INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A $\mu Ci/ml$ [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A $\mu Ci/ml$ [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 $\mu Ci/ml$

[$A_{LL}{}^{\beta}$] > 2E-10 $\mu Ci/ml$

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: K. Nugent Date: 10/15

~~INSTRUCTION 3:~~ Calculate the ~~Total Sample Volume:~~ [illegible]

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FORT McCLELLAN - B3192

A/S ID Number: 1192 RWP Number: FM-104 ATGS Number: FMA-124

Date Start: 11/30/95 Date Stop: 11/30/95

Time Start: 1115 Time Stop: 1200 Total Time: 45 minutes

Sample Location: HOT CELL - B3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Comments: HOT CELL - TRU HANDLING FLOOR

Technician Performing Sample: E. BUNTRES Date: 11-30-95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: EG&G ECLIPSE Type Counter: [illegible]

Sampler I.D.: 1192 Counter I.D.: [illegible]

Cal. Date: 11-R 11/3/95 Probe I.D.: [illegible]

Cal. Due Date: 11/3/96 Cal. Date: [illegible]

Flow Rate Start: 2 ☐ cfm ☒ lpm Cal. Due Date: [illegible]

Flow Rate Stop: 2 ☐ cfm ☒ lpm Count Time: 10 minutes

Alpha Eff: .351

Average Flow Rate: 2 ☐ cfm ☒ lpm Beta/Gamma Eff: [illegible]

Alpha Background: [illegible]

Beta/Gamma Background: [illegible]

Technician Performing Count: R Vincent Date: 11-30-95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
45 minutes	X	N/A cfm X 2.83E+4 / 90 lpm X 1.0E+3	=	4.1E6 ml

Technician Performing Calculation: R. Nugent Date: 11/30/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = $1.71E^{-12}$ Beta-Gamma MDA = $1.65E^{-11}$

Technician Performing Calculation: R TRANGAS Date: 11/30/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1215	117 cts	10 min	12 cpm	1.5 cpm	11 cpm	16 .67	.331	2.22E+6	$2.2E^{-5}$ µCi
βγ 1215	852 cts	10 min	91 cpm	57 cpm	34 cpm	25 .95	.141	2.22E+6	$6E^{-5}$ µCi

Technician Performing Initial Count: R. Nugent Date: 11/30/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α $2.2E^{-5}$ µCi X FR	÷	$4.1E6$ ml	=	$5.4E^{-12}$ µCi/ml α
βγ $6E^{-5}$ µCi X FR	÷	$4.1E6$ ml	=	$1.5E^{-11}$ µCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R. Nugent Date: 11/30/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \mu Ci\,(e^{-0.0655\,(-\_\_\_\_\,hrs)}}{1 - e^{-0.0655(\_\_\_\_\,hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A
_____ β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83
Total long-lived beta activity = .945 + .945 = 1.89

$\frac{1.89}{2.83}$ = 0.67

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 11/30/95

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 001192 RWP Number: FM-104 ATGS Number: FMA-125

Date Start: 11/30/95 Date Stop: 11/30/95

Time Start: 12:05 Time Stop: 15:10 Total Time: 190 minutes

Sample Location: HOT CELL JACK HAMMERING

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Comments: _____ N/A

Technician Performing Sample: PFEFFER Date: _____

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: Low Volume Air Sampler

Sampler I.D.: 001192

Cal. Date: 1-17-95

Cal. Due Date: 1-17-96

Flow Rate Start: 90 ☐ cfm ☒ lpm

Flow Rate Stop: 90 ☐ cfm ☒ lpm

Average Flow Rate: 90 ☐ cfm ☒ lpm

Type Counter: L-2929

Counter I.D.: # 99041

Probe I.D.: # 096923

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 MIN minutes

Alpha Eff: 0.341

Beta/Gamma Eff: 0.212

Alpha Background: .1

Beta/Gamma Background: 60

Technician Performing Count: R TEANGAS Date: 11/30/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
190 minutes	X	N/A cfm X 2.83E+4	=	1.71E7 ml
		90 lpm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 11/30/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = 2.9 E^{-13} Beta-Gamma MDA = 3.6 E^{-12}

Technician Performing Calculation: R TRANGAS Date: 11/30/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1515	36 cts	10 min	4 cpm	.1 cpm	4 cpm	6 .67	.341	2.22E+6	7.9E^{-6} µCi
βγ 1515	708 cts	10 min	71 cpm	60 cpm	11 cpm	12 .95	.216	2.22E+6	2.5E^{-5} µCi

Technician Performing Initial Count: R TRANGAS Date: 11/30/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 7.9E^{-6} µCi X FR	÷	1.7E7 ml	=	4.6 E^{-13} µCi/ml α
βγ 2.5E^{-5} µCi X FR	÷	1.7E7 ml	=	1.5 E^{-12} µCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGAS Date: 11/30/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \mu Ci\,(e^{-0.0655\,(-\_\_\_\ hrs)}}{1 - e^{-0.0655(\_\_\ hrs)}}$$

$$= \text{N/A} \ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83

Total long-lived beta activity = .945 + .945 = 1.89

$\frac{1.89}{2.83}$ = 0.67

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Vaught Date: 11/3/95

~~INSTRUCTION 3:~~ **Calculate the Total Sample Volume:** 960 liters

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FORT McCLELLAN

A/S ID Number: 1292 RWP Number: FM-102 ATGS Number: FM-126

Date Start: 12/4/95 Date Stop: 12/4/95

Time Start: 0900 Time Stop: 0913 Total Time: 73 minutes

Sample Location: TOP OF HOT CELL

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
~~☒ High Volume~~ R ☒ Low Volume ☐ Lapel/Personal

Comments: DECON OF PLUGS

Technician Performing Sample: JAMIE YOUNG Date: 12/4/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: GAST

Sampler I.D.: 1292

Cal. Date: 1/17/95

Cal. Due Date: 1/17/96

Flow Rate Start: 9C ☐ cfm ☒ lpm

Flow Rate Stop: 9C ☐ cfm ☒ lpm

Average Flow Rate: 9C ☐ cfm ☒ lpm

Type Counter: L 2929

Counter I.D.: 4446

Probe I.D.: 4693

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 minutes

Alpha Eff: 0.346

Beta/Gamma Eff: 0.24

Alpha Background: 0.7

Beta/Gamma Background: 58

Technician Performing Count: K. Mangum Date: 12/4/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
73 minutes	X	N/A cfm X 2.83E+4	=	6.6E6 ml
		90 lpm X 1.0E+3		

Technician Performing Calculation: R. Nugent Date: 12/4/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 1.1E-12 Beta-Gamma MDA = 9.2E-13

Technician Performing Calculation: R. Nugent Date: 12/4/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity
α 941	617 cts	10 min	61.7 cpm	0.7 cpm	61.0 cpm	91.7 .67	.341	2.22E+6	1.2E-3 µCi
βγ 941	9141 cts	10 min	914 cpm	56 cpm	858 cpm	901 .95	.214	2.22E+6	1.9E-3 µCi

Technician Performing Initial Count: R. Nugent Date: 12/4/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 1.2E-3 µCi X FR	÷	6.6E6 ml	=	1.8E-10 µCi/ml α
βγ 1.9E-3 µCi X FR	÷	6.6E6 ml	=	2.9E-10 µCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R. Nugent Date: 12/4/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm/dpm ÷	dpm/μCi ÷	Activity =
α 12:40	206 cts	10 min	21 cpm	0.3 cpm	21 cpm	31 .67	0.346	2.22E+6	4.1E^{-8} μCi
βγ 12:40	940 cts	10 min	94 cpm	58 cpm	36 cpm	38 .95	0.214	2.22E+6	8.0E^{-5} μCi

Technician Performing 3 Hour Count: R TRANGAS Date: 12/4/95

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α 4.1E^{-5} μCi X FR	÷	6.6E^{6} ml	=	6.2E^{-12} μCi/ml α
βγ 8.0E^{-5} μCi X FR	÷	6.6E^{6} ml	=	1.2E^{-11} μCi/ml βγ

Technician Performing Calculation: R TRANGAS Date: 12/4/95

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = 36.7 MIN

t½ βγ = 34.1 MIN

Technician Performing Calculation: R TRANGAS Date: 12/4/95

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\ A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\ (hrs))}\right.}{1 - e^{-0.0655\ (hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \mu Ci\ (e^{-0.0655\ (-\_\_\_\ hrs)}}{1 - e^{-0.0655(\_\_\ hrs)}}$$

$$= \_\_\_\_\_\ \mu Ci$$

Technician Performing Calculation: N/A Date: 12/4/95

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [A_{LL}^{α}]

$\frac{A_{LL}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [A_{LL}^{β}]

If: [A_{LL}^{α}] > 1E-13 μCi/ml

[A_{LL}^{β}] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: For Vincent Date: 12/2/95

~~INSTRUCTION 3: Calculate~~ the Total Sample Volume:

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FORT McCLELLAN B3192

A/S ID Number: 1292 RWP Number: FM-104 ATGS Number: FMA127

Date Start: 12/4/95 Date Stop: 12/4/95

Time Start: 0955 Time Stop: 1100 Total Time: 65 minutes

Sample Location: I/S HOT CELL

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: ☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Comments: SCABBLING TOP OF WALL

Technician Performing Sample: E. HUMPHRIES Date: 12/4/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: GAST LV

Sampler I.D.: 1292

Cal. Date: 1/17/95

Cal. Due Date: 1/17/96

Flow Rate Start: 90 ☐ cfm ☒ lpm

Flow Rate Stop: 90 ☐ cfm ☒ lpm

Average Flow Rate: 90 ☐ cfm ☒ lpm

Type Counter: 2929

Counter I.D.: #49041

Probe I.D.: #40923

Cal. Date: 11/12/95

Cal. Due Date: 5/12/96

Count Time: 10 minutes

Alpha Eff: 0.346

Beta/Gamma Eff: 0.214

Alpha Background: 0.2 cpm

Beta/Gamma Background: 50 cpm

Technician Performing Count: R. Vincent Date: 12/4/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
605 minutes	X	N/A cfm X 2.83E+4 / 90 1pm X 1.0E+3	=	5.9E6 ml

Technician Performing Calculation: R. Vurgent Date: 12/4/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 1.3E-12 Beta-Gamma MDA = 1.1E-11

Technician Performing Calculation: R. Vurgent Date: 12/4/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1115	527 cts	10 min	52.7 cpm	0.7 cpm	52 cpm	79 .67	4.3%	2.22E+6	1.1E-4 μCi
βγ 1115	3471 cts	10 min	347 cpm	56 cpm	291 cpm	246 .95	1,214	2.22E+6	1.2E-4 μCi

Technician Performing Initial Count: R. Vurgent Date: 12/4/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 1E-4 μCi X FR	÷	5.9E6 ml	=	1.7E-11 μCi/ml α
βγ 1.2E-4 μCi X FR	÷	5.9E6 ml	=	1.1E-10 μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R. Vurgent Date: 12/4/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\,(hrs)}\right)}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \_\_\_\_\ \mu Ci\left(e^{-0.0655\,(\_\_\_\_\ hrs)}\right)}{1 - e^{-0.0655(\_\_\_\_\ hrs)}}$$

$$= \text{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Yurgeat Date: 12/4/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~

11/15/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: Ft McClellan

A/S ID Number: 001192 RWP Number: FM104 ATGS Number: FMA-128

Date Start: Dec 5, 95 Date Stop: Dec 5, 95

Time Start: 1520 Time Stop: 1645 Total Time: 85 minutes

Sample Location: Hot cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ~~☒~~ Low Volume ☐ Lapel/Personal

Comments: N/A

Technician Performing Sample: Pete Shonkwiler Date: 12/5/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: Low Volume Air Sampler

Sampler I.D.: 001192

Cal. Date: 1-17-95

Cal. Due Date: 1-17-96

Flow Rate Start: 90 ☐ cfm ~~☒~~ lpm

Flow Rate Stop: 90 ☐ cfm ~~☒~~ lpm

Average Flow Rate: 90 ☐ cfm ~~☒~~ lpm

Type Counter: L-2929

Counter I.D.: #99043

Probe I.D.: #98327

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 min minutes

Alpha Eff: .336

Beta/Gamma Eff: .203

Alpha Background: .6 cpm

Beta/Gamma Background: 57 cpm

Technician Performing Count: R Tenyas Date: 12/5/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
65 minutes	X	N/A cfm X 2.83E+4	=	7.65E6 ml
		90 lpm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 12/5/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = 1.12 Beta-Gamma MDA = 1.2E 11

Technician Performing Calculation: R TRANGAS Date: 12/5/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 17:00	4178 cts	10 min	418 cpm	.6 cpm	417 cpm	622 .67	.336	2.22E+6	$8.3E^{-9}$ μCi
βγ 17:00	7298 cts	10 min	730 cpm	57 cpm	673 cpm	708 .95	.203	2.22E+6	$1.6E^{-3}$ μCi

Technician Performing Initial Count: R. TRANGAS Date: 12/5/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α $8.3E^{-4}$ μCi X FR	÷	$7.65E^{6}$ ml	=	$1.1E^{-10}$ μCi/ml α
βγ $1.6E^{-3}$ μCi X FR	÷	$7.65E^{6}$ ml	=	$2.1E^{-10}$ μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGAS Date: 12/5/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1300	62 cts	10 min	6.2 cpm	0.5 cpm	6 cpm	9 .67	.33	2.22E+6	1.1E μCi
βγ 1300	667 cts	10 min	67 cpm	50 cpm	34 cpm	41 .95	.148	2.22E+6	1.2E μCi

12/6/95

Technician Performing 20 Hour Count: F. Vaugant Date: 12/6/95

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\mu Ci - \mu Ci\,(e^{-0.0655\,(-\_\_\_hrs)}}{1 - e^{-0.0655(\_\_hrs)}}$$

$$= \_\_\_\_\_\mu Ci$$

α 1.2E-5 ÷ 7.6E6 = 1.6E-12 μCi/cc

β-γ 1.2E-4 ÷ 7.6E6 = 1.6E-11 μCi/cc

Technician Performing Calculation: F. Vaugant Date: 12/6/95

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

$$\_\_\_\_\_\ \beta\ A_{LL}\mu Ci = (\alpha\ A_{LL}\mu Ci)\ (0.67)$$

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\quad \frac{1.89}{2.83} = 0.67$

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: R. Nugent Date: 12/6/95

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{\text{volume}}$ = N/a μCi/ml $[A_{LL}{}^{\alpha}]$

$\frac{A_{LL}{}^{\beta}\mu Ci}{\text{volume}}$ = N/a μCi/ml $[A_{LL}{}^{\beta}]$

If: $[A_{LL}{}^{\alpha}] > 1E\text{-}13\ \mu Ci/ml$

$[A_{LL}{}^{\beta}] > 2E\text{-}10\ \mu Ci/ml$

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: R. Nugent Date: 12/6/95

HP Supervisor Review: Frank Whitaker Date: 12/6/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ 5130 11/15/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FORT McCLELLAN

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMH-129

Date Start: 12/6/95 Date Stop: 12/6/95

Time Start: 0850 Time Stop: 0900 Total Time: 10 minutes

Sample Location: TOP OF HOT CELL

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: JACK HAMMERING

Technician Performing Sample: T. SHONKWILER Date: 12/6/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: F&J 14400

Sampler I.D.: 1452

Cal. Date: 11/6/95

Cal. Due Date: 11/6/96

Flow Rate Start: 28 ☑ cfm ☐ lpm

Flow Rate Stop: 22 ☑ cfm ☐ lpm

Average Flow Rate: 25 ☑ cfm ☐ lpm

Type Counter: L2929

Counter I.D.: #9175

Probe I.D.: #93325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 minutes

Alpha Eff: 0.326

Beta/Gamma Eff: 0.148

Alpha Background: 0.5

Beta/Gamma Background: 50

Technician Performing Count: K. Jurgent Date: 12/6/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
10 minutes	X	25 cfm X 2.83E+4	=	7.1E^{6} ml
		N/A 1pm X 1.0E+3		

Technician Performing Calculation: R. Nugent Date: 12/6/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B}} (1 + t_{S+B} / t_B)}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 1E^{-12} Beta-Gamma MDA = 1.2E^{-11}

Technician Performing Calculation: R. Nugent Date: 12/6/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 0450	1165 cts	10 min	116.5 cpm	6.5 cpm	116 cpm	173 .67	.526	2.22E+6	9.4E^{-4} μCi
βγ 0430	3000 cts	10 min	300 cpm	50 cpm	250 cpm	263 .95	.146	2.22E+6	4.E^{-4} μCi

Technician Performing Initial Count: R. Nugent Date: 12/6/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity	
α 9.6E^{-4} μCi X FR	÷	7.1E^{6} ml	=	1.4E^{-10}	μCi/ml α
βγ 3.2E^{-3} μCi X FR	÷	7.1E^{6} ml	=	4.5E^{-10}	μCi/ml βγ

FR = Filter Ratio (4" Filters = ~~3.0~~ 4.0 R) (2" Filters = 1.0)

Technician Performing Calculation: R. Nugent Date: 12/6/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1230	1037 cts	10 min	3.7 cpm	0.5 cpm	3.2 cpm	4.7 .67	.326	2.22E+6	6.6E-6 μCi
βγ 1230	1064	10 min	64 cpm	50 cpm	14 cpm	15 .95	.148	2.22E+6	4.5E-5 μCi

Technician Performing 3 Hour Count: R. Nugent Date: 12/6/95

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α 6.6E-6 μCi X FR	÷	7.1E6 ml	=	3.7E-12 μCi/ml α
βγ 4.5E-5 μCi X FR	÷	7.1E6 ml	=	~~6.3E-12~~ 2.5E-11 μCi/ml βγ

Technician Performing Calculation: R. Nugent Date: 12/6/95

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = 343 min.

t½ βγ = 43 min.

Technician Performing Calculation: R. Nugent Date: 12/6/95

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm/dpm ÷	dpm/μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs))}}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\_\,\mu Ci - \_\_\_\_\_\,\mu Ci\,(e^{-0.0655\,(\_\_\_\_\_\,hrs)}}{1 - e^{-0.0655(\_\_\_\_\_\,hrs)}}$$

$$= \text{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Vaught Date: 12/16/15

~~INSTRUCTION 3: Calculate the~~ Total Sample Volume: GRS 11/13/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: FM 95-1 ATGS Number: FMA-130

Date Start: Dec 6 95 Date Stop: Dec 6 95

Time Start: 1400 Time Stop: 1410 Total Time: 10 minutes

Sample Location: Top of Cell

Sample Type: ☐ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: N/A

Technician Performing Sample: Shankwiler Date: 12/6/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: 1452

Cal. Date: 1-11-95

Cal. Due Date: 1-19-96

Flow Rate Start: 43 ☑ cfm ☐ lpm

Flow Rate Stop: 18 ☑ cfm ☐ lpm

Average Flow Rate: 30.5 ☑ cfm ☐ lpm

Type Counter: L-2929

Counter I.D.: 19045

Probe I.D.: 98325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 min minutes

Alpha Eff: 0.326

Beta/Gamma Eff: .148

Alpha Background: 0.5

Beta/Gamma Background: 50

Technician Performing Count: R Shankwiler Date: 12/6/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
10 minutes	X	30.5 cfm X 2.83E+4	=	8.6E 6 ml
		n/a 1pm X 1.0E+3		

Technician Performing Calculation: R TRANGS Date: 12/6/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = 9.3 E^{-13} Beta-Gamma MDA = 9.6 E^{-12}

Technician Performing Calculation: R TRANGS Date: 12/6/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 14:20	1110 cts	10 min	111 cpm	5 cpm	111 cpm	166 .67	.326	2.22E+6	2.3E^{-4} μCi
βγ 14:20	3532 cts	10 min	353 cpm	50 cpm	303 cpm	319 .95	.149	2.22E+6	9.7E^{-4} μCi

Technician Performing Initial Count: R TRANGS Date: 12/6/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 2.3E^{-4} μCi X FR	÷	8.6E^{6} ml	=	1.1 E^{-10} μCi/ml α
βγ 9.7E^{-4} μCi X FR	÷	8.6E^{6} ml	=	4.5E^{-10} μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGS Date: 12/6/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 17:20	39 cts	10 min	3.9 cpm	0.5 cpm	3.4 cpm	5 .67	.326	2.22E+6	7E-6 μCi
βγ 17:20	648 cts	10 min	65 cpm	50 cpm	15 cpm	16 .95	.148	2.22E+6	4.6E-5 μCi

Technician Performing 3 Hour Count: K. Nugent Date: 12/6/95

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

	3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α	7E-6 μCi X FR	÷	2.2E6 ml	=	3.3E-12 μCi/ml α
βγ	4.6E-5 μCi X FR	÷	2.2E6 ml	=	2.2E-11 μCi/ml βγ

Technician Performing Calculation: K. Nugent Date: 12/6/95

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = 36 min.

t½ βγ = 42 min.

Technician Performing Calculation: K. Nugent Date: 12/6/95

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\_\,\mu Ci - \mu Ci\,(e^{-0.0655\,(\_\_\_\_hrs)}}{1 - e^{-0.0655(\_\_\_\_hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is.

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev.
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Vincent Date: 12/6/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ CBC 1/12/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: Ft McClellan

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-131

Date Start: Dec 7, 95 Date Stop: Dec 7, 95

Time Start: 08:30 Time Stop: 08:45 Total Time: 15 minutes

Sample Location: Hot Cell Roof

Sample Type: ☐ Breathing Zone ☐ General Area ☐ Other:
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: N/A

Technician Performing Sample: Shonk Wiler Date: 12/7/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: 1452

Cal. Date: 1/18/95

Cal. Due Date: 1/18/96

Flow Rate Start: 45 ☒ cfm ☐ lpm

Flow Rate Stop: 10 ☐ cfm ☒ lpm

Average Flow Rate: 27.5 ☒ cfm ☐ lpm

Type Counter: L-2929

Counter I.D.: 99045

Probe I.D.: # 98325

Cal. Date: ± 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 MIN minutes

Alpha Eff: .326

Beta/Gamma Eff: .148

Alpha Background: 0.5

Beta/Gamma Background: 56

Technician Performing Count: R TRANGAS Date: 12/7/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
15 minutes	X	27.5 cfm X 2.83E+4	=	1.2 E 7 ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R Tramas Date: 12/7/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = 5.9 E -13 Beta-Gamma MDA = 7.2 E -12

Technician Performing Calculation: R Tramas Date: 12/7/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 9:15	171 cts	10 min	17 cpm	.5 cpm	17 cpm	25 .67	.326	2.22E+6	3.5E -5 μCi
βγ 9:15	940 cts	10 min	94 cpm	56 cpm	38 cpm	40 .95	.148	2.22E+6	1.2E -4 μCi

Technician Performing Initial Count: R Tramas Date: 12/7/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 3.5 E -5 μCi X FR	÷	1.2 E 7 ml	=	1.2 E -11 μCi/ml α
βγ 1.2E -4 μCi X FR	÷	1.2E 7 ml	=	4 E -11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R Tramas Date: 12/7/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. $\frac{cpm}{dpm}$ ÷	$\frac{dpm}{\mu Ci}$ ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\ A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\ (hrs)}\right)}{1 - e^{-0.0655\ (hrs)}}$$

$$= \frac{\mu Ci - \mu Ci\left(e^{-0.0655\ (\_\_\_\ hrs)}\right)}{1 - e^{-0.0655(\_\_\_ hrs)}}$$

$$= \text{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Vincent Date: 12/7/95

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-132

Date Start: 12/11/95 Date Stop: 12/11/95

Time Start: 10:25 Time Stop: 10:35 Total Time: 10 minutes

Sample Location: TOP OF HOT CELL

Sample Type: ☐ Breathing Zone ☒ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: JACK HAMMERING ON TOP OF HOT CELL

Technician Performing Sample: E Humphres Date: 12/11/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: 1452

Cal. Date: 1-18-95

Cal. Due Date: 1-18-96

Flow Rate Start: 45 ☐ cfm ~~☒ lpm~~

Flow Rate Stop: 27 ☒ cfm ~~☒ lpm~~

Average Flow Rate: 36 ☒ cfm ~~☒ lpm~~

Type Counter: L-2929

Counter I.D.: #99045

Probe I.D.: #98225

Cal. Date: 11/14/95

Cal. Due Date: 5/14/95

Count Time: 10 MIN minutes

Alpha Eff: .330

Beta/Gamma Eff: .148

Alpha Background: 0.2 cpm

Beta/Gamma Background: 56 cpm

Technician Performing Count: R TRANCAS Date: 12/11/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
10 minutes	X	36 cfm X 2.83E+4	=	1.0E7 ml
		N/A 1pm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 12/11/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = 5.8E-13 Beta-Gamma MDA = 8.7E-12

Technician Performing Calculation: R TRANGAS Date: 12/11/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 10:40	475 cts	10 min	48 cpm	0.2 cpm	48 cpm	72 .67	.330	2.22E+6	9.8E-5 μCi
βγ 10:40	1818 cts	10 min	182 cpm	56 cpm	126 cpm	133 .95	.148	2.22E+6	4.0E-4 μCi

Technician Performing Initial Count: R TRANGAS Date: 12/11/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 9.8E-5 μCi X FR	÷	1.0E7 ml	=	3.92E-11 μCi/ml α
βγ 4.0E-4 μCi X FR	÷	1.0E7 ml	=	1.6E-10 μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGAS Date: 12/11/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

	3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α	N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ	N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\_\,\mu Ci - \_\_\_\_\_\,\mu Ci\,(e^{-0.0655\,(-\_\_\_\_\,hrs)}}{1 - e^{-0.0655(\_\_\_\_\,hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Vaugent Date: 12/11/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ gbc 11/13/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1192 RWP Number: FM-104 ATGS Number: FMA-133

Date Start: Dec 11, 95 Date Stop: Dec 11, 95

Time Start: 13:30 Time Stop: 15:30 Total Time: 120 minutes

Sample Location: INSIDE HOT CELL

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Comments: N/A

Technician Performing Sample: Shoukuler Date: 12/11/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: Low Volume Air Sampler

Sampler I.D.: # 1192

Cal. Date: 1-17-95

Cal. Due Date: 1-17-96

Flow Rate Start: 95 ~~☒ cfm~~ ☑ lpm

Flow Rate Stop: 55 ~~☒ cfm~~ ☑ lpm

Average Flow Rate: 75 ~~☒ cfm~~ ☑ lpm

gbc 11/13/96

Type Counter: L-2929

Counter I.D.: #99045

Probe I.D.: #9825

Cal. Date: 11-14-95

Cal. Due Date: 5-14-95

Count Time: 10 min minutes

Alpha Eff: .330

Beta/Gamma Eff: .148

Alpha Background: 0.2 cpm

Beta/Gamma Background: 56 cpm

Technician Performing Count: R TEANEAS Date: 12/11/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
120 minutes	X	N/A cfm X 2.83E+4	=	9E6 ml
		75 lpm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 12/11/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = $6.4 E^{-13}$ Beta-Gamma MDA = $9.6 E^{-12}$

Technician Performing Calculation: R TRANGAS Date: 12/11/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 16:00	78 cts	10 min	8 cpm	0.2 cpm	8 cpm	12 .67	.330	2.22E+6	$1.6E^{-5}$ μCi
βγ 16:00	739 cts	10 min	74 cpm	56 cpm	18 cpm	19 .95	.148	2.22E+6	$5.8E^{-5}$ μCi

Technician Performing Initial Count: R TRANGAS Date: 12/11/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α $1.6E^{-5}$ μCi X FR	÷	9E6 ml	=	$1.8 E^{-12}$ μCi/ml α
βγ $5.8E^{-5}$ μCi X FR	÷	9E6 ml	=	$6.4 E^{-12}$ μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R Trangas Date: 12/11/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\,(hrs)}\right)}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \_\_\_\_\ \mu Ci\left(e^{-0.0655\,(\_\_\_\_\ hrs)}\right)}{1 - e^{-0.0655(\_\_\_\_ hrs)}}$$

$$= \text{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 12/11/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/13/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FORT McCLELLAN-3192

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-134

Date Start: 12/12/95 Date Stop: 12/12/95

Time Start: 0805 Time Stop: 0810 Total Time: 5 minutes

Sample Location: I/S HOT CELL - JACK HAMMERING

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: JACK HAMMERING

Technician Performing Sample: P. SHONKWILER Date: 12/12/

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: F&J HV 9400

Sampler I.D.: #1452

Cal. Date: 1/18/95

Cal. Due Date: 1/18/96

Flow Rate Start: 46 ☒ cfm ☐ lpm

Flow Rate Stop: 5 ☒ cfm ☐ lpm

Average Flow Rate: 25.5 ☒ cfm ☐ lpm

Type Counter: L-2929

Counter I.D.: 99045

Probe I.D.: 98325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 minutes

Alpha Eff: 0.339

Beta/Gamma Eff: 0.149

Alpha Background: 0 CTM

Beta/Gamma Background: 54 CPM

Technician Performing Count: F. Nugent Date: 12/12/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
5 minutes	X	35.5 cfm X 2.83E+4 lpm X 1.0E+3	=	3.6E6 ml

Technician Performing Calculation: R. Nugent Date: 12/12/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B}} (1 + t_{S+B} / t_B)}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 1E-12 µCi/cc Beta-Gamma MDA = 2.4E-11 µCi/cc

Technician Performing Calculation: R. Nugent Date: 12/12/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 0830	66 cts	10 min	6.6 cpm	0 cpm	6.6 cpm	10 .67	.334	2.22E+6	1.3E-5 µCi
βγ 0830	2311 cts	10 min	231 cpm	54 cpm	177 cpm	186 .95	.144	2.22E+6	5.6E-4 µCi

Technician Performing Initial Count: R. NUGENT Date: 12/12/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 1.3E-5 µCi X FR(4)	÷	3.6E6 ml	=	1.5E-11 µCi/ml α
βγ 5.6E-4 µCi X FR(1)	÷	3.6E6 ml	=	6.3E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R. Nugent Date: 12/12/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

$t\frac{1}{2}\ \alpha$ = N/A

$t\frac{1}{2}\ \beta\gamma$ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\ A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\ (hrs))}\right.}{1 - e^{-0.0655\ (hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \mu Ci\ (e^{-0.0655\ (\_\_\_\_\ hrs)}}{1 - e^{-0.0655(\_\_\_\_ hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 12/13/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/18/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-135

Date Start: Dec 12, 95 Date Stop: Dec 12, 95

Time Start: 11:22 Time Stop: 11:56 Total Time: 34 minutes

Sample Location: CLASSROOM Bldg 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: HEPA FILTER CHANGE OUT

Technician Performing Sample: SHANKWILER Date: 12/12/9

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Airsampler

Sampler I.D.: 1452

Cal. Date: 1-19-95

Cal. Due Date: 1-18-95

Flow Rate Start: 46 ☒ cfm ☐ lpm

Flow Rate Stop: 37 ☒ cfm ☐ lpm

Average Flow Rate: 41.5 ☒ cfm ☐ lpm

Type Counter: L-2:29

Counter I.D.: # 9905

Probe I.D.: # 98325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 MIN minutes

Alpha Eff: .339

Beta/Gamma Eff: .149

Alpha Background: 0

Beta/Gamma Background: 54

Technician Performing Count: R. TRANEAS Date: 12/12/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
34 minutes	X	41.5 cfm X 2.83E+4	=	4E7 ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R. TRANGAS Date: 12/12/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = 8.6E-14 Beta-Gamma MDA = 1.5E-12

Technician Performing Calculation: R. TRANGAS Date: 12/12/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1205	3333 cts	10 min	333 cpm	0.0 cpm	333 cpm	497 .67	0.339	2.22E+6	6.6E-4 μCi
βγ 1205	9117 cts	10 min	912 cpm	54 cpm	858 cpm	903 .95	0.149	2.22E+6	2.7E-3 μCi

Technician Performing Initial Count: R. TRANGAS Date: 12/12/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 6.6E-4 μCi X FR(4)	÷	4E7 ml	=	6.6E-11 μCi/ml α
βγ 2.7E-3 μCi X FR(4)	÷	4E7 ml	=	2.7E-10 μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R. TRANGAS Date: 12/12/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\ A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\ (hrs))}\right.}{1 - e^{-0.0655\ (hrs)}}$$

$$= \frac{\mu Ci - \mu Ci\ (e^{-0.0655\ (\_\_\_\_hrs)}}{1 - e^{-0.0655(\_\_\_\_hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Urgent Date: 12/12/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ QBC 11/13/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT. McCLELLAN

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-136

Date Start: 12/13/95 Date Stop: 12/13/95

Time Start: 14:25 Time Stop: 15:00 Total Time: 35 minutes

Sample Location: _____

Sample Type: ☐ Breathing Zone ☒ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: HOT CELL

Technician Performing Sample: SHONKWILER Date: 12/13/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: # 1452

Cal. Date: 1-18-95

Cal. Due Date: 1-18-96

Flow Rate Start: 45 ☒ cfm ☐ lpm

Flow Rate Stop: 10 ☒ cfm ☐ lpm

Average Flow Rate: 27.5 ☒ cfm ☐ lpm

Type Counter: L-2929

Counter I.D.: #99045

Probe I.D.: # 96923

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 MIN minutes

Alpha Eff: .335

Beta/Gamma Eff: ~~.214~~ 148

Alpha Background: 0.4 cpm

Beta/Gamma Background: 58 cpm

Technician Performing Count: R TRANCAS Date: 12/13/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
35 minutes	X	27.5 cfm X 2.83E+4	=	2.7E7 ml
		N/A 1pm X 1.0E+3		

Technician Performing Calculation: R TRAVERS Date: 12/13/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:

V	=	Sample Volume in ml
E	=	Counter Efficiency
R_B	=	Background Count Rate (cpm)
t_{S+b}	=	Sample Counting Time (min)
t_B	=	Background Counting Time (min)

Alpha MDA = $2.4E^{-13}$ Beta-Gamma MDA = $3.2E^{-12}$

Technician Performing Calculation: R TRAVERS Date: 12/13/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 15:15	85 cts	10 min	9 cpm	0.4 cpm	9 cpm	13 .67	.335	2.22E+6	$1.8E^{-5}$ μCi
βγ 15:15	705 cts	10 min	71 cpm	58 cpm	13 cpm	14 .95	.148	2.22E+6	$4.2E^{-5}$ μCi

Technician Performing Initial Count: R TRAVERS Date: 12/13/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α $1.8E^{-5}$ μCi X FR	÷	2.7E7 ml	=	$2.7E^{-12}$ μCi/ml α
βγ $4.2E^{-5}$ μCi X FR	÷	2.7E7 ml	=	$6.2E^{-12}$ μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRAVERS Date: 12/13/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \mu Ci\,(e^{-0.0655\,(\_\_\_\_\ hrs)}}{1 - e^{-0.0655(\_\_\_\_ hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 12/13/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/18/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: FM103 ATGS Number: FMA 137

Date Start: Dec 14, 95 Date Stop: Dec 14, 95

Time Start: 0730 Time Stop: 7:40 Total Time: 10 minutes

Sample Location: HOT CELL HEPA CHANGE OUT

Sample Type: ☒ Breathing Zone ~~☒ General Area~~ RV ☐ Other:
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: HEPA CHANGEOUT

Technician Performing Sample: P. SHONKWILER Date: 12/14/9

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: ~~Low Volume~~ HI-VOL Air Sampler

Sampler I.D.: 1452

Cal. Date: 1/18/95

Cal. Due Date: 1/18/96

Flow Rate Start: 40 ☒ cfm ☐ lpm

Flow Rate Stop: 40 ☒ cfm ☐ lpm

Average Flow Rate: 40 ☒ cfm ☐ lpm

Type Counter: L-2929

Counter I.D.: 99043

Probe I.D.: 98325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 minutes

Alpha Eff: 0.329

Beta/Gamma Eff: 0.198

Alpha Background: 0.6

Beta/Gamma Background: 56

Technician Performing Count: R. Nugent Date: 12/14/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
10 minutes	X	40 cfm X 2.83E+4	=	1.1E 7 ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R. Nugent Date: 12/14/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 6.7E-13 Beta-Gamma MDA = 5.9E-12

Technician Performing Calculation: R. Nugent Date: 12/14/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 0800	635 cts	10 min	63.5 cpm	0.6 cpm	63 cpm	94 .67	.329	2.22E+6	1.3E-4 μCi
βγ 0800	2365 cts	10 min	236 cpm	56 cpm	180 cpm	189 .95	.198	2.22E+6	4.3E-4 μCi

Technician Performing Initial Count: R. Nugent Date: 12/14/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 1.3E-4 μCi X FR(4)	÷	1.1E 7 ml	=	4.7E-11 μCi/ml α
βγ 4.3E-4 μCi X FR(4)	÷	1.1E 7 ml	=	1.6E-10 μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R. Nugent Date: 12/14/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\mu Ci - \mu Ci\,(e^{-0.0655\,(\_\_\_hrs)}}{1 - e^{-0.0655(\_\_hrs)}}$$

$$= \text{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67
Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 μCi/ml

[$A_{LL}{}^{\beta}$] > 2E-10 μCi/ml

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 12/14/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/13/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-130

Date Start: 12/14/95 Date Stop: 12/14/95

Time Start: 9:50 Time Stop: 10:00 Total Time: 10 minutes

Sample Location: HOT CELL VENTILATION ROOM

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: CUTTING METAL FROM HOT CELL.

Technician Performing Sample: ERIC PFEIFFER Date: 12/14

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: 1452

Cal. Date: 1/18/95

Cal. Due Date: 1/18/96

Flow Rate Start: 40 ☑ cfm ☐ lpm

Flow Rate Stop: 35 ☑ cfm ☐ lpm

Average Flow Rate: 37.5 ☑ cfm ☐ lpm

Type Counter: L 2929

Counter I.D.: 99043

Probe I.D.: 98325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 MIN minute

Alpha Eff: .329

Beta/Gamma Eff: .198

Alpha Background: 0.6

Beta/Gamma Background: 56

Technician Performing Count: R Ireys Date: 12/14/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
10 minutes	X	37.5 cfm X 2.83E+4	=	1.1 E 7 ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 12/14/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 6.6 E -13 Beta-Gamma MDA = 5.9 E -12

Technician Performing Calculation: R TRANGAS Date: 12/14/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 10:10	613 cts	10 min	61 cpm	.6 cpm	60 cpm	90 .67	.329	2.22E+6	1.2E-4 μCi
βγ 10:10	1888 cts	10 min	189 cpm	56 cpm	133 cpm	140 .95	.198	2.22E+6	3.2E-4 μCi

Technician Performing Initial Count: R TRANGAS Date: 12/14/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 1.2E-4 μCi X FR	÷	1.1 E 7 ml	=	4.4 E -11 μCi/ml α
βγ 3.2E-4 μCi X FR	÷	1.1 E 7 ml	=	1.2 E -10 μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGAS Date: 12/14/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm/dpm ÷	dpm/μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \_\_\_\_\ \mu Ci\,(e^{-0.0655\,(\_\_\_\_\ hrs)}}{1 - e^{-0.0655(\_\_\_\_ hrs)}}$$

$$= \text{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A $\beta\ A_{LL}\mu Ci = (\alpha\ A_{LL}\mu Ci)\ (0.67)$

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\quad \frac{1.89}{2.83} = 0.67$

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml $[A_{LL}^{\alpha}]$

$\frac{A_{LL}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml $[A_{LL}^{\beta}]$

If: $[A_{LL}^{\alpha}] > 1E\text{-}13\ \mu Ci/ml$

$[A_{LL}^{\beta}] > 2E\text{-}10\ \mu Ci/ml$

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 12/14/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/12/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT. McCLELLAN

A/S ID Number: 1452 RWP Number: FM-104 ATGS Number: FMA-139

Date Start: Dec 18, 95 Date Stop: Dec 18, 95

Time Start: 14:34 Time Stop: 1442 Total Time: 8 minutes

Sample Location: ENTRANCE TO HOT CELL

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: Jack Hammering

Technician Performing Sample: Shonkwiler Date: Dec 18,

INSTRUCTION 2: Complete the following information concerning sampling equipment and countin equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: 1452

Cal. Date: 1-18-95

Cal. Due Date: 1-18-96

Flow Rate Start: 41 ☒ cfm ☐ lpm

Flow Rate Stop: 21 ☒ cfm ☐ lpm

Average Flow Rate: 31 ☒ cfm ☐ lpm

Type Counter: L-2929

Counter I.D.: 99045

Probe I.D.: 98325

Cal. Date: 11/14/95

Cal. Due Date: 5/14/96

Count Time: 10 min minut

Alpha Eff: .326

Beta/Gamma Eff: .153

Alpha Background: 0.4

Beta/Gamma Background: 56

Technician Performing Count: R TRANEAS Date: 12/18/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
8 minutes	X	31 cfm X 2.83E+4	=	7.0 E6 ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 12/18/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B}} (1 + t_{S+B} / t_B)}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = $9.7E^{-13}$ Beta-Gamma MDA = $1.2E^{-11}$

Technician Performing Calculation: R TRANGAS Date: Dec 18, 95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 14:50	156 cts	10 min	16 cpm	0.4 cpm	16 cpm	24 .67	.326	2.22E+6	$3.3E^{-5}$ µCi
βγ 14:50	928 cts	10 min	93 cpm	56 cpm	37 cpm	39 .95	.153	2.22E+6	$1.1E^{-4}$ µCi

Technician Performing Initial Count: R. TRANGAS Date: 12/18/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α $3.3E^{-5}$ µCi X FR	÷	$7.0E^{6}$ ml	=	$1.9E^{-12}$ µCi/ml α
βγ $1.1E^{-4}$ µCi X FR	÷	$7.0E^{6}$ ml	=	$6.5E^{-11}$ µCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGAS Date: 12/18/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T_{1/2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

$t_{1/2}\ \alpha$ = N/A

$t_{1/2}\ \beta\gamma$ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\ A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\ (hrs))}}{1 - e^{-0.0655\ (hrs)}}$$

$$= \frac{\mu Ci - \mu Ci\,(e^{-0.0655\ (\_\_hrs)}}{1 - e^{-0.0655(\_\_hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the bet long-lived activity:

N/A $\beta\ A_{LL}\mu Ci = (\alpha\ A_{LL}\mu Ci)\ (0.67)$

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\quad \frac{1.89}{2.83} = 0.67$

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}^{\alpha}\mu Ci}{\text{volume}}$ = N/A μCi/ml $[A_{LL}^{\alpha}]$

$\frac{A_{LL}^{\beta}\mu Ci}{\text{volume}}$ = N/A μCi/ml $[A_{LL}^{\beta}]$

If: $[A_{LL}^{\alpha}] > 1E\text{-}13\ \mu Ci/ml$

$[A_{LL}^{\beta}] > 2E\text{-}10\ \mu Ci/ml$

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: Robert F. Nugent Date: 12/18/9

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/19/95

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/95

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: EM 104 ATGS Number: EMA-140

Date Start: Dec 19, 95 Date Stop: Dec 19, 95

Time Start: 1545 Time Stop: 1600 Total Time: 15 minutes

Sample Location: OUT SIDE JACK HAMMERING OF HOT CAT

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: N/A

Technician Performing Sample: HUMPHREYS Date: 12/19/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler Type Counter: L-2929

Sampler I.D.: 1452 Counter I.D.: # 99045

Cal. Date: 1-18-95 Probe I.D.: 98325

Cal. Due Date: 1-18-96 Cal. Date: 11/14/95

Flow Rate Start: 40 ☒ cfm ☐ lpm Cal. Due Date: 5/14/96

Flow Rate Stop: 20 ☒ cfm ☐ lpm Count Time: 10 min minutes

Alpha Eff: .325

Average Flow Rate: 30 ☒ cfm ☐ lpm Beta/Gamma Eff: .153

Alpha Background: 0.4 cpm

Beta/Gamma Background: 56 cpm

Technician Performing Count: R TRAMEL Date: 12/19/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
15 minutes	X	30 cfm X 2.83E+4	=	1.3 E^{7} ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R TRANGAS Date: 12/19/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 5.2E^{-13} Beta-Gamma MDA = 6.4 E^{-12}

Technician Performing Calculation: R TRANGAS Date: 12/19/95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 16:05	423 cts	10 min	42 cpm	04 cpm	42 cpm	63 .67	.325	2.22E+6	8.7E^{-5} μCi
βγ 16:05	1904 cts	10 min	190 cpm	56 cpm	134 cpm	141 .95	.154	2.22E+6	4.1E^{-4} μCi

Technician Performing Initial Count: R TRANGAS Date: 12/19/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 8.7E^{-5} μCi X FR	÷	1.3 E^{7} ml	=	2.7 E^{-11} μCi/ml α
βγ 4.1E^{-4} μCi X FR	÷	1.3E7 ml	=	1.2 E^{-10} μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRANGAS Date: 12/19/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\,(e^{-0.0655(\Delta T)})}{1 - e^{-0.0655\,(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\_\_\_\_\ \mu Ci - \mu Ci\,(e^{-0.0655\,(-\_\_\_\_\,hrs)}}{1 - e^{-0.0655(\_\_\_\_\,hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A β $A_{LL}\mu Ci$ = (α $A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = 0.67

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}{}^{\alpha}\mu Ci}{volume}$ = N/A $\mu Ci/ml$ [$A_{LL}{}^{\alpha}$]

$\frac{A_{LL}{}^{\beta}\mu Ci}{volume}$ = N/A $\mu Ci/ml$ [$A_{LL}{}^{\beta}$]

If: [$A_{LL}{}^{\alpha}$] > 1E-13 $\mu Ci/ml$

[$A_{LL}{}^{\beta}$] > 2E-10 $\mu Ci/ml$

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: Robert F. Wright Date: 12/19/95

~~INSTRUCTION 3: Calculate the Total Sample Volume:~~ JBC 11/13/96

AIR SAMPLE DATA AND ANALYSIS

ATGF-030 11/9

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location: FT McCLELLAN

A/S ID Number: 1452 RWP Number: EM-104 ATGS Number: EMA-14

Date Start: 12/20/95 Date Stop: 12/20/95

Time Start: 1627 Time Stop: 1637 Total Time: 10 minutes

Sample Location: C/S H.T. CELL WHILE JACKHAMMERING

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☐ Low Volume ☐ Lapel/Personal

Comments: N/A

Technician Performing Sample: HUMPHRIES Date: 12/20/95

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: High Volume Air Sampler

Sampler I.D.: 1452

Cal. Date: 1-15-96

Cal. Due Date: 1-15-96

Flow Rate Start: 42 ☒ cfm ☐ lpm

Flow Rate Stop: 25 ☒ cfm ☐ lpm

Average Flow Rate: 33.5 ☒ cfm ☐ lpm

Type Counter: [illegible]

Counter I.D.: [illegible]

Probe I.D.: [illegible]

Cal. Date: 11-14-96

Cal. Due Date: 5/14/97

Count Time: 10 min minute

Alpha Eff: .333

Beta/Gamma Eff: .155

Alpha Background: 0.4 cpm

Beta/Gamma Background: 56 cpm

Technician Performing Count: K TRAVIS Date: 12/20/95

INSTRUCTION 3: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume
10 minutes	X	33.5 cfm X 2.83E+4	=	9.5E6 ml
		N/A lpm X 1.0E+3		

Technician Performing Calculation: R. TRAVERS Date: 12/20/95

INSTRUCTION 4: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu Ci}{ml} = \frac{2.71 + 3.29\sqrt{R_B t_{S+B}(1 + t_{S+B}/t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where:
- V = Sample Volume in ml
- E = Counter Efficiency
- R_B = Background Count Rate (cpm)
- t_{S+b} = Sample Counting Time (min)
- t_B = Background Counting Time (min)

Alpha MDA = 6.9 E^{-13} Beta-Gamma MDA = 5.7E^{-12}

Technician Performing Calculation: Richard E Travers Date: 12-20-95

INSTRUCTION 5: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

	Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	11.4	24 cts	10 min	25 cpm	6.4 cpm	25 cpm	37 .67	.333	2.22E+6	5.1E^{-5} μCi
βγ	11.4	1342 cts	10 min	134 cpm	56 cpm	78 cpm	82 .95	.155	2.22E+6	2.4E^{-4} μCi

Technician Performing Initial Count: R. TRAVERS Date: 12/20/95

INSTRUCTION 6: Determine the Initial Airborne Concentration:

Initial Activity		Volume		Initial Activity
α 5.1E^{-5} μCi X FR	÷	9.5E^{6} ml	=	2.2 E^{-11} μCi/ml α
βγ 2.4E^{-4} μCi X FR	÷	9.5E^{6} ml	=	1.0 E^{-10} μCi/ml βγ

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: R TRAVERS Date: 12/20/95

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 3 Hour Count: N/A Date: N/A

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity		Volume		3 Hr. Decayed Activity
α N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml α
βγ N/A μCi X FR	÷	N/A ml	=	N/A μCi/ml βγ

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T\frac{1}{2}\ (\text{min}) = \frac{-.693\ (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t½ α = N/A

t½ βγ = N/A

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: N/A Date: N/A

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha}\left(e^{-0.0655(\Delta T)}\right)}{1 - e^{-0.0655(\Delta T)}}$$

where:

A_{LL}^{α}	=	long-lived activity which emits alpha
A_{20}^{α}	=	20 hour decayed activity due to alpha
A_3^{α}	=	3 hour decayed activity due to alpha
0.0655	=	Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
ΔT	=	elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\alpha\, A_{LL}\mu Ci = \frac{A_{20}\mu Ci - A_3\mu Ci\left(e^{-0.0655\,(hrs))}\right.}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{\mu Ci - \mu Ci\left(e^{-0.0655\,(\_\_hrs)}\right.}{1 - e^{-0.0655(\_\_hrs)}}$$

$$= \underline{N/A}\ \mu Ci$$

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

N/A $\beta\ A_{LL}\mu Ci = (\alpha\ A_{LL}\mu Ci)\ (0.67)$

where 0.67 is:

Nuclide	T½	Ci	Emission	Yield	Energy
Th-232	1.4E+10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

Total long-lived alpha activity = 1 + .917 + .917 = 2.83 $\quad \frac{1.89}{2.83} = 0.67$

Total long-lived beta activity = .945 + .945 = 1.89

Technician Performing Calculation: N/A Date: N/A

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$\frac{A_{LL}^{\alpha}\mu Ci}{volume}$ = N/A μCi/ml $[A_{LL}^{\alpha}]$

$\frac{A_{LL}^{\beta}\mu Ci}{volume}$ = N/A μCi/ml $[A_{LL}^{\beta}]$

If: $[A_{LL}^{\alpha}] > 1E\text{-}13\ \mu Ci/ml$

$[A_{LL}^{\beta}] > 2E\text{-}10\ \mu Ci/ml$

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A Date: N/A

HP Supervisor Review: R. Nugent Date: 12/20/95

AIR SAMPLE DATA WORK SHEET

Project/Location: FT. McCLELLAN Date: 7-2-96

A/S ID Number: 1210 RWP Number: FM-107 Survey Number: FM4-142

Date Start: 7-2-96 Date Stop: 7-2-96

Time Start: 07:50 Time Stop: 08:10 Total Time: 20 minutes

Flow Start: 5 Flow Stop: 5

Sample Location: BLDG 3192 HVAC Room

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time **Sample Average Flow Rate** **Total Volume**

20 minutes X 5 cfm X 2.83E+4 = 2.83E^{6} ml

____ lpm X 1.0E+3

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 9:30	1340 cts	10 min	134 cpm	1 cpm	133 cpm	198 .67	.300	2.22E+6	3E^{-4} μCi
βγ 9:30	3056 cts	10 min	306 cpm	53 cpm	253 cpm	266 .95	.236	2.22E+6	5.1E^{-4} μCi

Technician Performing Initial Count: R. TRANCAS Date: 7-2-96

Initial Activity **Volume** **Initial Activity**

α 3E^{-4} μCi X FR ÷ 2.83E^{6} ml = 1.1 E^{-10} μCi/ml α

βγ 5.1E^{-4} μCi X FR ÷ 2.83E^{6} ml = 1.8 E^{-10} μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: Rachel E Trancas Date: 7-2-96

ATG Supervisor: Neal S. Whitby Date: 7-2-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-2-96

A/S ID Number: 1210 RWP Number: FM-107 Survey Number: FMA new-436- 14

Date Start: 7-2-96 Date Stop: 7-2-96

Time Start: 09:25 Time Stop: 11:40 Total Time: 135 minutes

Flow Start: 5 Flow Stop: 5

Sample Location: OUTSIDE HOT CELL DOOR IN BLDG 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☐ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
135 minutes	X	5 cfm X 2.83E+4	=	1.9 E 7 ml
		___ lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1210	43 cts	10 min	4.3 cpm	0.1 cpm	4.1 cpm	6 .67	.300	2.22E+6	9.4E-6 μCi
βγ 1210	621 cts	10 min	62 cpm	53 cpm	9 cpm	9 .95	.236	2.22E+6	1.8E-5 μCi

Technician Performing Initial Count: RICHARD E TRANGAS Date: 7-2-96

Initial Activity		**Volume**		**Initial Activity**
α 9.4E-6 μCi X FR	÷	1.9 E 7 ml	=	4.95 E -13 μCi/ml α
βγ 1.8E-5 μCi X FR	÷	1.9 E 7 ml	=	9.5E-13 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trangas Date: 7-2-96

ATG Supervisor: Neal D. Whatley Date: 7-3-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-3-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA-7-14

Date Start: 7-3-96 Date Stop: 7-3-96

Time Start: 9:24 Time Stop: 1045 Total Time: 81 minutes

Flow Start: 3 Flow Stop: 2

Sample Location: HOT CELL BLDG 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
81 minutes	X	2.5 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	5.7 E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1130	1438 cts	10 min	144 cpm	.1 cpm	143 cpm	213.67	.294	2.22E+6	3.2E-4 µCi
βγ 1130	3566 cts	10 min	357 cpm	49 cpm	309 cpm	324.95	.259	2.22E+6	6.1E-4 µCi

Technician Performing Initial Count: R. TRANGAS Date: 7-3-96

Initial Activity		Volume		Initial Activity
α 3.2E-4 µCi X FR	÷	5.7E6 ml	=	5.7E-11 µCi/ml α
βγ 6.1E-4 µCi X FR	÷	5.7E6 ml	=	1.1E-10 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. TRANGAS Date: 7-3-96

ATG Supervisor: [signature] Date: 7-3-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-5-96

A/S ID Number: 211 RWP Number: FM-107 Survey Number: FMAT-38 145

Date Start: 7-5-96 Date Stop: 7-5-96

Time Start: 07:25 Time Stop: 0815 Total Time: 50 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: BLDG 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time **Sample Average Flow Rate** **Total Volume**

50 minutes X 2.75 cfm X 2.83E+4 = 3.89E6 ml
/ lpm X 1.0E+3

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 845	2236 cts	10 min	224 cpm	.1 cpm	224 cpm	334.67	.268	2.22E+6	5.6E-4 μCi
βγ 845	4739 cts	10 min	474 cpm	49 cpm	425 cpm	447.95	.237	2.22E+6	8.5E-4 μCi

Technician Performing Initial Count: K Trangas Date: 7-5-96

Initial Activity **Volume** **Initial Activity**

α 5.6E-4 μCi X FR ÷ 3.89E6 ml = 1.4E-10 μCi/ml α

βγ 8.5E-4 μCi X FR ÷ 3.89E6 ml = 2.2E-10 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: K Trangas Date: 7-5-96

ATG Supervisor: Neil White Date: 7-9-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McClellan Date: 7-8-96

A/S ID Number: 12 11 RWP Number: fm-107 Survey Number: fmo ~~+39~~ 146

Date Start: 7-8-96 Date Stop: 7-8-96

Time Start: 7:47 Time Stop: 818 Total Time: 31 minutes

Flow Start: 3 CFM Flow Stop: 2.5 cfm

Sample Location: Bldg 3192 Hot cell

Sample Type: ☐ Breathing Zone ☒ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
31 minutes	X	2.75 ~~31~~ cfm X 2.83E+4 (R=2) N/A 1pm X 1.0E+3	=	2.4E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 9:19	382 cts	10 min	38 cpm	.1 cpm	38 cpm	56 .67	.288	2.22E+6	8.9E-5 µCi
βγ 9:19	1231 cts	10 min	123 cpm	58 cpm	65 cpm	68 .95	.237	2.22E+6	1.3E-4 µCi

Technician Performing Initial Count: K Trangas Date: 7-8-96

Initial Activity		Volume		Initial Activity
α 8.9E-5 µCi X FR	÷	2.4E6 ml	=	3.7E-11 µCi/ml α
βγ 1.3E-4 µCi X FR	÷	2.4E6 ml	=	5.4E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: K Trangas Date: 7-8-96

ATG Supervisor: [signature] Date: 7-8-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT. McClellan Date: 7-9-96

A/S ID Number: 210 RWP Number: Em-107 Survey Number: FMA-~~96~~-14

Date Start: 7-8-96 Date Stop: 7-8-96

Time Start: 09:20 Time Stop: 09:48 Total Time: 28 minutes

Flow Start: 3 cfm Flow Stop: 2.5 cfm

Sample Location: Hot Cell Bldg 3192

Sample Type: ~~☒~~ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ~~☒~~ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
28 minutes	X	2.75 cfm X 2.83E+4	=	2.2E 6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 11:15	194 cts	10 min	19 cpm	0.1 cpm	19 cpm	28 .67	.288	2.22E+6	4.4E-5 µCi
βγ 11:15	851 cts	10 min	85 cpm	58 cpm	27 cpm	28 .95	.237	2.22E+6	5.4E-4 µCi

Technician Performing Initial Count: R. Trangas Date: 7-8-96

Initial Activity		Volume		Initial Activity
α 4.4E-5 µCi X FR	÷	2.2E6 ml	=	2E-11 µCi/ml α
βγ 5.4E-4 µCi X FR	÷	2.2E6 ml	=	2.5E-10 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. Trangas Date: 7-8-96

ATG Supervisor: [signature] Date: 7-8-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McClellan Date: 7-9-96

A/S ID Number: 12 11 RWP Number: FM-107 Survey Number: FMA-148

Date Start: 7-8-96 Date Stop: 7-8-96

Time Start: 12:30 Time Stop: 1325 Total Time: 65 minutes

Flow Start: 3 cfm Flow Stop: 2.5 CFM

Sample Location: BLDG 3192

Sample Type: ~~⊠~~ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ~~⊠~~ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
65 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	5.1 E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 06:30	56 cts	10 min	5.6 cpm	0.1 cpm	6 cpm	.9 .67	.264	2.22E+6	1.5E-5 µCi
βγ 06:30	604 cts	10 min	60 cpm	51 cpm	9 cpm	9 .95	.233	2.22E+6	1.8E-5 µCi

Technician Performing Initial Count: R Ramos Date: 7-9-96

Initial Activity		**Volume**		**Initial Activity**
α 1.5E-5 µCi X FR	÷	5.1E6 ml	=	2.9E-12 µCi/ml α
βγ 1.8E-5 µCi X FR	÷	5.1E6 ml	=	3.5E-12 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Ramos Date: 7-9-96

ATG Supervisor: [signature] Date: 7-9-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McClellan Date: 7-9-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA++2 14

Date Start: 7-9-96 Date Stop: 7-9-96

Time Start: 09:10 Time Stop: 09:50 Total Time: 40 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: Bldg 3192 HOTCELL Trench

Sample Type: ☐ Breathing Zone ☒ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
40 minutes	X	2 cfm X 2.83E+4	=	2.3E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 12:15	125 cts	10 min	13 cpm	0.1 cpm	13 cpm	19.67	.264	2.22E+6	3.2E-5 μCi
βγ 12:15	674 cts	10 min	67 cpm	51 cpm	16 cpm	17.95	.233	2.22E+6	3.3E-5 μCi

Technician Performing Initial Count: R Ivanoff Date: 7-9-96

Initial Activity		**Volume**		**Initial Activity**
α 3.2E-5 μCi X FR	÷	2.3E6 ml	=	1.4E-11 μCi/ml α
βγ 3.5E-5 μCi X FR	÷	2.3E6 ml	=	1.5E-11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Ivanoff Date: 7-9-96

ATG Supervisor: [signature] Date: 7-9-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-10-96

A/S ID Number: 1210 RWP Number: FM107 Survey Number: FM-RWP 150

Date Start: 7-9-96 Date Stop: 7-9-96

Time Start: 1310 Time Stop: 1345 Total Time: 35 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: HOT CELL PIPE CUT OUT

Sample Type: ☐ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☑ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
35 minutes	X	2 cfm X 2.83E+4	=	2 E 6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 900	6 cts	10 min	.6 cpm	0.1 cpm	.5 cpm	.7 .67	.270	2.22E+6	1.2E-6 µCi
βγ 900	532 cts	10 min	53 cpm	44 cpm	9 cpm	9 .95	.235	2.22E+6	1.9E-5 µCi

Technician Performing Initial Count: K TRANGS Date: 7-10-96

Initial Activity		Volume		Initial Activity
α 1.2E-6 µCi X FR	÷	2E6 ml	=	6E-13 µCi/ml α
βγ 1.8E-5 µCi X FR	÷	2E6 ml	=	9E-12 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: K Trangs Date: 7-10-96

ATG Supervisor: Neil White Date: 7-10-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-10-96

A/S ID Number: 1210 RWP Number: Fm-108 Survey Number: FMA 151

Date Start: 7-9-96 Date Stop: 7-9-96

Time Start: 1245 Time Stop: 1345 Total Time: 60 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: Bldg 3182 museum

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
60 minutes	X	2 cfm X 2.83E+4 / N/A lpm X 1.0E+3	=	3.4E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 8:00	26 cts	10 min	3 cpm	0.5 cpm	3 cpm	4 .67	.293	2.22E+6	6.9E-6 µCi
βγ 8:00	791 cts	10 min	79 cpm	55 cpm	24 cpm	25 .95	.153	2.22E+6	7.4E-5 µCi

Technician Performing Initial Count: R Tramps Date: 7-10-96

Initial Activity		Volume		Initial Activity
α 6.9E-6 µCi X FR	÷	3.6E6 ml	=	1.9E-12 µCi/ml α
βγ 7.4E-5 µCi X FR	÷	3.6E6 ml	=	2.1E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Tramps Date: 7-10-96

ATG Supervisor: Neal White Date: 7-10-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-10-96

A/S ID Number: 1452 RWP Number: FM-103 Survey Number: FMC-145-152

Date Start: 7-10-96 Date Stop: 7-10-96

Time Start: 750 Time Stop: 755 Total Time: 5 minutes

Flow Start: 20 Flow Stop: 20

Sample Location: BLdg 3182

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☒ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
5 minutes	X	20 cfm X 2.83E+4	=	2.83E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 945	261 cts	10 min	26 cpm	0.5 cpm	26 cpm	38 .67	.233	2.22E+6	5.9E-5 µCi
βγ 945	1010 cts	10 min	101 cpm	5 cpm	96 cpm	48 .95	.153	2.22E+6	1.4E-4 µCi

Technician Performing Initial Count: R. TRENEAS Date: 7-10-96

Initial Activity		Volume		Initial Activity
α 5.9E-5 µCi X FR	÷	2.8E6 ml	=	2.1E-11 µCi/ml α
βγ 1.4E-4 µCi X FR	÷	2.8E6 ml	=	5E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trenga Date: 7-10-96

ATG Supervisor: [signature] Date: 7-10-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-10-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMC 145 153

Date Start: 7-10-96 Date Stop: 7-10-96

Time Start: 06:55 Time Stop: 0810 Total Time: 75 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: 45T Cell Bldg 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
75 minutes	X	2.75 cfm X 2.83E+4 DIA lpm X 1.0E+3	=	5.8E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 945	772 cts	10 min	77 cpm	0.1 cpm	77 cpm	115 .67	.270	2.22E+6	1.9E-4 µCi
βγ945	2194 cts	10 min	219 cpm	49 cpm	170 cpm	179 .95	.235	2.22E+6	3.4E-4 µCi

Technician Performing Initial Count: R TRANGS Date: 7-10-96

Initial Activity		Volume		Initial Activity
α 1.9E-4 µCi X FR	÷	5.8E6 ml	=	3.3E-11 µCi/ml α
βγ 3.4E-4 µCi X FR	÷	5.8E6 ml	=	5.8E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R TRANGS Date: 7-10-96

ATG Supervisor: NW Whitty Date: 7-10-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft McClellan Date: 7-10-96

A/S ID Number: 1210 RWP Number: FM 108 Survey Number: Fmc 154 ~~147~~

Date Start: 7-10-96 Date Stop: 7-10-96

Time Start: 720 Time Stop: 910 Total Time: 110 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: Bldg 3182 Museum 1/s Tent

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
110 minutes	X	2 cfm X 2.83E+4	=	6.2E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1020	450 cts	10 min	45 cpm	0.1 cpm	45 cpm	67 .67	.270	2.22E+6	1.1E-9 µCi
βγ 1020	1726 cts	10 min	172 cpm	49 cpm	123 cpm	127 .95	.235	2.22E+6	2.5E-9 µCi

Technician Performing Initial Count: L Treanor Date: 7-10-96

Initial Activity		**Volume**		**Initial Activity**
α 1.1E-9 µCi X FR	÷	6.2E6 ml	=	1.8E-11 µCi/ml α
βγ 2.5E-9 µCi X FR	÷	6.2E6 ml	=	4E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: L Treanor Date: 7-10-96

ATG Supervisor: [signature] Date: 7-10-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft Mc Clellan Date: 7-10-96

A/S ID Number: 1210 RWP Number: Fm-108 Survey Number: FMA-~~145~~ 155

Date Start: 7-10-96 Date Stop: 7-10-96

Time Start: 1010 Time Stop: 1130 Total Time: 100 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: BUILDING 3182 - MUSEUM - INSIDE TENT

Sample Type: ☐ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☑ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
100 minutes	X	2 cfm X 2.83E+4	=	5.7E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1420	91 cts	10 min	9 cpm	2.1 cpm	7 cpm	13 .67	.270	2.22E+6	$2.2E^{-5}$ µCi
βγ 1420	775 cts	10 min	78 cpm	4 ½ cpm	49 cpm	52 .95	.235	2.22E+6	$9.9E^{-5}$ µCi

Technician Performing Initial Count: K Thompson Date: 7-10-96

Initial Activity		**Volume**		**Initial Activity**
α $2.2E^{-5}$ µCi X FR	÷	$5.7E^{+6}$ ml	=	$3.9E^{-12}$ µCi/ml α
βγ $9.9E^{-5}$ µCi X FR	÷	$5.7E^{6}$ ml	=	$1.7E^{-11}$ µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: K TRAV975 Date: 7-10-96

ATG Supervisor: Neil Watts Date: 7-10-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-11-96

A/S ID Number: 1211 RWP Number: Fm-107 Survey Number: Fm4-146 (156)

Date Start: 7-11-96 Date Stop: 7-11-96

Time Start: 08:15 Time Stop: 09:00 Total Time: 45 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: HOT CELL BDG 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
45 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	3.5E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1105	925 cts	10 min	11 cpm	0.1 cpm	11 cpm	16 .67	.270	2.22E+6	2.7E-5 µCi
βγ 1105	940 cts	10 min	94 cpm	51 cpm	43 cpm	45 .95	.235	2.22E+6	8.7E-5 µCi

Technician Performing Initial Count: R Tranaps Date: 7-11-96

Initial Activity		Volume		Initial Activity
α 2.7E-5 µCi X FR	÷	3.5E6 ml	=	7.8E-12 µCi/ml α
βγ 8.7E-5 µCi X FR	÷	3.5E6 ml	=	2.5E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Tranaps Date: 7-11-96

ATG Supervisor: [signature] Date: 7-11-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McClellan Date: 7-11-96

A/S ID Number: 1211 RWP Number: Fm-107 Survey Number: ~~Fma 150~~ 157

Date Start: 7-11-96 Date Stop: 7-11-96

Time Start: 930 Time Stop: 1030 Total Time: 60 minutes

Flow Start: 3 Flow Stop: 2

Sample Location: Bldg 3192 Hot Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ~~☒~~ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
60 minutes	X	2.5 cfm X 2.83E+4	=	4.2E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1110	393 cts	10 min	39 cpm	0.3 cpm	39 cpm	58.67	.286	2.22E+6	9.2E-5 µCi
βγ 1110	1686 cts	10 min	169 cpm	62 cpm	107 cpm	112.95	.154	2.22E+6	3.3E-4 µCi

Technician Performing Initial Count: R Trangas Date: 7-11-96

Initial Activity		**Volume**		**Initial Activity**
α 9.2E-5 µCi X FR	÷	4.2E6 ml	=	2.2E-11 µCi/ml α
βγ 3.3E-4 µCi X FR	÷	4.2E6 ml	=	7.9E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trangas Date: 7-11-96

ATG Supervisor: Nat Whitty Date: 7-11-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-11-96

A/S ID Number: 1210 RWP Number: FM-108 Survey Number: fma-158

Date Start: 7-11-96 Date Stop: 7-11-96

Time Start: 06:55 Time Stop: 10:30 Total Time: 215 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: Bldg 3182 I/S CONTAINMENT

Sample Type: ☐ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☑ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
215 minutes	X	2 cfm X 2.83E+4	=	1.2 E 7 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1130	2512 cts	10 min	251 cpm	0.1 cpm	251 cpm	375 .67	.270	2.22E+6	6.3E-9 μCi
βγ 1130	5282 cts	10 min	528 cpm	51 cpm	477 cpm	502 .95	.235	2.22E+6	9.6E-4 μCi

Technician Performing Initial Count: R TRANGAS Date: 7-11-96

Initial Activity		**Volume**		**Initial Activity**
α 6.3E-9 μCi X FR	÷	1.2E7 ml	=	5.3E-11 μCi/ml α
βγ 9.6E-4 μCi X FR	÷	1.2E7 ml	=	~~8E-8~~ 8E-11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. TRANGAS Date: 7-11-96

ATG Supervisor: [signature] Date: 7-11-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-11-96

A/S ID Number: 1452 RWP Number: Fm108 Survey Number: FMA-152 15

Date Start: 7-11-96 Date Stop: 7-11-96

Time Start: 06:55 Time Stop: 10:30 Total Time: 215 minutes

Flow Start: 32 Flow Stop: 32

Sample Location: Bldg 3182 Missouri O/S Containment

Sample Type: ~~X~~ Breathing Zone ☐ General Area ☐ Other: _____
~~X~~ High Volume ☐ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
215 minutes	X	32 cfm X 2.83E+4	=	1.9E-8 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 11:45	5922 cts	10 min	592 cpm	0.3 cpm	592 cpm	884 .67	.286	2.22E+6	1.9E-3 μCi
βγ 11:45	7820 cts	10 min	782 cpm	62 cpm	720 cpm	720 .95	.154	2.22E+6	2.2E-3 μCi

Technician Performing Initial Count: R Travis Date: 7-11-96

Initial Activity		**Volume**		**Initial Activity**
α 1.4E-3 μCi X FR	÷	1.9E8 ml	=	7.4E-12 μCi/ml α
βγ 2.2E-3 μCi X FR	÷	1.9E8 ml	=	1.2E-11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Travis Date: 7-11-96

ATG Supervisor: Neal Libby Date: 7-11-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-12-96

A/S ID Number: 1210 RWP Number: FM 108 Survey Number: FMA-160

Date Start: 7-11-96 Date Stop: 7-11-96

Time Start: 12:40 Time Stop: 16:20 Total Time: 220 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: I/S CONTAINMENT BLdg 3182 MUSEUM

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
220 minutes	X	2 cfm X 2.83E+4	=	1.2 E 7 ml
		DIA lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 06:30	8 cts	10 min	.8 cpm	0.2 cpm	.6 cpm	.9 .67	.292	2.22E+6	1.4E-6 µCi
βγ 06:30	681 cts	10 min	68 cpm	60 cpm	8 cpm	8 .95	.152	2.22E+6	2.5E-5 µCi

Technician Performing Initial Count: R Trangas Date: 7-12-96

Initial Activity		Volume		Initial Activity
α 1.4E-6 µCi X FR	÷	1.2E7 ml	=	1.2E-13 µCi/ml α
βγ 2.5E-5 µCi X FR	÷	1.2E7 ml	=	2.1E-12 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R TRANGAS Date: 7-12-96

ATG Supervisor: Neal Whitty Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McClellan Date: 7-12-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA-161

Date Start: 7-11-96 Date Stop: 7-11-96

Time Start: 1300 Time Stop: 1325 Total Time: 25 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: Hot cell during decon

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
25 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	1.9E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 06:30	8 cts	10 min	.8 cpm	.1 cpm	.7 cpm	1 .67	.280	2.22E+6	1.7E-6 μCi
βγ 06:30	600 cts	10 min	60 cpm	54 cpm	6 cpm	6 .95	.232	2.22E+6	1.2E-5 μCi

Technician Performing Initial Count: R Jones Date: 7-12-96

Initial Activity		**Volume**		**Initial Activity**
α 1.7E-6 μCi X FR	÷	1.9E6 ml	=	8.9E-13 μCi/ml α
βγ 1.2E-5 μCi X FR	÷	1.9E6 ml	=	6.5E-12 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Jones Date: 7-12-96

ATG Supervisor: Neal White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-12-96

A/S ID Number: 1210 RWP Number: FM-108 Survey Number: FmA-162

Date Start: 7-12-96 Date Stop: 7-12-96

Time Start: 07:15 Time Stop: 07:50 Total Time: 35 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: Bldg 3182 Museum Containment

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
35 minutes	X	2 cfm X 2.83E+4	=	1.9 E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1000	134 cts	10 min	13 cpm	.1 cpm	13 cpm	19 .67	.280	2.22E+6	3.1 E-5 μCi
βγ 1000	802 cts	10 min	80 cpm	54 cpm	26 cpm	27 .95	.232	2.22E+6	5.3 E-5 μCi

Technician Performing Initial Count: R TRANGAS Date: 7-12-96

Initial Activity		Volume		Initial Activity
α 3.1E-5 μCi X FR	÷	1.9E6 ml	=	1.6 E-11 μCi/ml α
βγ 5.3E-5 μCi X FR	÷	1.9E6 ml	=	2.8 E-11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R TRANGAS Date: 7-12-96

ATG Supervisor: Neal White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-12-96

A/S ID Number: 1211 RWP Number: Fm-107 Survey Number: FmA-163

Date Start: 7-12-96 Date Stop: 7-12-96

Time Start: 08:45 Time Stop: 0945 Total Time: 60 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: Hot Cell Bldg 3192

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
60 minutes	X	2.75 cfm X 2.83E+4	=	4.7E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1045	734 cts	10 min	73 cpm	0.2 cpm	73 cpm	108 .67	.292	2.22E+6	1.7E-8 µCi
βγ 1045	1886 cts	10 min	188 cpm	60 cpm	128 cpm	134 .95	.153	2.22E+6	4E-9 µCi

Technician Performing Initial Count: R Ivanez Date: 7-12-96

Initial Activity		**Volume**		**Initial Activity**
α 1.4E-9 µCi X FR	÷	4.7E6 ml	=	3.6E-11 µCi/ml α
βγ 4-E-9 µCi X FR	÷	4.7E6 ml	=	8.5E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Ivanez Date: 7-12-96

ATG Supervisor: Neal Whitley Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-15-96

A/S ID Number: 1210 RWP Number: FM-108 Survey Number: FM4-164

Date Start: 7-12-96 Date Stop: 7-12-96

Time Start: 08:23 Time Stop: 10:55 Total Time: 152 minutes

Flow Start: 2.1 Flow Stop: 2.1

Sample Location: Museum Containment Bldg 3182

Sample Type: ~~☒~~ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ~~☒~~ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
152 minutes	X	2.1 cfm X 2.83E+4	=	$9E^{6}$ ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 0655	17 cts	10 min	2 cpm	0.5 cpm	2 cpm	3 .67	.278	2.22E+6	$4.9E^{-6}$ µCi
$\beta\gamma$ 0655	636 cts	10 min	64 cpm	54 cpm	10 cpm	11 .95	.153	2.22E+6	$3.2E^{-5}$ µCi

Technician Performing Initial Count: R. Travagas Date: 7-15-96

Initial Activity		**Volume**		**Initial Activity**
α $4.9E^{-6}$ µCi X FR	÷	$9E^{6}$ ml	=	$5.4E^{-13}$ µCi/ml α
$\beta\gamma$ $3.2E^{-5}$ µCi X FR	÷	$9E^{6}$ ml	=	$3.6E^{-12}$ µCi/ml $\beta\gamma$

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Travagas Date: 7-15-96

ATG Supervisor: Neal Whitty Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft. McClellan Date: 7-15-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA-165

Date Start: 7-15-96 Date Stop: 7-15-96

Time Start: 08:00 Time Stop: 10:45 Total Time: 1.65 minutes

Flow Start: 2 Flow Stop: 2

Sample Location: Bldg 3192 B4 Trench

Sample Type: ~~X~~ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ~~X~~ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
165 minutes	X	2 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	9.3E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 1120	736 cts	10 min	74 cpm	0.5 cpm	74 cpm	110 .67	.278	2.22E+6	1.8E-4 μCi
βγ 1120	1153 cts	10 min	165 cpm	54 cpm	111 cpm	117 .95	.153	2.22E+6	3.4E-4 μCi

Technician Performing Initial Count: R Trangas Date: 7-15-96

Initial Activity		Volume		Initial Activity
α 1.8E-4 μCi X FR	÷	9.3E6 ml	=	1.9E-11 μCi/ml α
βγ 3.4E-4 μCi X FR	÷	9.3E6 ml	=	3.5E-11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trangas Date: 7-15-96

ATG Supervisor: Neal White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft McClellan Date: 7-16-96

A/S ID Number: 1211 RWP Number: FM 107 Survey Number: FMA-166

Date Start: 7-15-96 Date Stop: 7-15-96

Time Start: 1300 Time Stop: 1350 Total Time: 50 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: Bldg 3192 General Area

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
50 minutes	X	2.75 cfm X 2.83E+4	=	3.9E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 06:45	31 cts	10 min	3 cpm	0.3 cpm	3 cpm	4 .67	.279	2.22E+6	6.5E-6 μCi
βγ 06:45	566 cts	10 min	57 cpm	50 cpm	7 cpm	7 .95	.239	2.22E+6	1.4E-5 μCi

Technician Performing Initial Count: Richard E Iranzo Date: 7-16-96

Initial Activity		Volume		Initial Activity
α 6.5E-6 μCi X FR	÷	3.9 E6 ml	=	1.7E-12 μCi/ml α
βγ 1.4E-5 μCi X FR	÷	3.9E6 ml	=	3.6E-12 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: Richard E Iranzo Date: 7-16-96

ATG Supervisor: Neil Whitty Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft McClellan Date: 7-16-96

A/S ID Number: 1211 RWP Number: Fm-107 Survey Number: FmA-167

Date Start: 7-16-96 Date Stop: 7-16-96

Time Start: 09:15 Time Stop: 1045 Total Time: 90 minutes

Flow Start: 3 Flow Stop: 1

Sample Location: BLDG 3192 HOT Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
90 minutes	X	2 cfm X 2.83E+4 / 2 lpm X 1.0E+3	=	5.1 E 6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 12:15	58 cts	10 min	6 cpm	6.2 cpm	6 cpm	9 .67	.282	2.22E+6	1.4E-5 µCi
βγ 12:15	621 cts	10 min	62 cpm	57 cpm	5 cpm	5 .95	.153	2.22E+6	1.6E-5 µCi

Technician Performing Initial Count: R. Trangas Date: 7-16-96

Initial Activity		**Volume**		**Initial Activity**
α 1.4E-5 µCi X FR	÷	5.1 E 6 ml	=	2.7E-12 µCi/ml α
βγ 1.6E-5 µCi X FR	÷	5.1 E 6 ml	=	3. E-12 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. Trangas Date: 7-16-96

ATG Supervisor: Neil Whitty Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft McClellan Date: 7-16-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA-168

Date Start: 7-16-96 Date Stop: 7-16-96

Time Start: 12:15 Time Stop: 13:00 Total Time: 45 minutes

Flow Start: 3 Flow Stop: 2

Sample Location: Bldg 3192 Hot Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
45 minutes	X	2.5 cfm X 2.83E+4 PIP lpm X 1.0E+3	=	3.2E^{6} ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 14:10	197 cts	10 min	20 cpm	0.3 cpm	20 cpm	30 .67	.279	2.22E+6	4.9E^{-5} µCi
βγ 14:10	1399 cts	10 min	~~90~~ 140 cpm	50 cpm	90 cpm	95 .95	.239	2.22E+6	1.8E^{-4} µCi

Technician Performing Initial Count: R Trangas Date: 7-16-96

Initial Activity		**Volume**		**Initial Activity**
α 4.9E^{-5} µCi X FR	÷	3.2E^{6} ml	=	1.5E^{-11} µCi/ml α
βγ 1.8E^{-4} µCi X FR	÷	3.2E^{6} ml	=	5.6E^{-11} µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trangas Date: 7-16-96

ATG Supervisor: Neil White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft McClellan Date: 7-17-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FM4-168

Date Start: 7-16-96 Date Stop: 7-16-96

Time Start: 720 Time Stop: 750 Total Time: 30 minutes

Flow Start: 3 Flow Stop: 3

Sample Location: Bldg 3192 Roof of Hot Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
30 minutes	X	3 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	2.5E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1025	284 cts	10 min	28 cpm	0.1 cpm	28 cpm	42 .67	.272	2.22E+6	6.9E-5 µCi
βγ 1025	1083 cts	10 min	108 cpm	46 cpm	62 cpm	65 .95	.245	2.22E+6	1.2E-4 µCi

Technician Performing Initial Count: R. Trangas Date: 7-17-96

Initial Activity		Volume		Initial Activity
α 6.9E-5 µCi X FR	÷	2.5E6 ml	=	2.8E-11 µCi/ml α
βγ 1.2E-4 µCi X FR	÷	2.5E6 ml	=	4.8E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trangas Date: 7-17-96

ATG Supervisor: Neil White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-17-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA-169

Date Start: 7-17-96 Date Stop: 7-17-96

Time Start: 08:55 Time Stop: 09:55 Total Time: 60 minutes

Flow Start: 3 Flow Stop: 3

Sample Location: Bldg 3192 HOT Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: 5.1 E 6
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
60 minutes	X	30 cfm X 2.83E+4	=	~~5~~ 5.6E6 ml
		____ lpm X 1.0E+3		

gbc 7-22-96

Time Counted ÷	Gross Counts	Count Period =	Gross CR -	Bkgrnd CR =	Net CR ÷	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1040	129 cts	10 min	13 cpm	0.1 cpm	13 cpm	19 .67	.272	2.22E+6	3.1 E-5 µCi
βγ 1040	774 cts	10 min	77 cpm	46 cpm	31 cpm	33 .95	.245	2.22E+6	6E-5 µCi

Technician Performing Initial Count: R. TRANGAS Date: 7-17-96

Initial Activity		Volume		Initial Activity
α 3.1E-5 µCi X FR	÷	5.1 E6 ml	=	6.1 E-12 µCi/ml α
βγ 6E-5 µCi X FR	÷	5.1 E6 ml	=	1.2E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R TRANGAS Date: 7-17-96

ATG Supervisor: Neal White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-18-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: fMA-170

Date Start: 7-17-96 Date Stop: 7-17-96

Time Start: 11:40 Time Stop: 12:15 Total Time: 35 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: Bldg 3192 HOTCELL

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☐ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
35 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	$2.7E^{6}$ ml

Time Counted ÷	Gross Counts	Count Period	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 0.630	10 cts	10 min	.7 cpm	0.1 cpm	.6 cpm	.9 .67	.298	2.22E+6	$1.4E^{-6}$ µCi
$\beta\gamma$ 0.630	506 cts	10 min	51 cpm	53 cpm	-2 cpm	-2 .95	.239	2.22E+6	$-3.9E^{-6}$ µCi

Technician Performing Initial Count: R. TRANGAS Date: 7-18-96

Initial Activity		**Volume**		**Initial Activity**
α $1.4E^{-6}$ µCi X FR	÷	$2.7E^{6}$ ml	=	$5E^{-13}$ µCi/ml α
$\beta\gamma$ $3.9E^{-6}$ µCi X FR	÷	$2.7E^{6}$ ml	=	$-1.4E^{-12}$ µCi/ml $\beta\gamma$

FR = Fiiter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. TRANGAS Date: 7-18-96

ATG Supervisor: Neal White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-18-96

A/S ID Number: 1210 RWP Number: FM-108 Survey Number: FM4-171

Date Start: 7-18-96 Date Stop: 7-18-96

Time Start: 06:40 Time Stop: 1045 Total Time: 245 minutes

Flow Start: 3 Flow Stop: 2.5

Sample Location: Bldg 3182 Museum Containment

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
245 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	1.9E^{7} ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1100	68 cts	10 min	7 cpm	0.1 cpm	7 cpm	10 .67	.298	2.22E+6	1.6E^{-5} µCi
βγ 1100	704 cts	10 min	70 cpm	53 cpm	17 cpm	18 .95	.239	2.22E+6	3.4E^{-5} µCi

Technician Performing Initial Count: R. TRANGAS Date: 7-18-96

Initial Activity		**Volume**		**Initial Activity**
α 1.6E^{-5} µCi X FR	÷	1.9E^{7} ml	=	8.3 E^{-13} µCi/ml α
βγ 3.4E^{-5} µCi X FR	÷	1.9E7 ml	=	1.8 E^{-12} µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. TRANGAS Date: 7-18-96

ATG Supervisor: Neil Whitty Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-19-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA-172

Date Start: 7-18-96 Date Stop: 7-18-96

Time Start: 1350 Time Stop: 1530 Total Time: 100 minutes

Flow Start: 2.5 Flow Stop: 2.5

Sample Location: Bldg 3192 HOT CELL

Sample Type: ☑ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☑ Low Volume ☐ Lapel/Personal

Total Sample Run Time		**Sample Average Flow Rate**		**Total Volume**
100 minutes	X	2.5 cfm X 2.83E+4	=	$7.1E^{6}$ ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 0630	10 cts	10 min	1 cpm	0.2 cpm	1 cpm	2 .67	.282	2.22E+6	$2.4E^{-6}$ µCi
βγ 0630	603 cts	10 min	60 cpm	53 cpm	7 cpm	7 .95	.244	2.22E+6	$1.4E^{-5}$ µCi

Technician Performing Initial Count: R Trang45 Date: 7-19-96

Initial Activity		**Volume**		**Initial Activity**
α $2.4E^{-6}$ µCi X FR	÷	$7.1E^{6}$ ml	=	$3.4E^{-13}$ µCi/ml α
βγ $1.4E^{-5}$ µCi X FR	÷	$7.1E^{6}$ ml	=	$2E^{-12}$ µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R Trang Date: 7-19-96

ATG Supervisor: Neal White Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-19-96

A/S ID Number: 1211 RWP Number: EM-107 Survey Number: Fma-173

Date Start: 7-19-96 Date Stop: 7-19-96

Time Start: 06:40 Time Stop: 08:40 Total Time: 120 minutes

Flow Start: 3 CFM Flow Stop: 2.5 CFM

Sample Location: Bldg 3192 Hot Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
120 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	9.3E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 09:00	617 cts	10 min	62 cpm	0.2 cpm	62 cpm	92 .67	.282	2.22E+6	1.4E-4 µCi
βγ 09:00	2078 cts	10 min	208 cpm	53 cpm	155 cpm	163 .95	.294	2.22E+6	3E-4 µCi

Technician Performing Initial Count: R TRANQUI Date: 7-19-96

Initial Activity		Volume		Initial Activity
α 1.4E-4 µCi X FR	÷	9.3E6 ml	=	1.5E-11 µCi/ml α
βγ 3E-4 µCi X FR	÷	9.3E6 ml	=	3.2E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: R. TRANQUI Date: 7-19-96

ATG Supervisor: Neal Wilkins Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: FT McCLELLAN Date: 7-22-96

A/S ID Number: 1211 RWP Number: FM 107 Survey Number: FMH-174

Date Start: 7-22-96 Date Stop: 7-22-96

Time Start: 0855 Time Stop: 1055 Total Time: 120 minutes

Flow Start: 3 CFM Flow Stop: 2 CFM

Sample Location: BLDG 3192 Hot Cell

Sample Type: ☑ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☑ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
120 minutes	X	2.5 cfm X 2.83E+4	=	8.5 E6 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1200	301 cts	10 min	30 cpm	0.4 cpm	30 cpm	45 .67	.264	2.22E+6	7.7 E-5 µCi
βγ 1200	1242 cts	10 min	124 cpm	60 cpm	64 cpm	67 .95	.158	2.22E+6	1.9 E-4 µCi

Technician Performing Initial Count: Debora R. Holdston Date: 7-22-96

Initial Activity		Volume		Initial Activity
α 7.7 E-5 µCi X FR	÷	8.5 E6 ml	=	9.1 E-12 µCi/ml α
βγ 1.9 E-4 µCi X FR	÷	8.5 E6 ml	=	2.2 E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: Debora R. Holdston Date: 7-22-96

ATG Supervisor: Neil D. Whitty Date: 7-22-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft McClellan Date: 7-23-96

A/S ID Number: 1211 RWP Number: FM-107 Survey Number: FMA 175

Date Start: 7-23-96 Date Stop: 7-23-96

Time Start: 11:10 Time Stop: 13:40 Total Time: 180 minutes

Flow Start: 3 Flow Stop: 3

Sample Location: Bldg 3192 HOT Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
180 minutes	X	3 cfm X 2.83E+4	=	1.5E7 ml
		N/A lpm X 1.0E+3		

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 1340	2315 cts	10 min	232 cpm	0.1 cpm	232 cpm	346 .67	.282	2.22E+6	55E-8 µCi
βγ 1340	5450 cts	10 min	545 cpm	60 cpm	485 cpm	510 .95	.241	2.22E+6	9.5E-4 µCi

Technician Performing Initial Count: Richard E Traviga Date: 7-23-96

Initial Activity		Volume		Initial Activity
α 5.5E-4 µCi X FR	÷	1.5E7 ml	=	3.7E-11 µCi/ml α
βγ 9.5E-4 µCi X FR	÷	1.5E7 ml	=	6.4E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC vaiue of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: Richard E Traviga Date: 7-23-96

ATG Supervisor: Neal Whitty Date: 7-23-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft. McClellan Date: 07-23-96

A/S ID Number: 121 RWP Number: FM-107 Survey Number: FMA-176

Date Start: 07-23-96 Date Stop: 07-23-96

Time Start: 1345 Time Stop: 1545 Total Time: 120 minutes

Flow Start: 3.0 FM Flow Stop: 2.5

Sample Location: BLDG 3192 Hot Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
120 minutes	X	2.75 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	9.3E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α/600	1862 cts	10 min	186 cpm	0.1 cpm	186 cpm	278 .67	.282%	2.22E+6	4.4E-11 µCi
βγ/600	5046 cts	10 min	505 cpm	60 cpm	445 cpm	464 .95	.241	2.22E+6	8E-4 µCi

Technician Performing Initial Count: [signature] Date: 07-23-96

Initial Activity		Volume		Initial Activity
α 4.4E-11 µCi X FR	÷	9.3E6 ml	=	4.8E-11 µCi/ml α
βγ 8.8E-4 µCi X FR	÷	9.3E6 ml	=	9.5E-11 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: [signature] Date: 07-23-96

ATG Supervisor: [signature] Date: 7-24-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Ft. McClellan Date: 07-24-96

A/S ID Number: _____ RWP Number: FM-107 Survey Number: FMA-177

Date Start: 07-24-96 Date Stop: 07-24-96

Time Start: 0650 Time Stop: 0750 Total Time: 60 minutes

Flow Start: 3 Flow Stop: 3

Sample Location: BLDG 3192 Hot Cell

Sample Type: ☒ Breathing Zone ☐ General Area ☐ Other: _____
☐ High Volume ☒ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
60 minutes	X	3 cfm X 2.83E+4 N/A lpm X 1.0E+3	=	5.1E6 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / μCi ÷	Activity =
α 11:00 AM	115 cts	10 min	12 cpm	0.3 cpm	12 cpm	18 .67	.248%	2.22E+6	3.3E5 μCi
βγ 11:00 AM	994 cts	10 min	99 cpm	51 cpm	48 cpm	51 .95	.243%	2.22E+6	9.5E5 μCi

Technician Performing Initial Count: Ramon D Gray Date: 07-24-96

Initial Activity		Volume		Initial Activity
α 3.3E5 μCi X FR	÷	5.1E6 ml	=	6.6E-12 μCi/ml α
βγ 9.5E5 μCi X FR	÷	5.1E6 ml	=	1.9E-11 μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: Ramon D Gray Date: 07-24-96

ATG Supervisor: Neal White Date: 7-24-96

AIR SAMPLE DATA WORK SHEET

Project/Location: Fort McClellan Date: 7-25-96

A/S ID Number: 001211 RWP Number: Fm107 Survey Number: FMA178

Date Start: 7 22 96 Date Stop: 7 22 96

Time Start: 1240 Time Stop: 1545 Total Time: 185 minutes

Flow Start: 3 cfm. Flow Stop: 2.5

Sample Location: Hot Cell

Sample Type: ☆ Breathing Zone ☐ General Area ☐ Other:
☐ High Volume ☆ Low Volume ☐ Lapel/Personal

Total Sample Run Time		Sample Average Flow Rate		Total Volume
185 minutes	X	2.75 cfm X 2.83E+4 / X lpm X 1.0E+3	=	1.4E7 ml

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm / dpm ÷	dpm / µCi ÷	Activity =
α 6.45	4 cts	10 min	.4 cpm	.3 cpm	0.1 cpm	.2 .67	.263	2.22E+6	3.1E-7 µCi
βγ 6.45	611 cts	10 min	61 cpm	58 cpm	1. cpm	1 .95	.954	2.22E+6	2.92E-6 µCi

Technician Performing Initial Count: Richard A Ruprecht Date: 7-25-96

Initial Activity		Volume		Initial Activity
α 3.4E-7 µCi X FR	÷	1.4E7 ml	=	2.4E-14 µCi/ml α
βγ 2.92E-6 µCi X FR	÷	1.4E7 ml	=	2.1E-13 µCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: Richard A Ruprecht Date: 7-25-96

ATG Supervisor: Neal White Date: 7-25-96