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Selection of 3013 Containers for Field Surveillance: Fiscal Year 2016 Update

Los Alamos
NATIONAL LABORATORY
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ACRONYMS

Am	americium
BDT	binning decision tree
C&D	Cats and Dogs (containers)
Cl	chloride
DE	destructive examination
DOE	Department of Energy
EJ	engineering judgment
ER	engineering review
F	fluorine
FTIR	Fourier transform infrared (spectroscopy)
FY	fiscal year
HCl	hydrogen chloride
ICCWR	inner container closure weld region
ISP	Integrated Surveillance Program
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LOI	loss on ignition
MIS	Materials Identification and Surveillance
MS	mass spectroscopy
NDE	nondestructive examination
Np	neptunium
P&C	pressure and corrosion
PCD	Product Certification Database
PG	prompt gamma
ppm	parts per million
Pu	plutonium
RFETS	Rocky Flats Environmental Technology Site
SCC	stress corrosion cracking
SQL	Structured Query Language
SRS	Savannah River Site
TGA	thermal/thermogravimetric analysis
U	uranium
WG	Working Group
wt%	total weight percent

ABSTRACT

This update is the eighth in a series of reports that document the binning and sample selection of 3013 containers for the Field Surveillance program as part of the Integrated Surveillance Program. This report documents changes made to both the container binning assignments and the sample selection approach. Binning changes documented in this update are a result of changes to the prompt gamma calibration curves and the reassignment of a small number of Hanford items from the Pressure bin to the Pressure and Corrosion (P&C) bin. Field Surveillance sample selection changes are primarily a result of focusing future destructive examinations (DEs) on the potential for stress corrosion cracking in higher moisture containers in the P&C bin. The decision to focus the Field Surveillance program on higher moisture items is based on findings from both the Shelf-life testing program and DEs.

1.0 BACKGROUND

A Department of Energy (DOE) standard, "Stabilization, Packaging, and Storage of Plutonium-Bearing Materials"(DOE-STD-3013) (DOE 2012), was issued to define the stabilization and packaging requirements that assure excess plutonium can be safely stored for extended periods. Packaging of plutonium bearing materials into 3013 containers began in 2001 and over 5,000 containers are currently in storage. The most current guidance for the Integrated Surveillance Program (ISP) is described in "Integrated Surveillance and Monitoring Program for Materials Packaged to Meet DOE-STD-3013" (AMNMS-15-0014). This document summarizes findings to date and describes the path forward for the ISP. It draws extensively from the current (FY14) test plan, "Test Plan for Assessing Potential for Stress Corrosion Cracking in the 3013 Inner Container Closure Weld Region (FY 2014)" (Berg, et. al 2014).

The ISP is a combination of two focused activities, Field Surveillance and Shelf-life testing, to ensure the safe long-term storage of the 3013 container. Field Surveillance program staff examine containers randomly selected from the storage inventory and containers selected based on the Materials Identification and Surveillance (MIS) Working Group's (WG) engineering judgment (EJ). The Shelf-life testing includes representative and other materials tested in an accelerated manner to evaluate potential degradation mechanisms. Shelf-life testing began in 2001 and Field Surveillance started in 2005.

As described in AMNMS-15-0014 and the previous guidance (LANL 2001 and DOE 2003), two potential mechanisms for container failure were identified: over-pressurization and corrosive degradation of the 3013 container. The container inventory was sorted into three bins based on the potential for experiencing the identified degradation mechanisms: the Innocuous bin (pressurization and corrosion unlikely), the Pressure bin (pressurization possible, corrosion unlikely), and the Pressure and Corrosion (P&C) bin (both pressurization and corrosion possible).

For the Pressure bin and the P&C bin, the random sample selection was based on the criterion of achieving a 99.9% probability of examining at least one of the worst 5% of the containers in that bin. To meet this criterion 130 containers were randomly selected from the Pressure bin and 128 containers were randomly selected from the P&C bin.

Through fiscal year (FY) 2014, nondestructive examination (NDE) was performed on 152 containers (140 random and 12 EJ). The 140 randomly selected containers included the 130 Pressure bin containers and 10 Innocuous bin containers. Destructive examination (DE), which includes NDE, was performed on 93 containers (63 random and 30 EJ). Fifty-four of the random DEs were from the 128 random P&C containers, 8 were from the Pressure bin and one was from the Innocuous bin (see Section A.4.1 in AMNMS-15-0014). Nine DEs were performed in (FY) 2015 (seven random and two EJ) for a total of 102 DEs at the end of (FY) 2015.

Examination of the random containers selected from the Innocuous bin and Pressure bin is complete (Yeager et al 2010). Examination of containers in the P&C bin is ongoing (AMNMS-15-0014). The primary purpose of this report is to document the approach for binning and sample selection that will be used for the P&C bin in 2016 and into the future.

2.0 FIELD SURVEILLANCE SAMPLING THROUGH 2015

This update is the eighth in a series of documents that provide guidance for the Field Surveillance program for 3013 containers. In 2005, three reports were published documenting the binning approach "Binning of 3013 Containers for Field Surveillance" (Peppers et al. 2005a), the sampling approach "3013 Surveillance Sampling—The Statistical Sample" (Kelly et al. 2005), and the items in the statistical (random) and judgmental samples "3013 Container Statistical and Judgmental Samples Selected for Non Destructive Evaluation (NDE) in FY 2005" (Peppers et al. 2005b). In 2007, these three reports were combined into one document, "Selection of 3013 Containers for Field Surveillance" (Peppers et al. 2007), and the binning and sampling information was updated. In 2009, "Selection of 3013 Containers for Field Surveillance, Revision 1" (Peppers et al. 2009) was published. Readers unfamiliar with the 3013 Field Surveillance program are encouraged to read Peppers et al. (2009) for a thorough description and historical perspective.

In 2011, "Selection of 3013 Containers for Field Surveillance: 2011 Update" (Kelly et al. 2011) provided an update to the comprehensive Peppers et al. report (2009). In 2013, "Selection of 3013 Containers for Field Surveillance: 2013 Update" (Kelly et al. 2013) updated the information in Kelly et al. (2011). This current update (2016) documents the random and EJ DE items in FYs 2013, 2014, and 2015. [Note that DE surveillances are identified by the budgetary fiscal year in which they are performed.] In addition, this update describes the restructuring of the Field Surveillance program for FY 2016 and beyond. The Shelf-life studies and surveillance findings behind this restructuring are described in AMNMS-15-0014.

2.1 DE Surveillance in FY 2013

Because of budgetary constraints, only one DE was performed in FY 2013. This was an EJ item (H001236) chosen from the Hanford Secondary Material Type "Cats and Dogs" (C&D) inventory, oxides precipitated from impure laboratory solutions. It was selected due to its high moisture and because it was a material type that had not yet been subjected to DE. At the time of selection it was in the Pressure bin. However, because the C&D items were precipitated from miscellaneous laboratory solutions and it is not known what impurities might be present, all C&D containers are moved to the P&C bin in the current (2016) binning process (see Sections 3.2 and 3.3).

2.2 DE Surveillance in FY 2014

Table 2-1 shows the nine items that were recommended for DE in FY 2014. All but H004024 were completed. Container H002636 (a Pressure bin item) was examined instead of H004024 because there was a problem with its leak test at packaging. Container H004024 will undergo DE in 2016. This change resulted in two EJ items, six random items and a Pressure bin item with DEs in FY 2014.

Table 2-1. Recommended Containers for FY 2014 3013 DE Surveillance Samples for the ISP

ISP Bin	Selection Type	Site (packaged)	Surveillance Comment	3013 Container ID
Pressure and Corrosion	Judgmental	RFETS[1]	Stabilized during same work shift as R610960 (FY 2012 DE8).	R610996
Pressure and Corrosion	Judgmental	SRS[2]	High moisture by TGA-MS[3] with positive Cl[4] by prompt gamma	S002277
Pressure and Corrosion	Random	Hanford	Random sample prioritized by highest moisture from best available data	H003064
				H003307
				H003052
				H003898
				H004219
				H004024[5]
		SRS		S002116

1 RFETS = Rocky Flats Environmental Technology Site
2 SRS = Savannah River Site
3 TGA-MS = thermal/thermogravimetric analysis-mass spectroscopy
4 Cl = chloride
5 H002636 (a Pressure bin item) was substituted for this container.

2.3 DE Surveillance in FY 2015

For FY 2015 there were nine DEs completed, seven randomly selected and two EJs (Table 2-2). One EJ was chosen from the Hanford C&D inventory (H001181). It was chosen because it has the highest moisture of the remaining containers of this material type. The other EJ container, H003737, was selected based on a high glovebox relative humidity at packaging (49%), a reliable moisture measurement (0.24% by both mass spectroscopy (MS) and thermal/thermogravimetric analysis (TGA) to 650°C), a high moisture value (as compared with 0.28% for the highest remaining P&C bin items), and its similarity to H003710, which was a corrosion category 5 in 2010 (see the Appendix A for corrosion category definitions).

Table 2-2. FY 2015 3013 DE Surveillance Samples

ISP Bin	Selection Type	Site (Packaged)	Surveillance Comment	3013 Container ID
Pressure and Corrosion	Judgmental	Hanford	C&D item with highest moisture	H001181
Pressure and Corrosion	Judgmental	Hanford	High moisture by TGA-MS, similar to H003710 (FY 2010 DE03)	H003737
Pressure and Corrosion	Random	Hanford	Random sample prioritized by highest moisture from best available data	H003896
		SRS		S002162
		RFETS		R610156
		Hanford		H004302
		Hanford		H001979
		Hanford		H003181
		Hanford		H003258

3.0 Binning for 2016 and Beyond

3.1 Review of Binning Process

Binning is a key component of the statistical sampling approach. Although the emphasis for future field surveillance DEs is on the P&C bin, historically, binning consists of a two-tiered review of all 3013 containers with the primary objective of placing each container into one of the three bins (Innocuous, Pressure, or P&C) for the purpose of surveillance.

> Tier 1—Decision Tree Up to Engineering Review (ER) (Figure 3-1): containers that have already been packaged are assigned to the appropriate surveillance bin based on information in their data packages.
>
> Tier 2—ER: containers that have already been packaged but fall through the initial decision tree screening require an ER before they are assigned to an appropriate bin.

Information to facilitate binning of existing containers comes from the ISP database. The ISP database has several modules. The module used for binning is the Product Certification Database (PCD). It contains all of the information generated by the packaging sites, as well as additional data from reevaluation of existing data present in the database (e.g., moisture data). The PCD includes information such as MIS Represented group designation (referred to as the 3013 taxon) (Narlesky et al. 2009), moisture content of the material, prompt gamma analytical data taken after packaging, and chemical analysis data when available (Friday et al. 2010).

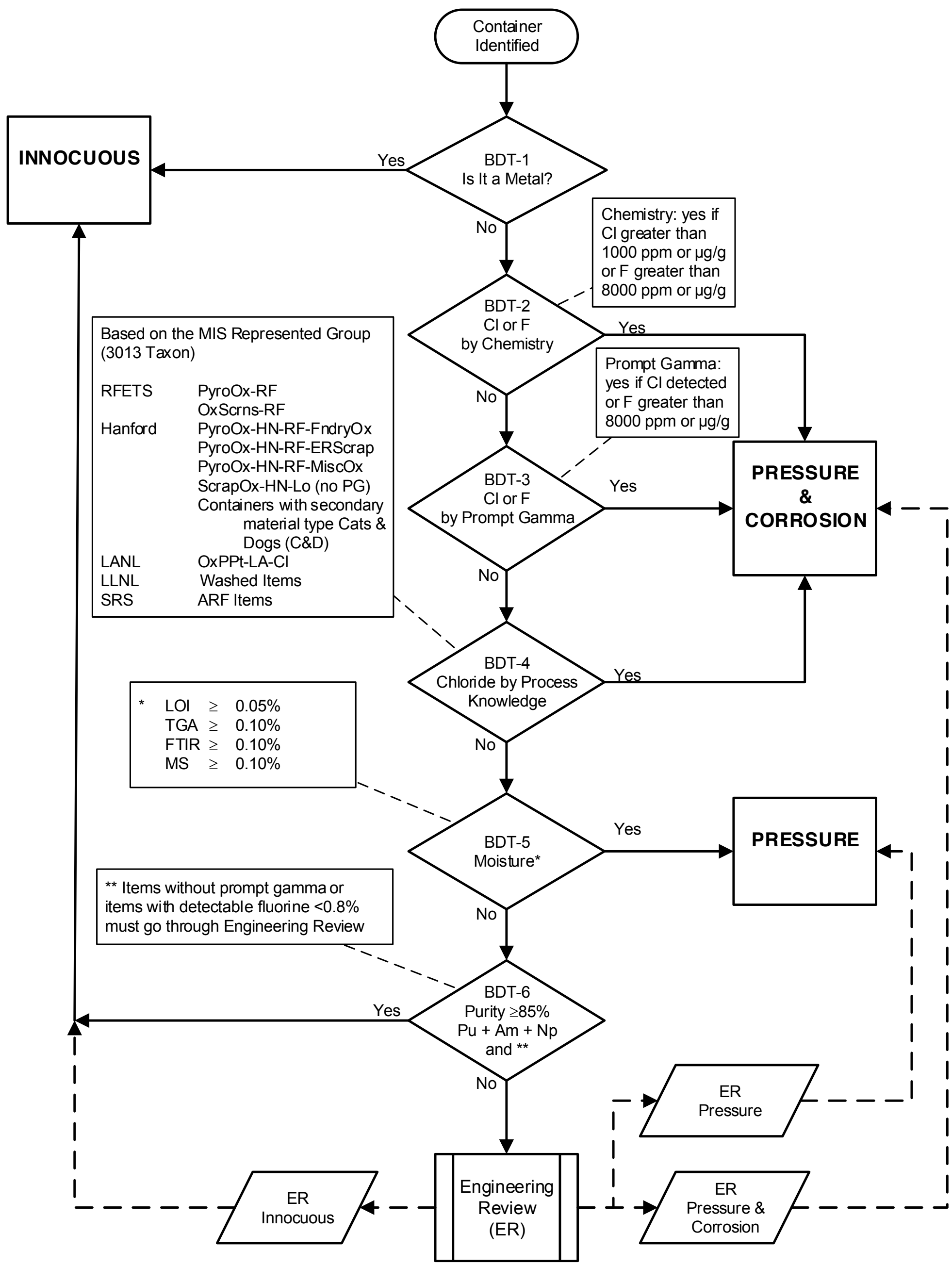

Figure 3-1. Generic decision tree for binning 3013-type containers for Field Surveillance.

Initial Binning of Materials. The initial binning evaluation has six principal binning tree decision (BDT) points (BDT-1 through BDT-6 in Figure 3-1). These are evaluated using a Microsoft Access SQL (structured query language) macro applied to the PCD. This was first documented in Appendix A in Kelly et al. 2011. The binning operations represented by Figure 3-1 are now implemented in modified SQL macros that accommodate the changes identified in this document (Appendix B in this document).

The first decision point assigns materials consisting of plutonium metal and associated impurities to the Innocuous bin (BDT-1). The second, third, and fourth decision points identify containers having the potential for corrosion. The primary constituent for causing corrosion is chloride salts or possibly fluoride-containing materials. Using information from the database, containers identified as containing either chlorine (Cl) or fluorine (F) are placed in the P&C bin. Identification of chlorine or fluorine can be accomplished by chemical analysis (BDT-2), prompt gamma analysis (BDT-3) or process knowledge of the material (BDT-4). Chemical data are limited to a small number of Hanford containers and based on results reported by Tingey and Jones (2005).

These methods for determining the presence of corrosive materials have varying degrees of accuracy and sensitivity. For example, if the chemical analysis shows Cl greater than 1,000 ppm or F greater than 8,000 ppm (BDT-2) or if the prompt gamma analysis detects either Cl (any positive detection) or F greater than or equal to 0.8 total weight percent (wt%) (8,000 ppm), the container is placed in the P&C bin (BDT-3). The prompt gamma detection limit for Cl is about 0.8 wt%, and the detection limit for F is about 0.1 wt%. The threshold of concern for Cl is below the detection limit of prompt gamma, so if the material in the container originated from a process that may have introduced chlorides, it is placed in the P&C bin (BDT-4), unless there is additional analytical information to the contrary.

Figure 3-1 contains a list of the 3013 represented groups (taxons) that were assigned to the P&C bin based on process knowledge (BDT-4). The MIS Represented Group (3013 taxon) is a designation given to each packaged 3013 container in the ISP database and each characterized item in the MIS Module. The purpose of the 3013 taxon is to match each 3013 container to the representative Shelf-life data of the MIS items. The 3013 taxons are assigned based on process knowledge, which links 3013 containers and MIS items produced by similar processes, or item-by-item linkages, which links 3013 containers and MIS items based on prompt gamma analysis, and/or by a thorough review documented in a report (e.g. 3013 containers represented by MIS Item 011589A).

The fifth decision point is based on the final moisture content of the oxide (BDT-5). The DOE-STD-3013 (DOE 2012) sets the moisture limit for oxide materials at 0.5 wt%. However, the actual acceptance limit for moisture content varies, depending on the method for moisture analysis and the uncertainties and biases associated with the particular method. For oxide materials without corrosive species (i.e., materials that pass the Cl and F screen), containers with a loss on ignition (LOI) result greater than or equal to 0.05 wt% are assigned to the Pressure bin.

Containers with TGA, Fourier transform infrared (FTIR) spectroscopy, or MS moisture measurements greater than or equal to 0.10 wt% are assigned to the Pressure bin.

The sixth (BDT-6) and last decision point of the initial binning protocol is based on the combined wt% of plutonium, americium, and neptunium. Containers in which this combined total weight percent is greater than or equal to 85% are placed in the Innocuous bin unless the fluoride or prompt gamma exception applies. Uranium is excluded from the initial binning process because its large measurement uncertainty could skew the binning results.

Note that these materials are considered for these purposes to be pure oxide with moisture content below the specified limits. If a container successfully passes the screening test for P&C as well as for Pressure, and had less than 85 wt% plutonium (Pu) + americium (Am) + neptunium (Np), it requires an ER by a committee of experts.

Binning by Engineering Review. Packaged material that is not assigned a bin using the initial binning protocol described above is required to undergo an ER. All packaged containers subject to ER have a Pu + Am + Np content of less than 85 wt% (or meet the detectable low fluoride or without prompt gamma exception) with no known chloride content from process knowledge or analytical analyses and have a moisture content of less than 0.05 wt% by LOI or less than 0.1 wt% by TGA and/or FTIR/MS. The presence of uranium (U) is addressed during the ER. The criteria that are used in the ER are described below.

Criterion 1: Containers with greater than 85 wt% Pu + Am + Np + U (total actinide) are placed in the Innocuous bin. These containers are reviewed on an individual basis to ensure that the material comes from a historically pure stream so that the uranium measurement uncertainty cannot cause an impure material to be binned as innocuous.

Criterion 2: Containers with total actinide content between 80 and 85 wt% are reviewed on an individual basis. Those containers from a process that historically produced pure material with a moisture content of less than 0.05 wt% by TGA are placed in the Innocuous bin unless there is a suspected problem with the moisture analysis identified through a nonconformance report or other documented production comment. Containers not meeting the moisture criteria are placed in the Pressure bin.

The only exception to the 0.05 wt% criterion is for mixed plutonium-uranium oxide containers processed in the stabilization packaging equipment dry line at Hanford. If these containers have a TGA moisture value exceeding 0.05 wt%, the TGA results are reviewed on an individual basis to determine if excess weight loss occurred at high temperatures and can be attributed to oxygen loss from the uranium oxide and not water. For these cases the container is placed in the Innocuous bin.

Criterion 3: Containers with a total actinide content of less than 80 wt% are placed in the Pressure bin. (Exceptions are oxide containers evaluated under Criterion 4.)

Criterion 4: Oxide containers produced by magnesium hydroxide precipitation from pure plutonium nitrate solutions represent a special class of items where the major impurity is magnesium oxide and prompt gamma indicates no other significant impurities.

Hanford–Containers from Hanford packaged in the stabilization packaging equipment dry line and having TGA moisture content of less than 0.05 wt% are placed in the Innocuous bin. All others are placed in the Pressure bin.

RFETS–Containers from RFETS must have a TGA value of less than 0.05 wt% and the glovebox moisture content at the time of packaging must be less than 1,000 ppm. Containers meeting these criteria are placed in the Innocuous bin. All others are placed in the Pressure bin. Containers suspected to have originated from other than pure plutonium nitrate (e.g., Pu/U solutions) are evaluated using Criteria 1, 2, or 3.

Criterion 5: This criterion applies only to RFETS containers; similar data are not available from other sites. During the moisture analysis using TGA/FTIR, evaluation of the FTIR data indicated the evolution of hydrogen chloride (HCl) from some samples (Berg et al. 2004). HCl was found to occur in three temperature ranges: 20°C–350°C, 350°C–670°C and 670°C–1,000°C. However, only the HCl values in the low temperature range are important to the material storage temperatures because the material temperatures are not expected to exceed 350°C. A total of 36 containers with low temperature HCl have been found in the RFETS inventory with four of those containers in the ER category. This analytical method is very sensitive and possibly subject to contamination from other chloride-bearing samples. However, taking a very conservative approach, all 36 containers are placed in the P&C bin. It is probable that other sites have materials that could exhibit this property, but these cannot be evaluated and are left in their assigned bins.

Sub-bins. Each 3013 container that was assigned a primary bin using the protocol described previously was also given a secondary hierarchical classification or sub-bin. The sub-bin provides additional detail that identifies the criterion that was used to assign the primary bin (Table 3-1). For example, BDT-4-SR-ARF means that the container was placed in the P&C bin because of process knowledge as defined in decision point number four. The sub-bin ER-C2-P means that the container was placed in the pressure bin based on an ER and that the material's total actinide content ranged between 80 and 85 % wt (criterion 2). Any sub-bin containing the letter E refers to an "exception" associated with unique properties as determined by an ER. A total of 39 distinct sub-bin designations (Table 3-1) were used in the binning assignments.

Table 3-1. Sub-bin Designations and Definitions

FY 2011 SubBin	Basis for Binning/Sub-Binning Determination
BDT-1-I	Physical form of material was metal (decision point 1)
BDT-2-Cl	Chemical data for chloride (decision point 2)
BDT-2-F	Chemical data for fluoride (decision point 2)
BDT-3-Cl	Prompt gamma data for chloride (decision point 3)
BDT-3-F	Prompt gamma data for fluoride (decision point 3)

Table 3-1 (con't). Sub-bin Designations and Definitions

FY 2011 SubBin	Basis for Binning/Sub-Binning Determination
BDT-4-H-1E	3013 taxon was Hanford 1E (i.e., PyroOx-HN-RF-ERScrap, PyroOx-HN-RF-FndryOx, or PyroOx-HN-RF-MiscOx)
BDT-4-H-2B	3013 taxon was Hanford 2B (ScrapOx-HN-Lo and no prompt gamma was performed)
BDT-4-H-CD	Hanford Secondary Material Type C&D
BDT-4-LANL-Cl	LANL oxalate precipitation-aqueous chloride (decision point 4)
BDT-4-LLNL-WASHED	Lawrence Livermore National Laboratory (LLNL) washed items (decision point 4)
BDT-4-RF-2B	3013 taxon was RFETS[1] 2B (PyroOx-RF)(decision point 4)
BDT-4-SR-ARF	Savannah River ARF items (decision point 4)
BDT-5	Binning was based on moisture (decision point 5)
BDT-6	Binning was based on total weight (%) of Am, Np, and Pu (decision point 6)
ER-BDT-6-I (Low F)	ER because of low fluoride (decision point 6)
ER-BDT-6-I (No PG)	ER because no prompt gamma (PG) was performed (decision point 6)
ER-C1-I	ER based on the total mass (%) of Am, Np, Pu, and U
ER-C1-I (No PG)	ER because no PG was performed
ER-C1-P	ER (criteria 1) - pressure bin
ER-C1-P (Low F)	ER (criteria 1) - pressure bin (low fluoride content)
ER-C1-P (No PG)	ER (criteria 1) -pressure bin (no PG)
ER-C2-E-I	ER (criteria 2) - designated as an exception
ER-C2-E-P	ER (criteria 2) - designated as an exception
ER-C2-I	ER (criteria 2) - innocuous bin
ER-C2-I (Low F)	ER (criteria 2) - innocuous bin (low fluoride content)
ER-C2-I (No PG)	ER (criteria 2) - innocuous bin (no PG)
ER-C2-P	ER (criteria 2) - pressure bin
ER-C2-P (Low F)	ER (criteria 2) - pressure bin (low fluoride content)
ER-C2-P (No PG)	ER (criteria 2) - pressure bin (no PG)
ER-C3	ER (criteria 3)
ER-C3 (Low F)	ER (criteria 3) - low fluoride content
ER-C3 (No PG)	ER (criteria 3) - no PG
ER-C3-E-P	ER (criteria 3) - but designated as an exception
ER-C3-P	ER (criteria 3) - pressure bin
ER-C4-I	ER (criteria 4) - innocuous bin
ER-C4-P	ER (criteria 4) - pressure bin
ER-C4-P (Low F)	ER (criteria 4) - pressure bin (low fluoride content)
ER-C5-HCl	ER (criteria 5) - hydrogen chloride present
ER-C5-HCl (No PG)	ER (criteria 5) - hydrogen chloride present (no PG)

1 RFETS = Rocky Flats Environmental Technology Site

3.2 P&C Binning Changes Resulting from Revised Prompt Gamma Calibration

The cutoff for an item going into the P&C bin based on F remains at 0.8% (see Figure 3-1). However, incorporation of the 2015 revised prompt gamma (PG) calibration data (Narlesky and Kelly 2015) into a re-analysis of existing PG measurements gives slightly higher estimated concentrations of F. This increase results in 49 containers moving into the P&C bin based on F only. Of these 49, two are Hanford Secondary Material Type Cats &Dogs (C&D) items. Eighteen of the 49 have best moisture greater than 0.08 wt%.

3.3 P&C Binning Changes Resulting from DE Analyses

The Hanford Secondary Material Type C&D inventory is reassigned from the Pressure bin to P&C bin. There are 10 C&D containers. Two of the C&D containers moved into P&C based on F levels and eight moved into the P&C bin based on the process knowledge that these items, originating from precipitation of laboratory nitrate, are likely to contain chloride and fluoride at some level. DE of H001236 (an EJ item in FY 2013) found a chloride level of 6,765 ppm and corrosion category 6 (see Appendix A for category definitions).

3.4 P&C Bin Changes Resulting from Revised Numbers of 3013 Containers Stored at Los Alamos National Laboratory

A recent evaluation of the 3013 containers packaged and stored at Los Alamos National Laboratory (LANL) showed that there are currently 11 P&C containers stored at LANL. Of these 11, four have LOI moisture measurements greater than 0.08 wt%.

These changes increase the number of items in the P&C bin from 1,102 initially stored at Savannah River Site (SRS) and five stored at LANL (Kelly et al. 2013) to 1,159 initially stored at SRS and 11 stored at LANL. This gives a total of 1,170 containers initially (before DE removed some) in the P&C bin.

3.5 Impact of New Best Available Moisture Measurements

When 3013 containers are loaded, the packaging sites are required to certify that the moisture content is below the 3013 Standard limit of 0.5 wt%. The packaging sites use one of several approved moisture measurement techniques. Some of these techniques overstate the moisture content to varying degrees. For example, TGA to 1,000°C will report all of the mass lost during heating (water, carbon dioxide, volatilized salt, etc.) as water. This is conservative when assuring compliance with the 3013 Standard, but it can be somewhat misleading when evaluating corrosion as a function of moisture content. The LOI technique can either over report water (due to loss of volatile content other than water) or under report water (due to readsorption of water from the glovebox atmosphere after cool down and before making the final mass measurement). Because of the potential for under reporting, when the LOI technique was used the packaging facility imposed a lower acceptance criteria (generally in the 0.2 wt% range) to bound the amount of water that could be readsorbed.

For surveillance recommendations in this revision, we use best moisture measurements rather than measurements designated to certify the moisture content at the time of packaging. The best moisture measurement for a container is defined as that measurement best reflecting the true moisture content from among the available data collected at the time of packaging. For the TGA example, the certified moisture in the PCD may be the TGA result, but in some cases MS or FTIR results may also be available. MS and FTIR are direct measurements of water driven off of the sample during the TGA. If only TGA results are available, the mass loss to 650°C is more representative of the actual moisture content, since it does not include the mass loss from salt volatilization.

The best moisture is the available value with the highest-ranked measurement method from the following ranked lists (highest to lowest) of possible entries for each packaging site. The list contains the entries found in the "MoistureMethod" field of ISP database:

RFETS
- FTIR Recalculated*
- FTIR
- TGA
- LOI

Hanford
- TGA-MS w StorWtGain
- TGA-MS, no StorWtGain
- AvgOfTGAto650plusStorWtGain*
- TGA w StorWtGain
- TGA, no StorWtGain
- LOI

SRS
- MS
- AvgOfTGAto650plusStorWtGain*
- TGA

LANL
- TGA-MS (or TGA/MS)
- LOI

LLNL
- LOI, Full Batch

* The MoistureMethod values marked by an asterisk were added to the ISP database after items had been placed in storage by reanalyzing data collected at the time of packaging.

Although changes in moisture measurements do not affect which items go into the P&C bin, they do affect the number of items in the P&C bin determined to have moisture levels greater than or equal to 0.08 wt% (see Section 4.1).

4.0 DE SURVEILLANCE SAMPLING IN 2016 AND BEYOND

As described in the new program guidance document (AMNMS-15-0014), 2016 marks a restructuring of sampling for the Field Surveillance program. This restructuring is based on what has been learned from field surveillance examinations and Shelf-life studies conducted over the past 14 years. The summary findings of the investigations to date are documented in AMNMS-15-0014. The most important high-level findings are (1) pressurization is no longer considered a significant failure mechanism for the current 3013 container population and (2) stress corrosion cracking (SCC) of the inner container by a mechanism involving gas-phase transport of corrosive species is the remaining credible failure mechanism for the existing 3013 population.

It should be noted that these findings are valid only for the types of materials that are currently in storage. If future 3013 containers are generated that have contents significantly different from those currently in storage, these findings will need to be re-evaluated and a new binning and sampling document will be generated. For example, there is a proposal to package high surface area, pure plutonium oxide in 3013 containers. In this case, additional gas generation work is necessary to assure that pressurization is not an issue.

4.1 Focusing Surveillance on SCC in Inner Container Closure Weld Region

Differences in this section as compared to the AMNMS-15-0014 document are a result of increased numbers of containers in the P&C bin and the use of best available moisture instead of packaging moisture.

One of the key findings from the DE results, as of the end of 2014, is that there is a positive correlation between the moisture fraction measured at packaging and the appearance of visible corrosion in DE. Figure 4.1 shows the distributions of moisture content for the DE populations that were categorized as showing some sign of corrosion (category >=1, see Appendix A for category definitions and listed as "Yes" below), and those deemed free of evident corrosion (category 0 and 0* and listed as "No" below). Of the 32 DE items that showed some corrosion, 31 had a best moisture of 0.08 wt% or greater.

There were 93 DE items evaluated for corrosion by the end of 2014, 64 had best moisture greater than or equal to 0.08 wt% and 29 were below 0.08 wt%. Assuming this sample is representative of remaining containers, these results indicate that there is a much higher probability (p_i) of finding visible corrosion in future samples drawn from the higher moisture group (S_1) of remaining containers ($p_1 = 31/64 = 0.48$) than from the lower moisture group (S_2) ($p_2 = 1/29 = 0.034$).[1] In the following text, the index $i = 1$ indicates the higher moisture group and $i = 2$ indicates the lower moisture group.

A crucial question is how closely the probability of finding visible corrosion correlates with the probability of finding the worst cases of corrosion in the inner container closure weld region (ICCWR). It is this region that is expected to have the greatest potential for SCC. This question cannot be answered from the DE results to date because there have been too few ICCWR examinations. However, both literature and Shelf-life studies clearly show that, other factors being equal, SCC of 304L is correlated with the activity of water (or relative humidity) and the amount of water that is free to migrate and condense on container surfaces. These characteristics of water in containers are in turn correlated with the moisture content measured at packaging. Therefore, it is reasonable to infer that the correlation between packaging moisture and visible corrosion will extend to the correlation between packaging moisture and the severity of corrosion in the ICCWR.

[1] These numbers and the number of items in S_1 are different than in the AMNMS-15-0014 because of the use of best moisture values.

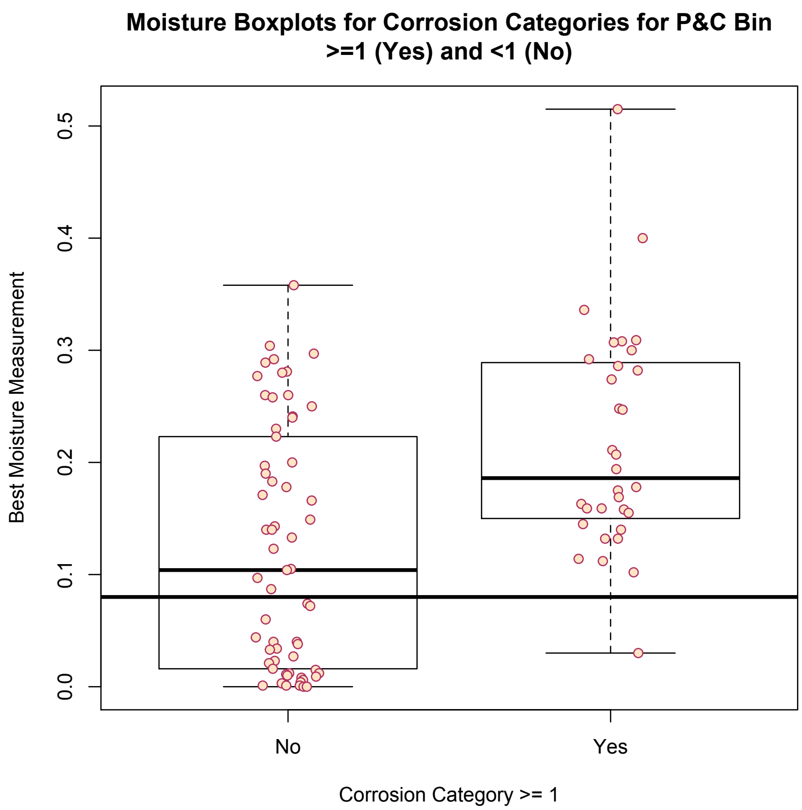

Figure 4.1. Box plot showing moisture content distributions of two populations of DE containers distinguished by whether they were categorized as showing corrosion. The vertical axis shows the best available value for the measured moisture content (wt%) of the material at the time of packaging. (This figure is slightly different than the comparable one in AMNMS-15-0014 because best available moisture is used rather than packaging moisture.)

The past DE statistical sampling approach is based on stratified random sampling of the P&C bin. The stratification is based on packaging sites with proportional allocation based on packaging site populations (Peppers et al. 2009). Stratification with proportional allocation is a common technique used in statistical sampling to determine a population proportion (Cochran 1977). Its optimality depends on the assumption that proportions do not differ too widely between strata. In this application, the assumption is that the probabilities of a potential problem do not differ significantly between the packaging sites. This was a reasonable assumption at the beginning of the Field Surveillance program but is no longer appropriate based on the DE data obtained since that time.

If the past packaging-site population stratification approach is retained, the remaining DE statistical sample calls for 50 items to be examined from the low-moisture group (less than 0.08 wt%) and 17 items from the high-moisture group (greater than or equal to 0.08 wt%). This misalignment is a result of one packaging site, Hanford, having a much higher proportion of high-moisture items. Given the observed correlation between moisture content and visible corrosion, continuing with this sampling plan would not be an optimal way to focus future DE resources on finding the most severe cases of corrosion in the ICCWR.

Therefore, the future DE statistical field sample is based on stratifying the remaining P&C population on moisture. A 0.08 wt% moisture cutoff for defining the two strata is used since this is a breakpoint for the probability of corrosion, is consistent with understanding of the physical process involved, and is believed to address the tradeoff between focusing the sampling appropriately to have a high probability of finding SCC if it exists (higher cutoff) and the concern of possibly missing a container with SCC (the cutoff should not be too high). The higher moisture stratum is designated S_1 and the lower moisture stratum is designated S_2.

Initially, DE did not include a full examination of the ICCWR for SCC. However, a number of recent DEs and the future DEs have the ICCWR available for examination. The sample allocation is based on detecting a 5% potential problem in the ICCWR-available P&C bin with high confidence. The ICCWR-available P&C population is defined as all P&C containers, including those that went through DE, (1,170 total containers in storage with 465 in S_1) minus those P&C containers with DE complete without an ICCWR examination (64 containers). This leaves 1,106 remaining P&C containers available for ICCWR examinations. Forty of the 64 containers without ICCWR examinations were in S_1 initially, leaving 425 ICCWR-available S_1 containers. Figure 4-2 provides a graphic summarizing this information.

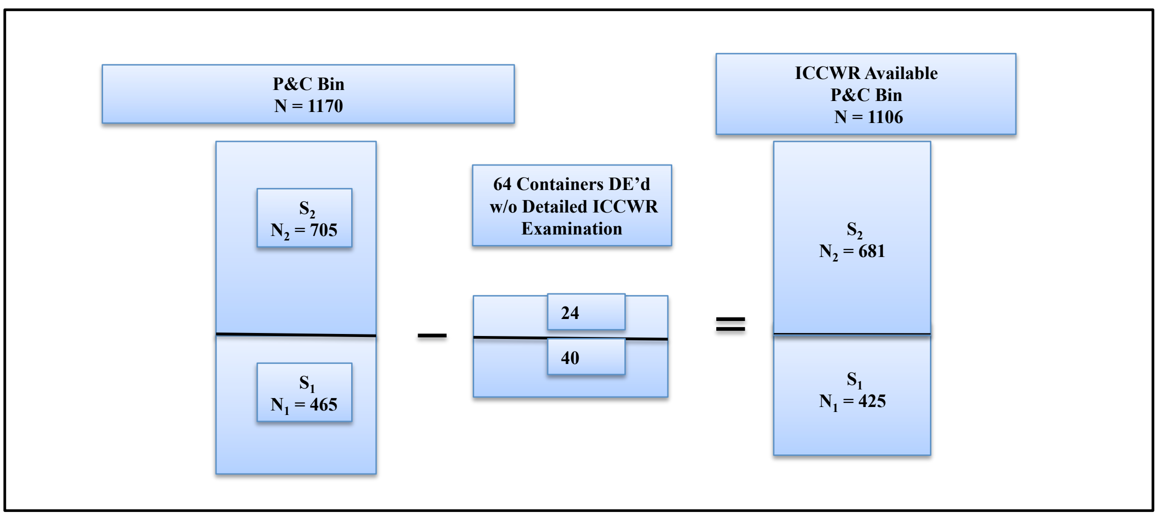

Figure 4- 2. Graphic depiction of P&C bin showing containers available for ICCWR examination.

The sample size depends on the ratio p_1/p_2, where p_1 is the probability of finding a potential problem in the high-moisture group (S_1) and p_2 is the probability of finding a potential problem in the low-moisture group (S_2). For example, for a 5% potential problem there are 55.3 potential problem items in the entire population of 1,106 containers. Therefore $55.3 = p_1 * N_1$ (number of containers in S_1) + $p_2 * N_2$ (number of containers in S_2). If, for example, we assume a ratio p_1/p_2 of 5,then $p_1 = 5p_2$. Substituting into the above equation gives $5p_2 * N_1 + p_2 * N_2 = 55.3$. The assumption that p_1 is at least five times greater than p_2 is based on the data (Section 4.1) and expert judgment and is considered a conservative yet reasonable assumption by the MIS WG. This gives $p_1 = 0.0985$ and $p_2 = 0.0197$ ($p_2*681 + p_1*425= 55.3$) predicting approximately 42 potential problem containers in S_1 and 13 potential problem containers in S_2. Applying the requirement of 99.9% confidence that at least one of the 42 potential problem containers from S_1 is examined requires a sample size of 62 from S_1 (based on the hypergeometric distribution). This gives a 14.6% sample from the higher risk population. The sampling focuses on S_1 because examining additional low-moisture items will contribute very little to the statistical confidence that an item from a 5% potential problem will be sampled in the cases where p_1 is at least five times greater than p_2. It is expected that sampling of S_2 could occur with EJ samples.

When all ICCWR DE items prior to FY 2016 are complete, there could be as many as 24 P&C containers from S_1 with ICCWR examinations (Table 4-1). Container R610996, 14DE01, does not appear on this list because it has low moisture and is not in S_1. However, seven of these containers (marked with asterisks) may not be counted in the 3013 surveillance sample for SCC in the ICCWR due to inappropriate storage prior to ICCWR examination or insufficient fraction of the ICCWR available for examination. The containers 08DE14 and 08DE15 were stored in the glove box at SRS with ambient air for five years and 11DE11 was stored for two years. All three have complete lids for examination. If no potential problems are found upon ICCWR examination, they can be included in the surveillance sample. However, if a potential problem is found, it could be from storage conditions and in this case would not necessarily be included. Container components waiting for examination are currently stored with a corrosion inhibitor to avoid the potential for corrosion during storage prior to examination. Containers 09DE2, 12DE04, 12DE06 and 12DE07 do not have the entire lids available for examination. In each case, it must be determined if the lid sections available for detailed ICCWR examination are adequate to find a potential problem, if it exists.

In addition to these containers, a high moisture container from Hanford, (H003328 with DE done in FY11), which has a moisture measurement higher than the allowed limit of 0.5 wt%, will undergo a detailed ICCWR examination. However, since the moisture upon packaging exceeded the 3013 specification for moisture, it will not be counted as a 3013 surveillance sample.

At this time, the assumption for determining the future surveillance sample is that there will be at least seventeen S_1 containers with DEs prior to 2016 with ICCWR examinations. This leaves 45 containers requiring DE ICCWR examinations from the high-moisture group in FY 2016 and beyond.

Table 4-1. Containers in S_1 with Completed or Planned ICCWR Examinations as of FY 2015

ICCWR List		Category Prior to ICCWR Examination (see Appendix A)
08DE14*	H002573	6
08DE15*	H002534	2
09DE02*	H004111	6
11DE11*	H003625	3B
12DE04*	H003390	3A
12DE06*	H004012	1

Table 4-1 (con't). Containers in S1 with Completed or Planned ICCWR Examinations as of FY 2015

ICCWR List		Category Prior to ICCWR Examination (see Appendix A)
12DE07*	H004048	3A
13DE01	H001236	6
14DE02	H003064	3A
14DE03	H003307	3A
14DE04	H003052	3A
14DE05	H003898	3A
14DE06	S002277	0
14DE07	S002116	0
14DE08	H004219	4
15DE01	H001181	
15DE02	H003737	
15DE03	H003896	
15DE04	S002162	
15DE05	R610156	
15DE06	H004302	
15DE07	H001979	
15DE08	H003181	
15DE09	H003258	

4.2 DE Surveillance for FY 2016 and Beyond

There are six containers identified for DE in FY 2016 (Table 4-2), five random items from the higher moisture items in the P&C bin and one based on EJ. The EJ container is from Hanford and is currently in the Pressure bin. The contents were precipitated from impure concentrated filtrate solutions (identified in the database as "Filtrate"). This item has the highest moisture (0.31 wt% H_2O) of this material type. A previous DE of a similar container (H001209) from this material type found a small amount of water soluble chloride (510 ppm) not detectable by prompt gamma but above what would be considered a de minimis level. Results from this DE will assist the MIS WG determination of whether all Filtrate containers should be moved to the P&C bin.

Table 4-2. Selection of FY 2016 3013 DE Surveillance Samples for the ISP

ISP Bin	Selection Type	Site (Packaged)	Surveillance Comment	3013 Container ID
Pressure	Judgmental	Hanford	Filtrate item with high moisture, detectable weight gain	H001191
Pressure and Corrosion	Random	Hanford	Containers with highest moisture in 2013 random sample	H002556
		Hanford		H004173
		Hanford		H004247
		Hanford		H003775
		Hanford		H004024

Assuming 17 ICCWR examinations of S_1 containers with DE before 2016 and five in 2016, there are 40 S_1 containers requiring ICCWR examinations to meet the requirement of 62 ICCWR examinations. Beginning in FY 2017, a new random sample of size 40 from the higher moisture S_1 group will be examined (Table 4-3).[2] This random sample is selected from the remaining 396 containers available for examination of the ICCWR in S_1 (425 minus 24 with possible ICCWR examinations and 5 with DEs in 2016). The current plan is that five of these containers will be examined each year resulting in completion of the surveillance program in approximately eight years. The plan is to also examine one EJ container each year. However, this number could increase or decrease depending on programmatic requirements and Shelf-life findings. The sample selection is ranked by the best moisture value, which is the recommended prioritization for DE. It should be noted that substitutions for randomly selected containers could be made based on logistical considerations and with MIS Working Group approval.

Table 4-3. Selection of 3013 DE Field Surveillance Containers Starting in FY2017

3013 Container ID	FY15 SubBin	MIS Represented	Total Actinides(%)	Best Moisture Percent
H002575	BDT-3-Cl	PyroOx-HN-RF-ERScrap	74.60%	0.296
H003352	BDT-3-Cl	PyroOx-HN-RF-ERScrap	72.70%	0.29
R610832	BDT-3-F	DisResd-RF	66.70%	0.28
R601859	BDT-3-Cl	MetalOx-RF	82.50%	0.272
H001304	BDT-4-H-CD	OxlPPt-HN-Impure	36.30%	0.267
H003695	BDT-3-Cl	PyroOx-HN-RF-ERScrap	71.80%	0.265
H002508	BDT-3-Cl	PyroOx-HN-RF-ERScrap	69.50%	0.242
H003345	BDT-3-Cl	PyroOx-HN-RF-ERScrap	62.00%	0.226
H003645	BDT-3-Cl	PyroOx-HN-RF-ERScrap	72.80%	0.225
H003626	BDT-3-Cl	PyroOx-HN-RF-MiscOx	75.50%	0.219
H001314	BDT-4-H-CD	OxlPPt-HN-Impure	47.00%	0.195
H003523	BDT-3-Cl	PyroOx-HN-RF-ERScrap	72.10%	0.194
H002524	BDT-3-Cl	PyroOx-HN-RF-ERScrap	71.40%	0.18
H003564	BDT-3-Cl	PyroOx-HN-RF-ERScrap	73.60%	0.179
H003715	BDT-3-Cl	PyroOx-HN-RF-ERScrap	75.30%	0.178
H004005	BDT-2-Cl	PyroOx-HN-RF-ERScrap	76.10%	0.171
S002151	BDT-4-SR-ARF	MetalOx-SR-RF	86.80%	0.167
H001746	BDT-3-Cl	ScrapOx-HN-Lo	50.40%	0.16
H004183	BDT-3-Cl	PyroOx-HN-RF-ERScrap	76.60%	0.155
S002219	BDT-4-SR-ARF	MetalOx-SR-RF	83.80%	0.153
H004006	BDT-3-Cl	PyroOx-HN-RF-ERScrap	73.40%	0.153
H003945	BDT-3-Cl	PyroOx-HN-RF-ERScrap	71.50%	0.152
R610910	BDT-3-Cl	OxScrns-RF	53.80%	0.15
H004004	BDT-3-Cl	PyroOx-HN-RF-ERScrap	68.50%	0.15
H002531	BDT-3-Cl	PyroOx-HN-RF-MiscOx	71.00%	0.15

[2] If some of the seven (7) items identified in Table 4-1 that may not be counted are found to be acceptable and included in the surveillance sample, this sample container list will be reduced appropriately.

Table 4-3 (con't). Selection of 3013 DE Field Surveillance Containers Starting in 2017

3013 Container ID	FY15 SubBin	MIS Represented	Total Actinides(%)	Best Moisture Percent
H003731	BDT-3-Cl	PyroOx-HN-RF-ERScrap	71.20%	0.147
S002117	BDT-3-Cl	MetalOx-SR-RF	83.80%	0.14
H002631	BDT-4-H-1E	PyroOx-HN-RF-MiscOx	56.20%	0.138
H002610	BDT-3-Cl	PyroOx-HN-RF-ERScrap	73.10%	0.135
H003308	BDT-3-Cl	PyroOx-HN-RF-ERScrap	61.80%	0.131
S002203	BDT-3-Cl	MetalOx-SR-RF	83.20%	0.13
R600563	BDT-3-F	MetalOx-RF	83.30%	0.128
H002766	BDT-3-F	PyroOx-HN-RF-MiscOx	53.30%	0.125
H004228	BDT-3-Cl	PyroOx-HN-RF-ERScrap	70.80%	0.12
H003639	BDT-3-Cl	PyroOx-HN-RF-FndryOX	73.10%	0.118
H004096	BDT-3-Cl	PyroOx-HN-RF-ERScrap	53.60%	0.118
H003469	BDT-3-Cl	PyroOx-HN-RF-ERScrap	72.10%	0.116
R610875	BDT-3-Cl	PyroOx-RF	67.60%	0.093
H002798	BDT-3-Cl	PyroOx-HN-RF-ERScrap	72.90%	0.093
H002512	BDT-3-F	PyroOx-HN-RF-MiscOx	44.80%	0.084

5.0 SUMMARY

This FY 2016 update for the selection of 3013 containers for the Field Surveillance program documents changes made to both the container binning assignments and the surveillance sample selection approach. Binning changes documented in this update are a result of the reassignment of ten[3] Hanford C&D items from the Pressure bin to the P&C bin, changes to the prompt gamma calibration curves resulting in an increase of 49 fluorine-only containers in the P&C bin, and an increase of six 3013 containers packaged and stored at LANL. These changes resulted in 1,170 P&C containers versus the 1,107 P&C containers reported in FY 2013 (an increase of 63 containers).

Field Surveillance sample selection changes are primarily a result of focusing future DEs on the potential for SCC in the ICCWR. The rationale for focusing DEs is documented in detail in the May 2015 document "Integrated Surveillance and Monitoring Program for Materials Packaged to Meet DOE-STD-3013" (AMNMS-15-0014). The decision to focus on the ICCWR resulted in focusing sampling on higher moisture containers in the P&C bin. This decision is also documented in AMNMS-15-0014 and is based on findings from both the corrosion Shelf-life studies and previous DEs. There are 62 ICCWR examinations of high moisture P&C containers needed to meet the 99.9% probability of finding a SCC in the ICCWR if it occurs in 5% or more

[3] Two of these ten move to the P&C bin because of F and are counted in the 49 fluorine-only containers that move because of changes in the prompt gamma calibration curves.

of the P&C population[4]. This means that 14.6% of the high-moisture items will be examined. To date, 17 ICCWR examinations were completed or are in progress. Five random P&C higher moisture containers and one EJ container are scheduled to be examined in FY 2016. An additional 40 randomly-selected higher moisture items will be examined in FY 2017 and beyond. It is possible that up to seven containers that had DE before 2016 can be included in the ICCWR surveillance sample. If this turns out to be the case, then the additional 40 items could be reduced by the number of acceptable containers and meet the requirement of 62 ICCWR examinations.

6.0 REFERENCES

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[4] This result is based on the assumption that the probability of a potential problem in the high-moisture group is at least five times greater than in the low-moisture group.

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APPENDIX A CORROSION CATEGORIES

The corrosion categorization scheme shown in the table below provides a semi-quantitative catalog of the severity of visible corrosion prior to ICCWR examination.

Category	Description
0	Nothing or wipeable coating
0*	Corrosion observed in RFETS convenience container threads or lids
1	Adherent coating on convenience container
2	Pitting <50 µm on convenience container
3A	Suspect pitting >50 µm on convenience container – pit covered with corrosion product
3B	Confirmed pitting >50 µm on convenience container – generally confirmed with scanning electron microscopy
4	Adherent coating on inner container
5	Pitting <50 µm on inner container
6	Pitting >50 µm on inner container
7	SCC on inner container (never observed)

APPENDIX B FY2016 BINNING USING STRUCTURED QUERY LANGUAGE (SQL)

Query 1 Makes table Physical Form (qry1_MakeTablePhysicalForm)

```
SELECT DISTINCT tblPCDInnerCan.[3013ContainerID], tblPCDInnerCan.SiteID,
tblPCDConvCan.PhysicalForm INTO PhysicalForm
FROM tblPCDInnerCan INNER JOIN tblPCDConvCan ON (tblPCDInnerCan.SiteID =
tblPCDConvCan.SiteID) AND (tblPCDInnerCan.InnerCanID = tblPCDConvCan.InnerCanID);
```

Query 2 Makes table BestPG. (qry2_MakeTableBestPG)
Data comes from qryPCDPromptGamma listed below

```
SELECT qryPCDPromptGamma.Done, qryPCDPromptGamma.[3013ContainerID],
qryPCDPromptGamma.Best, qryPCDPromptGamma.SurvID, qryPCDPromptGamma.SiteID,
qryPCDPromptGamma.[PredAl%], qryPCDPromptGamma.[PredBe%],
qryPCDPromptGamma.[PredCl%], qryPCDPromptGamma.[PredF%],
qryPCDPromptGamma.[PredMg%], qryPCDPromptGamma.[PredNa%],
qryPCDPromptGamma.[PredK%], qryPCDPromptGamma.[PredP%],
qryPCDPromptGamma.Comments INTO BestPG
FROM qryPCDPromptGamma
WHERE (((qryPCDPromptGamma.Best)=True));
```

(qryPCDPromptGamma)

```
SELECT 42257 AS LastUpdatedDate, tblPCDPromptGamma.Done,
tblPCDPromptGamma.[3013ContainerID], tblPCDPromptGamma.Best,
tblPCDPromptGamma.SurvID, tblPCDPromptGamma.SiteID,
tblPCDPromptGamma.CountingSite, tblPCDPromptGamma.MeasurementType,
tblPCDPromptGamma.Configuration, tblPCDPromptGamma.FullSpectrum,
tblPCDPromptGamma.[Raw Filename], tblPCDPromptGamma.[Result Filename],
tblPCDPromptGamma.[Spectrum Date], tblPCDPromptGamma.LiveTime,
tblPCDPromptGamma.EnergyMax, tblPCDPromptGamma.Normalization,
tblPCDPromptGamma.PuPR, tblPCDPromptGamma.Pu, tblPCDPromptGamma.CR_414,
tblPCDPromptGamma.CR_643, tblPCDPromptGamma.CR_646, tblPCDPromptGamma.Am,
tblPCDPromptGamma.CR_662, tblPCDPromptGamma.Al, tblPCDPromptGamma.[2236 keV],
tblPCDPromptGamma.[3498 keV], tblPCDPromptGamma.B, tblPCDPromptGamma.[2313
keV], tblPCDPromptGamma.[3684 keV], tblPCDPromptGamma.Be,
tblPCDPromptGamma.[4439 keV], tblPCDPromptGamma.[3928 keV],
tblPCDPromptGamma.Cl, tblPCDPromptGamma.[2167 keV], tblPCDPromptGamma.F,
tblPCDPromptGamma.[1274 keV], tblPCDPromptGamma.[891 keV],
tblPCDPromptGamma.[2081 keV], tblPCDPromptGamma.Mg, tblPCDPromptGamma.[1779
keV], tblPCDPromptGamma.[2028 keV], tblPCDPromptGamma.P,
tblPCDPromptGamma.[2127 keV], tblPCDPromptGamma.K, tblPCDPromptGamma.[1524
keV], tblPCDPromptGamma.Na, tblPCDPromptGamma.[1808 keV],
tblPCDPromptGamma.Comments, tblPCDPromptGamma.[PG Representation],
[1779 keV]/[1808 keV] AS [Ratio MgNa],
```

[1808 keV]/[2167 keV] AS [Ratio NaCl],
IIf([tblPCDPromptGamma]![2236 keV]>0,Round([tblPCDPromptGamma]![2236 keV]*1207000)/10000) AS [PredAl%],
IIf([tblPCDPromptGamma]![4439 keV]>0,Round([tblPCDPromptGamma]![4439 keV]*65500)/10000) AS [PredBe%], IIf([tblPCDPromptGamma]![2167 keV]>0,Round([tblPCDPromptGamma]![2167 keV]*10990000)/10000) AS [PredCl%],
IIf([tblPCDPromptGamma]![891 keV]>0,Round([tblPCDPromptGamma]![891 keV]*922500)/10000) AS [PredF%],
IIf([tblPCDPromptGamma]![1779 keV]>0,
IIf([tblPCDPromptGamma]![1808 keV]>0,
IIf(([tblPCDPromptGamma]![1779 keV]-0.028*[tblPCDPromptGamma]![1808 keV])>0,Round(([tblPCDPromptGamma]![1779 keV]-0.028*[tblPCDPromptGamma]![1808 keV])*2773000)/10000,Round([tblPCDPromptGamma]![1779 keV]*2773000)/10000),Round([tblPCDPromptGamma]![1779 keV]*2773000)/10000)) AS [PredMg%],
IIf([tblPCDPromptGamma]![1808 keV]>0,Round([tblPCDPromptGamma]![1808 keV]*251400)/10000) AS [PredNa%], IIf([tblPCDPromptGamma]![1524 keV]>0,Round([tblPCDPromptGamma]![1524 keV]*13620000)/10000) AS [PredK%],
IIf([tblPCDPromptGamma]![2127 keV]>0,Round([tblPCDPromptGamma]![2127 keV]*2603000)/10000) AS [PredP%]
FROM tblPCDPromptGamma;

Query 3 Updates PredCl% and PredF% for containers H002543 and H001863 to Null (qry3_UpdateBestPG_h001863_H002543)

UPDATE BestPG SET BestPG.[PredCl%] = Null, BestPG.[PredF%] = Null
WHERE (((BestPG.[3013ContainerID])="H002543" Or (BestPG.[3013ContainerID])="H001863"));

Query 4 Makes table PromptGamma_YesNo (qry4_MakeTablePromptGamma_YesNo)

SELECT tblPCDProcessed.[3013ContainerID], BestPG.[3013ContainerID], IIf([tblPCDProcessed]![3013ContainerID]=[BestPG]![3013ContainerID],"Yes","No") AS PGPerformed INTO PromptGamma_YesNo
FROM tblPCDProcessed LEFT JOIN BestPG ON tblPCDProcessed.[3013ContainerID] = BestPG.[3013ContainerID];

Query 5a Makes table Moisture (contains best moisture value) (qry5a_MakeTableMoistureBest)

SELECT tblPCDInnerCan.[3013ContainerID], tblPCDInnerCan.SiteID, tblPCDMoisture.BestMoisture, tblPCDMoisture.MoistureMethod, tblPCDMoisture.MoisturePercent, tblPCDSamples.GloveBoxRelativeHumidity, tblPCDSamples.SampleID INTO Moisture
FROM ((tblPCDInnerCan INNER JOIN tblPCDConvCan ON (tblPCDInnerCan.SiteID = tblPCDConvCan.SiteID) AND (tblPCDInnerCan.InnerCanID = tblPCDConvCan.InnerCanID))

```
INNER JOIN tblPCDMoisture ON (tblPCDConvCan.SiteID = tblPCDMoisture.SiteID) AND
(tblPCDConvCan.ConvCanID = tblPCDMoisture.ConvCanID)) LEFT JOIN tblPCDSamples
ON (tblPCDMoisture.ContainerID = tblPCDSamples.ItemSampled) AND
(tblPCDMoisture.SampleID = tblPCDSamples.SampleID)
WHERE (((tblPCDMoisture.BestMoisture)=True)) OR
(((tblPCDInnerCan.[3013ContainerID])="L000219"))
```

Query 5b Makes table MoistureCert (contains certified moisture value) (qry5b_MakeTableMoistureCert)

```
SELECT tblPCDInnerCan.[3013ContainerID], tblPCDInnerCan.SiteID,
tblPCDMoisture.CertMoistureValue, tblPCDMoisture.MoistureMethod,
tblPCDMoisture.MoisturePercent, tblPCDSamples.GloveBoxRelativeHumidity,
tblPCDSamples.SampleID INTO MoistureCert
FROM ((tblPCDInnerCan INNER JOIN tblPCDConvCan ON (tblPCDInnerCan.SiteID =
tblPCDConvCan.SiteID) AND (tblPCDInnerCan.InnerCanID = tblPCDConvCan.InnerCanID))
INNER JOIN tblPCDMoisture ON (tblPCDConvCan.SiteID = tblPCDMoisture.SiteID) AND
(tblPCDConvCan.ConvCanID = tblPCDMoisture.ConvCanID)) LEFT JOIN tblPCDSamples
ON (tblPCDMoisture.ContainerID = tblPCDSamples.ItemSampled) AND
(tblPCDMoisture.SampleID = tblPCDSamples.SampleID)
WHERE (((tblPCDMoisture.CertMoistureValue)=True)) OR
(((tblPCDInnerCan.[3013ContainerID])="L000219"));
```

Query 6 Makes table Binning_Data (qry6_MakeTableBinning_Data)

```
SELECT tblPCDProcessed.[3013ContainerID], Null AS Bin, tblPCDProcessed.SiteID, Null AS
SubBin, tblPCDProcessed.Destroyed, tblPCDProcessed.OuterCanWeldDateTime,
tblPCDProcessed.OuterCanWeldInspDate, tblPCDProcessed.HanfordProcessLine,
tblPCDProcessed.[3013ContainerComments], tblPCDProcessed.MISRepresented,
tblPCDProcessed.OrigMISRepresented, PromptGamma_YesNo.PGPerformed,
Chemistry_Cl_F_n18.[Cl- Assay], Chemistry_Cl_F_n18.FTOT, BestPG.[PredCl%],
BestPG.[PredF%], tblPCDCalGamma.[Pu%], tblPCDCalGamma.[Am%],
tblPCDCalGamma.[U%], tblPCDCalGamma.[Np%], tblPCDCalGamma.[TotalActinides(%)],
[tblPCDCalGamma]![Pu%]+[tblPCDCalGamma]![Am%]+[tblPCDCalGamma]![Np%] AS
SumAmNpPu, Moisture.MoistureMethod, Moisture.MoisturePercent,
PhysicalForm.PhysicalForm INTO Binning_data
FROM (((((tblPCDProcessed LEFT JOIN Chemistry_Cl_F_n18 ON
tblPCDProcessed.[3013ContainerID] = Chemistry_Cl_F_n18.[3013ID]) LEFT JOIN BestPG
ON tblPCDProcessed.[3013ContainerID] = BestPG.[3013ContainerID]) LEFT JOIN
tblPCDCalGamma ON tblPCDProcessed.[3013ContainerID] =
tblPCDCalGamma.[3013ContainerID]) LEFT JOIN Moisture ON
tblPCDProcessed.[3013ContainerID] = Moisture.[3013ContainerID]) LEFT JOIN PhysicalForm
ON tblPCDProcessed.[3013ContainerID] = PhysicalForm.[3013ContainerID]) LEFT JOIN
PromptGamma_YesNo ON tblPCDProcessed.[3013ContainerID] =
PromptGamma_YesNo.tblPCDProcessed_3013ContainerID
```

WHERE (((tblPCDProcessed.[3013ContainerID]) Not Like "R602584" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001456" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001508" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001524" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001526" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001531" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001574" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001585" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001587" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001603" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001604" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001623" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001626" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001630" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001633" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001653" And
(tblPCDProcessed.[3013ContainerID]) Not Like "S001733"));

Query 7 Sets Bin to Innocuous and SubBin to BDT-1-I for all metal cans

UPDATE Binning_Data SET Binning_Data.Bin = "Innocuous", Binning_Data.SubBin =
"BDT-1-I"
WHERE (((Binning_Data.PhysicalForm)="Metal"));

Query 8 Sets Bin to Pressure and Corrosion and Subbin to BDT-2-Cl where field Cl-Assay > 1000

UPDATE Binning_Data SET Binning_Data.Bin = "Pressure and Corrosion",
Binning_Data.SubBin = "BDT-2-Cl"
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND
((Binning_Data.[Cl- Assay])>1000));

Query 9 Sets Bin to Pressure and Corrosion and Subbin to BDT-2-F where field FTOF >8000

UPDATE Binning_Data SET Binning_Data.Bin = "Pressure and Corrosion",
Binning_Data.SubBin = "BDT-2-F"
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND
((Binning_Data.FTOT)>8000));

Query 10 Sets Bin to Pressure and Corrosion and Subbin to BDT-3-Cl where field PredCl% is not null

UPDATE Binning_Data SET Binning_Data.Bin = "Pressure and Corrosion",
Binning_Data.SubBin = "BDT-3-Cl"

```
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND
((Binning_Data.[PredCl%]) Is Not Null));
```

Query 11 Sets Bin to Pressure and Corrosion and Subbin to BDT-3-F where field PredF% >=0.8

```
UPDATE Binning_Data SET Binning_Data.Bin = "Pressure and Corrosion",
Binning_Data.SubBin = "BDT-3-F"
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND
((Binning_Data.[PredF%])>=0.8));
```

Query 12 Sets Bin to Pressure and Corrosion and Subbin to BDT-4-RF-2B where the form is oxide and the original MISRepresented equals RFETS-2B or RFETS-2E

```
UPDATE Binning_Data SET Binning_Data.Bin = "Pressure and Corrosion",
Binning_Data.SubBin = "BDT-4-RF-2B"
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND
((Binning_Data.SiteID)=4) AND ((Binning_Data.PhysicalForm)="Oxide") AND
((Binning_Data.OrigMISRepresented)="RFETS-2B" Or
(Binning_Data.OrigMISRepresented)="RFETS-2E"));
```

Query 13 Sets Bin to Pressure and Corrosion and Subbin to BDT-4-H-1E where the form is oxide and the original MISRepresented equals Hanford-1E

```
UPDATE Binning_data INNER JOIN PromptGamma_YesNo ON
Binning_data.[3013ContainerID] = PromptGamma_YesNo.BestPG_3013ContainerID SET
Binning_data.Bin = "Pressure and Corrosion", Binning_data.SubBin = "BDT-4-H-1E"
WHERE (((Binning_data.Bin) Is Null) AND ((Binning_data.SubBin) Is Null) AND
((Binning_data.SiteID)=1) AND ((Binning_data.PhysicalForm)="Oxide") AND
((Binning_data.OrigMISRepresented)="Hanford-1E"));
```

Query 13a Sets Bin to Pressure and Corrosion and Subbin to BDT-4-H-CD where the 3013 is in the Hanford Cats and Dogs group

```
UPDATE Binning_data SET Binning_data.Bin = "Pressure and Corrosion",
Binning_data.SubBin = "BDT-4-H-CD"
WHERE (((Binning_data.[3013ContainerID])="h001282" Or
(Binning_data.[3013ContainerID])="h001327" Or
(Binning_data.[3013ContainerID])="h001314" Or
(Binning_data.[3013ContainerID])="h001223" Or
(Binning_data.[3013ContainerID])="h001181" Or
(Binning_data.[3013ContainerID])="h001221" Or
(Binning_data.[3013ContainerID])="h001344" Or
(Binning_data.[3013ContainerID])="h001304"));
```

Query 14 Sets Bin to Pressure and Corrosion and Subbin to BDT-4-H-2B where the 3013 is in the OrigMisRepresented of Hanford-2B and no prompt gamma was performed.

UPDATE Binning_Data SET Binning_Data.Bin = "Pressure and Corrosion", Binning_Data.SubBin = "BDT-4-H-2B"
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND ((Binning_Data.[3013ContainerID]) Is Not Null) AND ((Binning_Data.SiteID)=1) AND ((Binning_Data.OrigMISRepresented)="Hanford-2B") AND ((Binning_Data.PGPerformed)="No"));

Query 15 Sets Bin to Pressure and Corrosion and Subbin to BDT-4-LLNL-WASHED where the 3013 is from Livermore and the material was washed.

UPDATE Binning_data INNER JOIN LLNL_Washed ON Binning_data.[3013ContainerID] = LLNL_Washed.[3013ContainerID] SET Binning_data.Bin = "Pressure and Corrosion", Binning_data.SubBin = "BDT-4-LLNL-WASHED"
WHERE (((Binning_data.Bin) Is Null) AND ((Binning_data.SubBin) Is Null) AND ((Binning_data.SiteID)=3) AND ((LLNL_Washed.Washed)="Yes"));

Query 16 Sets Bin to Pressure and Corrosion and Subbin to BDT-4-SR-AF where the 3013 is from SRS and the material is an oxide

UPDATE Binning_data INNER JOIN SRS_ARF ON Binning_data.[3013ContainerID] = SRS_ARF.[3013 Serial #] SET Binning_data.Bin = "Pressure and Corrosion", Binning_data.SubBin = "BDT-4-SR-ARF"
WHERE (((Binning_data.Bin) Is Null) AND ((Binning_data.SubBin) Is Null) AND ((Binning_data.SiteID)=5) AND ((Binning_data.PhysicalForm)="Oxide"));

Query 17 Sets Bin to Engineering Review and Subbin to ER-NoPG where the 3013 is oxide and actinide percent%>=.85 and no prompt gamma was performed

UPDATE Binning_data INNER JOIN PromptGamma_YesNo ON Binning_data.[3013ContainerID] = PromptGamma_YesNo.BestPG_3013ContainerID SET Binning_data.Bin = "Engineering Review", Binning_data.SubBin = "ER-NoPG"
WHERE (((Binning_data.Bin) Is Null) AND ((Binning_data.SubBin) Is Null) AND ((Binning_data.PhysicalForm)="Oxide") AND ((Binning_data.[TotalActinides(%)])>=0.85) AND ((PromptGamma_YesNo.PGPerformed)="No"));

Query 18 Sets Bin to Pressure and Subbin to BDT-5 where the 3013 is oxide and if the moisture method is not LOI with a moisture percent >=0.1 or if the moisture method is LOI and moisture percent >= 0.05

UPDATE Binning_Data SET Binning_Data.Bin = "Pressure", Binning_Data.SubBin = "BDT-5"
WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND ((Binning_Data.PhysicalForm)="Oxide") AND ((Binning_Data.MoistureMethod) Not Like "*LOI*") AND ((Binning_Data.MoisturePercent)>=0.1)) OR (((Binning_Data.Bin) Is Null)

AND ((Binning_Data.SubBin) Is Null) AND ((Binning_Data.PhysicalForm)="Oxide") AND ((Binning_Data.MoistureMethod) Like "*LOI*") AND ((Binning_Data.MoisturePercent)>=0.05));

Query 19 Sets Bin to Engineering Review and Subbin to ER where the 3013 is an oxide and no prompt gamma was performed.

UPDATE Binning_data INNER JOIN PromptGamma_YesNo ON Binning_data.[3013ContainerID] = PromptGamma_YesNo.tblPCDProcessed_3013ContainerID SET Binning_data.Bin = "Engineering Review", Binning_data.SubBin = "ER" WHERE (((Binning_data.Bin) Is Null) AND ((Binning_data.SubBin) Is Null) AND ((Binning_data.PhysicalForm)="Oxide") AND ((PromptGamma_YesNo.PGPerformed)="No"));

Query 20 Sets Bin to Engineering Review and Subbin to ER-Low F where the 3013 is an oxide and if the PredF% is >0 and the total actinides percent minus the U% is >=0.85.

UPDATE Binning_Data SET Binning_Data.Bin = "Engineering Review", Binning_Data.SubBin = "ER-Low F" WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND ((Binning_Data.[PredF%])>0) AND ((Binning_Data.PhysicalForm)="Oxide") AND (([Binning_Data]![TotalActinides(%)]-IIf(IsNull(-[Binning_Data]![U%]),0,[Binning_Data]![U%]))>=0.85));

Query 21 Sets Bin to Engineering Review and Subbin to ER where the 3013 is an oxide and if the total actinides percent minus the U% is <0.85.

UPDATE Binning_Data SET Binning_Data.Bin = "Engineering Review", Binning_Data.SubBin = "ER" WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND ((Binning_Data.PhysicalForm)="Oxide") AND (([Binning_Data]![TotalActinides(%)]-IIf(IsNull(-[Binning_Data]![U%]),0,[Binning_Data]![U%]))<0.85));

Query 22 Sets Bin to Innocuous and Subbin to BDT-6 where the 3013 is an oxide and the total actinides percent minus the U% is >=0.85.

UPDATE Binning_Data SET Binning_Data.Bin = "Innocuous", Binning_Data.SubBin = "BDT-6" WHERE (((Binning_Data.Bin) Is Null) AND ((Binning_Data.SubBin) Is Null) AND ((Binning_Data.PhysicalForm)="Oxide") AND (([Binning_Data]![TotalActinides(%)]-IIf(IsNull(-[Binning_Data]![U%]),0,[Binning_Data]![U%]))>=0.85));

Query 23 Sets the Bin and SubBin of the Engineering Review records to the Bin and Subbin from the last binning exercise (FY13). There were no Engineering Review records left after this update, so no records would be submitted for review.

```
UPDATE Binning_data INNER JOIN FY13_BinningResults ON
Binning_data.[3013ContainerID] = FY13_BinningResults.[3013ContainerID] SET
Binning_data.Bin = [FY13_BinningResults]![FY13Bin], Binning_data.SubBin =
[FY13_BinningResults]![FY13SubBin]
WHERE (((Binning_data.Bin)="Engineering Review"));
```