Evaluation of Isotopic Data Mismatches on DOE-STD-1027 Facility Categorization Inventories for the K-1065 Complex and the Above Grade Storage Facility (AGSF)

M.G. McHugh, G.H. Coleman
WESKEM, LLC
105 Mitchell Road, Suite 100, Oak Ridge, TN 37830
USA

ABSTRACT

The contents of a safety basis (SB) are based upon the facility's purpose of operation, radiological inventory, and safety systems in place to mitigate any releases to the employees, general public and environment. Specifically, the radiological inventory is used for facility categorizations (e.g., Category 2, Category 3) and determining the material at risk used in the associated nuclear safety analysis calculations. Radiological inventory discrepancies, referred to as "mismatches", have the potential to adversely impact the SB. This paper summarizes a process developed to: 1) identify these "mismatches" based on a facility's radiological inventory, 2) categorize these "mismatches" according to available data, and then 3) determine if these "mismatches" yield either trivial or significant cumulative impacts on credited assumptions associated with a particular facility's SB. The two facilities evaluated for "mismatches" were the K-1065 Complex and the Above Grade Storage Facility (AGSF). The randomly selected containers from each facility were obtained along with screening the radiological inventories found in the Waste Information Tracking System (WITS) database and the Request for Disposal (RFD) forms. Ideally, the radiological inventory, which is comprised of isotopic data for each container, is maintained in the WITS database. However, the RFD is the official repository record for isotopic data for each container. Historically, neither WITS nor the RFDs were required to contain isotopic data. Based on the WITS and RFD data, the containers were then categorized into five (5) separate conditions: Condition 1) Isotopic data in the RFD matches the isotopic data in WITS; Condition 2) Isotopic data in the RFD does not match the isotopic data in WITS; Condition 3) Isotopic data are in the RFD, but are not in WITS; Condition 4) No isotopic data in the RFD, but isotopic data are found in WITS; Condition 5) No isotopic data found in either the RFD or WITS. The results show trivial cumulative impacts (i.e., no inherent data biases) on credited assumptions associated with the K-1065 Complex and AGSF SBs. Recent random comparisons of WITS and RFDs continue to verify and validate that the administrative and procedural controls are adequate to ensure compliance with the SB for these facilities, thus providing a useful model for evaluating other facilities located at the Department of Energy's Oak Ridge Reservation (DOE-ORR).

INTRODUCTION

Title 10 of the Code of Federal Regulations, Part 830.3 defines *safety basis* (SB) as

> *"…the documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment".* (1)

The contents of an SB are based upon the facility's purpose of operation, radiological inventory, and safety systems in place to mitigate any releases to the employees, general public and environment. Specifically, the radiological inventory is used for facility categorizations (e.g., Category 2, Category 3) and determining the material at risk (MAR) used in the associated nuclear safety analysis (NSA) calculations (2, 3). Radiological inventory discrepancies, referred to as "mismatches" in this paper, have the potential to adversely impact the SB. This paper summarizes a process developed to: 1) identify these "mismatches" based on a facility's radiological inventory, 2) categorize these "mismatches" according to available data, and then 3) determine if these "mismatches" yield either trivial or significant cumulative impacts on credited assumptions associated with a particular facility's SB. The two facilities evaluated for "mismatches" in this paper were the K-1065 Complex and the Above Grade Storage Facility (AGSF) located in Oak Ridge, Tennessee (4).

HISTORICAL DEVELOPMENT OF THE RADIOLOGICAL INVENTORY SYSTEM

The Department of Energy's Oak Ridge Reservation (DOE-ORR) is comprised of three plants: the East Tennessee Technology Park (formerly known as the K-25 Site); the Y-12 Plant; and the Oak Ridge National Laboratory (ORNL). Because these plants continue to have such distinct missions, the types of waste materials they produce and the information needed to track these waste materials also vary.

Nevertheless, these waste materials must be tracked and managed when it is generated in accordance with federal and local regulatory requirements. A generator must completely and accurately declare the characteristics of the waste in order for the waste management organization to receive, handle, store, treat, repackage, transport and dispose of the waste appropriately. However, over time, each plant developed its own waste tracking system with multiple databases that resulted in collecting, reporting and managing waste information differently. For example, the information was managed on servers, desktops, and web-based applications resulting in a compilation of several interrelated systems utilized for tracking the various types of waste generated at the DOE-ORR.

FAT-CAT AND WITS

For the purposes of this paper, the radiological inventories of both facilities are maintained using the Facility Acceptance Testing - Container Analysis Tool (FAT-CAT), which extracts its data from the Waste Information Tracking System (WITS) database (5, 6). The database was deployed in three phases beginning in late 1997 with the conversion of the K-25 Waste Tracking and Reporting System (KWTARS) to WITS, followed by the conversion of the Y-12 Waste

Tracking System in early 1998, and conversion of the ORNL Waste Tracking System in mid-1999. The WITS database is designed as a model-driven, production-quantity application to provide cradle-to-grave tracking of waste. The information contained in WITS is comprised of project information obtained from Requests for Disposal (RFDs); sampling and analysis results; waste characterization; storage; repackaging; transportation and/or disposition. The information is used to assess and ensure quality, safety, and regulatory compliance of waste management activities. The WITS database is comprehensive enough to support the collection of information used in managing the following types of waste that includes, but is not limited to low-level radioactive waste, transuranic waste, Resource Conservation and Recovery Act (RCRA)/mixed wastes, Toxic Substances Control Act (TSCA) waste, and spent nuclear fuel.

The WITS database information enables sharing of information (e.g., generator, type of waste, point of origin, charge number) across departments and organizations, thus addressing the waste tracking and management information needs for various users. For example, waste coordinators, field technicians, sampling crew supervisors, facility technicians, data analysts, shipping coordinators, and project managers can access the same storage facility inventory data. The movement of waste containers (e.g., facility to facility, plant to plant, and ultimate disposition) is recorded in WITS using hand-held barcode readers that permit rapid inventory and summarize relevant container information such as location, history, and regulatory status.

Ideally, the radiological inventory, which is comprised of isotopic data for each container, is maintained in the WITS database. However, the RFD is the official repository record for isotopic data for each container. The RFD is a separate set of paperwork for recording specific container information (e.g., contents, type of waste, weight, volume, etc.). Historically, neither WITS nor the RFDs were required to contain isotopic data. However, there have been attempts to populate WITS with this information from the RFDs. For example, newly generated waste information and characterization data (e.g., non-destructive analysis [NDA]) are being added to the RFD files. Still, there are containers that: a) do not have any isotopic data, b) have unsupported isotopic data, or c) have inconsistent isotopic data in WITS and the RFDs.

QUANTIFYING RADIOLOGICAL INVENTORY BASED ON ESTIMATION

The overall radiological inventories of either facilities or containers are not simple sets of physical items that can be definitively quantified, for example, by counting each item like a "widget" (e.g., in integer values), where it is obvious to the casual observer whether one possesses five or six "widgets". In this specific situation, radioactivity, which is expressed in units of Becquerels (Bq) or Curies (Ci), generally represents a number of radioactive transitions (i.e., decays) per unit of time.

The decay of an unstable nucleus (i.e., radionuclide) is entirely random and it is impossible to predict when a particular atom will decay. However, it is equally likely to decay at any time. Therefore, given a sample of a particular radionuclide, the number of decay events expected to occur in a small interval of time dt is proportional to the number of atoms present. If N is the number of atoms, the following first-order differential equation can be written as shown in equation 1:

$$dN/dt = -\lambda N \qquad \text{(Eq. 1)}$$

Particular radionuclides decay at different rates, each having its own decay (i.e., transformation) constant (λ). The negative sign indicates that *N* decreases with each decay event. Therefore, if N_o is the initial number of atoms and *Exp* is the base of the system of natural logarithms, then *N(t)* is the amount remaining after time *t*. The solution to this equation is the following function shown in equation 2:

$$N(t) = N_o Exp(-\lambda t) \qquad \text{(Eq. 2)}$$

This function represents exponential decay. It is only an approximate solution for two reasons. The first reason is that the exponential function is continuous, but the physical quantity *N* can only take positive integer values. The second reason is that it describes a random process, having a probability of occurring per atom at any given time. However, in most common cases, *N* is a very large number and the function is a good approximation. These mathematical formulas provide a general estimation of the quantity of radioactivity present, but it is still simply a statistical estimation since radioactivity does not truly exist in integer quantities, even at the atomic level.

Measurement Values are Estimations

Measuring this estimation of radioactivity is even more difficult since it does not exist in a physical sense and can only be observed through the measurement of the radiation emitted during the decay process. Under ideal laboratory conditions, the estimated units of radioactivity in a given geometry and matrix can be quantitatively measured with reasonable uncertainties (e.g., less than 10%). Unfortunately, most radioactivity does not exist in ideal laboratory conditions, being heterogeneously spread as a contaminant (e.g., radioactive waste) that is heterogeneous in form (e.g., density, material type, distribution, etc.). To support the characterization of radioactive waste, the radiological data collected thus far consists of: a) laboratory analyses of small samples that, to some degree, represent the characteristics of an entire container, b) Non-Destructive Assay (NDA) of the material in the container, where the isotopic content of the container is determined by multiplying the measured penetrating (e.g., gamma-emitting) radiation from the container to a scaling or correction factor, based upon a generic model of the container and its contents, to indirectly estimate hard-to-measure (alpha- and beta-emitting) radionuclides, and/or c) historical process knowledge that estimates the isotopic content of the container. Therefore, any radiological inventory or isotopic data available begins with an approximate estimation of an estimated value, which in no case, is exact. Rather, it is an estimate of an estimate, whose true value lies somewhere within the uncertainty of the characterization (e.g., data collection and analysis) process.

Why Discuss This?

The above discussions on the radiological inventory and isotopic characterization processes were provided to ensure that the reader maintains an appropriate perspective. There is no "true" answer when discussing radiological inventory. The applicable question is whether the estimates are accurate to evaluate the credited assumptions, as follows:

- Is the MAR used to calculate the bounding radiological doses in the various NSA calculations found in the facility's SB?
- Is the facility's radiological inventory at or below the categorization threshold limit?

Therefore, data "mismatches" for individual containers may be trivial. If one datum point indicates that a container has 7.59E-6 Bq (2.05E-10 μCi) of uranium-238 (U-238) and another datum point indicates that it has 2.08E-4 Bq (5.61E-9 μCi) of U-238, the actual impact to the SB may not be significant. Still, one must keep in mind that neither value is "true". Instead, each individual datum point is an estimation of the "true" content, bearing in mind that the "true" value itself lies within the uncertainty (i.e., plus or minus within a certain percentage of the result) associated with the data characterization process. The significance of the uncertainty associated with the data "mismatch" must be compared, along with other "mismatches", to the probable cumulative impact on the credited assumptions associated with a particular facility's SB.

THE FIVE ISOTOPIC DATA CONDITIONS

Randomly selected containers from each facility were obtained along with screening the radiological inventories found in the WITS database and the RFD forms. Based on the WITS and RFD data, the containers were then categorized into five (5) separate conditions:

Condition 1) Isotopic data in the RFD matches the isotopic data in WITS.

To establish consistency, the first condition is ideal. Although the subject data are not necessarily "true", and are not necessarily representative of the activity in the container, the subject data are at least consistent. In this case, the overall facility's radiological inventory suggests that there will not be any adverse impacts to the credited assumptions.

Condition 2) Isotopic data in the RFD does not match the isotopic data in WITS.

Evaluation of the second condition is the primary intent of this document. In this case, conflicting data are found in each data system. It is the intention of this document to demonstrate that there is no inherent data bias that causes this condition to adversely impact the credited assumptions.

Condition 3) Isotopic data are in the RFD, but are not in WITS.

The third condition has a clear adverse impact on the credited assumptions. FAT-CAT pulls its data from WITS to ensure that the facility's inventory (2, 3) is maintained below the credited assumption values. However, if the data are not in WITS, then the data are not in FAT-CAT. To correct this adverse condition, all radiological containers with "zero" or "null" values in WITS (i.e., no Threshold Quantity [TQ] contribution in FAT-CAT), are procedurally assigned a facility-specific "hold-over" value in FAT-CAT. This "hold-over" value is derived from the average of all of the containers within the particular facility having radiological data. This practice assumes that the average of the total number of containers with data is representative of the average of the total number of containers without data. No mechanism has been identified to invalidate this assumption.

Condition 4) No isotopic data in the RFD, but isotopic data are found in WITS.

The fourth condition is more problematic. There is no automated mechanism for searching each RFD. Therefore, finding containers in this condition would require a 100% review of the RFD files. Therefore, it is assumed that there was a reason at the time the values were correct when entered into WITS, but the associated documentation was never included in the corresponding RFDs. The inclusion of untraceable values in WITS falls into the same category as those with "mismatches", but noting that data are not available to analyze the "mismatch" effects for these specific containers. Therefore, the data analysis provided herein regarding the "mismatched" containers (Second Condition) will also apply to these containers.

Condition 5) No isotopic data found in either the RFD or WITS.

Extensive reviews of the RFD files indicate that a majority of these containers were originally designated by the waste generator to be "Non-Rad" (i.e., contain no radioactive source term), but were later designated as radiological waste due to the absence of a programmatic "clearance" (e.g., free-release) program for bulk wastes. Therefore, since radiological data were not associated with these containers, radiological data were not part of the RFD files. This condition, similar to the third condition, could have an adverse impact upon the credited assumptions, especially if the container actually contained radioactivity. However, data were not available to support this assumption. Therefore, to correct this adverse condition, all radiological containers with "zero" or "null" values in WITS (i.e., no Threshold Quantity [TQ] contribution in FAT-CAT), are procedurally assigned a facility-specific "hold-over" value in FAT-CAT.

SCREENING RESULTS

This paper applied all 5 isotopic data conditions to the K-1065 Complex and AGSF to evaluate any inherent data biases that could adversely impact their respective SBs.

K-1065 Complex

To specifically evaluate radiological inventory data "mismatches", 96 containers in storage were randomly selected from the current facility inventory of ~ 11,200 containers (7). Of the 96 containers chosen, 47 containers (~ 49 %) exhibited identical radiological inventory data in WITS and the associated RFD files (Condition 1). Of the remaining 49 containers, 13 did not have data in the RFD files or WITS (i.e., "nulls," Condition 5). Of the remaining 36 containers, 12 did have data in WITS, but did not have data in the RFD files (Condition 4). This left 21 of the remaining 24 containers as true "mismatches" (i.e., Condition 2). The remaining three containers had data in the RFD files, but did not have data in WITS (Condition 3). In these three Condition 3 containers, the "hold-over values" conservatively bounded the RFD values.

Table I summarizes the information associated with these 96 containers consisting of container identification numbers (i.e., Container ID), whether the WITS data matched the RFD data

(Yes/No), the isotopic data condition (1 through 5), the Holdover TQ, WITS TQ, RFD TQ, Comments and Mismatch TQ. If the RFD and WITS TQs did not match (i.e., a Condition 2 “mismatch” identified by a “No” response in column 2), the Mismatch TQ was calculated according to equation 3:

$$\text{Mismatch TQ} = \text{RFD TQ} - \text{WITS TQ} \qquad \text{(Eq. 3)}$$

The total magnitude of any “mismatches” found in the randomly selected population was a “negative” 0.0165 (i.e., -0.0165) Cat 3 TQ. This negative result suggested the WITS/FAT-CAT data were conservative in comparison to the data in the RFD files. The total radiological inventory (TRI) based on the selected population was then recalculated using equation 4:

$$\text{TRI} = \text{Holdover TQ} + \text{WITS TQ} \qquad \text{(Eq. 4)}$$

When compared to the TRI based on the selected population having a 4.77E-2 Cat 3 TQ, the FAT-CAT tool overestimated the radiological inventory represented in the RFD files, as in this case, by (1.65E-02/4.77E-02) * 100% = ~35%. Numerous mechanisms have already been mentioned that would cause this conservative bias in the “mismatch”. The most common human performance error contributing to this bias typically resulted from assigning the entire radiological inventory of a shipment or multi-container RFD to each container in that RFD.

To assess the conservative nature of this evaluation, the highest conservative “mismatch” datum point of a specific container identified in Table I (Container Y12C9918827) was excluded as a potential outlier. The result is a total Mismatch TQ of 6.10E-04. This contribution of ~1.3% is relatively minor in comparison to the standard 10% uncertainty margin that is administratively and procedurally maintained by the FAT-CAT program.

Table I. Spreadsheet of Randomly Selected Containers

Container ID	Match?	Condition	Holdover TQ	WITS TQ	RFD TQ	Comments	Mismatch TQ
E91001622	N	5	1.16E-03	Null	No rad data		
E91001640	N	3	1.16E-03	Null	1.58E-07	Holdover conservative	
K25C0001362	Y	1		1.09E-06	1.09E-06		
K25C0007648	Y	1		1.23E-06	1.23E-06		
K25C0102186	Y	1		1.41E-07	1.41E-07		
K25C0202445	Y	1		6.30E-05	6.30E-05		
K25C0204427	Y	1		1.38E-07	1.38E-07		
K25C0204578	Y	1		1.09E-08	1.09E-08		
K25C0300195	Y	1		1.41E-08	1.41E-08		
K25C0301548	Y	1		9.25E-04	9.25E-04		
K25C0301554	Y	1		9.25E-04	9.25E-04		
K25C0301895	Y	1		1.32E-07	1.32E-07		
K25C0302338	Y	1		1.32E-07	1.32E-07		
K25C0302416	Y	1		7.55E-08	7.55E-08		
K25C9300765	Y	1		2.64E-04	2.64E-04		
K25C9307338	N	4		1.87E-07	No rad data		
K25C9308316	Y	1		2.31E-06	2.31E-06		
K25C9310251	N	5	1.16E-03	Null	No rad data		
K25C9310656	N	4		3.49E-05	No rad data		
K25C9310671	N	2		3.49E-05	0	NDA not updated	-3.49E-05
K25C9313776	N	2		3.81E-04	1.27E-05	U not updated	-3.68E-04
K25C9319491	N	4		3.49E-05	No rad data		
K25C9319615	N	4		3.49E-05	No rad data		
K25C9320625	N	4		5.41E-05	No rad data		
K25C9329251	N	4		3.00E-07	No rad data		
K25C9329362	N	5	1.16E-03	Null	No rad data		
K25C9334092	N	2		8.15E-04	3.98E-05	WITS conservative	-7.75E-04
K25C9336133	N	4		2.83E-07	No rad data		
K25C9336208	N	4		1.05E-07	No rad data		
K25C9338269	N	4		7.15E-07	No rad data		
K25C9404404	N	2		3.49E-05	1.39E-06	WITS conservative	-3.35E-05
K25C9407551	N	5	2.21E-04	Null	No rad data		
K25C9407568	N	4		4.63E-07	No rad data		
K25C9500751	N	4		5.41E-05	No rad data		
K25C9504533	N	2		3.49E-05	1.54E-08	WITS conservative	-3.49E-05

Container ID	Match?	Condition	Holdover TQ	WITS TQ	RFD TQ	Comments	Mismatch TQ
K25C9602862	N	5	1.07E-04	Null	No rad data	RFD says not rad	
K25C9603359	Y	1		6.26E-05	6.26E-05		
K25C9605470	N	5	1.07E-04	Null	No rad data	PK says non-rad	
K25C9712706	N	2		8.18E-14	6.81E-05		6.81E-05
K25C9725026	N	3	1.07E-04	Null	7.34E-06		
K25C9735820	Y	1		7.84E-05	7.84-5		
K25C9735845	N	2		4.39E-05	7.37E-04		6.93E-04
K25C9814302	N	2		1.39E-05	2.91E-07	NDA report in folder	-1.36E-05
K25C9814341	N	2		1.39E-05	0	NDA report in folder	-1.39E-05
K25C9814383	N	2		1.39E-05	0.00E+00	NDA report in folder	-1.39E-05
K25C9836857	N	5	1.07E-04	Null	No rad data	RFD says non-rad	
K25C9900221	N	2		4.97E-07	0.00E+00	NDA report in folder	-4.97E-07
K25S9800001	N	4		3.18E-04	No rad data		
X10C0011071	N	2		2.60E-06	2.94E-06		3.40E-07
X10C9302068	Y	1		7.94E-08	7.98E-08		
X10C9308845	N	2		4.95E-10	4.95E-10	Isotopes do not match	0.00E+00
X10C9403570	Y	1		4.46E-07	4.46E-07		
X10C9403580	Y	1		4.46E-07	4.46E-07		
X10C9500877	N	5	1.07E-04	Null	No rad data	RFD says not rad	
X10C9502808	N	2		3.40E-05	3.47E-05	Isotopes do not match	7.00E-07
X10C9600473	N	2		1.60E-04	8.60E-04	Isotopes do not match	7.00E-04
X10C9700209	Y	1		1.76E-04	1.76E-04		
X10C9701774	Y	1		1.24E-04	1.24E-04		
X10C9702279	Y	1		9.99E-08	9.99E-08		
Y12C0010164	Y	1		5.68E-07	5.68E-07		
Y12C0101608	Y	1		4.10E-05	4.10E-05		
Y12C0105138	Y	1		6.58E-10	6.58E-10		
Y12C0107451	Y	1		2.99E-06	2.99E-06		
Y12C0109110	N	2		1.39E-05	2.77E-05	Isotopes do not match	1.38E-05
Y12C0202205	Y	1		7.54E-08	7.54E-08		
Y12C0202624	Y	1		1.03E-03	1.03E-03		
Y12C0203148	Y	1		2.32E-04	2.32E-04		
Y12C0205340	Y	1		1.11E-09	1.11E-09		
Y12C0205735	Y	1		5.84E-08	5.84E-08		
Y12C0206194	Y	1		9.18E-06	9.18E-06		
Y12C0206592	Y	1		1.16E-08	1.16E-08		
Y12C0206593	Y	1		1.16E-08	1.16E-08		
K25C9602862	N	5	1.07E-04	Null	No rad data	RFD says not rad	

Container ID	Match?	Condition	Holdover TQ	WITS TQ	RFD TQ	Comments	Mismatch TQ
Y12C0207116	Y	1		8.80E-05	8.80E-05		
Y12C0208590	Y	1		1.58E-08	1.58E-08		
Y12C0209316	Y	1		3.30E-10	3.30E-10		
Y12C0211514	N	5	6.05E-04	Null	No rad data	RFD says non-rad	
Y12C0211550	Y	1		1.07E-02	1.07E-02		
Y12C0301209	Y	1		3.00E-04	3.00E-04		
Y12C0305368	N	3	6.05E-04	Null	2.03E-06		
Y12C0308895	Y	1		1.13E-07	1.13E-07		
Y12C0308921	Y	1		6.90E-07	6.90E-07		
Y12C0308923	Y	1		7.13E-07	7.13E-07		
Y12C9304565	N	5	6.05E-04	Null	No rad data	RFD says non-rad	
Y12C9402036	Y	1		2.88E-09	2.88E-09	RFD says non-rad	
Y12C9702884	Y	1		4.34E-05	4.34E-05		
Y12C9703374	N	5	3.08E-04	Null	No rad data	RFD says non-rad	
Y12C9801412	N	2		0.00E+00	3.70E-07		3.70E-07
Y12C9804532	Y	1		5.05E-07	5.05E-07		
Y12C9812972	Y	1		1.40E-06	1.40E-06		
Y12C9915307	N	2		1.05E-06	5.30E-03	isotopes don't match	5.30E-03
Y12C9917236	N	2		4.88E-03	2.52E-06	WITS Conservative	-4.88E-03
Y12C9918312	Y	1		5.53E-10	5.53E-10		
Y12C9918827[a]	N	2		1.77E-02	6.49E-04	WITS conservative	-1.71E-02
Y12C9920983	N	2		1.90E-05	2.04E-05	U-234 not in WITS	1.40E-06
Y12C9925586	N	5	3.08E-04	Null	No rad data	RFD says non-rad	
Σ = 96 Containers			Σ = 7.93E-03	Σ = 3.98E-02	Σ = 2.28E-02		Σ = -1.65E-02

a = Potential outlier

AGSF[1]

This evaluation was also performed on the AGSF facility inventory of approximately 3,400 containers that reported a radiological inventory of 0.72 Cat 3 TQs based on data in WITS (Conditions 1, 2, and 4). An additional "hold-over" value of 0.15 Cat 3 TQs was included in the FAT-CAT inventory to account for "zero" and "null" data sets identified in WITS to correct for Conditions 3 and 5.

Of the 89 containers randomly chosen from the AGSF to evaluate any "mismatches", 77 containers (i.e., ~ 87%) exhibited identical radiological inventory data in WITS and associated RFD files (i.e., Condition 1). Of the remaining 12 containers, four did not have data in the RFD files or WITS (i.e., "nulls," Condition 5). Of the remaining eight containers, six had data in WITS, but did not have data in the RFD files (i.e., Condition 4). The remaining two containers were true "mismatches" (i.e., Condition 2). Of these two containers, the "mismatches" were 7.69E-8 and 4.20E-8 Cat 3 TQs.

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[1] Due to page limitations, the spreadsheet of randomly selected containers from the AGSF was not included in this paper.

A linear correction factor was calculated by projecting the 89 containers over the total container population. This correction factor of 39 was then multiplied by the average "mismatch" value of 5.95E-8 Cat 3 TQs, yielding a projected "mismatch" magnitude of 2.32E-6 Cat 3 TQ, which is minor (i.e., <1.00E-3%) in comparison to the total facility TQ fraction of 0.86.

It is understood by the authors that a thorough statistical analysis is not meaningful on such a small number of "mismatches". However, if the magnitude of the "mismatches" was increased by three orders of magnitude (i.e., multiplied by 1,000 - an arbitrarily large factor) and extended to the six Condition 4 containers identified, and then projected over the entire container population, the resultant potential "mismatch" would be ~ 0.0092 Cat 3 TQs. This is still only ~1.1% of the total facility TQ fraction of 0.86. Similar to the K1065 Complex, this result is minor in comparison to the standard 10% uncertainty margin that is administratively and procedurally maintained by the FAT-CAT program.

CONCLUSION

The fundamental purpose for tracking cradle-to-grave waste information (e.g., data acquisition, verification, summarization, and reporting) electronically is to make the information, from generation through disposition, readily available to employees. This information then allows the employees to maintain and continuously improve their operations within the defined limits of a facility's SB. However, the radiological inventories of the K-1065 Complex and AGSF are neither absolutely complete nor consistent between the record RFD files and the WITS database from which the FAT-CAT program withdraws its data. However, intensive field characterization efforts and the preparation of WITS change logs provide continuous improvement as "mismatches" and potential outliers are discovered and reevaluated. Furthermore, after implementing the five isotopic data conditions and follow-up random checks of RFDs vs. WITS data, the observed remaining data gaps and "mismatches" have been compared to the 10% uncertainty factor, and accounted for by administratively operating FAT-CAT at 90% of the facility's categorization threshold limit. Thus far, results show there are trivial cumulative impacts (i.e., no inherent data biases) on credited assumptions associated with the K-1065 Complex and AGSF SBs. Recent random comparisons of WITS and RFDs continue to verify and validate that the administrative and procedural controls are adequate to ensure compliance with the SB for these facilities, thus providing a useful model for evaluating other facilities located at the ORR.

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ACKNOWLEDGEMENTS

The authors wish to thank Doris Becker for her assistance in preparing this paper for publication.

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