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PUREX PROCESSING - MEASUREMENTS QUALITY CONTROL PROGRESS REPORT

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7 pages.

PUREX PROCESSING

MEASUREMENTS QUALITY CONTROL PROGRESS REPORT

By

F. G. Kimble

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PUREX PROCESSING
MEASUREMENTS QUALITY CONTROL PROGRESS REPORT

Introduction

This review reports progress made in implementing the Purex Measurements Quality Control Program and findings of the initial statistical review of data obtained on the four major transfer stations.

Summary

The four transfer stations are the primary product streams, as measured through K6 Tank and the PR system, and the two principal waste streams, as measured through the D2 and F15 Tanks.

Uranium feed input to Purex through Tank D5 was measured starting with the first charges of CY-1965; comparisons with IPD statements have been developed.

Measurements Quality Control Data are being generated on four other Purex waste streams, and statements concerning these will appear in subsequent reports.

TK-K6 UNH Product Measurement

Three checks are made for each audit of the K6 transfer station:

Instrument Calibration Check

Sampling Procedure Audit

Analytical Control Audit

Measurement Precision

A statistical evaluation of twenty-three K6 instrument checks and sampling audits, together with the laboratory standards and referee program, permits statements of precision for a single batch transfer measurement as follows:

<u>Measurement</u>	<u>Average Value</u>	<u>Variation at 95% Confidence Level</u>		
		<u>Random</u>	<u>Fixed</u>	<u>Total</u>
Tank Volume Increments (units)	48 gal/in.	-	43 gals.	-
(percent)		-	1.14	-
Manometer Difference (units)	155 to 23 in.	49 gals.	-	-
(percent)	(3764 gallons)	1.30	-	-
Total (units)		-	-	65
(percent)		-	-	1.73

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<u>Measurement</u>		<u>Average Value</u>	<u>Variation at 95% Confidence Level</u>		
			<u>Random</u>	<u>Fixed</u>	<u>Total</u>
<u>Specific Gravity</u>					
Analytical	(Sp.Gr. units)	1.66	0.006	0.005	0.0061
	(percent)		0.36	0.030	0.37
Sampling	(Sp.Gr. units)		0.0068	-	0.0068
	(percent)		0.42	-	0.42
Total	(Sp.Gr. units)		0.009	0.0005	0.009
	(percent)		0.54	0.03	0.54
<u>Uranium</u>					
Analytical	pounds U/gal	4.05	0.048	0.017	0.051
	(percent)		1.20	0.42	1.25
Sampling	pounds U/gal		0.068	-	0.068
	(percent)		1.70	-	1.70
Total	pounds U/gal		0.084	0.017	0.086
	(percent)		2.10	0.42	2.10

The uncertainties calculated by typical propagation of error equations are:
 At approximately 95% confidence level, the total variation associated with a
 typical 15244 pound (uranium) batch transfer is ± 396 pounds or ± 2.60 percent.

Statements of variation expressed as "95% confidence level" are actually two
 standard deviation limits and are approximately equal to the .95 confidence level.

PR Loadout Measurement

Four checks are made for each audit of the PR loadout measurement:

PR Scales Calibration Check

Weighing Procedure Audit

Sampling Procedure Audit

Analytical Control Audit

Measurement Precision

A statistical evaluation of twenty audits of the PR loadout station and application
 of the laboratory standards and referee program developed precision estimates
 for a single batch loadout as follows:

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<u>Measurement</u>	<u>Average Value</u>	<u>Variation at 95% Confidence Level</u>		
		<u>Random</u>	<u>Fixed</u>	<u>Total</u>
PR Scales	10.4 kilograms (percent)	56 grams 0.54	28 grams 0.26	62 grams 0.60
<u>Pu (X-3a)</u>	2.04			
Analytical (pounds Pu/gal)		0.024	0.014	0.028
(percent)		1.20	0.7	1.40
Sampling (pounds Pu/gal)		0.008	-	0.008
(percent)		0.44	-	0.44
Total (pounds Pu/gal)		0.026	0.014	0.030
(percent)		1.28	0.70	1.46
<u>AT (Pu A-6B)</u>	7.44 x 10 ⁻³			
Analytical (AT/gal)		0.202	-	-
(percent)		2.72	-	-
Sampling (AT/gal)		0.21	-	-
(percent)		2.82	-	-
Total (AT/gal)		0.292	-	-
(percent)		3.92	-	-
<u>Specific Gravity</u>	1.50			
Analytical (Sp.Gr. units)		0.0044	0.001	0.0047
(percent)		0.30	0.10	0.32
Sampling (Sp.Gr. units)		0.0066	-	0.0066
(percent)		0.44	-	0.44
Total (Sp.Gr. units)		0.008	0.001	0.0081
(percent)		0.52	0.10	0.54

The uncertainties calculated by typical propagation of error equations are:
At approximately 95% confidence level the total variation associated with a typical 8800 gram (plutonium) loadout is ± 140 grams or ± 1.59 percent.

F15 Salt Waste Management

Three checks are made for each audit of the F15 transfer station:

Instrument Calibration Check

Sampling Procedure Audit

Analytical Control Audit

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Measurement Precision

A statistical evaluation of nineteen instrument checks and sampling audits, together with the laboratory standards and referee program, permits a statement of precision for a single batch transfer measurement as follows:

<u>Measurement</u>		<u>Nominal Value</u>	<u>Variation at 95% Confidence Level</u>		
			<u>Random</u>	<u>Fixed</u>	<u>Total</u>
<u>Tank Volume Increments</u>					
	(units)	71.5 gals/in.	-	173	173 gals.
	(percent)		-	7.0	7.0
<u>Weight Factor Recorder</u>					
	(units)	45 to 0			
Difference	(units)	inches	245	-	245 gals.
	(percent)	(2475 gals)	9.9	-	9.9
<u>Sp.Gr. Recorder</u>					
	(units)	1.3	0.02	0.02	0.027
	(percent)		1.50	1.50	2.1
<u>U Analysis</u>					
Analytical	(pounds U/gal)	6.6×10^{-3}	4.0×10^{-3}	0.8×10^{-3}	4.1×10^{-3}
	(percent)	lb/gal	60	12	62
Sampling	(pounds U/gal)		4.7×10^{-3}	-	4.7×10^{-3}
	(percent)		71	-	71
Total	(pounds U/gal)		6.1×10^{-3}	0.8×10^{-3}	6.3×10^{-3}
	(percent)		93	12	95
<u>Pu Analysis</u>					
Analytical	(AT/gal)	3.1×10^8	1.0×10^8	0.2×10^8	1.0×10^8
	(percent)	cpm/gal	33	9	34
Sampling	(AT/gal)		2.5×10^8	-	2.5×10^8
	(percent)		81	-	81
Total	(AT/gal)		2.7×10^8	0.2×10^8	2.7×10^8
	(percent)		88	9	88
ICF	(grams/count/min.)	1.24×10^{-11}	0.01×10^{-11}	0.02×10^{-11}	0.022×10^{-11}
	(percent)		0.8	1.6	1.8

The uncertainties associated with an average batch transfer as calculated by typical propagation of error equations are:

Pu Content - Approximately 95% confidence level. 9 grams (Pu) $\pm$ 8.1 grams
or $\pm$ 90 percent.

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Uranium Content - Approximately 95% confidence level. 16 pounds (U) $\pm$ 15.4 pounds or $\pm$ 96 percent.

The random errors associated with sampling and analytical operations are overriding and the apparent fixed error in the calibration is statistically insignificant. This vessel was installed new this year and the published calibration table is based on a single weighed water calibration. Additional calibrations will be performed, however, and the calibration table revised, if necessary.

D2 Coating Waste Measurement

The basis for the D2 measurement is the Cesium-137 index as published in HW-83725. A factor of 0.21 percent of materials charged to Purex dissolvers is applied to this stream.

This factor is monitored continuously by sampling each batch of coating waste for Cs-137. This result is converted to percent of material charged (average) for comparison with the factor.

Monthly averages of batch samples are listed below:

<u>Month</u>	<u>Percent Cs-137</u>
February 1965	0.22
March	0.21
April	0.19
May	0.21
June	0.19
July	0.17
August	0.17
September	0.18

The results of the annual review of the Cesium-137 index were published in RL-SEP-682 in August, 1965. The revised index will require no change in the Purex coating waste factor.

D5 Feed Input Measurement

A Purex feed input measurement across tank D5 was started with the first charges of Cy-1965 in February and is continuing on a batch basis to date.

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The typical measurements quality control checks have been applied to the measurement point periodically and twenty-three audits have been completed to date.

Changing conditions in volume measurement and analytical methods during this period prevent any meaningful statistical report on the various elements of measurement. A total of 623 batches have been measured to date and uranium values may be compared with IPD statements.

PUREX INPUT MEASUREMENT SUMMARY - JAN - SEPT 1965

Purex Measurement Difference:

<u>Run Period</u>	<u>Pounds</u>	<u>Percent</u>
Jan- Feb	+ 34516	+ 4.18
Mar-June	+258205	+ 4.27
July	+ 51213	+ 6.40
Aug-Sept	+107516	+ 5.51
Jan-Sept	+451450	+ 4.69

The plus figures indicating Purex higher than IPD. The input plutonium measurement is based on the uranium/plutonium ratio and no independent data exists which could develop error estimates for D5 plutonium measurement.

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