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8-120B CoC Rev. 21 Presubmittal Meeting #2

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Overview

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- Purpose- second presubmittal meeting for 8-120B license amendment request 21 to discuss proposed approach for reformed residue (RR)
- Items to Discuss
  - Update on Amendment request 21 status
  - Approach to RR shipments (proprietary)
  - Conclusions

Status Update/Recap

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- CoC Revision 19 changed the way radiological qualifications are performed in the 8-120B.
  - Rev 19 was a precursor to RIS 2013-04.
    - Previous to Revision 19, payload radiological qualification was confirmed by pre-shipment measurement.
    - Revision 19 includes bounding evaluations for all contents.
- This change has caused significant consequences to the 8-120B allowable payloads.
  - Shipments that have previously been made safely and compliantly can no longer be shipped.
  - Some shipment campaigns or programs are significantly affected.

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Status Update/Recap. continued

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- CoC Revision 20 was to regain lost capacity for resin shipments.
- CoC amendment request 21 was initiated last November to reduce unnecessary conservatisms introduced in the CoC Revision 19 shielding analyses.
- NRC has recently granted authorization to restart Zion decommissioning shipments that were unnecessarily disqualified by the Revision 19 CoC.
- Resin*Solutions* (previously Studsvik) reformed residue (RR) shipments will experience significant limitations due to the new qualification methods.
  - Interim request for authorization is forthcoming.
  - Long-term fix is CoC Revision 21.

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Status Update/Recap. continued

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- Preparation of Amendment Request 21 is nearly complete.
  - "Payload Specification" approach
  - Each Payload Specification describes a radioactive payload plus any characteristics of the secondary container or liner credited in the safety analysis.
    - Payload Specification 8-120B-1 (Generalized case)
      - essentially the current Revision 20 analyses
      - Add one more energy group above the current group so as not to unnecessarily disqualify 15 nuclides from the A_2 list in §173.435
    - Payload Specification 8-120B-2 (Activated Steel)
    - Payload Specification 8-120B-3 (Reformed Residue)
    - Payload Specification 8-120B-4 (Resins)

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Approach to RR Shipments

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- Short-term
  - Letter requesting authorization for a specific number of RR shipments over the next 12 months to be based on package external dose rate measurements.
- Long-term (CoC Revision 21)
  - Reformed Residue Background
  - Historical Shipment Example
  - Proposed Approach

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Reformed Residue Background

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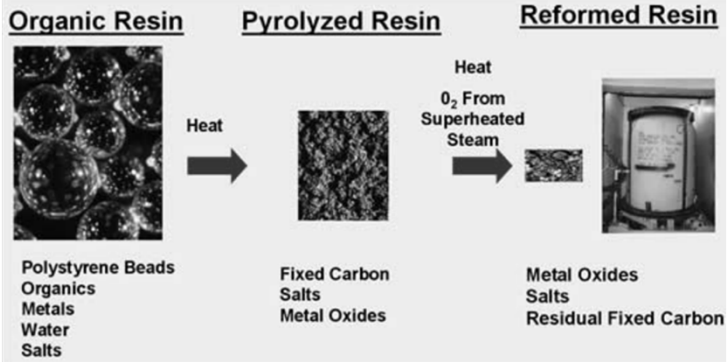
- What is RR?
  - Highly inert, stabilized, volume-reduced inorganic waste form (up to 5:1 ratio) created by proprietary pyrolysis/steam reforming technology



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Reformed Residue Background, cont.

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- THOR^{SM} Process
  - Significantly reduces the volume and weight of ion-exchange resins and other organic waste
    - Delays need for new disposal facilities.
    - Considerably reduces the cost of storage and final disposal.
  - Resulting end product (RR) is considerably more chemically stable than the original waste.
  - After treatment, the reduced waste is sent to a final disposal facility on the generator's behalf or returned to the generator for interim storage.

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Reformed Residue Background, cont.

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- Applications of the THOR^{SM} Process
  - DOE
  - DOD
  - Commercial
    (Erwin Resin*Solutions* Facility- Formerly Studsvik)
- This amendment request will only include Erwin RR.

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Reformed Residue Background, cont.

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- How is RR processed?

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Resin*Solutions* Erwin, TN Facility

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- Commercial operation since July 1999
- 7/24 operation
- Over 250,000 ft^3 of waste processed for 42 customers.
- Wastes with contact dose rates of up to 500 R/hr have been received, processed, and packaged for disposal.
- Over 1,600 incoming shipments received
- Over 250 disposal site shipments made

Resin*Solutions* Erwin, TN Facility

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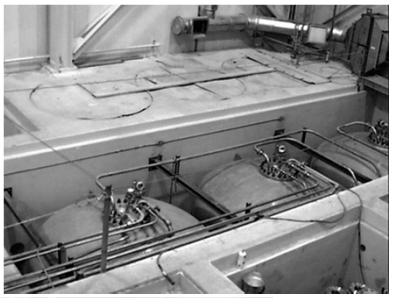
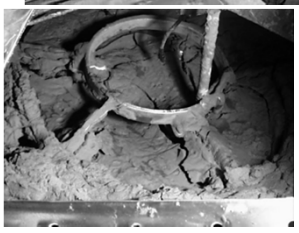
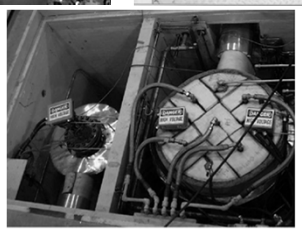
- Waste Receipt Tanks, Process Filters, Steam Superheaters







Resin*Solutions* Erwin, TN Facility

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- Control System

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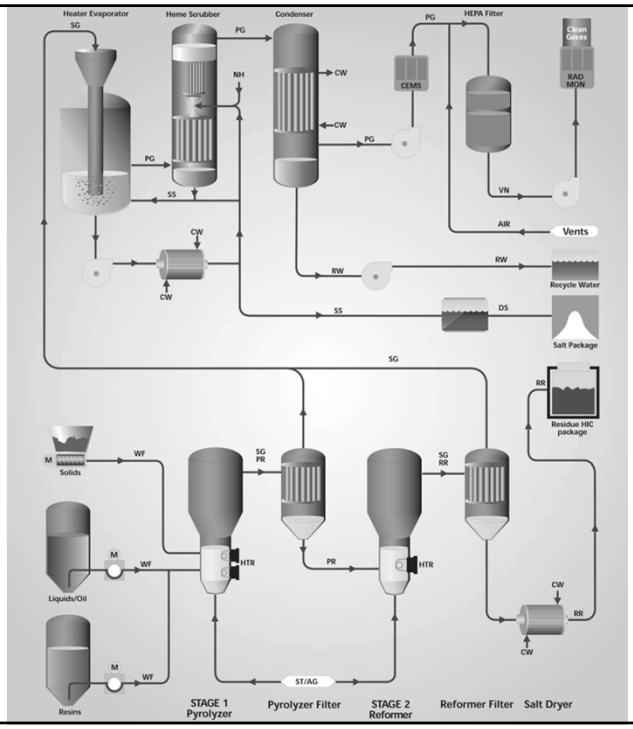

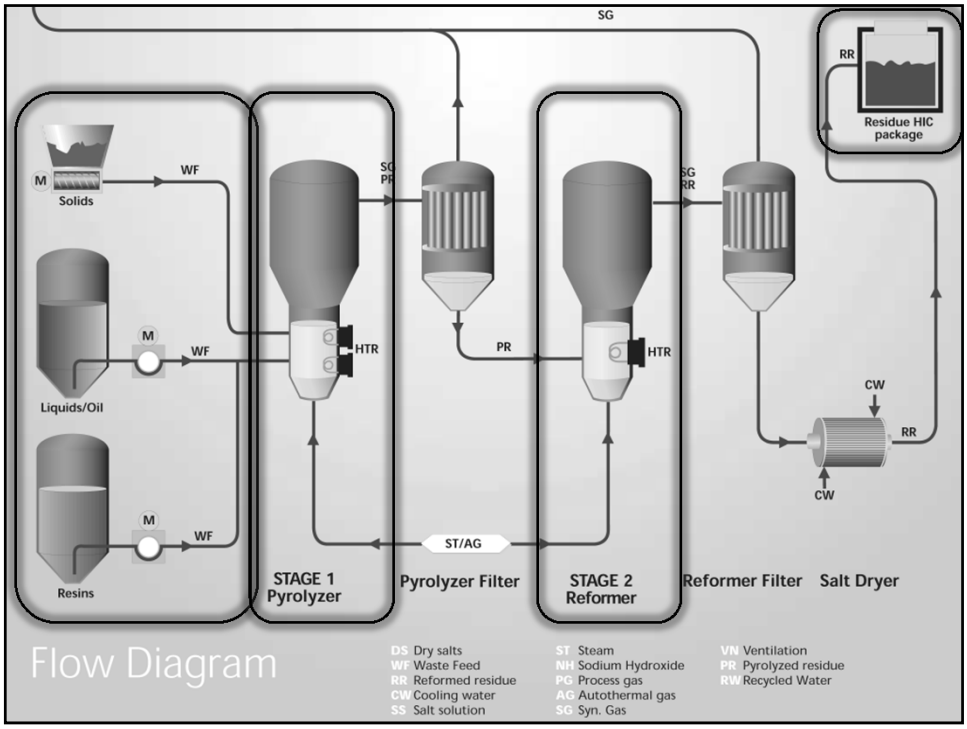

Reformed Residue Background, cont.

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- Why is RR so homogeneous?

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Demonstration of Mixing in a Fluidized Bed

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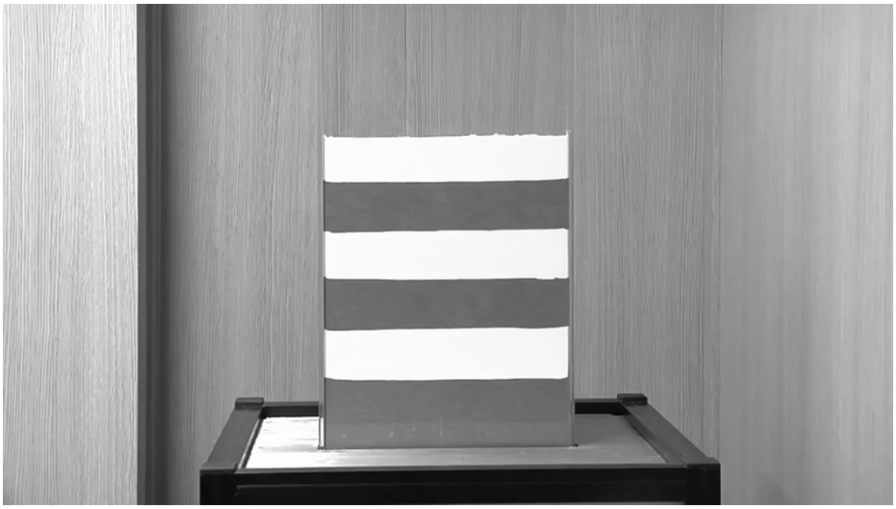

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Example of Fluidized Bed Reactor Turbulence

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Example of a Pyrolysis Reactor (600°C)

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- Why not just ship RR in accordance with CoC Revision 20?

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Historical RR Shipment

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- Shipment WCS-0513-01, May 2013
- Shipment made under CoC Revision 19 (aka Revision 17, measurement-based).

Parameter	Value	Limit	% of Limit
Surface dose	71 mrem/hr	200	35%
2m dose	4.4 mrem/hr	10	44%

- The shipment was 44% of the limit- a wide margin.
- Let's try to make that shipment today…

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Historical RR Shipment, cont.

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- Back to the Future – Shipping WCS-0513-01 Today
  - Rev. 20 of the CoC follows the guidance in RIS 2013-04:
    - Characterize the waste to obtain nuclide inventory
    - Qualify the payload using CoC limits based on NCT & HAC MCNP analyses that bound all contents configurations.
  - Using the sum-of-fractions methodology per the CoC:
    - The sum is 1.4 vs. a limit of 0.95 (147% of the limit)
    - But the actual shipment was only 44% of the limit
    - Analysis conservatisms do not explain the margin

Parameter	Value	Limit	% of Limit
Sum of Fractions (Rev. 20)	1.4	0.95	147%
- Correct for mass att'n factor	~20%		~118%
- Credit for poly HIC	~8%		~108%
Apparent conservatism due to source characterization	**44% → 108% is a factor of 2.5!**		

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Historical RR Shipment, cont.

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- What about the Source Characterization?
  - The "reasonable target" for determining radionuclide concentrations in waste characterization*:

> The regulatory staff is prepared to be flexible in the adaptation of a particular program to a particular waste generating facility. A principal consideration for the acceptability of a particular program will be whether a reasonable effort has been made to ensure a realistic representation of the distribution of radionuclides within waste, given physical limitations, and to classify waste in a consistent manner. Example "physical limitations" can include difficulties in obtaining and measuring representative samples at reasonable costs and acceptable occupational exposures. The staff considers a reasonable target for determining measured or inferred radionuclide concentrations is that the concentrations are accurate to within a factor of 10. The staff recognizes, however, that this target may be difficult to achieve for some waste types and forms.

  - Dose-to-Ci methods often based on peak vs. average.
  - Samples may be small- context is important.
  - Resin*Solutions* "inherits" the nuclide inventories from incoming resin shipments.

*NRC Branch Technical Position on Radioactive Waste Classification (1983)

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Historical RR Shipment, cont.

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- The current CoC approach effectively reduces the 10 mrem/hr limit in §71.47(b)(3) to a 4 mrem/hr limit in this case because of conservatisms in the source characterization.
  - §71.47 specifies limits for external "radiation levels", not external "calculated radiation levels".
- Consequences
  - More than doubles the required number of shipments.
  - Increases personnel dose due to the need to process and ship more shipments.
  - Increases overall shipment risks (accidents, etc.) due to the increase in required shipments.

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Long Term Approach – CoC Rev. 21

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- Proposed Approach for RR
  - No significant neutron sources in RR
  - Demonstrate in SAR that NCT bounds HAC.
  - Gamma acceptance based on pre-shipment measurements.
    - 10% margin for measurement uncertainty
    - prescriptive survey procedure
- Why are pre-shipment measurements valid for use?
  - RR is homogeneous and stable: a "perfect" payload in that it cannot shift, redistribute, or change in ways that would increase package external dose rates during shipment.
- Why not just use the existing CoC methodology to quality RR payloads?
  - Conservatisms in nuclide inventories are unnecessarily precluding shipments.

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Long Term Approach – CoC Rev. 21, cont.

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- But what about RIS 2013-04?
  - *"The A_2 value does not describe the nature of the source…"* *agreed*
  - *"A package that relies completely on pre-shipment dose measurements to determine if a package meets its regulatory dose rate limits may not address the possibility of contents shifting or settling during transport, which could potentially result in an increase in package radiation levels."* *We contend this does not apply for RR contents because of the inherent homogeneity and stability of RR*

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Long Term Approach – CoC Rev. 21, cont.

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- But what about RIS 2013-04?, cont.
  - *"Calculating the estimated dose rates provides reasonable assurance against natural uncertainties associated with measurements, especially for packages with small margins to the limit."*
    We disagree in this case
    - This implies that the calculations are more accurate than measurements. But the nuclide inventories come from waste characterizations that are themselves based on measurements and the additional uncertainties of waste sampling.
    - Current waste characterization technology was intended for Part 61 disposal purposes - not for packaging radiation source qualification.
    - We assert that direct measurement of the package is far more reliable for the case of RR.

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Long Term Approach – CoC Rev. 21, cont.

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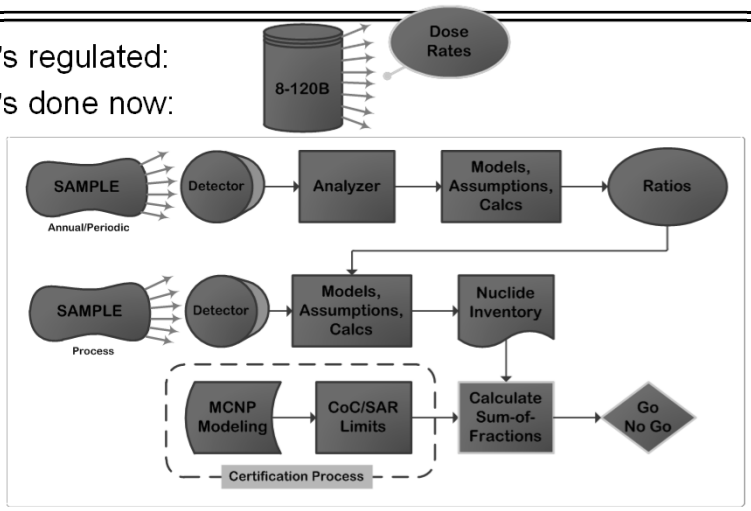
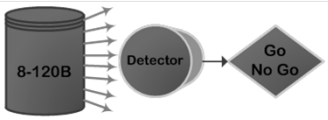
- What's regulated:
- What's done now:



- What we propose to do for RR:



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Conclusions

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- CoC Rev. 19 has introduced shielding conservatisms that are negatively impacting shipping campaigns that have been successfully made in the past.
- Amendment request 21 does not seek to ship new types of contents. These payloads have all been safely, compliantly shipped in the past.
- RR shipments that have been made historically are impacted by the current CoC.
  - Short term: Energy*Solutions* plans to send in a letter request for RR shipments immediately.
  - Long term: The proposed method for qualifying RR payloads based on pre-shipment measurements is acceptable because of the unique properties of RR.

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