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Treatment Processes Description
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D.10 Treatment Technologies

Many of the wastes disposed at USEI are restricted from direct disposal in landfills by the land disposal restrictions (LDRs) promulgated under 40 CFR Part 268. Because of the LDR requirements, these wastes typically require treatment to meet their specific regulatory treatment standards before they can be properly disposed. In addition, the facility provides treatment in the RCRA Wastewater Tank System for on-site generated and limited types of off-site generated liquids, and may treat on-site generated and limited types of off-site generated liquids in the facility surface impoundments.

Treatment schemes (i.e., recipe development) are performed with consideration of potential health and safety concerns such as off-gassing, heat generation, etc.. If necessary, the recipe is adjusted with the intent of minimizing or eliminating the potential for adverse reactions (proper pH adjustment etc.). Control measures are developed by the facility laboratory based on the type of waste(s) in question. Special monitoring may also be performed in the field during treatment to confirm laboratory testing and assigned PPE requirements. More details are also found in USEI's Health and Safety Manual.

Treatment of non-bulk and bulk containers is performed within all of the CMUs (except CSA #1) and within the Containment Building units. The treatment processes used for the non-bulk and bulk containers in these units include but are not limited to:

- Stabilization;
- Micro-encapsulation;
- Macro-encapsulation;
- Chemical Oxidation;
- Chemical Reduction;
- Deactivation;
- Solidification;
- Neutralization;
- Precipitation;
- Adsorption;
- Bio-Remediation;
- Evaporation;
- Size Reduction; and
- Decanting.
- Mechanical Processing (i.e., Sorting/Size Reduction/Crushing) in the Containment Building.

The following Sections provide the overview, applicability, treatment unit, process description, limitations, reagents, and performance control measurements for the treatment technologies listed above.

D.10.a Stabilization

The following sections provide specific process descriptions and performance control measures for types of treatment technologies utilized at USEI. As described in Section D.10.a.(1), USEI uses the term "stabilization" when referring to all the treatment technologies used at USEI. This provides a consistent term when referring to the treatment technologies throughout the Permit Application. Also, while conducting "stabilization" it is typical to use one or more of the treatment technologies during a treatment campaign. The type of treatment technology is dependent on the type and character of the waste in question. As a result, the term "stabilization" is used in its generic sense to mean the treatment of a waste material to make it physically and chemically stable.

Stabilization is defined by 40 CFR §268.42 as stabilization with the following reagents (or waste reagents) or combinations of reagents (1) Portland Cement; or (2) lime/pozzolans (e.g., fly ash and cement kiln

dust) – this does not preclude the addition of reagents (e.g., iron salts, silicates, and clays) designed to enhance the set/cure time and/or compressive strength, or to overall reduce the leachability of the metal or organic. Again, USEI uses the term Stabilization in a more generic sense to mean the treatment of a waste material to make it physically and chemically stable. In this sense, it consists of those processes which make the material conform to applicable LDR treatment standards or other applicable standard(s). Stabilization is the treatment of appropriate waste streams by use of pozzolanic materials or wastes with pozzolanic properties to reduce the leachability of organic or inorganic constituents of concern. Appropriate use of this treatment technology is determined during the approval process. A mix design is developed prior to the treatment of a waste stream. Stabilization may be performed within Mix Bin Tanks, or Containers, treatment locations may be the Containment Building, the Stabilization Facility or other appropriate CMU's. Treatment is performed to meet applicable LDR standards. Sampling, analytical verification of the treatment effectiveness and frequency of testing follows the guidelines presented in the facility WAP.

D.10.a.(1) Overview

The term "stabilization" is used in its generic sense to mean the treatment of a waste material to make it physically and chemically stable. In this sense, it is those processes which make the material pass the applicable LDR treatment standard or other applicable standard. Stabilization as a specific treatment technology is defined in the previous section.

D.10.a.(2) Applicability

Stabilization is applicable to all of the waste codes listed in USEI's Part A. Stabilization can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.a.(3) Process Description

As described, stabilization is conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building. Further details are provided in the applicable D.10 Sections. While reagents, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and reagents while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility;
- The volume or mass of reagents required to complete stabilization of the waste are added to the waste management unit;
- The waste and reagents are mixed to provide intimate contact between the components;
- The chemical reactions that provide the stabilizing effects are completed; and
- Completion of these reactions can take place in the mixing container or tank, depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.a.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.a.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building.

D.10.b Micro-Encapsulation

D.10.b.(1) Overview

Micro-encapsulation is the stabilization of the debris with the following reagents (or waste reagents) such that the leachability of the hazardous contaminants is reduced: (1) Portland cement; or (2) lime/pozzolans (e.g., fly ash and cement kiln dust). Additional reagents (e.g., iron salts, silicates, carbon, or clays) may be utilized to enhance the set/cure time, or to reduce the leachability of the hazardous constituents. Micro-encapsulation is also found in Section C.8.3.6 of the facility WAP.

D.10.b.(2) Applicability

Micro-encapsulation of debris is applicable to all of the waste codes listed in USEI's Part A. It can be used to achieve treatment standards for non-liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements. Material to be micro-encapsulated must meet the definition of hazardous debris in accordance with 40 CFR §268.2(h).

D.10.b.(3) Process Description

The micro-encapsulation process is similar to the stabilization process described in Section D.10.a.(3). The stabilization systems used for micro-encapsulation are located at the Stabilization Facility and the Containment Building.

Debris treatment is conducted in bulk at the Stabilization Facility and in the Containment Building. Micro-encapsulation at the Containment Building may be performed in a variety of smaller mixing vessels.

When these smaller mixing vessels are used, they are checked to demonstrate that they are not leaking and have sufficient integrity to contain the material being mixed. Such mixing vessels will be filled with all reagents and hazardous debris to allow adequate mixing capacity while minimizing the potential for spills. In all cases, a minimum freeboard of 12 in. will be maintained. Operators mix the debris and reagents manually or with available tools (e.g. with shovels or other hand tools). In some cases, a concrete vibrator or similar devices/equipment may be used to assist in providing thorough mixing.

D.10.b.(4) Performance Control and Measurement

Following the treatment process, the micro-encapsulated debris is visually inspected. The performance standard for the micro-encapsulation technology is generally described under 40 CFR Part §268.45, Table 1 titled "Alternative Treatment Standards for Hazardous Debris".

The waste process control protocols for treated debris, including process and performance control parameters, are described in more detail in Section C.8.3.6 of the WAP.

D.10.b.(5) Limitations

The limitations for the micro process are similar to those described in the Stabilization Section. Additional limitations are as follows:

- Intact containers of hazardous waste that are not ruptured and that retain at least 75% or their original volume;
- "Cyanide-reactive" debris (D003);
- Material for which a specific treatment standard is provided in 40 CFR Part 268, Subpart D (e.g., lead acid batteries);
- Process residuals such as smelter slag and residuals from the treatment of waste, wastewater sludge or air emission residues (e.g., collected particulate matter); and
- Material that is not conducive to micro-encapsulation such as a motor where surfaces are not exposed such that it is not reasonable to expect appropriate coating to occur.

D.10.c Macro-Encapsulation

D.10.c.(1) Overview

Macro-encapsulation is a confining or immobilization technology used to treat all types of hazardous debris independent of the hazardous constituents involved (with the exception of cyanide-reactive debris). The macro-encapsulation process encases the debris to provide a physical barrier that prevents/minimizes potential leaching of hazardous constituents from the debris. The encapsulating barrier does not need to chemically bond to either the debris or hazardous constituents. Macro-Encapsulation is defined in 40 CFR §268.42, Table 1 as in the application of surface coating materials such as polymeric organics (e.g., resins, plastics) or use of a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media. USEI has been approved to perform macro-encapsulation on regulated debris with an average volatile organic (VO) concentration exceeding 500 parts per million by weight (ppmw) at the point of origin (i.e. waste subject to 40 CFR Part 264, Subpart CC). Macro-encapsulation of this type material must be performed in containers meeting the Subpart CC Level 1 standards, as specified in 40 CFR § 264.1086(c)(ii). Macro-encapsulation is also found in Section C.8.3.5 of the facility WAP.

D.10.c.(2) Applicability

Macro-encapsulation is applicable to all of the waste codes listed in USEI's Part A and can be used to achieve alternate treatment standards for non-liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

In broad terms, macro-encapsulation is dependent on the ability of the encapsulate to create a barrier around hazardous debris and thereby reduce exposure to potential leaching media. Because macro-encapsulation is dependent on the properties of the encapsulate rather than the properties of the debris, macro-encapsulation can effectively treat most debris types.

Material to be macro-encapsulated must meet the definition of hazardous debris in accordance with 40 CFR §268.2(h).

D.10.c.(3) Process Description

The actual routing of each waste through the facility is selected according to the WAP as determined during the pre-acceptance evaluation.

Containers of debris (or the actual debris) are usually off-loaded at the Containment Building. Debris waste may also be offloaded in other Container Management Units. Containers are marked, opened, and inspected in accordance with applicable provisions in the WAP. After inspection, the debris may be encapsulated with an appropriate material (e.g., plastic, polymer, resin). Once encapsulated, the material may be placed within the landfill.

Large pieces of debris (e.g. steel beams) may be wrapped or coated in an appropriate material such as resins or plastic (e.g. polyethylene or equivalent). When wrapping the debris in plastic, the debris will be double wrapped with a polyethylene liner that meets the minimum specifications described in Section D.10.c.(4). The liner material is usually pre-placed above a forklift chock (or equivalent) so once the debris is encapsulated and sealed (e.g. welded or taped), the forklift is able to pick up encapsulated material without damaging the encapsulate material. The “chocks” are also used to facilitate placement in the landfill. As discussed in Section D.6.t.2, extreme care is taken during this final placement such that the surrounding material will not compromise the encapsulate. Macro-encapsulated debris treated in this manner is backfilled and covered with material that is free of objects that could damage the encapsulated material.

Macro-encapsulated debris will be sealed in such a manner that it minimizes the potential for liquids from coming into contact with the encapsulated debris. This can be accomplished with a number of methods and varies depending on the size and shape of the debris in question. Seams will be completed by using methods such as “shingling” or “J-wrapping” in order to minimize meteoric water from contacting the macro-encapsulated debris. By ensuring the macro-encapsulated debris is not damaged during transportation and placement and the seams are adequately sealed to minimize infiltration USEI will meet or exceed the requirements to “substantially reduce surface exposure to potential leaching media” found in 40 CFR 268.45

Debris that is coated with polymers or a form of liquid clay is primarily treated as an individual unit, such as rail-road ties, telephone poles, etc. Polymers may be applied by hand or with spray devices. Similar operations to protect the coating during application and placement will be used during landfilling operations.

Selection of an appropriate container and container liner that meets applicable regulatory performance standards is based upon several factors, including the debris size, quantity, type and shape. Types of forms utilized at the facility include, but are not limited to, the following:

- Containers (e.g., cardboard boxes) w/ a plastic liner;
- Steel containers with a plastic liner (including roll-off boxes and drums);
- Polyethylene containers;
- Direct resin/polymer and plastic encapsulation; and
- Macro boxes w/ liners.

Debris can be expected to come in all types of shapes, sizes and physical forms. As a result, it is not feasible to prescribe all possible methods to encapsulate debris. The primary objective of this section is to ensure macro-encapsulated debris will be sealed in such a manner that it minimizes liquids from coming into contact with the encapsulated debris.

D.10.c.(4) Performance Control and Measurement

Waste process control protocols are used during the processing steps to verify that each hazardous waste is properly managed based on the characteristics of the waste, the facility's treatment/disposal process capabilities, and the permit requirements. The waste process control procedures are designed to verify that treatment process objectives are met, including compliance with LDR treatments standards. In some cases, debris is received already meeting the macro-encapsulation standards specified in 40 CFR § 268.45, Table 1 and the permit. In those instances, a thorough inspection of each container is performed to verify all applicable regulatory criteria are met prior to approving the waste for disposal.

The performance standard for the macro-encapsulation technology is generally described under 40 CFR Part §268.45, Table 1, entitled "Alternative Treatment Standards for Hazardous Debris". This standard states that "Encapsulating material must completely encapsulate debris and be resistant to degradation by the debris and its contaminants, and materialswith which it may come into contact after placement (leachate, other wastes, microbes)."

In order to minimize void space and maintain the encapsulate integrity within the landfill, the encapsulate will be supported by the shape of the debris. Examples of the type of debris that would support the encapsulate by their shape are rail-road ties, telephone poles, steel/wooden beams, pumps, plywood or other objects that packaged alone or together would support the liner material and minimize void space. The important distinction is that the encapsulant material (e.g., plastic liner) does not provide the structural support for the encapsulated object. Extra care will be taken at sharp angles (e.g., corners) to protect the encapsulated debris. Examples of protection include cardboard cutouts or other methods that protects the material from potential sharp corners.

If the material is received in non-rigid containers (e.g., super sacks) and the debris will support the liner material (i.e., super sack) and not compromise the liner material during placement and burial within the landfill then debris may be encapsulated directly within the super sack (i.e., wrap super sack).

Alternatively, debris that is more inconsistent in shape may utilize a form (e.g., cardboard box with liner) that will be filled with compatible material to provide structural support during subsequent landfilling (e.g., clay, portland cement, non-hazardous waste). At a minimum, USEI will utilize a single plastic liner to encapsulate the debris within the form/box.

The backfill and cover in the landfill of macro-encapsulated materials treated with jackets of plastic or polymers will use a cover material with specifications similar to the select waste that may be used to protect the landfill liner system during construction (See Cell 15 design, Appendix D.3.1). This select backfill material has a maximum particle size of three (3) inches, free of debris or any object that may damage the encapsulated material liner.

In addition to the above criteria/guidelines, the following process parameters are requirements for disposal of the macro-encapsulated waste at the facility.

- During macro-encapsulation, any non-debris waste being used as filler must meet applicable LDR standards for the waste codes that the filler exhibits, if any. This criterion is achieved consistent with the WAP;
- Macro-encapsulated materials shall meet the paint filter test criteria prior to landfill as described in the WAP;
- If the debris is wrapped with multiple layers (minimum of two) of plastic, such as a polyethylene liner, the encapsulated material will be supported by the shape of the debris;
- If a container is used, the container is inspected to verify that it is 90% full; and
- Each container is visually inspected for structural integrity and confirmation that the filler material meets the paint filter test criterion.

At a minimum, if a liner material (HDPE or LDPE) is used as part of the encapsulation process, the material shall conform to the following minimum specifications (or equivalent test methods):

- 1" Tensile Strength, ASTM-D882 or D751– 17 lbf.
- Elongation at Break, ASTM-D751 – 200%'
- Impact Resistance, ASTM 1709, 882 or D751– 330 grams

D.10.c.(5) Limitations

Limitations associated with the macro process are as follows:

- Intact containers of hazardous waste that are not ruptured and that retain at least 75% of their original volume;
- "Cyanide-reactive" debris (D003)
- Material for which a specific treatment standard is provided in 40 CFR Part 268, Subpart D (e.g., lead acid batteries);
- Process residuals such as smelter slag and residuals from the treatment of waste, wastewater sludge, or air emission residues (e.g., collected particulate matter); and
- Container Level 1 controls or greater must be used for 40 CFR 264 Subpart CC waste.

D.10.d Chemical Oxidation

D.10.d.(1) Overview

Chemical oxidation is a treatment process targeted primarily at organic constituents, (e.g., toluene and benzene) but may also be used for inorganic constituents (e.g., cyanides and heavy metals such as mercury). An organic or inorganic species is oxidized when its respective chemical oxidation number increases (i.e., loses electrons). Consistent with 40 CFR §268.42, the following oxidation reagents (or waste reagents) may be used in part or whole: (1) Hypochlorite (e.g. bleach); (2) chlorine; (3) chlorine dioxide; (4) ozone or UV (ultraviolet light) assisted ozone; (5) peroxides; (6) persulfates; (7) perchlorates; (8) permanganates; and/or (9) other oxidizing reagents of equivalent efficiency. An approved mix design is formulated and tested prior to treatment. Chemical Oxidation is also found in Section C.8.3.2 of the facility WAP.

D.10.d.(2) Applicability

Chemical Oxidation is applicable to all of the waste codes listed in USEI's Part A. Chemical Oxidation can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.d.(3) Process Description

As described, Chemical Oxidation is conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building. While reagents, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and reagents while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility;

- The volume or mass of reagents required to complete stabilization of the waste are added to the waste management unit;
- The waste and reagents are mixed to provide intimate contact between the components;
- The chemical reactions that provide the stabilizing effects are completed; and
- Completion of these reactions can take place in the mixing container or tank depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.d.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.d.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building.

D.10.e Chemical Reduction

D.10.e.(1) Overview

Chemical reduction or redox occurs when the targeted component/constituent atoms change as a resultant transfer of electrons from one chemical species to another. The chemical oxidation number for the targeted components decreases (i.e., gains electrons) when the target constituents are reduced. Conversely, the reducing reagents used in this process lose electrons or become oxidized. Derived from 40 CFR §268.42, the following reducing reagents (or waste reagents) may be used in whole or part: (1) Sulfur dioxide; (2) sodium, potassium, (salts), or other alkali salts or sulfites, bisulfites, metabisulfites and polyethylene glycols (e.g., NaPEG and KPEG); (3) sodium hydrosulfide; (4) ferrous salts; and/or (5) other reducing reagents of equivalent efficiency. An approved mix design is formulated and tested prior to treatment.

Chemical reduction may be performed within Mix Bin Tanks or Containers. Treatment is performed to meet EPA LDR standards. Sampling, analytical verification of the treatment effectiveness and frequency of testing follows the guidelines presented in Section C.8.3.3 of the facility WAP.

D.10.e.(2) Applicability

Chemical Reduction is applicable to all waste codes listed in USEI's Part A that are amenable to chemical reduction. Chemical Reduction can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.e.(3) Process Description

As described, Chemical Reduction is conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building. While reagents, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and reagents while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility;
- The volume or mass of reagents required to complete stabilization of the waste are added to the waste management unit;
- The waste and reagents are mixed to provide intimate contact between the components;
- The chemical reactions that provide the stabilizing effects are completed; and
- Completion of these reactions can take place in the mixing container or tank, depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.e.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.e.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building.

D.10.f. Deactivation

D.10.f.(1) Overview

Deactivation is the treatment of those wastes that exhibit the characteristics of ignitability, corrosivity, and/or reactivity. Appropriate use of this treatment technology is determined during the pre-acceptance process. A mix design is developed prior to the treatment of the waste stream. Deactivation may be performed within Mix Bin Tanks, or Containers. Treatment is performed to meet applicable LDR standards. Sampling, analytical verification of the treatment effectiveness and frequency of testing follows the guidelines presented in the facility WAP. Deactivation is also found in Section C.8.3.4 of the facility WAP.

D.10.f.(2) Applicability

Deactivation is applicable to all waste codes listed in USEI's Part A that are amenable to deactivation. Deactivation can be used to achieve treatment standards for non-liquid and liquid waste streams,

although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.f.(3) Process Description

As described, Deactivation is conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building While reagents, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and reagents while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility;
- The volume or mass of reagents required to complete stabilization of the waste are added to the waste management unit;
- The waste and reagents are mixed to provide intimate contact between the components;
- The chemical reactions that provide the stabilizing effects are completed; and
- Completion of these reactions can take place in the mixing container or tank, depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.f.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.f.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building.

D.10.g Neutralization

D.10.g.(1) Overview

Neutralization is a treatment process designed to render corrosive matrices non-corrosive. According to 40 CFR 268.42, the following reagents (or waste reagents) in part or whole may be used for neutralization: (1) Acids; (2) Bases; or (3) water (including wastewaters) resulting in a pH greater than 2 but less than 12.5 measured in the aqueous residuals. An approved mix design will be formulated and tested before waste is treated by neutralization.

Neutralization may be performed within Mix Bin Tanks or Containers. Treatment is performed to meet EPA LDR standards. Sampling, analytical verification of the treatment effectiveness and frequency of testing follows the guidelines presented in the facility WAP

D.10.g.(2) Applicability

Neutralization is applicable to all waste codes listed in USEI's Part A that are amenable to neutralization. Neutralization can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.g.(3) Process Description

As described, Neutralization is conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building. While reagents, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and reagents while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility;
- The volume or mass of reagents required to complete stabilization of the waste are added to the waste management unit;
- The waste and reagents are mixed to provide intimate contact between the components;
- The chemical reactions that provide the stabilizing effects are completed; and
- Completion of these reactions can take place in the mixing container or tank, depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.g.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.g.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building.

D.10.h Precipitation

D.10.h.(1) Overview

Precipitation is the process by which regulated metals and/or inorganics are precipitated out as insoluble precipitates of oxides, hydroxides, carbonates, sulfates, chlorides, fluorides, or phosphates. This process entails adjusting the pH of the waste matrix between 9 and 11. This pH range is ideal for hydroxide precipitation. An alternative to this common standard practice is sulfide precipitation. Sulfide precipitates are less soluble and non-amphoteric (less pH dependent than hydroxyl precipitates). However, caution must be employed to ensure hydrogen sulfide is not released at harmful levels by maintaining a pH greater than 8 throughout the treatment process. Based on 40 CFR 268.42, the following reagents (or waste reagents) are typically used alone or in combination: (1) Lime (i.e., containing oxides and/or hydroxides of calcium and/or magnesium; (2) caustic (i.e., sodium and/or potassium hydroxides; (3) soda ash (i.e., sodium carbonate); (4) sodium sulfide; (5) ferric sulfate or ferric chloride; (6) alum; or (7) sodium sulfate. Additional flocculating, coagulation or similar reagents/processes that pertain to precipitation are not precluded from use. An approved mix design will be tested prior to treatment.

Precipitation may be performed within Mix Bin Tanks or Containers. Treatment is performed to meet EPA LDR standards. Sampling, analytical verification of the treatment effectiveness and frequency of testing follows the guidelines presented in the WAP.

D.10.h.(2) Applicability

Precipitation is applicable to wastes which contain metals and/or other inorganic contaminants requiring treatment. Precipitation can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.h.(3) Process Description

As described, Precipitation is conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building. While reagents, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and reagents while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility;
- The volume or mass of reagents required to complete stabilization of the waste are added to the waste management unit;
- The waste and reagents are mixed to provide intimate contact between the components;
- The chemical reactions that provide the stabilizing effects are completed; and
- Completion of these reactions can take place in the mixing container or tank, depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.h.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.h.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building. Additional limitations are also provided in the WAP and Section D.1

D.10.i Adsorption

D.10.i.(1) Overview

Adsorption using activated carbon or treated clay can be used to remove chemical components from aqueous or gaseous waste streams. Use of adsorption to remove contaminants from gaseous waste streams is not currently employed at USEI, but may be in the future with IDEQ's approval. It is most commonly employed for the removal of organic compounds, although some inorganic constituents are effectively removed as well. This process is achieved through physical, chemical, and electrostatic interactions between the waste material and the adsorbent media. Pursuant with 40 CFR 268.42, Total Organic Carbon can be used as an indicator parameter for the adsorption of many organic constituents that cannot be directly analyzed in wastewater residues.

Adsorption may be performed within Mix Bins, Tanks or Containers, but is currently performed in the carbon vessels associated with the site leachate system. Treatment is performed to meet EPA LDR standards. Sampling, analytical verification of the treatment effectiveness, and frequency of testing follow the guidelines presented in the facility WAP.

D.10.i.(2) Applicability

Adsorption is applicable to all waste codes listed in USEI's Part A which are amenable to treatment by adsorption. Adsorption can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.i.(3) Process Description

Adsorption is mainly conducted in the carbon vessels associated with the leachate system. USEI currently employs this treatment technology for site leachate only, but could also employ it for other RCRA waste streams that are compatible with the tank system and amenable to treatment by adsorption.

Measurement of Total Organic Carbon (TOC) in the waste stream prior to treatment and post-treatment could provide an indicator of treatment effectiveness for waste streams with organic constituents that cannot be readily analyzed in wastewater residues, as described in 40 CFR 268.42.

D.10.i.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed

to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.i.(5) Limitations

Any waste treated within the carbon vessels will be evaluated for compatibility with site leachate and with the components of the treatment system. No reactive, ignitable or incompatible waste will be treated in the site carbon vessels.

D.10.j Bio-Remediation

D.10.j.(1) Overview

Bio-remediation is the use of biological mechanisms to destroy, transform, or immobilize environmental contaminants. Bio-remediation is typically conducted in-situ; however, there may be scenarios where it would be conducted at an alternate facility such as a TSDF. Bio-remediation would be performed within tanks or containers. Bio-remediation is further described in the Facility WAP, Section C.8.3.11. Bio-remediation is not currently utilized at USEI, but may be used at some future time with prior process approval by IDEQ.

D.10.j.(2) Applicability

Bio-remediation is applicable to waste streams that contain contaminants amenable to bioremediation. Bio-remediation can be used to achieve treatment standards for non-liquid and liquid waste streams, although supplemental or concurrent treatment processes may be necessary to satisfy all disposal requirements.

D.10.j.(3) Process Description

As described, in the future, Bio-remediation may be conducted at many of the waste management units at the facility, such as the Stabilization Facility, stabilization portion of the Containment Building and Mixing Bin Tanks, and to a limited extent the CMU's and the debris portion of the Containment Building. While organisms, mixing, and handling requirements are tailored to each specific waste or waste type, the process can be generally described as follows:

- Before initiation of treatment, the waste is characterized in accordance with the WAP;
- The waste is placed in a waste management unit capable of holding the waste, and organisms while maintaining sufficient freeboard to prevent spills or releases from overtopping, splashing, etc. This may be the container in which the waste was shipped to the facility, however, a dedicated bio-remediation facility may be constructed in the future, with prior IDEQ approval;
- The volume or mass of organisms required to complete treatment of the waste are added to the waste management unit;
- The waste and organisms are mixed to provide intimate contact between the components;
- The biological reactions that provide the reduction/stabilization effects are completed; and
- Completion of these reactions can take place in the mixing container or tank, depending on the waste characteristics.

The actual routing of each waste through the facility is selected from the options described in this Section or in Sections C.4.2, Pre-Acceptance Evaluation, and Section C.6, Process Operations Procedures, and Section C.5 in the facility WAP and/or upon receipt. The development of this waste routing plan identifies the processing steps necessary to treat and/or dispose of the waste.

D.10.j.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.j.(5) Limitations

No fine wastes are managed in the Stabilization Facility; fine wastes are managed in the Containment Building.

D.10.k Evaporation

D.10.k.(1) Overview

Evaporation of wastes primarily occurs within the Evaporation Pond. Non-hazardous liquid wastes that meet the conditions of this WAP are placed in the Evaporation Pond for evaporation. The USEI facility has a net evaporation rate of approximately 43 inches per year, which allows for evaporation of liquids using solar energy. Waste liquids selected for evaporation must meet Evaporation Pond Parameters set forth in the facility WAP before being placed in the pond.

D.10.k.(2) Applicability

All surface impoundments are currently permitted to manage all of the RCRA wastes listed in Section A, provided the wastes do not exhibit concentrations of hazardous constituents above the land disposal restrictions (LDRs) described in 40 CFR Part 268 and are not F-listed dioxin wastes, ignitable, reactive or subject to the requirements of 40 CFR 264 Subpart CC for volatile organics.

D.10.k.(3) Process Description

Liquid waste for treatment in the Evaporation Pond normally comes from the RCRA tanks, the Collection Ponds, the leachate treatment system, or off-site generators. Waste from the Evaporation Pond may be transferred to Ponds 1, and 3, if necessary for water balance requirements. Prior to discharge of liquid wastes into any of the ponds, the waste and pond compatibility are determined in accordance with the WAP.

The Evaporation Pond may accept bulk liquid, or containerized liquid wastes. Containers or bulk loads may be staged on the apron for offloading.

D.10.k.(4) Performance Control and Measurement

Waste process control protocols are used during the waste processing steps to verify that each hazardous waste is properly managed according to the WAP. Wastes undergoing treatment are analyzed to verify the waste is properly managed and/or treated. The waste analyses are designed to verify that treatment process objectives, including, primarily, compliance with LDR treatment standards, are met.

D.10.k.(5) Limitations

Wastes placed into the Evaporation ponds shall comply with applicable treatment standards as outlined in the facility WAP.

D.10.l Size Reduction

D.10.l.(1) Overview

Size reduction is a pre-treatment process and refers to the purposeful reduction in material size of hazardous waste to accommodate subsequent storage, treatment or disposal. Size reduction is accomplished in a number of ways at the facility including:

- Manual reduction;
- Equipment-assisted segregation; and
- Crushing.

Size reduction is performed using heavy equipment or hand tools such as saws, hammers, etc. If heavy equipment is used for size reduction (e.g., a backhoe) it is performed on a steel lined sort floor or Mixing Bin Tank, on a concrete floor with a rubber, steel, or otherwise appropriate mat to protect the floor, or in the landfill. Crushing is accomplished in the crushing system described in Section D.9.
Size reduction activities take place at the Containment Building, except that size reduction of items that are easily reduced, including but not limited to PVC pipe, may be done at the Stabilization Facility; and crushing of empty drums in the landfill.

Crushing operations of empty drums in the landfill, and distance from any exposed surface of a liner in landfills by use of heavy equipment is provided in Section D.1.b.(5) of this Section.

D.10.l.(2) Applicability

Size reduction is applicable to all of the waste codes listed in USEI's Part A. The applicability of these treatment processes is largely dependent on the physical characteristics of the reduced material. The WAP discusses classification, acceptance, and handling of debris.

D.10.l.(3) Process Description

In general, debris is unloaded onto the sort floor area in the Containment Building or into the Mix Bin Tanks in the Containment Building, then separated for size reduction, if necessary (see Section D.10.c). The sort floor area in the Containment Building has three (3) separate sort floors with a single truck unloading apron. There are two (2) separate Mixing Bins with individual truck unloading aprons in the Containment Building.

In general, size reduction activities are preceded by waste unloading and segregation activities.

1. Hazardous waste is sorted/separated either manually or by equipment (i.e., loader, crane, backhoe…etc).
2. After the large items are removed, if warranted, the remainder of the load may be classified as either hazardous debris or non-debris (hazardous waste) and is directed, as required, for further processing/treatment (e.g., micro-encapsulation, macro-encapsulation, etc.).
3. The removed material is stored, reduced in size, processed, and/or disposed.

D.10.l.(4) Manual Size Reduction

Manual size reduction is conducted at the Containment Building and at the Containment Building floor or Mixing Bin Tanks. Additionally, manual size reduction of items that are easily reduced, including but not limited to PVC pipe, may be done on the Truck Unloading Aprons at the Containment Building, and at the Stabilization Facility. Manual size reduction consists of sawing, hammering, and segregating by hand. It is conducted in the Containment Building and at any of the Truck Unloading Aprons.

D.10.l.(5) Equipment Assisted Size Reduction

Equipment assisted size reduction (e.g., use of mechanical shears on the backhoe, breaking with the bucket edge of the backhoe, etc.) is conducted in both the Containment Building on a steel lined sort floor or on a concrete floor with a rubber, steel, or otherwise appropriate mat to protect the floor, and in the Containment Building's stationary steel lined Mix Bin Tanks.

D.10.l.(6) Crushing

Debris and other waste (e.g., process slags) processed through the Containment Building's crushing system may be reduced to less than 60 millimeters so it may be treated as non-debris waste. The crushing system is described in Section D.9.

D.10.l.(7) Performance Control and Measurement

The applicable performance goal for size reduction varies depending on the waste stream and the subsequent process. Because size reduction is an intermediate processing step that changes the physical characteristics of the waste, intermediate waste characteristics are reviewed to verify they meet all the necessary process input parameters for the next process (e.g., stabilization or disposal). As necessary to make this determination, the waste is measured for the appropriate process control parameters based on the nature of the next treatment train for the waste stream.

D.10.m Decanting

D.10.m.(1) Overview

Decanting is the movement of flowable material (e.g., liquids, some sludges, slurries) from one container to another. Decanting is also used to separate multi-phase wastes into their various fractions to facilitate treatment and disposal.

D.10.m.(2) Applicability

Any container with flowable material may be decanted. Only containers of compatible wastes are decanted at any one time. Prior to decanting, the chemical compatibility of the waste to be decanted is evaluated with the existing contents of the tank/container into which it is to be placed as described in the WAP.

D.10.m.(3) Process Description

Decanting may be conducted using a variety of equipment that may include tanks and pumps, vacuum-operated vessels and trucks, portable pumps, manual labor (pouring of small containers such as vials, bottles, etc.) or other container handling equipment (e.g., a forklift or bobcat with a drum dumping

attachment). Decanting may also involve bulk waste to facilitate storage or future processing. Additionally, it may be advantageous to decant bulk liquids for treatment in the Evaporation Pond and/or for off-site disposal. The container into which the liquids are decanted is labeled with the specific chemical compatibility group being handled at that time.

The following Sections summarize the general sequence of operation of decanting:

1. Before any containers of waste are processed, chemical compatibility is determined as described in the WAP.
2. Drums are opened by either removing the bung or the lid (on open-top drums). If necessary, the top of the drum is cut off. Bungs are removed from drums using non-sparking bung wrenches. If the drum is an open top drum with a lid requiring removal, the bolted ring holding the lid in place is taken off and the lid removed. If the top of the drum must be cut off, a manual drum cutter or an air-operated drum deheader (with a non-sparking blade) is generally used.
3. Empty containers are checked to verify that all material has been removed, to the extent practical, and that the containers of hazardous waste are empty. Containers that previously held liquids sometimes have some absorbent placed in them to eliminate the generation of any additional free liquids and are then crushed or disposed. Larger bulk or clean non-bulk containers may be reused.

Table D-4 – Liner Specifications

After careful review of the available literature and extensive discussions with the polyethylene liner manufacturers, the following test parameters will be used to establish the strength related specifications for the polyethylene liner used for macroencapsulation:

At a minimum, if a liner material (HDPE or LDPE) is used as a part of the encapsulation process, the material shall conform with the following minimum specification (or equivalent test methods):

- 1” Tensile Strength, ASTM-D882 – 17 lbf.
- Elongation at Break, ASTM-D751 – 200%
- Impact Resistance, ASTM 1709, 882 or D751-330 grams