

# The Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR)

## INDUSTRIAL RADIOGRAPHY



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ISEMIR is Information System on Occupational Exposure in Medicine, Industry and Research.

ISEMIR-IR is a tool for radiation protection optimization for non-destructive testing companies carrying out industrial radiography (IR). ISEMIR-IR is developed as a web-based tool for regular data collection and analysis of occupational doses for individuals in IR, and for the use of this information to improve occupational radiation protection.

It assists IR facilities in benchmarking their arrangements in radiation protection and safety, and hence in promoting of, implementation of optimization of occupational radiation protection.

### Why is ISEMIR-IR focused on industrial radiography?

Industrial radiography work by its nature is often carried out under difficult working conditions, such as in confined spaces or extreme cold or heat or working at night. Working under such adverse conditions might result in operational situations in which occupational radiation protection may be compromised. Experience shows that incidents involving IR sources have sometimes resulted in high doses to workers, causing severe health consequences such as radiation burns and, in a few cases, death.

It has been long known that there is a significant potential for IR personnel to receive non-trivial occupational exposure. As such, it is of utmost importance to have a mechanism to ensure sharing and exchanging knowledge and experience for improving occupational radiation protection in industrial radiography.

### What are the objectives of ISEMIR-IR?

- to facilitate the implementation of ALARA practices and effective exposure management
- to provide efficient collection and maintenance of data on occupational exposure, radiation practices and incidents
- to allow non-destructive testing (NDT) companies to benchmark their own facility and individual radiographers' performances against global or regional data to define follow-up actions to address identified gaps and disseminate lessons learnt
- to contribute to minimizing the likelihood of accidents, e.g. by identifying pre-cursors, user feedback and experience.





## How was ISEMIR-IR developed?

The ISEMIR project was initiated by the IAEA in January 2009 to focus on very specific topical areas where occupational radiation protection for the workers is not trivial and faces unresolved issues and gaps.

The ISEMIR is coordinated by the IAEA. In the design phase, the IAEA was assisted by an [Advisory Group](#) with representatives of international organizations as well as from the five main world regions. The Advisory Group identified two specific areas in radiation use, where non-trivial occupational exposures occur, interventional cardiology and industrial radiography.

For each of these 2 topical areas a working group was set up with experts covering the particular area in a comprehensive way with respect to professions, type of radiation usages, geographical regions and other factors.



## What was the role of the ISEMIR Working Group on Industrial Radiography?

ISEMIR Working Group on Industrial Radiography's (WGIR) main task was to draw an overview of the situation concerning occupational exposures and radiation protection of staff in IR worldwide.

The WGIR was comprised of professionals with experience of working for NDT companies, client companies, NDT societies, technical service organizations, including education, training and inspection, and regulatory bodies.

As a part of its actions, WGIR performed a [worldwide survey](#) of occupational radiation protection in IR over a period of about one year, from mid-2010 to mid-2011. Responses were received from 432 industrial radiographers, 95 NDT companies, and 59 regulatory bodies. The data collected were able to demonstrate:

- a clear need for worldwide improved optimization of occupational radiation protection in IR
- an ability to compare doses for specific occupational roles and conditions, and to assess the impact of radiation protection actions, and to follow dose trends.

Read more about the survey in [IAEA TEC- DOC 1747](#).

As a result, WGIR has proposed to the Advisory Group and IAEA [to set up an international database as a tool for optimization of occupational radiation protection](#).

## Benefits of participation in ISEMIR-IR

The participation is free of charge and many parts of the data entry are voluntary in order to make it accessible to all interested parties. Each participating NDT company is able to provide annual information about company, including the sources used, company procedures, training related to radiation protection, and individual industrial radiographers in the company.

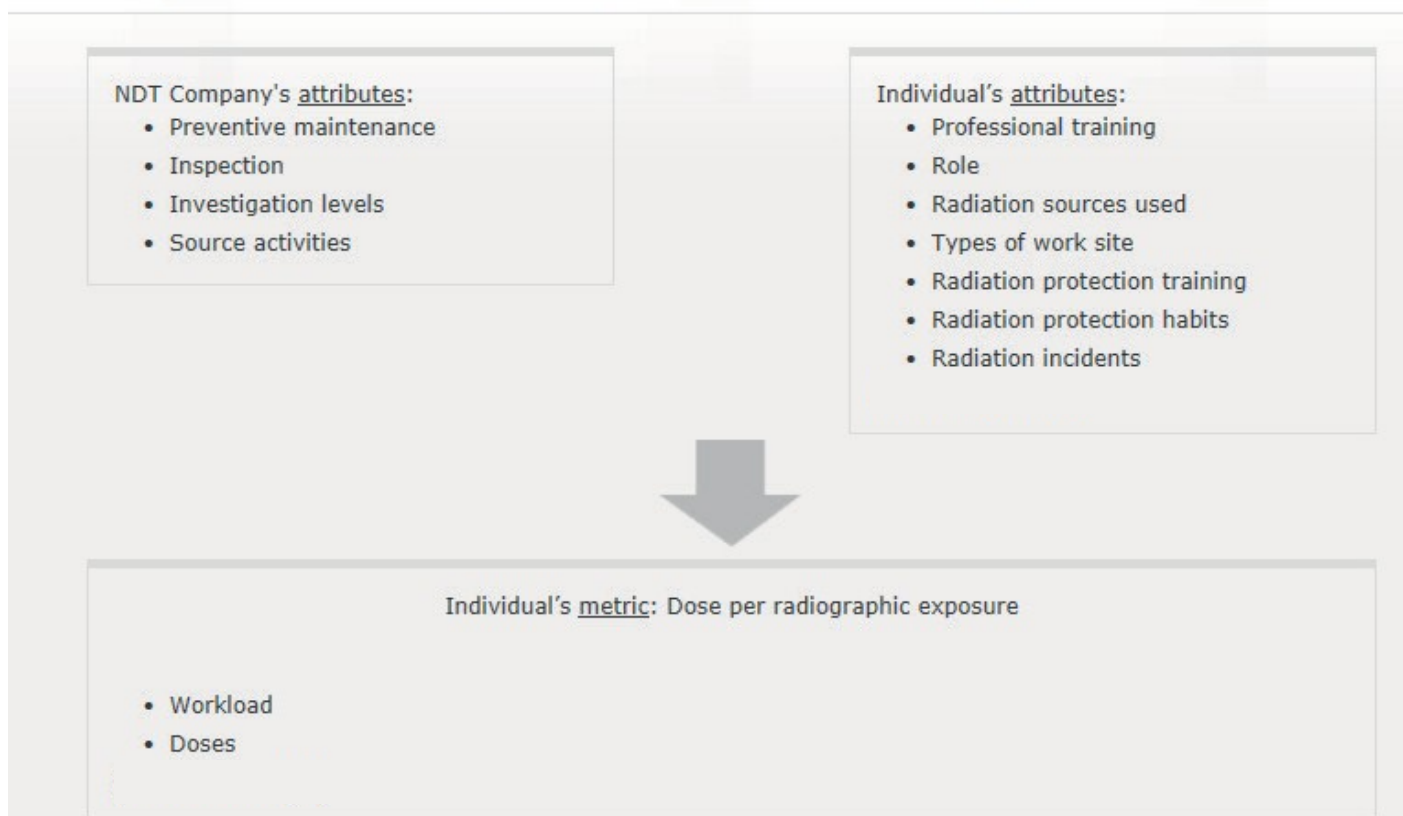
As an outcome of the data entry, a NDT company is able to assess the effectiveness of the optimization of radiation protection. The metric is determined by occupational dose per radiographic exposure for a given industrial radiographer. See the flowchart below:

The international database supports three broad types of analyses:

- occupational doses per radiographic exposure for a given industrial radiographer as a function of personnel and facility attributes
- benchmarking
- trends with time (per radiographic exposure over successive years).

With the help of ISEMIR-IR, the NDT facilities are able to benchmark their own company and individual personnel performances against global or regional data. They can also identify areas for improvement and corrective actions that should lead to an improvement in radiation protection.

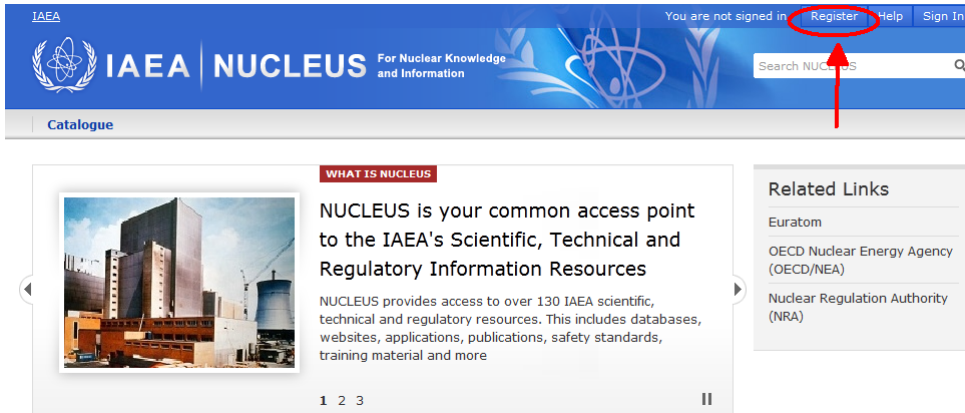
### Characterizing the circumstances of occupational exposure arising from Industrial Radiography.



## How to register for participating in ISEMIR-IR

The ISEMIR-IR database is based around individual NDT companies. Each NDT company needs to select a point of contact – the Company Coordinator (CC). This person is responsible for entering the company's data. In order to gain access to ISEMIR-IR, the CC should follow the steps below:

1. The Company Coordinator (CC) should first register with NUCLEUS, a common access point to about 130 IAEA's scientific, technical and regulatory information resources <http://nucleus.iaea.org/>\*



2. He/she needs to confirm the email link received after the registration
3. Once his/her IAEA Nucleus account is activated, the CC should return to ISEMIR <https://nucleus.iaea.org/isemir/>

### Welcome to ISEMIR

ISEMIR is the IAEA Information System on Occupational Exposure in Medicine, Industry and Research.

#### Biology (ISEMIR-IC)

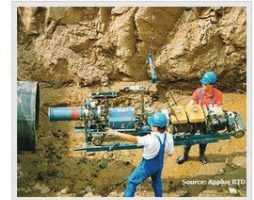
ology facilities to improve their  
rtional radiation protection.



#### ISEMIR Industrial Radiography (ISEMIR-IR)

Enter ISEMIR-IR ▶

ISEMIR IR - a tool for non-destructive testing companies carrying out industrial radiography to improve implementation of optimization of occupational radiation protection.



\*If the CC is already registered with Nucleus, he/she can simply sign in using the existing user name and password.

4. In order to participate in ISEMIR-IR, the CC should enter ISEMIR-IR



#### ISEMIR INDUSTRIAL RADIOGRAPHY (ISEMIR IR)

ISEMIR-IR – a tool for non-destructive testing companies carrying out industrial radiography.

ISEMIR-IR is developed as a web-based tool for data collection. It assists IR facilities in benchmarking their arrangements in radiation protection and safety, and hence in promoting of, implementation of optimization of occupational radiation protection.

[What is ISEMIR-IR?](#) | [User Guide](#) | [TECDOC](#)

On the home page of ISEMIR-IR, you need to click on the button “Request Access” to gain entry to the database.

Fields such as Nucleus Login, First Name, Last Name, and Phone Number, are automatically filled in from information in NUCLEUS. The “Request Access to ISEMIR” page requires some additional information about the NDT company. Mandatory fields are indicated with an asterisk. In the “Job Title” field please enter your professional role – e.g. radiation protection officer (RPO), industrial radiographer, manager, etc. The options for the “ISEMIR User Role” are limited to “Company Coordinator”.

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IR Home
My Companies
My Profile
Annual Collections
Statistical Reports
Statistical User

### My User Profile

* Required Information	
Nucleus Login:	
First Name:	
Last Name:	
Phone Number:	
User Role(s):	<ul style="list-style-type: none"> <li>• ISEMIRIR Company Coordinator</li> </ul>
Job Title*:	<input style="width: 80%;" type="text"/>



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[ISEMIR Home](#) | [IR Home](#) | [My Companies](#) | [My Profile](#) | [Annual Collections](#) | [Statistical Reports](#) | [Statistical User](#)

## Request New Company

\* Required Information

Company Information	
Name*:	<input type="text"/>
Street Address 1:	<input type="text"/>
Street Address 2:	<input type="text"/>
City*:	<input type="text"/>
Post Code:	<input type="text"/>
Country*:	-- select --
Phone Number:	<input type="text"/>
RPO Information	
RPO Name:	<input type="text"/>
RPO Email Address:	<input type="text"/>
RPO Phone Number:	<input type="text"/>

Please be accurate in entering your company's name, city, and country as the ISEMIR Administrator needs to be able to verify that it is a genuine request and to make sure that there is no confusion between companies with similar names.

Note that the optional "RPO Information" is a means for establishing contact with the radiation protection officer (RPO) or radiation safety officer (RSO) for the NDT company if the CC is not in that role.

Once the request for access has been submitted, the ISEMIR Administrator will be notified. After the request has been reviewed and approved, the CC will receive an email confirming the approval. The CC will now have access and be able to commence data entry for the NDT company.

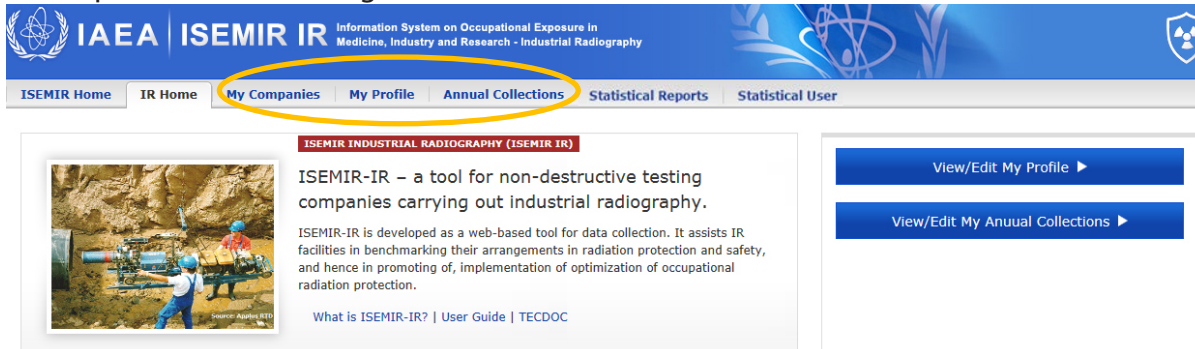
Note that a person can be a CC for more than one company. Once in the ISEMIR-IR database, a registered CC can click on the "My Companies" tab, and then click on the "Request New Company" button. This brings up a page requesting information for the new company. Once the new company is approved, the CC is notified accordingly and the CC will be able to commence data entry for the new company.





## How to enter data

When a registered CC logs into the ISEMIR-IR database, he/she will land on the home page/tab which provides some background information (see below).



ISEMIR INDUSTRIAL RADIOGRAPHY (ISEMIR IR)

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[What is ISEMIR-IR?](#) | [User Guide](#) | [TECDOC](#)

[View/Edit My Profile](#)

[View/Edit My Annual Collections](#)

There are 3 additional tabs available for data entry:

1. **My Companies**
2. **My Profile**
3. **Annual Collections**

Each of these will now be described in detail.

### 1. My Companies

This tab displays the NDT companies, for which you are the CC. This page allows the CC to edit any of the NDT companies – name, address and contact details, or to request to add a new company. Any saved changes will result in a notification being sent to the ISEMIR-IR Administrator, as a record of

#### My Companies

[Request New Company](#)

Company Name	City	Country	RP Officer	Action
				<a href="#">Edit Company Info</a> <a href="#">Add/Manage Custom Sources</a>

changes.

The CC can add/manage custom sources for each of the managed companies. Custom sources can be also managed (added or deleted) in the section Annual Collections.

### 2. My Profile

This tab displays your User Profile. The only action available on this page is to edit your job title.

### 3. Annual Collections

Data for each NDT company is entered per calendar year. The data entry may be progressive, occurring at various times during the year until complete, or it may be entered all at once.

The data for a given company can be in 1 of 3 possible states:

- *In progress*: The CC can view, edit and add data.
- *Submitted*: The CC has completed the data entry for the given year, and “submits” the data to the ISEMIR-Administrator. Once submitted, the CC coordinator cannot edit that year’s data.
- *Published*: The ISEMIR-Administrator has checked the submitted data for any anomalies. The data is ready to be “published”. Once published, the data is available in the ISEMIR-IR database for inclusion in any statistical analyses or benchmarking exercises. If there are queries regarding the submitted data, the ISEMIR Administrator will change the data status back to “In progress”, and the CC will be asked to address the issues and then re-submit.

Please note that an annual collection will stay in the status *In Progress* until the CC completes the annual data entry and submits the data for publication. In addition, the statistical and benchmarking capabilities are available only for the annual collections in the status “Published”.

The CC can view their own company data at all times, regardless of the status of a given year’s data.

A given company’s data can be viewed only by that company’s CC.

In order to enter the data, the CC first needs to select the particular year and company.



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Medicine, Industry and Research - Industrial Radiography

ISEMIR Home | IR Home | My Companies | My Profile | **Annual Collections** | Statistical Reports | Statistical User

## Annual Collections

**Search Annual Collections**

Company: TEST ▼ Year: 2010 ▼

**No Data**  
Data collection for year 2010 has not been started for this facility.

[Start Data Collection](#)

On the first page under the Annual Collections tab, the CC can choose the company and the calendar year to be viewed or edited. If there are no current data for a given company and year, the information box appears. A blue button labelled “Start Data Collection” can be used to initiate data entry for that company and year. The annual collection is automatically in status “In Progress”.

Each annual collection includes five datasets to be completed by the CC – four related to company information and one related to occupationally exposed personnel.

Type of dataset	Summary	Action
Radiography Sources	Input Data Radiography Sources (No data for radiography sources exists)	<a href="#">Input Data</a>
Company Procedures	Company Procedures' data not inputted.	<a href="#">Input Data</a>
Dose Information	Occupational workers' information record not inputted.	<a href="#">Input Data</a>
Company Events	Company events' data not inputted.	<a href="#">Input Data</a>
Personnel Info	Input Data Personnel Info (No data for personnel info exists)	<a href="#">Input Data</a>

Each of the datasets can be edited by clicking “Input Data” in the column labelled “Action” corresponding to the particular dataset. If you click on “Input Data”, a new page opens displaying the particular selection of the Annual Collections dataset. You can save or cancel every data input and return to the Annual Collections anytime. After you enter and save data in the particular dataset, the label in the “Action” column changes from “Input Data” to “View/Edit Data”.

Type of dataset	Summary	Action
Radiography Sources	View/Edit Data Radiography Sources (Data for 1 radiography sources exists)	<a href="#">View/Edit Data</a>
Company Procedures	Company Procedures' data not inputted.	<a href="#">Input Data</a>
Dose Information	Occupational workers' information record not inputted.	<a href="#">Input Data</a>
Company Events	Company events' data not inputted.	<a href="#">Input Data</a>
Personnel Info	Input Data Personnel Info (No data for personnel info exists)	<a href="#">Input Data</a>

Please note that any data saved in any of the datasets is editable, if required, at any stage up until the NDT company data for that year is submitted to the ISEMIR-IR Administrator for publication.

Filling-in data in a particular dataset is not mandatory, however the CC has to save at least one of the five offered datasets, otherwise he/she is not able to submit the Annual Collection.

The following datasets should be filled in:

**a. Company information**

- Radiography Sources
- Company Procedures
- Dose Information
- Company Events

**b. Personnel Info**

Each of these will now be described in detail.

**a. Company information**

- Radiography Sources

Radiography Sources Tab relates to the number and type of sources used by the company. Only the CC (and the ISEMIR-IR Administrator) can see this information.

Once you click on "Input Data" for the Radiography Sources, 2 types of Radiography sources are displayed. If you wish to enter or edit the particular source, please press "Edit" in the Action column. The CC can delete a source by pressing "Delete" in the Action column.

*Radioactive Source	Number of Sources	Typical Initial Activity			Typical End Of Use Activity			Action
		Value	Unit	Converted Value	Value	Unit	Converted Value	
<sup>60</sup> Co	5	20	Ci	0.74 TBq	75	Ci	2.775 TBq	Edit Delete
<sup>192</sup> Ir	0	0			0			Edit
<sup>75</sup> Se	0	0			0			Edit

The 2 types of Radiography sources are:

- *Radioactive Source:* For Iridium 192 (<sup>192</sup>Ir), Selenium 75 (<sup>75</sup>Se) and Cobalt 60 (<sup>60</sup>Co) sources, the CC should input the number of sources and identify the "Typical Initial Activity" and "Typical End of Use Activity." In the Activity tab, the CC fills the value and the units in either Ci (curie) or TBq (terabecquerel). After you click "Save", the application automatically converts the values from Ci to TBq and contrary. If you try to save empty source information, the system will notify you with the text message. If you wish to discard information about the source, you can always press "Cancel".
- *Radiation Generators:* If the NDT company uses X-Ray units, the CC should input the number of units. Optionally, he/she can enter the typical X-Ray unit settings expressed in kV (kilovoltage) and mA (milliamperage).

*Radioactive Source	Number of Sources	Typical Initial Activity			Typical End Of Use Activity		
		Value	Unit	Converted Value	Value	Unit	Converted Value
<sup>192</sup> Ir	0	0			0		
<sup>75</sup> Se	0	0			0		
<sup>60</sup> Co	0	0			0		

\*Click the 'Edit' link for a radioactive source in order to input data about that radioactive source.

*Radiation Generator	Number of Units	Typical kV	Typical mA	Action
X-ray Units	0	0	0	

\*Click the 'Edit' link for a radiation generator in order to input data about that radiation generator.



Custom Radiography Sources: ISEMIR-IR defines custom sources as radioactive sources other than  $^{192}\text{Ir}$ ,  $^{75}\text{Se}$  and  $^{60}\text{Co}$  or radiation generators other than X-ray units. The CC can add custom sources owned by the company by clicking on "Add/Manage Custom Sources". The custom source will always appear in the list of the radiography sources for the particular NDT company

### List of Custom Radiography Sources

[Add A Custom Source](#)

Isotope Number	Isotope Name	Description	Is A Radiation Generator	Is InActive	Action
					Edit
					Edit

Page 1 of 1 (2 items) ⏪ ⏩ 1 ⏪ ⏩ Page size: 20

### • Company Procedures

The section Company procedures captures the company investigation levels, information about maintenance and company's own compliance inspections.

Once you click on "Input Data" for the Company Procedures, the below questions are displayed. Please note that none of these questions are strictly mandatory, however they help the ISEMIR-IR to gather more information for the annual analysis and benchmarking of your company.

#### \* Required Information

Are there company investigation levels for occupational exposure*:	<input type="radio"/> Yes <input type="radio"/> No
If yes, what is the investigation level (in mSv) per month?:	<input type="text"/>
Does your company perform its own preventive maintenance*:	<input type="radio"/> Yes <input type="radio"/> No
If yes, what is the interval between preventative maintenance for gamma radiography exposure devices (in number of months):	<input type="text"/>
If yes, what is the interval between preventative maintenance for X-ray equipment (in number of months):	<input type="text"/>
Does your company perform its own compliance inspections of its radiographers*:	<input type="radio"/> Yes <input type="radio"/> No
If yes, approximately how many times per year would a radiographer be inspected by your Company*:	<input type="text"/>

If you answer "yes" to the question "Are there company investigation levels for occupational exposure?" or "Does your company performs its own compliance inspections of its radiographer?", you will be obliged to specify answers in the follow-up questions. Questions about intervals between preventive maintenance for gamma radiography exposure devices and for X-ray equipment must be answered with a numerical value for number of months.

- **Dose Information**

For Collective Dose Information, the CC should fill the number of occupationally exposed workers in the particular NDT company, the total number of radiography exposures conducted by all workers in the company and the total of the annual doses received by all workers. The annual dose information should be expressed in the dose quantity Hp(10) in units of man millsieverts (man.mSv). The CC may also provide the minimum detectable dose level.

For Number of Workers in Dose Ranges, the CC may provide the number of workers falling into each of the ranges listed. The choices range from lower than the minimum detectable level up to 50 mSv. No personal information about the employees is required.

\* Required Information

#### Collective Dose Information

Number of Occupationally Exposed Workers*:	<input type="text" value="0"/>	
Number of exposures in the year*:	<input type="text" value="0"/>	
Annual Collective Dose (in man.mSv/year)*:	<input type="text" value="0"/>	
Minimum Detectable Level (in mSv):	<input type="text" value="0"/>	

#### Number of Workers in Dose Ranges

Annual Dose < min detectable level:	<input type="text"/>	
min detectable level ≤ Annual Dose < 1 mSv:	<input type="text"/>	
1 mSv ≤ Annual Dose < 5 mSv:	<input type="text"/>	
5 mSv ≤ Annual Dose < 10 mSv:	<input type="text"/>	
10 mSv ≤ Annual Dose < 15 mSv:	<input type="text"/>	
15 mSv ≤ Annual Dose < 20 mSv:	<input type="text"/>	
20 mSv ≤ Annual Dose < 30 mSv:	<input type="text"/>	
30 mSv ≤ Annual Dose < 50 mSv:	<input type="text"/>	
50 mSv ≤ Annual Dose:	<input type="text"/>	

Please note that the information from this tab gives the ISEMIR-IR the possibility to calculate the dose metric used in statistical analysis, annual mean occupational dose per exposure. After the annual collection becomes published, the CC is able to benchmark his/her company. Therefore, it is important that you fill in as much information as possible in this section.

- **Company Events**

This section focuses on entering information about accidents, near misses and any deviations from normal.

Number of accidents with doses ≤ 20mSv*:	<input type="text" value="0"/>	
Number of accidents with doses > 20mSv*:	<input type="text" value="0"/>	
Number of near misses with doses ≤ 20mSv*:	<input type="text" value="0"/>	
Number of near misses with doses > 20mSv*:	<input type="text" value="0"/>	
Number of deviations from normal:	<input type="text"/>	

What is meant by an accident?

*Accident is any unintended event, including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection or safety.*

What is meant by a near miss?

*Near miss is a potentially significant event that could have occurred as the consequence of a sequence of actual occurrences but did not occur owing to the conditions prevailing at the time.*

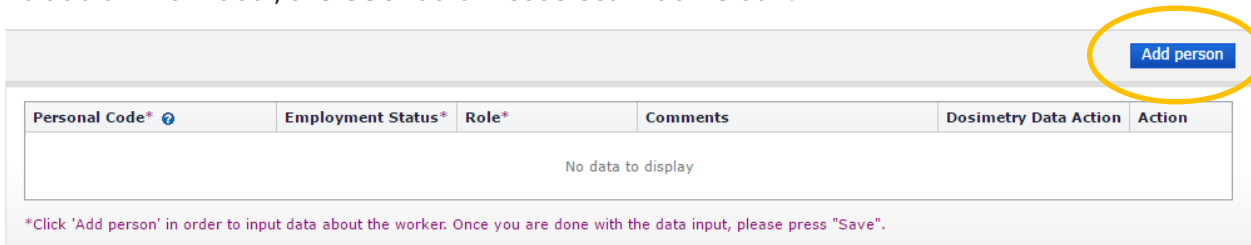
What is meant by deviation?

*Deviation from normal represents an event with no safety significance.*

In the final analysis available to the CC (after publishing the annual collection), this information helps to make any connection between the company event and the radiation dose received by a worker in the particular timeframe.

### b. Personnel Info

To add an individual, the CC should first select "Add Person."



The screenshot shows a web interface with a table header containing columns: Personal Code\*, Employment Status\*, Role\*, Comments, Dosimetry Data Action, and Action. The table body is empty with the text "No data to display". A blue button labeled "Add person" is circled in yellow in the top right corner. Below the table, a note reads: "\*Click 'Add person' in order to input data about the worker. Once you are done with the data input, please press 'Save'."

You can then fill in the personal code of the worker. A simple code or initials may be sufficient and ensures total anonymity. Note that ISEMIR-IR does not track individuals over years but tracks personal codes over the years. The CC may choose to use the same code for an individual over successive calendar years.



The screenshot shows the 'Add Person' form with the 'Role\*' column expanded to show a list of roles with checkboxes: Assistant to the radiographer, Industrial radiographer, Managerial, RPO, Source recovery, and Trainee industrial radiographer. The 'Action' column contains 'Save' and 'Cancel' buttons.

In addition, it is mandatory to indicate the level of seniority in the employment status and the role of the person. Once you are ready with the data entry, please press "Save".

You can now enter the data for the particular worker by clicking "Input Dosimetry Data". You can track the progress of your data entry in the percentage indicated under "Input Dosimetry Data".

Personal Code*	Employment Status*	Role*	Comments	Dosimetry Data Action	Action
TEST - E1	Full time	Assistant to the radiographer		<b>Input Dosimetry Data (0% complete)</b>	Edit Person Delete Person

After the main worker's information is inserted, the screen will appear with five tabs for entering annual doses, sources used, workload information, radiation protection training and other habits.

### Annual Doses

Please enter the Hp(10) annual dose of the worker. This information is mandatory. Without it, you will not be able to access the analysis and benchmarking part for this particular person.

Annual Doses	Sources Used	Workload	Radiation protection training	RP habits	
* Required Information					
Dose Type	Dose Value (mSv)				
Hp(10) dose * :	<input type="text"/>				
Shallow dose Hp(0.07) :	<input type="text"/>				
Lens dose Hp(3) :	<input type="text"/>				
Extremity dose Hp(0.07) :	<input type="text"/>				
				<input type="button" value="Save"/>	<input type="button" value="Cancel"/>

### Sources used

In this section, the CC should provide information about the usage and dose percentage of the particular sources (if owned by company).

"Usage percentage" indicates the time percentage that the employee spent working with the selected source.

"Dose percentage" stands for the distribution of the dose value received by the employee from that particular source.

Annual Doses	Sources Used	Workload	Radiation protection training	RP habits	
* Required Information					
Radioactive Source	Usage Percentage	Dose Percentage			
$^{192}\text{Ir}$ * :	<input type="text" value="0"/>	<input type="text" value="0"/>			
$^{75}\text{Se}$ * :	<input type="text" value="0"/>	<input type="text" value="0"/>			
$^{60}\text{Co}$ * :	<input type="text" value="0"/>	<input type="text" value="0"/>			
X-ray Units * :	<input type="text" value="0"/>	<input type="text" value="0"/>			
				<input type="button" value="Save"/>	<input type="button" value="Cancel"/>



## Workload

Workload is important information, which is needed for later analysis. The CC needs to enter number of exposures of the particular employee in that year. If you wish to specify the location and type of work of the employee, please enter also percentages of exposures which happened at a field site or in the bunker.

Annual Doses	Sources Used	Workload	Radiation protection training	RP habits
* Required Information				
Number of exposures in the year*:		<input type="text" value="0"/>		
Percentage of exposures on site:		-- select --		
Percentage of exposures in the bunker:		-- select --		
				<input type="button" value="Save"/>

## Radiation protection training

The CC should fill in the information about the radiation protection qualification and training of the worker. This is voluntary information, which helps to identify any correlation between high occupational doses and the potential lack of training.

Annual Doses	Sources Used	Workload	Radiation protection training	RP habits
* Required Information				
Question	Answer			
Does the worker have a valid radiation protection qualification? * :	<input type="radio"/> Yes <input type="radio"/> No			
Did the worker obtain an initial radiation protection training? * :	<input type="radio"/> Yes <input type="radio"/> No			
If yes, which year?:	<input type="text"/>			
Did the worker obtain a refresher radiation protection training? * :	<input type="radio"/> Yes <input type="radio"/> No			
If yes, which year?:	<input type="text"/>			
Did the radiation protection training included training for emergencies? * :	<input type="radio"/> Yes <input type="radio"/> No			
				<input type="button" value="Save"/> <input type="button" value="Cancel"/>

### Radiation protection habits

The CC can fill in the section about the use of radiation protection equipment and other practices conducted by the worker. Again, this section is voluntary but helps to improve the overall understanding of ISEMIR-IR about the trends in the company.

RP Exposure	Exposure Percentage
Use of collimators for gamma radiography, when appropriate or possible	-- select --
Use of diaphragms/collimators for X-ray radiography, when appropriate or possible	-- select --
Use of survey meter	-- select --
Use of direct reading dosimeter	-- select --
Checking for the presence of the source in the exposure device before taking the device from the store	-- select --
Checking for the presence of the source in the exposure device after finishing the NDT test	-- select --

Once the data entry of Company Information and Personnel Information for a given year is completed, the dataset can be submitted. When the submitted data has been reviewed and there are no further issues or queries from the ISEMIR-IR Administrator, the data can be published and become part of the ISEMIR-IR database, available for analysis and benchmarking.

## Benchmarking and analysis

After the annual collection has been submitted and published by the ISEMIR-IR Administrator, the CC receives an email notification. Afterwards, you can return to the ISEMIR-IR and go to the section "Statistical reports". You will be able to see your company (please see below an example - the company is called "Test RSM 1").

If the CC coordinates more companies, he/she can select which company he/she would like to benchmark/analyze.



IAEA | ISEMIR IR Information System on Occupational Exposure in Medicine, Industry and Research - Industrial Radiography

ISEMIR Home IR Home My Companies My Profile Annual Collections Statistical Reports Statistical User

### Statistical Reports

Search Statistical Reports

Company: Test RSM 1 Report Type: -- select -- [Get Report Filters](#)

Statistical reports available in ISEMIR-IR offer the CC further insights into the submitted company data and can serve as a benchmarking tool. The analysis is based on a mean occupational dose per exposure. This is calculated as the occupational dose received divided by the number of exposures.

Data may be filtered based on a variety of characteristics of the company and individual workers. Statistical analysis of the dose metrics for a company or a given group of persons can be used to identify areas that could be improved or, on the other hand, that represent good practices.

ISEMIR-IR provides the following types of benchmarking and analysis:

### 1. Company-based statistics and graphs:

- **Analysis** (= trends over time for your company)
- **Benchmarking** (= trends of dose exposure for companies)

### 2. Individual-based statistics and graphs:

- **Analysis** (= trends over time for a particular individual from your company)
- **Benchmarking** (= trends of dose exposure for individuals)

The following sections will describe in detail the use of the analytical and benchmarking tools. The examples are provided for every section. Please note that these are only informative and the tools can be used for production of many different analyses.

### 1. Company-based:

The company-based analysis and benchmarking is defined by the main metric - mean occupational effective dose per exposure. In this section, it is calculated from the company data. It represents the company collective dose divided by the total number of exposures.

If the CC has previously entered the total number of exposures in the company and the collective annual dose (in the "Dose Information" section of the data entry), he/she can see this analysis for the particular timeframe.

#### Company-based analysis

In order to conduct analysis of your own company, please follow these steps.

- a. Please select the timeframe – "Beginning Year" to "Ending Year"
- b. Press "Apply Filters"
- c. The statistics in the table will automatically appear as well as the associated graphs.
- d. If you wish to save your results and use it outside of ISEMIR, share it with your colleagues or simply save it for your own reference, you can do so by pressing "Download Report" button.

#### Statistical Reports

Search Statistical Reports

Company:  Report Type:  [Get Report Filters](#)

\* Required Information

Beginning Year\*

Ending Year\*

[Reset Filter](#) [Apply Filters](#)

[Download Report](#)

The use of this analytical tool can be demonstrated through an example:

In this case, the CC's company is called "Test RSM 1". The CC has selected the "Company-based analysis" and chose to see the analysis for the years from 2007 until 2016.

After the CC pressed "Apply Filters", the following statistics has appeared on the screen:

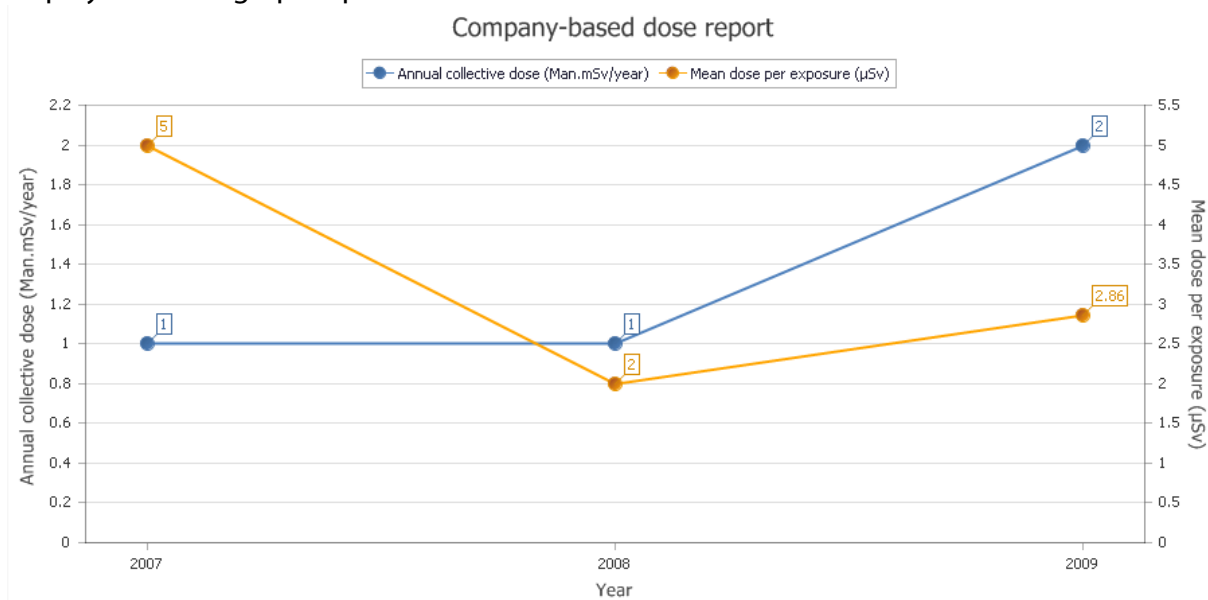
Dose values			
Test RSM 1			
Year	Annual collective dose (Man.mSv/year)	Average effective dose(mSv)	Mean dose per exposure (µSv)
2007	1	0.01	5
2008	1	0.02	2
2009	2	0.2	2.86

The CC can now see that only three of the company's annual collections are published. These are for the years - 2007, 2008 and 2009. Out of these numbers, he/she is able to see that the highest value of the mean dose per exposure for all workers in this company was measured in 2007 while the lowest value was in 2008.

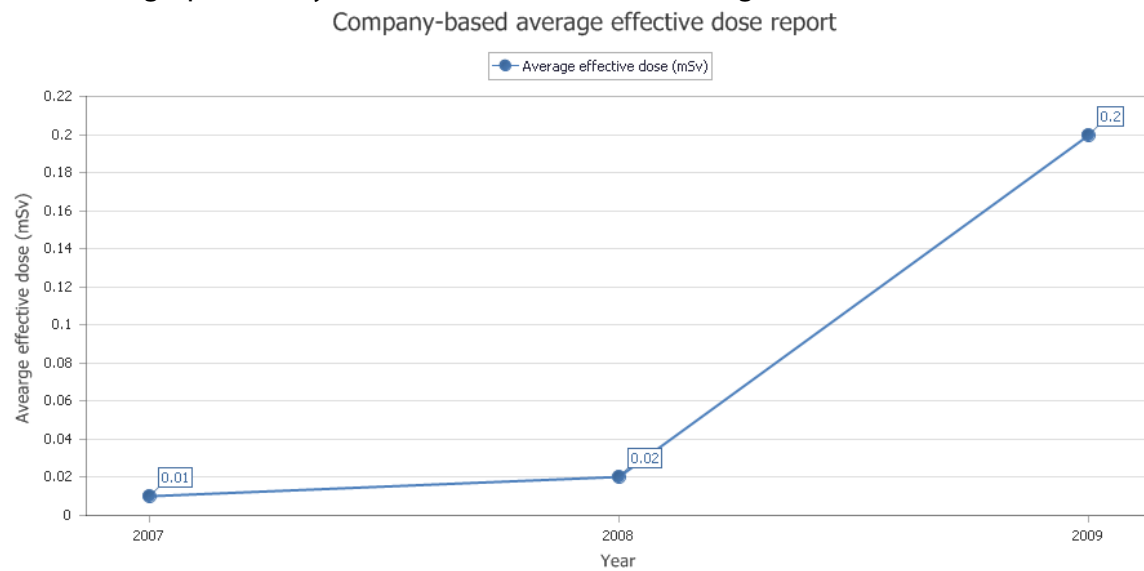
In addition to the mean dose per exposure, ISEMIR-IR also provides insights about the average effective dose. This is calculated as annual collective dose divided by the number of occupationally exposed workers in the company for the particular year.



The trends for the mean dose per exposure (in  $\mu\text{Sv}$ ) and for the annual collective dose (in  $\text{mSv}$ ) are displayed in one graph – please see below.



The other graph visually shows the trends for the average effective dose.



In addition to these graphs, the CC can review the trends of the company events over time. This graph is shown only when the CC has previously entered information about the accidents and near misses in the company.



## Company-based benchmarking

In order to benchmark your own company against others in the database, please follow these steps.

- Please select the year
- If you wish to apply further criteria for benchmarking (such as to see only companies from the same geographical region), please see apply "Advanced Filters"
- Press "Apply Filters"
- The statistics in the table will automatically appear as well as the associated graphs.
- If you wish to save your results and use it outside of ISEMIR, share it with your colleagues or simply save it for your own reference, you can do so by pressing "Download Report" button.

## Statistical Reports

Search Statistical Reports

Company:  Report Type:  [Get Report Filters](#)

---

\* Required Information [show/hide advanced filters](#)

**Mandatory filters**

Year\*:

**Advanced filters**

Country:

Region:

Company sources owned by a company:  <sup>192</sup>Ir  <sup>75</sup>Se  <sup>60</sup>Co  X-ray Units

Are there company investigation levels for occupational exposure?:  Yes  No

Does the company perform its own compliance inspections of radiographers?  Yes  No

Number of Occupationally Exposed Workers:

Preventive Maintenance  Yes  No

[Reset Filters](#) [Apply Filters](#)  
[Download Report](#)

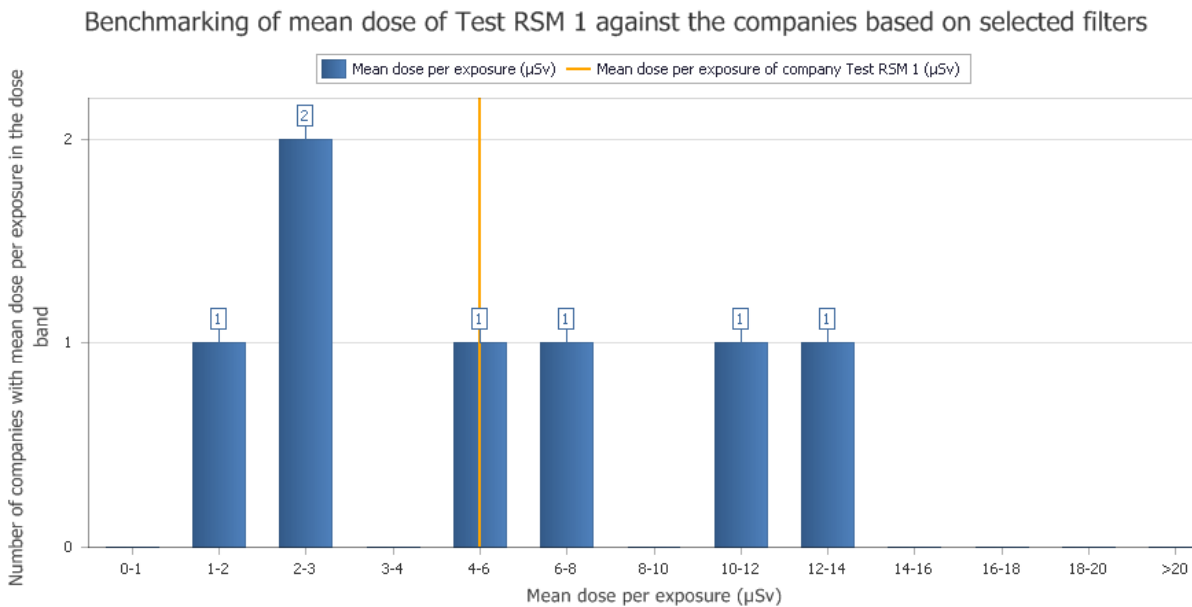
The use of this benchmarking tool can be again demonstrated though an example: In this case, the CC's company is called "Test RSM 1". The CC has selected the "Company-based benchmarking" and chose to see the analysis for 2007. He/she has not selected any further filters. After the CC pressed "Apply Filters", the following statistics appeared on the screen:

Statistics(based on the selected filter criteria)	
Mean dose per exposure of Test RSM 1 (in $\mu$ Sv) based on the selected filters	5
Average effective dose of Test RSM 1 (in mSv) based on the selected filters	0.01
Number of all companies based on the selected filters	7
Mean dose per exposure of all companies based on the selected filters (in $\mu$ Sv)	8.93
Standard deviation	4.71
Min	1.43
Q1	2
Median	5
Q3	8.835
Max	13.33

As discussed in the part “Company-based Analysis”, ISEMIR-IR shows the CC the values for the mean dose per exposure (5  $\mu\text{Sv}$ ) and the average effective dose (0.01 mSv) in 2007.

As shown below, there are 7 companies apart of the company “Test RSM 1”, which fulfill the selection criteria. The mean dose of the CC’s company, 5  $\mu\text{Sv}$ , is lower than the mean dose per exposure of the 7 companies, 8.93  $\mu\text{Sv}$ .

Please see below the visual representation of the benchmarking of mean dose per exposure. The results are displayed as the number of companies falling into each dose band with an yellow line representing “Test RSM 1”:



In addition, the ISEMIR-IR also offers the graph showing annual collective dose of all companies based on the selected filters. If any CC would be interested in taking into consideration the number of employees or size of the company, he/she can also proceed with this option.

## 2. Individual-based:

The individual-based analysis and benchmarking is defined by the main metric - mean occupational effective dose per exposure. In this section, it is calculated from the individual data, which the CC enters in the data entry section "Personnel Info". Mean occupational effective dose per exposure represents the annual effective dose divided by the number of exposures (of an individual or a group of individuals).

If the CC has previously entered the number of exposures for a particular individual and the annual dose information Hp(10) (in the "Dosimetry Data" of the "Personnel Info" section of the data entry), he/she can see this analysis for the particular timeframe.

### Individual-based analysis

In order to conduct analysis of one worker in your own company, please follow these steps.

- a. Please select the personal code of the worker, for whom you wish to see the analysis
- b. Please select the timeframe – "Beginning Year" to "Ending Year"
- c. Press "Apply Filters"
- d. The statistics in the table will automatically appear as well as the associated graphs.
- e. If you wish to save your results and use it outside of ISEMIR, share it with your colleagues or simply save it for your own reference, you can do so by pressing "Download Report" button.

### Statistical Reports

Search Statistical Reports

Company:  Report Type:  [Get Report Filters](#)

\* Required Information

Personal Code*	<input type="text" value="TEST RSM1 - E1"/>
Beginning Year*	<input type="text" value="2007"/>
Ending Year*	<input type="text" value="2016"/>

[Reset Filters](#) [Apply Filters](#)

[Download Report](#)

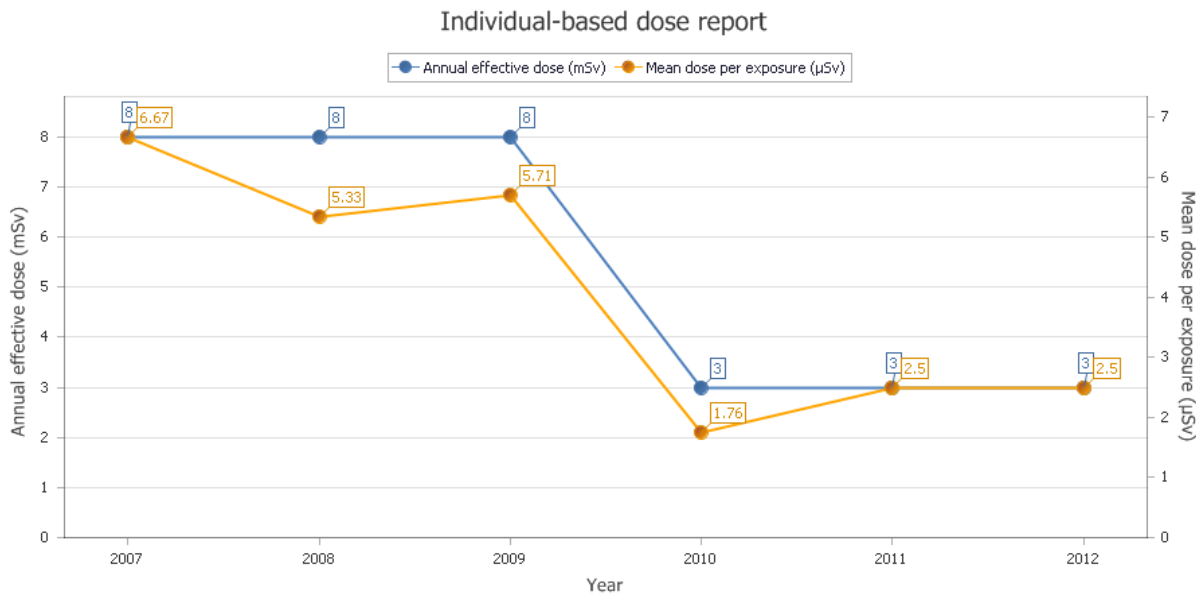
The use of this analytical tool can be demonstrated though an example:

In this case, the CC has selected the "Individual-based analysis" and chose to see the analysis for the years from 2007 until 2016. The CC has selected a worker called "TEST RSM1 – E1" from his/her company called "Test RSM 1". He/she knows that John Smith is the worker with the code "TEST RSM1 – E1" and keeps track of the codes used outside of ISEMIR-IR for maintaining confidentiality of workers.

After the CC pressed "Apply Filters", the following statistics appeared on the screen:

Dose values		
TEST RSM1 - E1		
Year	Annual effective dose (mSv)	Mean dose per exposure (µSv)
2007	8	6.67
2008	8	5.33
2009	8	5.71
2010	3	1.76
2011	3	2.5
2012	3	2.5

The CC can now see that John's annual effective dose as well as the mean dose per exposure has been higher in the years 2007-2009. As shown in the statistics, John's annual effective dose dropped to 3mSv in 2010 and remained at that level through 2012. This is visually shown in the graph below:



### Individual-based benchmarking

In order to benchmark the employees in your company against others in the database, please follow these steps.

- a. Please select the year
- b. If you wish to apply further criteria for benchmarking such as to see only workers with certain functions, please see apply "Advanced Filters"
- c. Press "Apply Filters"
- d. The statistics in the table will automatically appear as well as the associated graphs.
- e. If you wish to save your results and use it outside of ISEMIR, share it with your colleagues or simply save it for your own reference, you can do so by pressing "Download Report" button.



## Statistical Reports

Search Statistical Reports

Company:  Report Type:  [Get Report Filters](#)

\* Required Information show/hide advanced filters

**Mandatory filters**

Year\*:

**Advanced filters**

Role:

Employment status:

Number of exposures in the year:

Sources used:  <sup>192</sup>Ir  <sup>75</sup>Se  <sup>60</sup>Co  X-ray Units

Initial Radiation Protection Training:  Yes  No

Training for Emergencies:  Yes  No

Radiation Protection Qualification:  Yes  No

Refresher Radiation Protection Training:  Yes  No

Use of collimators for gamma radiography:  0-25  25-50  50-75  75-100

Use of diaphragms/collimators for X-ray radiography:  0-25  25-50  50-75  75-100

Use of survey meter:  0-25  25-50  50-75  75-100

Use of direct reading dosimeter:  0-25  25-50  50-75  75-100

Checking for presence of the source in the exposure device before taking the device from the store:  0-25  25-50  50-75  75-100

Checking for presence of the source in the exposure device after finishing the NDT test:  0-25  25-50  50-75  75-100

[Reset Filters](#) [Apply Filters](#)

[Download Report](#)

Again, the use of the benchmarking tool can be demonstrated on an example. In the previous section, the CC reviewed the dose trends for John Smith. The CC finds the results of John Smith for the years 2007-2009 particularly high. Therefore, he/she decided to compare the results of all full-time industrial radiographers from his/her company with the rest of the database.

In order to benchmark, the CC would select the year 2007 (or 2008 or 2009) and the option for full-time industrial radiographers in advance filters. The CC knows that his/her company strictly requires the fulfillment of radiation protection trainings by all occupationally exposed workers. Therefore, he/she selects this filter in the "Advanced filters".

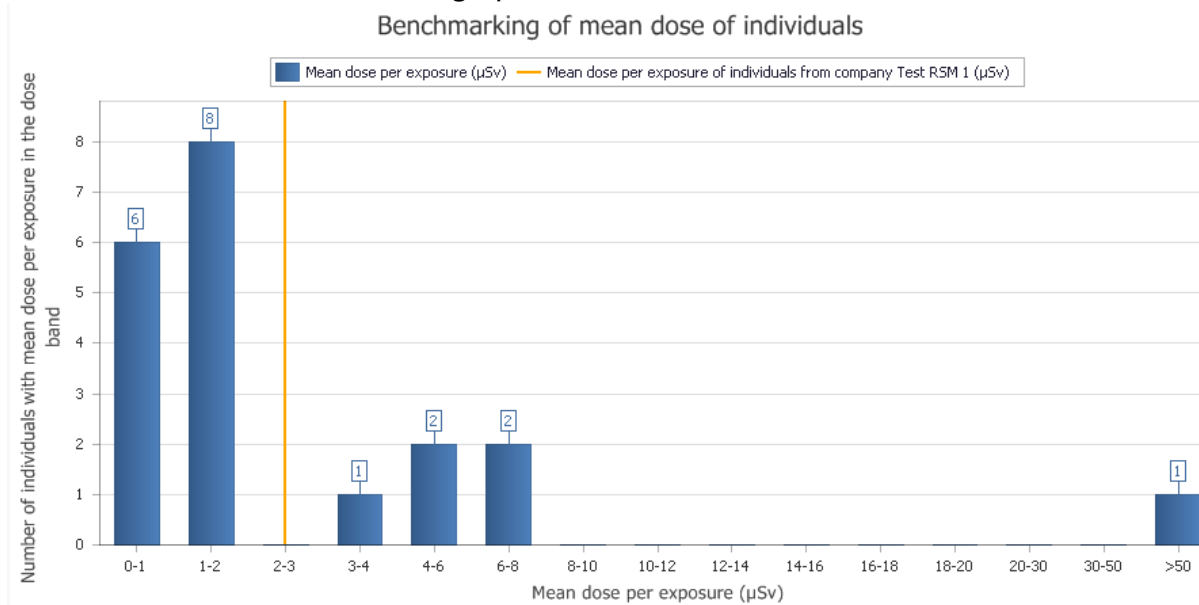
After pressing "Apply filters", the statistics as shown below appear.

Statistics based on selected filters	
Mean dose per exposure of individuals in Test RSM 1 (in $\mu\text{Sv}$ ) based on the selected filters <a href="#">?</a>	2.81
Average effective dose of individuals in Test RSM 1 (mSv) <a href="#">?</a>	0.01
Number of all individuals based on the selected filters	20
Mean dose per exposure of all individuals based on the selected filters (in $\mu\text{Sv}$ ) <a href="#">?</a>	7.22
Standard deviation <a href="#">?</a>	35.33
Min <a href="#">?</a>	0.83
Q1 <a href="#">?</a>	0.83
Median <a href="#">?</a>	1.67
Q3 <a href="#">?</a>	3.54
Max <a href="#">?</a>	160

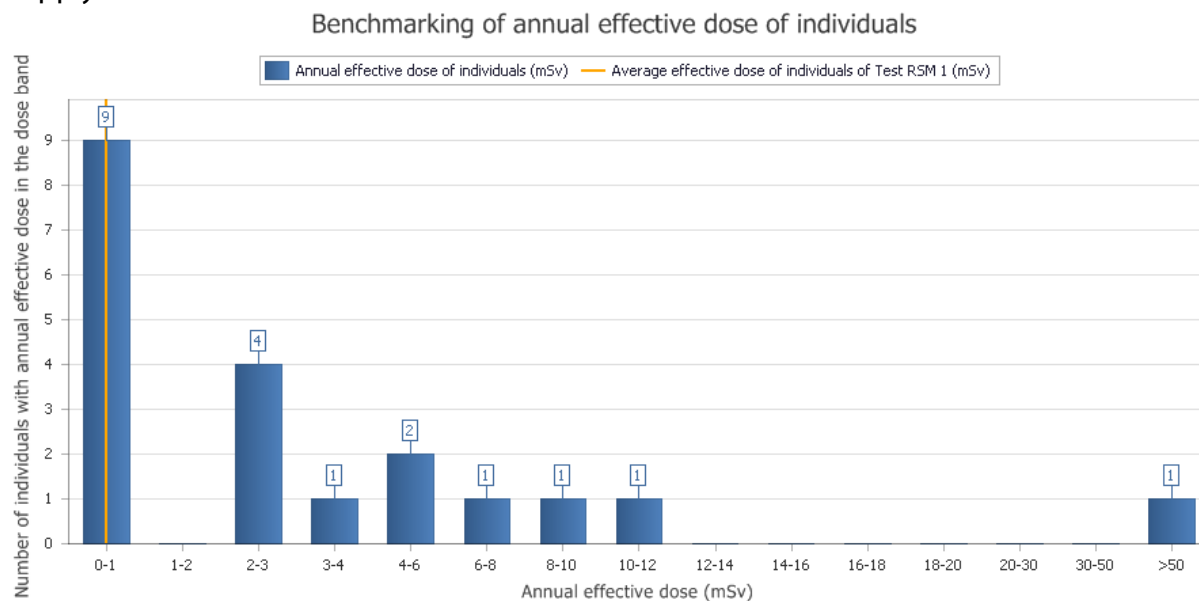
As you can see, there are 20 full time industrial radiographers in the database who have all radiation protection training as stated in ISEMIR-IR. Their mean dose per exposure is 7.22  $\mu\text{Sv}$  while the mean dose per exposure of all full time industrial radiographers in the CC company is 2.81  $\mu\text{Sv}$ . This means that the industrial radiographers working in the company "Test RSM 1" have a lower occupational exposure on average than the others having the same radiation protection training.

The statistics might differ if you further specify the group of workers through the use of protective equipment, the use of particular radioactive source or the actual number of exposures per year.

The statistics is also shown in the graph:



In addition, if you prefer to compare the annual effective dose instead of the mean dose per exposure, you can check the following graph. The graph is automatically displayed after pressing "Apply Filters".



## Confidentiality

Individuals and facilities are anonymized in the database. IAEA cannot and does not reveal the identity of the relevant company, and all submitted personal or company data are considered to be confidential and will not be shared.

The published analysis will be generic and will not refer to a specific company but will rather be based on a regional division.

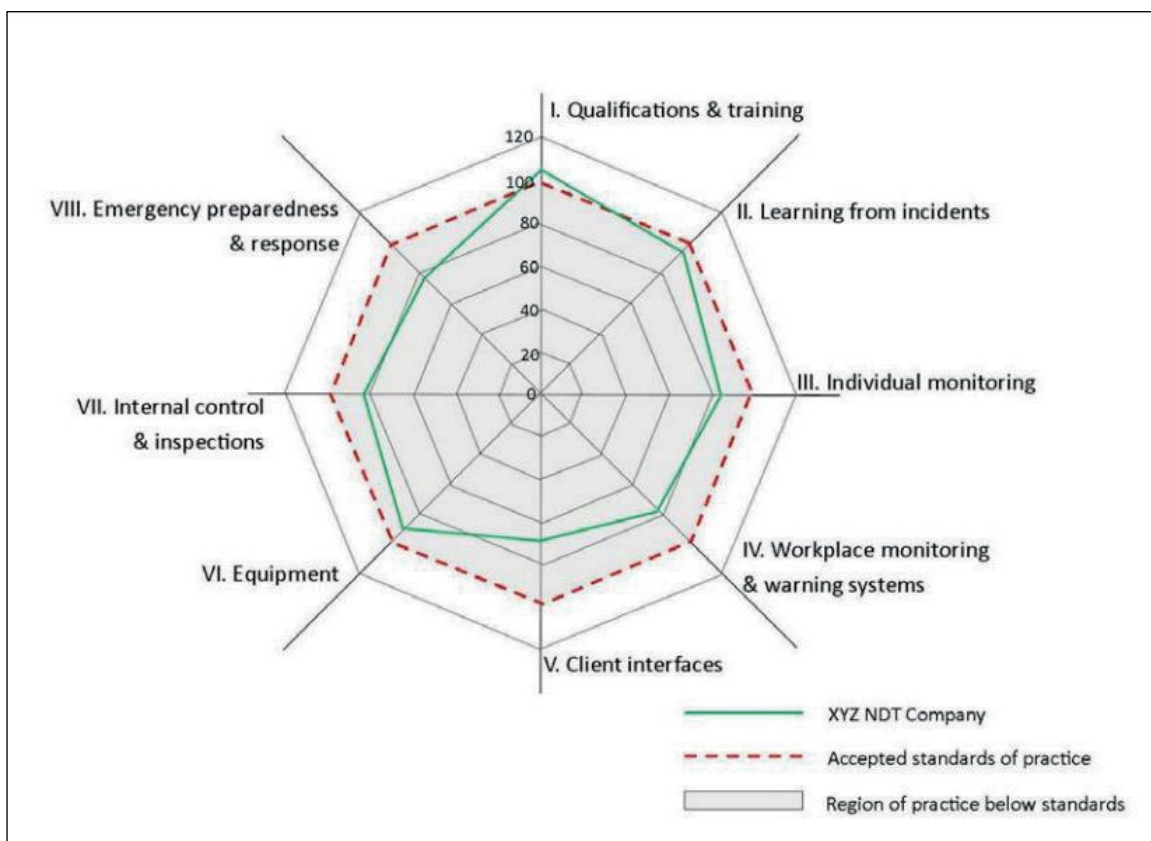
## The Road Map Tool

<https://www-ns.iaea.org/tech-areas/communication-networks/orpnet/isemir-roadmap-tool.asp>

In addition to the ISEMIR-IR data collection and benchmarking tool, the IAEA also offers NDT companies a possibility to use its offline software product focused on best practices.

The “road map” is an online tool that enables the NDT companies to assess their own performance in radiation protection against accepted practice. A NDT company answers the questions in the road map, based on a current practice in their company. The response to each question is then scored by comparing it with good practice measures.

Different weightings are applied to questions, depending on their relative importance. The scores are summed and the results presented to the user, including a graphical schematic that gives a quick visual overview of how the NDT company compares with current good practices. Areas that have been identified as being below par could then be addressed by the NDT company to improve occupational radiation protection in their facility.



Do you have any questions?

You can contact us at [ISEMIR-IR.Contact-Point@iaea.org](mailto:ISEMIR-IR.Contact-Point@iaea.org).

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