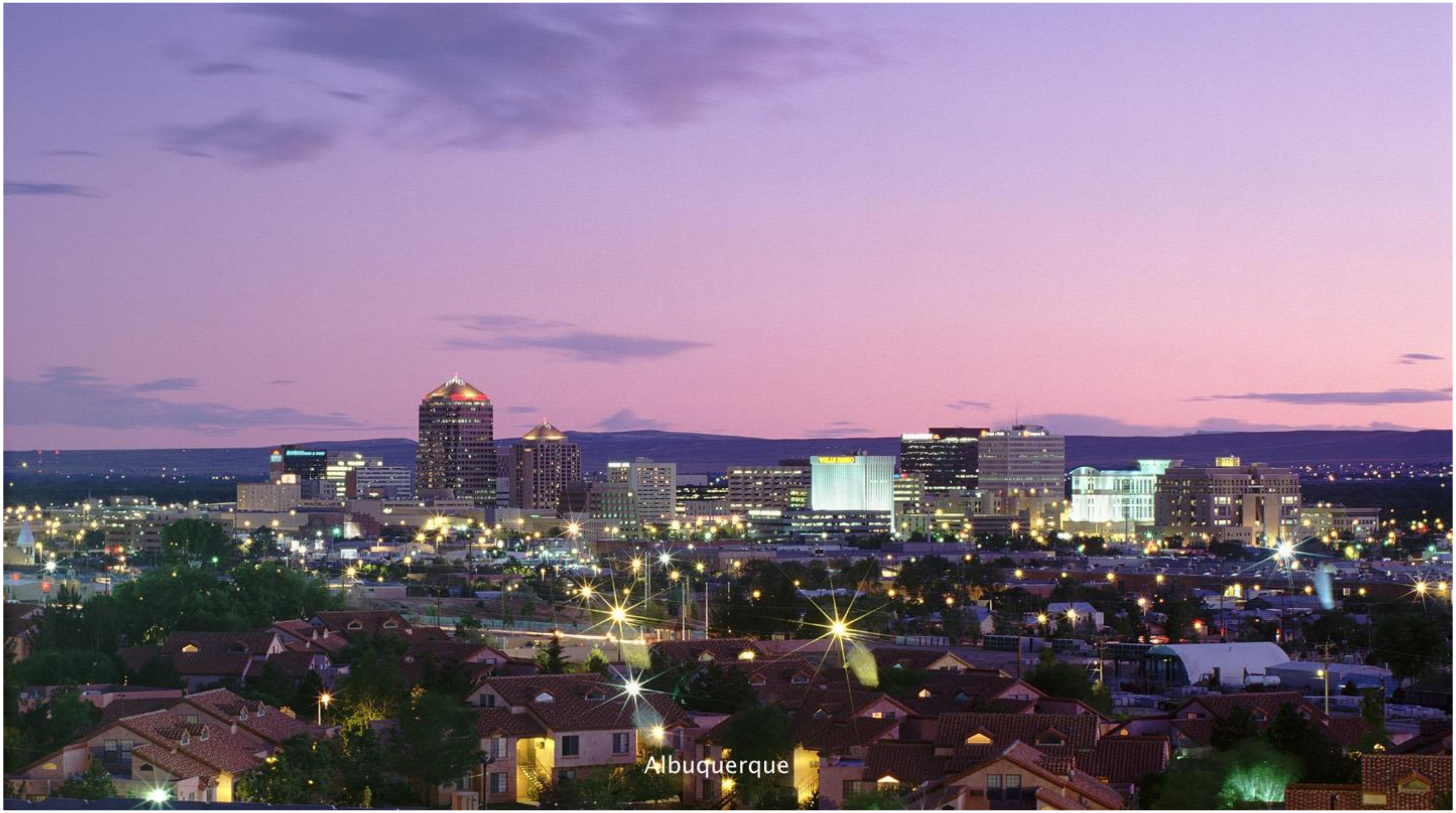
Air Sampling in Nuclear Facilities



DAY 5 – Hands-on Use of Air Samplers and Air Monitors

James Tom Voss, NRRPT, CHP

jtvoss@newmexico.com

WWW.VOSS-ASSOCIATES.COM

Technical Management Services

WWW.TMSCOURSES.COM

CLASS SCHEDULE

DAY 1 – Fundamentals of Air Monitoring

DAY 2 – DOE, EPA, and NRC Standards

DAY 3 – Methods of Extracting Representative Samples from Stacks and Ducts, the Work Area, and the Environment

DAY 4 – Types of Air Samplers and Monitors

DAY 5 – Hands-On Use of Air Samplers and Monitors

Hands-on Use of Air Samplers and Air Monitors

Day 5

Review Previous Four Days

Day 1 – Fundamentals of Air Sampling and Monitoring

Day 2 – Standard (CFRs and EPA)

Day 3 – Methods of Extracting Representative Samples from Stacks and Ducts and from the Environment and Work Areas

Day 4 – Types of Air Samplers and Air Monitors

What answers do you have for the following questions.

Q 1:

Assuming radon and thoron concentrations are not changing how long will it take for the radon short-lived progeny to come into 90% equilibrium on the Alpha 6 filter ?

Q 2:

How long will it take for the thoron short-lived progeny to come into 90% equilibrium on the Alpha 6 filter ?

Q 3:
Which radon progeny drives the radon progeny effective half-life ?

Q 4:
Which thoron progeny drives the thoron progeny effective half-life ?

Q 5:
After we stop the sample pump how long will it take for the radon progeny on the filter to decay to less than 10% of its value when the pump was stopped ?

Q 6:
After we stop the sample pump how long will it take for the thoron progeny on the filter to decay to less than 10% of its value when the pump was stopped ?

Did you complete the following Data Sheets correctly ?

From the previous slide
DPM on a filter for a 1DAC-HR exposure =
1.332E11 x DAC factor x CAM sampling rate

DAC factor	CAM Flow Rate LPM	DPM For 1 DAC-h	CAM Eff.	CPM For 1 DAC-h	CPM For 8 DAC-h

Calculate the CPM alarm values for the various DAC-h levels.

DAC factor	CAM Flow Rate LPM	DPM For 1 DAC-h	CAM Eff.	CPM For 1 DAC-h	CPM For 8 DAC-h
2E-12 uCi / ml	30		0.35		
5E-13 uCi / ml	42		0.28		
6E-7 uCi / ml	56		0.36		
7E-9 uCi / ml	28.3		0.22		

Calculate CPM alarm values for various DAC concentrations.

DAC factor	CAM Flow Rate LPM	Sample Time	CAM Eff.	CPM For 1 DAC	CPM For 100 DAC
3E-12 uCi / ml	56.6	30 min	0.33		
3E-12 uCi / ml	42	60 min	0.27		
3E-12 uCi / ml	30	120 min	0.38		
3E-12 uCi / ml	45	90 min	0.28		

1. Connect pump #1 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #1 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect sample pump #1 to the Alpha 6 CAM.
4. Check the Alpha 6's air flow rate indication and compare to the air sampling rate from step 2.

1. Connect pump #2 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #2 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect sample pump #2 to the Bladewerx BPM CAM.
4. Check the BPM's air flow rate indication and compare to the air sampling rate from step 2.

1. Connect pump #3 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #3 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect sample pump #3 to the mass flow meter.
4. Check the mass flow meter’s air flow rate indication and compare to the air sampling rate from step 2.

1. Connect pump #4 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #4 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect a CFV to sample pump #4
4. Connect the mass flow meter to pump #4.
5. Check the mass flow meter’s air flow rate indication and compare to the air sampling rate from step 2 and the air flow rate calculated for the CFV.

1. Connect the computer to the Alpha 6 and examine the spectrum and count data stored in the Alpha 6.
2. Examine the algorithms in the Alpha 6 using the software.
3. Retrieve a spectrum and load it into the Canberra CAM simulator.
4. Compare the Canberra CAM simulator data with the data from the Alpha 6.

1. Adjust the Alpha 6 spectrum to simulate a change in its electronics.
2. Reset the Alpha 6 spectrum and restart spectrum collection.
3. Observe the Alpha 6 spectrum after enough counts have accumulated.

ALPHA 6 REGIONS OF INTEREST

Q ROI_0 CH[000..255] Entire spectrum

R ROI_1 CH[100..121] Plutonium peak

S ROI_2 CH[128..139] 6 MeV upper part

T ROI_3 CH[147..178] RaC’ 7.68 MeV lower part

U ROI_4 CH[179..190] RaC’ 7.68 MeV upper part

V ROI_5 CH[196..215] ThC’ 8.78 MeV

Alpha 6 Algorithms

Pu239 cpm

Math model

(R-R59)-CONST(3)x(T-T59)/[(U-U59)+1]x(S-S59)

Eberline RPN

R,R(59)-,CONST(3),T,T(59)-,U,U(59)-,(1.0)+/*,S,S(59)-*-

Alpha 6 Algorithms

Fast Pu DAC-hrs
R,R(4)-,(12.0000)*,CONST(4)/,I/,CONST(5)/

Pu DAC-hrs
A,CONST(4)/,I/,CONST(5)/

Add extra filter media to any sample pump and observe for a change in the air flow rate.

Remove any sample filter from a sample pump and check the sample filter count rate with the alpha detector.

Remove any sample filter from a sample pump and check the sample filter with the portable alpha spec unit. See if you can identify the Po-218, Po-214, and Po-212 peaks.

Remove a sample filter from a sample pump that has been running for at least 90 minutes and check the sample filter with the alpha detector.

Record readings at 30 minute intervals. Do not put the sample filter back in service while you are doing this.

Repeat slides 13, 14, 15, and 16 until each attendee has the opportunity to work with each piece of air sampling equipment.

1. Connect pump #1 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #1 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect sample pump #1 to the Alpha 6 CAM.
4. Check the Alpha 6's air flow rate indication and compare to the air sampling rate from step 2.

1. Connect pump #2 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #2 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect sample pump #2 to the Bladewerx BPM CAM.
4. Check the BPM's air flow rate indication and compare to the air sampling rate from step 2.

1. Connect pump #3 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #3 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect sample pump #3 to the mass flow meter.
4. Check the mass flow meter’s air flow rate indication and compare to the air sampling rate from step 2.

1. Connect pump #4 to an AC source using the Watt meter to check power consumption.
2. Start sample pump #4 and check its air sampling rate and power consumption. Use the rotameter to check the air sampling rate.
3. Connect a CFV to sample pump #4
4. Connect the mass flow meter to pump #4.
5. Check the mass flow meter’s air flow rate indication and compare to the air sampling rate from step 2 and the air flow rate calculated for the CFV.

Repeat the steps in slides 17 and 18 until each attendee has the opportunity to perform those steps.

1. Connect the computer to the Alpha 6 and examine the spectrum and count data stored in the Alpha 6.
2. Examine the algorithms in the Alpha 6 using the software.
3. Retrieve a spectrum and load it into the Canberra CAM simulator.
4. Compare the Canberra CAM simulator data with the data from the Alpha 6.

1. Adjust the Alpha 6 spectrum to simulate a change in its electronics.
2. Reset the Alpha 6 spectrum and restart spectrum collection.
3. Observe the Alpha 6 spectrum after enough counts have accumulated.

Repeat steps in slides 22 through 25 until each attendee has the opportunity to observe or perform those steps.

Group Discussion and Questions and Answers about the use of Air Samplers and Air Monitors

Group Discussion “What Went Wrong” in Air Monitoring

Additional Material

Calculations for required CFV orifice Diameter for different conditions

Air-TBD 2008LANL ASME-ANSI MFC-7M-1987.xls

Throat dia inches	Altitude pressure ratio	Actual temp, ^{o}C	pressure at inlet,inH2O	Calculated ACFM flowrate ft^3/min
0.073	0.76	21.1	307.8	1.12
0.083	0.76	21.1	307.8	1.45
0.091	0.76	21.1	307.8	1.74
0.103	0.76	21.1	307.8	2.23
0.125	0.76	21.1	307.8	3.28
0.108	0.76	21.1	307.8	2.45

Throat dia Inches	Altitude pressure ratio	Actual temp, ^{o}C	pressure at inlet,inH2O	Calculated ACFM flowrate ft^3/min
0.073	0.82	21.1	332.1	1.12
0.083	0.82	21.1	332.1	1.45
0.091	0.82	21.1	332.1	1.74
0.103	0.82	21.1	332.1	2.23
0.125	0.82	21.1	332.1	3.28
0.108	0.82	21.1	332.1	2.45

Throat dia inches	Altitude pressure ratio	Actual temp, ^{o}C	pressure at inlet,inH2O	Calculated ACFM flowrate ft^3/min
0.073	1.00	21.1	405.0	1.12
0.083	1.00	21.1	405.0	1.45
0.091	1.00	21.1	405.0	1.74
0.103	1.00	21.1	405.0	2.23
0.125	1.00	21.1	405.0	3.28
0.108	1.00	21.1	405.0	2.45

Full Review For This Week

Day 1 – Fundamentals of Air Sampling and Monitoring

Day 2 – Standard (CFRs and EPA)

Day 3 – Methods of Extracting Representative Samples from Stacks and Ducts and from the Environment and Work Areas

Day 4 – Types of Air Samplers and Air Monitors

Day 5 - Hands-on Use of Air Samplers and Air Monitors

Final Round of Questions and Answers On Air Sampling in Nuclear Facilities

James Tom Voss, NRRPT, CHP

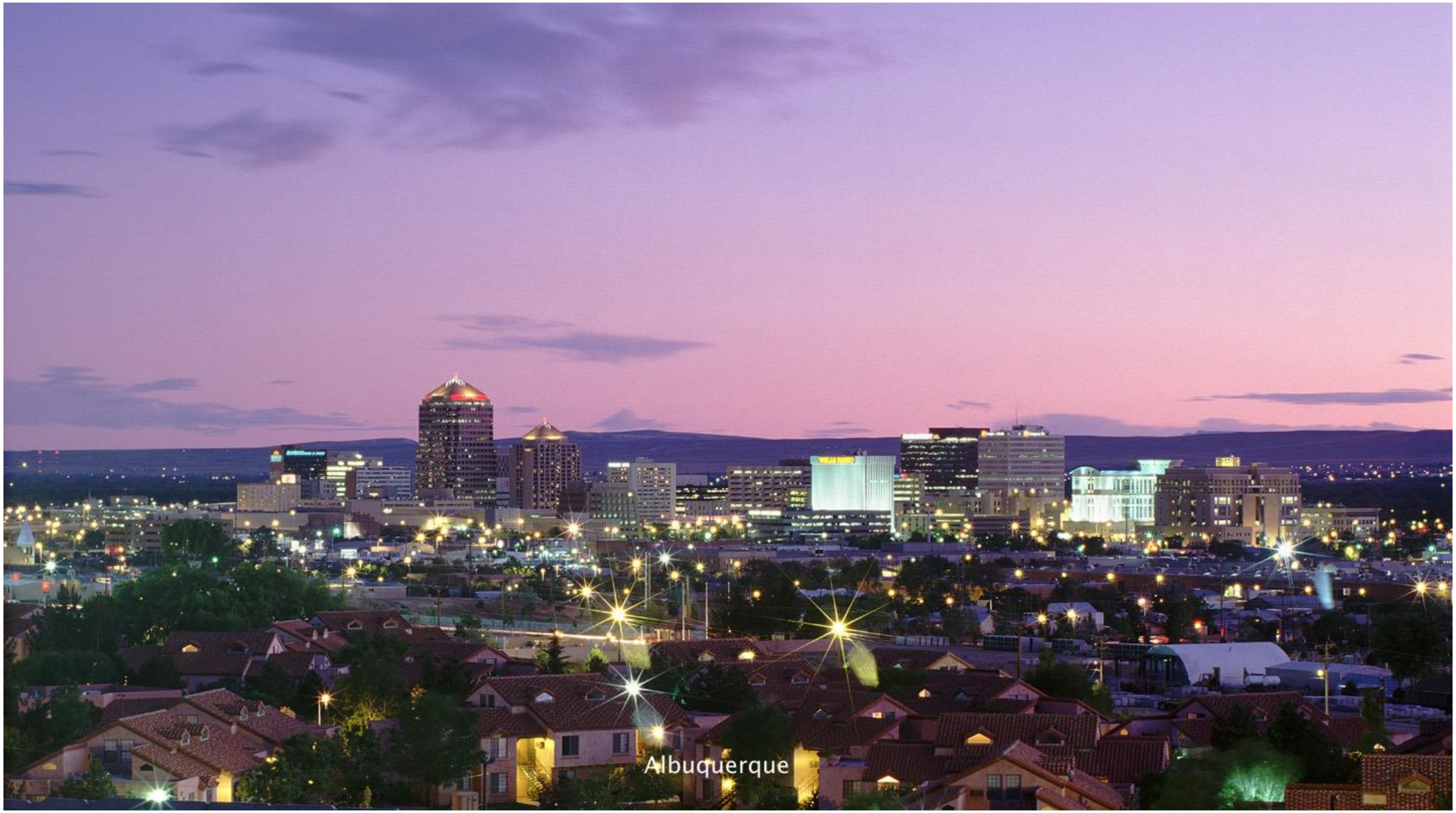
jtvoss@newmexico.com

WWW.VOSS-ASSOCIATES.COM

Technical Management Services

WWW.TMSCOURSES.COM

Air Sampling in Nuclear Facilities



DAY 5 – Hands-on Use of Air Samplers and Air Monitors