



Transportation  
Security  
Administration

May 23, 2012

Mr. Jeff Holmgren  
Federal Security Director  
Transportation Security Administration  
Boise-Gowen Field Airport (BOI)

Dear Mr. Holmgren:

The TSA Occupational Safety, Health, and Environment (OSHE) Division is sponsoring an independent radiation protection survey project of general-use backscatter x-ray advanced imaging technology (AIT) systems and cabinet x-ray systems through an interagency agreement with the U.S. Army Public Health Command (USAPHC). This survey project is not to be confused with the radiation surveys performed during preventive maintenance service. The preventive maintenance radiation surveys are conducted at least annually by certified equipment maintenance personnel under specific testing conditions, whereas this survey project is conducted by USAPHC personnel under normal operating conditions; e.g., baggage flow-through or passenger screening with TSOs in attendance.

As part of the survey project, a radiation protection survey of selected general-use backscatter x-ray AIT and cabinet x-ray systems used at TSA BOI was conducted on April 2-3, 2012, by a team lead by a certified health physicist from USAPHC's Health Physics Program, Army Institute of Public Health. The purpose of the survey was to ensure that the general-use backscatter x-ray AIT systems comply with the requirements of ANSI/HPS N43.17-2009, that the cabinet x-ray systems comply with the Food and Drug Administration's Performance Standards for Ionizing Radiation Emitting Products under Title 21, CFR, Subchapter J (21 CFR 1020.40 Cabinet x-ray systems), and to identify any health hazards associated with the use of either of these x-ray systems.

*General-use Backscatter X-ray AIT Systems*

The results for the surveyed AIT systems are described in the attached report and in applicable survey worksheets (Enclosure 1 of attached report), and are summarized as follows:

A total of three general-use backscatter x-ray AIT systems were surveyed and found to be in compliance with the radiation dose limits specified in ANSI/HPS N43.17-2009. There are no health hazards associated with the use of these general-use backscatter x-ray AIT systems provided appropriate operating procedures are followed. In addition, the general-use backscatter x-ray AIT systems were in compliance with other (non-emission) requirements of ANSI/HPS N43.17-2009.

*Cabinet X-ray Systems*

The results for the surveyed cabinet x-ray systems are described in the attached report and in the survey worksheets (Enclosure 2 of the attached report), and are summarized as follows:

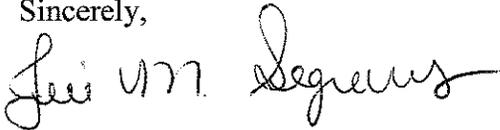
A total of five cabinet x-ray systems were surveyed and found to be in compliance with the emissions limit specified in Title 21, CFR, Subchapter J, Section 1020.40. There are no health hazards associated with the use of these cabinet x-ray systems provided appropriate operating procedures are followed. In addition, the cabinet x-ray systems complied with other (non-emission) requirements of Title 21, CFR, Subchapter J, Section 1020.40.

No corrective actions are required for any of the screening systems based on the results of this survey.

If you have questions or comments about the report's contents, please direct them to me at

[REDACTED]

Sincerely,



Jill M. Segraves, CSP  
Director  
Occupational Safety, Health, and Environment Division

cc: Mr. Jerry Murphy, Assistant Federal Security Director – Screening / Designated  
Occupational Safety and Health Official (BOI)  
Mr. Jeff Carson, Transportation Security Manager (BOI)  
Ms. Christine Halfacre, Chief of Staff, Office of Security Technology

Enclosure: TSA BOI Radiation Protection Survey Report, dated 15 May 2012



DEPARTMENT OF THE ARMY  
US ARMY INSTITUTE OF PUBLIC HEALTH  
5158 BLACKHAWK ROAD  
ABERDEEN PROVING GROUND MD 21010-5403

15 MAY 2012

Health Physics Program

Ms. Jill Segraves  
Transportation Security Administration  
TSA-17 OSHE  
601 South 12<sup>th</sup> Street  
Arlington, Virginia 20598-6017

Dear Ms. Segraves:

This letter is in reference to the Memorandum of Agreement between the U.S. Army Medical Command and the Transportation Security Administration (TSA), signed September 10, 2008; electronic mail message, subject: 2400.2.1 BOI Radiation Safety Surveys, March 2, 2012; American National Standards Institute/Health Physics Society (ANSI/HPS) N43.17-2009; and Title 21, Code of Federal Regulations (CFR), Subchapter J.

A radiation protection survey was performed on April 2-3, 2012 at Boise-Gowen Field Airport (BOI), Boise, ID, Project No. 26-MF-0FZ3-12. The survey was performed to:

- a. Evaluate three advanced imaging technology (AIT) x-ray systems to ensure compliance with the requirements of ANSI/HPS N43.17-2009.
- b. Evaluate selected cabinet x-ray systems to ensure compliance with the requirements of Title 21, CFR, Subchapter J.
- c. Identify any health hazards associated with the use of these x-ray systems.
- d. Provide recommendations to assist in correcting any areas of regulatory noncompliance or health hazards.

The survey was performed by [REDACTED], Certified Health Physicist (CHP), Health Physics Program (HPP), Army Institute of Public Health (AIPH) and [REDACTED], Research Analyst, HPP, AIPH. Three AIT x-ray systems were evaluated for compliance with the requirements of ANSI/HPS N43.17-2009 and five cabinet x-ray systems were evaluated for compliance with the requirements of Title 21, CFR, Subchapter J. The survey results for each AIT system are provided in Enclosure 1. The survey results for each cabinet x-ray system are provided in Enclosure 2.

All AIT x-ray systems tested were found to be in compliance with the radiation dose limits specified in ANSI/HPS N43.17-2009. All cabinet x-ray systems tested were found

to be in compliance with the emissions limit specified in Title 21, CFR, Subchapter J. There are no health hazards associated with the use of these systems provided appropriate operating procedures are followed.

The AIT system surveyed was found to be in compliance with the other requirements of ANSI/HPS N43.17-2009.

All cabinet x-ray systems tested were found to be in compliance with the other requirements of Title 21, CFR, Subchapter J.

Based on dosimetry and field measurements around the Secure 1000 SP and cabinet x-ray systems, it is estimated that Transportation Security Officers will receive a radiation dose of less than 10 millirem per year. For comparison, the occupational limit under Occupational Safety and Health Administration regulations is 1,250 millirem per quarter (5,000 millirem per year). The goal of the TSA radiation safety program is to keep all exposure less than 100 millirem per year.

The survey officers discussed the survey results with Mr. Jeff Carson, Transportation Security Manager, TSA, Idaho; Gerard Murphy, Assistant Federal Security Director, Operations, TSA, Idaho; and Mr. Larry Auman, CHP, TSA Headquarters on April 3, 2012. Draft survey notes were provided at that time. A copy of the final survey notes is provided in Enclosure 3.

For more information concerning the survey, please contact the AIPH, Health Physics Program, at (410) 436-3502.

Sincerely,

A large black rectangular redaction box covering the signature of the sender.

Portfolio Director  
Occupational Health Sciences

3 Enclosures

## Survey Results for Three AIT X-Ray System

# Survey Worksheet - AIT X-Ray Systems

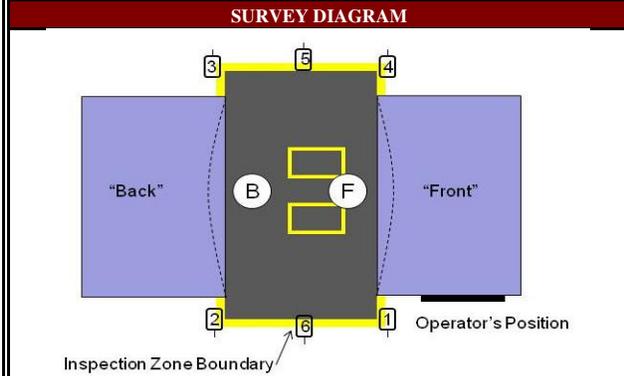
Health Physics Program  
U.S. Army Public Health Command  
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA				SURVEY LOCATION			
Project No.	26-MF-0FZ3-12			Location	Checkpoint Lane 1/2 (AIT #1)		
Survey Date	2 Apr 2012			Organization	Boise-Gowen Field Airport		
Surveyor(s)	██████████ CHP			Street Address	3201 Airport Way		
	██████████			City/Installation	Boise	State	ID ZIP 83705

INSTRUMENTS USED				SYSTEM INFORMATION				
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	Secure 1000SP	S51011001	Mar. 2010
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	NA	Place of Manufacture	Torrance, CA
Instrument #3	WB Johnson	TVX-2000	40155	*	Service Provider Survey Date	25 Jan 2012		

VISUAL INSPECTION			
Y	N	Requirement	Requirement
X		Key activated control with key capture? (ANSI N43.17-2009, paragraph 7.2.1.c)	At least one lighted scan in progress indicator visible from the inspection zone? (ANSI N43.17-2009, paragraph 7.2.1.b)
X		"Caution: X-Rays Produced When Energized" label present at control to initiate scan? (ANSI N43.17-2009, paragraph 7.2.2.d)	X-ray emission terminates after a preset time or exposure? (ANSI N43.17-2009, paragraph 7.2.2.e)
X		Technique factors preset for each mode of operation? (ANSI N43.17-2009, paragraph 7.2.2.b)	Operators have a clear view of the scanning area? (ANSI N43.17-2009, paragraph 7.2.1.f)
X		Means to initiate emission of radiation other than an interlock or main power control? (ANSI N43.17-2009, paragraph 7.2.1.d)	Tool or key required to open or remove access panels? (ANSI N43.17-2009, paragraph 7.2.1.i)
X		Means to terminate emission of radiation other than an interlock? (ANSI N43.17-2009, paragraph 7.2.1.e)	User provided with required information? (ANSI N43.17-2009, paragraph 7.5)
X		Scan in progress indicator visible for any location from which a scan can be initiated? (ANSI N43.17-2009, paragraph 7.2.1.a)	

NT=not tested; NA=not applicable.



SCANNING MEASUREMENTS			
Scanning below action levels?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
(If no, explain in comments)			
Inspection zone boundary scanned with Instrument #3.			

SCATTERED RADIATION (Optional)							
Location	Scan 1	Scan 2	Scan 3	Average			
#1	0.00 μR	0.07 μR	0.07 μR	0.05 μR			
#2	0.07 μR	0.00 μR	0.07 μR	0.05 μR			
#3	0.07 μR	0.00 μR	0.07 μR	0.05 μR			
#4	0.07 μR	0.00 μR	0.00 μR	0.02 μR			
#5	0.00 μR		#6	0.07 μR			

Measurements made with Instruments #1 & #2

DOSE PER SCREENING			
Exposure (X)			
Trial	"Front" Side	"Back" Side	Reference Effective Dose per Screening (max 25 μrem):
a	5.88 μR	5.90 μR	1.8 μrem
b	5.88 μR	5.90 μR	
c	5.96 μR	5.83 μR	or 0.018 μSv
d	5.89 μR	5.83 μR	
e	5.96 μR	5.83 μR	
AVG	5.91 μR	5.86 μR	
Energy Correction Factor	1.25		
<b>RESULT PASS</b>			

Measurements made with Instruments #1 & #2

BEAM QUALITY			
Exposure (X)			
mm Al	"Front" Side	"Back" Side	HVL "Front" Side
0	1.77 μR	1.77 μR	1.1 mm Al
0	1.77 μR	1.77 μR	HVL "Back" Side
1	0.92 μR	0.92 μR	Conversion Factor
1	0.92 μR	0.92 μR	0.120
1.5	0.71 μR	0.71 μR	Min. Filtration <sup>1</sup>
1.5	0.71 μR	0.78 μR	1.0 mm Al

<sup>1</sup> An HVL of 1 mm Al corresponds to a filtration of 1 mm Al for this system

**RESULT PASS**

Measurements made with Instruments #1 & #2

**COMMENTS AND RECOMMENDATIONS**

\* Instrument #3 was response checked before and after the survey.

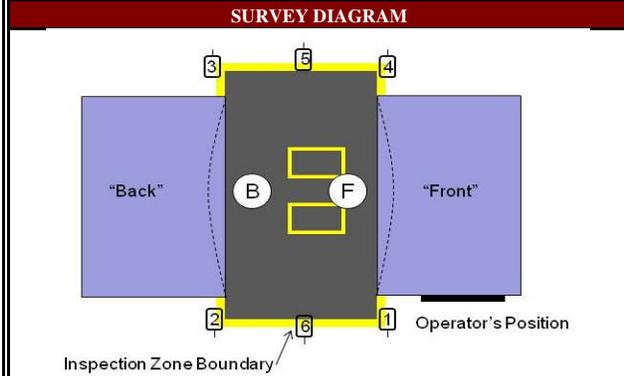
# Survey Worksheet - AIT X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command  
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA				SURVEY LOCATION			
Project No.	26-MF-0FZ3-12			Location	Checkpoint Lane 3/4 (AIT #2)		
Survey Date	2 Apr 2012			Organization	Boise-Gowen Field Airport		
Surveyor(s)	██████ CHP			Street Address	3201 Airport Way		
	██████			City/Installation	Boise	State	ID ZIP 83705

INSTRUMENTS USED				SYSTEM INFORMATION				
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	Secure 1000SP	S51010005	Mar. 2010
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	NA	Place of Manufacture	Torrance, CA
Instrument #3	WB Johnson	TVX-2000	40155	*	Service Provider Survey Date	25 Jan 2012		

VISUAL INSPECTION			
Y	N	Requirement	Requirement
X		Key activated control with key capture? <small>(ANSI N43.17-2009, paragraph 7.2.1.c)</small>	At least one lighted scan in progress indicator visible from the inspection zone? <small>(ANSI N43.17-2009, paragraph 7.2.1.b)</small>
X		"Caution: X-Rays Produced When Energized" label present at control to initiate scan? <small>(ANSI N43.17-2009, paragraph 7.2.2.d)</small>	X-ray emission terminates after a preset time or exposure? <small>(ANSI N43.17-2009, paragraph 7.2.2.e)</small>
X		Technique factors preset for each mode of operation? <small>(ANSI N43.17-2009, paragraph 7.2.2.b)</small>	Operators have a clear view of the scanning area? <small>(ANSI N43.17-2009, paragraph 7.2.1.f)</small>
X		Means to initiate emission of radiation other than an interlock or main power control? <small>(ANSI N43.17-2009, paragraph 7.2.1.d)</small>	Tool or key required to open or remove access panels? <small>(ANSI N43.17-2009, paragraph 7.2.1.i)</small>
X		Means to terminate emission of radiation other than an interlock? <small>(ANSI N43.17-2009, paragraph 7.2.1.e)</small>	User provided with required information? <small>(ANSI N43.17-2009, paragraph 7.5)</small>
X		Scan in progress indicator visible for any location from which a scan can be initiated? <small>(ANSI N43.17-2009, paragraph 7.2.1.a)</small>	
NT=not tested; NA=not applicable.			



SCANNING MEASUREMENTS			
Scanning below action levels?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
(If no, explain in comments)			
Inspection zone boundary scanned with Instrument #3.			

SCATTERED RADIATION (Optional)							
Location	Scan 1	Scan 2	Scan 3	Average			
#1	0.00 μR	0.07 μR	0.07 μR	0.05 μR			
#2	0.00 μR	0.07 μR	0.07 μR	0.05 μR			
#3	0.07 μR	0.07 μR	0.07 μR	0.07 μR			
#4	0.07 μR	0.07 μR	0.07 μR	0.07 μR			
#5	0.07 μR		#6	0.07 μR			

Measurements made with Instruments #1 & #2

DOSE PER SCREENING			
Exposure (X)			
Trial	"Front" Side	"Back" Side	Reference Effective Dose per Screening (max 25 μrem):
a	6.76 μR	7.12 μR	2.3 μrem or 0.023 μSv
b	6.84 μR	6.91 μR	
c	6.77 μR	7.05 μR	
d	6.77 μR	7.04 μR	
e	6.68 μR	6.91 μR	
AVG	6.76 μR	7.01 μR	
Energy Correction Factor	1.25		
<b>RESULT PASS</b>			
Measurements made with Instruments #1 & #2			

BEAM QUALITY			
Exposure (X)			
mm Al	"Front" Side	"Back" Side	HVL "Front" Side
0	2.07 μR	2.00 μR	1.2 mm Al
0	1.99 μR	2.07 μR	HVL "Back" Side
1	1.14 μR	1.00 μR	1.0 mm Al
1	1.07 μR	1.07 μR	Conversion Factor
1.5	0.93 μR	0.86 μR	0.132
1.5	0.86 μR	0.79 μR	Min. Filtration <sup>1</sup>
<b>RESULT PASS</b>			
Measurements made with Instruments #1 & #2			

**COMMENTS AND RECOMMENDATIONS**

\* Instrument #3 was response checked before and after the survey.

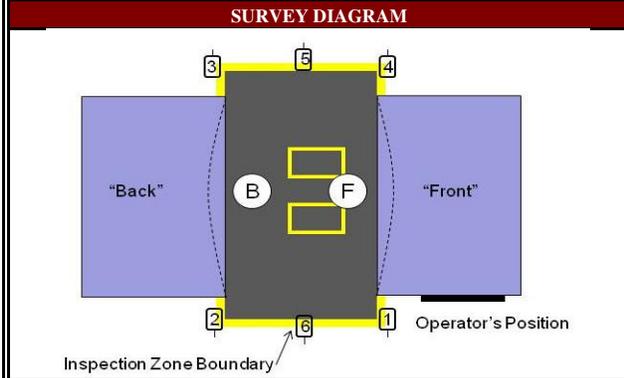
# Survey Worksheet - AIT X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command  
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA				SURVEY LOCATION			
Project No.	26-MF-0FZ3-12			Location	Checkpoint Lane 5 (AIT #3)		
Survey Date	2 Apr 2012			Organization	Boise-Gowen Field Airport		
Surveyor(s)	██████ CHP			Street Address	3201 Airport Way		
	██████			City/Installation	Boise	State	ID ZIP 83705

INSTRUMENTS USED				SYSTEM INFORMATION				
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	Secure 1000SP	S51010004	Mar. 2010
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	NA	Place of Manufacture	Torrance, CA
Instrument #3	WB Johnson	TVX-2000	40155	*	Service Provider Survey Date	25 Jan 2012		

VISUAL INSPECTION							
Y	N	<b>Requirement</b>		Y	N	<b>Requirement</b>	
X		Key activated control with key capture? (ANSI N43.17-2009, paragraph 7.2.1.c)		X		At least one lighted scan in progress indicator visible from the inspection zone? (ANSI N43.17-2009, paragraph 7.2.1.b)	
X		"Caution: X-Rays Produced When Energized" label present at control to initiate scan? (ANSI N43.17-2009, paragraph 7.2.2.d)		X		X-ray emission terminates after a preset time or exposure? (ANSI N43.17-2009, paragraph 7.2.2.e)	
X		Technique factors preset for each mode of operation? (ANSI N43.17-2009, paragraph 7.2.2.b)		X		Operators have a clear view of the scanning area? (ANSI N43.17-2009, paragraph 7.2.1.f)	
X		Means to initiate emission of radiation other than an interlock or main power control? (ANSI N43.17-2009, paragraph 7.2.1.d)		X		Tool or key required to open or remove access panels? (ANSI N43.17-2009, paragraph 7.2.1.i)	
X		Means to terminate emission of radiation other than an interlock? (ANSI N43.17-2009, paragraph 7.2.1.e)		X		User provided with required information? (ANSI N43.17-2009, paragraph 7.5)	
X		Scan in progress indicator visible for any location from which a scan can be initiated? (ANSI N43.17-2009, paragraph 7.2.1.a)		NT=not tested; NA=not applicable.			



SCANNING MEASUREMENTS			
Scanning below action levels?	Yes	<input checked="" type="checkbox"/>	No <input type="checkbox"/>
(If no, explain in comments)			
Inspection zone boundary scanned with Instrument #3.			

SCATTERED RADIATION (Optional)							
Location	Scan 1	Scan 2	Scan 3	Average			
#1	0.07 $\mu$ R	0.14 $\mu$ R	0.07 $\mu$ R	0.09 $\mu$ R	0.09 $\mu$ R		
#2	0.07 $\mu$ R						
#3	0.07 $\mu$ R						
#4	0.07 $\mu$ R	0.14 $\mu$ R	0.07 $\mu$ R	0.09 $\mu$ R	0.09 $\mu$ R		
#5	0.07 $\mu$ R		#6	0.07 $\mu$ R			
Measurements made with Instruments #1 & #2							

DOSE PER SCREENING				
	<b>Exposure (X)</b>			Reference Effective Dose per Screening (max 25 $\mu$ rem): <div style="border: 1px solid black; padding: 2px; display: inline-block;">2.1 <math>\mu</math>rem</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">0.021 <math>\mu</math>Sv</div>
Trial	"Front" Side	"Back" Side		
a	7.02 $\mu$ R	6.78 $\mu$ R	$\mu$ R	
b	6.95 $\mu$ R	6.63 $\mu$ R	$\mu$ R	
c	7.03 $\mu$ R	6.69 $\mu$ R	$\mu$ R	
d	6.96 $\mu$ R	6.77 $\mu$ R	$\mu$ R	
e	7.03 $\mu$ R	6.71 $\mu$ R	$\mu$ R	
AVG	7.00 $\mu$ R	6.72 $\mu$ R	$\mu$ R	
Energy Correction Factor	1.25			
<b>RESULT</b> <span style="border: 1px solid black; padding: 2px; color: white; font-weight: bold;">PASS</span>				
Measurements made with Instruments #1 & #2				

BEAM QUALITY				
	<b>Exposure (X)</b>			HVL "Front" Side <span style="border: 1px solid black; padding: 2px;">1.0</span> mm Al HVL "Back" Side <span style="border: 1px solid black; padding: 2px;">1.1</span> mm Al Conversion Factor <span style="border: 1px solid black; padding: 2px;">0.117</span> Min. Filtration <sup>1</sup> <span style="border: 1px solid black; padding: 2px;">1.0</span> mm Al  <sup>1</sup> An HVL of 1 mm Al corresponds to a filtration of 1 mm Al for this system
mm Al	"Front" Side	"Back" Side		
0	1.98 $\mu$ R	1.92 $\mu$ R	$\mu$ R	
0	1.98 $\mu$ R	1.98 $\mu$ R	$\mu$ R	
1	0.99 $\mu$ R	0.99 $\mu$ R	$\mu$ R	
1	0.99 $\mu$ R	0.99 $\mu$ R	$\mu$ R	
1.5	0.78 $\mu$ R	0.92 $\mu$ R	$\mu$ R	
1.5	0.78 $\mu$ R	0.85 $\mu$ R	$\mu$ R	
<b>RESULT</b> <span style="border: 1px solid black; padding: 2px; color: white; font-weight: bold;">PASS</span>				
Measurements made with Instruments #1 & #2				

**COMMENTS AND RECOMMENDATIONS**

\* Instrument #3 was response checked before and after the survey.

## Survey Results for Five Cabinet X-Ray Systems

# Survey Worksheet - Cabinet X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command

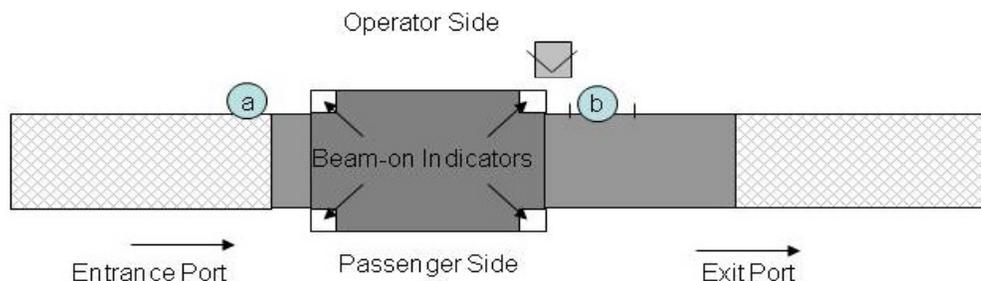
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA				SURVEY LOCATION			
Project No.	26-MF-0FZ3-12			Location	Checkpoint Lane 1		
Survey Date	3 Apr 2012			Organization	Boise-Gowen Field Airport		
Surveyor(s)	CHP			Street Address	3201 Airport Way		
				City/Installation	Boise	State	ID ZIP 83705

INSTRUMENTS USED				SYSTEM INFORMATION				
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	620DV	7110910	Feb. 2011
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Place of Manufacture	Torrance, CA
Instrument #3	Radcal	10X5-180	18793	28 Jul 2012	Type	Checkpoint <input checked="" type="checkbox"/>	EDS: In-line <input type="checkbox"/>	Stand-Alone <input type="checkbox"/>
Instrument #4	WB Johnson	TVX-2000	40155	*	Manufacturer Survey Date	16 Feb 2012		

VISUAL INSPECTION	
Y N	Requirement
X	Warning label "Caution: X-Rays Produced When Energized" present at control panel? (21 CFR 1020.40(c)(8)(i))
X	Warning label "Caution: Do Not Insert Any Part of the Body When System Is Energized - X-Ray Hazard" present at each port? (21 CFR 1020.40(c)(8)(ii))
X	Two independent "x-ray on" indicators visible from control panel? (21 CFR 1020.40(c)(6)(iii))
X	One "x-ray on" indicator visible from each port and access panel? (21 CFR 1020.40(c)(6)(iv))
X	Key Activated Control present? (21 CFR 1020.40(c)(6)(i))
X	Means to require operator presence at control panel? (21 CFR 1020.40(c)(10))
	Means to initiate and terminate x-ray generation? (21 CFR 1020.40(c)(6)(ii); 1020.40(c)(10)(i) or (ii))
	Leaded drapes in good condition?
	Interlocks not bypassed?
	Current User's Manual available? (21 CFR 1020.40(c)(9))
	Maintenance performed according to recommended schedule? (21 CFR 1020.40(c)(9))
	NT=not tested; NA=not applicable.

## SURVEY DIAGRAM



Accessible exterior surfaces of cabinet scanned with Instrument #4. All scanning results below action levels? Yes  No  (If no, explain below)

DOSE TO BAGGAGE			EXPOSURE OUTSIDE CABINET				
Trial	Exposure (X <sub>i</sub> )		Ambient Background	0.00 μR			
1	0.8738 mR	$CV = (1/X_{avg})(\sum(X_i - X_{avg})^2/(n-1))^{1/2}$	Location	Exposure	Time	Exposure in 1 hr	RESULT
2	0.8582 mR		a	7.56 μR	5.0 min	0.091 mR	PASS
3	0.8576 mR		b	3.21 μR	5.0 min	0.039 mR	PASS
4	0.8847 mR		c	μR	min	mR	
5	0.8539 mR		d	μR	min	mR	
			e	μR	min	mR	

## COMMENTS AND RECOMMENDATIONS

Dose to baggage measured with instrument #1/#2 combination.  
Exposure outside cabinet measured with instrument #1/#2 combination.  
Empty bins used for exposure outside cabinet measurements.

\* Instrument #4 was response checked before and after the survey.

# Survey Worksheet - Cabinet X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command

Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA					SURVEY LOCATION								
Project No.		26-MF-0FZ3-12			Location		Checkpoint Lane 2						
Survey Date		3 Apr 2012			Organization		Boise-Gowen Field Airport						
Surveyor(s)		CHP			Street Address		3201 Airport Way						
					City/Installation		Boise	State	ID	ZIP 83705			
INSTRUMENTS USED					SYSTEM INFORMATION								
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date					
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	620DV	7110911	Feb. 2011					
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Place of Manufacture		Torrance, CA				
Instrument #3	Radcal	10X5-180	18793	28 Jul 2012	Type	Checkpoint <input checked="" type="checkbox"/>	EDS: In-line <input type="checkbox"/>	Stand-Alone <input type="checkbox"/>					
Instrument #4	WB Johnson	TVX-2000	40155	*	Manufacturer Survey Date		16 Feb 2012						
VISUAL INSPECTION													
Y	N	Requirement				Y	N	Requirement					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Warning label "Caution: X-Rays Produced When Energized" present at control panel? (21 CFR 1020.40(c)(8)(i))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Means to initiate and terminate x-ray generation? (21 CFR 1020.40(c)(6)(ii); 1020.40(c)(10)(i) or (ii))					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Warning label "Caution: Do Not Insert Any Part of the Body When System Is Energized - X-Ray Hazard" present at each port? (21 CFR 1020.40(c)(8)(ii))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Leaded drapes in good condition?					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Two independent "x-ray on" indicators visible from control panel? (21 CFR 1020.40(c)(6)(iii))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Interlocks not bypassed?					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	One "x-ray on" indicator visible from each port and access panel? (21 CFR 1020.40(c)(6)(iv))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Current User's Manual available? (21 CFR 1020.40(c)(9))					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key Activated Control present? (21 CFR 1020.40(c)(6)(i))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Maintenance performed according to recommended schedule? (21 CFR 1020.40(c)(9))					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Means to require operator presence at control panel? (21 CFR 1020.40(c)(10))						NT=not tested; NA=not applicable.					
SURVEY DIAGRAM													
Accessible exterior surfaces of cabinet scanned with Instrument #4. All scanning results below action levels? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> (If no, explain below)													
DOSE TO BAGGAGE					EXPOSURE OUTSIDE CABINET								
<b>Trial</b>	<b>Exposure (X<sub>i</sub>)</b>				Ambient Background		0.00 μR						
1	0.6878 mR	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td>X<sub>avg</sub></td> <td>0.69 mR</td> </tr> <tr> <td>CV</td> <td>0.0088</td> </tr> </table>			X <sub>avg</sub>	0.69 mR	CV	0.0088	<b>Location</b>	<b>Exposure</b>	<b>Time</b>	<b>Exposure in 1 hr</b>	<b>RESULT</b>
X <sub>avg</sub>	0.69 mR												
CV	0.0088												
2	0.6856 mR	a	7.41 μR	5.0 min	0.089 mR	PASS							
3	0.6838 mR	b	3.92 μR	5.0 min	0.047 mR	PASS							
4	0.6991 mR	c	μR	min	mR								
5	0.6912 mR	d	μR	min	mR								
		e	μR	min	mR								
<b>COMMENTS AND RECOMMENDATIONS</b>													
Dose to baggage measured with instrument #1/#2 combination. Exposure outside cabinet measured with instrument #1/#2 combination. Empty bins used for exposure outside cabinet measurements.													
* Instrument #4 was response checked before and after the survey.													

# Survey Worksheet - Cabinet X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command

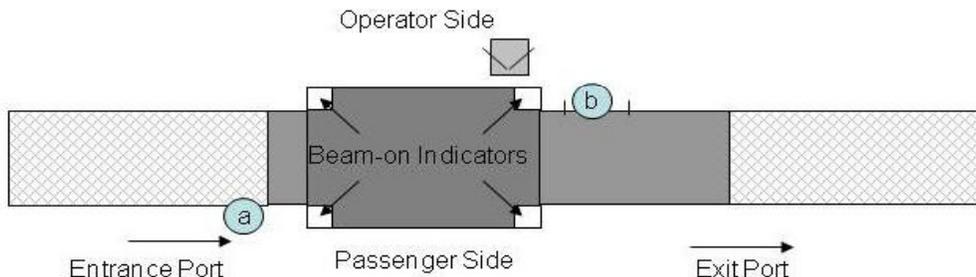
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA					SURVEY LOCATION					
Project No.	26-MF-0FZ3-12				Location	Checkpoint Lane 3				
Survey Date	3 Apr 2012				Organization	Boise-Gowen Field Airport				
Surveyor(s)	[Redacted] CHP				Street Address	3201 Airport Way				
	[Redacted]				City/Installation	Boise	State	ID	ZIP	83705

INSTRUMENTS USED					SYSTEM INFORMATION					
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date		
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	620DV	7110912	Feb. 2011		
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Place of Manufacture		Torrance, CA	
Instrument #3	Radcal	10X5-180	18793	28 Jul 2012	Type	Checkpoint <input checked="" type="checkbox"/>	EDS: In-line <input type="checkbox"/>	Stand-Alone <input type="checkbox"/>		
Instrument #4	WB Johnson	TVX-2000	40155	*	Manufacturer Survey Date		14 Feb 2012			

VISUAL INSPECTION											
Y	N	Requirement				Y	N	Requirement			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Warning label "Caution: X-Rays Produced When Energized" present at control panel? (21 CFR 1020.40(c)(8)(i))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Means to initiate and terminate x-ray generation? (21 CFR 1020.40(c)(6)(ii); 1020.40(c)(10)(i) or (ii))			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Warning label "Caution: Do Not Insert Any Part of the Body When System Is Energized - X-Ray Hazard" present at each port? (21 CFR 1020.40(c)(8)(ii))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Leaded drapes in good condition?			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Two independent "x-ray on" indicators visible from control panel? (21 CFR 1020.40(c)(6)(iii))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Interlocks not bypassed?			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	One "x-ray on" indicator visible from each port and access panel? (21 CFR 1020.40(c)(6)(iv))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Current User's Manual available? (21 CFR 1020.40(c)(9))			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key Activated Control present? (21 CFR 1020.40(c)(6)(i))				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Maintenance performed according to recommended schedule? (21 CFR 1020.40(c)(9))			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Means to require operator presence at control panel? (21 CFR 1020.40(c)(10))									NT=not tested; NA=not applicable.

### SURVEY DIAGRAM



Accessible exterior surfaces of cabinet scanned with Instrument #4. All scanning results below action levels? Yes  No  (If no, explain below)

DOSE TO BAGGAGE					EXPOSURE OUTSIDE CABINET																																				
<b>Trial</b>	<b>Exposure (X<sub>i</sub>)</b>				Ambient Background 0.00 μR																																				
1	0.9737 mR	<table border="1" style="margin: auto;"> <tr><td>X<sub>avg</sub></td><td>0.99 mR</td></tr> <tr><td>CV</td><td>0.0359</td></tr> </table> <p>Coefficient of Variation (CV): CV = (1/X<sub>avg</sub>)(Σ(X<sub>i</sub> - X<sub>avg</sub>)<sup>2</sup>/(n-1))<sup>1/2</sup></p>	X <sub>avg</sub>	0.99 mR	CV	0.0359	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Location</th> <th>Exposure</th> <th>Time</th> <th>Exposure in 1 hr</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>4.85 μR</td> <td>5.0 min</td> <td>0.058 mR</td> <td style="background-color: #90EE90;">PASS</td> </tr> <tr> <td>b</td> <td>2.35 μR</td> <td>5.0 min</td> <td>0.028 mR</td> <td style="background-color: #90EE90;">PASS</td> </tr> <tr> <td>c</td> <td>μR</td> <td>min</td> <td>mR</td> <td style="background-color: #FFB6C1;"></td> </tr> <tr> <td>d</td> <td>μR</td> <td>min</td> <td>mR</td> <td style="background-color: #FFB6C1;"></td> </tr> <tr> <td>e</td> <td>μR</td> <td>min</td> <td>mR</td> <td style="background-color: #FFB6C1;"></td> </tr> </tbody> </table>					Location	Exposure	Time	Exposure in 1 hr	RESULT	a	4.85 μR	5.0 min	0.058 mR	PASS	b	2.35 μR	5.0 min	0.028 mR	PASS	c	μR	min	mR		d	μR	min	mR		e	μR	min	mR	
X <sub>avg</sub>	0.99 mR																																								
CV	0.0359																																								
Location	Exposure		Time	Exposure in 1 hr	RESULT																																				
a	4.85 μR		5.0 min	0.058 mR	PASS																																				
b	2.35 μR	5.0 min	0.028 mR	PASS																																					
c	μR	min	mR																																						
d	μR	min	mR																																						
e	μR	min	mR																																						
2	0.9703 mR																																								
3	0.9898 mR																																								
4	0.9641 mR																																								
5	1.051 mR																																								

### COMMENTS AND RECOMMENDATIONS

Dose to baggage measured with instrument #1/#2 combination.  
Exposure outside cabinet measured with instrument #1/#2 combination.

\* Instrument #4 was response checked before and after the survey.

# Survey Worksheet - Cabinet X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command

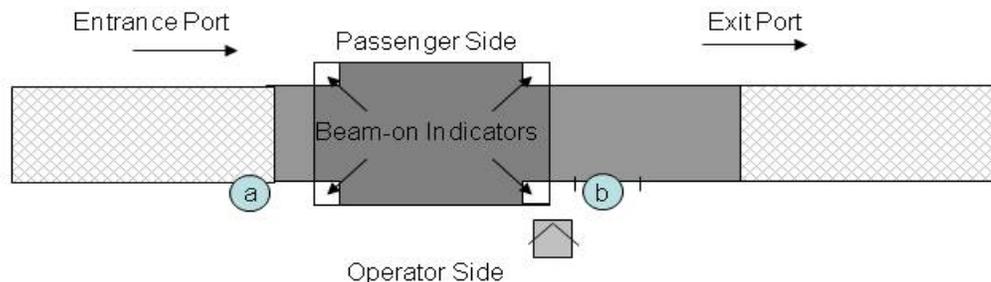
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA				SURVEY LOCATION			
Project No.	26-MF-0FZ3-12			Location	Checkpoint Lane 4		
Survey Date	3 Apr 2012			Organization	Boise-Gowen Field Airport		
Surveyor(s)	[Redacted] CHP			Street Address	3201 Airport Way		
	[Redacted]			City/Installation	Boise	State	ID ZIP 83705

INSTRUMENTS USED				SYSTEM INFORMATION				
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	620DV	7110913	Feb. 2011
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Place of Manufacture	Torrance, CA
Instrument #3	Radcal	10X5-180	18793	28 Jul 2012	Type	Checkpoint <input checked="" type="checkbox"/>	EDS: In-line <input type="checkbox"/>	Stand-Alone <input type="checkbox"/>
Instrument #4	WB Johnson	TVX-2000	40155	*	Manufacturer Survey Date	7 Feb 2012		

VISUAL INSPECTION	
Y	N
	<b>Requirement</b>
<input checked="" type="checkbox"/>	Warning label "Caution: X-Rays Produced When Energized" present at control panel? (21 CFR 1020.40(c)(8)(i))
<input checked="" type="checkbox"/>	Warning label "Caution: Do Not Insert Any Part of the Body When System Is Energized - X-Ray Hazard" present at each port? (21 CFR 1020.40(c)(8)(ii))
<input checked="" type="checkbox"/>	Two independent "x-ray on" indicators visible from control panel? (21 CFR 1020.40(c)(6)(iii))
<input checked="" type="checkbox"/>	One "x-ray on" indicator visible from each port and access panel? (21 CFR 1020.40(c)(6)(iv))
<input checked="" type="checkbox"/>	Key Activated Control present? (21 CFR 1020.40(c)(6)(i))
<input checked="" type="checkbox"/>	Means to require operator presence at control panel? (21 CFR 1020.40(c)(10))
	Means to initiate and terminate x-ray generation? (21 CFR 1020.40(c)(6)(ii); 1020.40(c)(10)(i) or (ii))
	Leaded drapes in good condition?
	Interlocks not bypassed?
	Current User's Manual available? (21 CFR 1020.40(c)(9))
	Maintenance performed according to recommended schedule? (21 CFR 1020.40(c)(9))
NT=not tested; NA=not applicable.	

### SURVEY DIAGRAM



Accessible exterior surfaces of cabinet scanned with Instrument #4. All scanning results below action levels? Yes  No  (If no, explain below)

DOSE TO BAGGAGE				EXPOSURE OUTSIDE CABINET					
Trial	Exposure (X <sub>i</sub> )			Ambient Background	0.00 μR				
1	0.8989 mR			Location	Exposure	Time	Exposure in 1 hr	RESULT	
2	1.793 mR	X <sub>avg</sub>	1.4 mR	a	6.21 μR	5.0 min	0.075 mR	PASS	
3	1.289 mR	CV	0.2663	b	3.63 μR	5.0 min	0.044 mR	PASS	
4	1.355 mR	Coefficient of Variation (CV): CV = (1/X <sub>avg</sub> )(Σ(X <sub>i</sub> - X <sub>avg</sub> ) <sup>2</sup> /(n-1)) <sup>1/2</sup>			c	μR	min	mR	
5	1.803 mR			d	μR	min	mR		
				e	μR	min	mR		

### COMMENTS AND RECOMMENDATIONS

Dose to baggage measured with instrument #1/#2 combination.  
Exposure outside cabinet measured with instrument #1/#2 combination.

\* Instrument #4 was response checked before and after the survey.

# Survey Worksheet - Cabinet X-Ray Systems

Health Physics Program  
U.S. Army Public Health Command

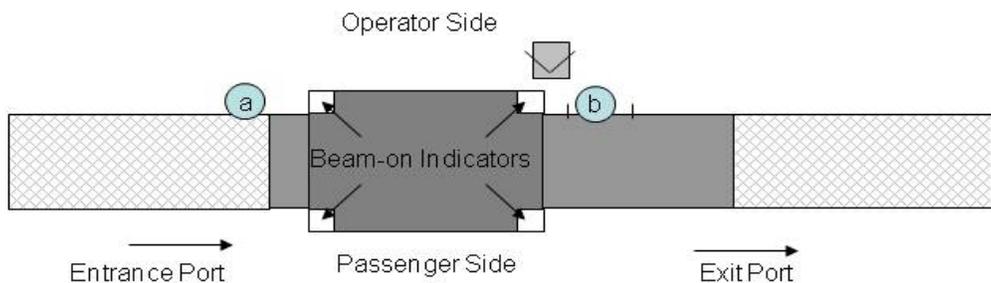
Aberdeen Proving Ground, Maryland 21010-5403

SURVEY DATA				SURVEY LOCATION			
Project No.	26-MF-0FZ3-12			Location	Checkpoint Lane 5		
Survey Date	3 Apr 2012			Organization	Boise-Gowen Field Airport		
Surveyor(s)	[Redacted] CHP			Street Address	3201 Airport Way		
	[Redacted]			City/Installation	Boise	State	ID ZIP 83705

INSTRUMENTS USED				SYSTEM INFORMATION				
	Manufacturer	Model	Serial No.	Cal. Due	Manufacturer	Model	Serial No.	Manuf. Date
Instrument #1	Radcal	9010	90-3291	28 Jul 2012	Rapiscan	620DV	7110914	Feb. 2011
Instrument #2	Radcal	10X5-1800	10299	28 Jul 2012	Certified	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Place of Manufacture	Torrance, CA
Instrument #3	Radcal	10X5-180	18793	28 Jul 2012	Type	Checkpoint <input checked="" type="checkbox"/>	EDS: In-line <input type="checkbox"/>	Stand-Alone <input type="checkbox"/>
Instrument #4	WB Johnson	TVX-2000	40155	*	Manufacturer Survey Date	7 Feb 2012		

VISUAL INSPECTION			
Y	N	Requirement	Y N
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Warning label "Caution: X-Rays Produced When Energized" present at control panel? (21 CFR 1020.40(c)(8)(i))	<input checked="" type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Warning label "Caution: Do Not Insert Any Part of the Body When System Is Energized - X-Ray Hazard" present at each port? (21 CFR 1020.40(c)(8)(ii))	<input checked="" type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Two independent "x-ray on" indicators visible from control panel? (21 CFR 1020.40(c)(6)(iii))	<input checked="" type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	One "x-ray on" indicator visible from each port and access panel? (21 CFR 1020.40(c)(6)(iv))	<input checked="" type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Key Activated Control present? (21 CFR 1020.40(c)(6)(i))	<input checked="" type="checkbox"/> <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Means to require operator presence at control panel? (21 CFR 1020.40(c)(10))	<input checked="" type="checkbox"/> <input type="checkbox"/>
			NT=not tested; NA=not applicable.

## SURVEY DIAGRAM



Accessible exterior surfaces of cabinet scanned with Instrument #4. All scanning results below action levels? Yes  No  (If no, explain below)

DOSE TO BAGGAGE			EXPOSURE OUTSIDE CABINET										
<b>Trial</b>	<b>Exposure (X<sub>i</sub>)</b>		Ambient Background		0.00 μR								
1	0.7952 mR	<table border="1" style="display: inline-table; margin: 5px;"> <tr><td>X<sub>avg</sub></td><td>0.8</td><td>mR</td></tr> <tr><td>CV</td><td>0.0102</td><td></td></tr> </table>	X <sub>avg</sub>	0.8	mR	CV	0.0102		<b>Location</b>	<b>Exposure</b>	<b>Time</b>	<b>Exposure in 1 hr</b>	<b>RESULT</b>
X <sub>avg</sub>	0.8		mR										
CV	0.0102												
2	0.7888 mR	a	5.65 μR	5.0 min	0.068 mR	PASS							
3	0.7782 mR	b	3.56 μR	5.0 min	0.043 mR	PASS							
4	0.7825 mR	Coefficient of Variation (CV): CV = (1/X <sub>avg</sub> )(Σ(X <sub>i</sub> - X <sub>avg</sub> ) <sup>2</sup> /(n-1)) <sup>1/2</sup>					c	μR	min	mR			
5	0.7756 mR	d	μR	min	mR								
			e	μR	min	mR							

## COMMENTS AND RECOMMENDATIONS

Dose to baggage measured with instrument #1/#2 combination.  
Exposure outside cabinet measured with instrument #1/#2 combination.  
Empty bins used for exposure outside cabinet measurements.

\* Instrument #4 was response checked before and after the survey.

Final Survey Notes

**Encl 3**

## Final Survey Notes

## 1. Project Information.

- a. Radiation Protection Survey No. 26-MF-0FZ3-12
- b. Survey dates: 2-3 April 2012
- c. Boise-Gowen Field Airport (BOI), Boise, ID
- d. Survey Officer(s) [REDACTED], Certified Health Physicist (CHP), U.S. Army Public Health Command (USAPHC) and [REDACTED], Research Analyst, USAPHC

## 2. Background Information.

- a. TSA Headquarters Contact: Jill Segraves, Director, Occupational Safety, Health, and Environment (OSHE), phone: [REDACTED] e-mail: [REDACTED]

## b. Airport Contacts:

- (1) Jeff Holmgren, Federal Security Director, email: [REDACTED]
- (2) Jerry Murphy, Assistant FSD/Operations, TSA, Idaho, Phone: [REDACTED]

## c. Individuals Assisting the Survey Team:

Name	Title/Position
[REDACTED]	Health Physicist TSA HQ
[REDACTED]	Transportation Security Manager, TSA Idaho
[REDACTED]	Transportation Security Officer (TSO) BOI
[REDACTED]	TSO BOI
[REDACTED]	TSO BOI
[REDACTED]	TSO BOI

## d. AIT (Backscatter X-Ray) Systems Surveyed:

Model	Serial No.	Location
Rapiscan Secure 1000 SP	S51011001	Checkpoint Lane 1/2 (AIT #1)
Rapiscan Secure 1000 SP	S510100005	Checkpoint Lane 3/4 (AIT #2)
Rapiscan Secure 1000 SP	S510100004	Checkpoint Lane 5 (AIT #3)

e. Cabinet X-Ray Systems Surveyed:

Model	Serial No.	Location
Rapiscan 620DV	7110910	Checkpoint Lane 1
Rapiscan 620DV	7110911	Checkpoint Lane 2
Rapiscan 620DV	7110912	Checkpoint Lane 3
Rapiscan 620DV	7110913	Checkpoint Lane 4
Rapiscan 620DV	7110914	Checkpoint Lane 5

3. Findings and Recommendations.

a. AIT (Backscatter X-Ray) Systems.

(1) All x-ray personnel screening systems surveyed were found to be in compliance with the radiation dose limits of American National Standards Institute/Health Physics Society (ANSI/HPS) Standard N43.17-2009, Radiation Safety for Personnel Security Screening Systems Using X-Ray or Gamma Radiation.

(2) All systems surveyed were found to be in compliance with the other requirements of ANSI/HPS N43.17-2009.

b. Cabinet X-ray Systems.

(1) All systems surveyed were found to be in compliance with the radiation emission limits of Title 21, Code of Federal Regulations, Section 1020.40.

(2) All systems surveyed were found to be in compliance with the other requirements of Title 21, Code of Federal Regulations, Section 1020.40.

c. Based on dosimetry and field measurements around the Secure 1000 SP and cabinet x-ray systems, it is estimated that TSOs will receive a radiation dose of less than 10 millirem in a year. For comparison, the occupational limit under Occupational Safety and Health Administration regulations is 1,250 millirem per quarter (5,000 millirem per year) and the goal of the TSA radiation safety program is to keep all radiation doses less than 100 millirem per year.