactive waste after counting is complete. Any sample received at the Lab exhibiting radioactivity is waste and must comply with our existing license conditions.

VI. WASTE ACCEPTANCE GUIDELINE (WAG)

ES has an established guide for waste acceptance that can be utilized by clients to determine if their waste meets the criteria for acceptance at the MMO facilities. Prior to shipping waste to ES the client will characterize the waste physically, chemically, and radiologically. Knowledge of how the waste was produced may be used to determine characteristics.

Upon staging at MMO facilities, waste packages are opened and sorted/inspected to remove any undesirable materials and to direct the waste to the appropriate process area. If the stated physical, radiological, or chemical composition of a waste becomes doubtful during sorting/inspection, appropriate analyses and determinations are done. Any unacceptable material may be removed for alternate processing, disposal, or return to the client. This direct inspection and sorting of wastes before processing provides major assurance that improper material will not be processed or disposed. Our experience has shown that this practice can be done safely with minimal exposure and is both practical and effective.

As appropriate, laboratory analyses may also be required when anomalies are identified with the characterization. If the waste meets the WAG the client may ship the material to the facility. When the approved waste is received, ES will review the shipment documentation for acceptability, physically inspect the container for compliance with shipping regulations, and perform a radiological survey on the shipment. The WAG is developed in accordance with the RSG, Section 11 and is based on conservative criteria that assure readily acceptable waste is shipped to ES.

A. OUT OF WAG

For clients that have waste that does not meet the WAG the "Out of WAG" committee has to review and approve the shipment of the waste. The Out of WAG committee is composed of individuals that have specialized knowledge of license requirements, process limitations, RCRA requirements, State Regulations for Protection Against Radiation, and health physics.

B. SPECIAL NUCLEAR MATERIAL (SNM)

Prior to this submittal, ES operated BCO under a combined SNM limit for TRML R-73008 and R-73016 for the possession of SNM. However, with the use of Enterprise Waste Tracking (EWT, aka Accutrak), ES has the ability to electronically track our waste inventory, to include SNM, in real time so that we know where each SNM container is upon receipt, during storage, during processing, and upon packaging and shipment for disposal. This unique ability to electronically track SNM allows ES to operate both TRMLs (R-73008 and R-73016) with their own SNM limits rather than a combined possession limit. Appendix A was modified to remove the combined limit for both TRMLs. The MMO radioactive material license will be held independently to a maximum unity (sum-of-fractions) calculation of one (1) given the isotope specific limits of 350 grams (g) U-235, 200 g U-233, and 200 g plutonium.

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ES will maintain SNM inventories for each TRML for BCO by virtually separating the bonded storage areas for SNM at the Guard House (main entrance), with MMO SNM being maintained in the bonded areas on the West side of the facility and DALW SNM being maintained in the bonded areas on the East side of the facility. This virtual tracking meets the intent of the mitigating criticality concerns as well as removing the need for non-contiguous licenses for the possession of SNM.

VII. LICENSED FACILITIES

The MMO facility occupies the western end of Energy*Solutions* operations on Bear Creek Road, approximately one mile due south of the East Tennessee Technology Park (the former Oak Ridge Gaseous Diffusion Plant), approximately two miles northeast of the former Breeder Reactor Site, four miles from Oak Ridge National Laboratory, and approximately 11 miles from downtown Oak Ridge. It is bounded on the north by Watts Bar Reservation Boundary and Bear Creek Road and on the south by Grassy Creek, which joins the Clinch River. The facility is on a 45-acre tract located in the Clinch River Industrial Park. The park was developed and zoned by the City of Oak Ridge for businesses that handle radioactive or hazardous materials. The Clinch River Industrial Park is surrounded on all sides by the DOE Reservation. The Industrial Park is located south and west of the City of Oak Ridge in Roane County and is northwest of the City of Knoxville. The Metal Melt Operations (MMO) processing complex includes interior waste storage and houses the following processing activities: Metal Melt Facility (MMF), Parcel 4 (P4), and Radioactive Material Solutions (RMS) facility. Although on the DALW license, the High Radiation Storage Facility is a shared building with the DALW license and houses the majority of radioactive waste to be processed that requires High Radiation Area controls. In addition, the High Radiation Storage Facility is used to control Radioactive Material Quantities of Concern (RAMQC).

The general philosophy for building process ventilation is to create an airflow pattern such that the air flows from areas of lower or no contamination into areas of higher contamination. That is areas of greater potential for contamination will be at a negative pressure to areas of lesser potential. The areas of more or less negative pressure may change as the work being performed changes but the working concept is to minimize the potential for spread of radioactive material by appropriate use of airflow. Pressurization tests (air balances) for each process ventilation system in operation shall be performed semi-annually to verify proper operation and airflow. Pressurization tests are conducted in accordance with approved engineering procedures. Pressurization tests shall also be performed whenever a modification has been made to a ventilation system or to the doors of a process building which could potentially alter the effectiveness of the system.

Common process building items are metal siding structures built on concrete slab with curbed areas, and a nominal 6-inch dike. The buildings have fire detection and protection systems. The system consists of fire, smoke and water flow detection devices with automatic local alarming and offsite notification to the alarm company with subsequent notification to the Oak Ridge Fire Department. Due to the incompatibility of water and molten metal at MMF, several dry chemical fire extinguishers and fire blankets are installed in these areas. In addition to the aforementioned, personnel entering these areas are equipped with protective clothing such as protective gloves and shoe covers as well as fire retardant coveralls that minimize potential hazards to personnel from heat or fire. For the P4 Decontamination Facility fire protection is provided by a sprinkler system. In addition, portable fire extinguishers are located throughout the MMO according to fire

code requirements. In the event of a fire, the curb on the perimeter of each area slab would retain water discharged by the sprinkler up to the building floors capacity, e.g., a square area of 10 feet with a 6 inch berm, which will hold approximately 374 gallons of water. Wherever appropriate, special coatings and paints have been applied to floors, walls, and ceilings to reduce the buildup of contamination and to make routine cleaning and ultimate decommissioning easier.

A. METAL MELT FACILITY (MMF)

The MMF consists of two buildings (the first being the Metal Melt Building (1991) and the second being the Best Way expansion commissioned in 2000 and added onto the north side of the Metal Melt Building (see Figure 3). Ventilation for the MMF (Figure 4 & 5), which is operated as one building, consists of (4) nominal 50,000 standard cubic feet per minute (scfm) exhaust fans providing approximately 200,000 total scfm. Each fan (#1 thru #4) has a dedicated baghouse and 3 stage filter bank. The baghouse provides up to 98% efficiency at 0.5 micron particle size and 4.6 inch water column pressure drop. The filter bags are pulse cleaned with compressed air, the particulate then falls into hoppers below the bags and is collected in drums through a damper system. From the bag house the filtered air proceeds to the three stage filter bank which consists of nominally 30% efficient pre-filters in the 1st stage, nominally 90% efficient Intermediate filters in the 2nd stage, and nominally 99.97% efficient HEPA filters in the 3rd stage. A portion of air from fan #2 and #3 is fed into cyclone separators before entering the baghouses in order to provide large particle drop-out, a more rigorous path and spark arrestor from the furnace hood and the preheater hood. An additional spark arrestor device is also employed at the furnace hood. After all filtration, the cleaned air is drawn to fans #1 thru #4 before being discharged into a common exhaust stack.

The use of four separate systems to provide ventilation gives the overall system a measure of flexibility so that if any of the fans fail to operate for any reason, the balance of the fans will continue to evacuate the building interior until repairs or remedies can be affected. In addition, some equipment may have self-contained ventilation that exhausts directly into the facility ducts. An emergency diesel generator system is provided and sized to maintain one (normally the #4 system) of the 50,000 scfm modular systems in operation during a loss of off-site AC power. The generator is inspected and run once a month, with quarterly preventative maintenance and a load test performed annually.

As a specific example of our use of ventilation as an engineering control, air from the outside is drawn into the clean end of Best Way Metals and flows to the decontamination area where it is drawn into the equipment or area enclosures for the activities handling contaminated items. From there it is pulled into the ventilation ductwork serving the east end of the building complex. Several pieces of equipment and certain areas have specifically dedicated air handling systems to ensure adequate and appropriate air turnover for their operation. These are areas or processes that have the potential to generate significant quantities of dust/contamination. Some of these processes have dedicated HEPA filter systems (these may be two stage systems) in which case the emissions will be exhausted into the general building or for non-filtered areas directly into the ventilation system. Outside air-intake louvers with gravity-operated backdraft dampers or pneumatic dampers supply air inflow to the building.

An intake damper system (operated electrically from outside the baghouse room) on the inlet to Baghouse #4 inside the baghouse room allows the #4 ventilation system to be used to clear the baghouse room of smoke and potential airborne radioactive material from the baghouse room in the event of a fire in one of the other baghouses. This allows ES and emergency response personnel to safely enter the baghouse room to fight a potential fire. Baghouse #4 was chosen because it is operable on the emergency diesel generator in the event of loss of power and this system does not provide exhaust ventilation directly from the preheater or the induction furnace. By using this method for ventilating the baghouse room in the event of a fire all the smoke and potential airborne radioactive material is processed through the #4 filter train before being exhausted into the environment.

The MMF stack is 108 inches in diameter and approximately 80 feet in height. Sampling points are 18 feet or 2 duct diameters upstream from the exit opening, and 42 feet or 4.7 duct diameters downstream from ductwork entries. Exhaust emissions are continuously sampled for radionuclides by a calibrated multi-point, near isokinetic sampling system positioned in-line with the exhaust stack in accordance with the RSG. Similar to all other stack emission samples, exhaust samples from the MMF are collected per ES procedures (typically weekly), and analyzed via gamma spectroscopy. On a quarterly basis a composite of the weekly particulate samples, is also sent to an independent laboratory for additional analysis for specific radionuclides as specified in the RSG. Activated charcoal filters are used in-line and downstream of the particulate filter to collect gaseous iodine emissions. These filters are analyzed by gamma spectroscopy for the presence of radioiodine. Tritium is sampled by an in-line ethylene glycol bubbler system and analyzed by liquid scintillation counting.

Waste material processed in the facility is handled using forklifts, bobcats, conveyors, lifts (such as box tilters, carts, or jib crane), or equivalent type equipment. The facility is designed for flow-through operation. This allows material to come in one end of the building and flow out the other.

1. MMF "Best Way"

An area for processing within the MMF consisting of approximately 15,750 square feet (ft^2) on the North side of the MMF to serve as a an area for decontamination, sorting, and recycle block preparation area (as referenced in the other processes in the MMF). This area can also serve as a location to perform radiological surveys of radioactive and/or decontaminated materials. The decontamination systems are installed in the east end of the building, occupying approximately 8,750 ft^2. The survey area occupies the west end of the facility, taking up the remaining 7,000 ft^2. A 14-ft-high, 12-in.-thick concrete shield wall divides the structure; a roll-up door allows access between the two areas.

This area provides for the decontamination and subsequent release surveys of metals for recycling or disposal. The methodology allows operations to select the "Best Way" for material processing. Incoming material will be evaluated, based on customer-supplied information (dose rates, isotopes present, levels of removable contamination, etc.) to determine if it is suitable for decontamination and free

release, melting, or disposal. Once staged for processing, the evaluation process is repeated based on the inspection of the actual contents, as they are unloaded.

The decontamination side of the facility consists of container unloading areas, a cutting and sizing area, a walk-in blast booth and a 14 cubic foot Tumblast unit. All equipment is located with consideration for easy access for operations and maintenance.

The walk-in blast booth is a commercially available unit that occupies approximately 400 ft^2. The unit has a self-contained ventilation system, which maintains negative pressure in the booth relative to the room. During operation of the booth, one man works inside blasting the material, with a second man (buddy) outside the door. The operator wears an air-supplied hood during the blasting operation; the blast gun uses a deadman switch to ensure positive control of the grit blasting operation. In addition to the deadman switch, an emergency stop is located outside the booth, allowing the operator's "buddy" to stop the operation in the event of an emergency.

The Tumblast unit is a grit media piece of equipment into which pieces of metal are loaded. Abrasive media is then directed toward the metal using high- velocity nozzles to remove paint, rust, or other types of coating on the metal. The abrasive media is collected by a reclamation system and recycled. The air stream from the unit includes a dust collector, which removes 99.97% of the particulate from the air stream. The exhaust from the collector will be connected to the facility ventilation system. Safeguards for the unit consist of an emergency stop button, a limit switch to disable the unit when the doors are open, and mufflers on air solenoid valves.

The Box Assay System for Bear Creek may be located in the northwestern corner of the survey area of the Best Way side of the facility. A conveyor monitor may be used for pre-screening materials destined for the BWAP. This monitor is not intended to operate as a stand-alone survey-for-release tool but may be used as a method to minimize rejection rates at the BWAP. The system will use NaI (sodium iodide) gamma detectors, beta-sensitive plastic scintillation detectors, or a combination of both.

Advanced Material Processing is used to sort through waste that did not meet the pre-screening criteria for BSFR (i.e., <50 μR/hr). During this process, the waste is removed from the container and any material found exceeding the BSFR criteria is to be segregated and repackaged as LLRW. The remaining material that meets the BSFR criteria is to be repackaged into the original container and sent to be analyzed by the onsite BSFR system.

Other activities include testing intermodal containers for water tightness, small repairs on containers, consolidation of low activity resins for disposal and drum compaction and furnace block preparation are done in the Best Way area.

2. MMF Furnace Side

The routine metals operation consists of containers of radioactively contaminated metals that are retrieved from the storage area, positioned into the building through

the northwest rollup door into the "Clean Area", and opened/unpackaged into the cutting and sizing area. The contaminated materials are sorted and segregated, forwarded to areas for processing and in some cases, repackaged and returned to storage for future processing, repackaged to go to another licensed operation, disposal, or return to the customer. The facility was built and designed to process metals contaminated with radioactive materials, either surface contaminated, volumetrically contaminated, or activated. There is no intent to process uranium or thorium or other radioactive metals as a product unto themselves, e. g., steel contaminated with uranium may be processed through the facility but the purpose will be to minimize the uranium contamination on the steel product and capture the uranium contamination in the slag for disposal as LLRW.

3. Sort, Cut, Shred, Bale and Shear

Various types of saws, torches (gas or plasma), shears or other cutting devices provide ES the capability to cut, size, bale, and size reduce a variety of materials. These devices, along with the baler, provide the capability of sectioning long pipes, beams, tanks, or other fabricated components or equipment. The obvious potential for airborne radioactivity exists as a result of these operations. That is mitigated by the use of local ventilation intakes, general facility ventilation, and other engineering controls as deemed necessary and pursuant to the RSG. A small shredder may be utilized to achieve a more acceptable waste form for incineration, compaction, or to destroy attributes of materials that are otherwise subject to special security considerations. Concrete scabbling may be performed on concrete and like materials to remove a surface layer and associated contamination.

4. Metal Preheat, Melt and Cast

When a metal melt campaign is underway, radioactively contaminated metals are retrieved from the staging bins and loaded in pre-heater load hopper. Metals may also be transferred directly from shipment/storage boxes to the pre-heater load hopper in some cases. The preheater load hopper weighs the metal and the metal is then dumped through the bombay doors of the load hopper into the pre-staged preheater cart located below the bombay doors. Once the pre-heater cart is full, it is moved forward to the preheater unit. The pre-heater consists of natural gas or propane fired burners which heat the metal for a specified period of time, driving off, in part, moisture, oil, paint, etc. The preheater has a dedicated hood to capture gasses, dust, smoke and other emissions, which are processed through the facilities ventilation system.

After the metal is pre-heated, the cart is moved forward with the open end positioned over the 20-ton coreless induction furnace opening. Then the cartload is vibrated to the open end of the cart and into the furnace in a methodical manner so as to not clog up the furnace. Electrical induction coils on the furnace exterior heat the furnace contents. The metal to be melted is contained inside refractory material designed to protect the outside walls of the furnace. The furnace also has a dedicated hood to capture gasses, dust, smoke and other emissions, which are processed through the facilities ventilation system. Once the furnace is fully charged and any slag on the melt is removed from the surface of the molten metal

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the operator reviews sample results and may adjust the metallurgy as necessary. The slag removed from the molten metal is collected in metal boxes and processed as radioactive waste.

When the melt is metallurgically ready it is poured into molds that produce the ingots or shield blocks. Molten metal may be cast into shield blocks or ingots of different sizes based on customer specifications. When the metal cools to an acceptable temperature, the shield block or ingot is stripped from the mold and allowed to cool further. A second method uses a clean steel form that acts as a mold for the molten steel where the clean steel contains the molten steel and becomes part of the final product. All restrictions on poured products will be recognized for either method of production. The molds occasionally have to be repaired and prepped for reuse.

The exterior of the furnace is cooled by a closed-loop water-cooling system that runs continuously while the furnace is in operation. The cooling system has two pumps (one running) and a second, standby pump. Upon initial startup (after extended shutdown) and when continuously operating, quarterly testing of cooling water will be performed for the presence of radionuclides. Radiological contamination of the system has not been observed over the facilities operating history or is expected due to the pressurized closed loop design but it is evaluated.

5. Welding and Cutting

The next step for the ingot or block is surface finishing which may involve void filling, grinding, cutting, welding, and/or other surface finishing techniques. This is typically done is Best Way, but can be done in any area of the MMF. Normal arc or gas welding is performed when necessary to prepare the final product. In addition, a special welding process called THERMIT welding is used to fill voids in cast steel blocks. The THERMIT welding process uses aluminum and iron oxide powders, which react to form molten steel and slag. The molten steel then flows into the void and fuses with the shield block. This process is normally used to weld rail ends for railroad and crane rails. It is designed for use in the field with minimal risk and little training necessary. The THERMIT materials are non-toxic and non-hazardous. The process is performed in the mold preparation area of the MMF. The molten steel will bond with the shield block metal filling the void. Because the THERMIT metal is radiologically clean and the shield block metal is not melted, no contaminant is released. In any event, the ventilation provided for routine operations in the MMF will remove any smoke and/or gases that could potentially be generated by the THERMIT process.

A sample of metal from each heat is analyzed for primary gamma emitters (e.g., Co-60, Mn-54) by gamma spectroscopy. Hard-to-detect radionuclides (HTDR), e.g., Fe-55, Ni-63, are assigned at an average value to all metal poured during a melt cycle by summing all activities put into the bins and distributing it over the mass melted. Partitioning values derived from NUREG 1640 (Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities), Table 4.5, are applied to the HTDR to more accurately address actual radionuclide retention in the final poured metal. Analytical data from composite samples is used

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to develop scaling factors for these radionuclides in bag house dust and slag. The use of these values has been reviewed by a Metallurgical Engineer, and deemed appropriate for the ES furnace.

Elements	Metal product fractional retention
Fe, C, Ni, Tc, Cu, Mo, Ru	0.98
H, Se, Os, Tl, Pb, Bi, Po	0.05
Ac, Am, Ba, Ca, Ce, Cl, Cm, Eu, Gd, I, Nb, Np, Pa Pm, Pu, Sr, Sm, Th, U, Y, Zr	0

Various techniques are used to prepare the shield block product for shipping to the customer. For example these involve cutting with torches, saws, drilling, oxygen lances, grit blasting, grinding/polishing, etc. The blocks are individually stamped with a unique identifying number that identifies the year of pour, the number of the pour and the block ID for that pour. They are then painted and labeled as appropriate (e.g., RAM) for storage until shipping can be accomplished. Other product finishing processes may also occur.

6. Hot Shop

The hot shop provides an area for the repair and maintenance of radioactively contaminated machines, tools or other equipment. The hot shop is routinely monitored for surface contamination pursuant to the RSG. Airborne monitoring consists of periodic and routine airborne contamination monitoring through the use of stationary air monitoring equipment and continuous air sampling.

7. Lead Decontamination, Melting and Cast

Because of its hazardous properties lead is handled separately with appropriate ventilation for all lead operations. In addition steps are taken to assure that clean lead is maintained radiologically clean when separated from contaminated encasements.

Some lead shielded pigs are small by design and may require manual decontamination, such as hand wiping and/or core drilling, to remove residual surface contamination from within the pocket that housed the RAM. The lead would be manually wiped (if necessary) and surveyed for loose surface contamination and core samples (shavings) may be obtained, as deemed necessary by the RPM or RST lead, by drilling into the pig and the area monitored for fixed surface contamination.

Melting and casting of lead is performed at this facility utilizing molds, kettles and/or melters that are specifically designed for lead melting and casting operations. An exhaust hood and point source capture hood are utilized to capture any potential airborne lead particles or vapor and radioactive contaminants that may be generated during the melting and casting process. Facility personnel

assigned to this process are trained in melting and casting practices including lead hygiene considerations that are consistent with those of commercial lead foundries.

Lead devices (including but not limited to: Pb bricks and sheets) and lead from lead-containing components (metal structures designed to hold lead, normally for shielding, and referred to as lead encased in metal or LEMs) are melted and cast into useful products for beneficial reuse. The lead to be melted will be in one of two states: (1) lead that is contaminated with radioactive materials or (2) lead that has been unconditionally released and is no longer licensed material. Products made using contaminated lead include cast lead shapes (bricks, etc.), lead-filled encasements (i.e., casks, shielded drum overpacks, etc.) and other items, all requiring a license for possession.

Lead components and devices are received, sorted, and/or prepared for melting by sizing (mechanical separation of lead from non-lead components by cutting or disassembly, or thermal sizing/separation from non-lead components). The lead in LEMs is recovered by melting the lead out of the metal encasement and capturing it in a suitable container, to be held for clean product production. Precautions are taken to prevent the contamination of the clean lead and verification of its clean status is accomplished by taking volumetric samples from each melt. The samples are counted using gamma spectroscopy with a minimum detectable activity (MDA) equal to 3.5 pCi/g of Co-60. Any volumetric lead sample which shows the presence of any detectable artificial radionuclide using this MDA shall be considered radioactive. Unconditionally released lead is sorted, sized, and stored separately from radioactive contaminated lead. Lead is melted in kettles or melters designed for lead melting. All melting operations have industry-standard safety systems, and are maintained for efficient and safe operation. Molten lead is transferred from the melter into the molds or steel encasements via ladle(s), pump, and/or gravity drained. Casting practices are consistent with those of commercial lead foundries. Exhaust volumes, velocities, and particulate capture are consistent with Industrial Ventilation Manual of Recommended Practices. Process waste (i.e., sizing/separation swarf, dross/slag, and dust collection fines) will be handled and disposed of per existing procedures and license requirements.

Each contaminated lead product will have cast or stamped on it, in 3/16-in. minimum height letters, the marking RADIOACTIVE MATERIAL. Other information may be cast, stamped, pasted, or stenciled, per processing needs, customer request, or regulatory requirements. A gamma spectroscopy analysis is performed on a sample from each heat. A volumetric sample is taken as is done in the encased lead (LEM) free-release program. A heat is defined as metal melted from the same physical raw materials and alloys. Metal from the same heat is considered to have the same chemistry and radiological content.

The melting equipment, transfer devices, and molds used for the processing of clean or free-released lead are separate from those used to process contaminated lead. In addition, before installation and start-up of the clean equipment, a contamination survey is performed in the work area to ensure the area is free of radioactive contamination. Radioactive contamination in excess of the limits for

unrestricted use (specified in the RSG) found during the pre-start-up contamination survey is removed prior to operation of the clean equipment.

8. Open, Sort, and Blend

Containers for sorting in MMF are opened, contents removed, sorted and repackaged for disposal or further processing. Material is sorted to maximize the benefit of the various technologies utilized by ES to minimize volume and produce a better waste form. Pre-compaction is used to compress waste removed from the sea-land containers into inner pack boxes or other containers prior to ultra-compaction, incineration or when light-pressure compaction is sufficient. In some cases materials are blended together to provide a better feed into the incinerator or other processes, e.g., adding waste oil or sludge to DAW. These activities take place primarily in the sorting area of the MMF but may also be done in other areas on a limited job specific basis and with direct RST support.

Waste processing technicians can sort the waste into the following general category options:

a. Waste for Commercial Certification

This category of waste includes waste that has been sorted and evaluated for non-conforming items that would not be acceptable to the waste disposal facility. Those non-conforming items, when identified, are removed and placed into a separate container for the appropriate disposition. The conforming waste is placed into an appropriate container for packaging and shipment to the authorized waste disposal facility.

b. Incinerable Waste

This category of waste will include wood, plastic, paper, cloth, and absorbed liquids. Wastes that is not acceptable for burning will be eliminated from this class of waste.

c. Waste for Shredding

This category of waste includes waste that may be shredded prior to compaction or incineration. The primary reason for shredding is for size reduction of the waste to fit compactable boxes or reduce the mass of large composite pieces that could damage the incineration furnace doors.

d. Waste for compaction

This includes light metals (e.g., conduit, mirror insulation), glassware, and other non-incinerables.

e. Waste for Decontamination and Release

This category of waste includes waste which can be decontaminated, and released, such as equipment, tools, some metals, and other materials.

f. Unacceptable Waste

This category of waste includes materials that cannot be accepted at the burial site in its present form. Waste in this category must be treated to make it

acceptable for burial. For example, lead shielding would be removed from the waste to comply with the ban on burying lead sheet.

Waste may also be sorted by radionuclide concentration to better manage radionuclide effluent and ash concentrations. Wastes that contain high concentrations of volatile radionuclides (such as H-3 and C-14) are evaluated relative to their effluent concentration limits and incinerated at controlled rates or will be processed in another manner and disposed appropriately.

Incinerable waste is packaged into containers that hold approximately 50 cf (usually 300 to 400 pounds) of waste. Loaded incinerator boxes are held in storage until scheduled for incineration.

9. Survey for Release

Monitoring and release of items and materials for unrestricted use (free release) is a normal and necessary part of routine operations. The criteria used for such releases are stipulated in the RSG (currently based on Regulatory Guide 1.86). The most common free release operation is that of company owned and employee owned property used at ES. Additionally, ES may monitor and free release customer items and materials such as shoring, metal, containers, or other items that are not contaminated or that have been sufficiently decontaminated to meet unrestricted release levels. Any other applicable requirements for hazardous or dangerous properties of the material must still be met. Although this subsection applies primarily to items contaminated on the surface, implicit in this discussion is the option to release liquids to the sewer according to the requirements and in conformity of the applicable regulations, specifically 0400-20-05.122, and the RSG.

In addition, asphalt and/or concrete type surfaces from areas previously used for radioactive material storage, that are to be released in accordance with the RSG can be released for use as fill material at a licensed ES facility; however, it will not be reintroduced to the general public for use as fill or recycling.

ES may release bulk tankers following the shipment of liquids containing primarily tritium with only traces of Co-60, Zn-65, and Fe-59. The release protocol supplements Regulatory Guide 1.86; however, due to the lack of field detection methods for H-3, ES conducts tanker flushes with direct analysis beta-gamma emitting radionuclide to verify the activity concentration below the MDC (typically <1E-6 μCi/ml for Co-60 and <4E-6 μCi/ml for H-3).

10. Transhipment Operations

Some packages are received from customers already prepared for disposal and are bulked with ES shipments to a disposal site. Those packages are inspected to validate the packaging, labeling, and other data prior to being shipped to a disposal site. With the exception of containers containing biological waste the packages are opened to inspect the contents to verify they are as described on the manifest, do not contain any unacceptable forms or types of waste, and verify container void space does not exceed 15%, test for liquids and inspect the container. Packages may also be opened for processing and/or repacking the waste if necessary.

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11. Miscellaneous Process Operations

Areas of the facility may also be used to lift (offload or load) casks, lift cask lids, lift cask loads (e.g. drums) because of the lifting capacity of the overhead cranes. Areas within the building may also be used to rubblize concrete because of the space available and the cutting tools available for cutting the reinforcing steel in the concrete.

At times other entrances may be utilized to input material into the Metal Melt Facility because of size, planned activities, prior use of the other entrances, etc.

12. Container Decontamination and Minor Repair

Sealands, intermodals, BUBS, or other large containers are mated to the roll-up door frame or moved inside, as appropriate, opened and the interior is decontaminated to applicable limits for reuse using normal cleaning processes. In some circumstances, where normal cleaning techniques fail, powered hand tools as approved by the RPM, e.g., belt sander or hand grinder, may also be used. Periodically sampling of the air in the immediate work area during decontamination is performed as well as sampling the air exiting the sealand. Personnel performing decontamination work do so in accordance with an RWP.

B. Parcel 4 (P4) Facility

The P4 Facility was originally designed and constructed to serve as a Liquid Waste Storage Facility although it has actually only been licensed and operated as a processing and decontamination facility. Early in its evolving history two additions were constructed to enhance the operational capabilities of the P4 facility. The enclosed drawing (Figure 6) shows the process operation layout for the complex consisting of the original 100 ft. x 112 ft. building and the two additions one on the south side 61 ft. x 54 ft. and one on the west side 34 ft. x 50 ft. Inside the west bay of the main building ES has constructed a concrete block containment structure to further isolate certain operations from the general operations of the facility.

P4 is located west of the MMF on Parcel 4 within the site boundary of BCO. Similar in design and construction of other ES radiological facilities, the main area of the P4 Facility has a six-inch bermed concrete slab, which is sloped inward to four (4) collection sumps each with a nominal capacity of 2025 gallons. This main area has four roll-up doors for material/equipment access as well as several doors for emergency personnel exit with one door for routine personnel access. A 61 x 54 ft addition is on the south side of the main building and provides space for the ventilation system HEPA banks, an area for an air compressor and a diesel generator. The generator provides power for emergency lighting and ventilation. The generator is inspected and run once per month, and quarterly preventative maintenance and an annual load test are performed.

The contained space also provides the radiological access control point with a personnel contamination monitoring station, offices for RST personnel, and restroom facilities. The 34 x 50 ft addition is on the west side of the original building. This space is equipped with three material/equipment access roll-up doors as well as two doors for personnel access (none of the exterior personnel doors are used routinely, personnel enter and leave through connections with the main building, i.e., one access point for the whole complex). Airflow

into the building, restricted use of the material entry doors during offloading, cleaning or loading of containers prevent the migration of contamination outside of the building. The P4 Facility is also equipped with overhead lighting and a fire suppression system (i.e. sprinklers).

When the facility was converted to an operations area it was decided to leave the sumps in the main area in place for additional liquid capacity in the unlikely event the fire suppression system is activated. The sumps are inspected on a quarterly basis to ensure against the buildup of liquids. With the exception of the planned sprinkler system breeches and damaged/leaking eye wash stations, no other liquids other than incidental cleaning solutions (i.e. mop water) are generated. Any liquids generated are containerized, processed, and/or transferred to other licenses for final processing.

The facility contains contamination control enclosures within the structure for such operations as lead processing and waste sorting and segregation. These enclosures are constructed of framing studs and drywall or concrete block, painted for ease of decontamination. These enclosures are equipped with entry and egress doors and during operations are maintained negative in air pressure in relation to the building and the environment. For transient activities a temporary containment area may be constructed per direction of the RST at times for additional contamination control.

The P4 facility is generally used for specialized operations involving specific waste streams, e. g., lead, certain decontamination technologies, as well as the more routine activities of void filling of waste containers, encapsulation, drying/dewatering of waste, and repair activities. ES is authorized to receive, possess, store, compact, unpackage, repackage, sort, dismantle, section, cut, shred, scabble, repair, survey for release, overfill (void filling or densification of waste containers), dry, verify dewatering conditions and decontaminate equipment or items contaminated with radioactive materials and to repackage and/or encapsulate sealed sources in accordance with this MMO license. Not all of the processes are operational at all times. The exact configuration and use of the building space changes over time as jobs and waste change.

The P4 ventilation system (Figure 7) consists of rigid metal duct and flexible exhaust hoses which collect process air from various locations throughout the P4 facility and route all air to a common duct which feeds a central 3-stage air-filtration unit where the air is filtered prior to being drawn into the induced draft exhaust fan and exhausted through an exhaust stack to the outdoors. Following is a description of the main system components:

- The majority of exhaust ventilation duct is rigid metal exhaust duct used to collect and route air to the P4 air-filtration unit. Flexible trunk hoses are sometimes used for temporary applications to route air from a temporary process to a section of fixed metal ventilation duct.
- Air is routed to a 3-stage filtration unit consisting of pre-filters, intermediate filters, and High Efficiency Particulate Air (HEPA) filters. The first two stages capture the vast majority of particulate matter, protecting and extending the life-expectancy of the HEPA filters.

- The exhaust ventilation fan, located just outside the east exterior wall of the P4 Facility, draws air from the nearby 3-stage air-filtration unit (which collects air from each of the process areas) and exhausts the air to the P4 exhaust stack.
- Air is exhausted from the facility through a vertical exhaust stack located just outside on the east side of P4.
- Monitor system operation and record system performance data in accordance with the P4 Stack Monitoring System procedure.

P4 Process Operations

a. In-Container Treatment Unit

In-container treatment will make up the majority of treatment activities conducted at P4. As the name indicates, waste treatment activities will be conducted within containers. Included in the description of each equipment piece are the treatment technologies performed by that equipment. Since the equipment is capable of performing several treatment technologies, numerous technologies may apply to each equipment type.

Drum Roller

The drum roller is an electrically powered machine used to rotate a closed cylindrical container (drum) of solid or liquid material. Container size may range from 3-gallons to as much as 89-gallons. The contents of the container are blended as the container is rotated on a set of powered rollers. Once the operation is complete, the container is lifted to the upright position using a hydraulic assist. The drum roller is surrounded by a cage to provide protection from the rotating equipment to personnel working in the immediate area. Fork truck lift provisions are provided to allow the drum roller unit to be portable.

Immersion Blender

The immersion blender is a motorized mixing system designed to mix the contents of open containers. Rotating equipment is guarded in compliance with OSHA standards to protect operating personnel. Mixing is performed by the action of a mixing blade, which is mounted to a shaft powered by an electric motor. Mixing rate is variable, allowing mixing intensity to be adjusted as required. Containers are secured in place during mixing activities. The head of the immersion blender machine is fitted with a hydraulic lift system which allows the mixing blade to be raised above the height of the desired mixing container. Once elevated, the container is positioned under the mixing blade and the blade lowered into the open container. The container is then securely fastened in place to prevent movement during mixing activities. A dedicated splash-guard cover will be installed on top of the mixing container to prevent any splashing materials from escaping the mixing container. The cover is constructed with a slotted hole to accommodate the mixing shaft during cover installation and removal. Once installed, mixing activities will commence. Following

adequate mixing, the mixer is stopped and the container removed in reverse of the above steps.

Waste Solidification Operations

Solidification activities may be performed as part of mixed waste stabilization activities or as a means to make wastes more suitable for subsequent handling or processing activities. Wastes will be blended or mixed with liquid and/or solidification agents to create a solid waste matrix. Solidification activities will be performed in containers.

Solidification is the process of blending waste with liquid, solid, or both to create a mixture capable of passing the "paint-filter test" for free-standing liquids, required to meet disposal facility disposal restrictions. Solidification will be performed within containers, typically a standard sized drum. A treatability study will be performed on each waste form to determine the treatment formula/recipe required to solidify the waste and to determine any additional treatment required to ensure that the final treated waste meets Land Disposal Restrictions. Treatment reagents specified in that treatment formula/recipe will be added to the waste and thoroughly blended to achieve solidification/stabilization. Solidification may be conducted using one of several approaches as follows:

- Neutralization/solidification – In the neutralization/solidification approach, acidic liquid will be added to a dry treatment agent such as Portland cement or magnesium oxide, to chemically neutralize and solidify the acidic liquid.
- Deactivation/solidification – In the deactivation/solidification approach, liquid mixtures of substances suitable for deactivation by solidification will be solidified using pozzolanic materials (Portland cement, fly-ash, etc.) to form a solid monolithic material which no longer exhibits the characteristic hazard of the original waste form.
- Solidification/Stabilization – In the solidification/stabilization approach, wastes will be blended with pozzolanic materials, various treatment reagents, and sufficient liquid to create a grout mixture capable of meeting Land Disposal Restrictions for Underlying Hazardous Constituents and meeting disposal facility requirements for free liquids.

Aerosol Can Depressurization System

The aerosol can depressurization system is a mechanically operated device which punctures aerosol cans, allowing the contents to be collected. Liquid contents are captured into a receiving container. Gaseous contents flow through a gas filtration system designed to capture volatile organic constituents. The system incorporates a color-change indicator in the off-gas exhaust line to monitor system for proper system function and to indicate when the system has reached its capacity for absorbing organic constituents. At that point, the indicator changes color, indicating the need for replacement of carbon media and the color-change indicator.

b. Size Reduction Treatment Activities

Physical size reduction activities will be performed when required to reduce the physical size of solid waste objects or material (RCRA Debris). Size reduction activities may be performed to improve personal handling safety, to improve material handling characteristics, or to improve the ability to efficiently package the material in approved waste packages. Size reduction equipment and activities are intended to make the waste easier, safer, and more efficient to manage or process during subsequent waste management activities, not to alter the hazardous nature of the waste. Size reduction equipment will include a variety of manual tools and powered equipment designed to cut, shear, shred, or compact the waste. The following equipment or methods will be used:

Alligator Shear

The alligator shear is an electrically powered, hydraulically operated machine capable of shearing wood, metal, plastics, or composite materials. Hardened steel cutting inserts on each of the shear's jaws allow it to cut through a wide variety of material types and hardness. The shear incorporates a safety barrier cage to keep the operator's hands clear of the cutting jaws during shear operation. An electric motor operates a hydraulic pump which supplies the hydraulic oil pressure necessary to open and close the jaws of the shear.

The shear is small enough to allow easy movement with the aid of a fork lift truck. Once positioned, the shear's electrical cord is routed to an available power source, making the unit ready for operation.

Shearing will be performed to allow waste packaging within smaller containers and will be performed within or over containers such that sheared items are captured within containers. For example, a long piece of pipe may be sheared over a container. Size reduced pieces will be contained in the container below the material or operation. Size reduction will not be performed on wastes containing liquid volatile organics.

Drum Compaction Equipment

Compaction methods may be performed to further reduce waste volume within a container. A hydraulically operated drum compactor may be used to compact empty drums or to compact waste within a drum. Waste compaction will be performed within containers. Waste contained in boxes or drums may be compacted using a metal weight. Empty drums may be compacted within the Drum Compactor drum enclosure housing. Wastes containing volatile organics will not be compacted.

Manually operated devices and hand tools

Various tools will be used to aid in solid waste handling and packaging. These include manual devices for waste compaction within containers and a variety of hand tools used to size reduce waste to allow easier, safer

handling or waste packaging. Manual devices and tools will be used within or over the top of containers such that wastes remain in or are collected in containers following size reduction. Size reduction will not be performed on wastes containing liquid volatile organics.

c. Treatment Technologies

The technologies may be applied at one or more of the units listed below. Some of these treatment technologies will be used more than once. However, the application of the method will be essentially identical regardless of which unit and where it is being performed.

- Amalgamation
- Carbon Adsorption
- Chemical Reduction
- Deactivation
- Neutralization
- Stabilization
- Macroencapsulation

d. Ancillary Processing Operations

Waste processing activities listed below are used to support mixed waste processing operations.

Waste Sorting and Segregation Equipment

The Sorting and Segregation System is comprised of equipment designed to retrieve waste from containers so that it can be inspected, segregated, or otherwise managed, prior to being returned to a waste container. The system includes two options. Option one is manually sorting through the waste using a container dumper and sorting through the waste on a flat top table. Once the manual sorting is complete, the waste is returned to the disposal container. Option two uses a vibratory system which consists of a container dumper, a vibratory conveyor, and a flat belt material conveyor. This system is designed and configured for management of solids only.

Sorting and segregation equipment will be used whenever it is necessary to perform visual inspection and potential manual or mechanical separation of waste items or material. Specific purposes include the following:

- Segregation of wastes requiring treatment by different treatment standards, allowing each waste stream to be managed in accordance with the appropriate EPA codes. Examples include removal and isolation of aerosol cans or mercury thermostats from otherwise non-hazardous waste material; or separation of hazardous debris from material not meeting the definition of debris
- Segregation of materials based upon radiological contamination for the purpose of waste minimization or volume reduction. An example would be identification and removal of discreet highly

contaminated or radioactive items or material from a larger waste population

- Segregation or radiological decontamination in order to meet the Waste Acceptance Criteria (WAC) of a particular waste disposal site. An example would be isolation and removal of discreet items or material with physical, chemical, or radiological content that prohibits the waste from meeting the WAC for the intended burial facility
- Segregation and recovery of classified, non-hazardous items or material from otherwise hazardous waste materials. An example would be the isolation and recovery of a classified item inadvertently placed in a container of mixed waste.

Industrial Vacuum

The industrial vacuum is an electrically powered machine used to pneumatically convey wet or dry media (no volatiles) from one location to another. Specifically, it will be used to remove free-flowing material from one waste container so that it may be packaged in another container. The vacuum will not perform any specific waste treatment. Rather, it will perform waste handling and conveying functions.

Container Handling Equipment

Manually operated and powered equipment will be used for handling and transport of waste containers. Equipment may include: pallet jacks, drum dollies, container lifting and dumping equipment, and fork lift vehicles. Additionally, manually operated and powered tools may be used to open and close container lids.

C. Radioactive Materials Solutions (RMS)

The RMS facility is metal-on-slab structure; the Main Bay is nominally 104 ft. by 300 ft (30,000 ft^2). Refer to attached drawing for the general layout (Figure 8). The entire Main Bay is surrounded by a berm to prevent the release of liquids to the environment in the unlikely event of a liquid spill. An enclosed walkway on each side of the main building is used to access specific areas of the process space. Truck bays running the full width of the building are present at the south end and the middle of the main building. A pathway is also provided at the north end of the building to permit delivery of packages to the shielded vaults (North Truck Bay [NTB] and Areas 8 & 9). Two overhead cranes have full access to the process areas to allow for transfer of materials and equipment. The RMS building is a controlled facility for RAMQC and with keys controlled by Security and authorization for key use/checkout by individual authorized by the RSO.

An additional building, adjacent to the east side of the main building and with direct access to the main building, contains office space, change rooms, restrooms, and a break area on the first floor. Additional office space is available on the second floor but there is no direct personnel access from the second floor to the main building. These offices areas are not a part of the RAMQC controlled area.

Another building adjacent to the west side of the main building houses much of the RMS ventilation system. The general ventilation (Figure 9) philosophy is to create an airflow pattern such that the air flows from areas of lower or no contamination into areas of higher contamination. That is, areas of greater potential for contamination will be at a negative pressure to areas of lesser potential. The areas of more or less negative pressure may change as the work being performed changes but the working concept is to minimize the potential for spread of radioactive material by appropriate use of airflow. The facilities are subject to air balance determinations every six months in accordance with the RSG. Air balancing (i.e. smoke testing) is performed semi-annually at each facility or when a modification occurs that could potentially alter the effectiveness of the ventilation system.

When operations are ongoing within the facility, daily checks are performed to verify ventilation system operating status. The stack samplers are operated continuously whenever operations are ongoing except for periods of maintenance, calibration, malfunction or sample filter changes. In lieu of sample data the inventory input activities of volatile radionuclides (e. g., H-3 or C-14) may be used for calculation of effluent concentrations. The RSG provides for limited operation during periods when monitors or samplers are inoperable. The authorized activities to be performed in the RMS facility area described below.

1. Interim Waste Storage

ES operates and manages the RMS facility to provide advanced characterization, interim storage and staging for enhanced industry optimization of high activity wastes. ES remodeled two shielded vaults by adding 27 liner storage slots with each having approximately 3 inch equivalent lead tenth value layer (TVL) lids (Figure 10 & 11), which provide significant exposure rate reductions on the BCO fenceline to ensure compliance with the member of the public restraint. The optimization improves the overall efficiency of the industry in utilization of the limited cask fleet, storage of the wastes in a facility specifically designed for ALARA while completing disposal import applications, disposal facility waste profiles/approvals, and characterization data refinement. The waste streams planned for RMS with respect to this interim storage activity include the following:

- Solidified and Reformed Process Residues
- Resin and water processing media
- Mechanical Filtration
- Sludge or sludge like waste forms
- DAW and Metals
- Sealed Sources and Standards

ES continues to carefully evaluate the risks associated with this license activity and the RMS facility was/is designed to accommodate radioactive waste with high exposure rates. ES has completed substantial research, including performing dose assessments and shielding evaluations using industry standard programs MicroShield® and MicroSkyshine®. The technical basis document for the interim activity describes the final shielding design for this operation with consideration

given to waste streams, source inventory, container type, and shielding currently in place. The dose assessment scenarios included:

- RMS Vault Exposure Rates (inside the vault during storage),
- Occupational Exposure Rates for Radiation Workers (cask handlers and characterization workers),
- RMS Interior General Area Exposure Rates (outside the vaults but within the building),
- RMS Exterior General Area Exposure Rates (outside the building but within the restricted area), and
- Fenceline Exposure Rates for Members of the Public (to include prior year storage exposure rate trend information).

Based on the results, the most restrictive parameter is the fenceline exposure rate for members of the public due to skyshine. The major factors subject to this modeling parameter are the source term, the solid angle of reflection from source to sky to fenceline, and the distance from the source to the fenceline. ES has added live time exposure rate monitoring instruments that are wireless feed to a server to allow monitoring and alerts for the RSO, RPM, and ALARA Manager.

2. Radioactive Material Dewatering and Consolidation

Removal of residual liquids and/or separation of solids and liquids from within various containers which includes resins and other filter media, sludge, filters, dry active waste, etc. to prepare the waste for additional processing, repackaging and/or disposal. The removal of liquids or separation of solids and liquids is accomplished by any of the following processes.

a. Dewatering processes

Pumping liquids through various filter types as needed, based on waste type, to retain and collect solids and pass the liquids: Waste resin/ion exchange and other filter media are produced during water processing or are received in containers from off-site. Since the waste is not in a container or form acceptable for disposal, the waste is transferred from the original container to a container acceptable for disposal. The general process for sluicing the media employs a closed loop to minimize the generation of extra liquids. With this method, the solids and liquids are pulled from the waste container and moved to the receiving container; and the liquids are extracted from the receiving container and returned to the waste container. When the transfer of the solids is complete, the gross liquids from both containers are drawn off and rerouted to a holding tank for future treatment by another process; such as evaporation, demineralization, or incineration. A vacuum is drawn on the gross dewatered container to ensure that the residual liquids have been removed. The dewatering process continues until the acceptance criteria for the receiving disposal site are achieved.

Decanting of freestanding liquids is similar to dewatering, except that freestanding liquids are siphoned off the top of the solids. Decanting is

normally employed to bring a liquid level to a correct value for another process, such as solidification.

b. Consolidation

Waste streams generated from nuclear utilities will be received at the RMS facility to be consolidated to meet the current revision of the NRC Concentration Averaging (CA) and Encapsulation Branch Technical Position (BTP). Those waste streams could be any of the following:

- Solidified and Reformed Process Residues
- Resin and water processing media
- Mechanical Filtration
- Sludge or sludge like waste forms
- DAW and Metals
- Sealed Sources and Standards

Waste media will be transferred from received containers to a final form container utilizing specific equipment based on the waste media, such as air operated diaphragm pumps and hoses, mechanical shredders, resizing equipment and/or tools, etc. The waste media transfer for resin/residues, sludge, etc. is a wet sluice process in that process water will be utilized to slurry the filtration media and make the transfer from the received container to the final form container. For other less fluid waste streams, mechanical handling will be utilized to minimize personal exposure and maintain ALARA. The containers will be staged in process shields to reduce personnel exposure during media transfers. During the typical process waste class B and C media will be consolidated with waste Class A media to achieve a final product that meets Class A under the current CA BTP. The final form container will be dewatered as necessary and shipped to an authorized disposal facility for final disposition.

3. Maintenance, Repair, and Decontamination

Perform maintenance, repairs, testing, troubleshooting, modifications, disassembly, refurbishment, and decontamination of radiologically contaminated equipment, tools, containers, casks, transportation packages, etc. These activities are performed within a designated process area that is equipped with building HEPA ventilation system exhausts to a monitored release pathway, or using temporary enclosures, as approved by Health Physics. Container Decontamination and Inspection

4. Repackaging of Radioactive Waste

Repackaging of radioactive wastes including dry active waste, metals, ion exchange media, filters, etc. to improve packaging efficiency, exposure rate, and/or concentration control, to meet disposal site criteria for void space restrictions, and/or meet applicable disposal site or receiving facility criteria.

5. RAMQC Material Segregation

Sorting, segregation, and repackaging of RAMQC material is performed to allow processing of radioactive material in non-RAMQC quantities.

6. Research and Testing

Fabricate, maintain, troubleshoot, upgrade and develop new and specialty equipment for the filtration, transfer, dewatering, separation of solids and stabilization of solids from liquid and flowable solid radioactive waste streams. Newly developed processing equipment may undergo testing for up to 6 months.