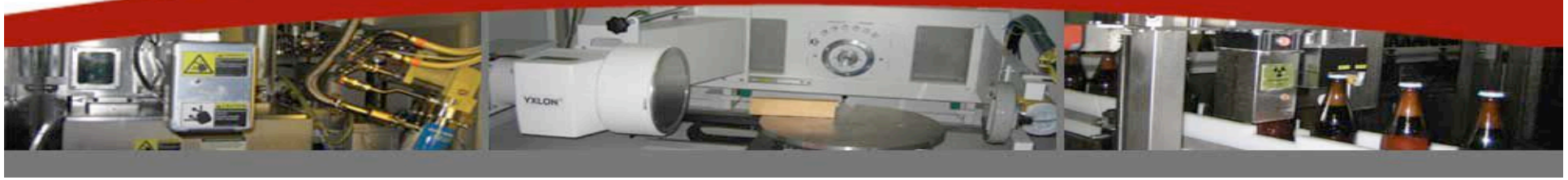

RADIATION PROTECTION CONTROL AREA AROUND CABINET X-RAY UNITS

I. Prlić et all

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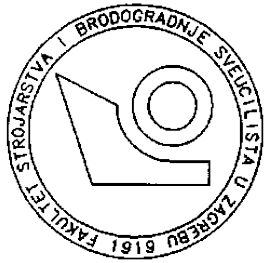
State Office for Radiation Protection , State Office for Nuclear Safety
Croatian Non Destructing Testing Society – HDKBR, Zagreb, Republic of Croatia,



ZRAČNA LUKA ZAGREB
Zagreb Airport

ALARA uređaji d.o.o.
za proizvodnju, održavanje i promet mjernih uređaja i usluge

HDKBR

dzns

Cabinet x-ray systems are primarily used for **security screening** and industrial quality control.

Some examples include:

- **Airport baggage security screening**
- Cargo inspection of trucks crossing international borders
- Food inspection to check for foreign objects
- Circuit board inspection to find manufacturing defects
- Tire inspection to identify manufacturing defects

Accepted Radiation Safety performance standard for cabinet x-ray systems

requires that external radiation emission from a cabinet x-ray system not exceed an exposure of 5 µGy/h

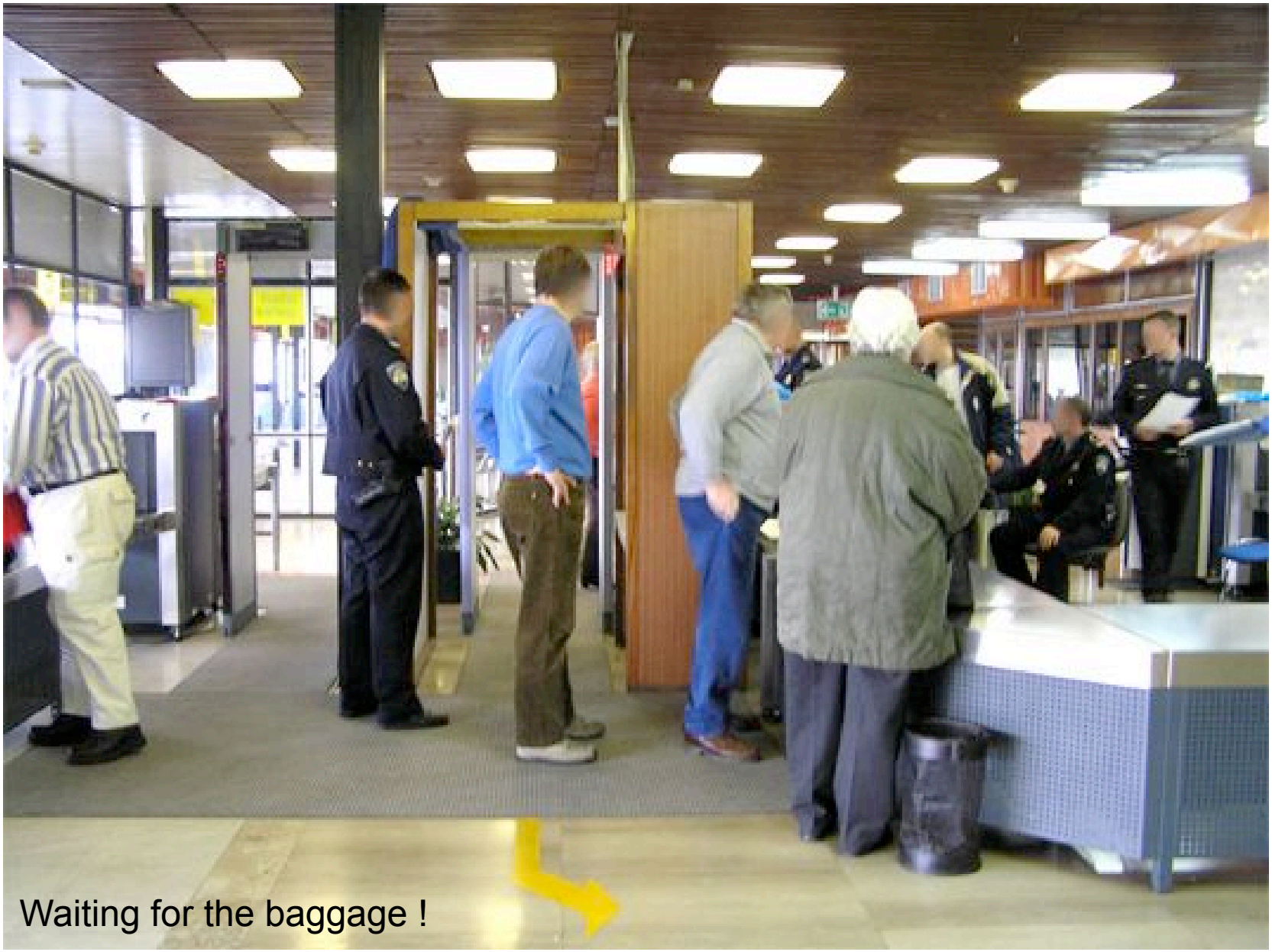
Most cabinet x-ray systems emit less than this "limit".

In addition, the standard also requires safety features that include warning lights, warning labels and interlocks to protect users and the public from radiation emissions.

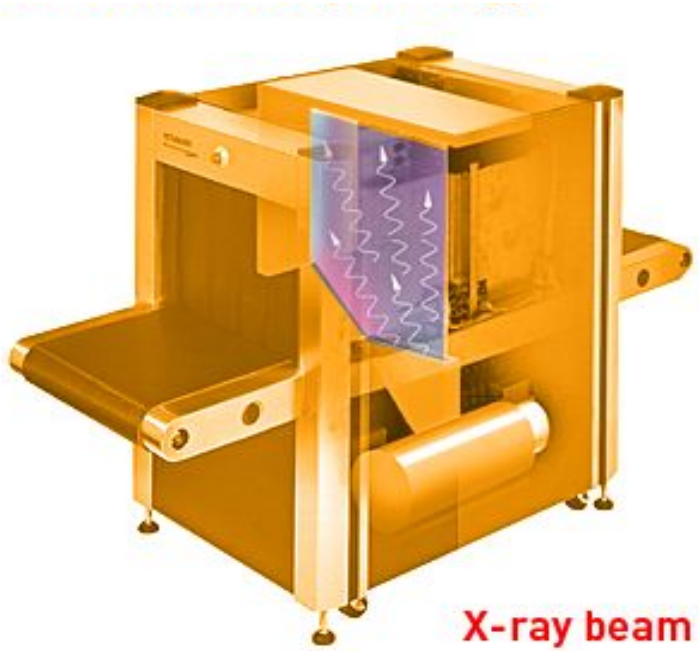
The scope of the study was to determine *if any of* security workers who operate cabinet X-ray inspection systems could receive annual personal dose equivalent greather than 1mSv due to occupational exposure in regular working environment respecting all prescribed airport security procedures per passanger.

For cabinet X-ray inspection systems ***control area*** is technically strictly restricted to area ***inside the unit's own housing***

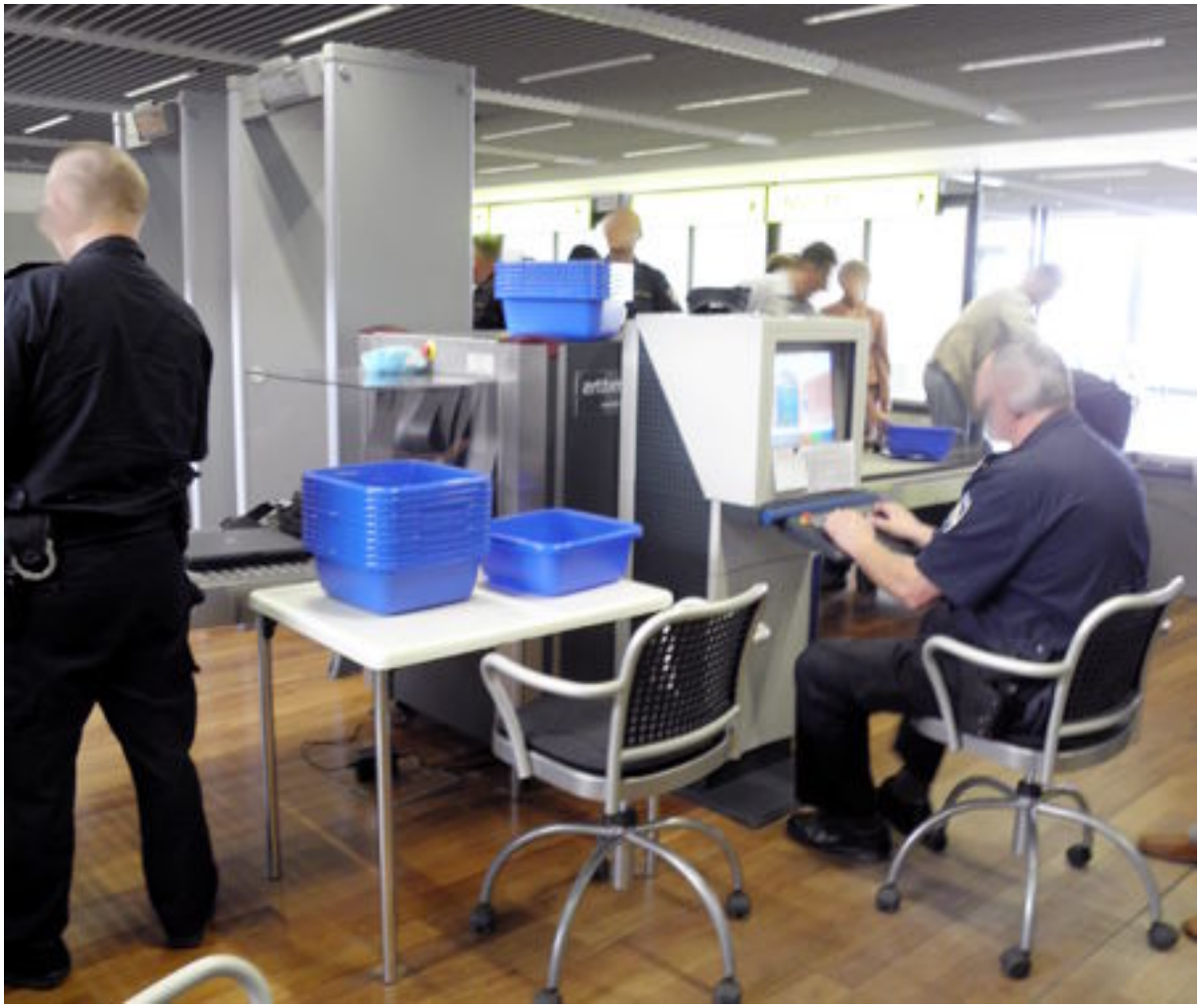
As the ***control area*** of cabinet X-ray units is technically restricted to area ***inside the unit's own housing*** inspection systems can be used with no additional safety requirement as a mobile units.


Waiting for the baggage !


Security working
places
arrangement !

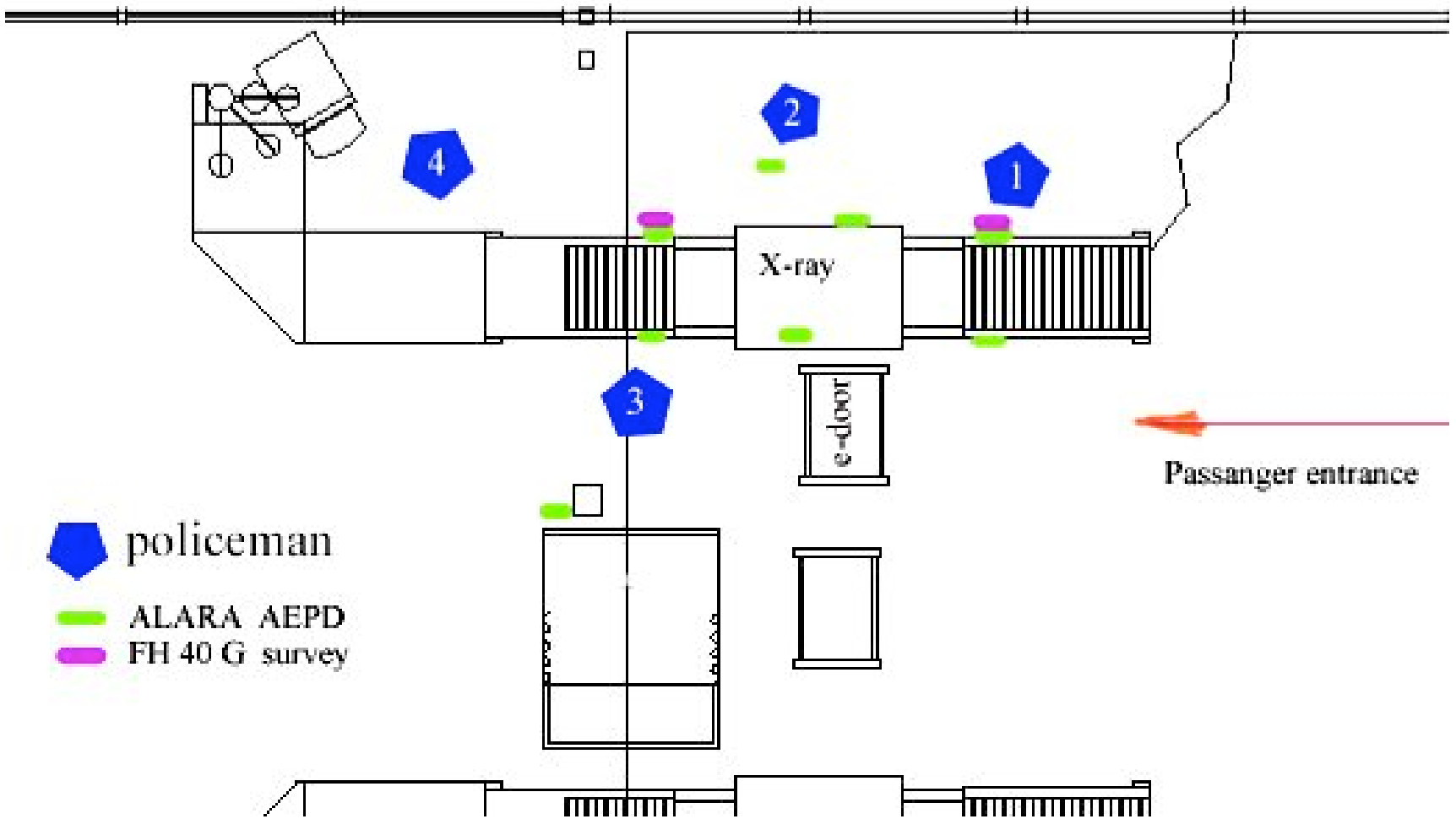


Source:
Smits Heiman courtesy



normal working conditions and geometry of x-ray beam
- fan beam directed away from “main” operator

	DURATION	LOCATION OF MEASUREMENT
PHASE 1	>1 year	inside working area around cabinet X-ray inspection systems installed on five airports in Croatia
PHASE 2	24 hours	exactly at the positions of security workers in working area around, on the housing and inside the tunel of chosen cabinet X-ray inspection system while operating under full workload
PHASE 3	1 month	selected positions on the housings of two adjacent cabinet X-ray inspection systems



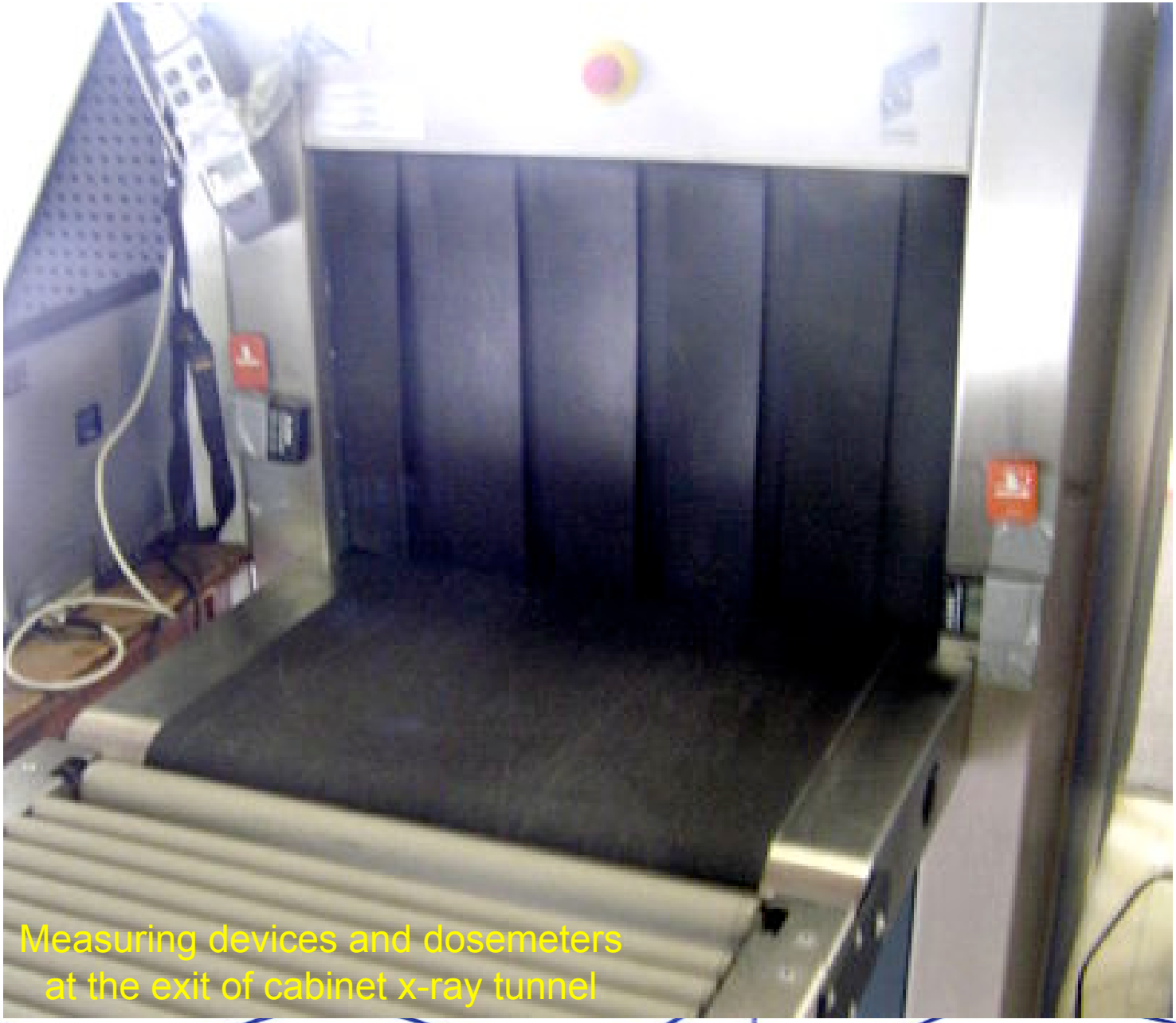
Airport Security working area around one cabinet x-ray system Workers possition arrangement - Experimental set up: **phase 2.**

Working position of security workers labeled 1- 4
"ALARA OD"© AED – active electronic dosemeters
FH 40G – dose rate measuring unit with two probes

DURATION	PURPOSE
1 year	to estimate total number of passangers and inspected pieces of baggage, their total number fluctuation in time, determination of working routine and to measure annual accumulated equivalent dose in the working area (the >< 1 mSv benchmark)
24 hours	dose rate measurements at **exact** (security workers) **workplace positions**, determination of **total** baggage **exposure time**, identification of bad practices, **direct dose rate** measurements of possible scattered radiation on all hot spots around the cabinet x-ray system
1 month	dose rate measurements the same as for phase 2 – fixed positions of AED out and inside the X-ray system in order to estimate the total exposure time


Baggage output !

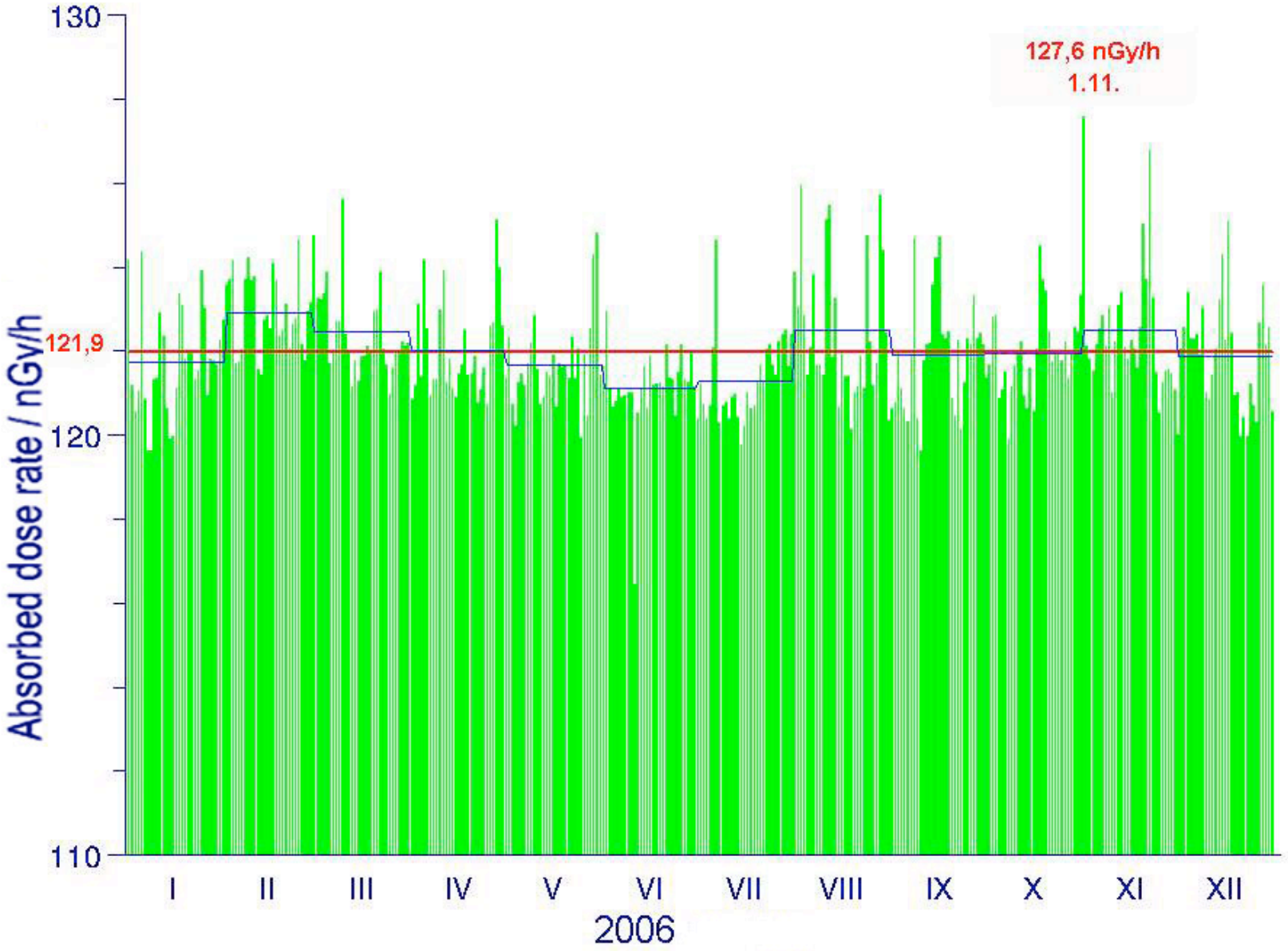
Measuring devices and dosemeters
at the entrance of cabinet x-ray tunnel



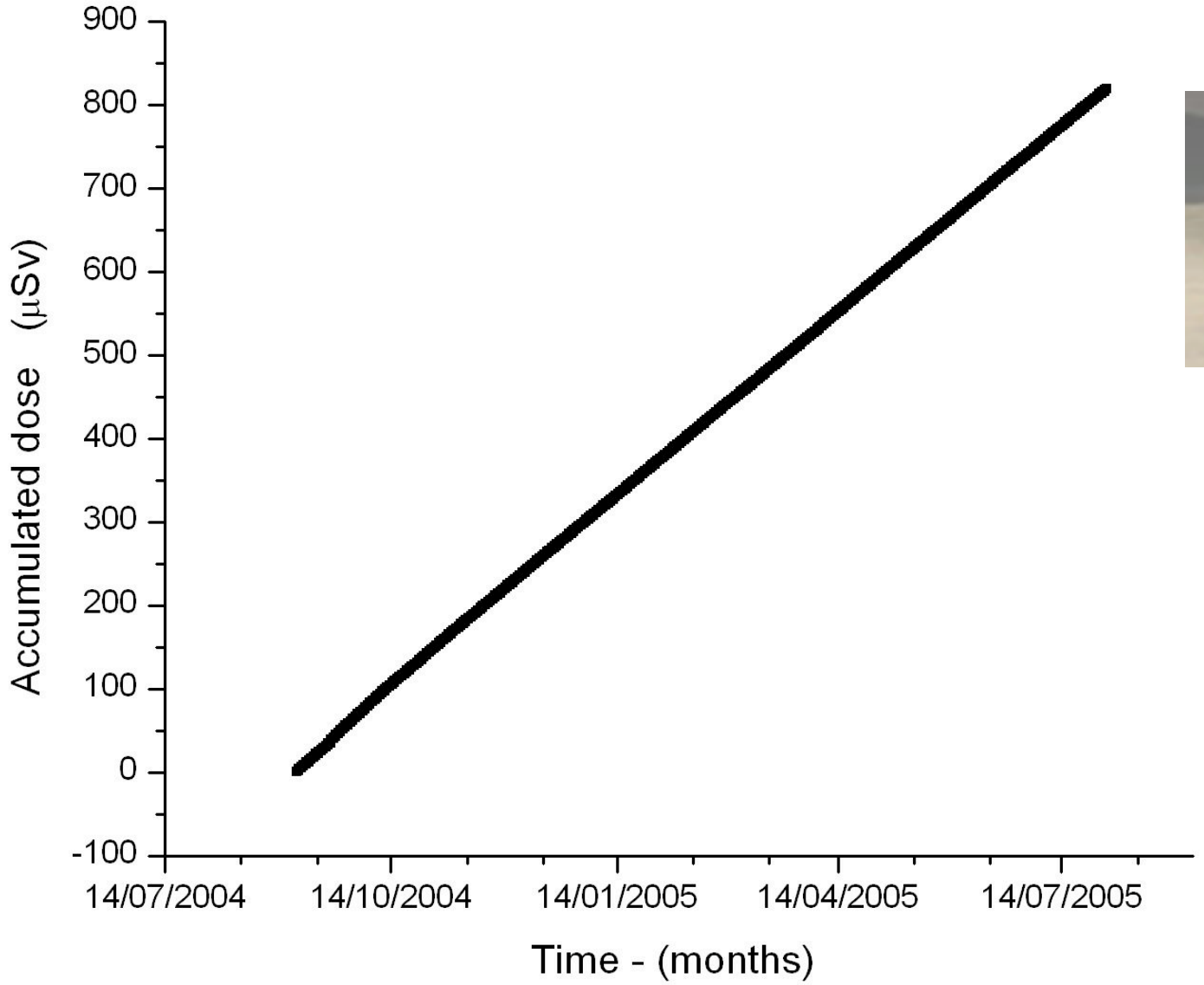
Measuring devices and dosemeters
at the exit of cabinet x-ray tunnel

Real situation - no gap between luggage
(up to 3-4,5 pieces per passanger depending on the season)

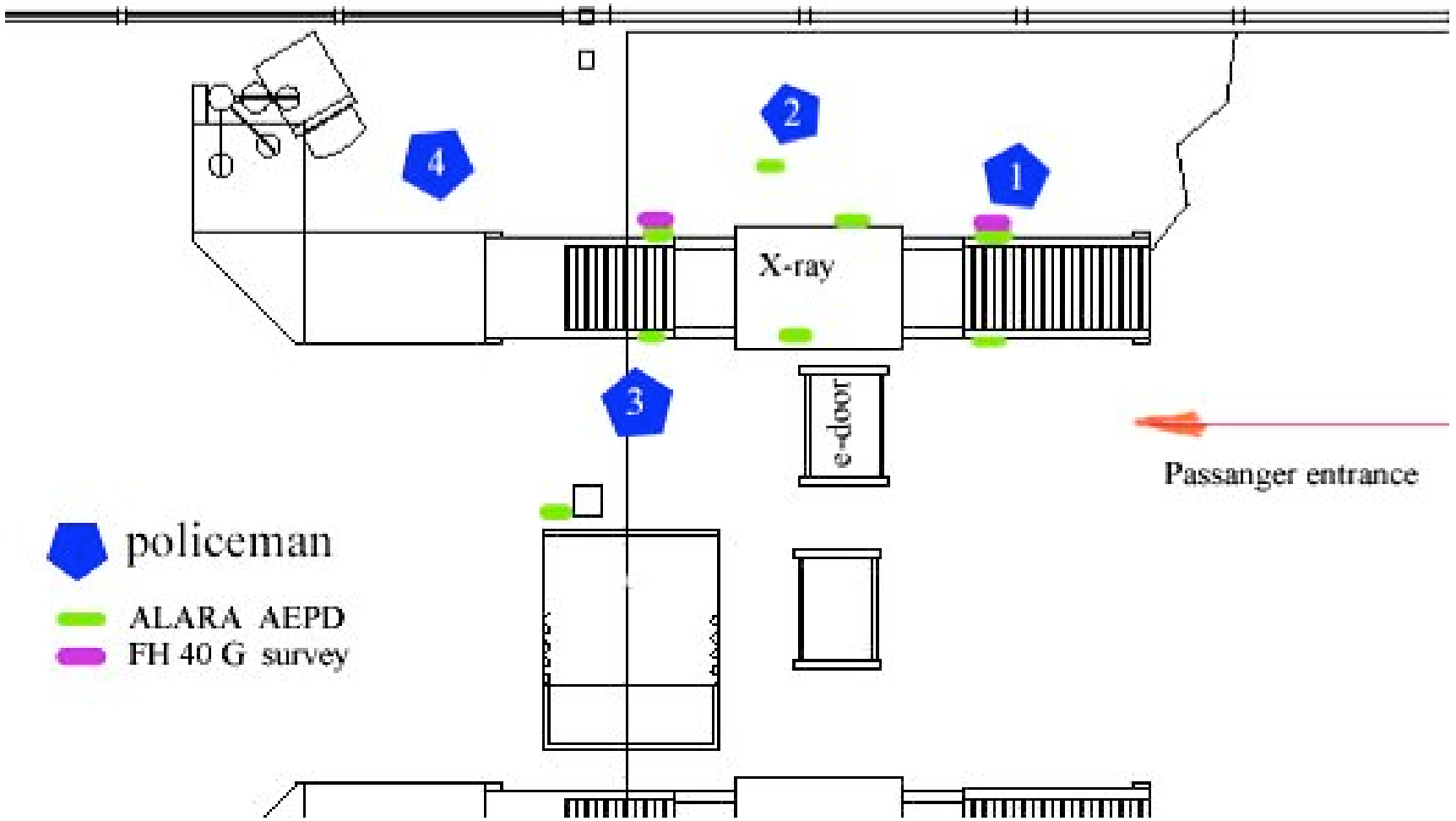
A situation after one year – protective and “security” approvement w.place 1.



local natural ionizing radiation background variation at IMI – Zagreb (one year period)

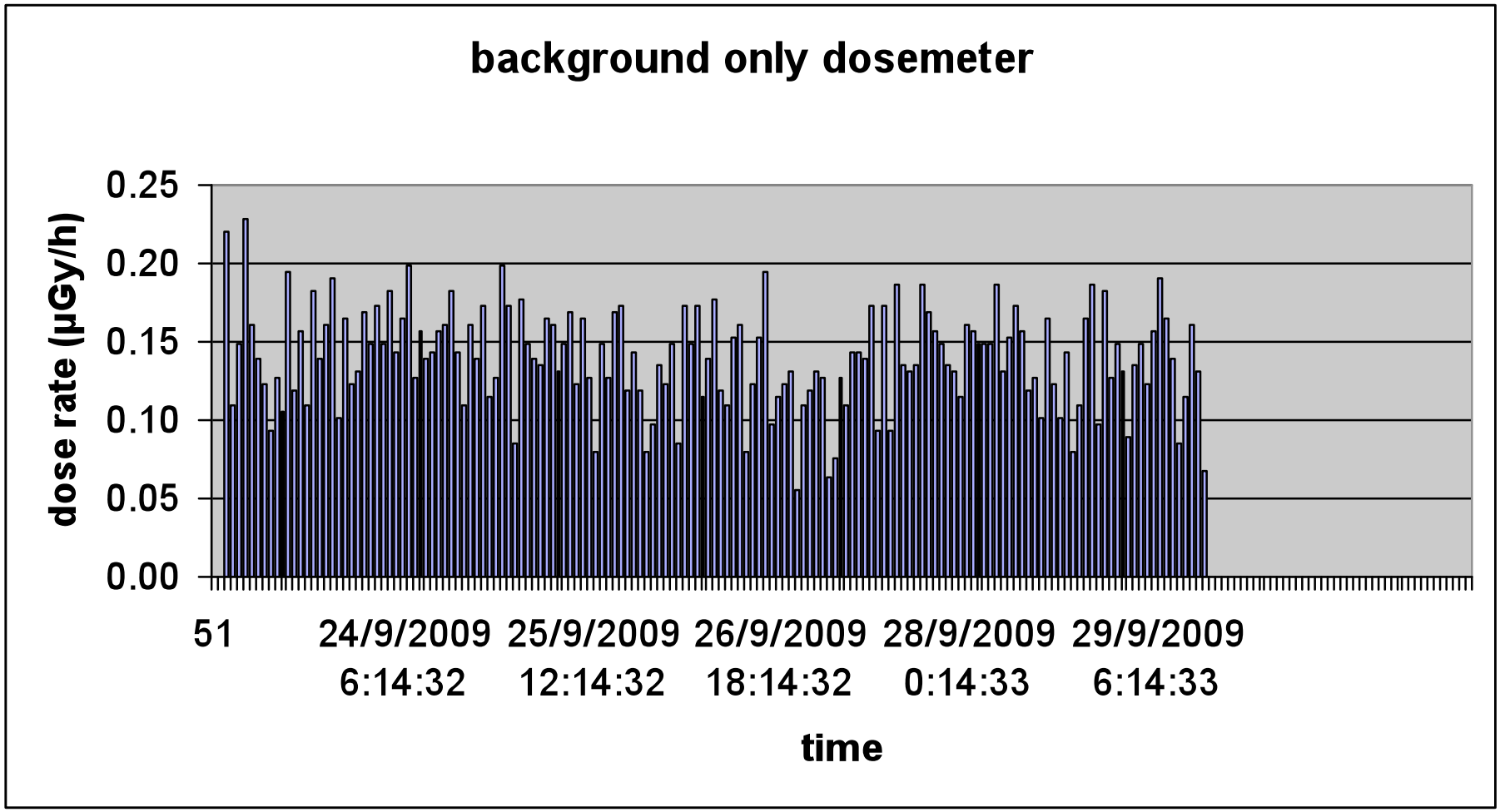


local natural ionizing radiation background variation at Airport – Zagreb indoors, measured with AED (one year period)



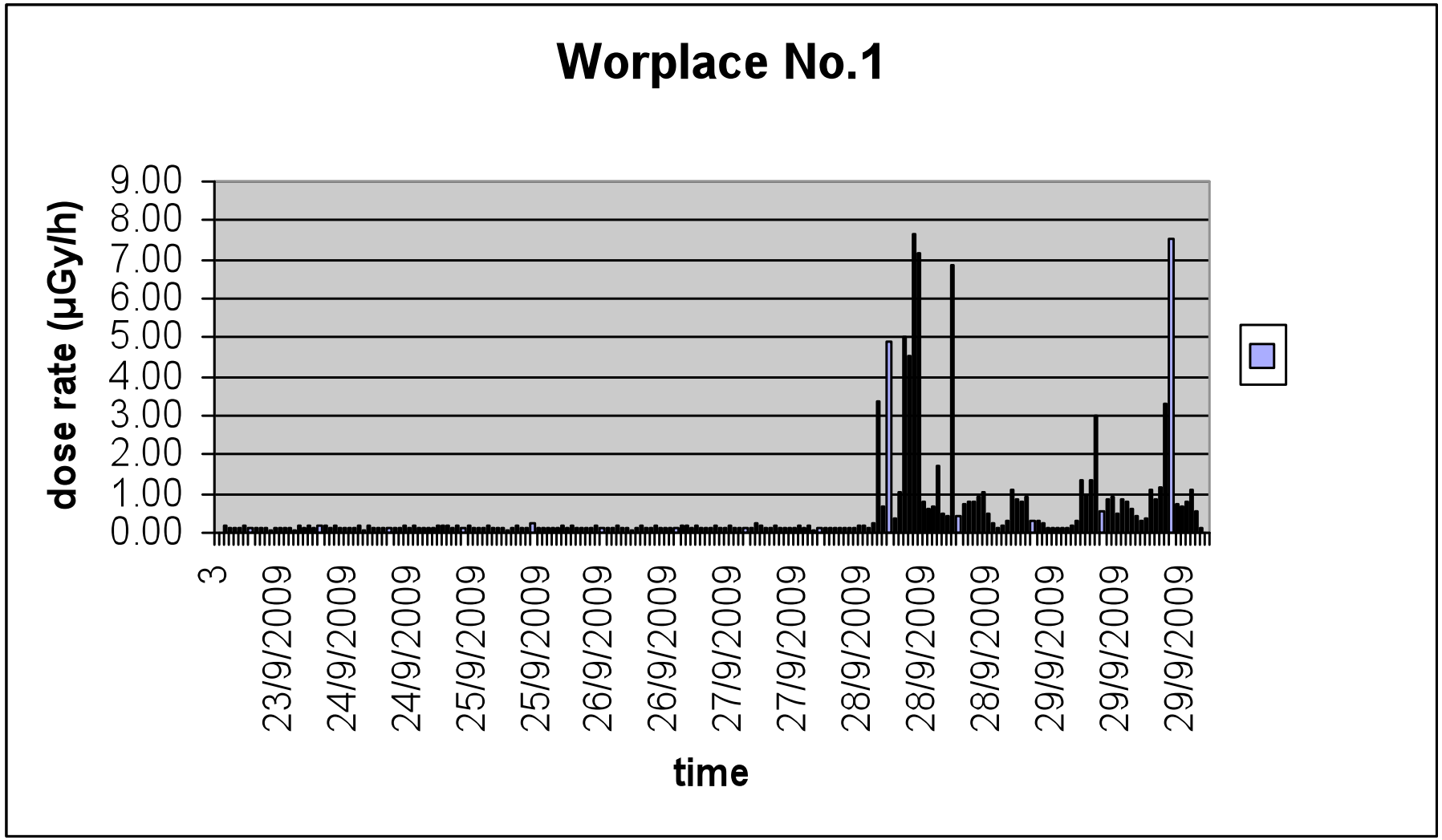
Airport Security working area around one cabinet x-ray system
Workers possition arrangement - Experimental set up: **phase 2.**

Working position of security workers labeled 1- 4
ALARA AEPD – active electronic personal dosemeters
FH 40G – dose rate measuring unit with two probes



Local background in the airport departure hall

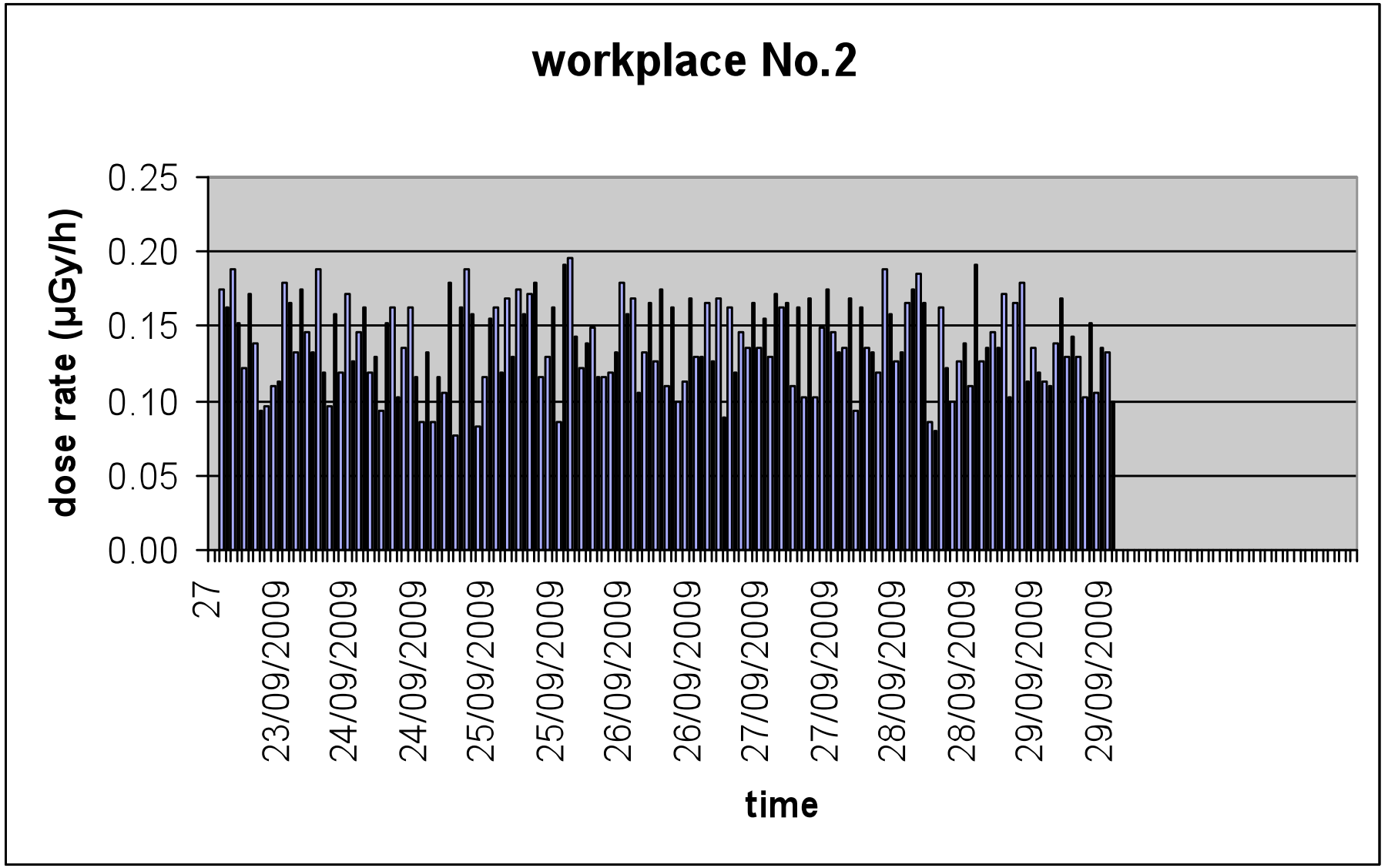
Security workers possition arrangement - Experimental set up: **phase 2.**

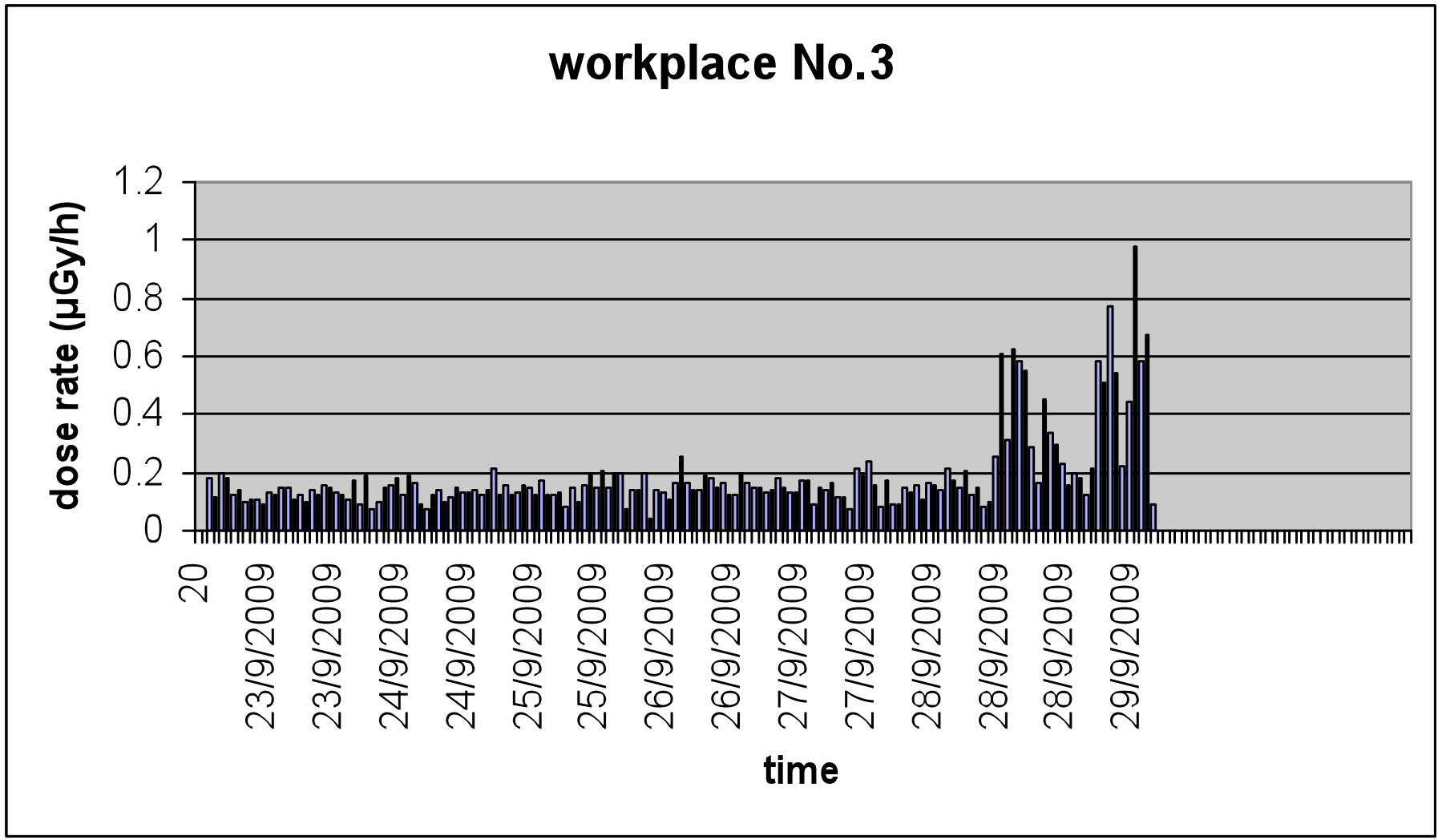


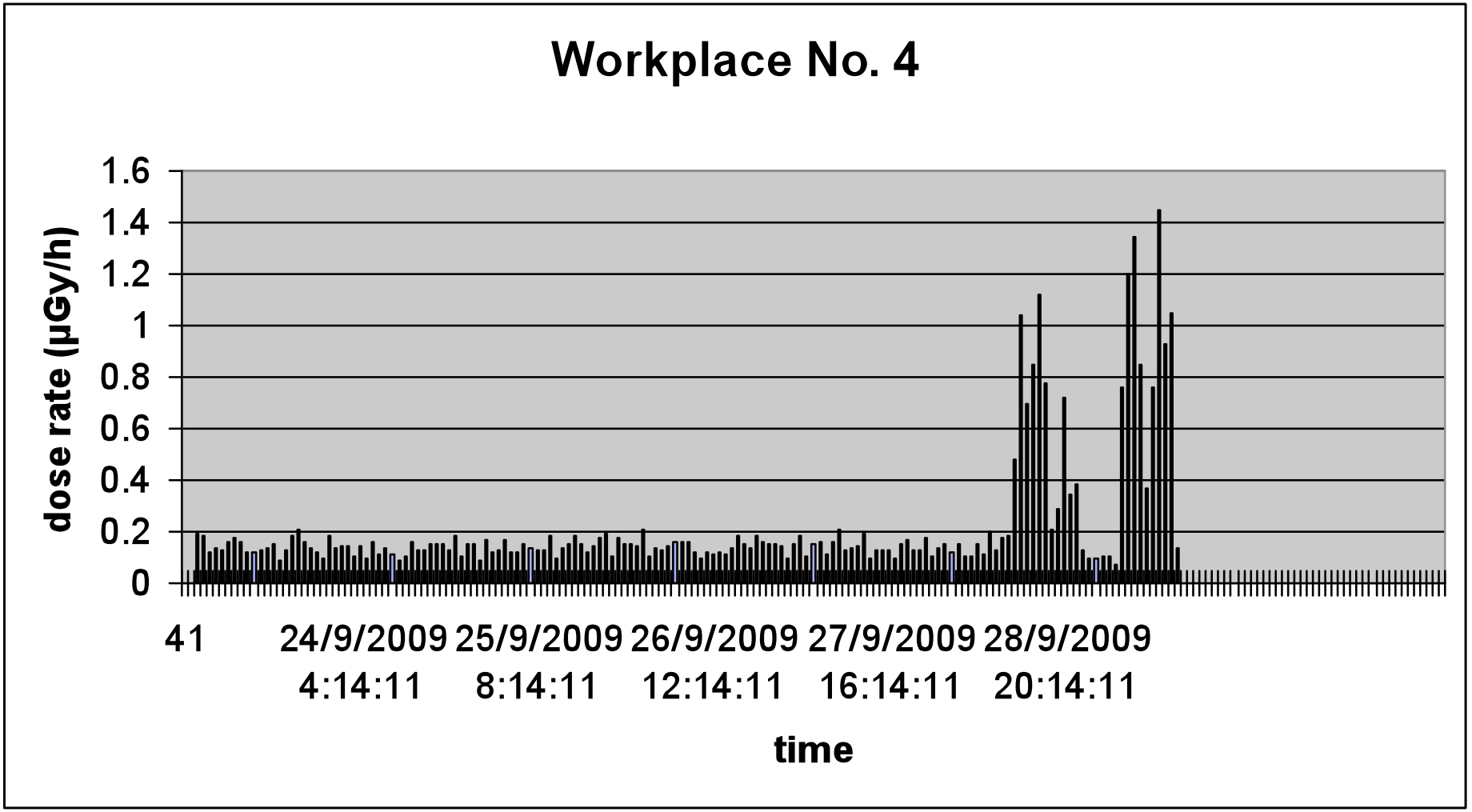
experiment started on 28.09.2009. at 11 am:

Security worker 1 possition arrangement - Experimental set up: **phase 2.**

Workload : 1956 passengers passing by in two rush hours – 3.5 pieces of baggs per passanger


workplace No.2
dose rate (µGy/h)
0.25
0.20
0.15
0.10
0.05
0.00
27
23/09/2009
24/09/2009
24/09/2009
25/09/2009
25/09/2009
26/09/2009
26/09/2009
27/09/2009
27/09/2009
28/09/2009
28/09/2009
29/09/2009
29/09/2009
time


workplace No.3
dose rate (µGy/h)
1.2
1
0.8
0.6
0.4
0.2
0
20
23/9/2009
23/9/2009
24/9/2009
24/9/2009
25/9/2009
25/9/2009
26/9/2009
26/9/2009
27/9/2009
27/9/2009
28/9/2009
28/9/2009
28/9/2009
29/9/2009
time


Workplace No. 4
dose rate (µGy/h)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
41
24/9/2009 4:14:11
25/9/2009 8:14:11
26/9/2009 12:14:11
27/9/2009 16:14:11
28/9/2009 20:14:11
time

Work place 1 – entrance tunnel site

REPUBLIC OF CROATIA
MINISTRY OF INTERIOR

PROGRAMM of the

Course for
AEP and Cabinet x-ray Operators

Zagreb, 2008.

4. Teaching plan and PROGRAM
4.1. course: Protection of civil air trafic
4.2. course: Terorism
4.3. course: Communication Culture
4.4. course: Drugs
4.5. course: Explosives, Anti explosives protection
4.6. course: Protective control
4.7. course: Degerous goods
4.8. course: explosives "……"
4.9. course: "……"
4.10. course: Technical equipment nad instruments
4.11. course : threat projections ……
4.13. course: RADIATION PROTECTION

12.	**Practical work with x-ray inspection systems**	hours theory	hours practice	hours total
12.1	Work with inspection systems and equipment		35*	35*
13.	**Radiation protection**			16
13.1	Basic of radiation physics	2		
13.2	Interaction with matter and biological effects	2		
13.3	Radiation protection culture	1		
13.4	Health surveilance	2		
13.5	Legal aspects and guidances	2		
13.6	X-ray equipment and radiation protection	3		
13.7	Ionizing radiation sources and radiation protection	4		

Source:
IMI data base
courtesy of Airport Zagreb

Greetings from

Source:
Smits Heiman courtesy

Simulation of container cargo scanning

The control area arrangement during the Linac scanning of cargo containers

EURopean Illicit TRAfficking Countermeasures Kit

Project coordinator
Jean-Louis Szabo, CEA LIST, France

PROTOTYPE DEMONSTRATION

Port of Rijeka
Croatia

Source:
IMI data base

EURITRACK

Source: Operating manual TELEROB
and IMI data base

tEODor : heavy duty Explosive Ordnance Disposal (EOD) robot

Remote explosive ordnance disposal technologies & integrated diagnostic system

security workers or *anti explosive defence unit*
are trained to execute special skills
and they are the profesional “upgrade” to
ordinary security workers at airports
responsible for setting the scene
if a real malicious radiological threat occurs

they need to have enough knowledge in
radiation protection in order to be able to act
properly

the threats situations are regarded as
accidental
describing the exposure burden and
occupational exposure limits

for the public
accidental situation and possible exposures
are compared with overall risk from any type
of accident that might occur during the flight