S

ENGINEERING CHANGE NOTICE

1. ECN 655135

Proj. ECN N/A

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ○ Direct Revision ◉ Change ECN ○ Temporary ○ Standby ○ Supersedure ○ Cancel/Void ○	MD Johnson, WRAP Engineering, T4-52, 373-2243	◉ Yes ○ No	02/08/00
	6. Project Title/No./Work Order No. WRAP Facility/AJ60	7. Bldg./Sys./Fac. No. 2336-W	8. Approval Designator Q
	9. Document Numbers Changed by this ECN (includes *sheet no. and rev.*) HNF-5408, Rev. 0, All	10. Related ECN No(s). N/A	11. Related PO No. N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
○ Yes (fill out Blk. 12b) ◉ No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ○ Yes ◉ No

This document is being revised to include the completed drum impact analysis

14a. Justification (mark one)	14b. Justification Details
Criteria Change ○ Design Improvement ○ Environmental ○ Facility Deactivation ○ As-Found ◉ Facilitate Const. ○ Const. Error/Omission ○ Design Error/Omission ○	Design verification not required USQ WRP-00-034

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): ECN-655135

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
○ Yes	Additional ○ $ N/A	Additional ○ $ N/A	Improvement ○ N/A
◉ No	Savings ○ $ N/A	Savings ○ $ N/A	Delay ○ N/A

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	*Seismic/Stress Analysis*	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	*Engineering Procedure*	☐	*Human Factor Consideration*	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	*Purchase Requisition*	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐	None	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
None		

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	MD Johnson MD Johnson	2/8/00	PE		
Cog. Mgr.	JR Weidert Michael Wilson for Jeff	2/16/00	QA		
QA	WR Thackaberry WR Thackaberry	03/06/2000	Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	WRAP Engineering	Date 01/08/00
Project Title/Work Order		EDT No. N/A
WRAP WEIGHT SCALE ANALYSIS RESULTS HNF-5408, REV. 1		ECN No. ECN-655135

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
EV DosRamos	T4-52				X
JE Geary	T4-51	X			
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WRAP Weight Scale Analysis Results

MD Johnson
Flour Hanford

EDT/ECN: ECN-655135 Total Pages: 24

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Assistant Secretary for Environmental Management

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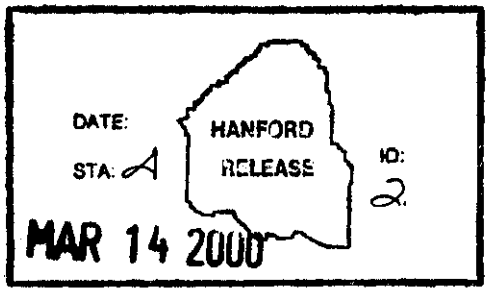

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☐ Other _____

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C. Title
WRAP Weight Scale Analysis Results

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1. Is document potentially Classified? ☒ No ☐ Yes (MANDATORY)

_____
Manager's Signature Required

If Yes _____ - ADC ☒ No ☐ Yes Classified
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RELEASE AUTHORIZATION

Document Number: HNF-5408, REV 1

Document Title: WRAP Weight Scale Analysis Results

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RECORD OF REVISION	(1) Document Number HNF-5408	Page 1

(2) Title
WRAP WEIGHT SCALE ANALYSIS, FAIRBANKS WEIGHT SCALE EVALUATION RESULTS

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Revision 0 released on 11/30/99 per EDT-623541		
1 RS	Complete revision per ECN-655135	MD Johnson	JR Weidert
		MD Johnson 2/16/00	Michael Pdee for JRW 2-16-00

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HNF-5408
Revision 1

WRAP Weight Scale Analysis Results

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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TECHNICAL ABSTRACT

Fairbanks Weight Scales are used at the Waste Receiving and Processing (WRAP) facility to determine the weight of waste drums as they are received, processed, and shipped. Due to recent problems, discovered during calibration, the WRAP Engineering Department has completed this document which outlines both the investigation of the infeed conveyor scale failure in September of 1999 and recommendations for calibration procedure modifications designed to correct deficiencies in the current procedures.

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ATTACHMENTS

PART 1-CALIBRATION FAILURE (OVERVIEW) FOR THE INFEED CONVEYOR SCALE

On September 9, 1999, an annual calibration procedure was performed on the infeed conveyor scale (101-CV-05-103A) at the WRAP Facility shipping and receiving area. Performance of that procedure indicated that the "as found" scale response was outside specified calibration tolerances. Drum measurement data analysis indicated that measurements taken for drums weighing between 113.4 kg and 453.6 kg should be questioned. 15 of the 379 drums measured during the previous year fell into this category. Statistical analysis shows that 14 of the drums have the potential to be over tolerance by as much as 3.436 lbs.* or under tolerance by as much as 1.806 lbs.. The measurement for the remaining drum has the potential of being over tolerance by as much as 13.89 lbs.* or under tolerance by as much as 10.15 lbs. The Engineering Department recommends re-calculation of drum data to correct for the identified error. Calculation results must be evaluated to ensure that the assigned TRU/LLW classification of each drum is accurate.

* (NOTE: these numbers revised in PART 3 as part of a follow up evaluation)

Background:

During performance of the calibration procedure the scale response was verified using three (known value) test weights; 250 lbs. (113.4 kg), 500lbs. (226.8 kg), and 1000 lbs. (453.6 kg). The scale was found within calibration at the 250 lb. (113.4 kg) level and out of calibration at the 500 lb. (226.8 kg) and 1000 lb. (453.6 kg) levels, as shown below:

Test Weight:	As found :	Tolerance (± 0.1% full scale):
250 lbs./ 113.4 kg	249.6 / 113.2 lbs. /kg	(249 to 251 lbs.)
500 lbs./ 226.8 kg	501.1 / 227.3 lbs. /kg	(499 to 501 lbs.)
1000 lbs./ 453.6 kg	1002.9 / 454.9 lbs. /kg	(999 to 1001 lbs.)

Immediate actions:

The scale was taken out of service and evaluated to determine the problem. An unbalance condition was discovered on the scale load cells. The load cell mounting hardware was shimmed to correct the problem and the unit was re-calibrated.

Follow up actions:

The scale is calibrated on an annual basis. All Waste Container Data Sheets generated the previous year were reviewed to determine the impact on waste drum measurements. Each data sheet includes a "test weight" measurement to ensure that the scale is properly calibrated prior to operations. The test weight is either a 113.4 kg or a 22.68 kg weight and varies from day to day. All test weight measurements taken during operations were within calibration at both the 113.4 kg and 22.68 kg levels, likewise the scale checked within calibration at the 113.4 kg level during the calibration procedure. The scale calibration becomes questionable only at higher weights. Only 15 of the 379 drums measured between September 30, 1998 and September 9, 1999, weighed 113.4 kg or more. The following are the container ID #s for the 15 drums measuring over 113.4 kg:

(Table 1)

* indicates drum that also measure over 226.8 kg

#	DRUM PIN	WEIGHT
1	9601879	116.15
2	9513558	117.25
3	9522295	127.2
4	9522503	200.25
5	9406635	144.55
6	9700807 *	282.05
7	9601581	116.9
8	996000008	202.4
9	996000009	205.1
10	9406601	163.3
11	9406618	141.65
12	9513608	117
13	9517481	132.4
14	9517461	135
15	9401105	150.3

Statistical Analysis:

The test weight data from the Waste Container Data Sheets was used to determine typical scale response. Using that response data an estimate of scale accuracy has been formulated for the drums weighing over 113.4 kg. A 95% confidence interval for the scale response was calculated using the test weight data. This data along with the "as-found" calibration test weight data allows us to determine a maximum upper and lower error interval for the measured drums. The error intervals at 226.8 kg (500lbs.) and 453.6 kg (1000 lbs.) are largely due to the limited amount of measurement data available at these ranges.

(Table 2)

95% Confidence Interval for Drums Weighing 0-50 lbs. (0-22.68 kg)				
Test weight	Mean Error	Uncertainty 95%	Lower Error Range	Upper Error Range
22.68 kg	-0.1504	-0.1504 ± .03965 kg	-0.419 lbs.(-0.19 kg*)	-0.2441 lbs.(-0.11 kg*)
95% Confidence Interval for Drums Weighing 50-250 lbs. (22.68-113.4 kg)				
Test weight	Mean Error	Uncertainty 95%	Lower Error Range	Upper Error Range
113.4 kg	-0.1344 Value was corrected Rev1/Rev 2	-0.1344 ± ..0869 kg (Value corrected Rev1→Rev 2)	-0.4879 lbs. (-0.2213 kg*) (Value corrected Rev1→Rev 2)	-0.1047 lbs. (-0.0475 kg*) (Value corrected Rev1→Rev 2)
95% Confidence Interval for Drums Weighing 250-500 lbs. (113.4-226.8 kg)				
Test weight	Mean Error	Uncertainty 95%	Lower Error Range	Upper Error Range
500 lb.	0.815	0.815 ± 3.621 lbs.	-2.806 lbs. (-1.273 kg*)	4.436 lbs.(2.012 kg*)
95% Confidence Interval for Drums Weighing 500-1000 lbs. (226.8-453.6 kg)				
Test weight	Mean Error	Uncertainty 95%	Lower Error Range	Upper Error Range
1000 lb.	1.875	1.875 ± 13.024 lbs.	-11.149 lbs. (-5.057 kg*)	14.899 lbs. (6.758 kg*)

Conclusions:

Of the 15 drums that measured over 113.4 kg, only 1 measured over 226.8 kg. Therefore, 14 drums may be over tolerance by 3.436 lbs.* or under tolerance by 1.806 lbs.. The remaining drum may be over tolerance by up to 13.90 lbs.* or under tolerance by 10.15 lbs.

* (NOTE: these numbers revised in PART 3 as part of a follow up evaluation)

Recommendations:

1. The Engineering Department recommends re-calculation of the drum data for the drums listed in Table 1. The calculation results must be reviewed for impact on TRU/LLW drum classification.

2. The weight scale calibration should be performed at a higher frequency on the WIPP impacting scales (i.e. quarterly rather than annually) to reduce programmatic impacts should scales be found out of calibration in the future.

3. During evaluation of the scale, information regarding scale set-up parameters and scale performance was discovered that suggests re-evaluation of set up criteria and tolerance limits is needed. The Engineering Department performed a follow up evaluation for scale set-up and calibration. The results of that evaluation are outlined in part 2 of this document.

4. Following the scale set-up and calibration evaluation, both infeed and discharge scales will require re-calibration to implement the recommendations of the evaluation.

5. In the future, control charts should be maintained on the test/check weight measurements taken prior to daily operation. This tool will help us recognize scale response problems early, before they significantly impact operations data.

PART 2-EVALUATION OF THE WRAP CALIBRATION PROCEDURE SET-UP PERAMETERS

This section serves as a follow up to PART 1 of this document performed on the infeed conveyor scale (101-CV-05-103A) at the Waste Receiving And Processing (WRAP) facility shipping and receiving area. Recommendation # 3 of PART 1 was to re-evaluate the set-up parameters for the infeed conveyor drum scale used to measure Waste Isolation Pilot Project (WIPP) related containers at the WRAP facility. This document outlines the Engineering Departments recommendations for changes to the scale settings at the WRAP facility and explains the reasoning behind those recommendations.

Background:

The Fairbanks weight scales used at WRAP are designed to operate in either one of two modes: general use mode (security level 0); or, commercial rated mode (Security levels 1 & 2). The scales operate by dividing their maximum capacity weight rating by the desired graduation size to determine the number of divisions required to calibrate the scale, it then assigns a number of digital counts to each division. In security level 0, that number of counts is 1 per division. In security levels 1& 2 that number is 3 counts per division. In security levels 1& 2 the scale uses the three counts to verify the measurement is at the weight indicated on the display. In security level 0 the scale uses only one count to measure the weight and does not verify the measurement. The scales have only a limited number of counts available when calibrating (36000 total); so, selection of the higher security levels (1 or 2) limits the graduation resolution available (i.e. in security level 0 the scale might allow a graduation size of .05 kg but in security level 1 & 2 the scale will only allow a graduation size of .1 kg). Another feature of the security level selection is a password protect function. When in security level 1or 2 the scales "set-up" parameters are protected by a control panel password, preventing unauthorized changes to the calibration of the scale. In security level 0 no password protection is provided and the scale parameters may be changed from the control panel by any user.

Issues:

It was previously believed that the scales at WRAP were calibrated in the commercial mode because security level 2 was selected in the scale set-up sequence as one of the final steps of the calibration procedure, this belief was in error. The security level must be selected before calibrating the scale in order to establish the commercial or general use mode. While changing the security level switch after calibration did provide password protection, the scale measurement function was still operating in the general use mode. During re-calibration efforts for the infeed conveyor scale, following the out of calibration condition found on September 9,1999, it was discovered that the scale was actually functioning in the general use mode rather than the commercial rated mode as was previously believed. After corrective maintenance on a loose load cell mounting pin the scale was re-calibrated in the commercial mode. This required that the graduation size of the scale be increased from 0.1 lbs.(0.05kg) to 0.5lbs.(0.2kg) do to the limited number of counts available in commercial mode. The scale was tested and returned to service. This new set-up configuration may create problems during future calibration attempts as the scales graduation size is now 0.5 lbs. and the tolerance range for the scale is only ± 1.0 lb.. An error of only 3 graduations will now result in an out of tolerance condition and observed error (as the scale returns to zero) has often been ± 1.0 lb. leaving no error tolerance for the actual measurement.

Recommendations:

1. The Engineering Department recommends re-calibrating all WRAP scales in the general use mode (security level 0) to allow the uses of a smaller (.05kg) graduation size. Test data shows that scale repeatability is excellent even when in the general use mode and selecting the smaller graduation size results in less "return to zero" error on the scales. After the re-calibration of the scales the security level can be returned to the level 2 setting to password protect the settings. The WRAP Authorization Basis documents take no credit for a commercial rating on these scales; so, no changes are needed to the current facility documents.

2. The current calibration procedure for the infeed scale lists an acceptance tolerance of ± 1.0 lb. for all measurements, this tolerance is calculated by taking 0.1% of the full scale reading (based on a scale capacity of 1000 lbs.). The actual scale capacity for the infeed conveyor scale is approximately 2200-2400 lbs. and although WRAP has no plans to weigh drums over 1000 lbs. the scale tolerance must be calculated using the actual capacity of the scale not on the maximum expected weight of a drum at the WRAP facility. The existing tolerance of ± 1.0 lb. is not realistic for this scale and should be re-established based on the actual rating of the scale. The Engineering Department recommends using 1000 kg (2204.6 lbs.) as the scale's maximum capacity when calculating the tolerance for future calibration procedures. This will result in a tolerance of ± 1.0 kg (or 2.2 lbs.) for each measurement. This recommendation also applies to the discharge conveyor scale and the calibration procedures for both should be revised to incorporate the new tolerance.

3. Lift table scales in the process area are not needed for WIPP certification of drums and the primary function of the scales is to measure drum pressure against the bottom of the glove box ports. It is not necessary for these scales to be as accurate as the WIPP certification scales. Present calibration procedures require that lift table scales be calibrated to the same tolerance as the infeed and discharge conveyor scales, this practice is not necessary and may result in costly corrective maintenance to bring the scales into tolerance. The Engineering Department recommends relaxing the tolerance on these scales to ± 1.0% or ± 10kg (22.04 lbs.).

4. The Engineering Department also recommends reducing the number of WIPP related scales at WRAP. Only the infeed conveyor, discharge conveyor, and NDE box scales are needed for WIPP certification at WRAP. Calibration of airlock scales is not necessary. As a cost saving measure the Engineering Department recommends discontinuing calibration of the airlock scales.

5. During present calibration of the scales only one "as left" measurement (with each test weight) is recorded to establish calibration of each scale. The Engineering Department recommends increasing the number of "as left" measurements to verify repeatability of the measurements and to provide additional measurement sample data for problem analysis in the future.

6. Additional check weight measurements are recommended (at higher weight values) to help determine scale response. A 453.6 kg (1000 lb.) and 226.8 kg (500 lb.) periodic check weight measurement would provide the data needed (i.e. measurements may be taken only on days when heavy drums are processed).

7. The Engineering Department recommends that scale calibration procedure WRP-18004 be revised and that the recommendations listed in this evaluation be incorporated.

REFERENCES:

Fairbanks Scales Service Manual, Digital Indicator Model H90-5200

PART 3-EVALUATION OF "SCALE OUT OF CALIBRATION" CONDITION ON DRUM DATA

This section serves as a follow up to PART 1 of HNF-5408 (Rev 0) Weight Scale Analysis, Fairbanks Weight Scale Evaluation Results completed for the infeed conveyor scale (101-CV-05-103A) at the Waste Receiving And Processing (WRAP) facility shipping and receiving area. Recommendation # 1 of PART 1 was to evaluate the impacts to drum data caused by the scale "out of calibration" condition. Listed below are the results of the Engineering Department's drum data evaluation.

Background: The 15 drums identified in Part 1 of this document were re-evaluated by the WRAP Non-Destructive Assay (NDA) group to determine if the infeed conveyor scale "out of calibration" condition resulted in a change of classification (LLW to TRU waste) for any drums (based on the potential error introduced by the scale). The calculated error listed in Part 1 of this document was re-calculated to include both type A and type B error. The results of these calculations were used as the basis to determine the drum impact. The calculations are attached on pages C1-C4 for reference.

Results: The attached spreadsheet (Page D1) shows the results of the re-evaluation. As shown on the spread sheet none of the listed drums, that had been through the WRAP NDA process, changed classification due to the scale measurement error. All but one of the impacted drums were initially classified as TRU waste drums and no drums, including the one LLW drum, changed classification as a result of the scale error.

Recommendations: As a result of the scale calibration problem a Corrective Action Report (CAR) TRU-WRP-99CAR-076 was issued. The Engineering Department recommends closure of the Corrective Action Report based on the findings of this drum evaluation, along with verification of the completion of all recommendations outlined in Parts 1 & 2 of this document (except item # 6 in Part 2 which operations cannot support. Additional repeatability measurements have been added to the calibration procedure and will provide the Engineering Department with sufficient weight measurement data, eliminating the need for implementation of this recommendation.)

Analysis Of 113.4 kg Test Weight Data (Rev 2)

Test Weight Data		(Find Standard Deviation) Method from HNF-3954		
Test	Measurements		Error	Deviation
Weight Date	113.4kg	Error	Deviation	Squared
10-Mar	113.3	-0.1	0.03437	0.001182
22-Mar	113.35	-0.05	0.08437	0.007119
22-Mar	113.35	-0.05	0.08437	0.007119
23-Mar	113.2	-0.2	-0.06562	0.004307
25-Mar	113.45	0.05	0.18438	0.033994
26-Mar	113.25	-0.15	-0.01562	0.000244
29-Mar	113.6	0.2	0.33437	0.111807
30-Mar	113.25	-0.15	-0.01562	0.000244
06-Apr	113.05	-0.35	-0.21563	0.046494
14-Apr	113.45	0.05	0.18438	0.033994
15-Apr	113.2	-0.2	-0.06562	0.004307
19-Apr	113.2	-0.2	-0.06562	0.004307
21-Apr	113.3	-0.1	0.03437	0.001182
19-May	113	-0.4	-0.26562	0.070557
19-May	113	-0.4	-0.26562	0.070557
02-Jun	113.3	-0.1	0.03437	0.001182
sum	1812.25	-2.15	sum	0.398594
Avg	113.265625	-0.1344	variance	0.026573

Statistical Analysis	
Mean	113.2656
Standard Error	0.040753
Median	113.275
Mode	113.3
Standard Deviation	0.163012
Sample Variance	0.026573
Kurtosis	0.113816
Skewness	0.050654
Range	0.6
Minimum	113
Maximum	113.6
Sum	1812.25
Count	16
Largest(1)	113.6
Smallest(1)	113
Confidence Level(95.0%)	0.086863

Uncertainty at 95% Confidence Level	
$t_{1-@}$=	2.13
S_e=	0.1630/Sqrt of 16
Uncert @ 95%=	- 0.13438 ± .08686 kg
Error upper limit=	113.35 kg
Error lower limit=	113.18 kg

Analysis Of 22.68 kg Test Weight Data (Rev2)

Test Weight Data		(Find Standard Deviation) Method from HNF-3954		
Test	Measurements		Error	Deviation
Weight Date	22.68	Error	Deviation	Squared
13-Apr	22.5	-0.18	-0.02963	0.000878
20-Apr	22.6	-0.08	0.07037	0.004952
25-May	22.6	-0.08	0.07037	0.004952
30-Jun	22.55	-0.13	0.02037	0.000415
01-Jul	22.4	-0.28	-0.12963	0.016804
02-Jul	22.4	-0.28	-0.12963	0.016804
06-Jul	22.65	-0.03	0.12037	0.014489

12-Jul	22.6	-0.08	0.07037	0.004952
13-Jul	22.45	-0.23	-0.07963	0.006341
15-Jul	22.45	-0.23	-0.07963	0.006341
14-Jul	22.65	-0.03	0.12037	0.014489
15-Jul	22.45	-0.23	-0.07963	0.006341
27-Jul	22.65	-0.03	0.12037	0.014489
30-Jul	22.5	-0.18	-0.02963	0.000878
02-Aug	22.4	-0.28	-0.12963	0.016804
02-Aug	22.4	-0.28	-0.12963	0.016804
09-Aug	22.65	-0.03	0.12037	0.014489
12-Aug	22.5	-0.18	-0.02963	0.000878
12-Aug	22.45	-0.23	-0.07963	0.006341
11-Aug	22.6	-0.08	0.07037	0.004952
12-Aug	22.5	-0.18	-0.02963	0.000878
16-Aug	22.65	-0.03	0.12037	0.014489
18-Aug	22.6	-0.08	0.07037	0.004952
19-Aug	22.3	-0.38	-0.22963	0.05273
30-Aug	22.6	-0.08	0.07037	0.004952
10-Sep	22.6	-0.08	0.07037	0.004952
14-Sep	22.6	-0.08	0.07037	0.004952
sum	608.3	-4.06	sum	0.261296
Avg	22.52962963	-0.1504	variance	0.01005

Statistical Analysis	
Mean	22.52963
Standard Error	0.019293
Median	22.55
Mode	22.6
Standard Deviation	0.100249
Sample Variance	0.01005
Kurtosis	-0.827448
Skewness	-0.471201
Range	0.35
Minimum	22.3
Maximum	22.65
Sum	608.3
Count	27
Largest(1)	22.65
Smallest(1)	22.3
Confidence Level(95.0%)	0.039657

Uncertainty at 95% Confidence Level	
$t_{1-@}$=	2.06
S_e=	0.100249/Sqrt of 27
Uncert @ 95%= -	0.1504± .03965 kg
Error upper limit=	22.56 kg
Error lower limit=	22.49 kg

Analsis of Calibration Procedure Measurements at 500 LBS. (Rev2)

Date	reading	Test wt	Error	Error Deviation	Deviation Squared
11-Aug-98	500.53	500	0.53	-0.285	0.081225
09-Aug-99	501.1	500	1.1	0.285	0.081225
		sum	1.63	sum	0.16245
		Avg	0.815	Variance	0.16245

Uncertainty at 95% Confidence Level	
$t_{1-@}$=	12.7
S_e=	0.4030/Sqrt of 2
Uncert @ 95% =	.815 ± 3.621 kg
Error upper limit=	504.436 kg
Error lower limit=	497.194 kg

Statistical Analysis	
Mean	500.815
Standard Error	0.285
Median	500.815
Mode	#N/A
Standard Deviation	0.403051
Sample Variance	0.16245
Kurtosis	#DIV/0!
Skewness	#DIV/0!
Range	0.57
Minimum	500.53
Maximum	501.1
Sum	1001.63
Count	2
Largest(1)	501.1
Smallest(1)	500.53
Confidence Level(95.0%)	3.621253

Analysis of Calibration Procedure Measurements at 1000 LBS. (Rev 2)

Date	reading	Test wt	Error	Error Deviation	Deviation Squared
11-Aug-98	1000.85	1000	0.85	-1.025	1.050625
09-Aug-99	1002.9	1000	2.9	1.025	1.050625
		sum	3.75	sum	2.10125
		Avg	1.875	Variance	2.10125

Uncertainty at 95% Confidence Level	
$t_{1-@}$=	12.7
S_e=	1.4495/Sqrt of 2
Uncert @ 95% =	1.875 ± 13.024 kg
Error upper limit=	1014.89 kg
Error lower limit=	988.85 kg

Statistical Analysis	
Mean	1001.875
Standard Error	1.025
Median	1001.875
Mode	#N/A
Standard Deviation	1.449569
Sample Variance	2.10125
Kurtosis	#DIV/0!
Skewness	#DIV/0!
Range	2.05
Minimum	1000.85
Maximum	1002.9
Sum	2003.75
Count	2
Largest(1)	1002.9
Smallest(1)	1000.85
Confidence Level(95.0%)	13.0238

Infeed Conveyor Scale # 101-CV-05-103A Calculated Uncertainty
(During the period of 9/30/98 to 9/9/99)
(Data accurate to 2 significant digits)

Infeed Scale 0-22.6 kg (0-50 lb.) Estimated Weight Uncertainty (KILOGRAMS)		
Error Source	Measurement	Measurement Squared
Type A Error(From HNF-5408, Table 2)		
Bias (from HNF-5408)	-0.1504	0.02262016 kg
Random (from HNF-5408)	0.03965	0.001572123 kg
Type B Error (From WHC-N-930, page 98, converted to kg)		
Estamates	Estimate	Estimate Squared
Temperature	0.0499	0.00249001 kg
Humidity	0.0499	0.00249001 kg
Air pressure	0.1996	0.03984016 kg
Ventilation air flows	0.1996	0.03984016 kg
Debris	0.0499	0.00249001 kg
Electrical supply	0.0499	0.00249001 kg
Sound/vibration	0.1996	0.03984016 kg
Installation	0.0998	0.00996004 kg
Gravity	0.0499	0.00249001 kg
Sum		0.166122853 kg
Estimated Error/Measured Uncertainty @ 95% Confidence level ±		0.407581713 kg

Infeed Scale 22.68-113.4 kg (50-250 lb.) Estimated Weight Uncertainty (KILOGRAMS)		
Error Source	Measurement	Measurement Squared
Type A Error(From HNF-5408, Table 2)		
Bias (from HNF-5408)	-0.1344	0.01806336 kg
Random (from HNF-5408)	0.086863	0.007545181 kg
Type B Error (From WHC-N-930, page 98, converted to kg)		
Estamates	Estimate	Estimate Squared
Temperature	0.0499	0.00249001 kg
Humidity	0.0499	0.00249001 kg
Air pressure	0.1996	0.03984016 kg
Ventilation air flows	0.1996	0.03984016 kg
Debris	0.0499	0.00249001 kg
Electrical supply	0.0499	0.00249001 kg
Sound/vibration	0.1996	0.03984016 kg
Installation	0.0998	0.00996004 kg
Gravity	0.0499	0.00249001 kg
Sum		0.167539111 kg
Estimated Error/Measured Uncertainty @ 95% Confidence level ±		0.409315417 kg
NOTE: To maintain consistancy with earlier estimates, the 50-250 lb. estimate will be used as an estimate for the entire range of 0-250 lbs.		

Infeed Scale 113.4-226.8 kg (250-500 lb.) Estimated Weight Uncertainty (KILOGRAMS)		
Error Source	Measurement	Measurement Squared
Type A Error(From HNF-5408, Table 2)		
Bias (from HNF-5408)	0.815	0.664225 kg
Random (from HNF-5408)	3.621	13.111641 kg
Type B Error (From WHC-N-930 converted to kg)		
Estamates	Estimate	Estimate Squared
Temperature	0.0499	0.00249001 kg
Humidity	0.0499	0.00249001 kg
Air pressure	0.1996	0.03984016 kg
Ventilation air flows	0.1996	0.03984016 kg
Debris	0.0499	0.00249001 kg
Electrical supply	0.0499	0.00249001 kg
Sound/vibration	0.1996	0.03984016 kg
Installation	0.0998	0.00996004 kg
Gravity	0.0499	0.00249001 kg
Sum		13.91779657 kg
Estimated Error/Measured Uncertainty @ 95% Confidence level ±		3.730656319 kg

Infeed Scale 226.8-453.6 kg (500-1000 lb.) Estimated Weight Uncertainty (KILOGRAMS)		
Error Source	Measurement	Measurement Squared
Type A Error(From HNF-5408, Table 2)		
Bias (from HNF-5408)	1.875	3.515625 kg
Random (from HNF-5408)	13.024	169.624576 kg
Type B Error (From WHC-N-930 converted to kg)		
Estamates	Estimate	Estimate Squared
Temperature	0.0499	0.00249001 kg
Humidity	0.0499	0.00249001 kg
Air pressure	0.1996	0.03984016 kg
Ventilation air flows	0.1996	0.03984016 kg
Debris	0.0499	0.00249001 kg
Electrical supply	0.0499	0.00249001 kg
Sound/vibration	0.1996	0.03984016 kg
Installation	0.0998	0.00996004 kg
Gravity	0.0499	0.00249001 kg
Sum		173.2821316 kg
Estimated Error/Measured Uncertainty @ 95% Confidence level ±		13.1636671 kg

Drum measurement uncertainty for drums in weight ranges affected by infeed conveyor scale calibration problems. Information based on data from HNF-5408 Rev 0 and WHC-N-930					
ITEM #	Drum PIN	Actual Measured Drum Weight (kg)	Possible Error +/- kg	Possible Minimum Weight kg	Possible Maximum Weight kg
1	9601879	116.15	3.73	112.42	119.88
2	9513558	117.25	3.73	113.52	120.98
3	9522295	127.2	3.73	123.47	130.93
4	9522503	200.25	3.73	196.52	203.98
5	9406635	144.55	3.73	140.82	148.28
6	9700807	282.05	13.16	268.89	295.21
7	9601581	116.9	3.73	113.17	120.63
8	996000008	202.4	3.73	198.67	206.13
9	996000009	205.1	3.73	201.37	208.83
10	9406601	163.3	3.73	159.57	167.03
11	9406618	141.65	3.73	137.92	145.38
12	9513608	117	3.73	113.27	120.73
13	9517481	132.4	3.73	128.67	136.13
14	9517461	135	3.73	131.27	138.73
15	9401105	150.3	3.73	146.57	154.03

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rum measurement uncertainty for drums in weight ranges affected by infeed conveyor
cale calibration problems.

ITEM #	Drum PIN	Batch	Status	Actual Measured Drum Weight (kg)	Gross Wt. (Kg) Used in Calculation	Raw nCi/g Initially Calculated	Initial Classification	Possible Error +/- kg	Possible Minimum Gross Weight (Kg)	Possible Maximum Gross Weight (Kg)	Minimum nCi/g	Maximum nCi/g	Classifications	Change?
1	9601879	99-22	OK, calculations exist	116.15	116.15	173.9	TRU	3.73	112.42	119.88	168.3	179.5	TRU/TRU	No
2	9513558	99-09	OK, calculations exist	117.25	117.25	12566.4	TRU	3.73	113.52	120.98	12166.6	12966.1	TRU/TRU	No
3	9522295	99-09	OK, calculations exist	127.20	127.20	2065.1	TRU	3.73	123.47	130.93	2004.6	2125.7	TRU/TRU	No
4	9522503	99-24	OK, calculations exist	200.25	200.25	8828.0	TRU	3.73	196.52	203.98	8663.6	8992.4	TRU/TRU	No
5	9406635	99-21	OK, calculations exist	144.55	144.55	24067.3	TRU	3.73	140.82	148.28	23446.2	24688.3	TRU/TRU	No
6	9700807	N/A	Not NDA'd	282.05	Drum will be re-weighed when brought back to the facility.			13.16						
7	9601581	N/A	Not NDA'd	116.90	Drum will be re-weighed when brought back to the facility.			3.73						
8	996000008	N/A	Not NDA'd	202.40	Drum will be re-weighed when brought back to the facility.			3.73						
9	996000009	N/A	Not NDA'd	205.10	Drum will be re-weighed when brought back to the facility.			3.73						
10	9406601	99-35	OK, calculations exist	163.30	163.30	68.9	LLW	3.73	159.57	167.03	67.3	70.4	LLW/LLW	No
11	9406618	99-35	OK, calculations exist	141.65	141.65	610.6	TRU	3.73	137.92	145.38	594.5	626.7	TRU/TRU	No
12	9513608	99-46	OK, calculations exist	117.00	117.00	4077.9	TRU	3.73	113.27	120.73	3947.9	4207.9	TRU/TRU	No
13	9517481	99-71	NDA'd, but batch not yet calculated	132.40	Drum will be re-weighed when brought back to the facility.			3.73						
14	9517461	99-70	OK, calculations exist	135.00	135.00	446.3	TRU	3.73	131.27	138.73	434.0	458.6	TRU/TRU	No
15	9401105	99-77	NDA'd, but batch not yet calculated	150.30	Drum will be re-weighed when brought back to the facility.			3.73						