UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

50-317/318
72-8

November 10, 1994

MEMORANDUM TO: Charles J. Haughney, Chief
Storage and Transport Systems Branch
Division of Industrial and
Medical Nuclear Safety

THRU: Frederick C. Sturz, Section Leader
Irradiated Fuel Section
Storage and Transport System Branch

FROM: Edward Y. Shum
Irradiated Fuel Section
Storage and Transport System Branch

SUBJECT: MEETING WITH BALTIMORE GAS AND ELECTRIC COMPANY (BG&E) TO DISCUSS LICENSE AMENDMENT ACTION

On November 1, 1994, NRC staff and its consultants (Science Applications International Corporation), BG&E staff, BG&E's consultants (MPR and VECTRA Technologies, Inc.) and staff from Maryland Department of Natural Resources met at the NRC Headquarter Office to discuss BG&E's license amendment action to exempt the first two dry shielded canisters at the Calvert Cliffs Nuclear Power Plant's independent spent fuel storage installations from the Technical Specifications limit on the vacuum dry process. The attendees are shown in attachment A.

The background for this proposed license amendment is that in the vacuum dry process of the DSC, the technical specifications require the DSC cavity pressure during canister vacuum drying not to exceed 3 torr (3 mm Hg) after stepped evacuation. In addition it requires this pressure to be maintained for not less than 30 minutes. The bases for these specifications are to ensure evaporation of all liquid water in the DSC cavity and to limit the resulting inventory of oxidizing gases in the DSC to less than 0.25 vol%. BG&E (the licensee) discovered, while the third DSC was being processed, that the low-range vacuum gauge head range switch had been improperly set during the processing of the first two DSCs, and the actual vacuums were 11.0 torr and 14.7 torr for the first and second DSC, respectively; thus, violating the technical specification. In addition, it appeared that the step-down vacuum procedure in the technical specification was not exactly followed. Also, in the draining of water, air displacement was applied rather than helium displacement as described in the licensee's Safety Analysis Report (SAR).

The meeting started at 9 a.m. NRC staff made introductory remarks on the license amendment action and pointed out the key issue in this license amendment action is to ensure that all liquid in the DSC will be evaporated so that the limit set for oxidant gas inside the DSC is met. NRC staff also raised its concern on the BG&E's application of 10 CFR 72.48 since it appeared that operations described in the technical specification were not followed. This was followed by BG&E's and VECTRA's brief presentations. See agenda and outlines of presentations in attachment B.

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The BG&E and VECTRA's presentation was to illustrate that the first two DSCs can meet the criteria with the same margin of safety even though the procedure was not exactly followed. As a follow-up to the meeting, NRC staff will request in writing detailed information on the presentation, and will send additional questions to the licensee to allow NRC to complete its independent evaluation of the proposed license amendment action.

Docket No. 72-8(50-317/318)

Attachments: Attendees
Agenda w/handouts

Distribution: Docket No. 72-8(50-317/318)
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G:\MTG.BGE *see previous concurrence

OFC	IMIF*	C	IMIF*	E	IMIF*	E	IMIF	E				
NAME	EYShum:jc		WKCheng		FBrown		FSturz					
DATE	11/07/94		11/07/94		11/07 /94		11/ /94					

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ATTACHMENT A

Attendees

NRC: C. Haughney
F. Sturz
E. Shum
W. Cheng
W. Reamer
M. Case
F. Lyon

NRC contractor (SAIC):
J. Stokley
R. Sievers

Maryland Department of Natural Resources:
R. McLean

BG&E: J. Lippold
P. File
G. Tesfaye
J. Bennett
J. Makar
B. Montgomery

VECTRA: M. Taylor, Jr.
K. Jones

MPR: T. Greene
N. Cole

ATTACHMENT B

AGENDA FOR THE NOVEMBER 1, 1994
NRC-BGE MEETING

1 - Meeting Introduction----------NRC

2 - Process Description and Basis for Technical
Specification Requirement----------BGE

3 - Discussion of DSC Design with Respect to
Vacuum Drying Requirement, and Past Experience
with Vacuum Drying Process----------Vectra

4 - Events Chronology that Led to the Technical
Specification Violation, and License Amendment Request
Summary Including Technical Evaluation of Calvert
Cliffs' DSC-1 and DSC-2----------BGE

4 - Question and Answer Session

5 - End of Meeting

LICENSE AMENDMENT REQUEST FOR CALVERT CLIFFS ISFSI

AMENDMENT REQUESTED DUE TO ISFSI TECHNICAL SPECIFICATION 2.2.1 NOT BEING MET FOR FIRST TWO DSCs LOADED

PRESENTED BY PENNEY FILE
BALTIMORE GAS AND ELECTRIC COMPANY
11/1/94

OBJECTIVE

DEMONSTRATE THAT THE AS-IS CONDITION OF THE DSCs IN QUESTION JUSTIFIES UNRESTRICTED ACCEPTANCE FOR CONTINUED STORAGE

DEMONSTRATE THAT LEAVING THE CANISTERS IN THE AS-IS CONDITION IS THE BEST ALTERNATIVE

AGENDA

VIOLATION OF ISFSI TS 2.2.1

- PROCESS DESCRIPTION
- BASIS FOR TS REQUIREMENT
- DETAILS OF VIOLATION

BASIS FOR AMENDMENT REQUEST

- TECHNICAL ASSESSMENT OF AS-IS CONDITION
- COMPARISON TO BASIS FOR TS

SUMMARY

PROCESS DESCRIPTION

CCNPP ISFSI DESIGN

LOADING PROCESS

BASIS FOR TS REQUIREMENT

ISFSI TS 2.2.1
- 3 TORR VACUUM

BASIS FOR TS 2.2.1
- REMOVE LIQUID WATER
- INVENTORY OF OXIDIZING GASES <.25% BY VOLUME

DERIVATION OF BASIS
- PNL REPORT ON COVER GAS IMPURITIES
- RECOMMENDED MAX INVENTORY OF OXIDIZING GAS

UNDERLYING BASIS IN 72.122
- DESIGN CRITERION TO PRECLUDE CLAD DEGRADATION LEADING TO GROSS RUPTURE WHICH WOULD POSE OPERATIONAL SAFETY PROBLEMS DURING REMOVAL FROM STORAGE

Vacuum Drying Design, Process, and Experience

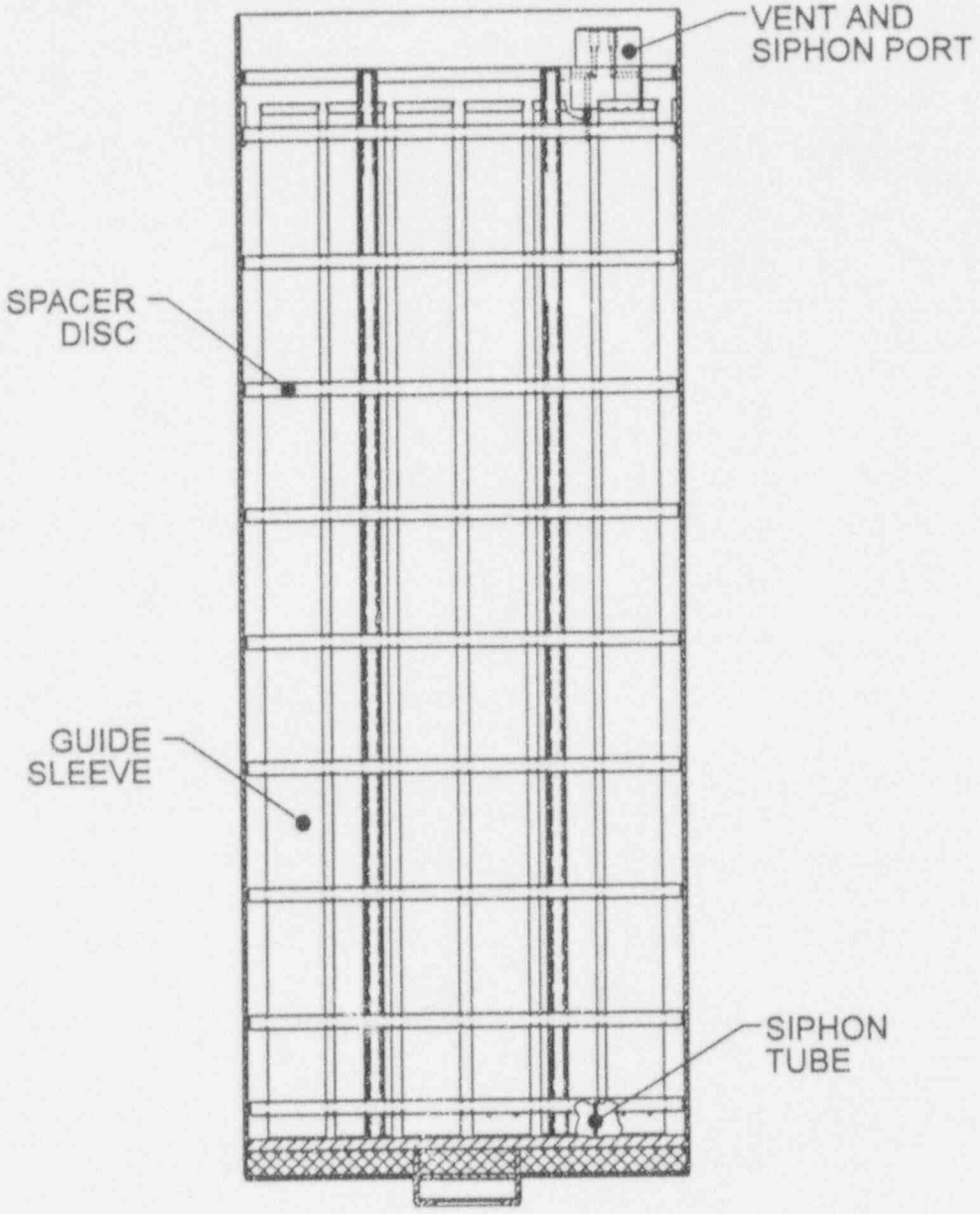
- DSC Design for Vacuum Drying
- Vacuum Drying Procedure to Meet Technical Specification Requirements
- Past Experience with Vacuum Drying

DSC Design for Vacuum Drying

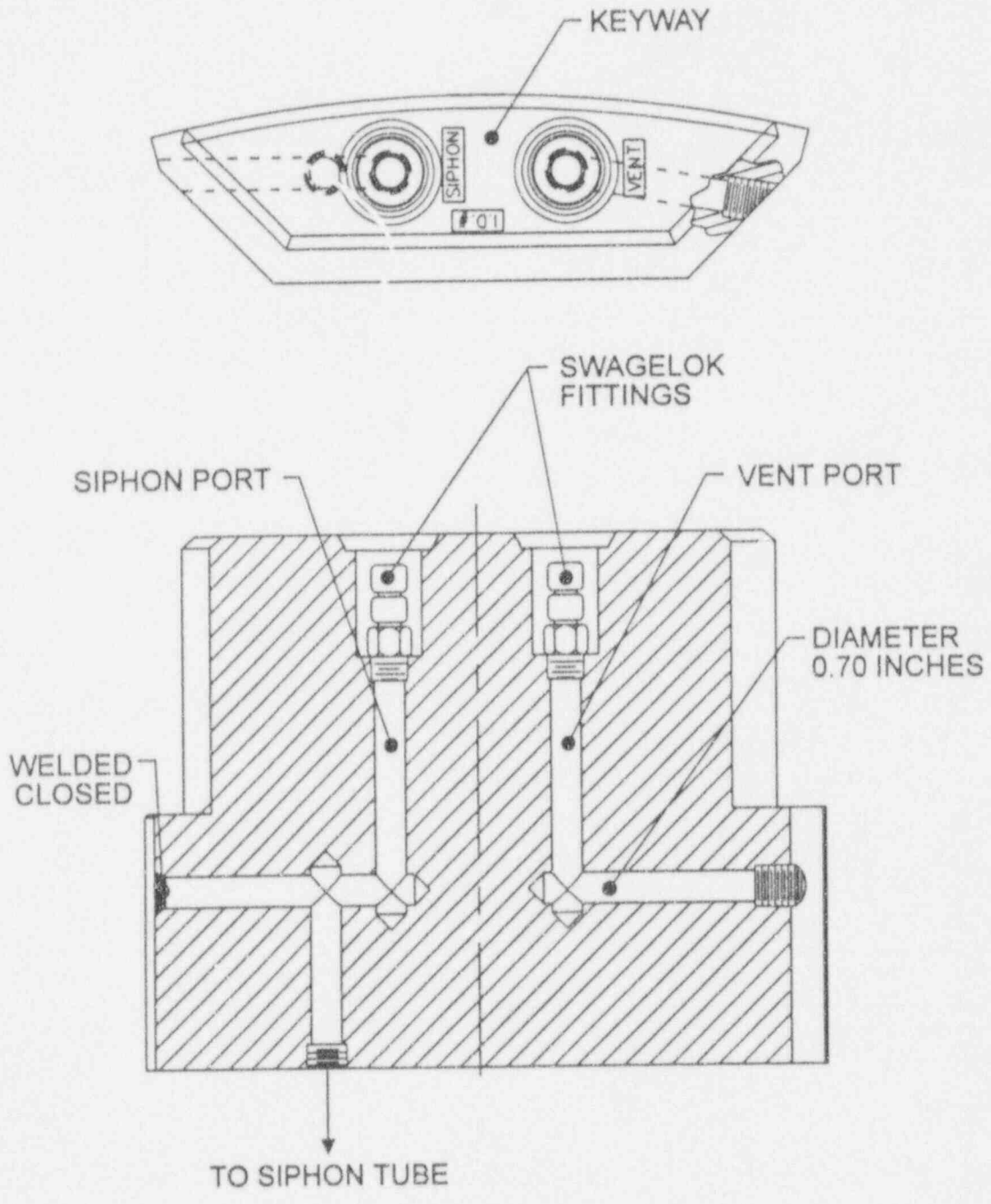
Generic Design Details

- Vent and Siphon Port Design
- Siphon Tube Interface with DSC
- Potential Water Traps
- Residual Water in DSC

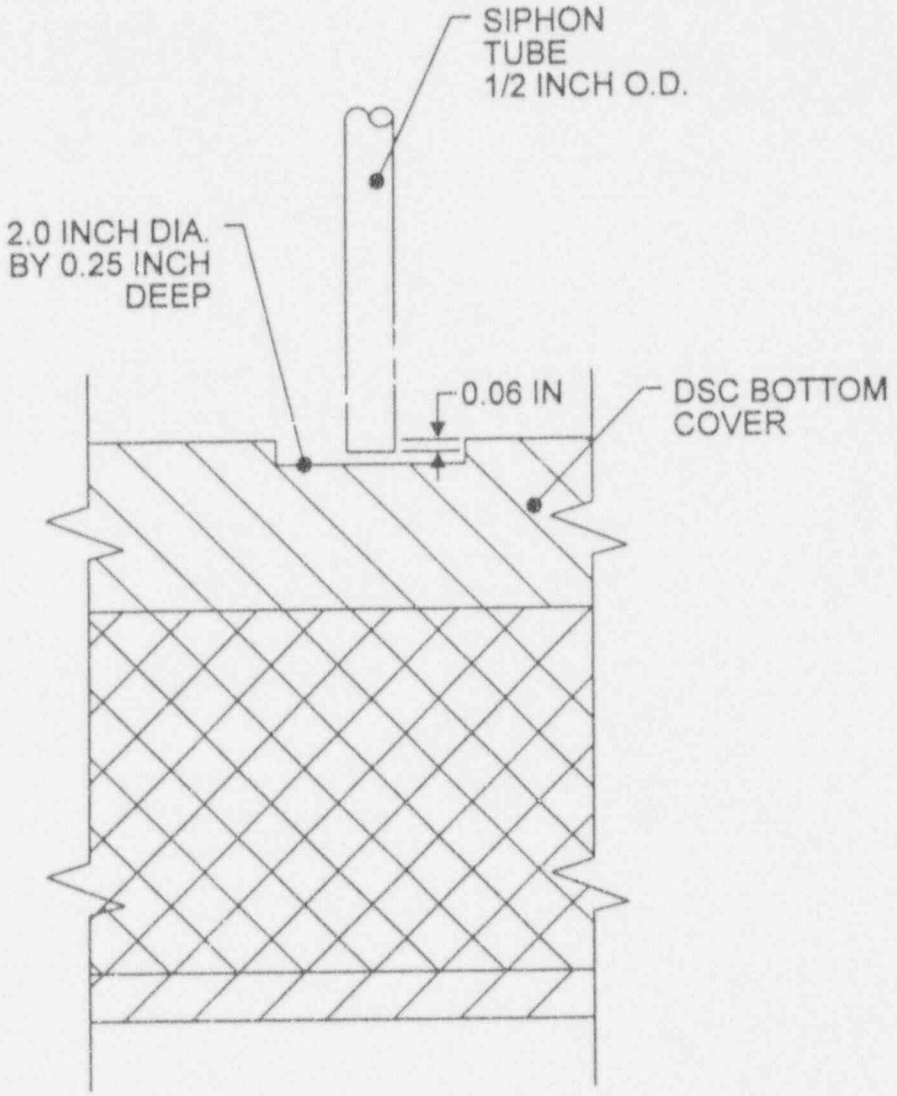
DSC Design



DSC Vent and Siphon Port Design



Siphon Tube Interface with DSC



Potential DSC Water Traps

- DSC Bottom Cover
  - Surface Area About 3400 Square Inches
  - Siphon Tube Extends Below DSC Bottom Cover
- Siphon Tube Counterbore
  - Two Inch Diameter Counterbore, 1/4 Inch Deep
  - Volume Less than One Cubic Inch
  - Dried by Initial Operation of Vacuum Drying System (VDS)
- Spacer Discs
  - Nine Horizontal Spacer Discs
  - Total Surface Area About 12,000 Square Inches

DSC Residual Water

- Free-Standing, Liquid Water Remaining in DSC After Blowdown
- Assumptions
  - 1/8 Inch Meniscus On All Horizontal Surfaces
  - Vertical Surfaces Assumed to be Dry
  - Washdown Pit Floor Flat Within 1/8 Inch over 10 Feet
  - Cask Bottom Flat Within 0.08 Inches
  - DSC Bottom Flat Within 0.06 Inches
  - Includes Full Volume of Siphon Tube
- Maximum Volume of Free Standing Water – **10 Gallons**
- Total DSC Free Volume – **1750 Gallons**

DSC 1 and 2 Payloads

Canister Heat Load

- Total Canister Decay Heat Power About 40% of Design Basis
- Temperature Differential Across Air Vents About 55% of Design Basis

Vacuum Drying Procedure to Meet Technical Specification Requirements

Basis for Specification

- PNL-6365 – Evaluation of Cover Gas Impurities and their Effects on the Dry Storage of LWR Spent Fuel
- 0.25 Volume Percent Oxidizing Gas Concentration

Technical Specifications

- DSC Vacuum
- DSC Backfill Pressure

Vacuum Drying Procedure to Meet Technical Specification Requirements (concluded)

Vacuum Drying Procedure

- Pressurized Blowdown of DSC
- Initial Vacuum Drying
- Initial Backfill and Leak Test
- Secondary Vacuum Drying
- Final Backfill

Vacuum Drying Technical Specifications

Required Vacuum

- Vacuum Shall Not Exceed Three Torr
  - Single Pumpdown to Three Meets Technical Specification Requirements and Removes Liquid Water
  - Second Pumpdown Performed in Accordance With PNL-6365
- Vacuum Shall Be Performed Using Stepped Evacuation
  - Allows Offgassing to be Monitored During Pumpdown
  - Prevents Sudden, Drastic Changes in DSC Cavity Pressure That May Induce Formation of Ice
- Vacuum Shall Be Maintained for At Least 30 Minutes
  - Assures That All Liquid Water Has Evaporated

Vacuum Drying Technical Specifications (concluded)

Helium Backfill Pressure

- DSC Cavity Shall be Backfilled With Helium to 2.5 psig ± 2.5 psi assures Inert Atmosphere in DSC
- Prevents In-Leakage of Air into DSC During Storage
- Specification Met for Both Canisters

Vacuum Drying Procedure

Procedure is not Affected by Change Request

Pressurized Blowdown of DSC

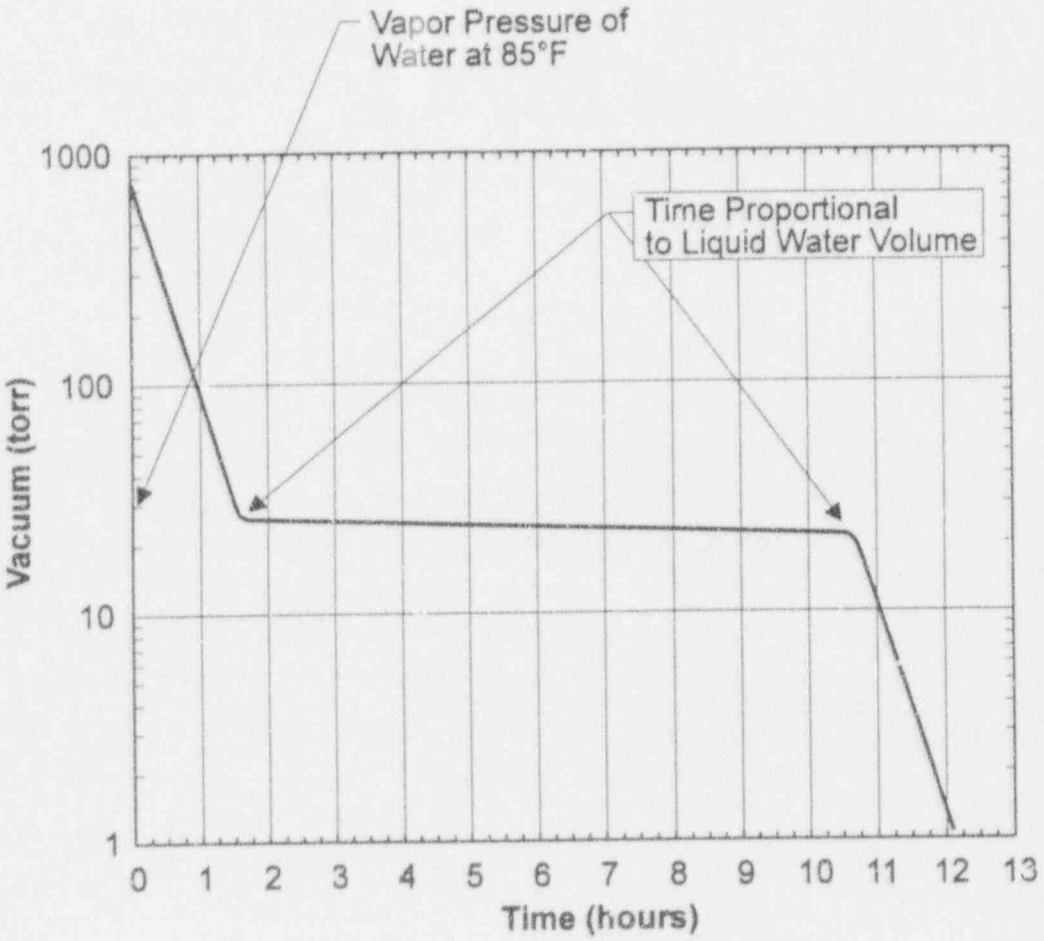
- Pressurized Gas Introduced Through Vent Port Forces Water Out of DSC Through Siphon Tube
- Use of Air Versus Helium for Blowdown of DSC
  - 72.48 Has Already Been Implemented
  - Air Doesn't Interfere With Helium Leak Test Equipment
  - Air Is More Readily Available Than Helium for the Blowdown
  - No Technical Need for Helium
  - Evaluation of DSC Cover Gas Impurity Assumes Concentration of Reactive Gas That Bounds Any Oxidant or Moisture Introduced by Air
  - Use of Air Does Not Increase Likelihood of Ice Formation
- Blowdown Terminated When Bubbles Exit the DSC Siphon Port
- DSC Pressure Allowed to Equalize After Blowdown

Vacuum Drying Procedure (continued)

Initial Vacuum Drying

- Allow Vacuum Pump to Reach Operating Temperature
- Connect VDS to Vent and Siphon Ports
- Begin Evacuation of DSC
  - Initial Evacuation Draws Water From Siphon Tube
  - Drain Water from Vacuum Hose As Necessary
- Perform Stepped Evacuation of DSC
  - Hold Vacuum at Several Plateaus as Measured on Vacuum Gauge
  - Pressure Rises Immediately After Valving-Off Pump Until DSC and VDS Pressures Equalize
  - Pressure Should Be Stable After Initial Increase Before Continuing to Next Plateau

Vacuum Drying Procedure (Expected VDS Performance)



Vacuum Drying Procedure (Stepped Evacuation)

- Stepped Evacuation Intended to Prevent Formation of Ice in VDS Lines
- Prevention of Ice Formation Increases Efficiency of Vacuum Drying Process
- Formation of Ice in VDS Lines Does Not Affect Conditions Within DSC
- Performance of Final Vacuum Test Assures All Water Removed from DSC

Vacuum Drying Procedure (continued)

Initial Backfill and Leak Test

- Connect Helium Supply to VDS
- Pressurize DSC to 1.5 atm
- Perform Helium Leak Test of DSC Shield Plug

Secondary Vacuum Drying

- Allow DSC to De-Pressurize
- Begin Evacuating DSC
  - DSC Pressure Should Decrease Steadily
  - Time Required for Second Pumpdown Significantly Less Than First
- Draw Three Torr Vacuum in DSC

Vacuum Drying Procedure (concluded)

Final Backfill

- Connect Helium Supply to VDS
- Fill DSC With Helium to 2.5 psig ± 2.5 psi as Measured on Compound Gauge

Past Experience with Vacuum Drying

- Water Blowdown Times
- Vacuum Level Versus Time

Water Blowdown Times

- Data from 20 Oconee Fuel Loads
- Times Range from 4 to 11 Hours
- Average Blowdown Time is 6.75 Hours
- Water Removed When High Pressure Gas Observed to Exit Drain Line
- Calvert Cliffs DSC 1 Blowdown
  - Blowdown Required 7.5 Hours
- Consistency With Oconee Data Indicates Liquid Water Removed to the Same Degree

Vacuum Level Versus Time

- Time-to-Pressure Compared for Oconee and Calvert Cliffs DSCs Below

Vacuum (torr)	Oconee Time (hours)	Calvert Cliffs Time (hours)
90	0.7	1.0
50	3.0	2.3
30	5.0	7.3
15	7.0	12.0

3 12.0

DETAILS OF VIOLATION

VACUUM GAUGE SET INCORRECTLY

OUTPUT LOW BY FACTOR OF 10

DISCOVERED DURING PROCESSING OF THIRD DSC

IMPACT - FIRST TWO DSCs PROCESSED AT HIGHER THAN 3 TORR - VIOLATION OF TS 2.2.1

GAUGE SYSTEM REDESIGNED

TECHNICAL ASSESSMENT OF AS-IS CONDITION

VECTRA AND MPR PERFORMED INDEPENDENT ASSESSMENTS

ACTUAL VACUUM PRESSURES ACHIEVED IN 10-15 TORR RANGE AS OPPOSED TO 3 TORR AS REQUIRED BY TS 2.2.1

INVENTORY OF OXIDIZING MATERIAL CALCULATED BASED ON ACTUAL OPERATING HISTORY

BGE REVIEWED RESULTS OF ASSESSMENTS, ENSURED BASES FACTUAL, ASSUMPTIONS REASONABLE - CONCUR WITH FINDINGS

INVENTORY ESTIMATES RANGE FROM .009% TO .05% DEPENDING ON CONSERVATISM OF ASSUMPTIONS MADE

OBSERVED CASK TEMPERATURES AND OBSERVED VACUUM PRESSURE STABILIZATION INDICATIVE OF CANISTER DRYNESS

COMPARISON TO BASIS FOR TS

BASIS FOR ABSENCE OF LIQUID WATER MET BASED ON OBSERVED TEMPERATURES AND VACUUM PRESSURE STABILIZATION (SEE CURVE)

BASIS FOR INVENTORY OF OXIDIZING MATERIAL MET WITH SIGNIFICANT MARGIN -

- CALCULATED RANGE OF .009% - .05% IS SIGNIFICANTLY LESS THAN BASIS LIMIT OF .25%
- INVENTORY BASED ON REALISTIC ASSUMPTIONS CONSERVATIVE BY MORE THAN FACTOR OF 25
- .25% LIMIT CONSERVATIVE FOR NUHOMS CASK COMPARED TO UNDERLYING BASIS LIMIT OF 1 MOLE OF OXYGEN

COMPARISON TO BASIS OF TS (CONT)

UNDERLYING CONCERNS WITH OXIDIZING ENVIRONMENT NOT AN ISSUE

OXIDATION OF ZIRCALOY NOT AN ISSUE, ESPECIALLY IN SEALED, NONREPLENISHABLE ENVIRONMENT OF DSC

OXIDATION OF EXPOSED URANIUM DIOXIDE FUEL NOT AN ISSUE - FUEL STORED IN DSCs WAS VACUUM SIPPED PRIOR TO STORAGE TO ENSURE ABSENCE OF CLADDING DEFECTS

SUMMARY

WHILE TS 2.2.1 NOT MET, ALL BASES BEHIND TS MET, INVENTORY OF OXIDIZING GAS MET WITH SIGNIFICANT MARGIN

TECHNICAL ASSESSMENT FULLY SUPPORTS ADEQUACY OF DSCs FOR UNRESTRICTED CONTINUED STORAGE

ONLY VIABLE ALTERNATIVE (TO OFFLOAD DSCs) HAS ADVERSE CONSEQUENCES WITH RESPECT TO DOSE, GENERATION OF WASTE AND COST

BEST PATH IS TO ACCEPT DSCs AS-IS, CONSISTENT WITH REQUEST FOR AMENDMENT