Oceaneering Asset Integrity Norway	Document ID: AIN-RAD-REP-008
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# REPORT: MEASUREMENT OF X-RAY DOSE SECURITY CHECK BERGEN AIRPORT FLESLAND (AVINOR)	Revision issued date: 06.10.2017
	Revision: 1.0
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Limited external distribution	

Rev.	Issue date	Revision summary	Originator	Approver	Owner
4					
3					
2					
1	06.10.2017	Issued for use	SK	GY	SK

Table 1:Equipment used

Equipment	Type	Måleenhet	Serie nr	Kalibrert
	**Instadose DIS**	**µSv/t**	**5017617** **5017644**	**NA**
Hand-Carried Baggage scanner	Smith Detector / Heimann X-Ray detector	x-ray scanner		
Checked-In Baggage scanner	BBC L3 MV 3D	x-ray scanner		

1. Definitions:

Occupational Exposure: Exposure to workers in connection with their occupation, where the radiation source or exposure situation is an integral part of the profession and associated with it.

2. Dose limits (Norway):

Body dose	20 mSv/year
Skin dose (skin, hands and feet):	500 mSv/year
Eye lens:	150 mSv/year
Allmennheten og arbeidstakere som ikke er yrkeseksponerte	1 mSv/year
Pregnant	1 mSv

Pregnant: The dose to the fetus should not exceed 1 mSv in the remaining part of pregnancy, ie after pregnancy is known.

The measurements performed by

Geir Yndestad, Responsible ISO Level III NDT Oceaneering Asset Integrity Norway

3. Technical:

Oceaneering Asset Integrity Norway (OAI) are using Instadose DIS (Direct Ion Storage) dosimeters. This technology provides radiation workers with a precise measurement of radiation dose and includes accurate long-term exposure tracking. A built-in memory chip stores each user's identity via an embedded unique serial code assigned to the user.

Technical information:

USB compatible detector	
Minimum Reportable Dose:	3 mrem (0.03 mSv)
Lower Limit of Detection:	1 mrem (0.01 mSv)
Useful Dose Range:	3 mrem - 500 rem (0.03 mSv - 5 Sv)
Energy Response	: Photon 5 keV - 6 MeV

The accumulated dose stored on Instadose is processed through a proprietary algorithm. This automated transfer of data minimizes the chance of human error and misidentification. Once complete a graphical representation of the current dose will load on the screen.

From the Instadose web server a variety of reports are available for download through AMP (Account Management Program). The reports include:

- Radiation Exposure Summary Report
- History Detail Report
- Who Has Not Read Their Device

The Instadose DIS are automatically calibrated upon connection with the server, and as a part of Quality process from the supplier, a number of random DIS are collected for quality checks.

4. Administrative

In the procedure “AIN-RAD-PRO-010” the responsibility for personnel performing radiographic work is described (translated): *Read your dosimeter by the 1st of the following month, regardless of whether you have worked with ionizing radiation or not*. For the line management (translated): *Monitor and follow up reading of dosimeter*. To ensure control of potential high exposures, the following is describes as part of the rad coordinators responsibility (translated): *At doses (> 1.5 mSv) during a measurement period, radiation protection coordinator will initiate investigation.*

5. History

Since OAI started to use Instadose in late 2014, we have had no high readings on the monthly DIS reports. Starting August/September 2017 we started to get quite high readings for an amount of personnel. Based on the follow up on these individuals it came clear that the exposure was not related to rad work, but probably some other exposure. Some of the personnel had not performed any rad work, but still had high readings:

Exposure Date	First Name	Last Name	Username	Deep	Body
05.09.2017 11:12:45	Ind A			5,13	Torso
06.09.2017 14:20:22	Ind B			2,16	Torso
28.09.2017 14:49:46				1,87	Torso
26.09.2017 14:07:00				1,75	Torso
02.10.2017 16:41:55				1,7	Torso
02.10.2017 10:25:35				1,52	Torso
02.10.2017 20:22:34				1,44	Torso
30.08.2017 13:32:46				1,42	Torso
24.04.2017 09:19:14				0,99	Torso

Individual A have the following reading history YTD (Only readings with value):

Exposure Date	First	Last Name	Username	Deep	Body R
02.10.2017 10:25:35	Ind A			1,52	Torso
05.09.2017 11:12:45				5,13	Torso
23.08.2017 12:32:57				0,58	Torso
23.01.2017 11:05:52				0,1	Torso

Individual B have the following reading history YTD (Only readings with value):

Exposure Date	First Name	Last Name	Username	Deep	Body R
06.09.2017 14:20:22	Ind B			2,16	Torso
04.07.2017 11:05:29				0,08	Torso
25.04.2017 10:28:47				0,29	Torso
05.06.2016 17:30:29				0,18	Torso
14.03.2016 18:31:04				0,08	Torso

The initial investigation identified no change in work process / method / amount. The only change where related to the rebuild of Bergen Airport Flesland, and the luggage handling / security system.

All personnel affected had travelled through Flesland, and all personnel have checked in their dosimeter with checked-In Baggage scanner.
Dosimeters checked in with Hand-Carried Baggage scanner was not affected.

Based on the information a Safety alert was sent from OAI 02.10.17 to all rad technicians, telling them to hand-carry all Dosimeters through any security control:

OCEANEERING

HSE Bulletin: Høy avlesing av verdier på persondosimetre

HVA SKJEDDE?

- Det har blitt avlest relativt høye verdier på noen dosimetre av typen Instadose
- Ingen av operatørene har identifisert noe radiografiarbeid som skulle tilsi de forhøyede avlesningene
- Ved gjennomgang av de de avleste dosimetrene er følgende fellesnevnere identifiserte:

  - Alle dosimetrene har vært sendt som innsjekket bagasje.
  - Alle dosimetrene har vært sendt over Flesland nye terminal
  - Flesland har fått nytt nye standard-3 røntgenmaskinene for innsjekket bagasje
  - De nye røntgenmaskinene genererer mere røntgenstråling enn standard-2 maskinene man brukte tidligere på Flesland.
  - Vi har ikke målt påvirkningen på dosimetrene ved tidligere flyreiser

HVA GJØR VI?

  - Hendelsene er under gransking
  - Vi vil også måle eksponeringen fra røntgenskannerne standard-3 til Instadose dosimetre så snart vi får en avtale med Avinor om å gjennomfør dette.

NB: Instadose dosimetre skal IKKE transporteres som innsjekket bagasje,

men medbringes som håndbagasje

ER DU USIKKER:

STOPP JOBBEN

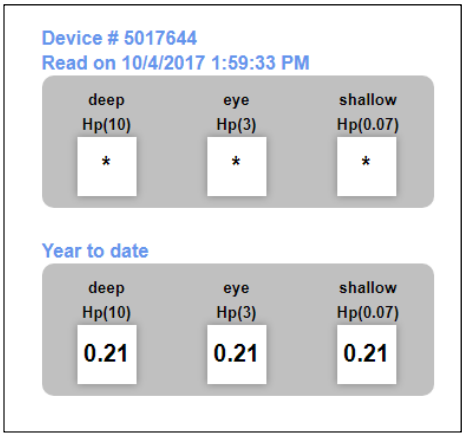
The information related to this incident also forwarded to Statens Strålevern (The Norwegian Radiation authorities).

We established contact with AVINOR (which operates most of the civil airports in Norway) to get access to the X-ray machine for baggage scanning, and so was granted 05.10.17

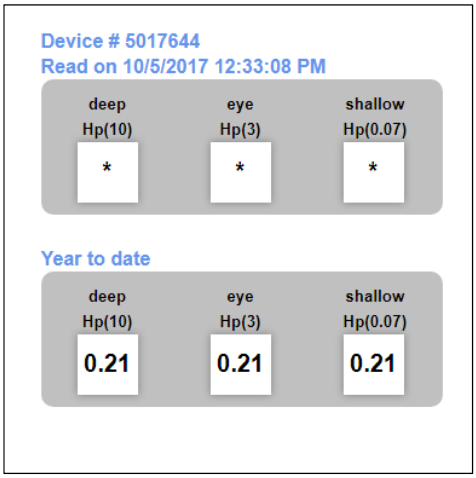
The check was done with two Instadose dosimeters, read immediately before they were sent through the scanner, and the re-read just after the scanning. The result is visualized below:

Dosimeter: 5017644

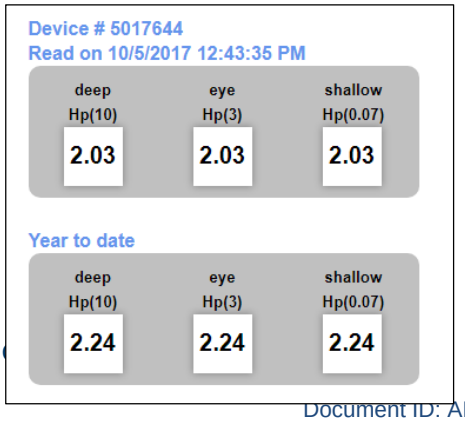
Prior to check-inn:



After check-in hand-carried:

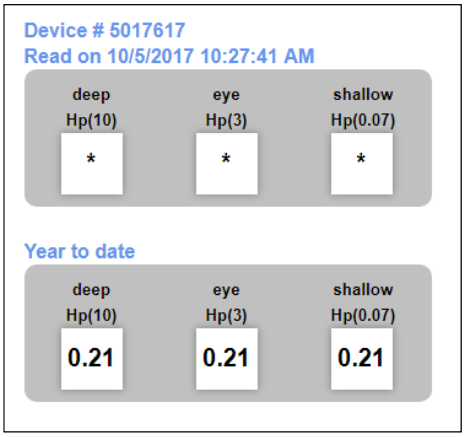


After check-in luggage:

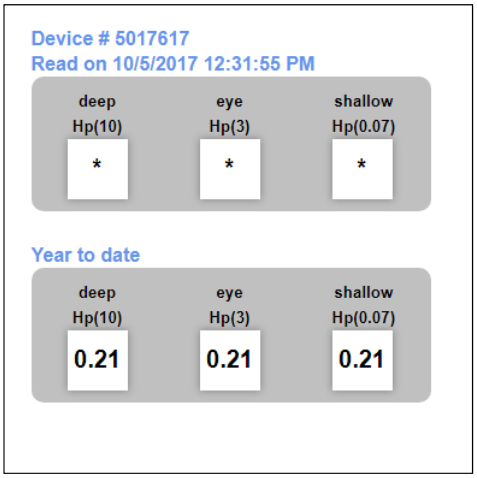


Dosimeter: 5017617

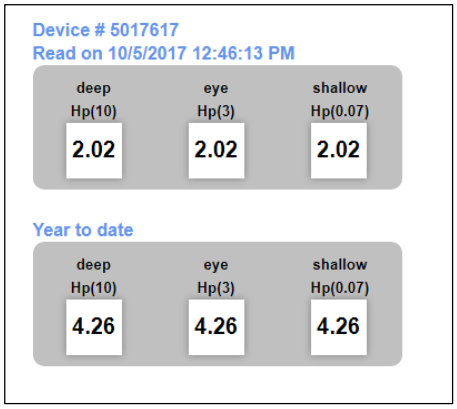
Prior to check-inn:



After check-in hand-carried:



After check-in luggage



6. Conclusion

Based on the information found during this test, we find it reasonable to exclude any other sources to contribute to the high dose rating.

We will continue to follow up monthly checks from the dosimeter readings, and based on the available information our procedures will be updated and pinpoint hand carrying of all dosimeters during security checks.

Details about the baggage scanner are not available, but AVINOR informed that this, or similar, are to be the standard equipment on European airports.

Standard film dosimeters are not checked, but we have no reason to believe that they will not be affected likeways.