



ALPHA Q, INC.

RECEIVED  
REGION 1

2006 MAR 10 PM 1:12

February 27, 2006

Todd J. Jackson, CHP  
US Nuclear Regulatory Commission  
475 Allendale Road  
King of Prussia, PA 19406-1415

Docket No. 04008940  
Control No. 136636

STB-1504

MS 16  
Q-6

Dear Mr. Jackson,

I am writing in response to your letter dated October 21, 2005 regarding the decommissioning of our facility. In this letter you stated that the alternate screening criteria proposed in our letter dated October 21, 2005 should be based upon the latest version of DandD computer code or another acceptable code for ease of approval.

#### Loose Activity

We understand that the default screening value for Th-232 is 6.03 dpm/100 cm<sup>2</sup> for Th-232 in equilibrium. Therefore, the actual total limit (for Th-232 + daughters) would be around 60 dpm/100 cm<sup>2</sup>.

Wipe samples obtained in our radiological assessment performed on 11/29/04 were analyzed by liquid scintillation counting. This analysis method would have been able to detect alpha particles from Th-232 and daughters at an efficiency of 100%. Beta emissions would have been detected with an efficiency of approximately 90%. Assuming a conservative efficiency of 90% for all emissions, the minimum detectable concentration (MDC) of the wipe analysis was determined to be 31 dpm/100 cm<sup>2</sup>. This MDC value is below the default limit of 60 dpm/100 cm<sup>2</sup>. Since no samples identified loose radioactivity in excess of the MDC, the survey data for loose activity supplied to the NRC should be adequate to show compliance with the default free release criteria.

#### Fixed Activity

Based upon the results of the surveys for loose radioactivity, it is apparent that the only possible dose pathway remaining at the Alpha Q facility would be from external exposure to residual fixed radioactive contamination. DandD Version 1.0 Build 1.00.02 was used to determine annual external dose from a proposed 5,000 dpm/100cm<sup>2</sup> screening limit.

136636

"where quality comes first"

NMSS/RONI MATERIALS-002



Based upon a fixed activity level of 5,000 dpm/100 cm<sup>2</sup>, the total annual external dose to an exposed individual would be 1.64 mrem. A printout of this calculation is included as Attachment 1 to this letter.

To be even more conservative, an additional dose calculation was performed assuming the presence of loose radioactive contamination at the facility at the level of the MDA (31 dpm/100 cm<sup>2</sup>). For this calculation, all default parameters were used. This dose calculation resulted in a calculated annual dose of 14.7 mrem. A printout of this calculation is included as Attachment 2 to this letter.

Summing the theoretical dose from both loose and fixed residual activity, results in a maximum calculated annual dose of 16.34 mrem. This calculated dose is below the limit of 25 mrem established in 10 CFR 20.1402. Therefore, we propose using a fixed activity limit of 5,000 dpm/100 cm<sup>2</sup>.

Instrument Efficiency for Th-232

In response to Item 3 from your letter dated July 21, 2005, a more appropriate isotope (Co-57) was used to establish beta efficiency for Th-232. Efficiency for Th-232 beta emissions was determined to be 13%. The revised MDC calculations are provided in Attachment 3 to this letter.

Based upon these revised calculations, it appears that the results of the surveys already performed would be sufficient to show that any residual activity remaining at our facility is below the limits required for unrestricted release.

If you have any questions regarding this letter or our decommissioning efforts, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'Ron Bonito', is written over a horizontal line.

Ron Bonito  
Vice President/General Manager

Enclosures

## **Attachment 1**

DandD Calculation #1



# DandD Building Occupancy Scenario

**DandD Version:** 2.1.0  
**Run Date/Time:** 2/13/2006 5:06:16 PM  
**Site Name:** alpha q  
**Description:** decom

**FileName:** C:\Documents and Settings\David\My Documents\alphaq.mcd

## Options:

**Implicit progeny doses NOT included with explicit parent doses**  
**Nuclide concentrations are distributed among all progeny**  
**Number of simulations:** 100  
**Seed for Random Generation:** 8718721  
**Averages used for behavioral type parameters**

**External Pathway is ON**  
**Inhalation Pathway is OFF**  
**Secondary Ingestion Pathway is OFF**

**Justification for Pathway Selection:** Only considering external exposure

## Initial Activities:

Nuclide	Area of Contamination (m <sup>2</sup> )	Distribution
232Th+C	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Chosen MDC for free release		Value 5.00E+03

## Chain Data:

Number of chains: 1

Chain No. 1: 232Th+C  
 Nuclides in chain: 11

Nuclide	Chain Position	Half Life	First Parent	Fractional Yield	Second Parent	Fractional Yield	Ingestion CEDE Factor	Inhalation CEDE Factor	Surf Dose Fac

							(Sv/Bq)	(Sv/Bq)	((Sv/d)/(l
232Th+C	1	5.13E+12							
228Ra	2	2.10E+03	1	1	0	0	3.88E-07	1.29E-06	0.00E+00
228Ac	Implicit		2	1			5.85E-10	8.33E-08	8.01E-11
228Th	3	6.99E+02	2	1	0	0	1.07E-07	9.23E-05	2.03E-13
224Ra	4	3.66E+00	3	1	0	0	9.89E-08	8.53E-07	8.26E-13
220Rn	Implicit		4	1			0.00E+00	0.00E+00	3.29E-14
216Po	Implicit		4	1			0.00E+00	0.00E+00	1.43E-15
212Pb	5	4.43E-01	4	1	0	0	1.23E-08	4.56E-08	1.23E-11
212Bi	Implicit		5	1			2.87E-10	5.83E-09	1.54E-11
212Po	Implicit		5	0.6407			0.00E+00	0.00E+00	0.00E+00
208Tl	Implicit		5	0.3593			0.00E+00	0.00E+00	2.58E-10

### Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
232Th	5.00E+02
228Ra	5.00E+02
228Ac	5.00E+02
228Th	5.00E+02
224Ra	5.00E+02
220Rn	5.00E+02
216Po	5.00E+02
212Pb	5.00E+02
212Bi	5.00E+02
212Po	3.20E+02
208Tl	1.80E+02

### Model Parameters:

#### General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy	The duration of the occupancy	CONSTANT(days)

<b>Period</b>	exposure period	
Default value used		Value 3.65E+02
<b>Vo:Breathing Rate</b>	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
<b>RFo*:Resuspension Factor</b>	Effective resuspension factor during the occupancy period = RFo * FI	DERIVED(1/m)
Default value used		
<b>GO*:Ingestion Rate</b>	Effective secondary ingestion transfer rate of removable surface activity from building surfaces to the mouth during building occupancy = GO * FI	DERIVED(m**2/hr)
Default value used		
<b>Tstart:Start Time</b>	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
<b>Tend:End Time</b>	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
<b>dt:Time Step Size</b>	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
<b>Pstep:Print Step Size</b>	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
<b>AOExt:External Exposure Area</b>	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
<b>AOInh:Inhalation Exposure Area</b>	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
<b>AOIng:Secondary Ingestion Exposure Area</b>	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
<b>AO:Exposure Area</b>	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
<b>FI:Loose Fraction</b>	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)

Default value used		Value	1.00E-01
<b>Rfo:Loose Resuspension Factor</b>	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)	
Default value used		Value	Probability
		9.12E-06	0.00E+00
		1.10E-04	7.67E-01
		1.46E-04	9.09E-01
		1.62E-04	9.50E-01
		1.85E-04	9.90E-01
		1.90E-04	1.00E+00
<b>GO:Loose Ingestion Rate</b>	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)	
Default value used		Value	1.10E-04

**Correlation Coefficients:**

None

**Summary Results:**

90.00% of the 100 calculated TEDE values are < 1.64E+00 mrem/year .  
 The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.64E+00 to 1.64E+00 mrem/year

**Detailed Results:**

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

**Concentration at Time of Peak Dose:**

Nuclide	Surface Concentration (dpm/100 cm**2)
232Th	5.00E+02
228Ra	5.00E+02
228Ac	5.00E+02
228Th	5.00E+02
224Ra	5.00E+02
220Rn	5.00E+02
216Po	5.00E+02
212Pb	5.00E+02

212Bi	5.00E+02
212Po	3.20E+02
208Tl	1.80E+02

### Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External
1.64E+00	1.64E+00

### Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
232Th	3.87E-04
228Ra	0.00E+00
228Ac	6.51E-01
228Th	1.65E-03
224Ra	6.71E-03
220Rn	2.67E-04
216Po	1.16E-05
212Pb	9.99E-02
212Bi	1.25E-01
212Po	0.00E+00
208Tl	7.53E-01
All Nuclides	1.64E+00

### Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External
232Th	3.87E-04
228Ra	0.00E+00
228Ac	6.51E-01
228Th	1.65E-03
224Ra	6.71E-03
220Rn	2.67E-04
216Po	1.16E-05
212Pb	9.99E-02
212Bi	1.25E-01
212Po	0.00E+00



208T1	7.53E-01
-------	----------

## **Attachment 2**

Dand D Calculation #2



# DandD Building Occupancy Scenario

**DandD Version:** 2.1.0  
**Run Date/Time:** 2/13/2006 5:03:43 PM  
**Site Name:** alpha q  
**Description:** decom

**FileName:** C:\Documents and Settings\David\My Documents\alphaq.mcd

## Options:

**Implicit progeny doses NOT included with explicit parent doses**  
**Nuclide concentrations are distributed among all progeny**  
**Number of simulations:** 100  
**Seed for Random Generation:** 8718721  
**Averages used for behavioral type parameters**

**External Pathway is ON**  
**Inhalation Pathway is ON**  
**Secondary Ingestion Pathway is ON**

## Initial Activities:

Nuclide	Area of Contamination (m <sup>2</sup> )	Distribution
232Th+C	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: Chosen MDC for free release		Value 3.10E+01

## Chain Data:

Number of chains: 1

Chain No. 1: 232Th+C  
 Nuclides in chain: 11

Nuclide	Chain Position	Half Life	First Parent	Fractional Yield	Second Parent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surf Dose Fac ((Sv/d)/(l

<b>232Th+C</b>	1	5.13E+12							
<b>228Ra</b>	2	2.10E+03	1	1	0	0	3.88E-07	1.29E-06	0.00E+00
<b>228Ac</b>	Implicit		2	1			5.85E-10	8.33E-08	8.01E-11
<b>228Th</b>	3	6.99E+02	2	1	0	0	1.07E-07	9.23E-05	2.03E-13
<b>224Ra</b>	4	3.66E+00	3	1	0	0	9.89E-08	8.53E-07	8.26E-13
<b>220Rn</b>	Implicit		4	1			0.00E+00	0.00E+00	3.29E-14
<b>216Po</b>	Implicit		4	1			0.00E+00	0.00E+00	1.43E-15
<b>212Pb</b>	5	4.43E-01	4	1	0	0	1.23E-08	4.56E-08	1.23E-11
<b>212Bi</b>	Implicit		5	1			2.87E-10	5.83E-09	1.54E-11
<b>212Po</b>	Implicit		5	0.6407			0.00E+00	0.00E+00	0.00E+00
<b>208Tl</b>	Implicit		5	0.3593			0.00E+00	0.00E+00	2.58E-10

### Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
232Th	3.10E+00
228Ra	3.10E+00
228Ac	3.10E+00
228Th	3.10E+00
224Ra	3.10E+00
220Rn	3.10E+00
216Po	3.10E+00
212Pb	3.10E+00
212Bi	3.10E+00
212Po	1.99E+00
208Tl	1.11E+00

### Model Parameters:

#### General Parameters:

Parameter Name	Description	Distribution
<b>To:Time In Building</b>	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
<b>Tto:Occupancy Period</b>	The duration of the occupancy exposure period	CONSTANT(days)

Default value used		Value 3.65E+02
<b>Vo:Breathing Rate</b>	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
<b>RFo*:Resuspension Factor</b>	Effective resuspension factor during the occupancy period = RFo * FI	DERIVED(1/m)
Default value used		
<b>GO*:Ingestion Rate</b>	Effective secondary ingestion transfer rate of removable surface activity from building surfaces to the mouth during building occupancy = GO * FI	DERIVED(m**2/hr)
Default value used		
<b>Tstart:Start Time</b>	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
<b>Tend:End Time</b>	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
<b>dt:Time Step Size</b>	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
<b>Pstep:Print Step Size</b>	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
<b>AOExt:External Exposure Area</b>	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
<b>AOInh:Inhalation Exposure Area</b>	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
<b>AOIng:Secondary Ingestion Exposure Area</b>	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
<b>AO:Exposure Area</b>	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
<b>FI:Loose Fraction</b>	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)
Default value used		Value 1.00E-01

<b>Rfo:Loose Resuspension Factor</b>	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)	
Default value used		<u>Value</u>	<u>Probability</u>
		9.12E-06	0.00E+00
		1.10E-04	7.67E-01
		1.46E-04	9.09E-01
		1.62E-04	9.50E-01
		1.85E-04	9.90E-01
		1.90E-04	1.00E+00
<b>GO:Loose Ingestion Rate</b>	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)	
Default value used		<u>Value</u>	1.10E-04

**Correlation Coefficients:**

None

**Summary Results:**

90.00% of the 100 calculated TEDE values are < 1.29E+01 mrem/year .  
 The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.15E+01 to 1.47E+01 mrem/year

**Detailed Results:**

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

**Concentration at Time of Peak Dose:**

Nuclide	Surface Concentration (dpm/100 cm**2)
232Th	3.10E+00
228Ra	3.10E+00
228Ac	3.10E+00
228Th	3.10E+00
224Ra	3.10E+00
220Rn	3.10E+00
216Po	3.10E+00
212Pb	3.10E+00
212Bi	3.10E+00

212Po	1.99E+00
208Tl	1.11E+00

**Pathway Dose from All Nuclides (mrem)**

All Pathways Dose	External	Inhalation	Secondary Ingestion
1.47E+01	1.02E-02	1.47E+01	1.79E-02

**Radionuclide Dose through All Active Pathways (mrem)**

Nuclide	All Pathways Dose
232Th	1.21E+01
228Ra	4.04E-02
228Ac	6.32E-03
228Th	2.52E+00
224Ra	2.46E-02
220Rn	1.66E-06
216Po	7.20E-08
212Pb	2.03E-03
212Bi	9.39E-04
212Po	0.00E+00
208Tl	4.67E-03
All Nuclides	1.47E+01

**Dose from Each Nuclide through Each Active Pathway (mrem)**

Nuclide	External	Inhalation	Secondary Ingestion
232Th	2.40E-06	1.21E+01	9.82E-03
228Ra	0.00E+00	3.52E-02	5.16E-03
228Ac	4.03E-03	2.27E-03	7.78E-06
228Th	1.02E-05	2.52E+00	1.42E-03
224Ra	4.16E-05	2.33E-02	1.32E-03
220Rn	1.66E-06	0.00E+00	0.00E+00
216Po	7.20E-08	0.00E+00	0.00E+00
212Pb	6.20E-04	1.24E-03	1.64E-04
212Bi	7.76E-04	1.59E-04	3.82E-06
212Po	0.00E+00	0.00E+00	0.00E+00

208TI	4.67E-03	0.00E+00	0.00E+00
-------	----------	----------	----------



---

## **Attachment 3**

### **Revised MDA Calculations**

**The equations used for determining the MDCs for Field Instruments are as follows: (Based upon NUREG-1575)**

Variables: MDC = Minimum Detectable Concentration (in dpm/100 cm<sup>2</sup>)  
MDCR = Minimum Detectable Count Rate  
 $s_i$  = minimum detectable number of net source counts  
 $d'$  = True positive and false positive rate (Assume 1.38 from Table 6.5 NUREG-1575)  
 $b_i$  = Number of background counts  
 $i$  = Time interval  
 $\epsilon_i$  = Instrument efficiency  
 $\epsilon_s$  = Surface efficiency (Assume 0.521 from Table 5.10 NUREG-1575)  
 $\sqrt{\rho}$  = Surveyor efficiency (Assume 0.5 from NUREG-1575)  
 $A$  = Active detector area in cm<sup>2</sup>  
 $B$  = Background Count rate

$$s_i = d' (\sqrt{b_i}) \quad MDCR = s_i \times (60/ i)$$

MDC for surface scans using Ludlum Model 43-37A:

Assume 1 second count, so  $b_i = 1938 \text{ cpm} \times (1/60) = 32.3$

$$s_i = 1.38 (\sqrt{32.3}) = 7.84$$

$$MDCR = 7.84 \times (60/1 \text{ sec}) = 470 \text{ cpm}$$

$$\begin{aligned} \text{Scan MDC} &= MDCR / (\sqrt{\rho}) \epsilon_i \epsilon_s (A/100 \text{ cm}^2) = 470 / (\sqrt{0.5})(0.13)(0.521)(475/100) \\ &= 2,066 \text{ dpm}/100 \text{ cm}^2 \end{aligned}$$

MDC for integrated measurement using Ludlum Model 43-37A:

1-minute integrated count, so  $b_i = 1938 \text{ cpm} \times (60/60) = 1938$

$$s_i = 1.38 (\sqrt{1938}) = 60.75$$

$$MDCR = 61 \times (60/60 \text{ sec}) = 24 \text{ cpm}$$

$$\begin{aligned} \text{Scan MDC} &= MDCR / (\sqrt{\rho}) \epsilon_i \epsilon_s (A/100 \text{ cm}^2) = 61 / (\sqrt{0.5})(0.13)(0.521)(475/100) \\ &= 268 \text{ dpm}/100 \text{ cm}^2 \end{aligned}$$

MDA for surface scans using Ludlum Model 43-68:

Assume 1 second count, so  $b_i = 300 \text{ cpm} \times (1/60) = 5$

$$s_i = 1.38 (\sqrt{5}) = 3.09$$

$$\text{MDCR} = 3.09 \times (60/1 \text{ sec}) = 185 \text{ cpm}$$

$$\begin{aligned} \text{Scan MDC} &= \text{MDCR}/(\sqrt{\rho}) \varepsilon_i \varepsilon_s (A/100 \text{ cm}^2) = 185/(\sqrt{0.5})(0.13)(0.521)(100/100) \\ &= 3,863 \text{ dpm}/100 \text{ cm}^2 \end{aligned}$$

MDA for integrated measurement using Ludlum Model 43-68:

1-minute integrated count, so  $b_i = 300 \text{ cpm} \times (60/60) = 300$

$$s_i = 1.38 (\sqrt{300}) = 23.90$$

$$\text{MDCR} = 24 \times (60/60 \text{ sec}) = 24 \text{ cpm}$$

$$\begin{aligned} \text{Scan MDC} &= \text{MDCR}/(\sqrt{\rho}) \varepsilon_i \varepsilon_s (A/100 \text{ cm}^2) = 24/(\sqrt{0.5})(0.13)(0.521)(100/100) \\ &= 501 \text{ dpm}/100 \text{ cm}^2 \end{aligned}$$

MDA for counting 100 cm<sup>2</sup> wipe samples on LSC:

$$\text{MDC} = [3 + 4.65\sqrt{(B)}] \div (\varepsilon_i)$$

$$\text{MDA} = [3 + 4.65\sqrt{(29\text{cpm})}] \div (0.9) = 31 \text{ dpm}/100 \text{ cm}^2$$