

# **NIOSH Airport X-Ray Study Update**

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**Transportation Security Administration  
Washington, DC  
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# Outline

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- **Background**
- **Study Objectives**
- **Phase I - Methods**
- **Phase I - Findings and Results**
- **Phase I - Recommendations**
- **Phase II – Dosimetry**
- **Acknowledgments**

# Background

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- **1975** – FAA rules to screen *passenger baggage (carry-on)*; included radiation monitoring
- **1990** – Aviation Security Improvement Act establish criteria for EDS
- **1994** – White House Commission on Aviation Security recommends *checked baggage* screening
- **1995** – EDS installed at some airports
- **1996** – FAA establishes the Security Equipment Integrated Project Team

# Background

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- **July 2001** – FAA removed requirement for radiation monitoring [*66 Fed. Reg. 37330 (2001)*]
- **September 11, 2001** – Terrorist Attack
- **November 19, 2001** – Aviation and Transportation Security Act (ATSA)
  - Created the Transportation Security Administration (TSA)
  - Transferred the FAA rules governing civil aviation security to TSA

# Background

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- **Dec. 2002** - ATSA required that ALL airports be equipped with EDS (significantly accelerating pre-9/11 implementation plans).
- **Nov. 2002 to Mar. 2003** – NIOSH received three Health Hazard Evaluation Requests
- **March 2003** – TSA Management made a request that NIOSH “*perform an independent study to determine the levels of radiation emissions from the various TSA screening equipment.*”

# Study Objectives

HETA #20030206

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1. Assess the work practices, procedures, and training provided to TSA employees who operate machines that generate X-rays; (Phase I)
2. Characterize the radiation exposure among employees who operate these machines; (Phase I and II) and
3. Determine if TSA employees who operate these machines are exposed at sufficient levels to require/warrant routine monitoring with radiation dosimeters. (Phase II)

# Reasons to Monitor Workers

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- **Assess exposures**
- **Document exposures or lack of exposure for legal purposes**
- **Detecting unsafe work practices**
- **Detecting changes in exposure conditions**
- **Satisfy union or employee concerns**
- **Verify effectiveness of eng. controls**

# Study Timeline

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- **November 2003 – January 2004**
  - Complete walk-throughs
- **February – May 2004**
  - Conduct field tests at six airports
  - Initiate radiation monitoring programs
- **August – November 2004**
  - Complete radiation monitoring
- **December – January 2005**
  - Complete final report

# 12 Selected Airports



# Phase I - Methods

## COMMUNICATION

### ➤ Disseminating Info.

- Website Development
- Dosimetry Data
- Individual Inquiries

### ➤ Presentations

### ➤ Developing FAQs



**National Institute for Occupational Safety and Health**

**Do I Need a Dosimeter?**

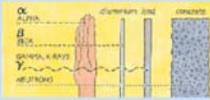
Health Hazard Evaluation #20030206




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**Educational Material**

**Ionizing Radiation:** Has enough energy to dislodge electrons from the atom. Mostly associated with medical X-rays and radioactive decay.



**Protective Measures:**  
**TIME:** reduce the amount of time spent in a radiation area.  
**DISTANCE:** increase distance from a radiation source.  
**SHIELDING:** shield yourself from a radiation source.

**U.S. Occupational Dose Limits:**  
 Whole body 5,000 mrem / yr  
 Hands, feet, and skin 50,000 mrem / yr

**NIOSH HHE Contacts**

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**Occupation: TSA Screener**  
**Scenario: Baggage Screening Operations**

**What is NIOSH doing?**

- The Transportation Security Administration requested that National Institute for Occupational Safety and Health (NIOSH) conduct an independent study to determine the potential radiation exposures to employees who operate X-ray generating machines. NIOSH researchers will also assess the work place practices, training information, and equipment and maintenance requirements. NIOSH will use its findings to make recommendations regarding the need for radiation badges.

**Why is this study being done?**

- With recent changes to screening requirements, procedures, and equipment, new information is needed to assess the radiation hazard to employees operating X-ray generating machines.

**How long will the study take?**

- About two years, since several hundred TSA employees, as well as areas around the X-ray machines, will be monitored for at least six months, and possibly up to a year.

**How were the airports selected for this study?**

- NIOSH researchers met with TSA management and employees. After considering (1) baggage volume, (2) number and variety of X-ray generating machines, (3) seasonal travel patterns, (4) number of TSA employees operating X-ray generating machines, (5) work practices (rotation and work shifts), (6) type of airport (originating vs. connecting), (7) prior employee complaints, and (8) geographic location, we ultimately focused on 12 airports. These 12 airports are listed below, along with the airport category (size) and the type of activities that will be conducted during the NIOSH study.

Airport	Characterize Category	Work Practices	Radiation Monitoring*
Baltimore	X	Yes	Yes
Boston	X	Yes	Yes
Chicago	X	Yes	No
Cincinnati	I	Yes	Yes
Harrisburg	II	Yes	No
Honolulu	X	Yes	No
Las Vegas	I	Yes	No
Los Angeles	X	Yes	Yes
Miami	X	Yes	No
Philadelphia	X	Yes	No
Providence	I	Yes	Yes
West Palm Beach	I	Yes	Yes

\* Airports with no radiation monitoring will have their work practices compared to similarly sized airports with radiation monitoring data to decide if additional radiation monitoring is warranted.

**What can I do?**

- Contact TSA Management, Screener Representatives, or NIOSH researchers
- Provide comments or suggestions to improve the study

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**Further NIOSH Information:**  
 1-800-35NIOSH  
<http://www.cdc.gov/niosh>

**Additional resources for radiation protection:**

- FDA FAQs about X-ray Machines: [www.fda.gov/ohrt/comp/cabinetravfaq.html](http://www.fda.gov/ohrt/comp/cabinetravfaq.html)
- EPA Radiation: [www.epa.gov/radiation/](http://www.epa.gov/radiation/)

Safety and Health – Through Prevention and Research



# Phase I - Methods

## ➤ Walk-throughs / Field Surveys

- Interacted with workers
- Spot Measurements
- Record Reviews
- Data collection
- Noted non-radiation concerns and safety hazards



# Phase I

## Findings and Results

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### ➤ Non-radiation concerns raised by employees or management

- Ergonomics
- Noise (NIOSH HHE)
- Jet exhaust / Tug exhaust (NIOSH HHE)
- Diesel
- Asbestos
- Carbon monoxide
- Heat Stress
- Indoor air quality (dust) (NIOSH HHE)
- Bloodborne pathogens (NIOSH HHE)

# Phase I

## Findings and Results

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### ➤ Safety Hazards Observed

- Conveyor belt systems (In-line)
  - ✓ moving parts / guarding
  - ✓ Low head-space
  - ✓ Access to EDS
- Slip, Trip, Fall Hazards



# Phase I

## Findings and Results

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### ➤ FAQs

- Why are we not wearing dosimeters?
- Residual radiation?
- Is it safe for pregnant workers?
- What are the health effects?

# Phase I

## Findings and Results

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### ➤ FAQs

- How much radiation is inside the machines?
- How much radiation is too much to receive?
- Is radiation stored in the body?
- How do we know if these machines are FDA compliant?

# Phase I

## Finding and Results

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- No. of EDS machines: 281
- No. of CTX machines: 123
- No. of L3 machines: 158
- No. of CTXs shut down: 0
- No. of L3s shut down: 6

### reason

- 3 – gaps between gantry and entry tunnel;
- 1 – bypassed interlock system;
- 2 – damaged interior curtains;

### resolution

- bolted together
- training
- replace parts / maintenance

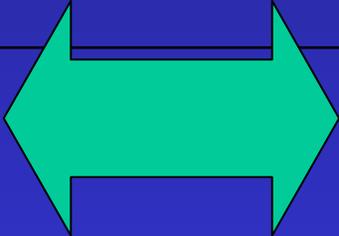
# What do the Numbers Mean?

(above background radiation levels; 20 uR/hr or 360 mrem/yr)

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- **50** uR/hr leads to 100 mrem, which is the public dose limit
- **50** mrem / month – PREGNACY DOSE LIMIT
- **500** uR/hr is FDA leakage limit at 5cm from the surface of the cabinet X-ray unit
- **5,000** mrem is the occupational dose limit to the whole body
- **50,000** mrem is the occupational dose limit to the hands / feet
- **2,000** mrem is the ICRP recommended annual dose limit

# Interpreting Dose

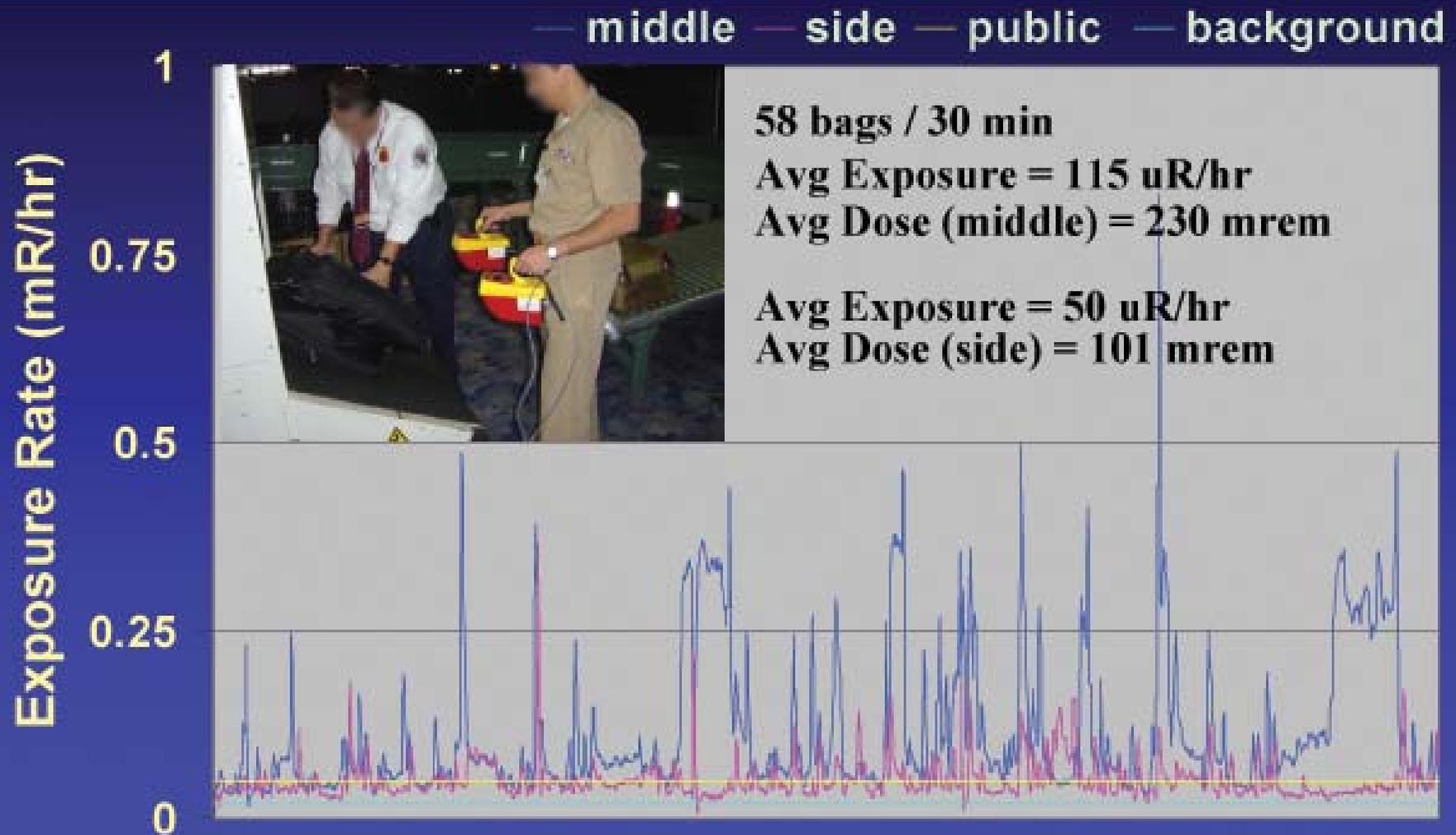
<b>Exposure Rate</b> <b>(uR / hr)</b>	<b>2000</b> <b>hours/year</b> <b>or</b> <b>160</b> <b>hours/month</b>	<b>Dose</b>	<b>Comment</b>
<b>50</b>		<b>100 mrem/ yr</b>	<b>Public Dose</b>
<b>313</b>		<b>50 mrem/mth</b>	<b>Pregnancy Dose Limit</b>
<b>500</b>		<b>- na -</b>	<b>FDA Leakage Limit</b>
<b>2,500</b>		<b>5,000 mrem/yr</b>	<b>Whole Body Dose</b>
<b>1,000</b>		<b>2,000 mrem/yr</b>	<b>ICRP Dose</b>

# Phase I Findings and Results

Machine	Exposure Rate mR/hr Inside lead curtains	
	Entrance	Exit
L3	2 to 5	2 to 5
CTX 2500	3 to 50	3 to 50
CTX 5500	2 to 5	3 to 50
TRX	up to 3	up to 3

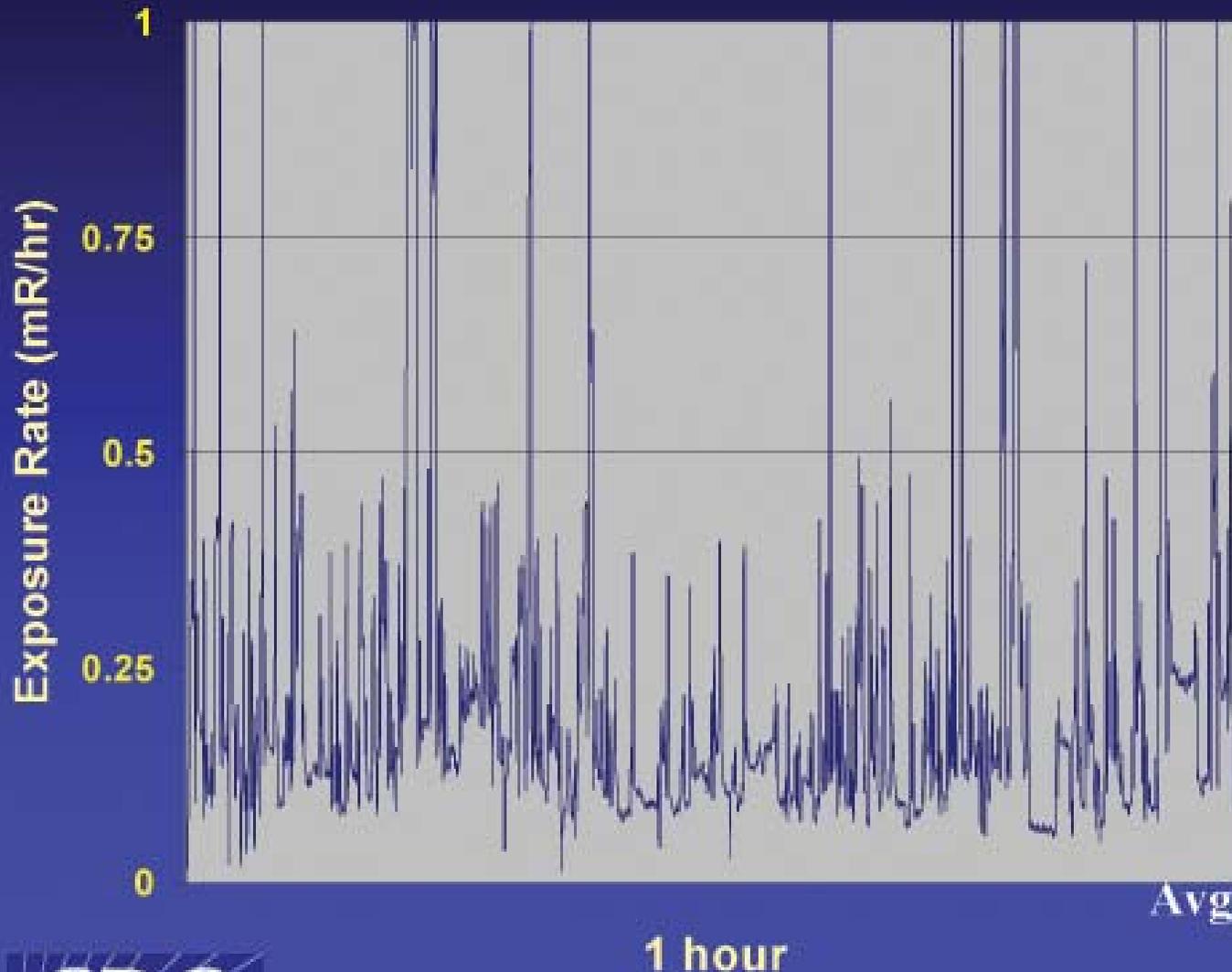


# What a difference 1 foot makes!



30 Minute Period

# FDA Leakage Test



112 bags / 60 min

Avg Exposure Rate = 222  $\mu$ R/hr

# L3 Operator Exit Location



# EDS vs. TRX Dose Potentials (L3 Loading vs. TRX exit)



# Phase I - Recommendations

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- **Radiation Training**
- **Emphasize MAINTENANCE**
  - Keep radiation leaks “as low as reasonably achievable” ALARA
- **Post Radiation Survey Results**
  - Improves awareness
  - Encourages communication
  - Empowers the workforce



# Phase I - Recommendations

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- **Access Panel Keys**
  - Encourage use but limit abuse
- **“Push-Sticks”**
  - solid material (prevent “funnel effect”)
  - non-metallic (reduces scatter)
- **Prevent blockage of emergency shut-off switches (TRX and EDS)**



# Phase I - Recommendations (L3 EDS)

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- **Re-engineer Entrance and Exit Tunnels**
  - Ergonomics
  - Greatest radiation exposure potential (stand-alones)
- **Bolt tunnels to gantry**
- **Improve conveyor belts**
- **Improve safety interlock system**
- **Change color of “Default” indicator**

# Phase I - Recommendations (InVision EDS)

- Be aware of “Hot Spot”
  - About 8 inches from curtain
  - $>1,500$   $\mu\text{R} / \text{hr}$
  - Not a direct hazard to TSA workers, but it is correctable.



# Phase I - Recommendations (InVision EDS)

- Increase distance of exit electric eye



# Tentative dates for Phase II

<b>Airport</b>	<b>Proposed dates</b>
<b>Cincinnati</b>	<b>Week of March 15</b>
<b>West Palm Beach</b>	<b>Week of March 22</b>
<b>Los Angeles</b>	<b>Week of April 19</b>
<b>Baltimore-Washington</b>	<b>Week of June 14</b>
<b>Boston/Providence</b>	<b>Week of June 28</b>

# PHASE II – Dosimetry

- **Up to 7 Airports**
  - Baltimore, Boston, Cincinnati, Los Angeles, Providence, West Palm Beach, and Miami.
- **Whole Body Dosimeter**
- **Wrist Dosimeter**
  - Replaces ring dosimeter



# Dosimetry Challenges

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## ➤ Dynamic Environment

- Evolving airport policies
- Workforce
  - ✓ Various work schedules, assignments
  - ✓ Part-time vs. Full-time
- Historical Practices
- Training
- Technology



# Dosimetry

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- **6-month monitoring period**
- **Monthly exchange frequency**
- **Electronic access to results**
  - [www.cdc.gov/niosh/topics/airportscreener](http://www.cdc.gov/niosh/topics/airportscreener)
- **Fact sheets**
  - How to wear
  - How to interpret results

# Phase II - Participants

<b>Airport</b>	<b># Screeners</b>	<b>Comments</b>
<b>Baltimore</b>	<b>217</b>	<b>Mostly L3s</b>
<b>Boston</b>	<b>144</b>	<b>L3 In-line system</b>
<b>Cincinnati</b>	<b>56</b>	<b>L3 Stand-alones</b>
<b>Los Angeles</b>	<b>134</b>	<b>TIBIT Terminal</b>
<b>Providence</b>	<b>134</b>	<b>InVision stand-alones</b>
<b>West Palm Beach</b>	<b>136</b>	<b>L3 stand-alones</b>
<b>Miami</b>	<b>tbd</b>	<b>April start date</b>

# Current Status

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- [www.cdc.gov/niosh/topics/airportscreener](http://www.cdc.gov/niosh/topics/airportscreener)
  - Study Framework Available
  - Study Fact Sheet Available
  - FAQ, Photos, Interim Reports, Non-radiation HHEs
- **Completed Walk-throughs**
- **Developing Databases**
  - Images and videos
  - Dosimetry
  - Field Testing
- **Developing Dosimetry Logistics**

# Future Activities

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- **State Radiation Program Conference**
  - Obtain State input on this issue
  - Identify assets/resources that may be available for TSA
- **American Industrial Hygiene Conference and Exposition, May 2204**
- **Health Physics Conference, July 2004**
- **Multi-agency Meeting**
  - NIOSH, TSA, FDA, Customs, OSHA, etc.

# Acknowledgements

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- **Jill Lozis**
- **Airport Management and Screener Representatives**
- **Dan Kassiday and Frank Cerra – FDA**
- **NIOSH Team members**