UCRL-ID-136223

Form Development Sample Test Matrix

B.B. Ebbinghaus

October 15, 1999

U.S. Department of Energy

Lawrence
Livermore
National
Laboratory

Approved for public release; further dissemination unlimited

DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

Work performed under the auspices of the U. S. Department of Energy by the University of California Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

This report has been reproduced
directly from the best available copy.

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information
P.O. Box 62, Oak Ridge, TN 37831
Prices available from (423) 576-8401
http://apollo.osti.gov/bridge/

Available to the public from the
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Rd.,
Springfield, VA 22161
http://www.ntis.gov/

OR

Lawrence Livermore National Laboratory
Technical Information Department's Digital Library
http://www.llnl.gov/tid/Library.html

PIP Approval Sheet

Approved: Principal Investigator(s)

Signature: 10-13-99
Name: Date:

Approved:

Signature: _____
Name: Date:

Approved: Site Leader

Signature: _____
Name: Date:

Approved: Task Leader

Signature: 10-13-99
Name: Date:

Approve: Activity Leader

Signature: 10/13/99
Name: Date:

Approved: Project Manager

Signature: _____
Name: Date:

Sample Text Matrix

This document summarizes the status of sample fabrication and analysis in the Form Development Sample Test Matrix. Since its publication in the "Baseline Formulation" report (UCRL-ID-133089, PIP-99-012) and in the "Complete Single-Phase Sample Fabrications that Support the Licensing Application and Complete Process and Compositional Extreme Sample Fabrications that Support the Licensing Application" report (PIP-99-078), the Sample Test Matrix has been updated and expanded. This version is current though September 30, 1999.

Headings used in each of the Tables are as follows:

Sub-Series. The ID for the sample, composition, or series. Each composition typically corresponds to between 2 and 12 samples, and each series typically corresponds to between 2 and 12 compositions.

Site(s). The sites involved in the preparation of the sample, composition, or series. If this column is blank, the sample, composition, or series has very low priority at this time.

Target Composition. A general description of the sample composition or range of compositions.

Pu Sample. The sample contains plutonium. If the particular sample identified contains Pu, then a "Y" is used in this column. If the particular sample identified does not contain Pu, then a "N" is used in this column. If the sample contains ^{238}Pu or ^{244}Cm, then a "Y/^{238}Pu" or a "Y/^{244}Cm" appears in this column.

Impurity Elements. The description of the impurity elements added to the sample, composition, or series. This column is left blank if the impurities are already included in the "Target Composition."

Impurity Amount. The total amount of impurities added. This includes only those impurities identified in the Impurity Elements column and not any impurities that happen to be identified by the "Target Composition."

Fabricated. The sample, composition or series has been fabricated. The site fabricating the sample identified is the same as appears in the "Site(s)" column.

Density. The density of the sample has been determined. Generally, this is a geometric (i.e. bulk) density or an Archimedes (i.e. apparent) density. These measurements are being performed at all of the participating sites.

XRD. Mineralogical composition of the sample has been determined by X-ray diffraction on the ceramic sample. This type of analysis is being performed at all of the participating sites.

SEM. Sample has been photographed by scanning electron microscopy. This type of analysis is being performed at all of the participating sites.

Microprobe or Q-EDS. Sample has been analyzed to determine the elemental composition of the mineral constituents. Electron microprobe analysis is being performed at LLNL. Quantitative EDS is being performed at ANL and ANSTO.

TEM. Sample has been analyzed by transmission electron microscopy. This type of analysis is being performed at ANL.

MCC-1. Durability tests on monoliths of ceramic material have been completed. This includes but is not necessarily limited to the MCC-1 tests. These types of tests are being performed primarily at ANL and ANSTO.

SPFT. Durability tests on powdered ceramic material have been completed. This includes but is not necessarily limited to the Single Pass Flow Through Tests. These types of tests are being performed at ANSTO, LLNL, and PNNL.

Ion Beam. Sample has been ion beam irradiated. These samples are fabricated at PNNL and/or SRTC.

SI-XRF. The self induced X-ray fluorescence has been measured. Measurements on non-Pu materials are have been performed at LBNL and measurements on Pu materials are performed at LLNL.

Enthalpy. The standard enthalpy of formation at 298 K has been determined. The datum is obtained by drop solution calorimetry measurements. These measurements on non-Pu materials are being performed at UCD and measurements on Pu materials will be performed at LANL in the near future.

Entropy. The standard entropy at 298 K has been determined. The datum is obtained by integrating the low temperature heat capacity measurements. These measurements on non-radioactive materials are being performed at BYU. Measurements on radioactive materials are not planned.

Additional Samples. The preparation of additional samples is required. More material is needed, the sample was not successfully prepared, or the fabrication of the required sample has not yet been attempted.

Table 1. The Series A Samples Matrix

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*mpurity Amount*	*Fabricated*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalp y*	*Entropy*	*Additional Samples*
A-0	ANL	Baseline	N	None	0	Y	Y	Y	Y	N	X	Y	X	X	X	X	X	N
			Y			Y	Y	Y	Y	N	Y	Y	X	X	Y	X	X	N
	ANSTO		N			X	X	X	X	X	?	X	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	?	Y	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	Y	Y	X	?	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	N	N	?	Y^{ANL}	?	X	Y	X	X	N
	PNNL (Hbase6)		N			Y	Y	Y	Y	X	X	Y^{WSRC}	?	Y	X	X	X	N
			Y			Y	Y	Y	N	X	X	N	?	X	X	X	X	N
			Y/^{238}Pu			Y	Y	N	N	X	X	N	?	X	X	X	X	N
	SRS		N			Y	Y	Y	Y	X	?	?	X	X	X	X	X	N
			Y			Y	Y	Y	?	X	X	Y^{ANL}	X	X	X	X	X	N
	BOCHVAR		N			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
	RADIUM		N			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			Y	Y	Y	Y	?	X	Y	X	X	X	X	X	N
	RIAR		N			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			Y	Y	Y	X	X	X	P	X	X	X	X	X	N
			Y/^{238}Pu			P	N	N	N	N	X	X	X	X	X	X	X	Y
			Y/^{244}Cm			N								X	X	X	X	Y
A-1	LLNL	Typical Impure Oxide	N	All	2.8%	Y	Y	Y	Y	X	?	?	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	N	Y	?	?	X	X	N	X	X	N
	SRS		N			Y	Y	Y	Y	N	?	?	X	X	N	X	X	N
A-2	LLNL	ZPPR Fuel	N	MoO_3, Al_2O_3	0.6%	Y	Y	Y	Y	?	?	?	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	Y	Y	?	?	X	X	N	X	X	N
A-3	ANSTO	Atypical Impure Metal	N	Ga_2O_3, MgO, Al_2O_3, Fe_2O_3, Ta_2O_5, NiO, WO_3	2.2%	Y	Y	Y	Y	Y	X	Y	X	X	N	X	X	N
			Y			Y	Y	Y	Y	Y	X	Y	X	X	N	X	X	N
A-4	LLNL	Atypical Clean Metal	N	Ga_2O_3, ZnO,MgO	0.3%	Y	Y	Y	Y	?	?	?	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	Y	Y	?	?	Y	X	N	X	X	N
A-5	ANSTO	U/Pu Oxides	N	Al_2O_3, MgO, Fe_2O_3, MoO_3	1.0%	Y	Y	Y	Y	Y	X	Y^{ANL}	X	X	N	X	X	N
			Y			Y	Y	Y	Y	Y	X	Y^{ANL}	X	X	N	X	X	N
A-6	LLNL	Pu Alloys	N	Al_2O_3, MgO	1.2%	Y	Y	Y	Y	?	?	?	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	Y	Y	?	?	X	X	N	X	X	N
	SRS		N			Y	Y	Y	Y	X	Y	N	X	X	N	X	X	N

A-7	ANSTO	Average	N	All	1.5%	Y	Y	Y	Y	Y	X	Y^{ANL}	X	X	X	X	X	N
		Impurity	Y			Y	Y	Y	Y	Y	X	Y^{ANL}	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	?	?	?	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	Y	Y	N	?	X	X	N	X	X	N
	SRS		N			Y	Y	Y	Y	X	?	?	X	X	X	X	X	N
A-8	ANSTO	Extreme Oxide	N	All	13.0%	Y	Y	Y	Y	Y	X	Y	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	X	Y	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	?	?	Y^{ANL}	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	Y	Y	?	X	X	X	N	X	X	N
	SRS		N			Y	Y	Y	Y	X	?	X	X	X	X	X	X	N
A-9	ANL	Intermediate	N	All	5.1%	Y	Y	Y	Y	X	N	Y	X	X	X	X	X	N
		Impurity	Y			Y	Y	Y	Y	X	N	Y	X	X	X	X	X	N
	ANSTO		N			Y	Y	Y	Y	Y	X	Y	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	X	Y	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	?	?	Y^{ANL}	X	X	Y^{LBNL}	X	X	N
			Y			Y	Y	N	Y	Y	?	Y^{ANL}	X	X	N	X	X	N
	PNNL		N			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			Y			Y	Y	Y	N	X	X	N	?	X	X	X	X	N
			Y/^{238}Pu			Y	Y	N	N	X	X	N	?	X	X	X	X	N
	SRS		N			Y	Y	Y	Y	Y	Y	N	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 2. Series B0 Samples (Single Phases)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabricated*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B0-1	ANSTO	$CaZrTi_2O_7$	N	None	N/A	Y	X	Y	Y	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	X	X	X	X	X	X	Y^{UCD}	Y	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
	UCD		N			X	X	X	X	X	X	X	X	X	X	X	X	N
B0-2	ANSTO	$CaHfTi_2O_7$	N	None	N/A	Y	X	Y	Y	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	X	X	X	X	X	X	X	X	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
	UCD		N			Y	X	Y	Y	Y	X	X	X	X	X	Y	Y	N
B0-3	ANSTO	$CaCeTi_2O_7$	N	None	N/A	Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
	UCD		N			Y	X	Y	Y	Y	?	X	X	X	X	Y	$?^{BYU}$	Y
B0-4	ANSTO	$CaPuTi_2O_7$	Y	None	N/A	P	X	P	P	X	X	X	?	X	X	X	X	N
	LLNL		Y			P	X	N	N	N	X	X	X	X	X	$!^{LANL}$	X	?
B0-5	ANSTO	$CaUTi_2O_7$	N	None	N/A	Y	X	Y	Y	X	X	X	?	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	X	X	X	X	X	X	Y^{UCD}	X	N
	SRS		N			P	X	P	X	X	X	X	X	X	X	X	X	N
B0-6	ANSTO	$Gd_2Ti_2O_7$	N	None	N/A	Y	X	Y	Y	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	X	X	X	X	X	X	Y^{UCD}	Y^{BYU}	N
	PNNL		N			Y	X	Y	?	X	X	X	X	X	X	X	X	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
B0-7	ANSTO	$CeTi_2O_6$	N	None	N/A	Y	X	Y	Y	X	X	X	X	X	X	Y^{UCD}	Y^{BYU}	N
	LLNL		N			Y	X	Y	Y	X	X	X	X	X	X	X	X	N
	PNNL (HCB1x)		N			Y	Y	Y	?	X	X	Y^{WSRC}	X	Y	X	X	X	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
B0-8	ANSTO	$PuTi_2O_6$	Y	None	N/A	Y	X	Y	Y	X	X	X	Y	X	X	X	X	N
	LLNL		Y			!	X	N	N	X	X	X	X	X	X	$!^{LANL}$	X	?
B0-9	ANSTO	UTi_2O_6	N	None	N/A	Y	X	Y	Y	X	X	X	Y	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	Y	X	X	Y	X	X	Y^{UCD}	N	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
B0-10	BYU	$CaTiO_3$	N	None	N/A	X	X	Y	Y	X	X	X	X	X	X	Y^{UCD}	Y	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
B0-11	PNNL (HZirc5x)	Zirconolite ss (Ce)	N	None	N/A	Y	Y	Y	?	X	X	Y^{WSRC}	X	Y	X	X	X	N
	SRS					Y	X	Y	X	X	X	!	X	X	X	X	X	N

B0-12	PNNL (Pyro17)	Pyrochlore ss (Ce)	N	None	N/A	Y	Y	Y	?	X	X	Y[WSRC]	X	Y	X	X	X	N
B0-13	PNNL	Brannerite ss (Ce)	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B0-14	ANL	Glass (Ce)	N	None	N/A	Y	X	X	X	X	X	X	X	X	X	X	X	N
	SRS		N			Y	X	Y	X	X	X	X	X	X	X	X	X	N
B0-15	PNNL	Zirconolite ss (Pu)	Y	None	N/A	Y	Y	Y	N	X	X	N	?	X	X	X	X	N
			Y/^{238}Pu			Y	Y	N	N	X	X	N	?	X	X	X	X	N
B0-16	PNNL	Pyrochlore ss (Pu)	Y	None	N/A	Y	Y	Y	N	X	X	N	?	X	X	X	X	N
			Y/^{238}Pu			Y	Y	N	N	X	X	N	?	X	X	X	X	N
B0-17	PNNL	Brannerite ss (Pu)	Y	None	N/A	P	P	P	N	X	X	X	?	X	X	X	X	?
			Y/^{238}Pu			N	N	N	N	X	X	X	?	X	X	X	X	?
B0-18	ANL	Glass (Pu)	Y	None	N/A	Y	X	N	N	X	X	Y	X	X	X	X	X	N
	SRS		Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B0-19	PNNL	Brannerite ss (Th)	N	None	N/A	Y	Y	Y	N	X	X	X	X	X	X	X	X	N
B0-20	ANSTO	Perovskite ss (Pu)	Y	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B0-21	ANSTO	Perovskite ss (Ce)	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B0-22	LLNL	Ca Phosphate (Pu)	Y	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
	ANL		Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B0-23	LLNL	Ca Phosphate (Ce)	N	None	N/A	Y	X	Y	Y	N	!	X	X	X	X	X	X	N
	ANL		N			X	X	X	X	X	X	X	X	X	X	X	X	N
B0-24	SRS	Rutile ss	N	None	N/A	Y	X	Y	X	X	X	X	X	X	X	X	X	N
B0-25	UCD	$CaHf_{1/2}Zr_{1/2}Ti_2O_7$	N	None	N/A	Y	X	Y	Y	?	X	X	X	X	X	Y	X	N
B0-26	UCD	$CaHf_{1/4}Zr_{3/4}Ti_2O_7$	N	None	N/A	Y	X	Y	Y	?	X	X	X	X	X	Y	X	N
B0-27	UCD	$CaHf_{3/4}Zr_{1/4}Ti_2O_7$	N	None	N/A	Y	X	Y	Y	?	X	X	X	X	X	Y	Y[BYU]	N
B0-28	UCD	$ZrTiO_4$	N	None	N/A	Y	X	Y	Y	?	X	X	X	X	X	Y	Y[BYU]	N
B0-29	UCD	$HfTiO_4$	N	None	N/A	Y	X	Y	Y	?	X	X	X	X	X	Y	X	N
B0-30	ANSTO	Zirc w/2+ Imp (Ce)	N	MgO	Max	Y	Y	Y	Y	N	X	X	X	X	X	![UCD]	?	N
B0-31	ANSTO	Zirc w/3+ Imp (Ce)	N	Al_2O_3	Max	Y	Y	Y	Y	N	X	X	X	X	X	![UCD]	?	N
B0-32	ANSTO	Pyro w/5+ Imp (Ce)	N	Ta_2O_5	Max	Y	Y	Y	Y	N	X	X	X	X	X	?	X	N
B0-33	ANSTO	Pyro w/6+ Imp (Ce)	N	MoO_3	Max	P	P	P	X	X	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In Progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 3. Series B1 Samples (Near Equilibrium)

Sub-Series	Site(s)	Target Composition	Pu Sample	Impurity Elements	Impurity Amount	Fabricated	Density	XRD	SEM	Microprobe or Q-EDS	TEM	MCC-1	SPFT	Ion Beam	SI-XRF	Enthalpy	Entropy	Additional Samples
B1-1	ANSTO	A-0 (Pu)	Y-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		Y-A			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-2	ANSTO	A-0 (Th)	N-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		N-A			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B1-3	ANSTO	A-9 (Pu)	Y-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		Y-A			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-4	ANSTO	A-9 (Th)	N-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		N-A			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-5		B3-1 (Pu)	Y-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-6		B3-1 (Th)	N-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-7		B3-2 (Pu)	Y-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N

B1-8		B3-2 (Th)	N-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-9	ANSTO	B3-3 (Pu)	Y-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B1-10	ANSTO	B3-3 (Th)	N-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		N-A			X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-11	ANSTO	B3-4 (Pu)	Y-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B1-12	ANSTO	B3-4 (Th)	N-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		N-A			X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-13	ANSTO	B3-9 (Pu)	Y-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B1-14	ANSTO	B3-9 (Th)	N-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B1-15	ANSTO	B3-11 (Pu)	Y-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B1-16	ANSTO	B3-11 (Th)	N-A	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-W			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B1-17	LLNL	B3-13 (Pu)	Y-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			Y	Y	N	Y	Y	X	Y[ANI.]	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-18	LLNL	B3-13 (Th)	N-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
			N-D			Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
B1-19	LLNL	B3-17 (Pu)	Y-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N

B1-20	LLNL	B3-17 (Th)	N-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-21	LLNL	B3-19 (Pu)	Y-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y-D			X	X	X	X	X	X	X	X	X	X	X	X	N
B1-22	LLNL	B3-19 (Th)	N-A	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-W			X	X	X	X	X	X	X	X	X	X	X	X	N
			N-D			X	X	X	X	X	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 4. Series B2 Samples (Equilibrium Phase Diagram)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabricated*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B2-1	ANL	$CaTiO_3$-$CeTi_2O_6$-$HfTiO_4$	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
B2-2	LLNL	$CaTiO_3$-$ThTi_2O_6$-$HfTiO_4$	N	None	N/A	P	N	N	N	N	X	X	X	X	X	X	X	Y
B2-3	ANL	$CaTiO_3$-UTi_2O_6-$HfTiO_4$	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	Y
B2-4	ANL	$CaTiO_3$-$PuTi_2O_6$-$HfTiO_4$	Y	None	N/A	P	P	N	N	N	X	X	X	X	X	X	X	Y
	LLNL		Y			P	N	N	N	N	X	X	X	X	X	X	X	Y
B2-5		$CaZrTi_2O_7$-$Gd_2Ti_2O_7$	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B2-6	ANSTO	$CaHfTi_2O_7$-$Gd_2Ti_2O_7$	N	None	N/A	Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL	"	N			Y	Y	Y	Y	Y	N	X	X	X	X	X	X	N
B2-7	ANSTO	$CaHfTi_2O_7$-$CaCeTi_2O_7$-	N	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL	$Gd_2Ti_2O_7$				Y	X	Y	Y	Y	N	X	X	X	X	X	X	N
B2-8	ANSTO	$CaHfTi_2O_7$-$CaThTi_2O_7$- $Gd_2Ti_2O_7$	N	None	N/A	Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
B2-9	ANSTO	$CaHfTi_2O_7$-$CaUTi_2O_7$-	N	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL	$Gd_2Ti_2O_7$	N			Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B2-10	ANSTO	$CaHfTi_2O_7$-$CaPuTi_2O_7$-	Y	None	N/A	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL	$Gd_2Ti_2O_7$	Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B2-11		CaO-ZrO_2-TiO_2	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B2-12	ANSTO	CaO-HfO_2-TiO_2	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B2-13	ANSTO	CaO-CeO_2-TiO_2	N	None	N/A	N	N	N	N	N	X	X	X	X	X	X	X	Y
	LLNL		N			Y	X	Y	Y	Y	X	X	X	X	X	X	X	N
B2-14	ANSTO	CaO-ThO_2-TiO_2	N	None	N/A	N	N	N	N	N	X	X	X	X	X	X	X	Y
B2-15	ANSTO	CaO-UO_2-TiO_2	N	None	N/A	N	N	N	N	N	X	X	X	X	X	X	X	Y
B2-16	ANSTO	CaO-PuO_2-TiO_2	Y	None	N/A	N	N	N	N	N	X	X	X	X	X	X	X	Y

Y = Yes, N = No, S = Some, P = Partial Completion or In progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 5. Series B3 Samples (Process and Compositional Extremes)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabricated*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B3-1		~95% Pyrochlore (Pu)	Y	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B3-2		Low in Gd and Hf (Pu)	Y	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
B3-3	ANL	Zirconolite-rich (Pu)	Y	None	N/A	Y	Y	Y	Y	N	X	Y	X	X	X	X	X	N
	PNNL		Y			Y	Y	Y	N	X	X	N	X	X	X	X	X	N
			Y/^{238}Pu			Y	Y	N	N	X	X	N	X	X	X	X	X	N
	SRS		Y			Y	Y	Y	N	X	X	Y^{ANL}	X	X	X	X	X	N
B3-4	ANL	Brannerite-rich (Pu)	Y	None	N/A	Y	Y	Y	Y	N	N	Y	X	X	X	X	X	N
	SRS		Y			Y	Y	Y	N	X	X	Y^{ANL}	X	X	X	X	X	N
B3-5	LLNL	95% Pyrochlore (Ce)	N	None	N/A	Y	Y	Y	Y	X	X	X	Y	X	X	X	X	N
B3-6	LLNL	Low in Gd and Hf (Ce)	N	None	N/A	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B3-7	ANL	Zirconolite-rich (Ce)	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
	PNNL		N			Y	Y	Y	Y	X	X	X	?	X	X	X	X	N
	SRS		N			Y	N	Y	X	X	X	X	X	X	X	X	X	N
B3-8	ANL	Brannerite-rich (Ce)	N	None	N/A	X	X	X	X	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
	SRS		N			Y	N	Y	X	X	X	X	X	X	X	X	X	N
B3-9	ANL	~10% Perovskite (Pu)	Y	Excess CaO	~2%	Y	Y	Y	Y	N	X	Y	X	X	X	X	X	N
	SRS		Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B3-10	ANL	~10% Perovskite (Ce)	N	Excess CaO	~2%	X	X	X	X	X	X	X	X	X	X	X	X	N
	SRS		N			Y	N	Y	X	X	X	X	X	X	X	X	X	N
B3-11	ANL	~10% Phosphate (Pu)	Y	P_2O_5	~3.5%	Y	Y	Y	Y	N	X	Y	X	X	X	X	X	N
	SRS		Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B3-12	ANL	~10% Phosphate (Ce)	N	P_2O_5	~3.5%	X	X	X	X	X	X	X	X	X	X	X	X	N
	SRS		N			Y	N	Y	X	X	X	X	X	X	X	X	X	N
B3-13	ANL	Average Impurity (Pu)	Y	All	~6.6	Y	Y	Y	Y	N	N	Y	X	X	X	X	X	N
	LLNL		Y			Y	Y	N	N	Y	N	Y^{ANL}	X	X	X	X	X	N
	SRS		Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B3-14	ANL	Average Impurity (Ce)	N	All	~6.7	X	X	X	X	X	N	X	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
	SRS		N			Y	Y	Y	N	X	X	X	X	X	X	X	X	N
B3-15	LLNL	Am Enriched (Pu/Am)	Y	Am_2O_3	~0.6%	X	X	X	X	X	X	X	X	X	X	X	X	N

B3-16	ANL	Am Enriched (Ce/Nd)	N	Nd_xO_y	~0.4%	X	X	X	X	X	X	X	X	X	X	X	X	N
	LLNL		N			Y	Y	N	N	X	X	X	X	X	X	X	X	N
	SRS		N			N	X	X	X	X	X	X	X	X	X	X	X	N
B3-17	ANL	Avg. Impure Oxide	Y	All	~10.6	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	N
	SRS	(Pu)	Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B3-18	ANL	Avg. Impure Oxide	N	All	~10.9	X	X	X	X	X	X	X	X	X	X	X	X	N
	LLNL	(Ce)	N			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
	SRS		N			Y	Y	Y	N	X	X	X	X	X	X	X	X	N
B3-19	ANL	Maximum Impurity	Y	All	~25.0	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	N
	SRS	(Pu)	Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B3-20	ANL	Maximum Impurity	N	All	~25.7	Y	Y	X	X	X	X	X	X	X	X	X	X	N
	LLNL	(Ce)	N			Y	X	X	X	X	X	X	X	X	X	X	X	N
	SRS		N			X	X	X	X	X	X	X	X	X	X	X	X	N
B3-21	ANL	~20% Perovskite (Pu)	Y	Excess CaO	~TBD%	Y	Y	Y	Y	X	X	Y	X	X	X	X	X	N
B3-22	ANL	~20% Perovskite (Ce)	N	Excess CaO	~TBD%	X	X	X	X	X	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In Progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 6. Series B4-S Samples (Impurity Saturation)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabricated*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B4-S1	LLNL	A-0	N	$AlO_{1.5}$	Saturated	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S2	LLNL	A-0	Y	$AmO_{1.5}$	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S3	LLNL	A-0	N	$BO_{1.5}$	Saturated	Y	Y	Y	Y	N	X	X	X	X	X	X	X	N
B4-S4	LLNL	A-0	N	BaO	Saturated	Y	Y	Y	P	N	P^{ANL}	X	X	X	X	X	X	N
B4-S5	LLNL	A-0	N	CaO	Saturated	Y	X	N	Y	Y	X	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S6	LLNL	A-0	N	CeO_2	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S7	LLNL	A-0	N	$CrO_{1.5}$	Saturated	Y	Y	Y	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	Y	Y	X	X	X	X	X	X	X	N
B4-S8	LLNL	A-0	N	$CuO_{0.5}$	Saturated	Y	X	N	Y	Y	X	X	X	X	X	X	X	N
B4-S9	LLNL	A-0	N	$FeO_{1.5}$	Saturated	Y	X	N	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S10	LLNL	A-0	N	$GaO_{1.5}$	Saturated	Y	Y	Y	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S11	LLNL	A-0	N	$GdO_{1.5}$	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S12	LLNL	A-0	N	HfO_2	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S13	LLNL	A-0	N	$KO_{0.5}$	Saturated	P	N	N	N	X	X	X	X	X	X	X	X	Y
B4-S14	LLNL	A-0	N	$LaO_{1.5}$	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S15	LLNL	A-0	N	MgO	Saturated	Y	X	X	Y	Y	X	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S16	LLNL	A-0	N	$MnO_{1.5}$	Saturated	Y	X	N	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S17	LLNL	A-0	N	MoO_{2+x}	Saturated	Y	Y	Y	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S18	LLNL	A-0	N	$NaO_{0.5}$	Saturated	Y	Y	Y	Y	N	X	X	X	X	X	X	X	N
B4-S19	LLNL	A-0	N	$NbO_{2.5}$	Saturated	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B4-S20	LLNL	A-0	N	NiO	Saturated	Y	X	N	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S21	LLNL	A-0	N	$NdO_{1.5}$	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S22	LLNL	A-0	Y	NpO_2	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S23	LLNL	A-0	N	$PO_{2.5}$	Saturated	Y	X	N	Y	Y	P^{ANL}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N

B4-S24	LLNL	A-0	N	PbO	Saturated	P	N	N	N	X	X	X	X	X	X	X	X	Y
B4-S25	LLNL	A-0	N	SiO_2	Saturated	Y	Y	Y	Y	Y	P^{ANI}	X	X	X	X	X	X	N
			Y			Y	Y	N	N	N	X	X	X	X	X	X	X	N
B4-S26	LLNL	A-0	N	SnO_2	Saturated	P	N	N	N	X	X	X	X	X	X	X	X	Y
B4-S27	LLNL	A-0	N	$TaO_{2.5}$	Saturated	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
B4-S28	LLNL	A-0	N	ThO_2	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S29	LLNL	A-0	N	TiO_2	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S30	LLNL	A-0	N	$VO_{1.5}$	Saturated	Y	Y	Y	Y	Y	P^{ANL}	X	X	X	X	X	X	N
B4-S31	LLNL	A-0	N	$WO_{2.4}$	Saturated	Y	Y	Y	Y	Y	P^{ANL}	X	X	X	X	X	X	N
B4-S32	LLNL	A-0	N	ZnO	Saturated	Y	X	N	Y	Y	X	X	X	X	X	X	X	N
B4-S33	LLNL	A-0	N	ZrO_2	Saturated	X	X	X	X	X	X	X	X	X	X	X	X	N
B4-S34	ANL	A-0	N	C	Saturated	Y	Y	Y	Y	Y	X	X	X	X	X	X	X	N
	LLNL		N			Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B4-S35	LLNL	A-0	N	CaF_2	Saturated	Y	Y	N	Y	Y	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 7. Series B4-E Samples (Impurity Equivalence)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabricated*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B4-E1	ANSTO	A-0 + Impurity	N	+2	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			Y	Y	Y	P	P	X	?	X	X	X	X	X	N
B4-E2	ANSTO	A-0 + Impurity	N	+3	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
B4-E3	ANSTO	A-0 + Impurity	N	+4	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
B4-E4	ANSTO	A-0 + Impurity	N	+6	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
B4-E5	ANSTO	A-0 + Impurity	N	+5	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
B4-E6	ANSTO	A-0 + Impurity	Y	+4 Actinde	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
B4-E7	ANSTO	A-0 + Impurity	N	Variable	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-E8	ANSTO	A-0 + Impurity	N	+3/+4=+2 /+5	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-E9	ANSTO	A-0 + Impurity	N	+2/+4=+3/+3	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-E10	ANSTO	A-0 + Impurity	N	+3/+4= +2/+5	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-E11	ANSTO	A-0 + Impurity	N	+2/+2= +1/+3	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-E12	ANSTO	A-0 + Impurity	N	+2/+4= +4/+2	As Needed	Y	Y	Y	Y	Y	X	?	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In Progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Table 8. Series B4-V Samples (Impurity Volatility)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabrication*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B4-V1	SRS	A-0 + Impurity	N-Ce/Ce	Common	Fixed (0.600)	Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			N-Ce/U			Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			N-Th/U			Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-V2	SRS	B3-3/7 + Impurity	N-Ce/Ce	Common	Fixed (0.600)	Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			N-Ce/U			Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-V3	SRS	B3-4/8 + Impurity	N-Ce/Ce	Common	Fixed (0.600)	Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			N-Ce/U			Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-V4	SRS	A-0 + Impurity	N-Ce/Ce	All	Variable	Y	Y	Y	S	X	X	X	X	X	X	X	X	N
			N-Ce/U			Y	Y	P	N	X	X	X	X	X	X	X	X	N
			Y			P	N	N	N	X	X	X	X	X	X	X	X	Y
B4-V5	SRS	B3-3/7 + Impurity	N-Ce/Ce	All	Variable	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-Ce/U			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B4-V6	SRS	B3-4/8 + Impurity	N-Ce/Ce	All	Variable	X	X	X	X	X	X	X	X	X	X	X	X	N
			N-Ce/U			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In Progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.

Common Volatiles = B_2O_3, $CaCl_2$, CaF_2, KCl, PbO, $MgCl_2$, MgF_2, MoO_3, NaCl, WO_3, ZnO
All Volatiles = Common Volatiles + K_2O, Na_2O, P_2O_5, PbO, and $ZnCl_2$

Table 9. Series B5 Samples (Sintering Aids)

Sub-Series	*Site(s)*	*Target Composition*	*Pu Sample*	*Impurity Elements*	*Impurity Amount*	*Fabrication*	*Density*	*XRD*	*SEM*	*Microprobe or Q-EDS*	*TEM*	*MCC-1*	*SPFT*	*Ion Beam*	*SSI-XRF*	*Enthalpy*	*Entropy*	*Additional Samples*
B5-1	LLNL	A-0 + Impurity	N	NaOH	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-2	LLNL	A-0 + Impurity	N	NaF	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-3	LLNL	A-0 + Impurity	N	Na_2SO_4	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-4	LLNL	A-0 + Impurity	N	BaO	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-5	LLNL	A-0 + Impurity	N	CaF_2	< 3%	X	X	X	X	X	X	X	X	X	X	X	X	N
B5-6	LLNL	A-0 + Impurity	N	Al_2O_3	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-7	LLNL	A-0 + Impurity	N	B_2O_3	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-8	LLNL	A-0 + Impurity	N	P_2O_5	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-9	LLNL	A-0 + Impurity	N	SiO_2	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N
B5-10	LLNL	A-0 + Impurity	N	Mix	< 3%	X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
	SRS		N			X	X	X	X	X	X	X	X	X	X	X	X	N
			Y			X	X	X	X	X	X	X	X	X	X	X	X	N
B5-11	LLNL	A-0 + Impurity	N	Na_2CO_3	< 3%	Y	Y	Y	Y	X	X	X	X	X	X	X	X	N

Y = Yes, N = No, S = Some, P = Partial Completion or In Progress, ! = Needed or Planned in Near Future, X = Not Needed or Do Latter, ? = Unknown or Undetermined.