**Washington**
*TRU Solutions LLC*

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February 23, 2009

ATTN: Document Control Desk
Director, Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF AN APPLICATION FOR REVISION 22 OF THE TRUPACT-II SHIPPING PACKAGE APPLICATION (DOCKET No. 71-9218, TAC No. L24217) AND REVISION 5 OF THE HalfPACT SHIPPING PACKAGE APPLICATION (DOCKET No. 71-9279, TAC No. L24218)

References:
1. Letter from T. E. Sellmer to M. Rahimi dated April 14, 2008, subject: Response to Request for Additional Information for Review of an Application for Revision 22 of the TRUPACT-II Shipping Package Application (Docket No. 71-9218, TAC No. L24110) and Revision 5 of the HalfPACT Shipping Package Application (Docket No.71-9279, TAC No. L24111)
2. Letter from K. J. Hardin to T. E. Sellmer dated November 26, 2008, subject: Request for Additional Information for Review of the Certificates of Compliance No. 9218 and 9279, Revision for the Model Nos. TRUPACT-II and HalfPACT Packages

Dear Sir or Madam:

Washington TRU Solutions LLC, on behalf of the U.S. Department of Energy, hereby submits an amendment to Revision 22 of the application for a Certificate of Compliance (CoC) for the TRUPACT-II Packaging, U.S. Nuclear Regulatory Commission (NRC) Docket No. 71-9218, and Revision 5 to the application for a CoC for the HalfPACT Packaging, NRC Docket No. 71-9279 (Reference 1). The amendment is in response to the Request for Additional Information (RAI) (Reference 2).

The amendment consists of the following documents:

- TRUPACT-II Safety Analysis Report (SAR), Revision 22
- HalfPACT SAR, Revision 5
- Contact-Handled Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC), Revision 3
- CH-TRU Payload Appendices, Revision 2.

NMSS01

P.O. Box 2078 • Carlsbad, New Mexico USA 88221-2078
Phone: (505) 234-7200 • Fax: (505) 234-7083

This letter includes the following attachments:

- Attachment A – Responses to RAI
- Attachment B – Revised Documents
- Attachment C – Supplementary References
- Attachment D – Thermal Analysis Files.

Individual responses to the RAI are provided in Attachment A, which also outlines specific changes to the revised documents provided in Attachment B. In addition, a revised calculation package for the thermal analysis of the HalfPACT package containing three shielded containers is provided in Attachment C. The shielded container thermal analysis model input and output files are provided in Attachment D. All technical changes necessary to specifically address the RAI are indicated by right-bars in the margin of the documents ("|"). Right-bars in the margin of the documents indicating technical changes made to the documents in the original submittal of this application have been retained.

To facilitate implementation, it is requested that the current package CoCs be valid for use one year from the date of issuance of the revised CoCs.

If you have any questions regarding this submittal, please contact Mr. B. A. Day of my staff at (575) 234-7414.

Sincerely,

Todd Sellmer

T. E. Sellmer, Manager
Packaging Integration

TES:clm

cc: M. Brown, CBFO
D. Gadbury, CBFO

## TRUPACT-II SAR

### Chapter 3 Thermal Review

3-1 Original 3-1: Provide an uncertainty analysis for the TRUPACT-II maximum normal operating pressure (MNOP) analysis. Justify the pressure calculation conservatively accounts for uncertainty of decay heat, temperature, void volume, etc.

Original: In the payload assembly decay heat limits analysis, Table 3.4-6 shows pressure increase of 49.74 psig for Type III.1. The pressure increase is very close to the specification of 50 psig. Same issue applies to Table 3.4-7 to 3.4-11.

This information is needed to ensure compliance with 10 CFR 71.4 and 71.33(a)(5).

New: Provide measurement data to validate the calculated flammable gas generation rate. Clarify whether the $G_{theoretical}/G_{actual}$ ratio estimated in CH-TRAMPAC Section 5.2.5.3.3 holds for all types of waste and configuration. Provide experiment measurements of MNOP to validate the MNOP analysis for both TRUPACT-II and HalfPACT.

In the RAI 3-1 response, the applicant states "An analysis of the relationship between flammable gas generation and total gas generation is provided in CH-TRAMPAC Section 5.2.5.3.3. The payload container flammable gas generation limits correspond to low total gas generation, which means that the 50-psig design pressure specification will be met by a large margin for payloads comprised of payload containers that meet flammable gas generation limits. Therefore, compliance with the payload container flammable gas generation limits will ensure compliance with the MNOP." In CH-TRAMPAC Section 5.2.5.3.3, an example was presented to show the relation between actual G value and theoretical G value and the conclusion was the actual G value is 18 times lower than the theoretical value. However, the "actual" value is obtained from the hydrogen gas generation rate formula derived by the gas generation methodology, not a measurement value. In light of the small margin for the payload container flammable gas generation limits, staff needs experimental validation to support the methodology.

This information is needed to ensure compliance with 10 CFR 71.31(a)(2) and 71.43(d).

**<u>Response</u>:**
The calculated flammable gas generation rate (FGGR) of 1.79E-07 moles/second (mol/s) used in the example presented in CH-TRAMPAC Section 5.2.5.3.3 is the <u>FGGR limit</u> specific to the hypothetical standard waste box (SWB) used in the example. By comparison, data for all SWBs shipped to

date under the test category show the highest actual FGGR value based on headspace measurement to be 5.683E-09 mol/s. Similarly, the gas generation ratio ($G_{theoretical}/G_{actual}$) estimated in CH-TRAMPAC Section 5.2.5.3.3 is specific to the hypothetical Waste Material Type III.1 SWB. The $G_{theoretical}/G_{actual}$ ratios for other types of waste and configurations differ, but are greater than one when the FGGR limits are met, meaning that $G_{actual}$ is always lower than $G_{theoretical}$. For Waste Types I, II, and III, when FGGR limits are met, compliance with the design pressure limit (due to total gas generation) is ensured because the primary mechanism for flammable and total gas generation is the same (i.e., radiolysis).

In order to more clearly illustrate this fact and directly address the purpose of the CH-TRAMPAC Section 5.2.5.3.3 example, alternate pressure increase calculations for Waste Material Type III.1 have been added to CH-TRAMPAC Section 5.2.5.3.3. These calculations are based on the maximum possible FGGR limits. Maximum possible FGGR limits per payload container type were used to calculate maximum possible FGGR-limited pressures at the end of the 60-day shipping period. In each case, the pressure increase is well below the 50-psig pressure design limit. For comparison, pressure increase calculations based on actual FGGR values calculated from measurement data also are provided. Sample shipment data for 4,008 payload containers shipped in 354 payloads, each of which included at least one test category container, were evaluated to determine the highest possible pressure increase based on the actual payload FGGR and wattage values. The shipment data calculations validate the bounding FGGR-limited pressure values as the highest pressure increase for each is less than the maximum pressure increase for the applicable payload container type.

Experimental measurements of MNOP to validate the MNOP analysis for TRUPACT-II and HalfPACT packages are not available. Upon shipment completion (typical shipping periods are not more than 5 days; see Table 3.6-3 of CH-TRU Payload Appendix 3.6, *Shipping Period – Controlled Shipments*), the packages are connected to a vacuum system and the inner containment vessels (ICVs) are partially evacuated to facilitate rotation of the locking rings and removal of the lids. Pressure in the ICVs is monitored during the evacuation process, but the pressure at the start of the evacuation process has not historically been recorded. However, the more than 7,000 TRUPACT-II and HalfPACT shipments completed to date have arrived with no evidence of any significant pressurization above normal atmospheric pressures.

**Contact Handled-Transuranic Waste Authorized Methods for Payload Control (CH-TRAMPAC)**

CH-1 Original CH-2: Provide validation of the analytical shipping category for waste Type I, II, and III based on existing shipment data.

Original: The staff needs to verify the consistency between gas generation compliance methods and the gas generation methodology based on the measurement of flammable gas concentration or flammable gas generation rate (FGGR) from shipments, particularly validation of analytical category for Type I, II, and III. For analytical category, the head space sampling data should prove the flammable gas concentration meets the limit predicted by the methodology based on waste type, package configuration, decay heat, and shipping period.

New: Characterize the analytical category shipments that show unqualified FGGR limits in the validated set and provide a methodology to exclude them from the analytical category. Alternatively, the applicant should justify why the current configuration of the analytical category drums and methodology ensure that hydrogen concentrations will not exceed 5% even without headspace sampling. Specify the phenomena and waste configurations of the analytical category shipments that result in hydrogen concentrations that are not as conservative as initially expected.

The applicant stated in the CH-2 RAI response that an analysis of the estimated FGGR for individual drums shows that approximately 96% of the 9,665 drums have measured headspace sampling hydrogen concentration values that comply with the assigned payload shipping category FGGR limits. The applicant indicates the drums in the remaining 4% of the data set comply with the 5% hydrogen concentration limit based on the reported headspace hydrogen concentration data and other mitigating factors.

The applicant indicated these FGGR unqualified drums were shipped based on compliance of reported headspace hydrogen concentration data in consideration with other factors such as venting, overly estimated hydrogen concentration, drum opening, and overly conservative confinement assumptions. The analytical category containers basically require confirmation with only decay heat requirements. However, the historical shipping data indicates that a significant number of package configurations (i.e., 4%) may need to undergo a remediation process or some other type of evaluation. The licensee should characterize these exceptional configurations and determine if they require a special category. A methodology should be developed to identify these packages and exclude them out of the analytical shipping category (similar to the approach for 100-gallon drums containing 55-gallon puck drums). The applicant should clarify the extent that headspace sampling is relied upon to identify analytical configurations that may not comply with FGGR. The staff notes that headspace sampling is not required in the current CoC for analytical configurations.

This information is needed to ensure compliance with 10 CFR 71.31(a)(2) and 71.43(d).

**Response:**

Reference CH-1.1: Letter from T. E. Sellmer to M. Rahimi dated April 14, 2008; subject: Response to Request for Additional Information for Review of an Application for Revision 22 of the TRUPACT-II Shipping Package Application (Docket No. 71-9218, TAC No. L24110) and Revision 5 of the HalfPACT Shipping Packaging Application (Docket No. 71-9279, TAC No. L24111).

Reference CH-1.2: Letter from T. E. Sellmer to K. Hardin dated December 5, 2008; subject: Teleconference Summary and Clarification Regarding the Verification of the Analytical Shipping Category Based on Existing Shipment Data.

There is no compliance issue with respect to the 5% hydrogen concentration limit for the entire data set of 9,665 55-gallon drums used in the validation analysis presented in response to the original CH-2 RAI (Reference CH-1.1). The hydrogen headspace measurement method consistently validates the analytical category decay heat limits. Both methods are conservative with respect to the 5% hydrogen concentration limit. A drum passing either method will not violate the regulatory boundary of less than or equal to 5% hydrogen in the innermost confinement layer.

The results of the Reference CH-1.1 validation analysis reflected the facts that the headspace data was not collected for the purpose of determining compliance with FGGR limits under the test category and the analysis was simplified (Reference CH-1.2). For approximately 4% of the 9,665 drum population (410 drums), these limitations of the data analysis resulted in overestimated FGGR values. Further analysis of this population showed that there were no compliance issues for these 410 drums with respect to the 5% limit on hydrogen concentration in the innermost layer of confinement. Attachment A-1 (at the end of Attachment A) provides a summary of this analysis on a drum-by-drum basis. Key elements of this analysis are provided below.

Drums with No Detectable Hydrogen Measured (288 of 410 drums)

The majority of the 410 drums (288 drums) detected no hydrogen upon headspace measurement. The hydrogen concentration in these containers was below the detection limit, which is the minimum hydrogen concentration that can be measured by a given piece of analytical equipment (i.e., gas chromatograph [GC] or GC/mass spectrometer). For drums with no detectable hydrogen measured in the headspace, the value of the hydrogen detection limit was used (instead of zero) in the Reference CH-1.1 validation analysis. The FGGR values calculated by the AltMeth model were overestimated for these drums due to the use of the hydrogen detection limit value as the measured value.

As a specific example, no detectable hydrogen was measured in the headspace of Drum No. SR510338A. The hydrogen detection limit value of 700 ppm (0.07 volume percent) was used in the simplified AltMeth model. With the large number of layers of confinement for this container (five) and a short time interval between drum generation/venting and sampling (25 days), the AltMeth measurement methodology results in a high FGGR. Figure CH-1.1 shows a graphical depiction of the headspace hydrogen profile for this drum. The gradient between the headspace and the innermost confinement layer predicted by AltMeth for this drum is greater than a factor of 70 (7,000%). When combined with the use of the hydrogen detection limit value, this results in an overprediction of the FGGR value even when no hydrogen is detected.

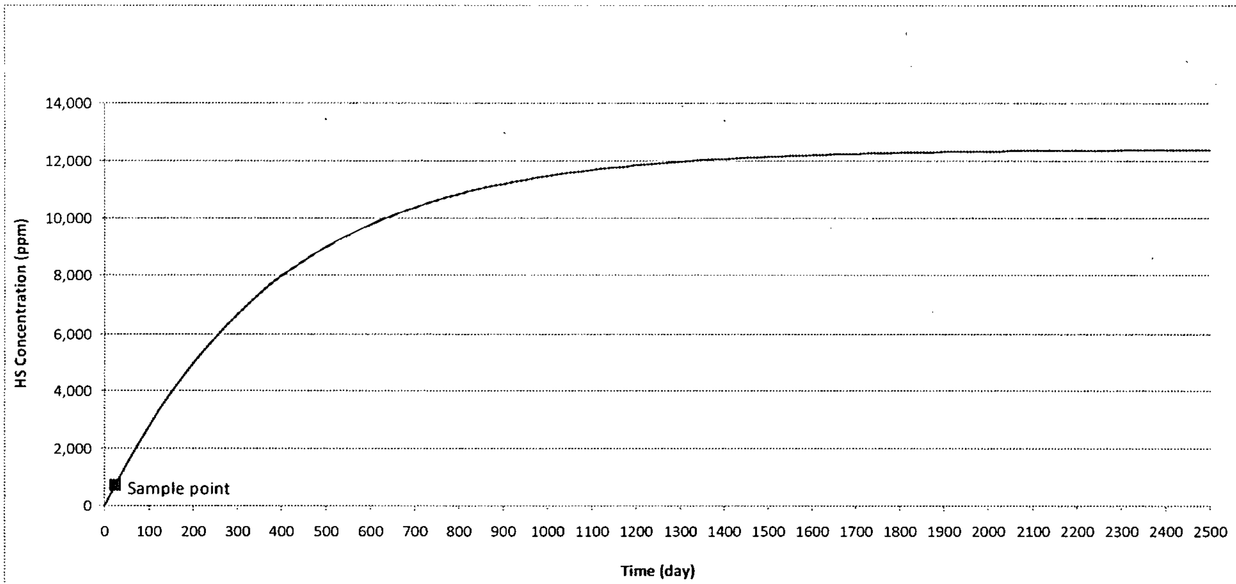



**Figure CH-1.1 - Headspace Hydrogen Profile Predicted by AltMeth for Drum No. SR510338A**

Location of Hydrogen Sampling (53 of 410 drums)

The simplified AltMeth model compliance evaluation assumed that each of the 410 drums was sampled for hydrogen in the drum headspace just below the drum lid. Of the 410 drums, 53 drums were actually sampled inside the rigid drum liner at the time of container and rigid liner venting instead of above the unvented high-density polyethylene rigid drum liner. As such, the FGGR values calculated by the AltMeth model in the Reference CH-1.1 validation analysis are overestimated for these drums due to the use of an inaccurate simplifying assumption. When correctly modeled with respect to sampling location (below the rigid drum liner), these drums do not fail FGGR limits.

For example, the FGGR limit for Drum No. NT041865 is 8.170E-09 mol/s. The simplified AltMeth model incorrectly calculated an FGGR value of 1.863E-07 mol/s. The revised calculation (correcting the sampling location) results in an FGGR value of 5.871E-10 mol/s (below the FGGR limit). In this case, the incorrect assumption of sampling above an unvented rigid liner results in an AltMeth prediction of a very large gradient across the rigid liner (which does not exist when the sample is collected under the rigid liner).

Drums Sampled During Aspiration (31 of 410 drums)
An additional 31 drums were generated in an unvented condition and were vented some time after generation prior to sampling. Payload containers that have been stored in an unvented condition are subject to the aspiration requirements of the CH-TRAMPAC and aspirate until equilibration of any gases that may have accumulated in the closed container. Because these drums were sampled while aspiration was occurring, the headspace hydrogen concentration of these drums at the time of shipment is expected to be lower than that used in the Reference CH-1.1 validation analysis.

Hydrogen Gradients Likely Overpredicted (38 of 410 drums)
The Reference CH-1.1 validation analysis results for the remaining 38 drums can be explained by the likely overestimation of the number of confinement layers associated with a conservatively assigned payload shipping category (i.e., the assigned payload shipping category assumes more confinement layers than are actually present) and the assumption of slow hydrogen transport across the layers. The overestimation of the number of confinement layers results in the overprediction of hydrogen gradients. The AltMeth model predicts hydrogen concentrations per innermost confinement layer by building up the headspace concentration to the steady state value. A significant overprediction of the gradient between the headspace and innermost layer occurs whenever the actual gas release rates are higher than predicted by the model and/or when sampling of the headspace is performed close to the generation/venting date.

Drum No. NT042003 provides an example of the result of AltMeth hydrogen gradient overprediction when the number of confinement layers is overestimated. This drum is assigned to a payload shipping category describing four confinement layers and was sampled 50 days after generation/venting. For Drum No. NT042003, the FGGR limit associated with the four-layer payload shipping category is 8.170E-09 mol/s. The Reference CH-1.1 validation analysis calculated an FGGR value of 3.436E-07 mol/s. Assuming that the number of confinement layers is one, the resulting FGGR value is 5.524E-08 mol/s, which is below the revised FGGR limit of 6.667E-08 mol/s corresponding to a payload shipping category describing one confinement layer.

In summary, there is no compliance issue with respect to the analytical category inventory, and all drums that meet analytical category limits meet the 5% limit on hydrogen concentration in the innermost layer of confinement.

CH-2 Clarify if waste type IV materials are proposed authorized contents for the shielded container.

The applicant stated in Section 5.2.5.4.1 "Compliance with flammable (gas/VOC) limits for shielded containers may not be evaluated by testing." For Type IV waste, the shipment is subject to full container testing according to Figure 5.2-1. The applicant should clarify whether Type IV waste is an authorized content for the shielded container.

This information is required by the staff to assess compliance with 10 CFR 71.31(a)(2) and 71.43(d).

**Response:**

Comment incorporated. Waste Type IV material is not an authorized content for the shielded container. CH-TRAMPAC Sections 5.2.2.4, 5.2.5.2, and 5.2.5.4.1 have been revised to state that "Compliance with flammable (gas/VOC) limits for shielded containers shall not be evaluated by testing." CH-TRAMPAC Sections 5.2.2.4, 5.2.5.1.2, 5.2.5.2, and 5.2.5.4.1 have been revised to add text explicitly stating that Waste Type IV material is not authorized for shipment in the shielded container. Because testing is the only method of qualification for Waste Type IV containers, Waste Type IV is not allowed in shielded containers.

CH-3 Original CH-6: Explain the procedure to handle the scenario when a 9-day transport and unloading time limit is not met.

Original: In Procedure 6.2.3.3, a procedure is specified if the 24-hr limit is not met. For procedure 6.2.3.7, there is no procedure specified if the 9-day transport and unloading time limit is not met. Provide the procedure for this scenario.

New: Provide the procedure to handle the scenario when a 9-day transport and unloading time is not met.

Revised Procedure 6.2.3.7 in response to RAI CH-6 does not provide a procedure for the scenario that the 9-day transport and unloading time is not met. A procedure similar to 6.2.3.3 should be provided (i.e., if total loading time is less than or equal to 24 hours, proceed to Step 6.2.3.4. If total loading time exceeds 24 hours, the package must be vented for a period at least as long as the period the TRUPACT-II or HalfPACT ICV was sealed and the closure process must be repeated.)

This information is needed to ensure compliance with 10 CFR 71.35(c) and 71.43(d).

**Response:**

Comment incorporated. As detailed in CH-TRU Payload Appendix 3.6, the determination of the 10-day controlled shipping period is based on conservative time estimates for loading, transport, and unloading activities and includes a margin of safety of three days. CH-TRU Payload Appendix 3.6 and CH-TRAMPAC Section 6.2.3 outline administrative controls imposed for the controlled 10-day shipping period to ensure venting of the ICV within 9 days of shipment departure from the shipping site. Should it ever become evident that the 9-day period may be exceeded, circumstance-specific actions will be identified and taken as needed to ensure venting within 9 days (e.g., prohibit initiation of a controlled shipment at times when adverse weather exists or is forecasted). If the 9-day transport and unloading time is exceeded, the shipment is noncompliant with the Certificate of Compliance for the applicable package. Under the scenario in which the 9-day transport and unloading time is not met, the protocol established by 10 CFR §71.95 requires that the incident be reported to the NRC. CH-TRAMPAC Section 6.2.3.6 has been revised to add text to this effect.

## Contact Handled-Transuranic (CH-TRU) Payload Appendices

AP-1 Provide materials of construction for the 30-gallon payload drum. Refer to CH-TRU Payload Appendices, Appendix 4.5, page 4.5-1.

This information is necessary to accurately provide a sufficient basis for evaluation of the SAR.

This information is needed to ensure compliance with 10 CFR 71.33.

**Response:**

Comment incorporated. The material of construction of the 30-gallon payload drum is steel. Steel 30-gallon drums were utilized for certification testing as referenced in Section 4.5.3.2, *Structural Evaluation for Hypothetical Accident Conditions*, of CH-TRU Payload Appendix 4.5, *Description of Shielded Container*.

CH-TRAMPAC Section 2.9.10 and Section 4.5.2 of CH-TRU Payload Appendix 4.5 have been revised to specify that the 30-gallon payload drum is to be constructed of steel.

AP-2 Original AP-2: Include the proposed controls for the 100-gallon drums loaded with compacted 55-gallon drums in CH-TRAMPAC (Section 3.10.1) with the additional information on adjusted hydrogen concentration based on the decay curve.

Original: Per January 21, 2008 letter, WTS proposed to include specific controls for 100-gallon drums loaded with compacted 55-gallon drums in the CH-TRAMPAC. Staff agrees with the addition of the proposed control. However, more explanation is needed on the use of the decay curve for determining an adjusted hydrogen concentration.

New: Revise Figure 6.14-2 in CH-TRU Payload Appendices and provide a measurement time for hydrogen concentration.

The decay curve provided (Figure 6.14-2) in the RAI response (AP-2) does not include the original data points and has no numerical values on the axes. It is merely a statistical trend with no indication of measurement time. No definitive time in days is specified in the curve or in the method to perform the proposed hydrogen concentration measurement. A conservative measurement time is needed to ensure the acceptable hydrogen concentration limit is met.

This information is required by the staff to assess compliance with 10 CFR 71.31(a)(2) and 71.43(d).

**Response:**

Reference AP-2.1: Letter from T.E. Sellmer to M. Rahimi dated January 21, 2008; subject: Proposed Methodology for Shipment of Analytical Category 100-Gallon Drum Transuranic Wastes in TRUPACT-II and HalfPACT Packages.

Figure 6.14-2 of CH-TRU Payload Appendix 6.14, *Test Category Measurement Methodology for Analytical Category 100-Gallon Drums Containing 55-Gallon Puck Drums*, is not used, but rather the headspace hydrogen concentration at the time of sampling is used without decay in the evaluation of compliance with the applicable FGGR limit. This conservative approach was selected in order to facilitate use of the existing CH-TRAMPAC methodology (i.e., with no adjustment for the decay of the hydrogen concentration after sampling) for 100-gallon drums as outlined in CH-TRU Payload Appendix 6.14.

Figure 6.14-2 was generated as a curve-fit for data points from resampling of 100-gallon drums containing 55-gallon puck drums that had initially elevated headspace hydrogen concentrations (Reference AP-2.1). The resampling data showed that the initially elevated headspace hydrogen concentrations decreased exponentially with time. While some intermediate headspace hydrogen concentration data points showed slight increases, subsequent sampling supported the downward trend of the decay curve concentrations. The proposed methodology of using the measured headspace hydrogen concentration without credit for any decay establishes a conservative compliance limit. For example, the proposed methodology (using the measured headspace hydrogen concentration as the steady state value) when applied to a payload of six 100-gallon drums and a 60-day shipping period limits the headspace hydrogen concentration of each drum to only 0.5883 volume percent. Any measured headspace hydrogen concentration greater than 0.5883 volume percent for this configuration will fail the FGGR limit. Therefore, the FGGR limit established by the proposed methodology requires that any initially elevated headspace hydrogen concentration decay to very low levels before a drum can pass.

For clarity, Figure 6.14-2, which is not used (i.e., no credit is taken for the decay of hydrogen), has been deleted from CH-TRU Payload Appendix 6.14. Text in Section 6.14.3 of CH-TRU Payload Appendix 6.14 referring to Figure 6.14-2 also has been deleted.

AP-3 Justify the load resistance for the shielded container. Explain the difference between the values and other drums.

Table 2.2-4 shows load type resistance for the shielded container. The resistance factor for the shielded container is relatively smaller than 55, 85, or 100 Gallon drums for different shipping periods.

This information is needed to ensure compliance with 10 CFR 71.31(a)(2) and 71.43(d).

**Response:**

The load type resistance defines the resistance to hydrogen release that is attributed to the buildup of hydrogen in the package void space during the defined shipping duration. The load type resistance is represented by the term "(t)($n_{gen}$)/$N_{tg}$" that is added to the "effective resistance" ($R_{eff}$) in the denominator of Equation 4 of CH-TRU Payload Appendix 2.3, *Derivation of Decay Heat Limits.*

The load type resistance values specified in Table 2.2-4 of CH-TRU Payload Appendix 2.2, *Procedure for Determining Numeric Payload Shipping Category*, are determined using the following formula:

$$R_{LoadType} = \frac{t * n_{gen} / N_{tg}}{100}$$

where,

$t$ = shipping period duration (i.e., 60, 20, or 10 days), in seconds

$n_{gen}$ = number of hydrogen generators (number of payload containers per payload – 3 shielded containers per HalfPACT)

$N_{tg}$ = total moles of gas inside the ICV cavity, calculated as:

$$N_{tg} = (P)(V_{void}) / RT$$

where,

P = 760 mm Hg

$V_{void}$ = ICV cavity void volume for a given payload (2,100 liters per HalfPACT payload of 3 shielded containers)

R = 62.361 mm Hg-liter/mole-K

T = 70°F (294K)

For the HalfPACT payload of three shielded containers, $N_{tg}$ is:

$$N_{tg} = \frac{(760 mmHg)(2{,}100 L)}{(62.361 mmHg - L/mole - K)(294 K)} = 87.05 \text{moles}$$

The load type resistance value calculation for the shielded container HalfPACT payload and a 60-day shipping period is as follows:

$$R_{LoadType} = \frac{[(60 days)(86{,}400 \sec/day)(3 containers)]/87.05 moles}{100} = 1{,}787$$

Per the above formula, the load type resistance value is directly proportional to the ratio of the number of generators to the ICV cavity void volume for the payload. The table below provides values for number of hydrogen generators and ICV cavity void volume in drum payloads, which are inputs to the formula for calculating the load type resistance values. Per the formula for load type resistance, the ratio of these two parameters is controlling. Among comparable drum payloads, this ratio is the lowest for the shielded container payload as shown below. Consequently, the load type resistance values for shielded container payloads are lower (by this ratio) than those for 55-, 85-, and 100-gallon drum payloads.

| Payload Type | No. of Hydrogen Generators① | ICV Cavity Void Volume① | Ratio of No. of Hydrogen Generators to ICV Cavity Void Volume (x $10^{-3}$) |
|---|---|---|---|
| 55-gallon drum | 14 | 2,450 | 5.714 |
| Shielded container | 3② | 2,100② | 1.429 |
| 85-gallon drum | 8 | 2,087 | 3.833 |
| 100-gallon drum | 6 | 2,715 | 2.210 |

① References: TRUPACT-II SAR Section 3.4.4.2.1, Tables 3.4-6, 3.4-9, and 3.4-10; HalfPACT SAR Section 3.4.4.2.1, Table 3.4-8.

② As the shielded container is proposed only as a HalfPACT payload, the parameters reflect HalfPACT payload values (55-, 85-, and 100-gallon drum payloads use the bounding TRUPACT-II payload values).

## HalfPACT Review Contact Handled-Transuranic (CH-TRU) Payload Appendices

HP-1 Provide the shielded container thermal analysis model input and output files.

The licensee provided HalfPACT Shielded Container Thermal Analysis Report (P04F.M2.02-03) with computer run records. A complete thermal model input deck and run results should be provided to facilitate the review. Refer to ISG-21 for guidance on the use of computational modeling software and the kinds of information to be provided to support a licensing action.

This information is needed to ensure compliance with 10 CFR 71.35, 71.71(b)(c).

**Response:**

Electronic copies of the input and output files are provided on the CD-ROM entitled Shielded Container Thermal Analysis Model Input and Output Files attached to this transmittal (Attachment D).

HP-2 Justify the direct application of insolation load to the components on the inside of polyurethane foam.

In SAR Section 3.4, the applicant states "Accordingly, a 100°F ambient temperature with the following insolation values are used for heat input to the exterior package surfaces." While in Section 4.5.4.1 of CH-TRU Payload Appendices, the 24-hour averaged insolation load is applied to the components on the inside of polyurethane foam including payload and internal package. The licensee should reconcile this difference. The solar load is usually applied on the package exterior boundary and then the heat diffuses to the internal package through heat transfer mechanisms (conduction, convection, and radiation). The applicant should provide the reasons for applying direct heat source on the internal components.

This information is required by the staff to assess compliance with 10 CFR 71.35 and 71.71(c).

**Response:**

Comment incorporated. There is no inconsistency between SAR Section 3.4 and Section 4.5.4.1 of the CH-TRU Payload Appendices in regards to how the solar heat load is applied; in all cases it is applied to the external surfaces of the HalfPACT package. As described in HalfPACT SAR Section 3.1.3, *Boundary Conditions*, the application of insolation values averaged during 24 hours is used to determine the peak temperature of components interior to the polyurethane foam, while the application of insolation values averaged during 12 hours is used to determine the peak temperature of the outer segments of the polyurethane foam and outer containment assembly outer shell. The justification for the use of two separate steady-state analyses is provided in HalfPACT SAR Section 3.1.3.

The RAI appears to misinterpret the intent of the wording in Section 4.5.4.1 of the CH-TRU Payload Appendices stating that "...components on the inside of the polyurethane foam use the insolation values of 10 CFR§71.71(c)(1), averaged over 24 hours" to mean the insolation is applied directly to the components. The text in CH-TRU Payload Appendix 4.5.4.1 has been revised along with the Calculation Package (P04F.M2.02-03, Section 2.4.1) to provide a consistent and clear description of how the insolation heat loads are handled.

HP-3 Provide the following clarifications to the thermal models for HalfPACT/Shielded Container configuration.

a. The thermal model of HalfPACT is a three-dimensional 180 degree symmetry model. According to the model description, six segments of the two-dimensional lumped parameter HalfPACT SAR model, each encompassing a 30 degree wide segment of the packaging circumference, are combined to form a 180 degree symmetry model. The applicant needs to clarify how these 2-D segments can simulate 3-D effects.

b. In Section 6.2.2 of Calculation Package P04F.M2.02-03, the applicant states "Figure 6-6 repeats the model layout shown in Figure 6-5 but with the addition of the ICV shell and honeycomb spacer surfaces. These surfaces represent the boundary with the HalfPACT modeling obtained from the HalfPACT SAR." The applicant should clarify whether the final solution is obtained from simultaneous solution of both HalfPACT and Shielded Container models. If not, the applicant should clarify the details of integrated solution method, which include the interface between two models and the sequence of calculation.

c. Provide thermal properties of the material inside shielded container.

The applicant stated "The payload within the shielded containers is conservatively assumed to be paper and to exhibit the thermal conductivity of air in order to bound the potential temperature rise and temperature limit within the payload." The thermal properties of the materials (paper) are not included in either SAR or the calculation package (P04F.M2.02-03). The applicant needs to provide these properties and the actual material thermal properties to verify the adequacy of conservatism in this assumption.

This information is needed to ensure compliance with 10 CFR 71.35 and 71.71(b)(c).

**<u>Response</u>:**

a. Comment incorporated. As described in HalfPACT SAR Section 3.4.1.1, *Analytical Model*, the thermal model of the HalfPACT packaging represents a two-dimensional lumped parameter model encompassing a 30 degree wide segment of the packaging circumference. In the same manner that a series of 1-D models can be connected to form a 2-D model, the HalfPACT 2-D lumped parameter representation is applicable in the construction of a 3-D lumped parameter model of the HalfPACT packaging. In this instance, the 2-D modeling from the original HalfPACT packaging model is used to determine the radial and axial conduction of heat within each 30 degree wide circumferential segment of the 3-D lumped parameter model. To complete the 3-D model, circumferential thermal conductors were added under this modeling effort in order to capture the interaction between the individual thermal nodes representing the temperature at each 30 degree segment. The combined effect is a 3-D lumped parameter model of the HalfPACT packaging.

Section 4.5.4.1 of CH-TRU Payload Appendix 4.5 and the Calculation Package (P04F.M2.02-03, Section 6.2.1) have been revised to clarify the modeling approach.

b. Comment incorporated. As explained in Calculation Package P04F.M2.02-03, Section 6.2.1, the thermal model of the Shielded Containers within the HalfPACT packaging is a composite of a newly generated 'solids' model of the Shielded Containers, the waste contents, dunnage, pallets, etc., and an existing 2-D lumped parameter model of the HalfPACT packaging that was incorporated into a 3-D representation (see the response to HP-3 a, above). These two sub-models are combined using a feature of the SINDA/FLUINT computer code and solved simultaneously to generate a unified thermal solution.

The common boundary between the two sub-models is the inner surfaces of the ICV shell and the honeycomb spacers. The heat transfer mechanisms interior to these surfaces is determined by the 'solids' submodel, while the heat transfer exterior to these surfaces, including the ICV shell and the honeycomb spacers, is determined by the 3-D submodel of the HalfPACT packaging.

The above details have been added to the description of the thermal model in Section 4.5.4.1 of CH-TRU Payload Appendix 4.5 and the Calculation Package (P04F.M2.02-03, Section 6.2.1) to clarify the modeling approach.

c. Comment incorporated. As stated in Section 4.5.4.1 of CH-TRU Payload Appendix 4.5, "The payload within the shielded containers is conservatively assumed to be paper and to exhibit the thermal conductivity of air ...." The thermal properties of air are provided in Table 3-3 of calculation package P04F.M2.02-03. A similar set of properties are provided in Table 3.2-3 of the HalfPACT SAR.

The definition of the payload as being paper with the thermal properties of air is meant to imply that the heat transfer within the waste containers is via conduction only since the thermal conductance of crumpled paper would be dominated by the trapped air spaces and the multiple paper surfaces will prevent any significant radiation heat transfer from the payload interior to the surfaces of the waste container. This analysis approach is consistent with the prior thermal evaluations performed for all other authorized HalfPACT payload configurations.

The description of the payload has been revised in Section 4.5.4.1 of CH-TRU Payload Appendix 4.5 and the Calculation Package (P04F.M2.02-03, Section 6.2.2) to add clarification and to specifically reference the properties of air for the thermal properties of the waste payload.

HP-4 Justify the reason for no HAC thermal evaluations of the shielded container, and that the evaluations of the approved containers are bounding, given the following differences and discrepancies between the shielding container and approved containers.

a. The third justification in CH-TRU Payload Appendices 4.5.4.2 assumes greater thermal mass for a single shielded container than a single 55-gallon drum. The 4-th justification in the calculation package (Section 5.0 in P04F.M2.02-03) assumes the maximum payload mass of the shielded container payload is identical to the maximum base payload mass. The applicant should clarify the difference in these statements.

b. In Calculation Package P04F.M2.02-03, a statement of less heat transfer rate to the shielded containers is used to support no safety evaluation for HAC. The justification of this statement is not provided in the CH-TRU Payload Appendices. The applicant should revise the CH-TRU Payload Appendices 4.5.4.2 to reconcile the differences.

c. The applicant predicts the shielded container configuration will be bounded by the base load configuration (seven 55-gallon drums) in HAC. Based on the NCT calculation results, Table 4.5-1, the shielded container is more limiting than the base load configuration. It appears to staff that the shielded containers would expect to be less limiting under both NCT and HAC. The applicant should explain this discrepancy.

This information is needed to ensure compliance with 10 CFR 71.35 and 71.73(4).

**Response:**

a. Comment incorporated. The third justification provided in Section 4.5.4.2 of CH-TRU Payload Appendix 4.5 and the fourth justification in P04F.M2.02-03 are each correct as stated. The third justification refers to the thermal mass of an individual payload container, whereas the fourth justification refers to the thermal mass of the packaging contents (i.e., payload containers, waste contents, dunnage, pallets, etc.). As defined in Table 2.3-1 of the CH-TRAMPAC, the maximum gross weight of a 55-gallon drum is 1,000 lbs., whereas the maximum gross weight of a shielded container is 2,260 lbs. As defined in Table 2.3-3 of the CH-TRAMPAC, the maximum gross weight of the payload (contents) in a HalfPACT is 7,600 lbs. for all payload assembly configurations. Table 2.2-1 of the HalfPACT SAR defines how the total weight of the payload (packaging contents), when maximally loaded, is restricted to the same limit in both the 55-gallon drum and shielded container payload configurations.

The fourth justification in Section 5.0 of P04F.M2.02-03 has been modified to clarify that the statement is referring to the entire payload (i.e., the packaging contents). The fourth justification has been added to Section 4.5.4.2 of CH-TRU Payload Appendix 4.5.

b. Comment incorporated. Section 4.5.4.2 of CH-TRU Payload Appendix 4.5 has been revised to include the statement and associated justification.

c. Comment incorporated. The justification provided in Section 4.5.4.2 of CH-TRU Payload Appendix 4.5 for not requiring a specific hypothetical accident conditions (HAC) thermal analysis or testing for the shielded containers is based on the expected temperature rise. It is temperatures of the shielded container base, lid, and sidewall that are of importance as it relates to the ability of the package to continue to serve its shielding function in a post-fire scenario. Per Table 4.5-1 of CH-TRU Payload Appendix 4.5, the normal conditions of transport (NCT) thermal response of the shielded container is within 3°F of the 55-gallon drum payload configuration when comparing the container enclosure temperatures. Similarly, per Table 4.5-2 of CH-TRU Payload Appendix 4.5, with all decay heat in a single container, the NCT thermal response of the shielded container is within 7°F of the 55-gallon drum payload configuration. Further, for this latter case, temperatures for the worst-case 55-gallon drum are greater than temperatures for the worst-case shielded container.

As discussed in Section 4.5.4.2 of CH-TRU Payload Appendix 4.5, the significantly higher thermal mass of an individual shielded container will ensure that the temperature rise exhibited by an individual 55-gallon drum sidewall under HAC conditions (i.e., $\Delta T$ = 156 °F to 290 °F = +134 °F) will bound that which would be seen by a shielded container under the same HAC condition. As such, the peak temperature of the shielded container base, lid, and sidewall can be conservatively predicted by applying the same $\Delta T$ to their respective NCT temperature.

The HAC justification logic has been clarified in Section 4.5.4.2 of CH-TRU Payload Appendix 4.5 and the Calculation Package (P04F.M2.02-03, Section 5.0).

# ATTACHMENT A-1

## Summary of 410 Drums Referenced in RAI CH-1 Response

# Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| 0015819 | RH225I | 3001091018 | 0 | 91 | 90 | 4.912E-09 | 5.054E-09 | No detectable hydrogen measured |
| 0017087 | RH225I | 3003401018 | 0 | 166 | 230 | 4.912E-09 | 7.531E-09 | No detectable hydrogen measured |
| 0017130 | RH225I | 3001091018 | 0 | 76 | 90 | 4.912E-09 | 5.994E-09 | No detectable hydrogen measured |
| 0017141 | RH225I | 3003401018 | 0 | 163 | 230 | 4.912E-09 | 7.650E-09 | No detectable hydrogen measured |
| 0017146 | RH225I | 3003401018 | 0 | 160 | 220 | 4.912E-09 | 7.434E-09 | No detectable hydrogen measured |
| 0017149 | RH225I | 3003401018 | 0 | 177 | 210 | 4.912E-09 | 6.513E-09 | No detectable hydrogen measured |
| 0017180 | RH225I | 3001091018 | 0 | 218 | 230 | 4.912E-09 | 6.011E-09 | No detectable hydrogen measured |
| 0017184 | RH225I | 3001091018 | 0 | 177 | 240 | 4.912E-09 | 7.443E-09 | No detectable hydrogen measured |
| 0017212 | RH225I | 3001091018 | 0 | 168 | 230 | 4.912E-09 | 7.455E-09 | No detectable hydrogen measured |
| 0017213 | RH225I | 3001091018 | 0 | 238 | 220 | 4.912E-09 | 5.364E-09 | No detectable hydrogen measured |
| 0017272 | RH225I | 3001091018 | 0 | 154 | 240 | 4.912E-09 | 8.382E-09 | No detectable hydrogen measured |
| 0017288 | RH225I | 3001091018 | 0 | 163 | 220 | 4.912E-09 | 7.317E-09 | No detectable hydrogen measured |
| 0017312 | RH225I | 3001091018 | 0 | 160 | 220 | 4.912E-09 | 7.434E-09 | No detectable hydrogen measured |
| 0017322 | RH225I | 3003401018 | 0 | 166 | 220 | 4.912E-09 | 7.204E-09 | No detectable hydrogen measured |
| 0017403 | RH225I | 3001091018 | 0 | 142 | 220 | 4.912E-09 | 8.246E-09 | No detectable hydrogen measured |
| 0017411 | RH225I | 3003401018 | 0 | 90 | 90 | 4.912E-09 | 5.106E-09 | No detectable hydrogen measured |
| 0017413 | RH225I | 3003401018 | 0 | 90 | 90 | 4.912E-09 | 5.106E-09 | No detectable hydrogen measured |
| 0017442 | RH225I | 3001091018 | 0 | 142 | 210 | 4.912E-09 | 7.871E-09 | No detectable hydrogen measured |
| 0017445 | RH225I | 3001091018 | 0 | 85 | 90 | 4.912E-09 | 5.389E-09 | No detectable hydrogen measured |
| 0018119 | RH225I | 3001091018 | 0 | 85 | 90 | 4.912E-09 | 5.389E-09 | No detectable hydrogen measured |
| 0018160 | RH225I | 3001091018 | 0 | 92 | 90 | 4.912E-09 | 5.002E-09 | No detectable hydrogen measured |
| 0018175 | RH225I | 3001091018 | 0 | 84 | 90 | 4.912E-09 | 5.449E-09 | No detectable hydrogen measured |
| 0019420 | RH225I | 3003401018 | 0 | 57 | 90 | 4.912E-09 | 7.933E-09 | No detectable hydrogen measured |
| 0020412 | RH225I | 3003401018 | 0 | 50 | 90 | 4.912E-09 | 9.039E-09 | No detectable hydrogen measured |
| D16789A | NT233AR | 3003400455 | 0 | 53 | 270 | 1.099E-08 | 1.213E-08 | No detectable hydrogen measured |
| FBL05104A | SR225A | 3003400839 | 0 | 27 | 80 | 5.959E-09 | 1.238E-08 | No detectable hydrogen measured |
| H-0017274 | RH225I | 3001091018 | 0 | 159 | 210 | 4.912E-09 | 7.135E-09 | No detectable hydrogen measured |
| H-0019057 | RH225I | 3001091018 | 0 | 83 | 90 | 4.912E-09 | 5.512E-09 | No detectable hydrogen measured |
| H-0022872 | RH225I | 3003401018 | 0 | 89 | 90 | 4.912E-09 | 5.160E-09 | No detectable hydrogen measured |
| H-0023208 | RH225I | 3003401018 | 0 | 75 | 90 | 4.912E-09 | 6.071E-09 | No detectable hydrogen measured |
| H-0023216 | RH225I | 3003401018 | 0 | 83 | 90 | 4.912E-09 | 5.512E-09 | No detectable hydrogen measured |
| H-0023884 | RH225I | 3003401018 | 0 | 124 | 130 | 4.912E-09 | 5.495E-09 | No detectable hydrogen measured |
| H-0023922 | RH225I | 3003401018 | 0 | 89 | 90 | 4.912E-09 | 5.160E-09 | No detectable hydrogen measured |
| H-0026843 | RH225I | 3003401018 | 0 | 71 | 90 | 4.912E-09 | 6.400E-09 | No detectable hydrogen measured |
| H-0036050 | RH225F | 3003400481 | 0 | 117 | 970 | 1.040E-08 | 2.125E-08 | No detectable hydrogen measured |
| LA00000052045 | LA125G | 3001090813 | 0 | 119 | 900 | 6.150E-09 | 3.357E-08 | No detectable hydrogen measured |
| LA00000052374 | LA125B | 3003400233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000052451 | LA117J | 2000320813 | 0 | 336 | 900 | 6.150E-09 | 1.664E-08 | No detectable hydrogen measured |
| LA00000052471 | LA125B | 3003400233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LA00000053069 | LA125B | 3001090233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LA00000053134 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000053175 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000053206 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000053335 | LA125G | 3001090813 | 0 | 132 | 900 | 6.150E-09 | 3.067E-08 | No detectable hydrogen measured |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| LA00000053369 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000053415 | LA125B | 3001090233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000053423 | LA125B | 3001090233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000053547 | LA125B | 3001090211 | 0 | 51 | 900 | 2.370E-08 | 5.355E-08 | No detectable hydrogen measured |
| LA00000053572 | LA125B | 3001090233 | 0 | 50 | 9000 | 2.146E-08 | 2.234E-07 | No detectable hydrogen measured |
| LA00000053581 | LA125B | 3001090233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LA00000053599 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000053903 | LA125B | 3001090233 | 0 | 46 | 900 | 2.146E-08 | 2.394E-08 | No detectable hydrogen measured |
| LA00000053950 | LA125B | 3001090233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LA00000054489 | LA125G | 3001090813 | 0 | 5178 | 900 | 6.150E-09 | 8.540E-09 | No detectable hydrogen measured |
| LA00000054506 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000054521 | LA125B | 3003400233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LA00000054529 | LA125B | 3001090233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000054715 | LA125B | 3003400233 | 0 | 46 | 900 | 2.146E-08 | 2.394E-08 | No detectable hydrogen measured |
| LA00000054727 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000055213 | LA117J | 2000320813 | 0 | 189 | 900 | 6.150E-09 | 2.575E-08 | No detectable hydrogen measured |
| LA00000057389 | LA125G | 3001090813 | 0 | 474 | 900 | 6.150E-09 | 1.228E-08 | No detectable hydrogen measured |
| LA00000058055 | LA125B | 3003400233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LA00000058135 | LA125G | 3003400813 | 1181 | 575 | 900 | 6.150E-09 | 6.611E-09 | No detectable hydrogen measured |
| LA00000058304 | LA125G | 3001090813 | 802 | 575 | 900 | 6.150E-09 | 7.480E-09 | No detectable hydrogen measured |
| LA00000058366 | LA125B | 3003400233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LA00000058372 | LA125B | 3001090233 | 0 | 49 | 2000 | 2.146E-08 | 5.048E-08 | No detectable hydrogen measured |
| LA00000058374 | LA125B | 3003400233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LA00000059007 | LA125B | 3001090233 | 0 | 51 | 900 | 2.146E-08 | 2.198E-08 | No detectable hydrogen measured |
| LA00000059012 | LA125B | 3003400233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LA00000059037 | LA125B | 3003400233 | 0 | 46 | 900 | 2.146E-08 | 2.394E-08 | No detectable hydrogen measured |
| LA00000059039 | LA125B | 3001090233 | 0 | 46 | 900 | 2.146E-08 | 2.394E-08 | No detectable hydrogen measured |
| LA00000059047 | LA125G | 3003400813 | 816 | 61 | 2800 | 6.150E-09 | 1.726E-08 | No detectable hydrogen measured |
| LA00000059054 | LA125G | 3001090813 | 782 | 582 | 900 | 6.150E-09 | 7.551E-09 | No detectable hydrogen measured |
| LA00000059056 | LA125G | 3003400813 | 782 | 582 | 900 | 6.150E-09 | 7.551E-09 | No detectable hydrogen measured |
| LA00000059061 | LA125G | 3001090813 | 782 | 582 | 900 | 6.150E-09 | 7.551E-09 | No detectable hydrogen measured |
| LA00000059064 | LA117J | 2000320813 | 728 | 61 | 2700 | 6.150E-09 | 1.983E-08 | No detectable hydrogen measured |
| LA00000059065 | LA125G | 3003400813 | 780 | 582 | 900 | 6.150E-09 | 7.557E-09 | No detectable hydrogen measured |
| LA00000059075 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000059084 | LA125G | 3003400813 | 810 | 582 | 900 | 6.150E-09 | 7.475E-09 | No detectable hydrogen measured |
| LA00000059089 | LA125B | 3003400233 | 0 | 51 | 900 | 2.146E-08 | 2.198E-08 | No detectable hydrogen measured |
| LA00000059180 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LA00000059315 | LA125B | 3003400233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000059322 | LA125G | 3001090813 | 0 | 130 | 900 | 6.150E-09 | 3.108E-08 | No detectable hydrogen measured |
| LA00000059336 | LA125B | 3003400233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000059368 | LA125G | 3003400813 | 780 | 582 | 900 | 6.150E-09 | 7.557E-09 | No detectable hydrogen measured |
| LA00000059375 | LA125G | 3001090813 | 748 | 575 | 900 | 6.150E-09 | 7.632E-09 | No detectable hydrogen measured |
| LA00000059379 | LA125B | 3003400233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LA00000059380 | LA125G | 3003400813 | 780 | 575 | 900 | 6.150E-09 | 7.541E-09 | No detectable hydrogen measured |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| LA00000059385 | LA117B | 2000320211 | 0 | 33 | 300 | 2.370E-08 | 2.908E-08 | No detectable hydrogen measured |
| LA00000059395 | LA125G | 3003400813 | 777 | 575 | 900 | 6.150E-09 | 7.550E-09 | No detectable hydrogen measured |
| LA00000059425 | LA125B | 3003400233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000059426 | LA125G | 3001090813 | 697 | 582 | 900 | 6.150E-09 | 7.795E-09 | No detectable hydrogen measured |
| LA00000059437 | LA125G | 3001090813 | 686 | 575 | 900 | 6.150E-09 | 7.817E-09 | No detectable hydrogen measured |
| LA00000059470 | LA125B | 3001090233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LA00000059485 | LA125G | 3001090813 | 564 | 575 | 900 | 6.150E-09 | 8.218E-09 | No detectable hydrogen measured |
| LA00000059568 | LA225G | 3003400813 | 0 | 91 | 200 | 6.150E-09 | 9.497E-09 | No detectable hydrogen measured |
| LA00000059713 | LA125G | 3001090813 | 593 | 575 | 900 | 6.150E-09 | 8.118E-09 | No detectable hydrogen measured |
| LA00000059734 | LA125G | 3003400813 | 560 | 582 | 900 | 6.150E-09 | 8.237E-09 | No detectable hydrogen measured |
| LA00000059760 | LA125B | 3001090233 | 0 | 46 | 900 | 2.146E-08 | 2.394E-08 | No detectable hydrogen measured |
| LA00000060413 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000060462 | LA125G | 3001090791 | 0 | 537 | 200 | 6.321E-09 | 6.524E-09 | No detectable hydrogen measured |
| LA00000060706 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LA00000060747 | LA125B | 3003400233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LA00000061048 | LA125B | 3003400233 | 0 | 51 | 900 | 2.146E-08 | 2.198E-08 | No detectable hydrogen measured |
| LA00000061262 | LA125G | 3003400813 | 0 | 49 | 200 | 6.150E-09 | 1.719E-08 | No detectable hydrogen measured |
| LA00000062026 | LA225G | 3003400791 | 0 | 197 | 200 | 6.321E-09 | 1.237E-08 | No detectable hydrogen measured |
| LA00000062029 | LA225G | 3003400791 | 0 | 196 | 200 | 6.321E-09 | 1.242E-08 | No detectable hydrogen measured |
| LA00000062030 | LA225G | 3003400791 | 0 | 226 | 200 | 6.321E-09 | 1.115E-08 | No detectable hydrogen measured |
| LA00000062043 | LA225G | 3003400791 | 0 | 211 | 200 | 6.321E-09 | 1.174E-08 | No detectable hydrogen measured |
| LA00000062045 | LA225G | 3003400791 | 0 | 191 | 200 | 6.321E-09 | 1.267E-08 | No detectable hydrogen measured |
| LA00000062422 | LA125G | 3003400791 | 193 | 302 | 200 | 6.321E-09 | 6.590E-09 | No detectable hydrogen measured |
| LA00000062540 | LA225G | 3003400791 | 193 | 345 | 200 | 6.321E-09 | 6.355E-09 | No detectable hydrogen measured |
| LA00000062555 | LA225G | 3001090791 | 193 | 332 | 200 | 6.321E-09 | 6.422E-09 | No detectable hydrogen measured |
| LA00000062557 | LA125G | 3003400791 | 173 | 304 | 200 | 6.321E-09 | 6.758E-09 | No detectable hydrogen measured |
| LA00000062566 | LA225G | 3003400791 | 193 | 329 | 200 | 6.321E-09 | 6.438E-09 | No detectable hydrogen measured |
| LA00000062570 | LA125G | 3001090791 | 193 | 311 | 200 | 6.321E-09 | 6.537E-09 | No detectable hydrogen measured |
| LA00000062814 | LA225G | 3003400791 | 295 | 166 | 200 | 6.321E-09 | 6.331E-09 | No detectable hydrogen measured |
| LA00000062833 | LA225G | 3001090791 | 246 | 124 | 200 | 6.321E-09 | 7.280E-09 | No detectable hydrogen measured |
| LA00000062835 | LA225G | 3003400791 | 224 | 130 | 200 | 6.321E-09 | 7.598E-09 | No detectable hydrogen measured |
| LA00000062839 | LA225G | 3001090791 | 210 | 140 | 200 | 6.321E-09 | 7.737E-09 | No detectable hydrogen measured |
| LA00000062842 | LA225G | 3003400791 | 232 | 140 | 200 | 6.321E-09 | 7.359E-09 | No detectable hydrogen measured |
| LA00000062852 | LA225G | 3001090791 | 218 | 139 | 200 | 6.321E-09 | 7.606E-09 | No detectable hydrogen measured |
| LA00000062859 | LA225G | 3003400791 | 185 | 131 | 200 | 6.321E-09 | 8.356E-09 | No detectable hydrogen measured |
| LA00000062865 | LA225G | 3001090791 | 184 | 140 | 200 | 6.321E-09 | 8.242E-09 | No detectable hydrogen measured |
| LA00000062888 | LA225G | 3001090791 | 175 | 147 | 200 | 6.321E-09 | 8.326E-09 | No detectable hydrogen measured |
| LA00000062916 | LA125G | 3003400791 | 0 | 169 | 200 | 6.321E-09 | 1.397E-08 | No detectable hydrogen measured |
| LA00000062917 | LA125G | 3001090791 | 0 | 188 | 200 | 6.321E-09 | 1.283E-08 | No detectable hydrogen measured |
| LA00000062918 | LA125G | 3001090791 | 0 | 184 | 200 | 6.321E-09 | 1.305E-08 | No detectable hydrogen measured |
| LA00000062920 | LA125G | 3003400791 | 0 | 180 | 200 | 6.321E-09 | 1.328E-08 | No detectable hydrogen measured |
| LA00000062924 | LA125G | 3003400791 | 0 | 191 | 200 | 6.321E-09 | 1.267E-08 | No detectable hydrogen measured |
| LA00000062934 | LA125G | 3003400791 | 0 | 134 | 200 | 6.321E-09 | 1.693E-08 | No detectable hydrogen measured |
| LA00000062940 | LA125G | 3001090791 | 0 | 154 | 200 | 6.321E-09 | 1.507E-08 | No detectable hydrogen measured |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| LA00000062972 | LA225G | 3003400791 | 0 | 146 | 200 | 6.321E-09 | 1.575E-08 | No detectable hydrogen measured |
| LA00000062991 | LA125G | 3003400791 | 0 | 100 | 200 | 6.321E-09 | 2.184E-08 | No detectable hydrogen measured |
| LA00000063221 | LA225G | 3003400791 | 149 | 209 | 200 | 6.321E-09 | 7.943E-09 | No detectable hydrogen measured |
| LA00000063245 | LA225G | 3001090791 | 129 | 230 | 200 | 6.321E-09 | 7.994E-09 | No detectable hydrogen measured |
| LA00000063248 | LA125G | 3003400791 | 136 | 158 | 200 | 6.321E-09 | 9.014E-09 | No detectable hydrogen measured |
| LA00000063291 | LA225G | 3003400791 | 0 | 182 | 200 | 6.321E-09 | 1.317E-08 | No detectable hydrogen measured |
| LA00000063507 | LA225G | 3003400791 | 0 | 245 | 200 | 6.321E-09 | 1.050E-08 | No detectable hydrogen measured |
| LA00000063513 | LA225G | 3003400791 | 0 | 257 | 200 | 6.321E-09 | 1.015E-08 | No detectable hydrogen measured |
| LA00000063516 | LA225G | 3003400791 | 0 | 261 | 200 | 6.321E-09 | 1.004E-08 | No detectable hydrogen measured |
| LA00000063528 | LA225G | 3003400791 | 0 | 281 | 200 | 6.321E-09 | 9.533E-09 | No detectable hydrogen measured |
| LA00000063542 | LA125G | 3001090791 | 0 | 236 | 200 | 6.321E-09 | 1.079E-08 | No detectable hydrogen measured |
| LA00000063544 | LA225G | 3003400791 | 0 | 75 | 200 | 6.321E-09 | 2.835E-08 | No detectable hydrogen measured |
| LA00000063552 | LA225G | 3001090791 | 0 | 237 | 200 | 6.321E-09 | 1.076E-08 | No detectable hydrogen measured |
| LA00000063565 | LA225G | 3001090791 | 0 | 212 | 200 | 6.321E-09 | 1.170E-08 | No detectable hydrogen measured |
| LA00000063598 | LA225G | 3003400791 | 0 | 215 | 200 | 6.321E-09 | 1.157E-08 | No detectable hydrogen measured |
| LA00000063617 | LA225G | 3003400791 | 0 | 89 | 200 | 6.321E-09 | 2.424E-08 | No detectable hydrogen measured |
| LA00000063618 | LA225G | 3001090791 | 0 | 90 | 200 | 6.321E-09 | 2.400E-08 | No detectable hydrogen measured |
| LA00000063621 | LA225G | 3003400791 | 0 | 77 | 200 | 6.321E-09 | 2.767E-08 | No detectable hydrogen measured |
| LA00000063664 | LA225G | 3003400791 | 0 | 64 | 200 | 6.321E-09 | 3.286E-08 | No detectable hydrogen measured |
| LA00000063674 | LA225G | 3003400791 | 0 | 62 | 200 | 6.321E-09 | 3.385E-08 | No detectable hydrogen measured |
| LA00000063677 | LA125G | 3003400791 | 0 | 64 | 200 | 6.321E-09 | 3.286E-08 | No detectable hydrogen measured |
| LA00000063679 | LA125G | 3003400791 | 0 | 61 | 200 | 6.321E-09 | 3.438E-08 | No detectable hydrogen measured |
| LA00000063702 | LA225G | 3003400791 | 0 | 63 | 200 | 6.321E-09 | 3.335E-08 | No detectable hydrogen measured |
| LA00000063911 | LA225G | 3003400791 | 0 | 104 | 90 | 6.321E-09 | 9.455E-09 | No detectable hydrogen measured |
| LAS818268 | LA125G | 3003400813 | 0 | 189 | 900 | 6.150E-09 | 2.277E-08 | No detectable hydrogen measured |
| LAS833446 | LA125B | 3001090233 | 0 | 50 | 900 | 2.146E-08 | 2.234E-08 | No detectable hydrogen measured |
| LAS833495 | LA125B | 3003400233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LAS833602 | LA125B | 3003400233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LAS845327 | LA125B | 3003400233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LAS846154 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LAS846578 | LA125B | 3001090233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LAS852544 | LA125B | 3001090233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LAS852930 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS853736 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS853821 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LAS853879 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LAS853897 | LA125B | 3001090233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LAS854577 | LA125B | 3003400233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LAS854610 | LA125B | 3001090233 | 0 | 51 | 900 | 2.146E-08 | 2.198E-08 | No detectable hydrogen measured |
| LAS855624 | LA125B | 3001090233 | 0 | 52 | 900 | 2.146E-08 | 2.164E-08 | No detectable hydrogen measured |
| LAS856118 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS856121 | LA125B | 3003400233 | 0 | 48 | 900 | 2.146E-08 | 2.311E-08 | No detectable hydrogen measured |
| LAS860166 | LA125B | 3003400233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS861741 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| LAS862961 | LA125B | 3001090233 | 0 | 49 | 900 | 2.146E-08 | 2.271E-08 | No detectable hydrogen measured |
| LAS863031 | LA125B | 3003400233 | 0 | 46 | 900 | 2.146E-08 | 2.394E-08 | No detectable hydrogen measured |
| LAS864242 | LA125B | 3001090233 | 0 | 51 | 900 | 2.146E-08 | 2.198E-08 | No detectable hydrogen measured |
| LAS864353 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS864641 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS865302 | LA125B | 3003400233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LAS870008 | LA117J | 2000320813 | 5424 | 1296 | 900 | 6.150E-09 | 6.548E-09 | No detectable hydrogen measured |
| LAS870250 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | No detectable hydrogen measured |
| LL85000953TRU | LL216A | 3003400521 | 0 | 34 | 200 | 9.597E-09 | 1.314E-08 | No detectable hydrogen measured |
| LL85000967TRU | LL216A | 3001090481 | 0 | 31 | 600 | 1.040E-08 | 4.328E-08 | No detectable hydrogen measured |
| LL85100269TRU | LL216A | 3001090481 | 0 | 39 | 300 | 1.040E-08 | 1.722E-08 | No detectable hydrogen measured |
| LL85100655TRU | LL216A | 3001090481 | 0 | 31 | 600 | 1.040E-08 | 4.328E-08 | No detectable hydrogen measured |
| LL85101231TRU | LL216C | 3001090839 | 0 | 455 | 450 | 5.959E-09 | 6.182E-09 | No detectable hydrogen measured |
| LL85101306TRU | LL216A | 3001090521 | 0 | 35 | 200 | 9.597E-09 | 1.277E-08 | No detectable hydrogen measured |
| LL85201292TRU | LL216A | 3001090481 | 0 | 34 | 260 | 1.040E-08 | 1.709E-08 | No detectable hydrogen measured |
| LL85300287TRU | LL216A | 3001090481 | 0 | 33 | 300 | 1.040E-08 | 2.031E-08 | No detectable hydrogen measured |
| LL85300409TRU | LL216A | 3001090481 | 0 | 36 | 500 | 1.040E-08 | 3.104E-08 | No detectable hydrogen measured |
| LL85300485TRU | LL216A | 3001090481 | 0 | 34 | 600 | 1.040E-08 | 3.943E-08 | No detectable hydrogen measured |
| LL85300739TRU | LL216A | 3001090481 | 0 | 35 | 300 | 1.040E-08 | 1.915E-08 | No detectable hydrogen measured |
| LL85401333TRU | LL216A | 3001090481 | 0 | 33 | 500 | 1.040E-08 | 3.386E-08 | No detectable hydrogen measured |
| LL85500125TRU | LL216A | 3001090481 | 0 | 46 | 300 | 1.040E-08 | 1.468E-08 | No detectable hydrogen measured |
| LL85500291TRU | LL216A | 3001090481 | 0 | 40 | 500 | 1.040E-08 | 2.799E-08 | No detectable hydrogen measured |
| LL85500427TRU | LL216A | 3001090481 | 0 | 41 | 440 | 1.040E-08 | 2.405E-08 | No detectable hydrogen measured |
| LL85501257TRU | LL216A | 3001090481 | 0 | 35 | 490 | 1.040E-08 | 3.128E-08 | No detectable hydrogen measured |
| LL85601186TRU | LL216A | 3001090481 | 0 | 34 | 900 | 1.040E-08 | 5.915E-08 | No detectable hydrogen measured |
| LL85701015TRU | LL216A | 3003400481 | 0 | 41 | 390 | 1.040E-08 | 2.132E-08 | No detectable hydrogen measured |
| LL85800416TRU | LL216A | 3003400481 | 0 | 34 | 300 | 1.040E-08 | 1.972E-08 | No detectable hydrogen measured |
| LL85800421TRU | LL216A | 3001090481 | 0 | 36 | 200 | 1.040E-08 | 1.242E-08 | No detectable hydrogen measured |
| LL85801185TRU | LL216A | 3003400481 | 0 | 34 | 300 | 1.040E-08 | 1.972E-08 | No detectable hydrogen measured |
| LL85801213TRU | LL216C | 3001090839 | 0 | 598 | 7000 | 5.959E-09 | 8.445E-08 | No detectable hydrogen measured |
| LL85801374TRU | LL216A | 3001090481 | 0 | 41 | 500 | 1.040E-08 | 2.733E-08 | No detectable hydrogen measured |
| LL85900294TRU | LL216A | 3001090481 | 0 | 39 | 480 | 1.040E-08 | 2.755E-08 | No detectable hydrogen measured |
| LL85900369TRU | LL216A | 3001090481 | 0 | 34 | 600 | 1.040E-08 | 3.943E-08 | No detectable hydrogen measured |
| LL85901175TRU | LL216A | 3003400481 | 0 | 35 | 400 | 1.040E-08 | 2.554E-08 | No detectable hydrogen measured |
| LL85901340TRU | LL216A | 3003400481 | 0 | 34 | 700 | 1.040E-08 | 4.600E-08 | No detectable hydrogen measured |
| NT041440 | NT225A | 3003400612 | 0 | 56 | 170 | 8.170E-09 | 9.696E-09 | No detectable hydrogen measured |
| NT041512 | NT225A | 3001090612 | 0 | 69 | 250 | 8.170E-09 | 1.172E-08 | No detectable hydrogen measured |
| NT041541 | NT225A | 3003400612 | 0 | 50 | 650 | 8.170E-09 | 4.136E-08 | No detectable hydrogen measured |
| NT041542 | NT225A | 3003400660 | 0 | 80 | 250 | 7.576E-09 | 1.023E-08 | No detectable hydrogen measured |
| NT041557 | NT225A | 3003400612 | 0 | 113 | 310 | 8.170E-09 | 9.383E-09 | No detectable hydrogen measured |
| NT041567 | NT225A | 3001090660 | 0 | 55 | 170 | 7.576E-09 | 9.865E-09 | No detectable hydrogen measured |
| NT041579 | NT225A | 3001090612 | 0 | 47 | 190 | 8.170E-09 | 1.284E-08 | No detectable hydrogen measured |
| NT041636 | NT225A | 3003400612 | 0 | 75 | 260 | 8.170E-09 | 1.128E-08 | No detectable hydrogen measured |
| NT041657 | NT225A | 3001090612 | 0 | 58 | 180 | 8.170E-09 | 9.929E-09 | No detectable hydrogen measured |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| NT041758 | NT225A | 3003400612 | 0 | 61 | 640 | 8.170E-09 | 3.366E-08 | No detectable hydrogen measured |
| NT041790 | NT225A | 3003400612 | 0 | 55 | 260 | 8.170E-09 | 1.509E-08 | No detectable hydrogen measured |
| NT041822A | NT225A | 3003400612 | 0 | 44 | 270 | 8.170E-09 | 1.947E-08 | No detectable hydrogen measured |
| NT041859 | NT225A | 3003400612 | 0 | 59 | 280 | 8.170E-09 | 1.520E-08 | No detectable hydrogen measured |
| NT041868 | NT225A | 3003400612 | 0 | 90 | 270 | 8.170E-09 | 9.948E-09 | No detectable hydrogen measured |
| NT041933 | NT225A | 3003400612 | 0 | 83 | 270 | 8.170E-09 | 1.069E-08 | No detectable hydrogen measured |
| NT041940 | NT225A | 3003400612 | 0 | 104 | 270 | 8.170E-09 | 8.770E-09 | No detectable hydrogen measured |
| NT041954 | NT225A | 3003400612 | 0 | 117 | 2700 | 8.170E-09 | 7.937E-08 | No detectable hydrogen measured |
| NT041967 | NT225A | 3003400612 | 0 | 127 | 430 | 8.170E-09 | 1.181E-08 | No detectable hydrogen measured |
| NT042013 | NT125A | 3003400660 | 0 | 118 | 270 | 7.576E-09 | 7.881E-09 | No detectable hydrogen measured |
| NT042015 | NT125A | 3003400660 | 0 | 123 | 270 | 7.576E-09 | 7.614E-09 | No detectable hydrogen measured |
| NT042023 | NT225A | 3003400612 | 0 | 113 | 270 | 8.170E-09 | 8.172E-09 | No detectable hydrogen measured |
| NT042029 | NT225A | 3003400612 | 0 | 108 | 270 | 8.170E-09 | 8.492E-09 | No detectable hydrogen measured |
| NT042032 | NT225A | 3003400612 | 0 | 107 | 270 | 8.170E-09 | 8.559E-09 | No detectable hydrogen measured |
| NT042033 | NT225A | 3003400612 | 0 | 107 | 270 | 8.170E-09 | 8.559E-09 | No detectable hydrogen measured |
| NT042038 | NT225A | 3003400612 | 0 | 98 | 270 | 8.170E-09 | 9.232E-09 | No detectable hydrogen measured |
| NT042039 | NT125A | 3001090612 | 0 | 107 | 270 | 8.170E-09 | 8.559E-09 | No detectable hydrogen measured |
| NT042052 | NT225A | 3003400612 | 0 | 97 | 270 | 8.170E-09 | 9.315E-09 | No detectable hydrogen measured |
| NT042097 | NT125A | 3003400660 | 0 | 82 | 200 | 7.576E-09 | 8.006E-09 | No detectable hydrogen measured |
| NT052117 | NT125A | 3003400660 | 0 | 63 | 270 | 7.576E-09 | 1.377E-08 | No detectable hydrogen measured |
| NT052122 | NT225A | 3003400700 | 0 | 63 | 220 | 7.143E-09 | 1.122E-08 | No detectable hydrogen measured |
| NT052124 | NT125A | 3003400660 | 0 | 64 | 350 | 7.576E-09 | 1.759E-08 | No detectable hydrogen measured |
| NT052132 | NT125A | 3003400660 | 0 | 60 | 180 | 7.576E-09 | 9.615E-09 | No detectable hydrogen measured |
| NT052140 | NT225A | 3003400612 | 0 | 49 | 270 | 8.170E-09 | 1.752E-08 | No detectable hydrogen measured |
| NT052148 | NT225A | 3003400660 | 0 | 50 | 160 | 7.576E-09 | 1.018E-08 | No detectable hydrogen measured |
| NT052149 | NT125A | 3003400660 | 0 | 49 | 150 | 7.576E-09 | 9.733E-09 | No detectable hydrogen measured |
| NT052153 | NT125A | 3003400612 | 0 | 47 | 140 | 8.170E-09 | 9.462E-09 | No detectable hydrogen measured |
| NT052154 | NT125A | 3003400612 | 0 | 47 | 140 | 8.170E-09 | 9.462E-09 | No detectable hydrogen measured |
| RFD82532 | RF121A | 3001090455 | 234 | 0 | 135 | 1.099E-08 | 1.416E-08 | No detectable hydrogen measured |
| RFD88375 | RF121A | 3003400455 | 282 | 0 | 135 | 1.099E-08 | 1.150E-08 | No detectable hydrogen measured |
| RFDD3608 | RF116N | 3003400433 | 0 | 15 | 76 | 1.155E-08 | 1.206E-08 | No detectable hydrogen measured |
| RFDD9811 | RF130A | 3000400455 | 244 | 0 | 148 | 1.099E-08 | 1.480E-08 | No detectable hydrogen measured |
| RFDE4148 | RF121N | 3003400433 | 0 | 12 | 101 | 1.155E-08 | 2.093E-08 | No detectable hydrogen measured |
| RFDE4470 | RF116N | 3001090433 | 0 | 33 | 181 | 1.155E-08 | 1.226E-08 | No detectable hydrogen measured |
| RFDE7225 | RF121N | 3003400433 | 0 | 13 | 101 | 1.155E-08 | 1.899E-08 | No detectable hydrogen measured |
| RFDE7232 | RF121N | 3003400433 | 0 | 13 | 101 | 1.155E-08 | 1.899E-08 | No detectable hydrogen measured |
| RFDE8960 | RF116N | 3003400433 | 0 | 6 | 101 | 1.155E-08 | 5.336E-08 | No detectable hydrogen measured |
| RFDE8961 | RF121N | 3003400433 | 0 | 12 | 101 | 1.155E-08 | 2.093E-08 | No detectable hydrogen measured |
| RFDE8971 | RF121N | 3003400433 | 0 | 13 | 285 | 1.155E-08 | 5.358E-08 | No detectable hydrogen measured |
| RFDE9470 | RF130A | 3000400455 | 0 | 35 | 171 | 1.099E-08 | 1.147E-08 | No detectable hydrogen measured |
| RFDE9472 | RF130A | 3000400455 | 0 | 35 | 185 | 1.099E-08 | 1.241E-08 | No detectable hydrogen measured |
| RFDF0036 | RF118N | 2001700433 | 0 | 12 | 101 | 1.155E-08 | 2.349E-08 | No detectable hydrogen measured |
| RFDF0138 | RF118N | 2001700433 | 0 | 12 | 101 | 1.155E-08 | 2.349E-08 | No detectable hydrogen measured |
| RFDF0151 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |

**Attachment A-1**
**Summary of 410 Drums Referenced in RAI CH-1 Response**

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| RFDF0152 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0705 | RF118N | 2001700433 | 0 | 12 | 101 | 1.155E-08 | 2.349E-08 | No detectable hydrogen measured |
| RFDF0706 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0707 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0710 | RF118N | 2001700433 | 0 | 12 | 76 | 1.155E-08 | 1.767E-08 | No detectable hydrogen measured |
| RFDF0716 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0717 | RF118N | 2001700433 | 0 | 13 | 76 | 1.155E-08 | 1.608E-08 | No detectable hydrogen measured |
| RFDF0722 | RF118N | 2001700433 | 0 | 12 | 101 | 1.155E-08 | 2.349E-08 | No detectable hydrogen measured |
| RFDF0724 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0747 | RF117N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0762 | RF116N | 3003400433 | 0 | 15 | 101 | 1.155E-08 | 1.602E-08 | No detectable hydrogen measured |
| RFDF0764 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0767 | RF118N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0794 | RF117N | 2001700433 | 0 | 13 | 101 | 1.155E-08 | 2.137E-08 | No detectable hydrogen measured |
| RFDF0795 | RF116N | 3003400433 | 0 | 13 | 101 | 1.155E-08 | 1.899E-08 | No detectable hydrogen measured |
| RFDF0819 | RF116N | 3003400433 | 0 | 13 | 144 | 1.155E-08 | 2.707E-08 | No detectable hydrogen measured |
| RFDF2555 | RF121N | 3003400433 | 0 | 4 | 101 | 1.155E-08 | 1.002E-07 | No detectable hydrogen measured |
| SR109915A | SR225A | 3003400839 | 0 | 41 | 90 | 5.959E-09 | 9.009E-09 | No detectable hydrogen measured |
| SR500318A | SR225G | 3003401018 | 0 | 38 | 700 | 4.912E-09 | 9.299E-08 | No detectable hydrogen measured |
| SR501109A | SR125A | 3003400839 | 0 | 37 | 700 | 5.959E-09 | 7.782E-08 | No detectable hydrogen measured |
| SR501711A | SR225A | 3003400839 | 0 | 45 | 80 | 5.959E-09 | 7.289E-09 | No detectable hydrogen measured |
| SR510338A | SR125A | 3003400839 | 0 | 25 | 700 | 5.959E-09 | 1.177E-07 | No detectable hydrogen measured |
| SR512872A | SR225D | 3003400302 | 0 | 53 | 700 | 1.656E-08 | 1.799E-08 | No detectable hydrogen measured |
| SR514765A | SR225A | 3003400839 | 0 | 29 | 700 | 5.959E-09 | 1.004E-07 | No detectable hydrogen measured |
| D04307 | NT233AR | 3001090455 | 7050 | 0 | 3860 | 1.099E-08 | 2.589E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D09240 | NT233AR | 3001090455 | 7097 | 0 | 2020 | 1.099E-08 | 1.352E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D09241 | NT233AR | 3003400455 | 7121 | 0 | 1970 | 1.099E-08 | 1.317E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D09798 | NT233AR | 3001090455 | 7034 | 0 | 2200 | 1.099E-08 | 1.476E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D10859 | NT233AR | 3003400455 | 7135 | 0 | 2750 | 1.099E-08 | 1.837E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D13722 | NT233AR | 3001090455 | 7034 | 0 | 2900 | 1.099E-08 | 1.946E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D14755 | NT233AR | 3001090455 | 7097 | 0 | 1960 | 1.099E-08 | 1.312E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D15371 | NT233AR | 3001090455 | 7133 | 0 | 4980 | 1.099E-08 | 3.328E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D15862 | NT233AR | 3003400455 | 7135 | 0 | 3260 | 1.099E-08 | 2.178E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D16820 | NT233AR | 3001090455 | 7148 | 0 | 1650 | 1.099E-08 | 1.102E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D18792 | NT233AR | 3003400455 | 7159 | 0 | 2860 | 1.099E-08 | 1.909E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D20161 | NT225A | 3001090612 | 7049 | 0 | 23380 | 8.170E-09 | 1.579E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D20242 | NT233AR | 3001090455 | 7034 | 0 | 1930 | 1.099E-08 | 1.295E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D24032 | NT233AR | 3001090455 | 7130 | 0 | 5020 | 1.099E-08 | 3.355E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D24730 | NT233AR | 3001090455 | 7096 | 0 | 2640 | 1.099E-08 | 1.767E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D24991 | NT233AR | 3001090455 | 7096 | 0 | 2090 | 1.099E-08 | 1.399E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| D31283 | NT233AR | 3001090455 | 7033 | 0 | 2600 | 1.099E-08 | 1.745E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041585 | NT225A | 3001090660 | 8306 | 0 | 1380 | 7.576E-09 | 8.882E-09 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041612 | NT225A | 3001090612 | 7266 | 0 | 2010 | 8.170E-09 | 1.344E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041751A | NT225A | 3001090612 | 7170 | 0 | 1870 | 8.170E-09 | 1.256E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| NT041813 | NT225A | 3001090612 | 8853 | 0 | 1360 | 8.170E-09 | 8.618E-09 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041823 | NT225A | 3001090612 | 6511 | 0 | 2720 | 8.170E-09 | 1.887E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041830 | NT225A | 3001090612 | 7537 | 0 | 4720 | 8.170E-09 | 3.121E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041851 | NT225A | 3001090660 | 6542 | 0 | 1870 | 7.576E-09 | 1.295E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041865 | NT225A | 3001090612 | 7511 | 0 | 28150 | 8.170E-09 | 1.863E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041872 | NT225A | 3001090612 | 7507 | 0 | 4730 | 8.170E-09 | 3.132E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041882 | NT225A | 3001090612 | 8081 | 0 | 2390 | 8.170E-09 | 1.550E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041908 | NT225A | 3001090612 | 7528 | 0 | 4030 | 8.170E-09 | 2.666E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041917 | NT225A | 3001090612 | 7278 | 0 | 5630 | 8.170E-09 | 3.763E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041921 | NT225A | 3001090612 | 7347 | 0 | 1450 | 8.170E-09 | 9.663E-09 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041928 | NT225A | 3001090612 | 6544 | 0 | 15820 | 8.170E-09 | 1.096E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041942 | NT225A | 3001090612 | 7829 | 0 | 25180 | 8.170E-09 | 1.647E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041944 | NT225A | 3001090612 | 7679 | 0 | 10520 | 8.170E-09 | 6.919E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041957 | NT225A | 3001090612 | 7515 | 0 | 1900 | 8.170E-09 | 1.258E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041959 | NT225A | 3001090612 | 8088 | 0 | 6370 | 8.170E-09 | 4.129E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041961 | NT225A | 3001090612 | 7268 | 0 | 4200 | 8.170E-09 | 2.808E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041965 | NT225B | 3001090075 | 7954 | 0 | 13950 | 6.667E-08 | 8.913E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041977 | NT225A | 3001090612 | 8057 | 0 | 27230 | 8.170E-09 | 1.767E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041978 | NT225A | 3001090612 | 7124 | 0 | 9080 | 8.170E-09 | 6.110E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041979 | NT225A | 3001090612 | 8298 | 0 | 20890 | 8.170E-09 | 1.345E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041982 | NT225A | 3001090612 | 7307 | 0 | 21340 | 8.170E-09 | 1.425E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT041996 | NT225A | 3001090612 | 7494 | 0 | 1340 | 8.170E-09 | 8.876E-09 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT042027 | NT125B | 3003400075 | 7262 | 0 | 17620 | 6.667E-08 | 1.153E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT042054 | NT225A | 3001090612 | 6567 | 0 | 3240 | 8.170E-09 | 2.241E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT042089 | NT225A | 3001090612 | 6356 | 0 | 1550 | 8.170E-09 | 1.085E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT285126 | NT225A | 3001090612 | 7095 | 0 | 9540 | 8.170E-09 | 6.428E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| NT980327 | NT225A | 3001090612 | 6499 | 0 | 1400 | 8.170E-09 | 9.720E-09 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| RFD72075 | RF132A | 1001300107 | 5483 | 0 | 9423 | 4.673E-08 | 5.640E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| RFD84731 | RF121A | 3001090455 | 2295 | 0 | 4242 | 1.099E-08 | 5.188E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| RFDC4240 | RF118N | 2000320481 | 843 | 0 | 1460 | 1.040E-08 | 4.424E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| RFDD4825 | RF130A | 3000400455 | 306 | 0 | 173 | 1.099E-08 | 1.348E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| RFDD7739 | RF130A | 3001850455 | 244 | 0 | 530 | 1.099E-08 | 5.301E-08 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| RFDE5303 | RF116I | 3001090079 | 6346 | 0 | 17235 | 6.329E-08 | 1.176E-07 | Container sampled below rigid liner; FGGR calculated based on sampling in drum headspace |
| A12751 | RH225AL | 3001092020 | 7037 | 19 | 1260 | 2.475E-09 | 2.843E-09 | Container vented after generation and subject to aspiration requirements |
| A13378 | RH225AL | 3001091995 | 6649 | 62 | 2300 | 2.506E-09 | 7.384E-09 | Container vented after generation and subject to aspiration requirements |
| BN10061453 | ID225K | 3001090302 | 10604 | 239 | 22000 | 1.656E-08 | 5.420E-08 | Container vented after generation and subject to aspiration requirements |
| BN10113493 | ID211P | 1001600133 | 11558 | 72 | 8100 | 3.759E-08 | 6.762E-08 | Container vented after generation and subject to aspiration requirements |
| BN10119720 | ID211P | 1001600133 | 11491 | 41 | 8400 | 3.759E-08 | 3.796E-08 | Container vented after generation and subject to aspiration requirements |
| BN10130270 | ID211P | 1001600133 | 11537 | 37 | 18000 | 3.759E-08 | 6.103E-08 | Container vented after generation and subject to aspiration requirements |
| BN10130307 | ID211P | 1001600133 | 11517 | 50 | 6700 | 3.759E-08 | 4.500E-08 | Container vented after generation and subject to aspiration requirements |
| H-PNL-TRU-95045 | RH225I | 3001091044 | 5219 | 108 | 4300 | 4.789E-09 | 7.600E-09 | Container vented after generation and subject to aspiration requirements |
| LA00000053671 | LA125G | 3001090813 | 6428 | 153 | 3961 | 6.150E-09 | 7.679E-09 | Container vented after generation and subject to aspiration requirements |
| LA00000054741 | LA225G | 3001090791 | 4380 | 1190 | 3700 | 6.321E-09 | 7.317E-08 | Container vented after generation and subject to aspiration requirements |
| LA00000055739 | LA125G | 3001090813 | 3016 | 189 | 4083 | 6.150E-09 | 1.207E-08 | Container vented after generation and subject to aspiration requirements |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| LA00000059323 | LA125G | 3001090813 | 798 | 609 | 4700 | 6.150E-09 | 3.952E-08 | Container vented after generation and subject to aspiration requirements |
| LA00000059585 | LA225G | 3003400813 | 933 | 200 | 2500 | 6.150E-09 | 1.578E-08 | Container vented after generation and subject to aspiration requirements |
| LA00000059738 | LA125G | 3003400861 | 525 | 429 | 800 | 5.807E-09 | 7.359E-09 | Container vented after generation and subject to aspiration requirements |
| LA00000062548 | LA225G | 3001090791 | 193 | 318 | 300 | 6.321E-09 | 9.747E-09 | Container vented after generation and subject to aspiration requirements |
| LA00000062810 | LA225G | 3003400791 | 302 | 209 | 700 | 6.321E-09 | 2.125E-08 | Container vented after generation and subject to aspiration requirements |
| LA00000062838 | LA225G | 3001090791 | 232 | 221 | 600 | 6.321E-09 | 2.014E-08 | Container vented after generation and subject to aspiration requirements |
| LA00000062856 | LA125G | 3003400791 | 161 | 168 | 300 | 6.321E-09 | 1.244E-08 | Container vented after generation and subject to aspiration requirements |
| LAS810466 | LA211A | 1001300085 | 8238 | 718 | 13200 | 5.882E-08 | 1.117E-07 | Container vented after generation and subject to aspiration requirements |
| LAS816462 | LA225G | 3001090813 | 8210 | 1190 | 28900 | 6.150E-09 | 2.090E-07 | Container vented after generation and subject to aspiration requirements |
| LAS816775 | LA125G | 3003400813 | 8154 | 784 | 6400 | 6.150E-09 | 3.254E-08 | Container vented after generation and subject to aspiration requirements |
| LAS818512 | LA211A | 1001300085 | 8063 | 1092 | 9411 | 5.882E-08 | 7.961E-08 | Container vented after generation and subject to aspiration requirements |
| LAS823146 | LA125G | 3001090813 | 7923 | 770 | 2000 | 6.150E-09 | 1.004E-08 | Container vented after generation and subject to aspiration requirements |
| LAS832580 | LA125G | 3003400813 | 8366 | 371 | 7300 | 6.150E-09 | 1.993E-08 | Container vented after generation and subject to aspiration requirements |
| LAS854575 | LA125G | 3001090813 | 6733 | 449 | 1100 | 6.150E-09 | 9.294E-09 | Container vented after generation and subject to aspiration requirements |
| NT980488 | NT225A | 3001090612 | 6066 | 2021 | 1570 | 8.170E-09 | 1.478E-08 | Container vented after generation and subject to aspiration requirements |
| RHZ-103-A14893 | RH225AL | 3001091995 | 6374 | 56 | 1160 | 2.506E-09 | 3.774E-09 | Container vented after generation and subject to aspiration requirements |
| RHZ-301-A14217 | RH225AL | 3001091995 | 6541 | 176 | 1620 | 2.506E-09 | 5.644E-09 | Container vented after generation and subject to aspiration requirements |
| RHZ-301-A14687 | RH225AL | 3001092020 | 6719 | 47 | 2420 | 2.475E-09 | 6.210E-09 | Container vented after generation and subject to aspiration requirements |
| Z84A11053 | RH225AL | 3001092020 | 7301 | 18 | 1450 | 2.475E-09 | 3.121E-09 | Container vented after generation and subject to aspiration requirements |
| Z84A11334 | RH225AL | 3003402020 | 7254 | 25 | 5690 | 2.475E-09 | 1.378E-08 | Container vented after generation and subject to aspiration requirements |
| NT041715 | NT225A | 3003400612 | 0 | 77 | 1060 | 8.170E-09 | 4.492E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0005570 | RH225I | 3001091018 | 0 | 2028 | 2300 | 4.912E-09 | 2.214E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0020469 | RH225F | 3001090481 | 0 | 904 | 3400 | 1.040E-08 | 3.264E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0026811 | RH225F | 3003400481 | 0 | 337 | 3600 | 1.040E-08 | 4.219E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0030327 | RH225F | 3003400481 | 0 | 373 | 3100 | 1.040E-08 | 3.498E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0030338 | RH225F | 3003400481 | 0 | 355 | 2400 | 1.040E-08 | 2.757E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0031607 | RH225G | 3003400660 | 0 | 299 | 2000 | 7.576E-09 | 2.985E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0031682 | RH225G | 3001090660 | 0 | 378 | 2100 | 7.576E-09 | 2.761E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0032652 | RH225F | 3003400481 | 0 | 264 | 2100 | 1.040E-08 | 2.742E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0032824 | RH225F | 3003400481 | 0 | 322 | 2300 | 1.040E-08 | 2.745E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0034588 | RH225F | 3001090481 | 0 | 182 | 2400 | 1.040E-08 | 3.863E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0034648 | RH225F | 3003400481 | 0 | 118 | 1000 | 1.040E-08 | 2.176E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0034766 | RH225F | 3003400481 | 0 | 304 | 1100 | 1.040E-08 | 1.345E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0036067 | RH225F | 3003400481 | 0 | 235 | 1000 | 1.040E-08 | 1.386E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0036616 | RH225F | 3003400481 | 0 | 296 | 1400 | 1.040E-08 | 1.732E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0036728 | RH225B | 3003400280 | 0 | 209 | 2100 | 1.786E-08 | 2.273E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0036826 | RH225B | 3003400280 | 0 | 175 | 6700 | 1.786E-08 | 7.696E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0037168 | RH225B | 3001090280 | 0 | 143 | 1600 | 1.786E-08 | 1.999E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0037203 | RH225F | 3003400481 | 0 | 97 | 2700 | 1.040E-08 | 6.848E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0037602 | RH225F | 3003400481 | 0 | 182 | 2500 | 1.040E-08 | 4.024E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0037764 | RH225F | 3003400481 | 0 | 203 | 2800 | 1.040E-08 | 4.217E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0037944 | RH225F | 3003400481 | 0 | 188 | 2400 | 1.040E-08 | 3.786E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| H-0040900 | RH225B | 3003400280 | 0 | 79 | 2200 | 1.786E-08 | 3.868E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LA00000058024 | LA125B | 3001090211 | 0 | 56 | 500 | 2.370E-08 | 2.770E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |

## Attachment A-1
## Summary of 410 Drums Referenced in RAI CH-1 Response

| Container No. | CH-TRUCON Code | Shipping Category | Time Between Venting and Generation (days) | Time Between Sampling and Venting (days) | Hydrogen Conc. (ppm) | FGGR Limit (mol/s) | Simplified AltMeth FGGR (mol/s) | Comments / Explanation |
|---|---|---|---|---|---|---|---|---|
| LA00000059410 | LA125B | 3001090233 | 0 | 47 | 900 | 2.146E-08 | 2.351E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LA00000062020 | LA225G | 3003400813 | 0 | 196 | 300 | 6.150E-09 | 7.375E-09 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LA00000062607 | LA125B | 3001090211 | 0 | 60 | 500 | 2.370E-08 | 2.631E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LA00000063600 | LA225G | 3003400791 | 0 | 90 | 300 | 6.321E-09 | 3.600E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LA00000063620 | LA225G | 3003400791 | 0 | 117 | 500 | 6.321E-09 | 4.755E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LAS822057 | LA211A | 1001300055 | 0 | 58 | 27262 | 9.091E-08 | 5.213E-07 | Appears to be outlier based on ≈ 1,800 drum population. Actual number of layers likely lower |
| LAS824231 | LA125B | 3001090233 | 0 | 49 | 2700 | 2.146E-08 | 6.814E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| LAS841060 | LA211A | 1001300085 | 0 | 364 | 31470 | 5.882E-08 | 2.662E-07 | Appears to be outlier based on ≈ 1,800 drum population. Actual number of layers likely lower |
| LAS862049 | LA125B | 3001090233 | 0 | 50 | 4300 | 2.146E-08 | 1.067E-07 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| NT041664 | NT225A | 3001090612 | 0 | 7354 | 1690 | 8.170E-09 | 1.604E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| NT042003 | NT225A | 3003400612 | 0 | 50 | 5400 | 8.170E-09 | 3.436E-07 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| NT042010 | NT225A | 3001090612 | 0 | 124 | 2020 | 8.170E-09 | 5.658E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| NT052142 | NT125A | 3001090660 | 0 | 6567 | 1130 | 7.576E-09 | 1.072E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |
| RFDE5587 | RF116A | 3003400455 | 0 | 100 | 1495 | 1.099E-08 | 3.858E-08 | Actual number of layers likely lower; hydrogen gradient likely overpredicted |

(Two Hard Copies and Seven CDs in Adobe PDF Format)

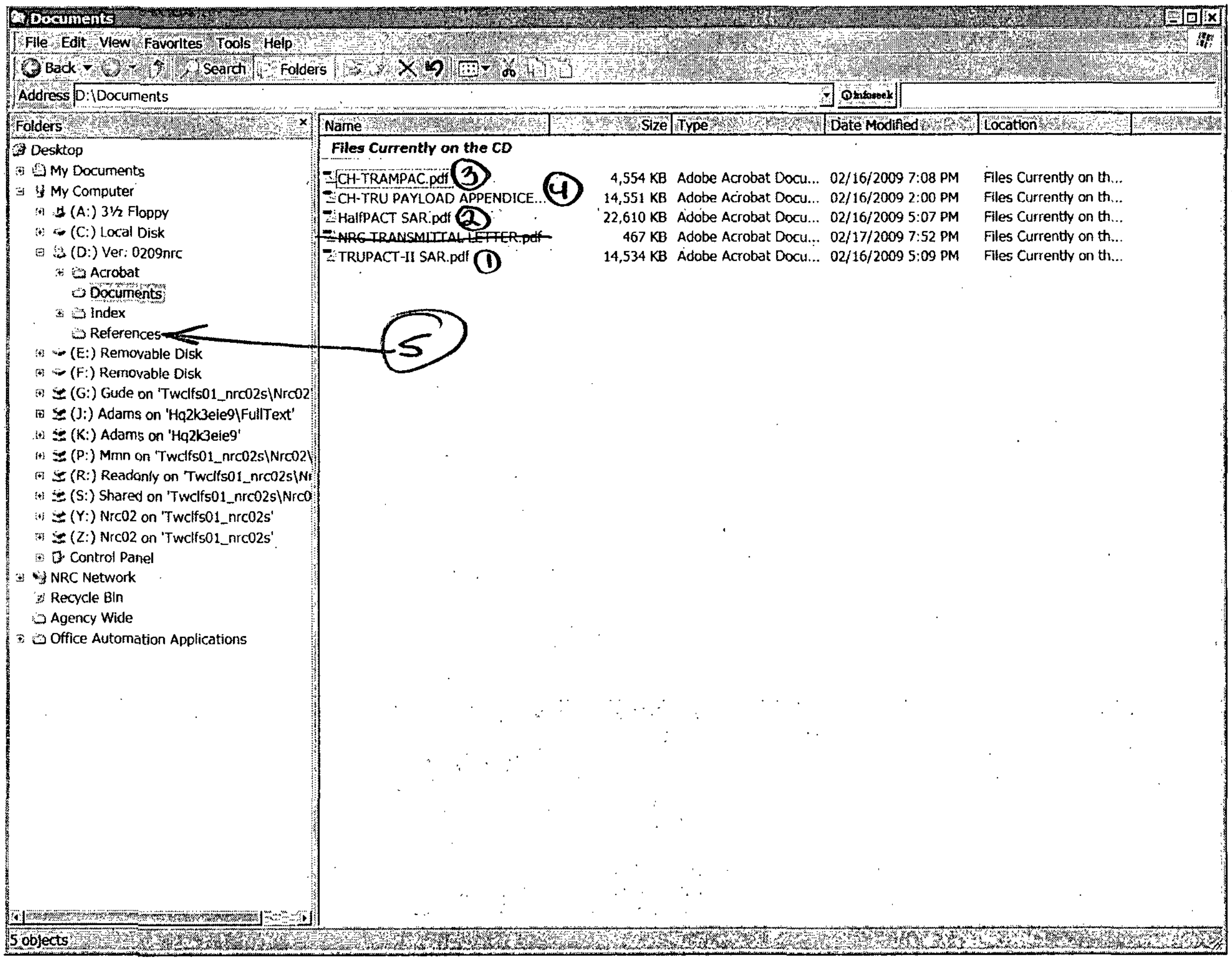
- TRUPACT-II SAR, Revision 22
- HalfPACT SAR, Revision 5
- CH-TRAMPAC, Revision 3
- CH-TRU Payload Appendices, Revision 2

(Two Hard Copies and Seven CDs in Adobe PDF Format)

- G. J. Banken, *HalfPACT Shielded Container Thermal Analysis*, P04F.M2.02-03, Rev. 2, AREVA Federal Services LLC, Tacoma, WA, February 2009.

(Seven CDs in Adobe PDF Format)

- Electronic copies of the shielded container thermal analysis model input and output files.



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(S:) Shared on 'Twclfs01_nrc02s\Nrc0
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