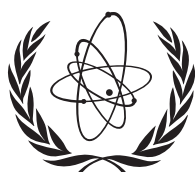# International Radiation Monitoring Information System

User Manual
IRMIS Version 3.0.0

DATE EFFECTIVE: **20 FEBRUARY 2020**

IAEA
International Atomic Energy Agency

IAEA SAFETY STANDARDS AND RELATED PUBLICATIONS

IAEA SAFETY STANDARDS

Under the terms of Article III of its Statute, the IAEA is authorized to establish or adopt standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards.

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Information on the IAEA's safety standards programme is available on the IAEA Internet site

https://www.iaea.org/resources/safety-standards

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INTERNATIONAL RADIATION MONITORING INFORMATION SYSTEM

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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

INTERNATIONAL RADIATION MONITORING INFORMATION SYSTEM

USER MANUAL
IRMIS VERSION 3.0.0

DATE EFFECTIVE: 20 FEBRUARY 2020

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2020

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Foreword

The Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency are the prime legal instruments that establish an international framework to facilitate the exchange of information and the prompt provision of assistance in the event of a nuclear or radiological incident or emergency, with the aim of minimizing the potential consequences. The IAEA has specific functions assigned to it under these conventions. The arrangements between the IAEA, States and international organizations for facilitating the practical implementation of those articles of the two conventions that are operational in nature are documented in the Operations Manual for Incident and Emergency Communication, EPR–IEComm (2019).

This publication is an attachment to EPR–IEComm (2019). It provides general operational instructions for the International Radiation Monitoring Information System (IRMIS) and information on its concept, description and scope. IRMIS is a client–server based web application that provides Member States a tool to share and visualize large quantities of radiation monitoring data during routine and emergency situations.

DISCLAIMER

The views expressed in this publication do not necessarily reflect those of the governments of States that are IAEA Member States and/or Parties to either or both of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, of other relevant international intergovernmental organizations or of the Governments of other States.

Guidance provided in this manual, describing good practices, represents expert opinion but does not constitute recommendations made on the basis of a consensus of IAEA Member States.

The IAEA makes no warranties, either expressed or implied, concerning the accuracy, completeness, reliability, or suitability of the information. Neither does it warrant that use of the information is free of any claims of copyright infringement.

Throughout this operations manual, simulated charts, tables of data and maps with locations and names of specific fixed radiation monitoring stations have been used to illustrate various functionalities of IRMIS. These data were used during the ConvEx–2d exercise in October 2016 and were provided by the Romanian Competent Authority, the National Commission for Nuclear Activities Control (CNCAN). The CNCAN agreed to the inclusion of these data in this manual for illustration purposes only and with the full understanding that these data are simulated and fictitious and are not related to any real event.

Although great care has been taken to maintain the accuracy of information contained in this publication, neither the IAEA nor its Member States assume any responsibility for consequences that may arise from its use.

NOTES FOR THE USER

This publication is issued as an attachment to the Operations Manual for Incident and Emergency Communication, EPR–IEComm (2019).

This attachment describes the IRMIS web application version 3.0.0. For more information about its latest enhancements and features, please contact: IRMIS.Contact-Point@iaea.org.

The IAEA's Incident and Emergency Centre (IEC) is ready to provide any clarification on the implementation of the arrangements described here and may be contacted as follows:

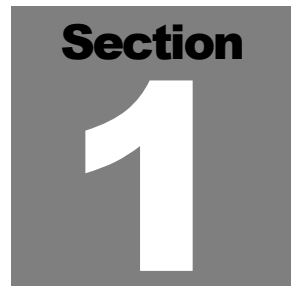**email: iec-routine@iaea.org**

fax: +43 1 2600 7 29309

CONTENTS

FIGURES

1. INTRODUCTION

1.1. Purpose

The purpose of this manual is:

1. To present the user with the background to and an overview of the International Radiation Monitoring Information System (IRMIS);

2. To provide step-by-step guidance on how to use IRMIS.

1.2. Scope

This manual describes IRMIS version 3.0.0, a web based tool for sharing, aggregating and visualizing large quantities of radiation monitoring data during a nuclear or radiological incident or emergency, to aid in decision making. The manual does not describe routine file sharing or file formatting procedures.

IRMIS is a web application that is continuously improved. For more information about its latest enhancements and features, please contact: IRMIS.Contact-Point@iaea.org.

1.3. Structure

Following this introductory section, the manual is structured into three further sections. Section 2 describes the background to IRMIS, its objectives, concept and scope; Section 3 provides an overview of IRMIS and its features; Section 4 gives step-by-step guidance on how to use IRMIS.

1.4. Definition of terms

Some of the key terms used in this manual are defined as follows:

Accident	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.
Competent Authority	A Contact Point in a State or international organization that has the competency and responsibility to notify/report a nuclear or radiological emergency to the IAEA, or that has the competency and responsibility to receive notifications from other States or the IAEA on nuclear or radiological emergencies which could

affect its State, or that has the competency and responsibility to make and receive requests for and to accept offers of assistance.

Confidentiality   A situation in which information is not made available or disclosed to unauthorized individuals, entities or processes.

Emergency   A non-routine situation that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment. This includes nuclear and radiological emergencies and conventional emergencies such as fires, release of hazardous chemicals, storms or earthquakes. It includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard.

Incident   Any unintended event, including operating errors, equipment failures, initiating events, accident precursors, near misses, other mishaps, or unauthorized acts, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of protection or safety.

1.5. Abbreviations

CA	Competent Authority
EPR–IEComm	IAEA Operations Manual for Incident and Emergency Communication
EURDEP	European Radiological Data Exchange Platform
IAEA	International Atomic Energy Agency
IEC	IAEA's Incident and Emergency Centre
IRMIS	International Radiation Monitoring Information System
NPP	Nuclear power plant
NWP	National Warning Point
OILs	Operational intervention levels
PPA	Public protective action
USIE	Unified System for Information Exchange in Incidents and Emergencies

2. IRMIS — CONCEPT AND SCOPE

2.1. Background

In the event of a nuclear or radiological emergency, the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) [1] requires the accident State to provide relevant information about the emergency situation (Article 5). This should include information about the results of environmental monitoring relevant to the transboundary release of radioactive materials, and information about the off-site protective actions that have been taken or that are planned.

IRMIS has been developed to support the implementation of the Early Notification Convention, facilitating the reporting and visualization of large quantities of radiation monitoring data during nuclear or radiological incidents or emergencies. In addition, IRMIS supports and enhances some of the features of the Unified System for Information Exchange in Incidents and Emergencies (USIE) [2]. USIE is a protected and secure web site that provides IAEA Competent Authorities (CAs) and points of contact designated under the Early Notification Convention with a unified communication tool through which they can share relevant information and data in a nuclear or radiological incident or emergency with the IAEA Secretariat, Member States and relevant international organizations.

2.2. Objectives of IRMIS

IRMIS assists IAEA Member States in meeting the requirements of the Early Notification Convention. It complements USIE when a large quantity of radiation monitoring data needs to be shared and visualized. Thus, IRMIS enables near real time monitoring of the evolving radiological situation worldwide as a consequence of a nuclear or radiological emergency. IRMIS also aims to support the assessment of radiological hazards caused by the release of radioactive materials and facilitate the decision making process for protective actions on the part of any Member State impacted by a release and the provision of credible public information on the developing situation.

2.3. Concept of IRMIS

Radiation monitoring during a nuclear or radiological incident or emergency needs to be integrated into decision making systems in such a way that its use will not impede the effective implementation of

response actions. Conceptually, IRMIS is a collaborative Decision Support Tool shared between the IAEA, the Accident State(s) and neighbouring States. In an emergency situation, through the aggregation and display of routine monitoring data, IRMIS can quickly be expanded into a powerful emergency communications tool that aids the assessment and prognosis conducted by the Accident State, the IAEA and supporting States. As a Decision Support Tool, IRMIS is fully capable of integrating fixed point monitoring data with the data collected by deployed emergency monitoring systems and comparing these to pre-established operational intervention levels (OILs) as well as planned or executed public protective actions (PPAs) [3].

2.4. Scope of IRMIS

IRMIS is primarily a data sharing platform that provides CAs with 24/7 access to data collected and collated by routine monitoring in the participating states.

IRMIS is not an early warning system. However, IRMIS analysis tools may be used to determine where elevated levels of radiation observed in monitoring data are significant as far as radiological safety is concerned. The detection of time correlated elevation of gamma dose rate in nearby fixed radiation monitoring stations can signify a release of radioactivity into the atmosphere. The time series analysis can also provide the duration of the release. Thus, IRMIS routine monitoring data can seamlessly transition into nuclear or radiological emergency data.

IRMIS does not replace other emergency communication channels, but when used jointly with USIE, it will collectively provide the necessary quantitative technical information required to support a comprehensive assessment and prognosis of the situation.

Early in an emergency, the results obtained by monitoring may be limited and confusing. By providing gamma dose rates from routine monitoring, IRMIS establishes a foundation upon which data can be quickly shared during an emergency. The ambient dose equivalent rate is shared and visualized in IRMIS. The ambient dose equivalent rate $H_p^*(10)$ [4] is an appropriate and effective indicator under emergency conditions. All ambient gamma dose rate data are visualized on a map with reference to the OIL, an ambient dose equivalent rate that corresponds to a generic criterion for taking protective actions [5]. An OIL is used immediately and directly (without further assessment) to determine the appropriate protective actions on the basis of an environmental monitoring measurement (a measurement by instruments in the field or determined by laboratory analysis). In its current configuration, IRMIS data are compatible with OIL 1, 2 and 3 for the gamma dose rates [3]. To support decision making and inform PPAs beyond those supported by OIL 1, 2 and 3 for gamma dose rates it is planned that IRMIS will incorporate other data types that will be supported by and used in conjunction with additional OILs.

3. IRMIS — OVERVIEW AND FEATURES

3.1. Technical requirements

The application is fully functional in Internet Explorer 11 and Google Chrome on the Windows operating systems. The data visualization works best at screen resolutions of 1280 × 1024 pixels or more, assuming the browser window is displayed in full screen mode. The data visualization screens have been optimized for use with a scroll wheel mouse (map zoom).

3.2. Radiological monitoring data

The radiological monitoring data in IRMIS are reported in either of two categories:

1. **Routine Data**, in the form of radiation dose rates from fixed monitoring stations voluntarily reported by participating Member States. The maximum or latest values reported per fixed station are displayed over the previous 24, 48 or 72 hours; or over user defined dates and times.

2. **Emergency Data**, collected during a nuclear or radiological emergency or on other occasions where the Member States deem it necessary to share radiation monitoring data with the IAEA and other Member States.

3.2.1. Routine Data

The routine provision, on a voluntary basis, of the radiation dose rate data from fixed monitoring stations in non-emergency situations is intended to ensure that the data can be reported effectively during an emergency. IRMIS provides a time series analysis tool which enables users to observe the systematic time correlated rise of dose rate data indicating a pre-release condition at a nuclear power plant. Thus, IRMIS provides a mechanism through which measurements recorded at the fixed monitoring stations can be reported in a timely manner during the early phase of an emergency. Routine Data are normally reported through an agreed arrangement where the organizations authorized to report these data will make them available in the International Radiological Information Exchange (IRIX) [6] format on a secure data server hosted within their country, or via a regional hub (e.g. the European Radiological Data Exchange Platform (EURDEP)) [7]. IRMIS routinely retrieves radiation monitoring data from the servers: the web

application gathers large amounts of data continuously with a periodicity of one hour. The maximum aggregated value of dose rate data over a number of spatially-close fixed monitoring stations is presented. The aggregated data correspond to either the maximum dose rate readings or the latest dose rate readings.

The type(s) of data, and the frequency and volume of Routine Data (as defined above) reported by Member States to IRMIS are at the discretion of the Member State, the CAs and the IRMIS Data Provider(s).

3.2.2. Emergency Data

During an emergency, Member States may wish to provide additional data, for example: dose rate data collected through monitoring networks that do not routinely provide IRMIS with data, data from temporary fixed stations, data from hand held measurements or data from mobile monitoring systems (e.g. backpack, vehicle or aerial systems). Normally, these systems record dose rate measurements automatically, along with the location and time. Member States may, in certain circumstances, want to report event data that may not be of any safety significance, but nevertheless will provide situational awareness to neighbouring States. A web interface has been designed in IRMIS through which authorized users may upload the Emergency Data onto IRMIS, either in IRIX format or using a pre-formatted spreadsheet template. These Data Reports are subsequently reviewed and published on IRMIS by the IAEA's Incident and Emergency Centre (IEC).

3.3. IRMIS Data Providers

All CAs officially designated under the Early Notification Convention and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) [1] and in accordance with the operational arrangements defined in EPR–IEComm (2019) [8], are authorized to report Routine Data and Emergency Data in IRMIS. The USIE and IRMIS roles of a national user can be found in the USIE Settings area.

In addition, technical organizations that operate national systems of fixed monitoring stations, or that have a role in collecting and reporting radiation monitoring data during an emergency, may be authorized to be IRMIS Data Providers. The authorization of these organizations needs to be provided by the relevant CA or the Permanent Missions of the Member States to the IAEA (States' PMs) to the IAEA.

The level of permissions that IRMIS Data Providers have for reporting Routine Data and/or Emergency Data in IRMIS is determined by the relevant CA or the States' PMs.

3.4. Data ownership and retention

All data reported in IRMIS remain the property of the reporting Member State. The IAEA does not claim any ownership over the data reported by Member States.

The type(s) of data and the frequency and volume of Routine Data reported by Member States to IRMIS during an emergency is dependent on the nature and status of the emergency. Emergency Data from the IRMIS Data Providers and Routine Data from secure FTP servers maintained by globally distributed radiation monitoring networks are uploaded to a database. A query database then delivers those data via a web interface to the client users, on request by the user.

The IAEA retains Routine Data for 30 days, unless it is associated with an actual event, in which case it is retained for longer. The 30 day period allows sufficient time to capture some baseline data prior to an actual or suspected event, or to retain data relevant to an actual or suspected event that occurred or may have occurred within the past 30 days.

When an event is notified to the IEC through a proper channel and after discussing the details with the Accident State, the IEC creates a USIE event under the following classification:[1]

Based on sets of emergency conditions or event types defined in EPR–IEComm (2019) [8] that warrant immediate response actions.

(a) Nuclear emergencies (events specific to nuclear installations):
     i.   General emergency;
     ii.   Site area emergency;
     iii.   Facility emergency;
     iv.   Alert;
     v.   Other event in the facility that may trigger public concerns and/or media interest.

(b) Radiological emergencies (events not specific to nuclear installations):

     i.   Release from a facility;
     ii.   Missing dangerous source;
     iii.   Severe overexposure;
     iv.   Space object re-entry;
     v.   Elevated radiation levels;
     vi.   Other radiological event.

If the event is considered to have a radiation monitoring component, the IEC will create an event on IRMIS based on the created USIE Event (*i.e. importing all the details of the event from the USIE created event*). In consultation with the 'Accident State' or reporting State, the IEC will determine the amount of time the Routine Data should be retained for this event. In such a situation, the Routine Data retained is then considered part of the overall data reported for the event, together with any additional Emergency Data reported. The overall retention of data associated with an event will be determined by the IEC, as is pertinent to the nature and scale of the event.

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[1] For more information, see EPR–IEComm (2019) [8].

3.5. Access to IRMIS and IRMIS users

All USIE users from CAs, National Warning Points (NWPs) and States' PMs are automatically granted read-only access to IRMIS. In addition, IRMIS Data Providers endorsed by their relevant CA and/or Permanent Mission to the IAEA may have read-only users registered in both USIE and IRMIS.

Authorized users from CAs and IRMIS Data Providers may be given additional permissions on IRMIS through which they can upload radiological monitoring data through the web site interface.

The public has no access to IRMIS. However, a public version of IRMIS is planned for a later stage of development.

Currently there are two access modes for IRMIS:

1. **Reader**: Users with this access mode can access the web site and can visualize and analyse data.

2. **Uploader**: Users with this access can read/view data and upload data to IRMIS database.

3.6. Data confidentiality

Member States determine the level of confidentiality to be applied to Routine and Emergency Data reported to IRMIS by selecting one of the three confidentiality levels described below, in the same approach that is applied to reports submitted on USIE. In addition, the level of confidentiality that is applied to an event in USIE is automatically applied in IRMIS:
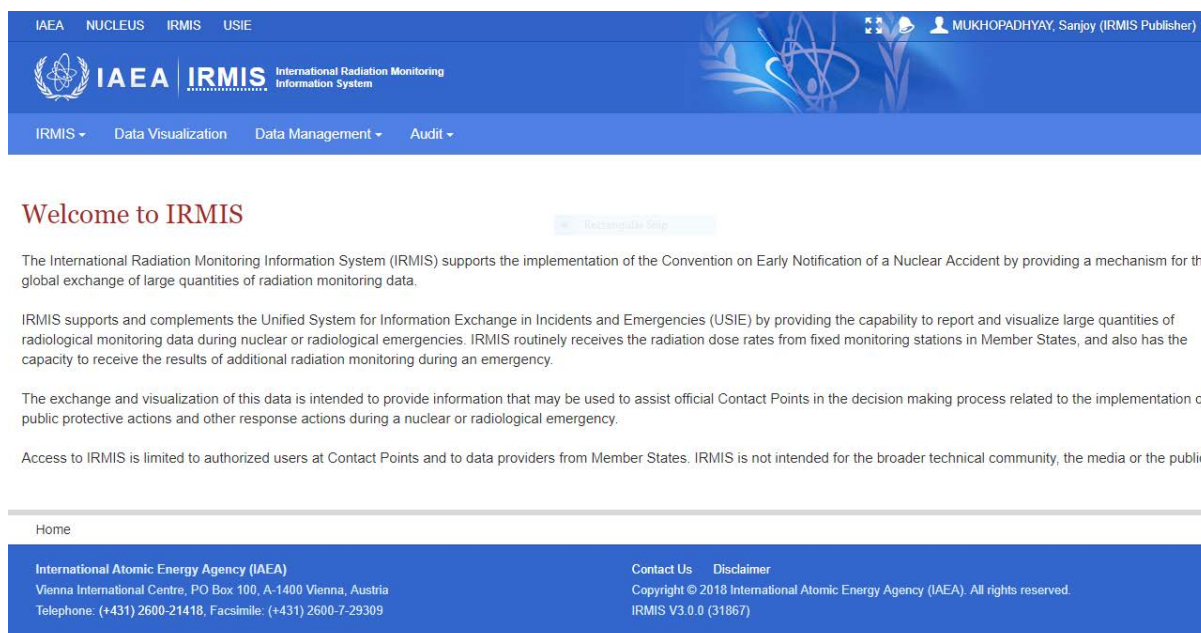
1. **For Authority use only**: The information/data reported are provided for official use only and are not for public disclosure. The data reported will be available on IRMIS to official counterparts authorized to access IRMIS.

2. **For IAEA Secretariat use only**: The information/data reported are provided 'in confidence' to the IAEA Secretariat. Note: The data reported will not be seen by any Member States, including the reporting State.

3. **Free for public use**: The information/data reported are provided without restrictions on their use.

In addition, in situations in which an event is created in USIE for a restricted number of Member States or international organizations, the restriction is also applied within IRMIS, and any Emergency Data reported and published as part of that USIE Event will be available only to the Member States and international organizations that have access to the USIE Event.

4. IRMIS — OPERATIONAL GUIDANCE

4.1. Navigating IRMIS

FIG. 1. Home page of the IRMIS Version 3.0.0 website.

Figure 1 shows the IRMIS home page. The top left of the page displays links to the IAEA main web site, NUCLEUS, IRMIS and USIE. Below the IAEA logo the main navigation bar displays four menu items that cover the entire gamut of IRMIS functionalities:

1. IRMIS menu (described in Section 4.2);

2. Data Visualization menu (described in Section 4.4);

3. Data Management menu (described in Section 4.5);

4. Audit menu (described in Section 4.6).

4.2. IRMIS menu

The IRMIS menu contains links to further information: 'About IRMIS', 'IRMIS Documentation' and 'IRIX Documentation'. Users can read up on these particular topics by clicking the respective links.

4.3. Reporting data

As a rule, any data exchange with IRMIS will be using the IRIX format version 1.0. IRMIS provides the following means of receiving routine and event related radiation monitoring data:

1. **Routine Data**: A data collection service regularly harvests IRIX files containing routine radiation monitoring data via secure FTP. Only IRIX-formatted Routine Report files can be uploaded via these secure FTP servers.

2. **Emergency Data**: There is a secure file upload facility for event-related radiation monitoring data contained in IRIX Reports and specially-formatted Excel files

All three types of files — Routine Reports, IRIX-formatted Emergency Reports and Excel-based Emergency Reports — can be uploaded manually. To upload Emergency Report files, it is first necessary for Member States to let the IEC know about a nuclear or radiological emergency, ask the IEC to create a USIE/IRMIS event, and provide Emergency Data related to the event.

The difference between the Emergency and Routine Report files is in an XML section *<id:ReportContext>* that distinguishes between 'Routine' and 'Emergency'.

4.3.1. Routine Data

The data collection service is used for sharing routine radiation monitoring data. Placing an IRIX Report under the control of the service is equivalent to submitting it to the IAEA.

Before setting up a Routine Data collection service, the Data Provider in a State establishes a Contact Point that is responsible for the configuration and maintenance of the data gathering and provides the IAEA with the contact's details (email address). The IAEA contact point for this service is: IRMIS.Contact-Point@iaea.org. The Contact Point in the State will then receive a thorough technical specification of the data collection process. In the event of data collection problems, it is expected that the contact will be responsible for communicating with the IAEA Secretariat on behalf of the Data Provider. In the event of no upload or a failed upload of a Routine Report from a reporting organization within the last 72 hours, the Secretariat will receive the email notification as described later in this manual (Section 4.7.2).

It is envisaged that the data providing organization will operate an automated monitoring network. The network should be able to produce averages, preferably at 10 minute or hourly intervals. Only raw data, without any corrections, need to be delivered. The roles of the Contact Points and IRMIS Data Provider(s) are described in EPR–IEComm (2019) [8].

As a prerequisite, the following preliminary tasks will need to be carried out before data collection begins:

1. The Data Provider develops the export/conversion script or software that prepares the data for submission in the IRIX format required for IRMIS.

2. The Data Provider sets up an FTP server from which the data collection service will collect the data.

3. The Data Provider develops the necessary procedures to make the data available to the shared network.

There are further specific technical requirements for setting up an FTP server for uploading purposes, as well as for providing Routine Data, and for the format and contents of uploaded IRIX files. The IAEA Secretariat will provide complete information about these details to States expressing an interest in providing data.

4.3.2. Emergency Data

Emergency Data are uploaded through a designated area of the IRMIS web site in the format of IRIX files. They can also be supplied as Microsoft Excel files with the extension .xlsx, if these files include relevant IRIX fields as part of a pre-established and compatible internal XML structure.

To upload Emergency IRIX Data Reports, the Data Provider logs in to IRMIS as an IRMIS Uploader. Data Providers' access privileges can be obtained by any IRMIS user from her/his organization's USIE Administrator.

If there is no USIE Administrator within the organization, the IRMIS Data Provider organization should contact the IAEA Secretariat via IRMIS.Contact-Point@iaea.org, or, in the case of an ongoing emergency, via designated emergency communication contacts.

4.3.2.1. Steps for uploading IRIX emergency data files

1. On the main IRMIS menu bar, click **Data Management** then select **Upload Reports**.

2. Prepare an IRIX file for upload. If the user has not developed a procedure for producing files in IRIX format — for example, by exporting from a database or by converting them from another type of file — he or she may want to use the pre-defined Excel template offered on the **Upload Reports** page, 'Irmis_ImportTemplate.xltx'. The procedure for populating this template is explained in Section 4.3.2.2.

3. Drag the IRIX/Excel file to the grey upload area on the Upload Reports page (Fig. 2). Alternatively, click inside the area. A 'Choose File to Upload' dialogue box appears. Navigate to the folder containing the data file, select it and upload it.
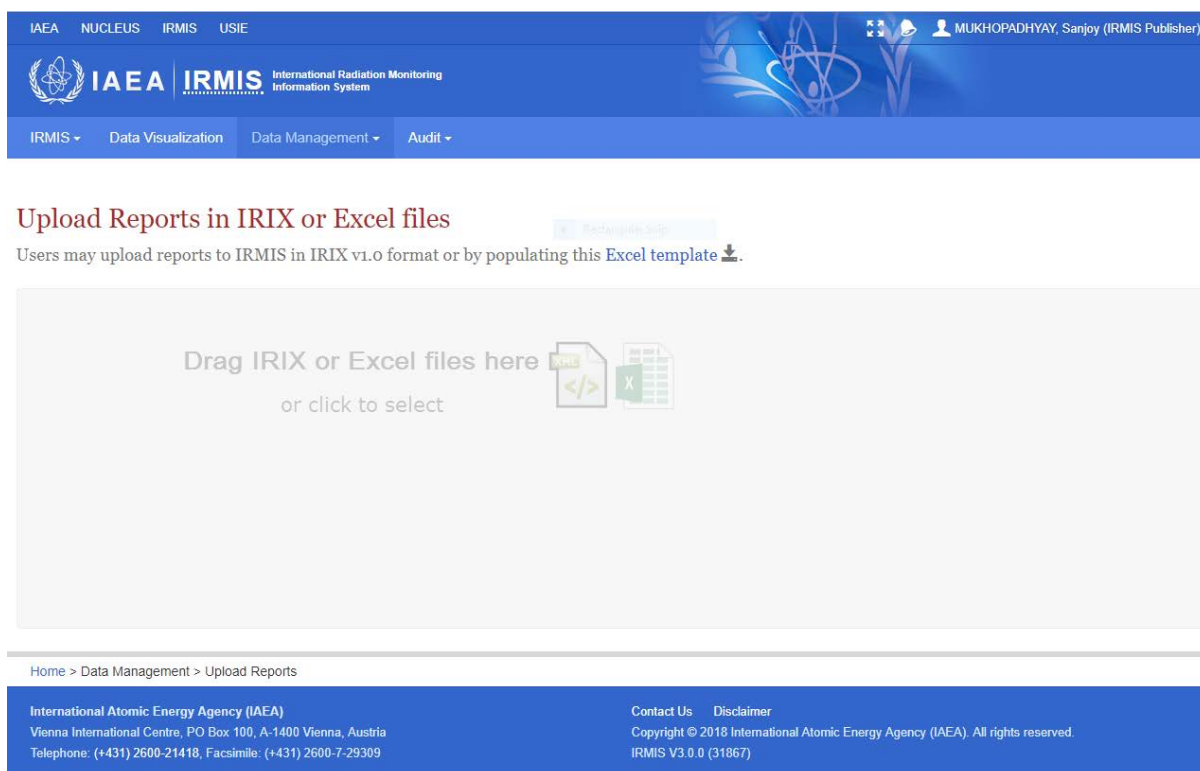
4

FIG. 2. IRIX/Excel data files can be dragged and dropped directly to the Upload Reports page.

4. If the upload was successful, the user is presented with three choices, as shown in Fig. 3:

    a) **Review and Submit**;
    b) **Submit**;
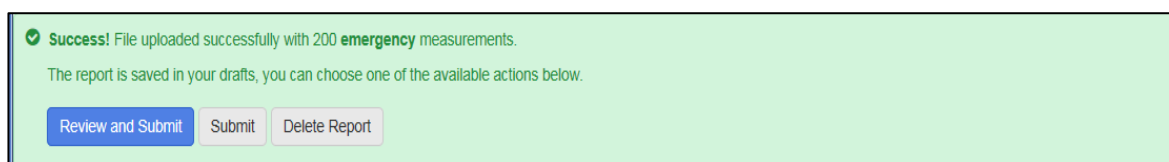   c) **Delete Report**.

FIG. 3. Options available after a successful upload of a data report.

5. Click **Review and Submit** — the uploaded data are visualized on the map and the user has three choices now:

    a) **Submit Report**;
    b) **Continue to Publish**;
    c) **Delete Report**.

Note: By choosing **Submit Report**, the user will continue to submit the report to the IAEA. If the user chooses **Delete Report**, he or she will be asked to confirm the deletion and provide reasons for doing so. If the user chooses **Continue to Publish**, he or she will be shown properties of the uploaded report, but will not be allowed to publish the report on IRMIS unless he or she has IAEA publisher rights.

6. When the system asks: 'Are you sure you want to submit the report to IEC?', click **OK** to confirm. The system will then acknowledge the successful submission of the Data Report. The IEC will publish this Data Report in connection with the USIE Event that has been created by you, or it will create a new USIE Event.

4.3.2.2. Populating the IRMIS pre-defined IRIX Excel file

It is preferable to use IRIX files for Emergency Data upload. However, in some cases Excel files may be more suitable (for example, smaller size Data Reports generated from individual deployed equipment like backpacks, dose rate meters etc.). The pre-defined Excel file available on the IRMIS site consists of two worksheets, covering **Summary Information** (Fig. 4) and **Dose Rates**.

1	Report ID		Optional. Indicate the report identifier provided by the reporting organization, if applicable
2	Report Context	Emergency	Required. Select Emergency report context for event-related data or Routine otherwise
3	Report Date Time (UTC)	2016-09-15 08:00	Required. Enter the date and time when the data was reported in the format YYYY-MM-DD HH:MM
4	Confidentiality Level	For Authority use only	Required. Select the appropriate confidentiality level.
5	Measurement Data Type	Dose Rate(Gamma)	Required. Select the type of dose rate data reported
6	Survey Type	Hand-held surveys	Optional. Select the appropriate survey type (fixed point dose rate measurements assumed by default)
7	Survey Type (Other Details)		Optional. If the above selected survery type is other,enter the other survery type.

FIG. 4. Summary Information worksheet of the 'Irmis_ImportTemplate.xltx' data report.

Fill out the Summary Information worksheet as follows:

1. **Report ID**: This should be left blank — it will be assigned by USIE/IEC.

2. **Report Context**: Select 'Routine' or 'Emergency'. Of course, it is expected that this type of upload will occur during an emergency.

3. **Report Date Time (UTC)**: The format is YYYY-MM-DD HH:MM.

4. **Confidentiality Level**: 'For IAEA Secretariat use only' (strictest), 'For Authority use only' (commonly used) or 'Free for public use' (least stringent confidentiality).

5. **Measurement Data Type**: 'Dose Rate (Gamma)', 'Dose Rate (Beta)', 'Dose Rate (Beta–Gamma)', 'Dose Rate (Neutron)', 'Air Concentration (Cs-137)', 'Air Concentration (I-131)', 'Ground deposition (Cs-137)' or 'Ground deposition (I-131)'.

6. **Survey Type**: 'Aerial based surveys', 'Vehicle based surveys', 'Ground based surveys (e.g. backpack)', 'Hand held surveys', 'Fixed point dose rate measurements' (most Routine Data are in this form) or 'Other'.

The second worksheet contains dose rate data in a very specific pre-defined format. In Fig. 5 the inputs required for this sheet are explained column by column.

Note: The system will not accept duplicate values within a single report. Values are considered duplicates if they have the same location (latitude, longitude and height) and date/time.

A **Enter the measurement date and time (UTC)** (YYYY-MM-DD HH:MM:SS) *Required* *Please note that the system wil...* **Date Time** ⤶	This information is required; the time needs to be carefully entered in the format YYYY-MM-DD HH:MM:SS.
B **Enter the name of the measurement location** *Optional* *I not accept duplicate values within a s...* **Location Name** ▾	This information is optional — it may be used to group data in a report from specific locations of interest.
C **Enter the latitude in decimal degrees** (up to 6 decimal places) *Required* *single report. Values are ...* **Latitude** ▾	This information, the latitude of data observation, is required. It is given in signed number format, with north indicated by plus (+) and south indicated by minus (−). Data precision of up to six decimal degrees is accepted.
D **Enter the longitude in decimal degrees** (up to 6 decimals places) *Required* *considered duplicates if the...* **Longitude** ▾	Like latitude, this information is required and is given in signed number format, with east indicated by plus (+) and west indicated by minus (−). Data precision of up to six decimal degrees is accepted.
E **Enter the height above ground level in metres** *Optional* *es if they have the same location (l...* **Height Above Ground** ▾	The height above ground level at which the dose rates were measured is optional, but nevertheless could be considered important: including that information helps normalize data from different measurements.

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F **Enter the measured value in microSv/h** *Required* *atitude, longitude, I* **Value** ▾	The dose rate value in µSv/h is required.
G **Enter measurement uncertainty in microSv/h or in %** *Optional* *height) and date/time.* **Uncertainty** ▾	The measurement uncertainty is optional information, but if it is entered, it is given either in µSv/h or in terms of percentage of the measured value.
H **Select the unit of the measurement uncertainty** *Required if Uncertainty is given* **Uncertainty Unit** ▾	This is optional information; however, if measurement uncertainty data are entered, this field is required.
I **Select validation status** *Optional (Default: No)* **Validated** ▾	This is a required value; select 'Yes' or 'No'. The data provider needs to indicate whether the data have been validated or not.

FIG. 5. Detailed descriptions of the Dose Rates Worksheet of the 'Irmis ImportTemplate.xltx' Data Report.

When the Excel file is populated, save it in the most recent .xlsx format. No other Excel format will be accepted by the system.

4.4. Data Visualization menu

The results of measurements reported in IRMIS are georeferenced and visualized on a map. Owing to the large volume of data that may be reported in the system, the visualizations have been designed to reduce overplotting on the map. The radiation monitoring data are aggregated in two different ways — spatially, according to the spatial proximity of the fixed monitoring stations, and according to time.

In Fig. 6, three fixed point monitoring stations, A, B and C, are considered. The dose rate for the three stations is on the vertical axis; time is on the horizontal axis.
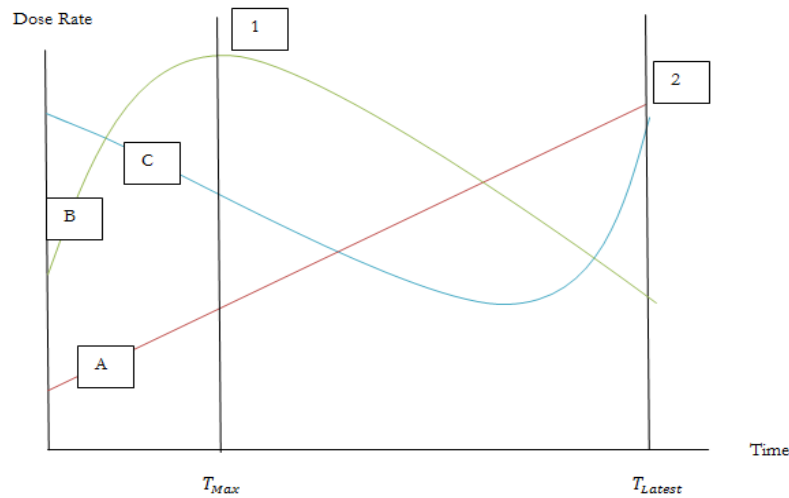
FIG. 6. Spatial and Time Data Aggregation in IRMIS.

Assume the three stations are proximate to each other and are spatially aggregated in a single hexagon (the aggregated data are shown on the map on the visualization page in the form of hexagons). If the user were to choose aggregation by maximum data value, IRMIS would display the value of fixed station B. This is the highest dose rate among all three sensors aggregated in the hexagon of interest for the time range selected. Time ranges can be selected for fixed periods of 24, 48 and 72 hours and are also customizable either by selecting specific dates or by using the sliding variable time window. If the user wishes to aggregate the data by time, the most recent data will be considered from all three stations and the maximum dose rate among the three will be displayed. This can be seen at fixed station A in Fig. 6.

OILs can be used as break points for the dose rate levels. IRMIS uses IAEA OILs for light water nuclear power plants (NPPs) as default values. Users can apply their own national pre-established criteria to define the break points.

4.4.1. Customization

IRMIS allows users to select a range of pre-defined colour palettes that can be applied to the default IAEA OILs, to user specified levels such as national OILs, to event specific OILs or to other preferred OILs. The colour palettes available allow users to specify 3, 4 or 5 different ranges between which the respective colours are displayed.

The coloured legend displays the levels chosen (Fig. 7). The default colour palette is set to display the IAEA default value. IAEA default OIL values for ambient dose equivalent rate at 1 metre above ground level for a light water NPP event are used:

— Green <1 µSv/h;

— Yellow ≥1 µSv/h;

— Orange ≥100 µSv/h (for $t \leq 10$ days);

— Red ≥1000 µSv/h.

Once an event is shown over a specific time range (instructions for this are provided in points 1–4 in this section), the colour legend will become visible. Click the **Change** button then **+Add** to set another group of OILs as desired (Fig. 7). Type a **Name**, click 'Select palette', then add μSv/h threshold values for each shade of the palette and finally click **Save** (Fig. 8). Once the new palette is defined all subsequent data viewed will be based on these OILs.
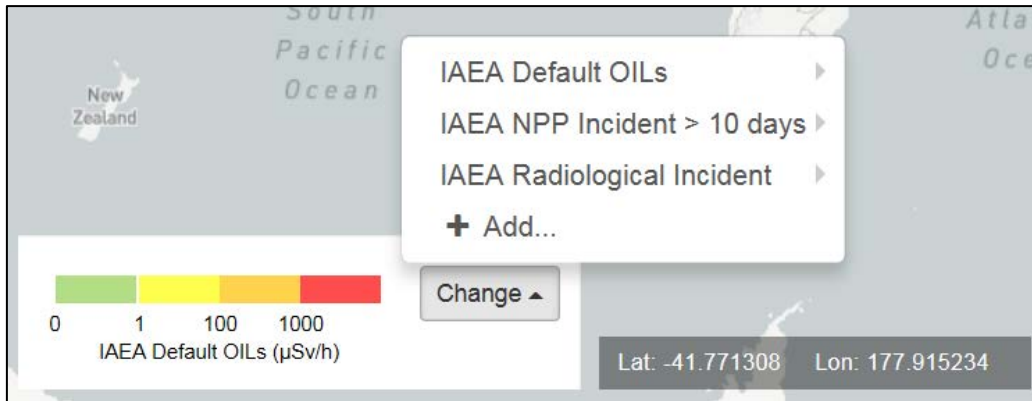
FIG. 7. Addition of a new colour palette to indicate new OILs.
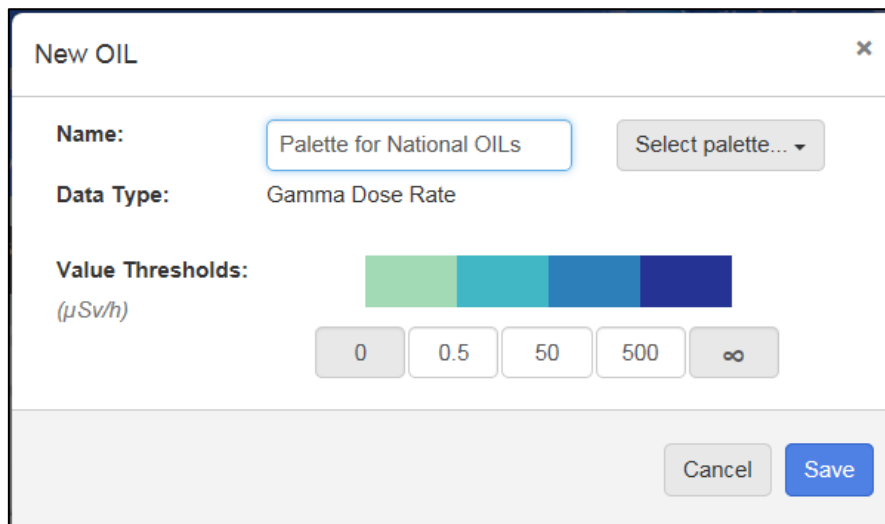
FIG. 8. New palette for customized OILs setting.

On the map on the visualization page, solid coloured hexagons indicate that there is more than one fixed monitoring station in this area, while hexagons with a white dot in the centre show data from a single monitoring station. The dose rate values are represented on a colour palette chosen by the user. The default visualization screen is shown in Fig. 9.
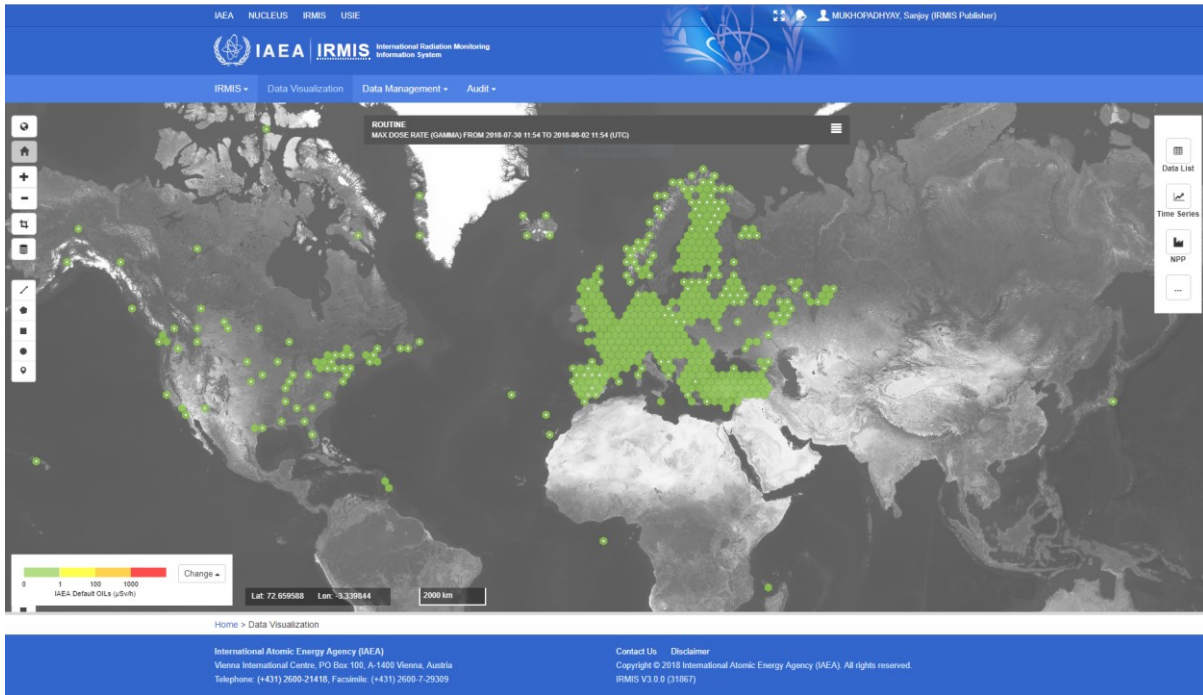
FIG. 9. Default visualization screen.

Figure 10 shows how the black bar at the top of the map would expand in the absence of any event from the IRMIS.
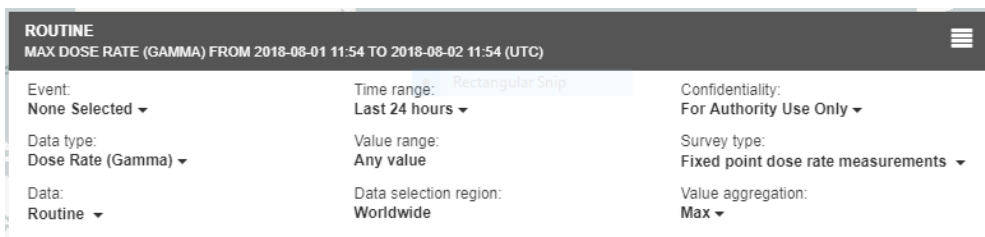
FIG. 10. Options for Visualization.

To demonstrate how events can be found and displayed on the Visualization page, choose an Event from the IRMIS training instance, https:\\iec.iaea.org\irmis-training. For example, to choose the event titled 'GC Side Event IRMIS':

1. Click on **Data Visualization** in the main menu bar under the IAEA logo.

2. Click on the black bar, and under the 'Event:' menu, select **GC Side Event IRMIS**.

3. Click on 'Time range:' to bring up options for custom time selection, such as 24, 48 or 72 hours. In this case, choose 'Or Select Free Dates'. Set the start date and time **From:** as 2016-08-02 00:00 and the end date and time **To:** as 2016-08-06 00:00 using the built-in calendar. Click **OK** to accept the dates and times (Fig. 11).

4. Click **Apply** on the 'Time range:' menu. The Visualization page now shows the relevant fixed-point dose rate measurements associated with this event. Zoom in to the desired level of detail (Fig. 12).
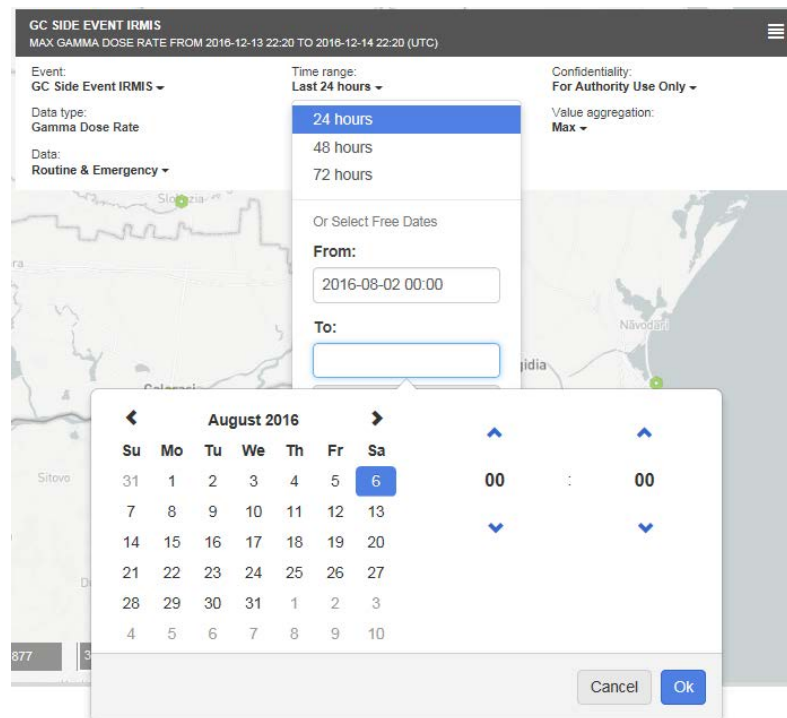
FIG. 11. Selection of Time Range using Built-in Calendar.
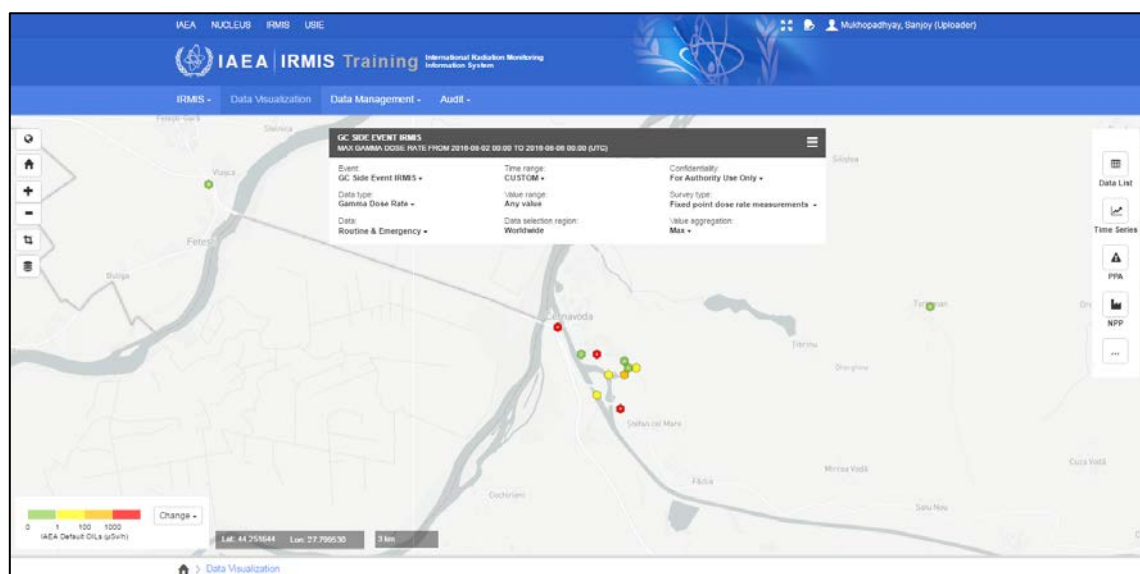
FIG. 12. Display of Dose Rate Data for fixed points on the Data Visualization page.

5. Click on 'Data type:' in the black bar to see the different types of monitoring and sampling data that can be viewed. The types available are shown in Fig. 13. Note that only the data types available are listed. In this case, four types are available:

   a) **Beta Dose Rate**;
   b) **Beta Gamma Dose Rate**;
   c) **Gamma Dose Rate**;
   d) **Neutron Dose Rate**.
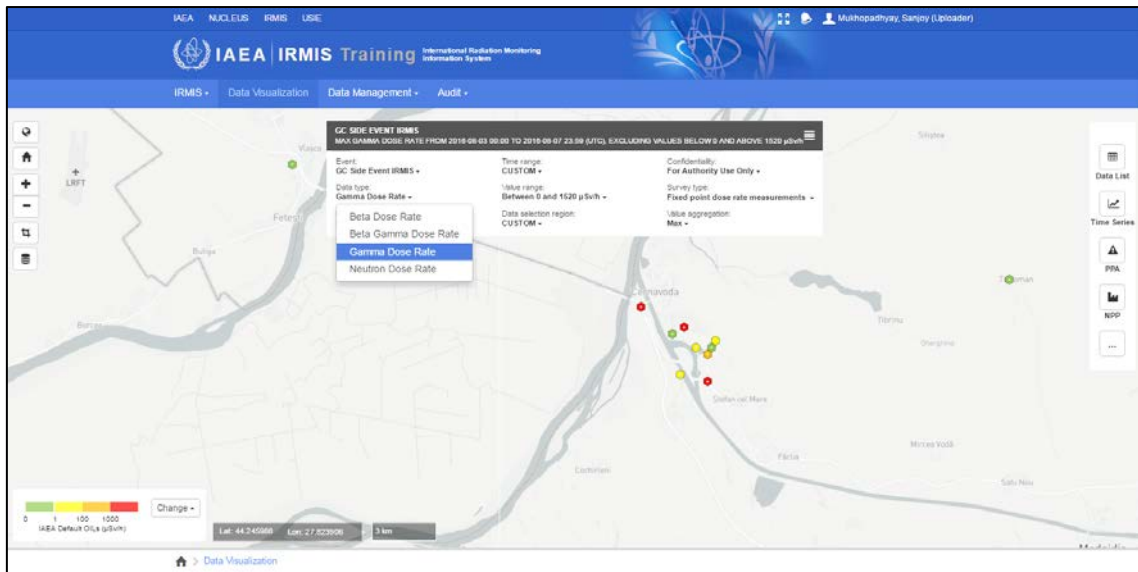
FIG. 13. Selection of Data Type.

6.   When more than one type of survey is present, the default 'Survey type:' is **All**, otherwise three distinct survey types are available — **Fixed point dose rate measurements**, **Vehicle based surveys** and **Ground based surveys (e.g. backpack)**. Click on 'Survey type:' to see which type of survey data are available for that data type (Fig. 14). Data can be selected for any combination of one or more of the individual survey types available.
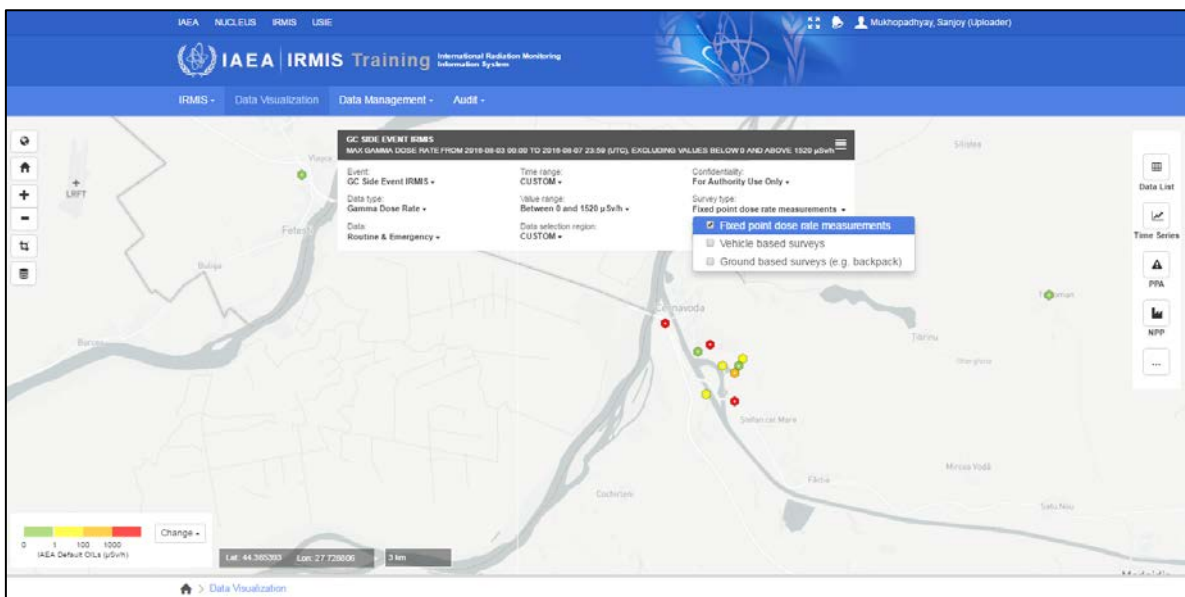
FIG. 14. Selection of survey type.

7.   To toggle between the **Max** values or **Latest** values of the recorded dose rates to be visualized, click on 'Value aggregation:'.

8.   Click on 'Data:' to select **Routine Data** or **Emergency Data**, or both. If they are both available and selected, **Routine & Emergency** will be shown (Fig. 14). Otherwise only **Routine** or **Emergency** will be shown, depending on which is present.

9. Click on 'Confidentiality:' and scroll down the menu to select from three different values for the event. These are:

    a) **For IAEA Secretariat use only**;
    b) **For Authority use only**;
    c) **Free for public use**.

10. The upper left-hand panel of the Visualization page shows six items (Fig. 15).

FIG. 15. Upper left-hand panel on the Data Visualization page.

a) Click on ⊕ to zoom out to global view from the map focusing on the event area.

b) Click on 🏠 to zoom in to the map focusing on the event area (Home) from the global view. This option is active for event mode only.

c) Click on ➕ to zoom in to the location of interest.

d) Click on ➖ to zoom out from the location of interest to a broader area or global view.

e) Click on ✄ to select the region of interest spatially. Click and drag to draw a rectangle around the area required (Fig. 16). The following steps explain how this spatial selection can lead to the selection of a time range.
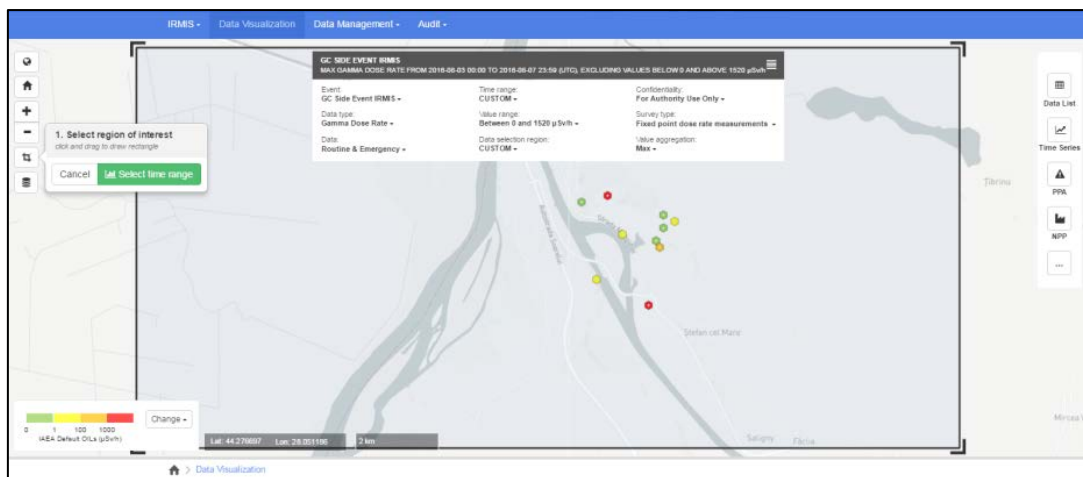
FIG. 16. Defining the selection of spatial data by dragging the rectangle.

Click **Select time range** (Fig. 17) to launch the time range selector. Two horizontal time range selectors will appear (Fig. 18) showing two time scales, a coarse version (top) and a detailed version (bottom). Each scale has two dark handles, one on the left and one on the right, to select a desired time range. Drag the handles to select the time range **2016-08-02** through **2016-08-06**.
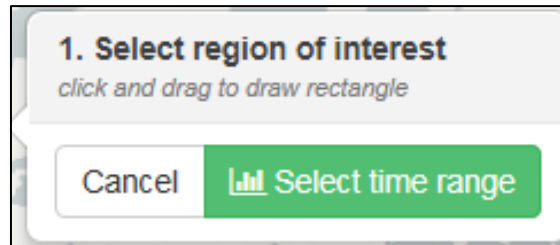
FIG. 17. Selecting the Time Range.
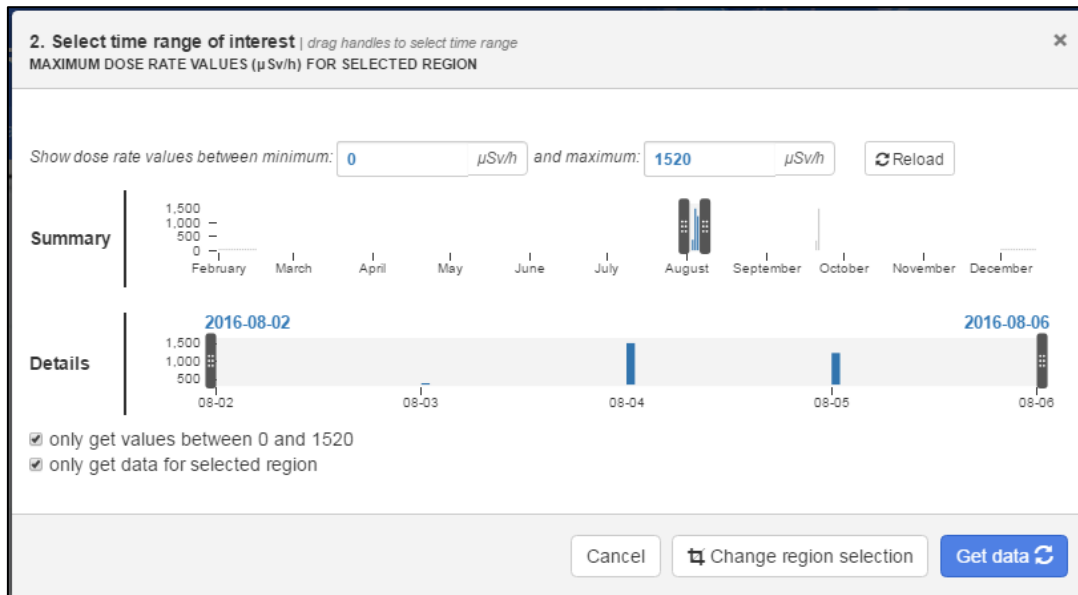
FIG. 18. Two more specific scales for selection of Time Range.

a) Click **Get data**.

b) Click on **Data List** at the top right.

c) Choose the four highest **Dose Rate** values from the Data List (Fig. 19).
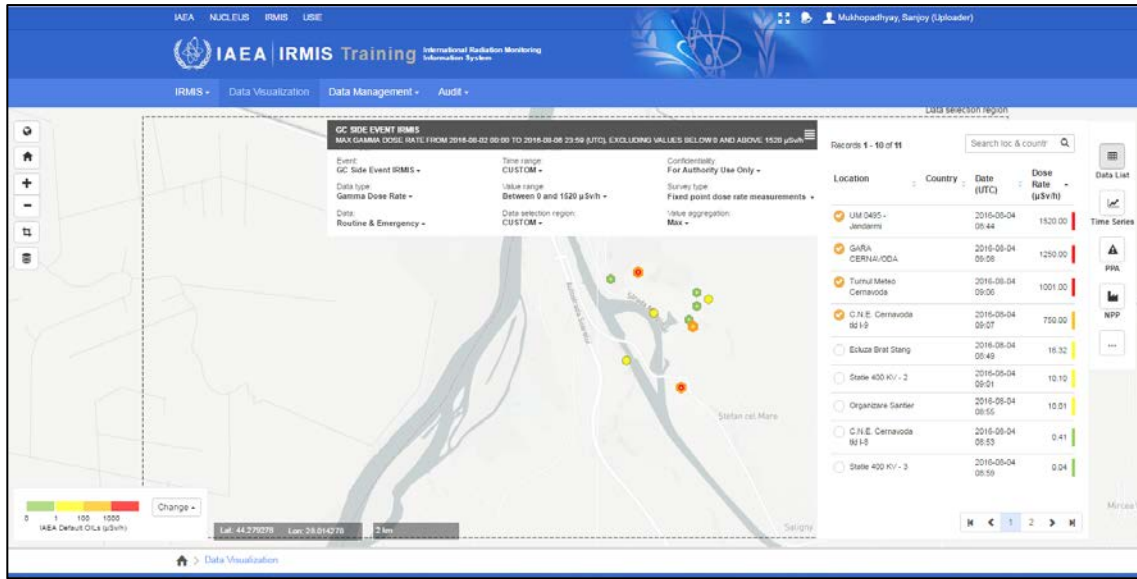
FIG. 19. Selection of locations for a display of Time Series.
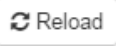
11. Click on **Time Series** ![Time Series icon] to observe the dose rate changes recorded by those four fixed monitoring stations (Fig. 20). The user will need to adjust the position of the handles to view the data as precisely as possible.

FIG. 20. Time Series Analysis of Data from Fixed Monitoring Stations.

The data values seen when the user first clicks **Select time range** can be refined further by adjusting the lower threshold and the upper limit. The absolute lower and upper limits are defined by the complete set of data that have been gathered, but the user can choose his or her own values within the range. For this particular example:

a) Change the lower threshold value (meaning 'exclude values below') to 0.1 μSv/h.

b) Change the upper limit value (meaning 'exclude values above') to 1000 μSv/h.

c) Click the **Reload** ⟳ Reload button to obtain the data, which are re-binned as shown in Fig. 21. Again, the user will need to adjust the position of the handles to view the data as precisely as possible.
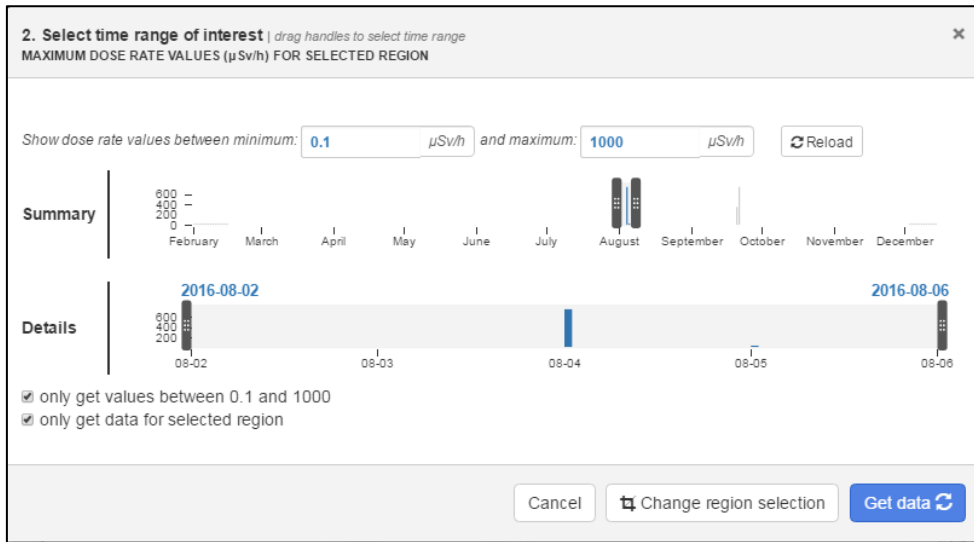
FIG. 21. Re-binned Dose Rate Data on Time Range Scales.

12. Click **Change region selection** to redefine the spatial selection of data.

13. Or click **Get data** to see all the Routine Data within the time period from 2016-08-02 00:00 to 2016-08-06 00:00. Figure 22 shows all the routine monitoring data within the spatial and time boundary defined in the above process.
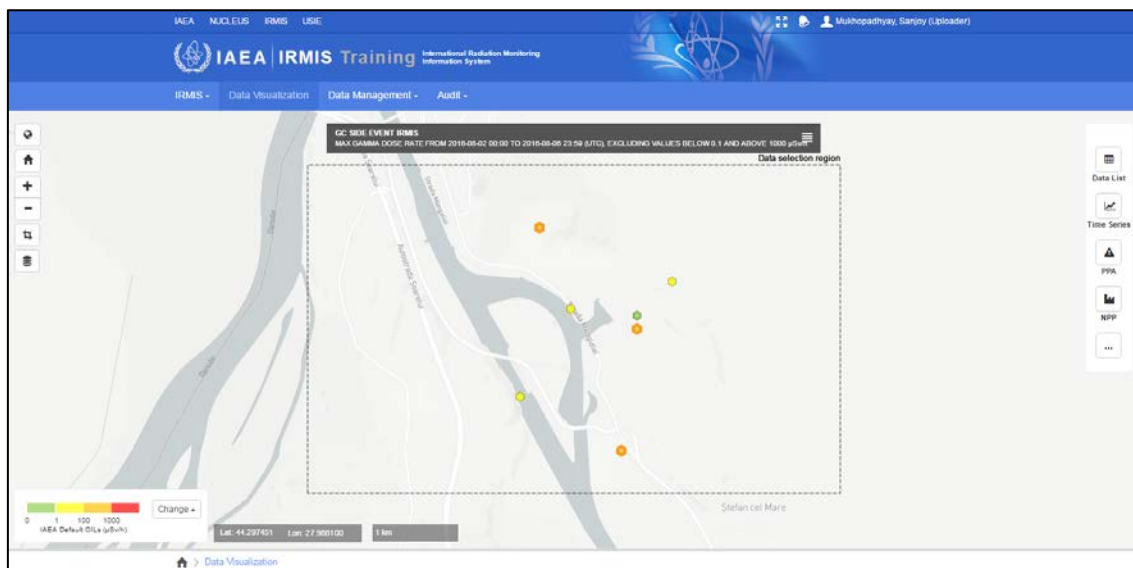
FIG. 22. Spatially and Time-selected Gamma Dose Rate Data.

It is worth mentioning here that Routine Data can sometimes display unusually high dose rates that are above the OILs scale (Fig. 23). This can happen for a number of reasons, for example:

a) Spurious readings resulting from electronic malfunctions causing spikes in dose rate values;

b) Sources that might have been brought close to where monitoring data are being collected, e.g. for calibration or other verification purposes.
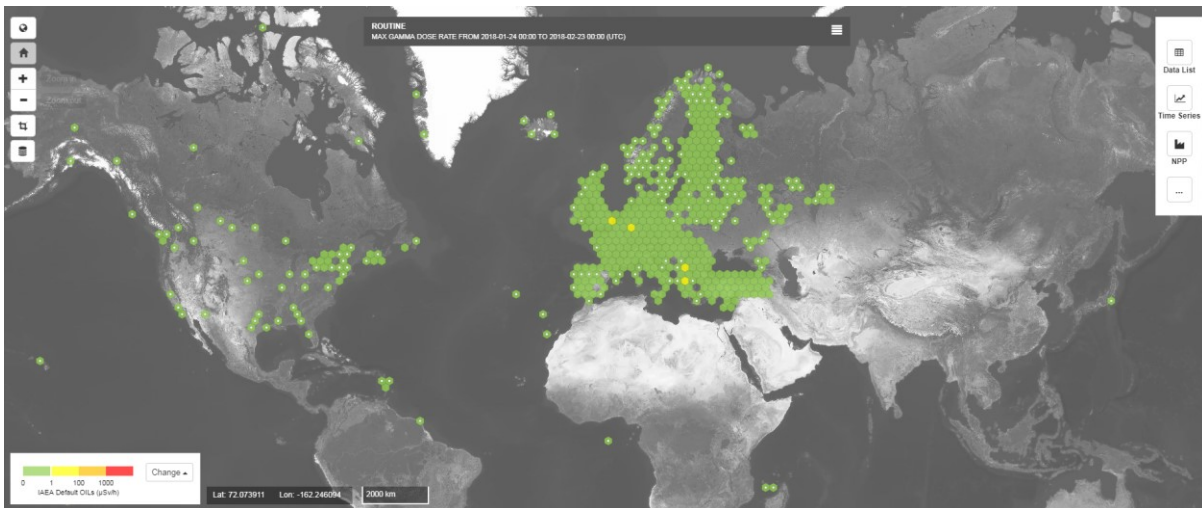
FIG. 23. Visualization of Routine Data with Several High Dose Rate Values.

14. The sixth button [⬛] in the upper left-hand panel of the Visualization page is for selecting the base map for Visualization. At present, data can be displayed on three base maps:

a) 'Map Light' (default);
b) 'Satellite Images Color + Streets';
c) 'Satellite Images Black & White' — this base map is shown in Fig. 24.

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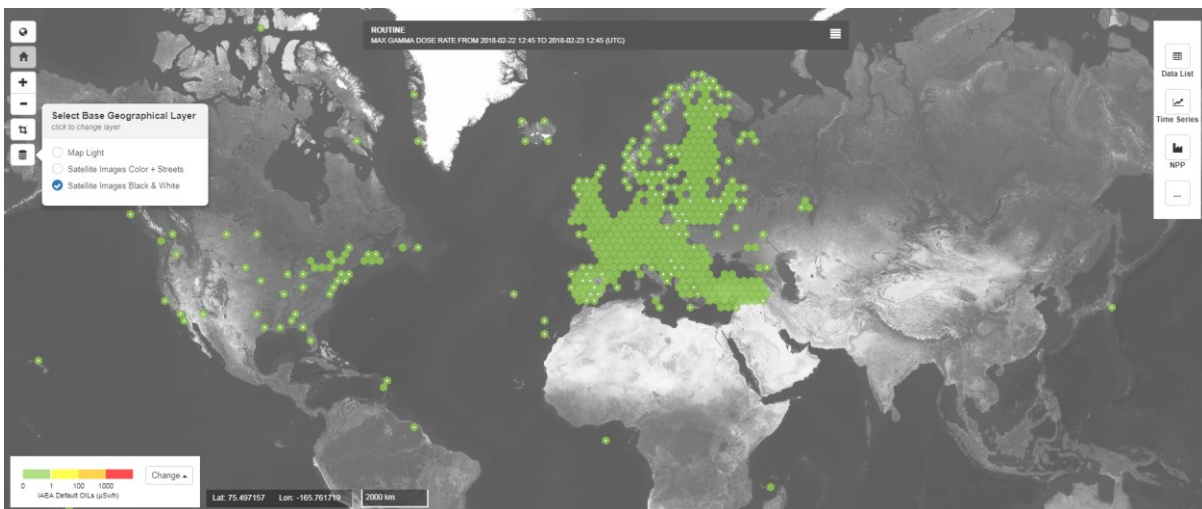
FIG. 24. Visualization of Routine Data using 'Satellite Images Black & White'.

The lower left hand panel of the Visualization page shows five items (Fig.26). These are the elements of the Drawing Tools available on Visualization page.

FIG. 25. Buttons on the lower left hand panel on Visualization page.

a) Click on ╱ to draw a straight line anywhere on the map

b) Click on ⬟ to draw a polygon of any size and shape anywhere on the map

c) Click on ■ to draw a rectangle of any size anywhere on the map

d) Click on ● to draw a circle of any radius anywhere on the map

e) Click on 📍 to annotate a location on the map

The right-hand panel of buttons on the Visualization page includes four buttons (for Routine Data) or five buttons (for Emergency Data), as shown in Fig. 26.
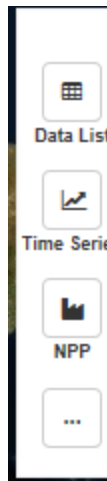
FIG. 26. Buttons on the Right-Hand Panel on Visualization page for IRMIS Routine Monitoring Data.

15. Click on **Data List** ⊞ Data List to show a tabular view of data that includes: the **Location** of the data collected, the **Country** that reported the data, the **Date** and time in **UTC** of the collection of data and the **Dose Rate** in μSv/h. A partial Data List is shown in Fig. 27.

This list normally contains just the single value for each station: either the maximum value or the latest value over the time period selected. The data can be sorted into ascending or descending order based on the four variables just described. Users can also search by location and country using the 'Search loc & country' field [Search loc & country Q] . If no sorting is performed, the default Data List display moves the highest dose rate within the range to the top, and displays the remaining dose rates in descending order.

Records 15 - 28 of 854   Search loc & country   Q

Location	Country	Date (UTC)	Dose Rate (µSv/h)
○ Depozit Seiru	RO	2016-10-06 00:45	2024.21
○ Ecluza Brat Stang	RO	2016-10-05 18:00	1807.74
○ Statia Ecluza Cernavoda	RO	2016-10-05 18:00	1277.58
○ Survey1	RO	2016-10-05 10:53	557.37
○ Survey1	RO	2016-10-05 10:54	515.55
○ Survey1	RO	2016-10-05 10:53	483.03
○ Survey1	RO	2016-10-05 11:02	472.72
○ Survey1	RO	2016-10-05 10:54	455.25
○ Survey1	RO	2016-10-05 10:53	433.04
○ Survey1	RO	2016-10-05 10:53	420.41
○ Survey1	RO	2016-10-05 11:02	412.40
○ Survey1	RO	2016-10-05 10:54	407.57
○ Survey1	RO	2016-10-05 10:53	390.86

K ‹ 1 2 3 › M

FIG. 27. Radiation Monitoring Data in the List Mode.

Any row in the Data List can be highlighted by hovering over it with the mouse. The row turns pale blue and crosshairs appear on the map at the location selected (Fig. 28).
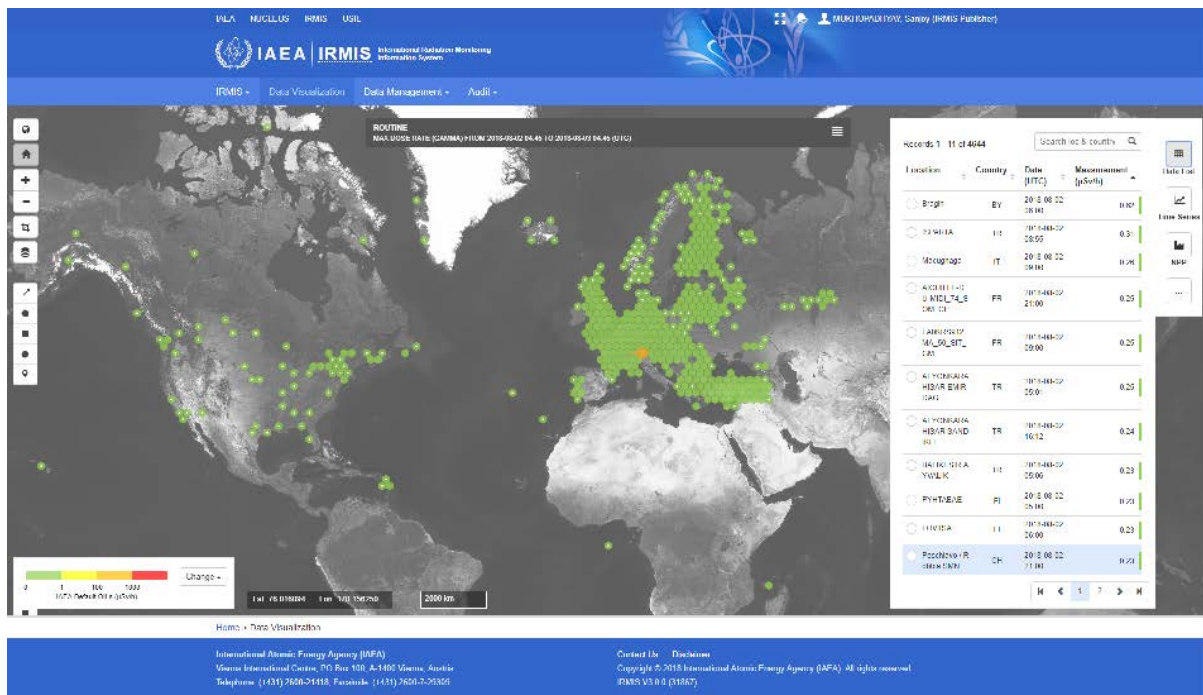
FIG. 28. Location highlighted on the Data List, shown on the Map using crosshairs.

16. **Time Series** ![Time Series icon] analysis of the data from one or more locations can be carried out in two different ways:

   a) Via **Data List**: by bringing up locations and selecting their names, then clicking **Time Series**, as discussed earlier;

   b) In the Visualization view, double clicking on a well resolved location that has a single dose rate value — shown by a hexagon with a white dot in the centre — then clicking

   Time Series ![Time Series icon] (Fig. 29).
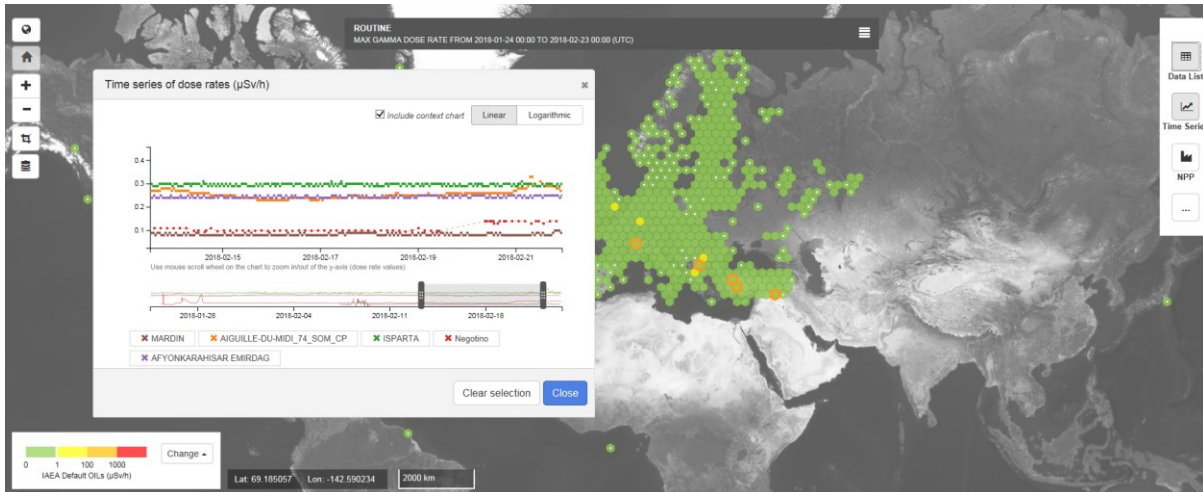
FIG. 29. Obtaining Time series display of Dose rate data by selecting location on Map.

17. On the Visualization page, click on **PPA** [PPA icon] to observe the different PPA that have been 'Planned', 'Ordered', 'Taken' or 'Withdrawn'. Note that PPAs are only defined for Emergency Data. To illustrate the PPAs, visit the IRMIS training web site at https:\\iec.iaea.org\irmis-training and choose the 'GC Side Event IRMIS'. The PPAs reported by the 'Accident State' to the IEC through USIE (or fax, email, telephone, etc.) during a nuclear or radiological emergency are displayed in IRMIS as circles, to provide approximate visualization of the areas where protective actions have been reported. These visualizations may not necessarily depict, in detail, the actual area(s) where measures have been implemented locally. Additional details may be available in USIE or through information from the 'Accident State'. Users in the 'Accident State' may choose to display the reported PPAs and compare them to the measurements reported by selecting an appropriate set of OILs to help determine whether the reported PPAs appear to be suitable, and whether these PPAs may be extended, reduced or removed. On clicking **PPA** [PPA icon], the actions that have already been defined for the event are shown (Fig. 30).

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Type	Radius	Status	Date (UTC)
⭕ Stable iodine	60Km	Ordered	2016-09-30 10:00
⭕ Sheltering	30Km	Ordered	2016-09-30 10:00
⭕ Evacuation	5Km	Taken	2016-09-30 10:00
⭕ Food restrictions / advisories	150Km	Planned	2016-09-30 10:00
⭕ Water Restrictions	200Km	Planned	2016-09-30 10:00
⭕ Traffic restrictions	250Km	Taken	2016-09-30 10:00
⭕ Other actions	300Km	Withdrawn	2016-09-30 10:00

FIG. 30. PPAs already defined in the event 'GC Side Event IRMIS'.

18. Select as many of the defined PPAs as is desired, to display these on the Visualization page (Fig. 31). These are shown as circles of a specific radius, within which the PPA is 'Planned', 'Ordered', 'Taken' or 'Withdrawn'.
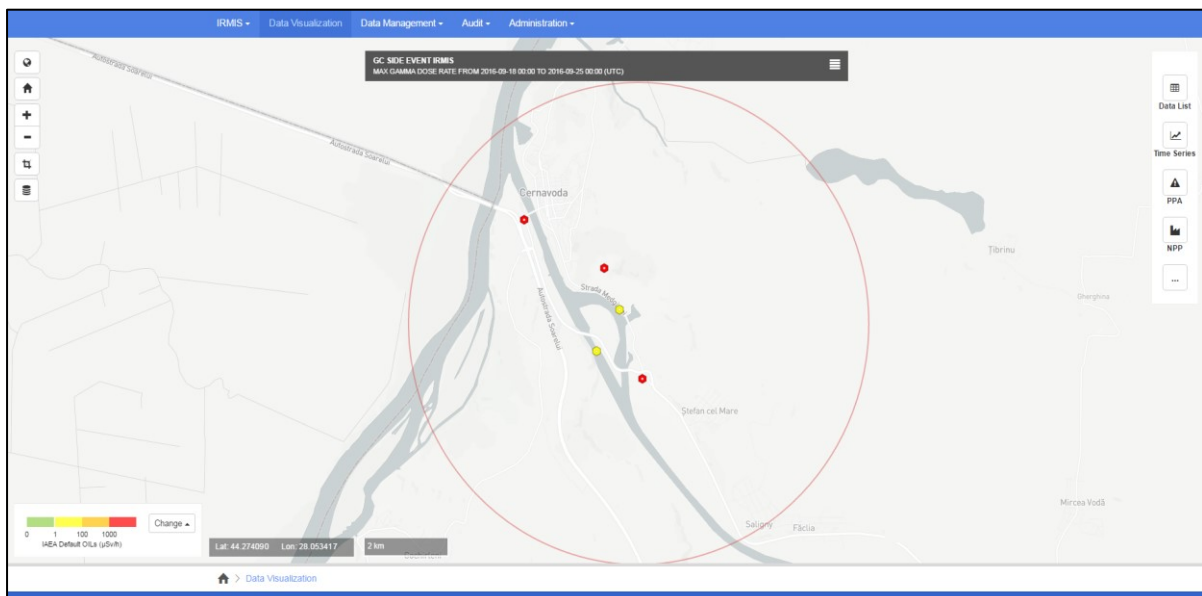
FIG. 31. The display of PPAs defined for an event shown on the Visualization page.

An example of a PPA on the IRMIS Visualization page that is defined as a more specific shape file is shown in Fig. 32.
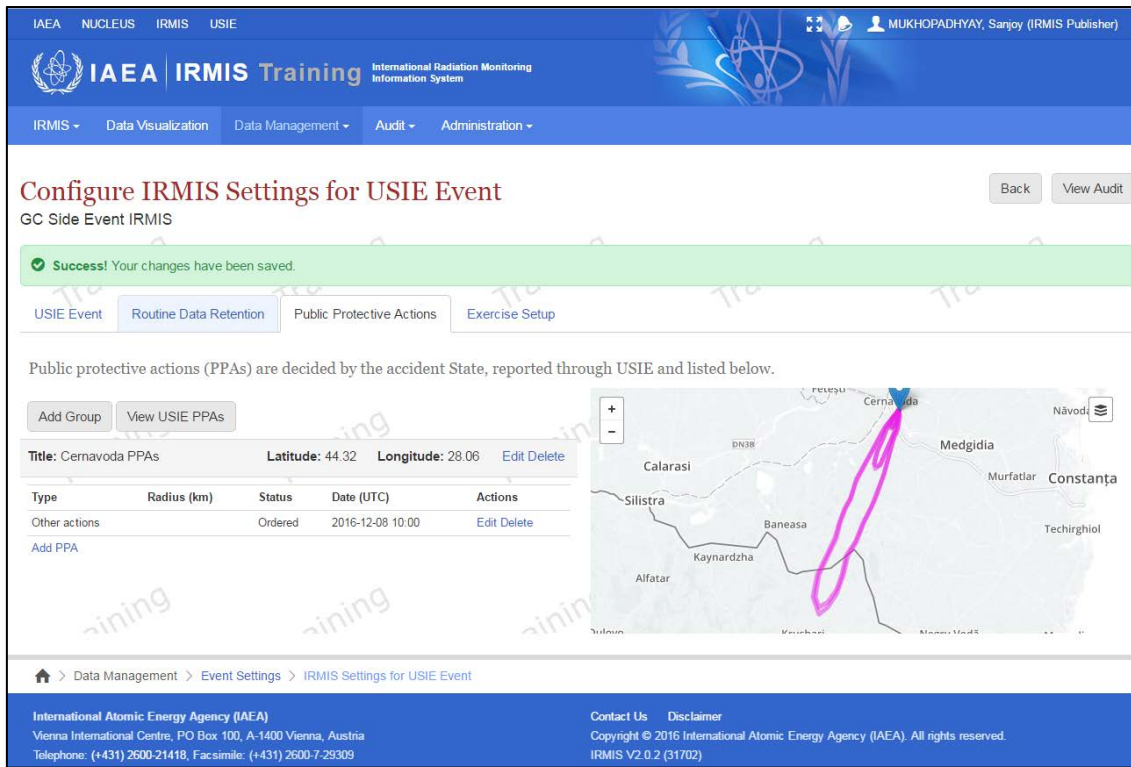
FIG. 32. PPAs uploaded in the form of shape files to IRMIS are visualized.

19. Click on **NPP** ![NPP icon] to bring up a table of NPPs around the world, listing NPPs by country and by site. The NPPs can also be searched by country and site. A display of a few NPPs selected from the table is shown in Fig. 33.
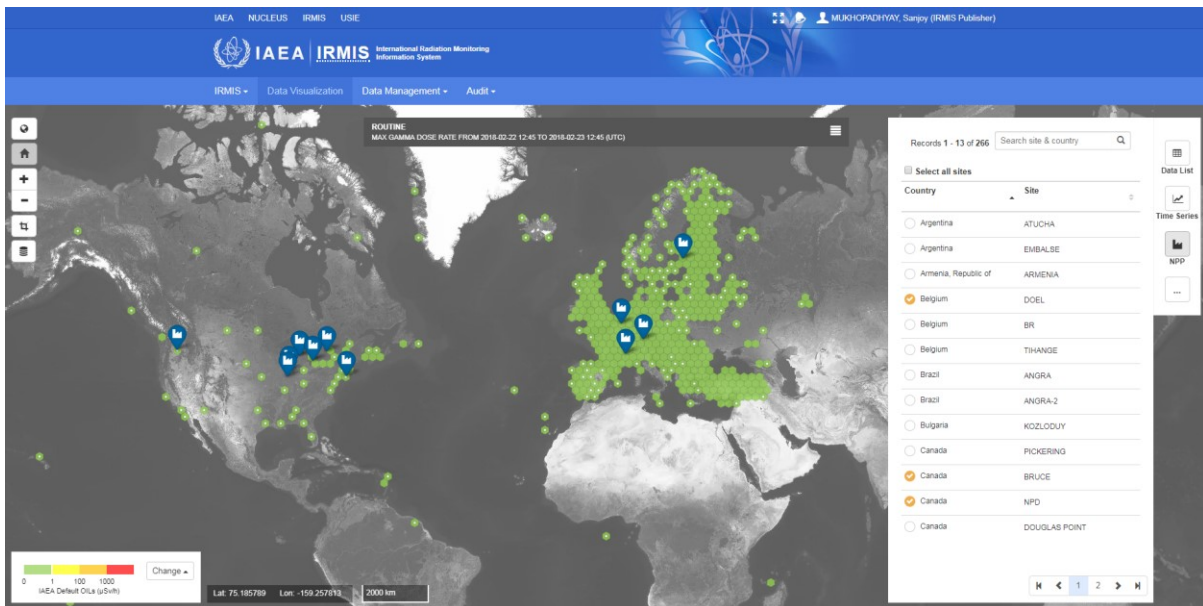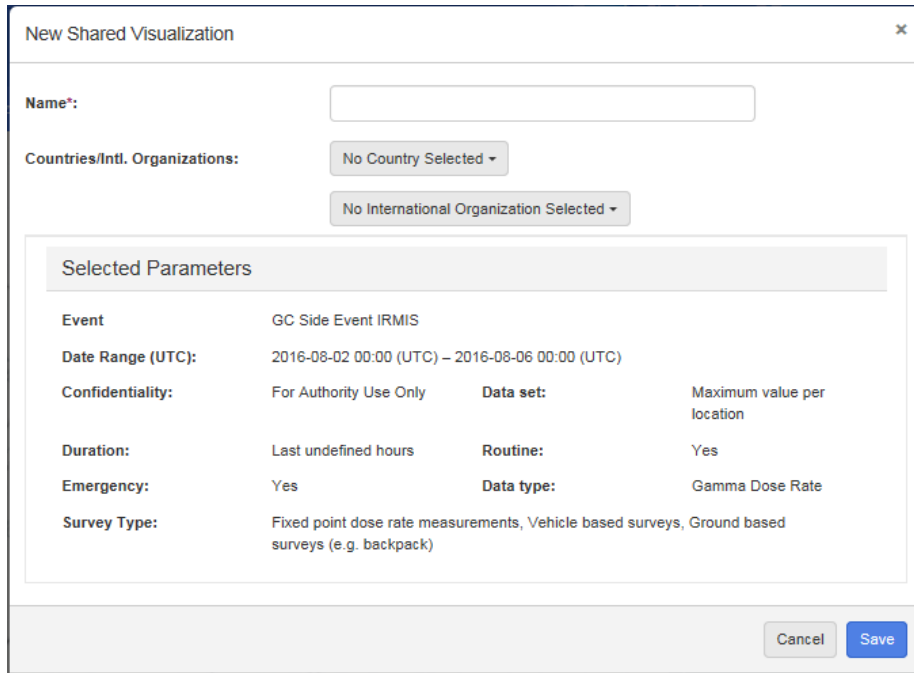

FIG. 33. Display of NPPs from a selection table.

20. Click on **Options** ⟨ ··· ⟩ to expand the set of buttons and display two extra operations:

    Share (visualization) ⟨ Share ⟩ and **Export** (to Excel) ⟨ Export ⟩ .

21. Click the **Share** (visualization) ⟨ Share ⟩ button to share visualization settings with other
    States or the IEC; a pop up page appears (Fig. 34). This feature is explained in detail in
    Section 4.4.3.
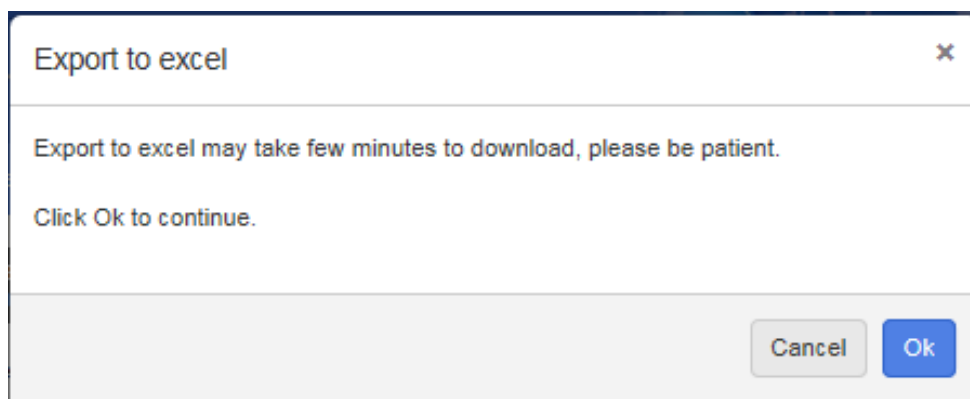
FIG. 34. Shared Visualization Form.

22. Click **Export** ⟨ Export ⟩ to export data in Excel format. The data will be filtered as per the
    selection from the main Visualization page (Fig. 35).

FIG. 35. Data Export.

23. Click **Ok**. After a short time, an orange dialogue box will appear at the bottom of the screen, asking if the user would like to **Open**, **Save** or **Cancel** the export of the Excel file. By clicking **Open**, one can see all data exported in Excel format as shown in Fig. 36.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Report Context	Time	Reporting Country	Location Name	Latitude	Longitude	Height Above Land	DoseRateType	Value	Unit	Validated	Superseded
2	Emergency	2016-08-04 10:02:50	20	Hodmezovasarhely	46.42	20.37		1 Gamma Dose Rate	0.08	microSv/h	Yes	No
3	Emergency	2016-08-04 17:45:55	20	OHRUM	52.1174	10.5664		1 Gamma Dose Rate	0.098	microSv/h	Yes	No
4	Emergency	2016-08-04 09:07:50	20	GARA CERNAVODA	44.3373	28.0262		1 Gamma Dose Rate	0.106	microSv/h	Yes	No
5	Emergency	2016-08-04 18:58:30	20	DINSLAKEN	51.5653	6.7225		1 Gamma Dose Rate	0.084	microSv/h	Yes	No
6	Emergency	2016-08-04 22:09:30	20	STROMBERG	49.9471	7.7895		1 Gamma Dose Rate	0.1	microSv/h	Yes	No
7	Emergency	2016-08-04 08:02:15	20	Montana	43.3903	23.2194		1 Gamma Dose Rate	0.04	microSv/h	Yes	No
8	Emergency	2016-08-04 08:55:20	20	Organizare Santier	44.3205	28.0529		1 Gamma Dose Rate	10.01	microSv/h	Yes	No
9	Emergency	2016-08-04 13:21:35	20	AUW BEI PRÜM	50.3025	6.341		1 Gamma Dose Rate	0.095	microSv/h	Yes	No
10	Emergency	2016-08-04 22:40:35	20	SCHWERIN	53.643	11.3864		1 Gamma Dose Rate	0.086	microSv/h	Yes	No
11	Emergency	2016-08-04 18:55:40	20	HOHENPEIßENBERG	47.8018	11.0226		1 Gamma Dose Rate	0.082	microSv/h	Yes	No
12	Emergency	2016-08-04 08:58:05	20	Statie 400 KV - 3	44.3228	28.0639		1 Gamma Dose Rate	0.043	microSv/h	Yes	No
13	Emergency	2016-08-04 20:52:50	20	BERLIN-BUCH	52.6308	13.5025		1 Gamma Dose Rate	0.078	microSv/h	Yes	No
14	Emergency	2016-08-04 08:01:15	20	Botev Peak	42.7208	24.9222		1 Gamma Dose Rate	0.03	microSv/h	Yes	No
15	Emergency	2016-08-04 20:58:40	20	BURGAU OT UNTERKNÖRRINGEN	48.4374	10.3879		1 Gamma Dose Rate	0.082	microSv/h	Yes	No
16	Emergency	2016-08-04 20:15:45	20	LIPPSTADT-HÖRSTE	51.6904	8.4365		1 Gamma Dose Rate	0.061	microSv/h	Yes	No
17	Emergency	2016-08-04 22:12:45	20	GÜTZKOW	53.9458	13.4192		1 Gamma Dose Rate	0.081	microSv/h	Yes	No
18	Emergency	2016-08-04 15:57:45	20	UELZEN	52.9562	10.5668		1 Gamma Dose Rate	0.067	microSv/h	Yes	No
19	Emergency	2016-08-04 13:07:30	20	BORKEN-RHEDEBRÜGGE	51.8336	6.7874		1 Gamma Dose Rate	0.064	microSv/h	Yes	No
20	Emergency	2016-08-04 22:28:35	20	STADTALLENDORF	50.8204	8.9894		1 Gamma Dose Rate	0.087	microSv/h	Yes	No
21	Emergency	2016-08-04 19:51:45	20	EBRINGEN	47.9555	7.8046		1 Gamma Dose Rate	0.1	microSv/h	Yes	No
22	Emergency	2016-08-04 11:27:10	20	M?dling	48.0825	16.2992		1 Gamma Dose Rate	0.08	microSv/h	Yes	No
23	Emergency	2016-08-04 20:28:35	20	FREIBURG ST WALTERSHOFEN	48.0213	7.7266		1 Gamma Dose Rate	0.11	microSv/h	Yes	No
24	Emergency	2016-08-04 18:28:55	20	ST. BLASIEN	47.7703	8.1145		1 Gamma Dose Rate	0.14	microSv/h	Yes	No
25	Emergency	2016-08-04 20:31:55	20	LÜBTHEEN	53.3174	11.1069		1 Gamma Dose Rate	0.074	microSv/h	Yes	No
26	Emergency	2016-08-04 09:45:25	20	Ploiesti - Babele RA Station	45.3762	25.4536		1 Gamma Dose Rate	0.07	microSv/h	Yes	No
27	Emergency	2016-08-04 19:00:55	20	LANGENAU	48.5037	10.1744		1 Gamma Dose Rate	0.084	microSv/h	Yes	No
28	Emergency	2016-08-04 17:50:35	20	HOHENBERG A.D.EGER	50.092	12.2241		1 Gamma Dose Rate	0.11	microSv/h	Yes	No
29	Emergency	2016-08-04 18:32:40	20	RUHPOLDING OT LAUBAU	47.7273	12.6588		1 Gamma Dose Rate	0.094	microSv/h	Yes	No
30	Emergency	2016-08-04 09:39:55	20	#15 Ilok	45.1856	19.4172		1 Gamma Dose Rate	0.07	microSv/h	Yes	No
31	Emergency	2016-08-04 21:08:30	20	PEENEMÜNDE	54.1593	13.7679		1 Gamma Dose Rate	0.068	microSv/h	Yes	No
32	Emergency	2016-08-04 16:02:10	20	OTTMARING	48.3284	11.0056		1 Gamma Dose Rate	0.093	microSv/h	Yes	No
33	Emergency	2016-08-04 08:25:35	20	PISCICOLA DUNARENI	43.8817	23.5924		1 Gamma Dose Rate	0.06	microSv/h	Yes	No
34	Emergency	2016-08-04 12:26:00	20	VETTWEIß	50.7335	6.5916		1 Gamma Dose Rate	0.086	microSv/h	Yes	No
35	Emergency	2016-08-04 17:54:30	20	WELDEN	48.4589	10.6671		1 Gamma Dose Rate	0.087	microSv/h	Yes	No
36	Emergency	2016-08-04 10:05:20	20	Targu Mures	46.5167	24.5667		1 Gamma Dose Rate	0.08	microSv/h	Yes	No
37	Emergency	2016-08-04 18:41:10	20	GRÜNSTADT	49.5664	8.1778		1 Gamma Dose Rate	0.093	microSv/h	Yes	No
38	Emergency	2016-08-04 17:39:15	20	ARNSBERG-NEHEIM	51.4634	7.9772		1 Gamma Dose Rate	0.085	microSv/h	Yes	No
39	Emergency	2016-08-04 10:05:45	20	Ferlach	46.5422	14.3053		1 Gamma Dose Rate	0.08	microSv/h	Yes	No

FIG. 36. Excel file opened to view from Export.

4.4.2. Navigation within Data Visualization

Following is a quick list of action items that users may need to perform while navigating within the IRMIS Visualization page. The details have been given before — here they are gathered together in one place for convenience. These are solutions to frequently asked questions.

1. After clicking on **Event:** and selecting the event, click on **Data:** and select, or do nor select, the **Routine** box to include or exclude Routine Data. Note that the IRMIS training site does not contain any Routine Data — the data shown in Fig. 37 are taken from the IRMIS site.
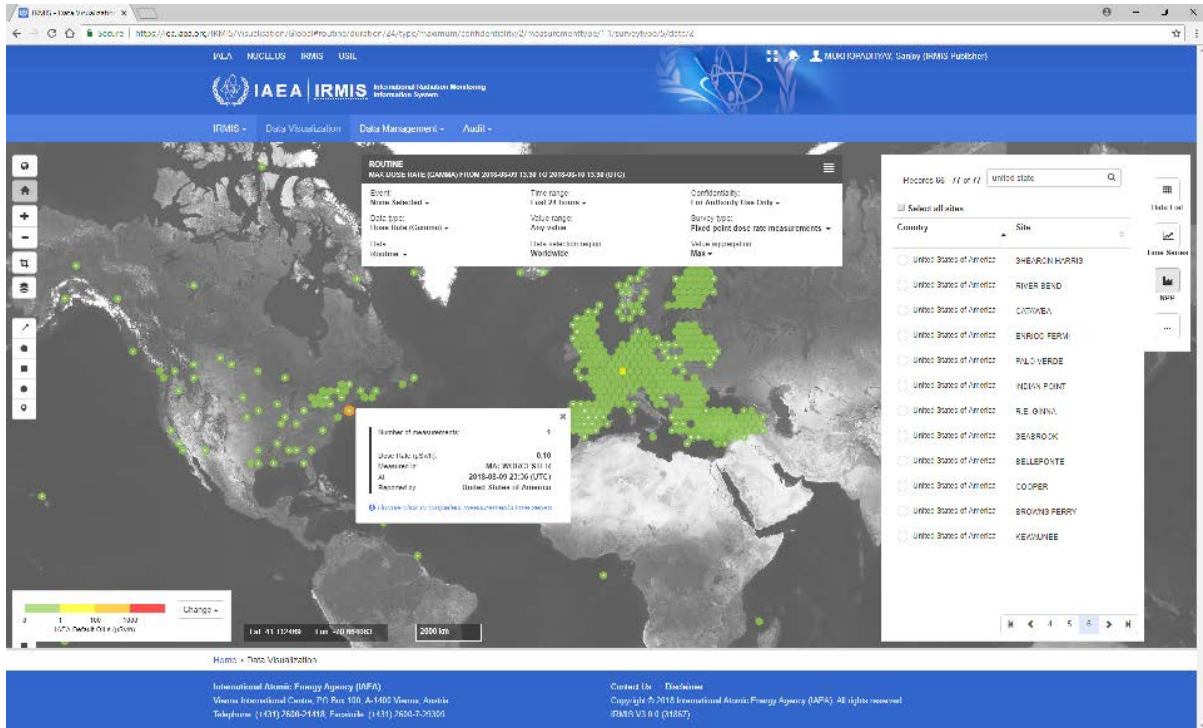
4

FIG. 37. Selection of Routine Data.

2. Select the **Emergency** box to include or exclude Emergency Data.

3. To observe what is shown in Fig. 38, customize the 'Time range:' between 2016-09-20 00:00 and 2016-09-22 00:00.
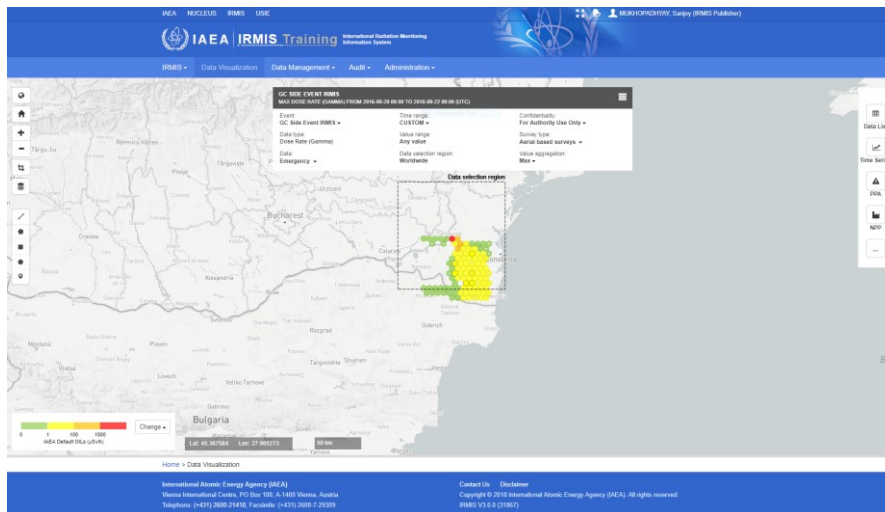

FIG. 38. Selection of Emergency Data.

4. When the user clicks on **Data List** , the data are listed by default from high dose rate to low dose rate, i.e. in descending order.

5. Click the double headed arrow button on **Date (UTC)** to arrange data chronologically.

6. Type in the two letter **Country** name (UN Country Code) to select data from that country only (Fig. 39).

FIG. 39. Manipulating the Data List.

7. Click in the circle to the left of the Location name to choose particular stations. Hovering over the Location of a particular station will turn that row pale blue; crosshairs also show up on the map on the location selected (Fig. 40).
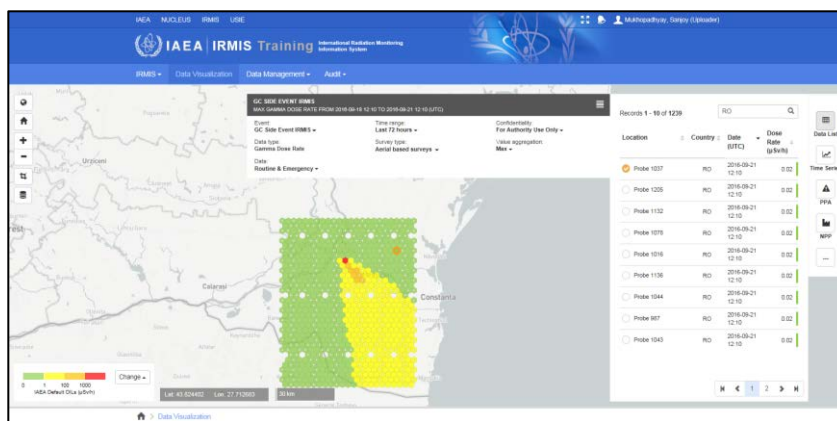
FIG. 40. Locating a particular fixed monitoring station on the map from Data List.

8. Moving the cursor on the map displays the current GPS coordinates at the bottom of the map. The map scale is shown at the bottom right.

9. Hovering over any coloured hexagon displays a white pop up card. This indicates the number of measurements that have been aggregated under that hexagon, the maximum

measurement value, the name of the station, the time of the measurement and the country reporting the data (Fig. 41).

FIG. 41. Data Content for an individual location.

10. Data displayed in a hexagon with a white dot at the centre represent a single measurement value at that location.

4.4.3. Sharing Data Visualization

During an emergency, it is often very important that technical personnel analysing data be able to harmonize their visualizations. The visualization sharing functionality is a quick and efficient way of distributing a specific visualization with other stakeholders.

This process lets users share visualization parameters, exactly as seen on their screen, from the IRMIS Visualization page. Multiple visualization shares for different scenarios are possible. Note that prerequisite knowledge of navigation within the visualization function of IRMIS is needed, as described in Section 4.4.1. Some of the navigation information is repeated here for convenience.

The 'GC Side Event IRMIS' event can be used to exemplify the data sharing process:

1. Go to the https://iec.iaea.org/irmis-training site.

2. Click **Data Visualization** in the main menu bar, then click anywhere on the top black tool bar (Fig. 42).
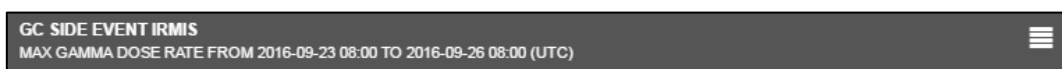
FIG. 42. Screenshot of the Black Tool Bar on the Visualization page.

3. Click on **Event:** and select **GC Side Event IRMIS**.

4. Select **Time range,** click in the **Or select date range** fields, then choose values **From:** 2016-09-19 10:00 and **To:** 2016-09-23 00:00 using the pop-up calendar (Fig. 43).
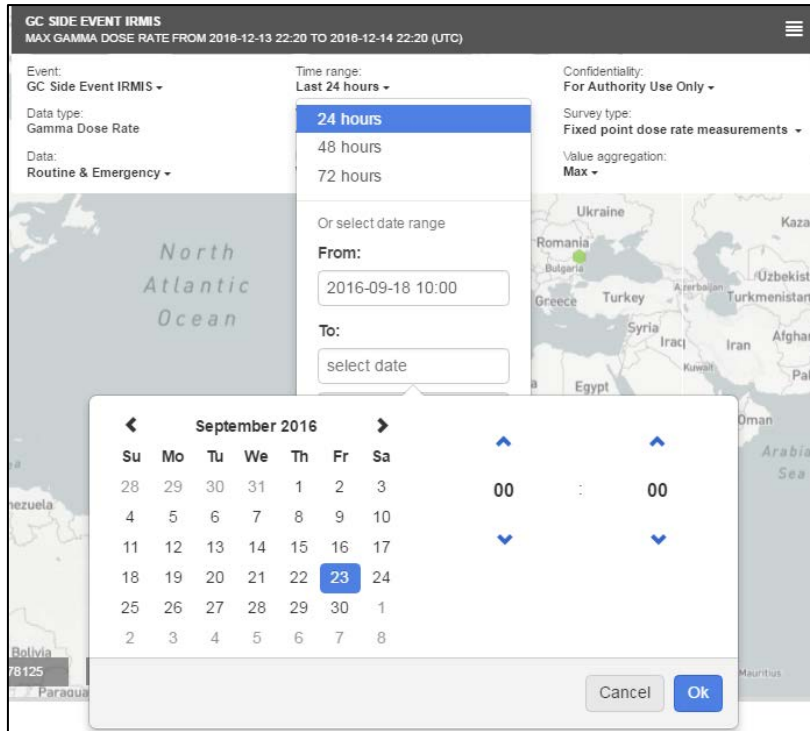
FIG. 43. Use of Custom Time Range to Define Visualization Timeline.

The visualization as shown in Fig. 44 can now be appreciated by zooming in on the Cernavoda area of Romania.
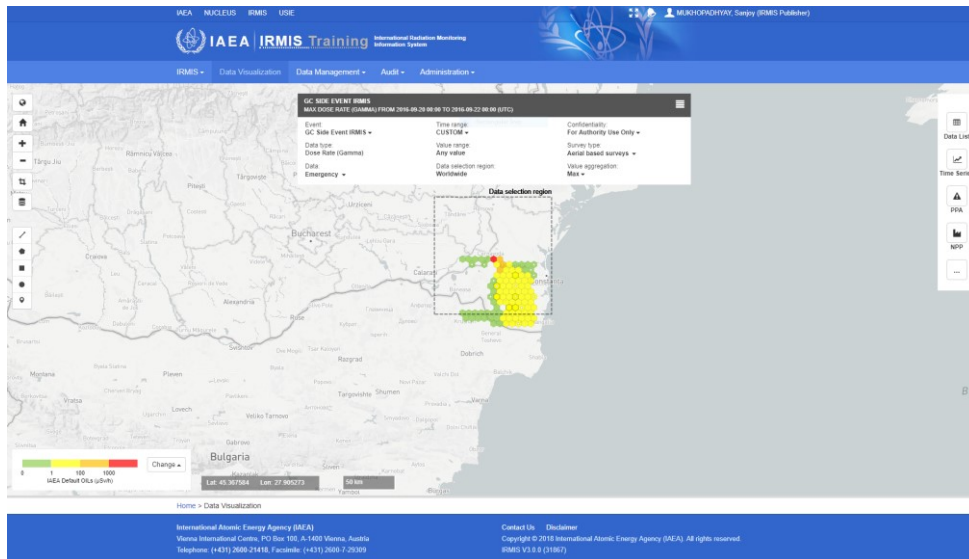
FIG. 44. Visualization of Routine and Emergency Data for 'GC Side Event IRMIS'.

5.   These data can now be shared. From the 'Survey type:' menu, select **Fixed point dose rate measurements** and deselect **Aerial based surveys**.

6.   Click on **Data List** and select the **Locations** that recorded the four highest **Dose Rates**.

7. Add the NPP at Cernavoda to the map: click on NPP ![NPP icon] , then search for and select 'CERNAVODA' in the search field.

8. Include the evacuation PPA circle on the map: click on **PPA** ![PPA icon] then select 'Evacuation'.

9. Include the time series analysis of the dose rate data for the four stations chosen (Fig. 45): click on **Time Series** ![Time Series icon] and move the two dark handles in the bottom timeline so that the data for the desired date range are clearly visible (2016-09-19 10:00 to 2016-09-23 00:00). As shown in Fig. 45, he Visualization to be Shared contains high dose rate data from Fixed Point Dose Rate Monitoring Stations, the Evacuation PPA, the location of the Cernavoda NPP, and the Time Series Analysis of the Dose Rate Data from the four stations
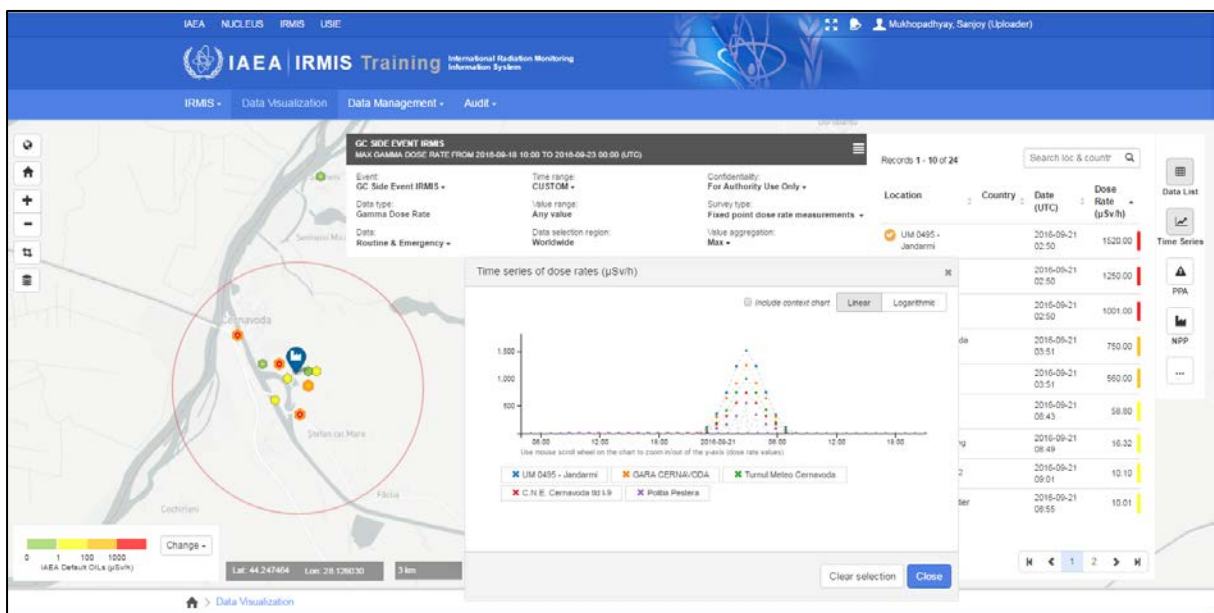
FIG. 45. Contents of Shared Visualization.

10. Click on **Options** ![Options icon] and then on **Share** ![Share icon] . A form will pop up to be filled out with relevant data. The **Name** field can be filled out with any title the user feels is appropriate. Countries and international organizations are chosen on the basis of need to know, level of technical collaboration, and need for exchanging detailed technical information. In Fig. 46, eight countries were chosen (Bulgaria, Croatia, Hungary, Republic of Moldova, Serbia, Slovakia, Turkey, Ukraine), one international organization was chosen (International Atomic Energy Agency) and the data were given the title 'GC SIDE EVENT IRMIS — SHARED VISUALIZATION 01'.

FIG. 46. Naming and Defining a Shared Visualization.

Click on **Share** — the data have now been formally gathered together.

a) To check on what is actually being shared, click on **Data Management**.

b) Click on **Shared Visualization** — the Visualization as named by the user will now be visible (Fig. 47).

FIG. 47. List of Shared Visualizations.

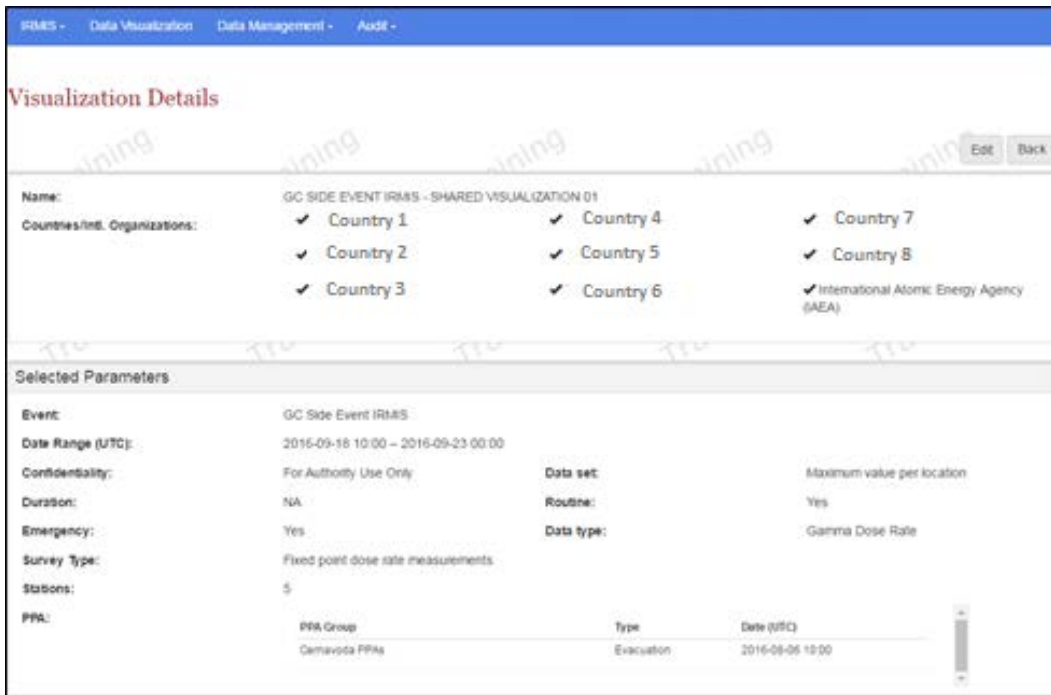c) Click 'View' next to the GC SIDE EVENT IRMIS — SHARED VISUALIZATION 01. This will show the parameters for the shared visualization (Fig. 48).

FIG. 48. Parameters of Shared Visualization.

d) Click 'Back' near the top right of the screen.

e) Click 'Visualize' at the far right of the row for 'GC SIDE EVENT IRMIS – SHARED VISUALIZATION 01'. The essential elements are now shown in global view (Fig. 49). Note that the system does not remember the exact zoom level; nor does it remember the exact location of the NPP.
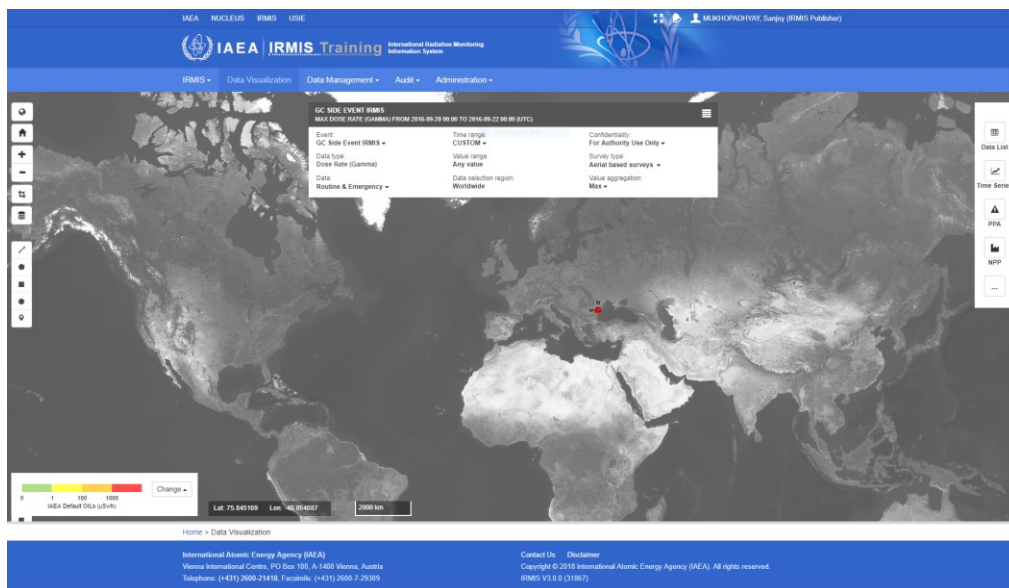
FIG. 49. 'GC SIDE EVENT IRMIS — SHARED VISUALIZATION 01'.

4.4.4. Preparing Data for Time Series Display

There are two ways to select dose rate data by location and display it as a time series:

1. On the Visualization map, double click on the individual monitoring station locations, designated by a hexagon with a white dot in the centre — the locations will be highlighted with a thick orange outline to the hexagon. Click **Time Series** Time Series and a plot will be generated. Use the grey handles to zoom in on the relevant range of the time selection. If the location names are not known, usually it is useful to pick the fixed monitoring stations that are showing radiation measurements at a higher level, above defined OILs.

2. Alternatively, select locations from the **Data List** Data List and then click the **Time Series** Time Series button to observe the time variation of the dose rate data. Once again, the context chart includes a time scale with grey handles so that the user can zoom in on the relevant range of the time selection (Fig. 50).

Note: Normally, dose rates will be uncorrelated in time unless there are systematic correlated changes in the dose rate due to the passage of a radioactive plume through that area.
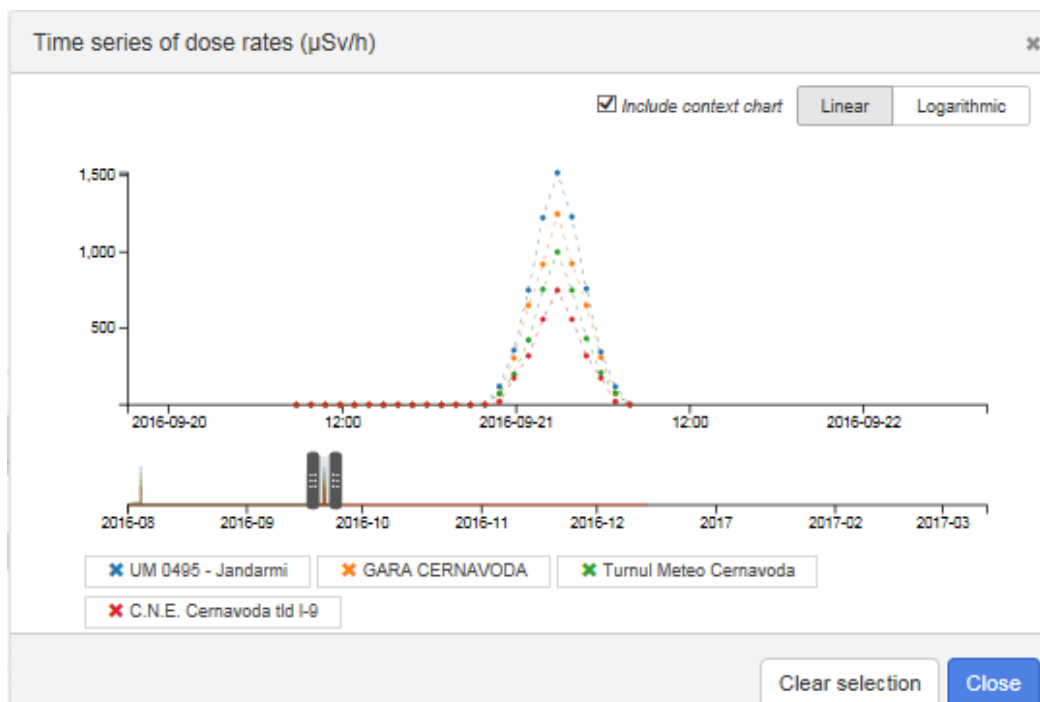
FIG. 50. Linear Display of Dose Rate Values on the Time Series.

In this 'Time series of dose rates' window, the user can also delete any of the selected data points by clicking on its name, which appears in a rectangle below the lower timeline, e.g. 'GARA CERNAVODA' in Fig. 50. Or the user can uncheck the data points in the Data List.

This window also allows the user to visualize the data either in **Linear** or **Logarithmic** scales. Choose these options using the buttons at the top right corner of the window.

Click on the **Clear selection** button to remove all of the selected points instantly; a completely new set of points can now be selected. Clicking the **Close** button, or the cross symbol at the top right, removes this 'Time series of dose rates' window from the screen.

4.5. Data Management menu

4.5.1. Event Settings

The task of defining 'IRMIS settings for USIE Events' that are deemed to have a substantial radiation monitoring component will be performed by users with IRMIS publisher privileges at the IAEA IEC. It is introduced here in this manual for completeness, and so that external users have a better understanding of how an IRMIS event is created.

Under the **Data Management** menu, the **Event Settings** option displays the 'IRMIS Settings for USIE Events', including the **Event Status**, **Country** and **Published Date**, among others. If there are retention parameters for Routine Data, or any PPAs reported by the Member State during an event, further details of these can also be viewed.

1. Click on **Event Settings**. A complete list of events appears; these can be ordered according to different parameters, using the double headed arrows in the title area of each column.

2. Click on **View**, on the far right of a particular Event's row, to see specific details of an Event. A new window appears with tabs that provide further information: 'USIE Event', 'Routine Data Retention' and 'Public Protective Actions'.

4.5.2. Data Reports

1. Under the **Data Management** menu, click on **Data Reports**:

   a) A new page with a list of Routine and Emergency Reports is opened, organized under two tabs.

   b) The user can choose to look at Reports associated with Emergency or Routine Data, Reports associated or not associated with a USIE Event, or Reports selected by Country that are either published or unpublished.

2. Click on the **Routine** tab and select Romania as country to access all reports uploaded by Romania (Fig. 51):

   a) In the **Action** column, click on 'View' to see the report.

   b) A new page opens that lists the measurements associated with that Report. It also provides buttons to **Visualize** or **Download** the Report, or move **Back** to the previous page (Fig. 52).

c)   Click **Visualize** to bring up the map view. As usual, data can be viewed by hovering over a specific hexagon, or selecting specific data points from the Data List, or using the Time Series option. Both Maximum and Latest values are reported.

FIG. 51. List of Routine Monitoring Data Reports submitted to IRMIS by different countries.

d)   The user can check further information for each individual location by clicking **Details** in the row corresponding to each value. The information provided is: Measurement Time, Location, Country, Height Above Land, Height Above Sea, Measurement Type, Value and Validation Status (Fig. 53).

4

FIG. 52. Details of a Specific Routine Report from Romania.

FIG. 53. Further Measurement Data from a Routine Monitoring Location in the Romanian Report.

3. Click on the **Emergency** tab to access specific Emergency Reports (Fig. 54):

   a) In the drop-down list, select '– Reports associated with any USIE Event —', then choose the Not Active 'GC Side Event IRMIS'.

   b) Select Romania as the country and click **Go!**

c) A new page opens showing the Data Reports for this Event. As usual, detailed measurement data can be accessed for each Report by clicking **View** (Fig. 54).

FIG. 54. Truncated list of Data Reports associated with the Not Active 'GC Side Event IRMIS'.

4.5.3. My Reports

Returning to the **Data Management** menu, another Reports option is **My Reports**. Choose this option and a new page opens showing details of reports uploaded by the user. This feature tabulates all the manually submitted data reports for the user's organization (Fig. 55). The data can be queried on the basis of:

1. Whether the Data Report is associated with a USIE Event or not (Active USIE Events are listed if the Event title is known);

2. Whether the data are Emergency or Routine;

3. The status of the report: Draft, Submitted or Published;

4. The origin Country the Report came from.
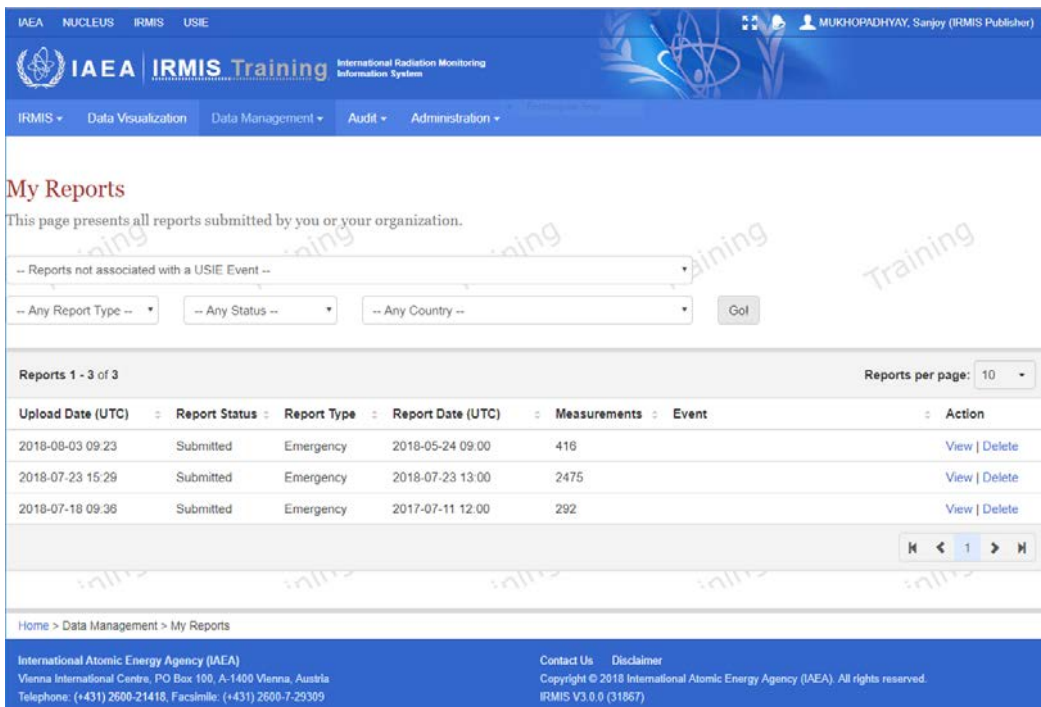
FIG. 55. Submitted Report not yet associated with an event.

4.5.4. Validate IRIX

IRMIS provides a tool to validate the IRIX formatting of a prepared Data Report through the Data Management page. From **Data Management** Click on **Validate IRIX**. A page as shown in Fig. 56 will appear.
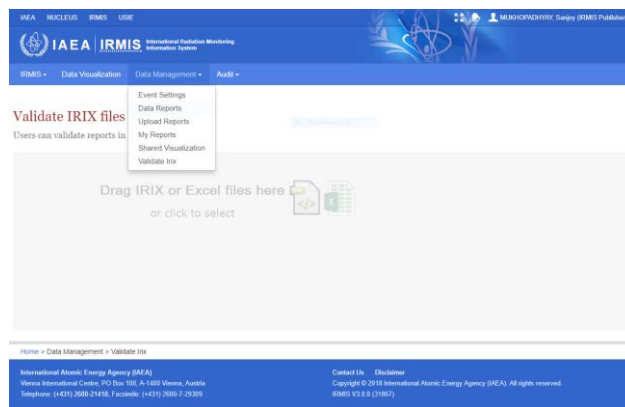
FIG. 56. Validate IRIX page to drag and drop the IRMIS Data Reports to be validated.

On successful validation of the IRIX formatted file, a page as shown in Fig. 57 will appear.
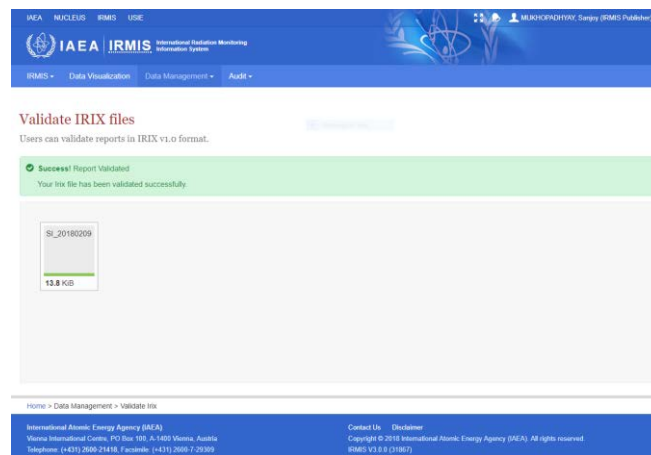
FIG. 57. Successful validation of a properly formatted IRMIS Data Report.

If the Data Report is not formatted according to IRIX, a schema failure notification is shown (Fig. 58).

FIG. 58. Unsuccessful validation of an improperly formatted IRMIS Data Report.

4.6. Audit menu

Audit records are maintained for the sake of data integrity and for chain of custody purposes. They represent a comprehensive history and documentation of how the entire data set for an Event was gathered and managed, during and after the event. Keeping such records also helps to avoid data tampering and maintains data transparency. An IRMIS Reader will have access to the **Measurement Audit Log** menu item only.

4.6.1. Measurement Audit Log

1. On the IRMIS main menu bar click on **Audit** and select **Measurement Audit Log**. A new screen titled 'View Measurement Audit Log' opens (Fig. 59).

The search and filter functions presented are designed to allow the user to review changes to data that have been made in IRMIS, such as changes in values or deletion of data.

2. Select the date range from the two calendar fields presented, then select the reporting Country.

3. Select the type of data change: the only two values available are 'Updated' and 'Deleted', so only updated and/or deleted Data Reports will be listed.

4. Select the magnitude of change of the value. The default number, 0.001, is the current minimum recognizable change in magnitude.

5. Click **Go!** to display the results.

When a Data Report changes status from Not Validated to Validated, this change is reported in the Measurement Audit Log as 'V' or 'NV'.
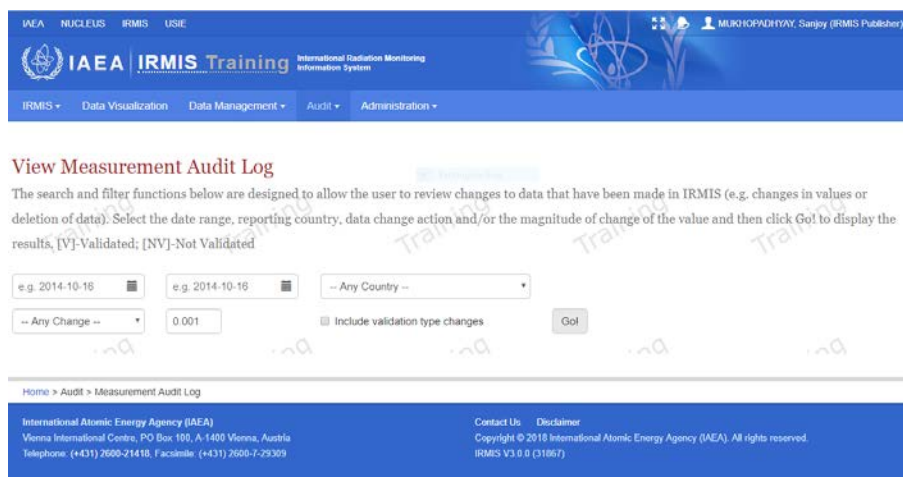
FIG. 59. The 'View Measurement Audit Log' screen.

4.6.2. Report Audit Log

On the IRMIS main menu bar click on **Audit** and select **Report Audit Log**. A new screen titled 'Report Audit Log' opens.

The Report Audit Log tracks all changes made to Reports on IRMIS. The user can review the log using the available filters: the calendar fields for the start and end dates; 'Any Change' to the event (Uploaded, Updated, Submitted, Published, Unpublished, Deleted); and the UserID of the user who it was 'Changed By'.

4.7. Notification

4.7.1. Onscreen Notification

During an active event, all online users logged into IRMIS receive an onscreen notification on publication of a new Routine Report or a new Emergency Report.

During an active event, online IAEA users receive an onscreen notification on submission of a new Emergency Report.

All online users logged into IRMIS will receive an onscreen notification when there are new data available on the visualization.

4.7.2. Email Notification

IRMIS Contact Points receive an email notification if there has been no upload or a failed upload during the last 72 hours of a Routine Report from a reporting organization.

IAEA users receive an email notification on submission of a new Emergency Report.

All IRMIS users receive an email notification on publication of a new Emergency Report.

4

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[2]   INTERNATIONAL ATOMIC ENERGY AGENCY, USIE User Manual, IAEA, Vienna (2014).

[3]   INTERNATIONAL ATOMIC ENERGY AGENCY, Operational Intervention Levels for Reactor Emergencies: And Methodology for Their Derivation, EPR-NPP-OILs 2017, IAEA, Vienna (2017).

[4]   EUROPEAN NUCLEAR SOCIETY, Dose (2013),
https://www.euronuclear.org/info/encyclopedia/d/dose.htm

[5]   FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CIVIL AVIATION ORGANIZATION, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, INTERPOL, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, WORLD METEOROLOGICAL ORGANIZATION, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

[6]   INTERNATIONAL ATOMIC ENERGY AGENCY, International Radiological Information Exchange (IRIX) Format: Reference Description, IRIX Version, 1.0 (EPR–IEComm Attachment 3), IAEA, Vienna (2019.).

[7]   EUROPEAN COMMISSION, EURDEP (2017),
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