From: <Tony_Banks@Dom.com>
To: "Nitin Patel" <NXP1@nrc.gov>
Date: 6/8/2006 3:14:12 PM
Subject: Re: References--RAIs 4 AND 6 of RAI Letter dated 5/10/2006

Nitin - attached are the relevant pages from GE correspondence referenced in Dominion's May 24, 2006 responses to NRC's May 10, 2006 RAIs 4 and 6. Content from GEDO letters -0014 and -0026 provide information for RAI 4. Content from GEDO letter -0020 provides information for RAI 6. (This is the same information that was provided in the 5/24/06 response.)

Joe and I will follow up this transmittal with a letter.

Please let me know if you have any questions - thank you.

Tony Banks, MPH, CHMM
Dominion
ESP/COL Project
Project Lead - Environmental
804/273-2170

(See attached file: 060806 GEDO-SR5-2006-0026-ESBWR_EAB Dose_tb.pdf)(See attached file: 060806 GEDO-SR5-2006-0014-ESBWR_LOCA_Values_Report_tb.pdf) (See attached file: 060806 GEDO-SR5-2006-0020-ESBWR Source Term based on MAAP runs_tb.pdf)

CC: "Jack Cushing" <JXC9@nrc.gov>, <Joseph_Hegner@Dom.com>, <rlbaker@bechtel.com>, "Kingston, Rick E. (GE Infra, Energy)" <Rick.Kingston@ge.com>, <Tony_Banks@Dom.com>

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Subject: Re: References--RAIs 4 AND 6 of RAI Letter dated 5/10/2006
Creation Date 6/8/2006 3:13:06 PM
From: <Tony_Banks@Dom.com>

Created By: Tony_Banks@Dom.com

Recipients
nrc.gov
TWGWPO03.HQGWDO01
NXP1 (Nitin Patel)

nrc.gov
OWGWPO03.HQGWDO01
JXC9 CC (Jack Cushing)

ge.com
Rick.Kingston CC (Rick E. (GE Infra Energy) Kingston)

bechtel.com
rlbaker CC

Dom.com
Joseph_Hegner CC

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Files	Size	Date & Time
MESSAGE	1601	6/8/2006 3:13:06 PM
060806 GEDO-SR5-2006-0026-ESBWR_EAB Dose_tb.pdf	93518	
060806 GEDO-SR5-2006-0014-ESBWR_LOCA_Values_Report_tb.pdf	110488	
060806 GEDO-SR5-2006-0020-ESBWR Source Term based on MAAP runs_tb.pdf	105872	
Mime.822	428118	

Options
Expiration Date: None
Priority: Standard
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Return Notification: None

Concealed Subject: No
Security: Standard

ENCLOSURE 1

Table 1 - ESBWR Core Inventory ESBWR Core Power is 4500 MWt			
Nuclide	**Bq/MWt**	**Nuclide**	**Bq/MWt**
Co-58	5.10E+12	Te-131m	1.42E+14
Co-60	4.92E+12	Te-132	1.41E+15
Kr-85	1.23E+13	I-131	9.90E+14
Kr-85m	2.73E+14	I-132	1.44E+15
Kr-87	5.27E+14	I-133	2.04E+15
Kr-88	7.42E+14	I-134	2.25E+15
Rb-86	2.35E+12	I-135	1.91E+15
Sr-89	9.93E+14	Xe-133	2.03E+15
Sr-90	9.76E+13	Xe-135	6.72E+14
Sr-91	1.25E+15	Cs-134	1.98E+14
Sr-92	1.34E+15	Cs-136	6.89E+13
Y-90	1.01E+14	Cs-137	1.28E+14
Y-91	1.27E+15	Ba-139	1.84E+15
Y-92	1.34E+15	Ba-140	1.77E+15
Y-93	1.55E+15	La-140	1.82E+15
Zr-95	1.70E+15	La-141	1.68E+15
Zr-97	1.69E+15	La-142	1.62E+15
Nb-95	1.71E+15	Ce-141	1.68E+15
Mo-99	1.89E+15	Ce-143	1.56E+15
Tc-99m	1.68E+15	Ce-144	1.36E+15
Ru-103	1.50E+15	Pr-143	1.53E+15
Ru-105	1.00E+15	Nd-147	6.69E+14
Ru-106	5.21E+14	Np-239	1.93E+16
Rh-105	9.10E+14	Pu-238	3.34E+12
Sb-127	1.03E+14	Pu-239	4.02E+11
Sb-129	3.15E+14	Pu-240	5.21E+11
Te-127	1.05E+14	Pu-241	1.51E+14
Te-127m	1.37E+13	Am-241	1.70E+11
Te-129	3.10E+14	Cm-242	4.01E+13
Te-129m	4.60E+13	Cm-244	1.94E+12

Table 2 - Relationship Between MAACS and MAAP Fission Product Groups		
MACCS Release Groups	**MAAP Release Groups**	**MAAP Output Parameter**
1-Xe/Kr	noble gases	FREL (1)
2-I	CsI	FREL (2)
3-Cs	CsOH	FREL (6)
4-Te	TeO2 (Sb & Te2 fractions are included)	FREL (3), FREL (10) and FREL (11)
5-Sr	SrO	FREL (4)
6-Ru	MoO2 (Mo is in Ru MACCS category)	FREL (5)
7-La	La2O3	FREL (8)
8-Ce	CeO2 (included UO2 in this category)	FREL (9) and FREL (12)
9-Ba	BaO	FREL (7)

Table 3 - Summary of ESBWR Release Categories and Associated Frequencies		
Release Category	**Summary Description**	**Release Frequency (reactor year^{-1})**
BYP	Containment is bypassed because of CIS failure with large (>12" diameter hole) opening in containment. Lower drywell debris bed covered.	1E-12
BOC	Break outside of containment.	4E-12
CCID	Containment fails due to core concrete interaction; lower drywell debris bed uncovered.	2.9E-11
CCIW	Containment fails due to core concrete interaction; lower drywell debris bed covered.	2.9E-10
DCH	Direct containment heating (high pressure RPV failure) event damages containment	<1E-12
EVE	Ex-vessel steam explosion fails containment	2.5E-10
FR	Release through controlled (filtered) venting from suppression chamber	2.3E-10
OPVB	Containment fails due to failure of vapor suppression (vacuum breaker) function.	<1E-12
OPW1	Containment fails due to early (<24 hours) loss of containment heat removal.	<1E-12
OPW2	Containment fails due to late (>24 hours) loss of containment heat removal.	1.4E-11
TSL	Containment leakage at Technical Specification limit.	2.8E-8

Table 4 -

Radionuclide Source Terms (Release Fraction 72 hours after onset of core damage)

Release Category	Xe/Kr	CsI	TeO_2	SrO	MoO_2	CsOH	BaO	La_2O_3	CeO_2	Sb	Te_2	UO_2
BOC	1.0E+00	8.5E-01	7.5E-01	1.5E-02	7.2E-02	3.8E-01	1.5E-02	6.1E-04	3.4E-03	1.5E-01	6.1E-03	2.9E-05
BYP	9.8E-01	4.3E-01	2.3E-01	1.6E-02	1.2E-01	3.7E-01	2.9E-02	5.3E-04	3.3E-03	5.0E-01	1.2E-02	2.4E-05
CCID	9.2E-01	5.3E-01	2.3E-01	2.3E-06	5.1E-06	3.2E-01	2.2E-05	1.4E-07	1.1E-06	3.5E-01	1.5E-02	3.0E-07
CCIW	9.2E-01	1.1E-02	2.7E-03	1.4E-06	4.5E-06	2.5E-02	1.1E-06	1.3E-07	7.6E-07	6.8E-03	6.5E-05	7.9E-09
DCH	9.0E-01	8.0E-01	2.2E-01	3.2E-04	2.7E-04	1.5E-01	3.2E-04	3.2E-04	3.2E-04	2.7E-01	1.1E-04	1.6E-07
EVE	8.4E-01	2.5E-01	1.4E-01	1.3E-02	1.1E-04	3.4E-01	5.7E-03	8.2E-04	6.2E-03	5.4E-01	9.8E-03	5.0E-05
FR	1.0E+00	9.8E-06	8.1E-07	1.1E-08	1.9E-07	4.6E-05	3.2E-08	4.1E-10	1.5E-09	2.5E-03	2.9E-05	1.0E-11
OPVB	9.9E-01	2.8E-01	3.9E-02	1.7E-03	1.2E-04	3.4E-02	8.7E-04	1.5E-04	3.1E-04	7.1E-02	3.1E-05	5.2E-07
OPW1	9.9E-01	6.0E-01	2.1E-01	1.6E-03	4.3E-07	1.4E-01	7.5E-04	5.8E-06	1.8E-04	1.6E-01	3.2E-05	5.9E-07
OPW2	9.9E-01	3.8E-02	5.7E-02	1.2E-03	2.0E-07	4.3E-02	5.7E-04	3.9E-06	1.4E-04	1.0E-01	1.5E-05	3.4E-07
TSL	2.0E-03	1.5E-04	9.5E-05	2.1E-06	3.9E-05	5.5E-05	7.7E-06	7.3E-08	2.0E-07	1.2E-04	4.8E-08	1.0E-10

Table 5 - ESBWR Plume Characterization MACCS2 Data								
Release Category	OALARM[1] (s)	NUMREL[2]	MAXRIS[3]	REFTIM[4] (s)	PLHEAT[5] (W)	PLHITE[6] (m)	PLDUR[7] (s)	PDELAY[8] (s)
BOC	1,200	1	1	0.0	0	47.7	9,000	2,100
BYP	1,200	1	1	0.0	0	47.7	7,800	1,800
CCID	21,100	1	1	0.0	0	47.7	36,000	53,100
CCIW	21,100	1	1	0.0	0	47.7	36,000	69,500
DCH	16,300	1	1	0.0	0	47.7	36,000	16,200
EVE	22,400	1	1	0.0	0	47.7	36,000	22,500
FR	9,800	1	1	0.0	0	47.7	36,000	102,600
OPVB	16,500	1	1	0.0	0	47.7	36,000	65,300
OPW1	16,600	1	1	0.0	0	47.7	36,000	91,500
OPW2	17,600	1	1	0.0	0	47.7	36,000	146,900
TSL	21,000	1	1	0.0	0	47.7	36,000	1,100

Notes:

1. OALARM defines the time notification is given by site personnel to off-site emergency response officials to initiate protective measures for the surrounding population (i.e., General Emergency is declared). This time is a function of the accident sequences and is measured from accident initiation (i.e. SCRAM time). OALARM is a function of the application of Emergency Action Levels by a utility to the unfolding sequence. The OALARM values presented are typical values based on the loss or potential loss of multiple fission product barriers. Typically a General Emergency is declared when there is a loss of two fission product barriers (e.g., fuel cladding, RCS) and the potential loss of a third fission product barrier (e.g., containment). Sensitivity cases using various OALARM values are suggested to test for site-specific impacts related to this variable. The following outlines the OALARM bases for the release categories:
   a. BOC: The RCS and containment are lost at the start of the event. Loss of the fuel cladding would be expected quickly following the failure of ECCS to initiate. An OALARM = 20 minutes is used for the crew to diagnose the event and declare a General Emergency.
   b. BYP: The containment is lost at the start of the event. RCS is lost when the DPVs open. Loss of fuel cladding would be expected quickly following the failure of ECCS to initiate. An OALARM = 20 minutes is used for the crew to diagnose the event and declare a General Emergency.
   c. CCID, CCIW, FR, OPVB, OPW1, OPW2, TSL: The fuel cladding and RCS are lost early in the event. The containment would be considered potentially lost when the containment pressure equals the design pressure. OALARM is based on the time when containment pressure = 60 psia. (design pressure)
   d. DCH & EVE: The fuel cladding and RCS are lost early in the event. The containment integrity would be challenged at the time of the energetic vessel breach. OALARM is based on the time of vessel breach.
2. NUMREL=1 specifies that one plume is modeled.
3. MAXRIS=1 specifies that Plume 1 (the only plume modeled) is the risk dominant plume.
4. REFTIM=0.0 specifies that the plume leading edge is used as the representative time point for the plume decay, dry deposition, and dispersion calculations (Options include: 0.0=leading edge, 0.5=mid-point, 1.0=trailing edge).
5. PLHEAT=0.0 specifies the rate of release of sensible heat in the plume and is used to determine the amount of buoyant plume rise. This quantity is calculated as the amount of sensible heat in the plume divided by the duration of the plume. A zero value, selected here, represents ambient conditions for the plume and is usually more conservative for potential human impacts. A larger value creates buoyant effects that cause the plume to rise away from the ground. Sensitivity cases using a PLHEAT = 1E5, 1E6, and 1E7 are suggested.
6. PLHITE=47.7 meter specifies the height of the plume release above ground level. This 47.7 m height corresponds to the top of the reactor building.
7. PLDUR specifies the duration in seconds of each plume segment.
8. PDELAY specifies the start time of each plume segment after accident initiation (i.e., SCRAM).