Intellectual information system for a regulatory authority to ensure nuclear and radiation safety

sytova@inp.bsu.by

Svetlana Sytova

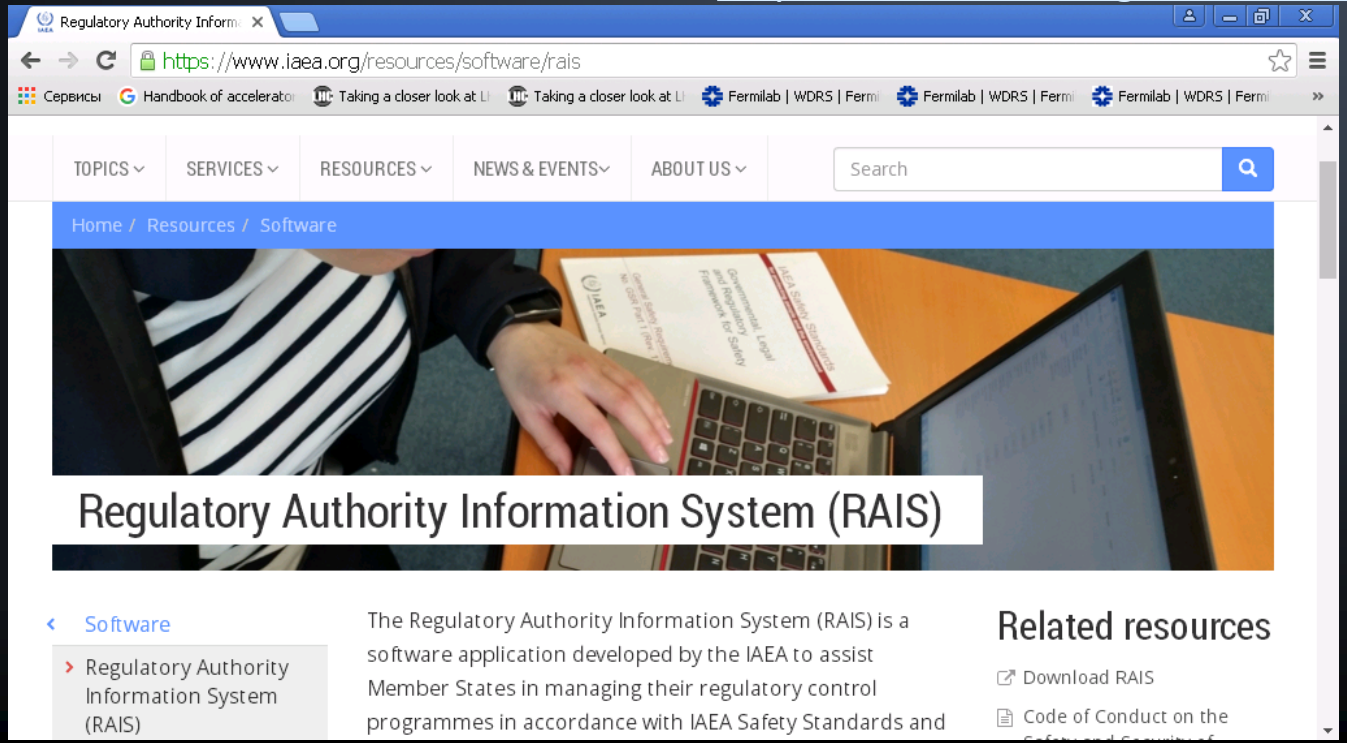
Интеллектуальная информационная система регулирующего органа для обеспечения ядерной и радиационной безопасности

sytova@inp.bsu.by

С. Н. Сытова

Regulatory Authority Information System

https://www.iaea.org/resources/software/rais



Regulatory Authority Information System

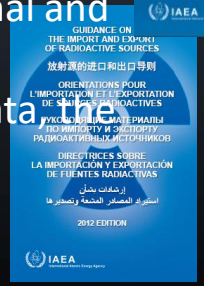
https://www.iaea.org/resources/software/rais

The Regulatory Authority Information System (RAIS) is a software application developed by the IAEA to assist Member States in managing their regulatory control programmes in accordance with IAEA Safety Standards and guides.

This includes the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources.

RAIS promotes a consistent and common approach to the regulatory control of radiation sources while offering the flexibility to respond to the specific needs of Member States with respect to their national legislative frameworks, administrative structures and institutional and regulatory frameworks.

The main features of RAIS are the maintenance of registries and records of regulatory data, the management of regulatory information, and the management of regulatory activities.

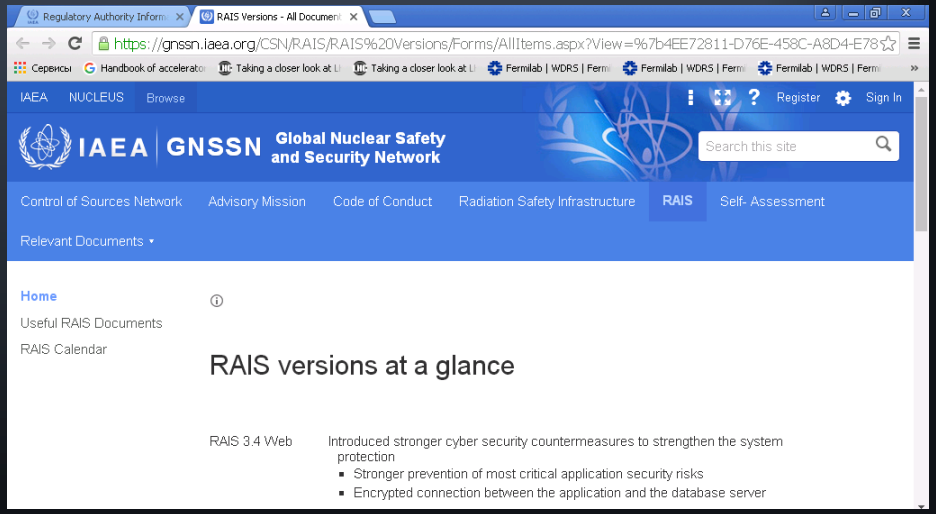


Regulatory Authority Information System

https://gnssn.iaea.org/CSN/RAIS/RAIS%20Versions/Forms/AllItems.aspx?View=%7b4EE72811-D76E-458C-A8D4-E78296FAB9ED%7d

The latest version of the system, RAIS 3.4 web, features improved information security and faster system operation.

RAIS is available in all official United Nations languages. RAIS 3.4 Web is also equipped with a translation mechanism, making it a multilingual application



Regulatory Authority Information System

https://gnssn.iaea.org/CSN/RAIS/Useful%20RAIS%20Library/Forms/AllItems.aspx

Region	Total no. of countries using RAIS	Countries received RAIS servers in the last 3 years	Countries received experts on RAIS in the last 3 years
Africa	32	11	9
Asia and Pacific	21	12	10
Latin America	12	7	3
Europe	9	3	4
Total	**74**	**33**	**26**

Regulatory Authority Information System

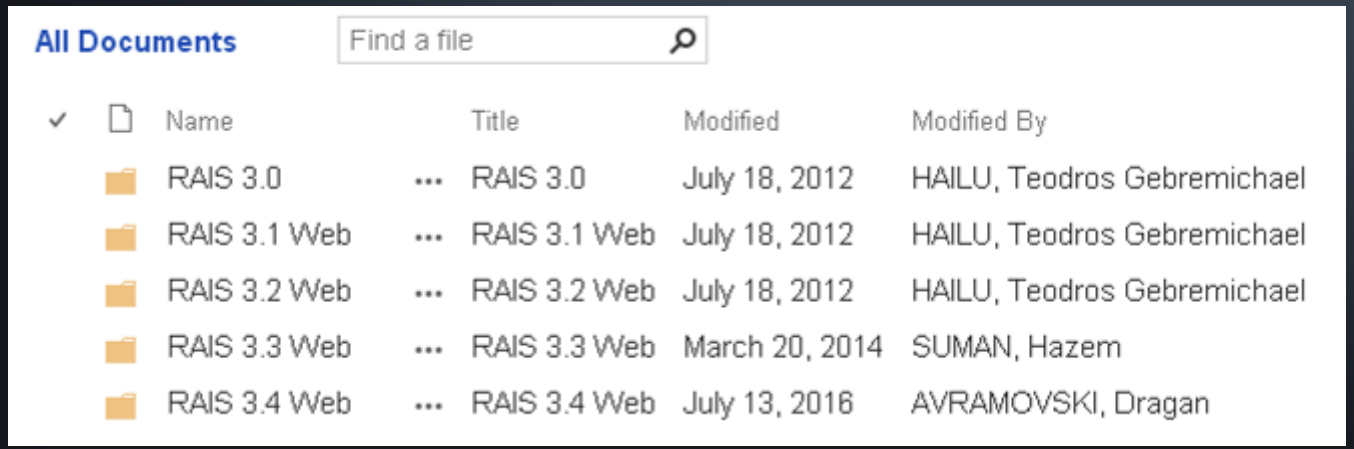
https://gnssn.iaea.org/CSN/RAIS/Useful%20RAIS%20Library/Forms/AllItems.aspx

Regional training course organised during the last 4 years

Course title	Country Region	date
Advanced RTC on The Application of RAIS 3.3 Web to Support the Regulatory Body Management and to Enhance the Effectiveness of the Regulatory System (French)	Niger **Africa**	Oct. 2014
Advanced RTC on The Application of RAIS 3.3 Web to Support the Regulatory Body Management and to Enhance the Effectiveness of the Regulatory System (English)	Nigeria **Africa**	June 2014
RTC on National Register for Radiation Sources including Regulatory Authority Information System RAIS 3.4 Web	Trended and Tobago **Caribbean**	Jan. 2017
RTC on Establishment of National Registry of Radiation Sources using RAIS 3.4 Web.	Tunis **Africa**	Nov. 2017
Advanced RTC on the Application of RAIS 3.3 Web for Management of Regulatory Programme	Mongolia **Asia and Pacific**	Aug. 2014

Regulatory Authority Information System

https://gnssn.iaea.org/CSN/RAIS/RAIS%20Versions/Forms/AllItems.aspx?View=%7b4EE72811-D76E-458C-A8D4-E78296FAB9ED%7d



Name	Title	Modified	Modified By
RAIS 3.0	RAIS 3.0	July 18, 2012	HAILU, Teodros Gebremichael
RAIS 3.1 Web	RAIS 3.1 Web	July 18, 2012	HAILU, Teodros Gebremichael
RAIS 3.2 Web	RAIS 3.2 Web	July 18, 2012	HAILU, Teodros Gebremichael
RAIS 3.3 Web	RAIS 3.3 Web	March 20, 2014	SUMAN, Hazem
RAIS 3.4 Web	RAIS 3.4 Web	July 13, 2016	AVRAMOVSKI, Dragan

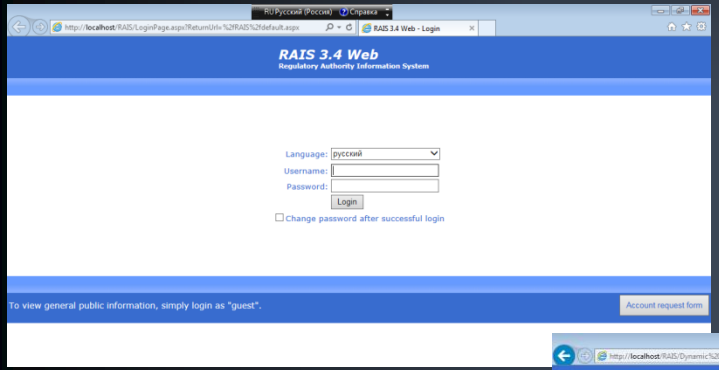
Regulatory Authority Information System – our experience

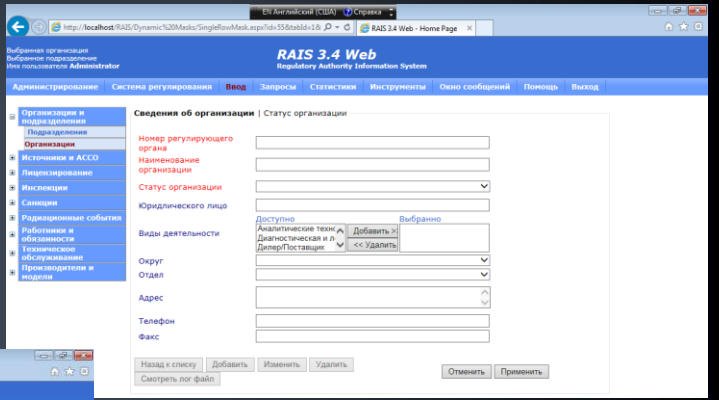
2013 : RAIS 3.3 Web-> The system is deployed only on Windows with certain versions of SQL Server and IIS, .NET. The translation of the user interface into Russian is not finished yet. Some messages are automatically translated and meaning is lost as a result. DB Reference books, a list of activities are available only in English. The list of manufacturers and the list of equipment types does not include the manufacturers of the Former Soviet Union. There is a possibility of expanding the database (adding fields and queries), which requires an in-depth knowledge of MS SQL from the system administrator.

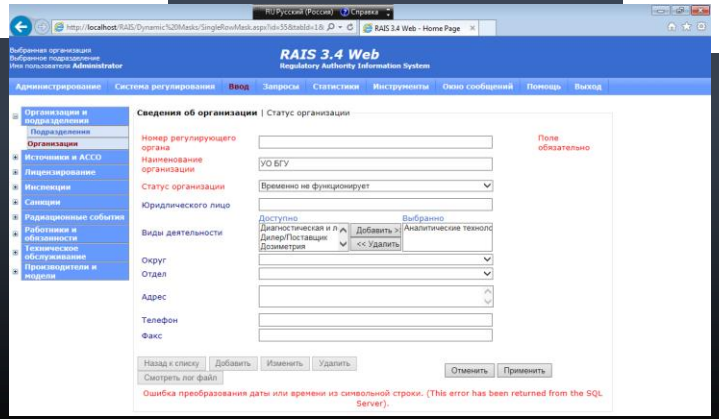
2016: RAIS 3.4 Web-> The following changes have been made since RAIS 3.3 Web: 65 new functions (queries) and stored procedures have been introduced; 118 functions and 5 stored procedures have been modified; 55 deprecated functions (requests) have been removed. Crypto containers for encrypting passwords were created. However, the main problems mentioned above have not been eliminated.

2021: RAIS 3.4 Web-> The installation requires outdated versions of Microsoft software dated by 2005-2008. It doesn't want to work on supported MS versions from 2012. It doesn't work under Windows 10. It works under Windows 7.

RAIS 3.4 Web – results of installation







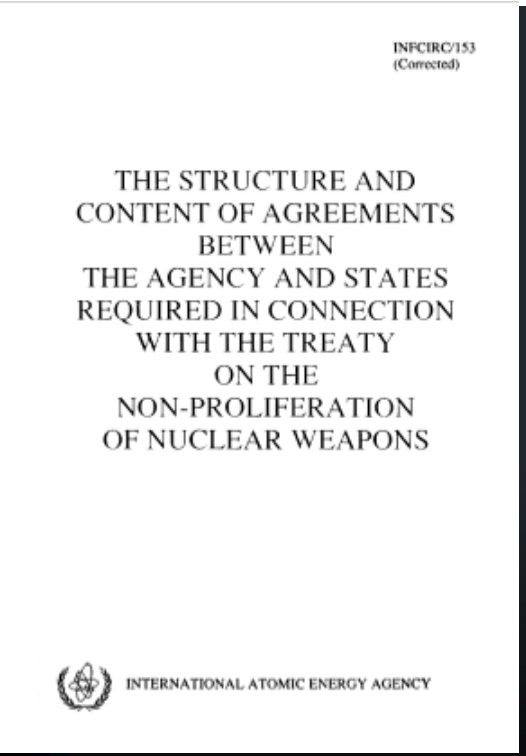
Regulatory Authority Information System

RAIS is a comprehensive system covering all major areas of the regulatory framework, including:

1. information on the national regulatory infrastructure,
2. objects and departments,
3. radiation sources and related equipment,
4. permissions,
5. inspection,
6. enforcement,
7. workers,
8. radiation events,
9. technical services.

What about accounting and control of nuclear materials, radioactive waste, spent nuclear fuel?
What about supervision of the construction of a nuclear power plant or research reactor?

Nuclear material accounting and control



INFCIRC/153
(Corrected)

THE STRUCTURE AND CONTENT OF AGREEMENTS BETWEEN THE AGENCY AND STATES REQUIRED IN CONNECTION WITH THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS

INTERNATIONAL ATOMIC ENERGY AGENCY

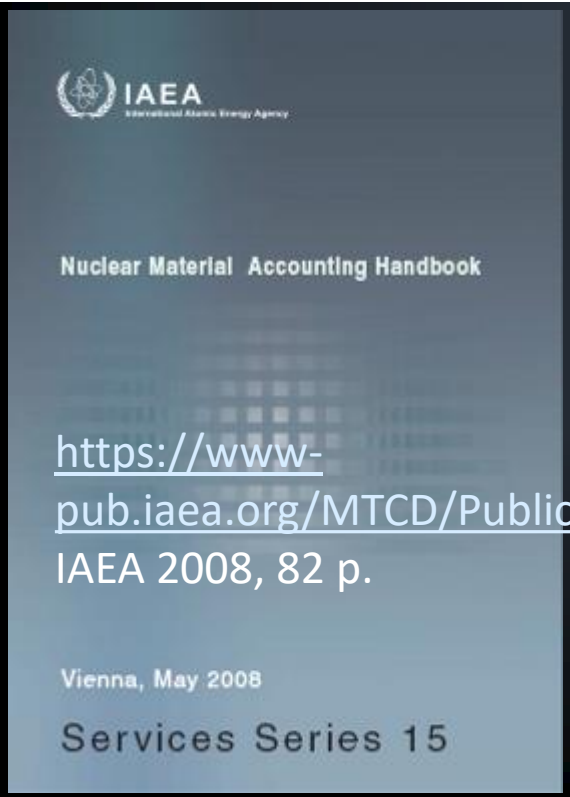
Safeguards Agreements such as INFCIRC / 153 provide a framework for informing the IAEA about all nuclear materials in Member States. The reports to be submitted to the Agency are of three types:

- Nuclear material inventory change report (ICR);
- Material balance report (MBR);
- Physical inventory listing (PIL);

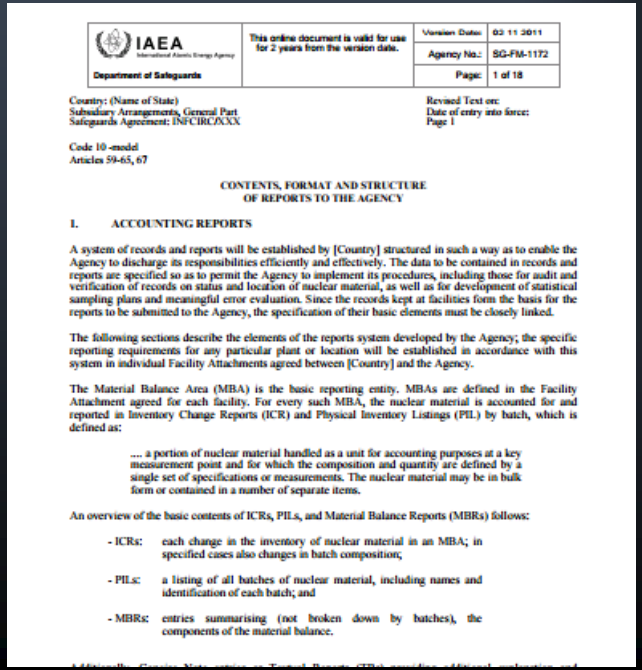
Brief notes may be provided for any of these reports.

https://www.iaea.org/sites/default/files/publications/documents/infcircs/1972/infcirc153.pdf

Nuclear material accounting and control



https://www.iaea.org/sites/default/files/sg-fm-1172_-_model_subsidiary_arrangement_code_10_labelled.pdf
IAEA 2011, 18 p.



IAEA International Atomic Energy Agency
Department of Safeguards

This online document is valid for use for 2 years from the version date.

Version Date:	03 11 2011
Agency No.:	SG-FM-1172
Page:	1 of 18

Country: (Name of State)
Subsidiary Arrangements, General Part
Safeguards Agreement: INFCIRC/XXX

Revised Text on:
Date of entry into force:
Page 1

Code 10 -model
Articles 59-65, 67

CONTENTS, FORMAT AND STRUCTURE OF REPORTS TO THE AGENCY

I. ACCOUNTING REPORTS

A system of records and reports will be established by [Country] structured in such a way as to enable the Agency to discharge its responsibilities efficiently and effectively. The data to be contained in records and reports are specified so as to permit the Agency to implement its procedures, including those for audit and verification of records on status and location of nuclear material, as well as for development of statistical sampling plans and meaningful error evaluation. Since the records kept at facilities form the basis for the reports to be submitted to the Agency, the specification of their basic elements must be closely linked.

The following sections describe the elements of the reports system developed by the Agency; the specific reporting requirements for any particular plant or location will be established in accordance with this system in individual Facility Attachments agreed between [Country] and the Agency.

The Material Balance Area (MBA) is the basic reporting entity. MBAs are defined in the Facility Attachment agreed for each facility. For every such MBA, the nuclear material is accounted for and reported in Inventory Change Reports (ICR) and Physical Inventory Listings (PIL) by batch, which is defined as:

> ... a portion of nuclear material handled as a unit for accounting purposes at a key measurement point and for which the composition and quantity are defined by a single set of specifications or measurements. The nuclear material may be in bulk form or contained in a number of separate items.

An overview of the basic contents of ICRs, PILs, and Material Balance Reports (MBRs) follows:

- ICRs: each change in the inventory of nuclear material in an MBA; in specified cases also changes in batch composition;
- PILs: a listing of all batches of nuclear material, including names and identification of each batch; and
- MBRs: entries summarising (not broken down by batches), the components of the material balance.

https://www-pub.iaea.org/MTCD/Publications/PDF/svs_015_web.pdf
IAEA 2008, 82 p.

The system of legal regulation of radiation safety in Belarus

According to agreements with the IAEA, in the state system of accounting and control of nuclear materials of the Republic of Belarus, all nuclear material weighing more than 0 grams of plutonium, uranium (depleted, enriched, natural) and thorium is subject to accounting and control.

These elements are widely used not only in various nuclear installations and reactors of operating organizations, such as the Belarusian NPP, the State Scientific Institution "JIPNR - Sosny" of the National Academy of Sciences of Belarus, but also in small quantities in various medical devices, transport containers, as a part of control and measuring equipment, radioisotope smoke detectors, etc., used in a large number of enterprises and organizations.

Problems of information support for the system of legal regulation of radiation safety

- Often, the software for accounting for radiation sources, nuclear materials, radioactive waste, even in one organization, is represented by disparate, unrelated software products developed at different times by different manufacturers on different platforms.

- It can be just documentation that appears in the process of work, which is printed by employees in the MS Office applications, and, as practice shows, which can be saved simply in a printed form on paper.

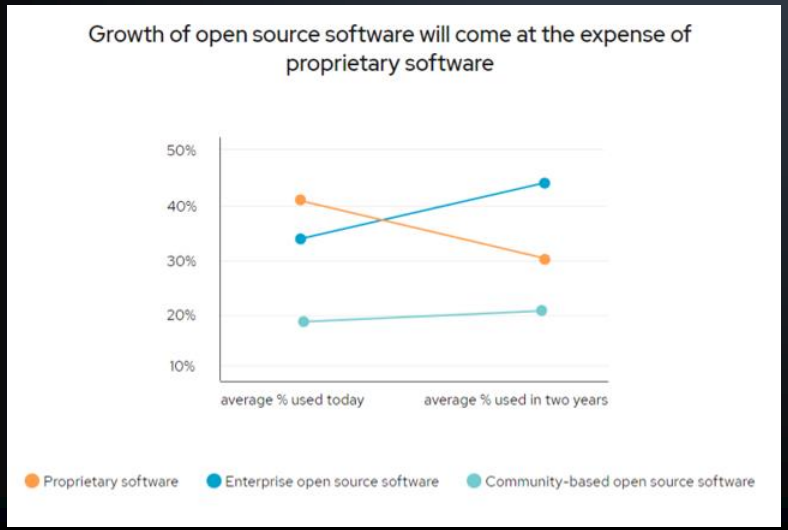
Free software

Free software (open source software, also libre software) is a software, the users of which have the rights ("freedom") to install, run, freely use, study, distribute and change (improve), and distribute copies and results of the change. If software has exclusive rights, then freedoms are declared through free licenses.

Frequently, a distinction is made between *free* and *open* source software, although the availability of source code for open source software is mandatory, and many open source software are free at the same time.

Proprietary software

Proprietary software (non-free software) is a software that is the proprietary property of its authors or copyright holders and does not meet the criteria for free software.

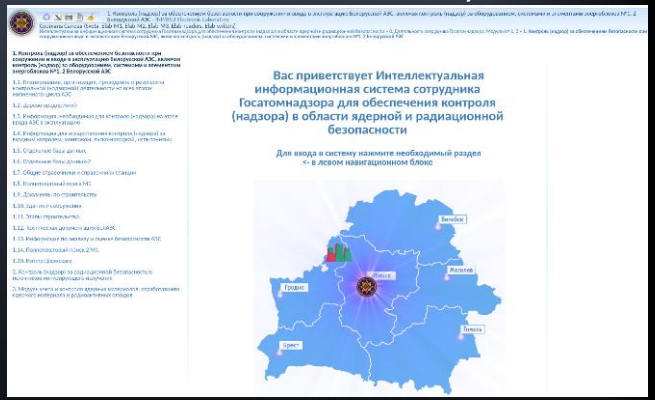


https://www.redhat.com/cms/managed-files/rh-enterprise-open-source-report-detail-f21756-202002-en.pdf

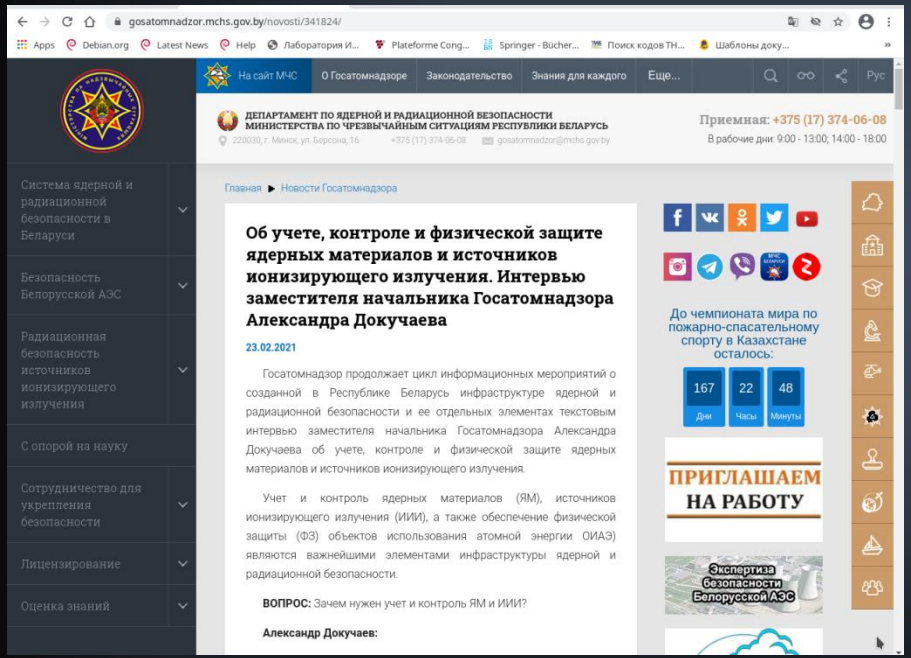
Intellectual information system of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety

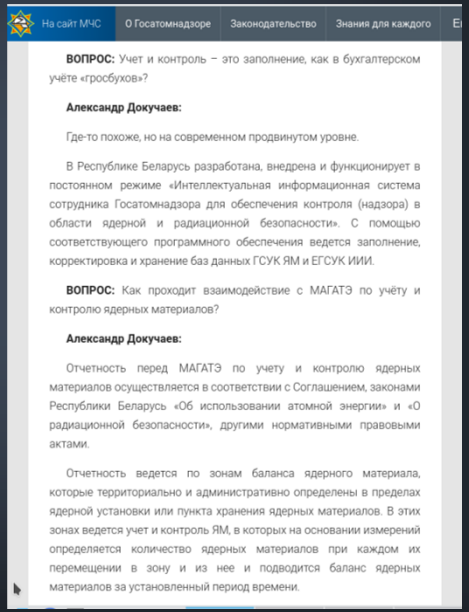
System contains the following modules:

1. The module of control (supervision) over ensuring safety during the construction and commissioning of the Belarusian NPP, including control (supervision) over the equipment, systems and elements of power units No. 1, 2 of the Belarusian NPP;
2. Module of control (supervision) over radiation safety of ionizing radiation sources;
3. Module for accounting and control of nuclear materials, radioactive waste and spent nuclear material;
4. Module "General information and auxiliary tools ".



Intellectual information system of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety





https://gosatomnadzor.mchs.gov.by/novosti/341824/

Intellectual information system of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety

eLab is a client-server architecture system running undo Windows and Linux operating systems, based on free software:

- Debian GNU / Linux
- Apache web-server
- Firebird database server
- PHP application server.

It works through the Web interface in multi-user mode with shared access rights through any browsers: Mozilla Firefox, Google Chrome, Opera, etc.


РЕСПУБЛИКА БЕЛАРУСЬ

СВИДЕТЕЛЬСТВО

О РЕГИСТРАЦИИ КОМПЬЮТЕРНОЙ ПРОГРАММЫ

№ 1117

Наименование компьютерной программы:
Интеллектуальная информационная система сотрудника Госатомнадзора для обеспечения контроля (надзора) в области ядерной и радиационной безопасности

Правообладатель компьютерной программы:
Научно-исследовательское учреждение «Институт ядерных проблем «Белорусского государственного университета»

Год создания компьютерной программы:
2018

Автор (авторы) компьютерной программы:
Сытова Светлана Николаевна
Мазаник Аркадий Леонидович
Ковалёнок Антон Николаевич
Черепица Сергей Вячеславович
Дунец Андрей Петрович

Дата подачи заявки: 25.10.2018

Дата внесения записи в Реестр зарегистрированных компьютерных программ: 10.12.2018

И. о. генерального директора Национального центра интеллектуальной собственности А.В. Курчан

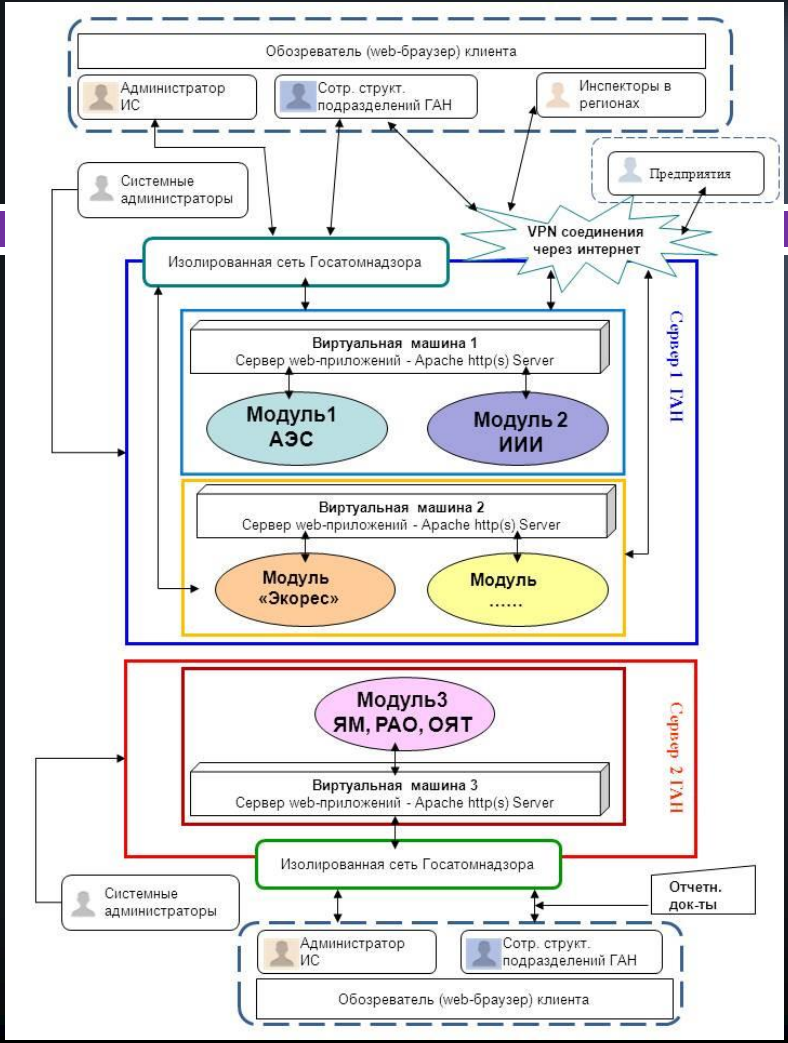
Настоящее свидетельство выдано на основании сведений и материалов, представленных в составе заявки на оказание услуг по регистрации компьютерной программы и депонированных в Национальном центре интеллектуальной собственности.

Intellectual information system of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety

The following algorithms have been developed :

1. An in-depth specification of the kernel code and system databases in order to provide a general systematic approach to retrieving and editing data in the database.
2. Own system of user interface controls, including dedicated buttons, e.g. for sending emails and checking data in the State Internet registries.
3. Several levels of sorting and filtering records.
4. A declarative markup language for importing complex shapes and data from Excel files, text files with special labels and coordinates for dynamic and static data.
5. Module for processing incoming mail and attached files.
6. The system for the formation of final documents according to the established samples with the ability for the user to make changes to templates.
7. "Statistical" reports, notification system, change log.
8. Enterprise tree tool.
9. Full-text search in documents.

System architecture



The system is a web application in the PHP scripting language connected to database with user data and organizing the business logic of the application. The general structure of the system consists of the following components:

- databases (DB), including reference books, technical documentation, etc.
- user authentication system,
- user interface,
- reporting module,
- full-text search module,
- system documentation.

Intellectual information system of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety

Principles of the work in the system are the next:

1. Complete all reference-book, that are small logs referenced from the main data logs (journals).
2. Create, complete and save an entry in the main data log.
3. Load files into the record if necessary.
4. Fill in the entries in the auxiliary logs, information from which is accumulated and displayed in the main journal using ”view”.
5. If there is additional data in the files, import it into the log.
6. Generate a reporting document using the available report templates.
7. If necessary, create an additional report template, create a record for it and upload it to the system.
8. If necessary, export data to files.

Intellectual information system of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety

Data from the old databases of Gosatomnadzor on accounting for radiation sources and nuclear materials were loaded into the system with the help of special scripts.

The system is connected to the Unified Register of Licenses https://license.gov.by/ and the database of the Ministry of Taxes and Duties of the Republic of Belarus http://nalog.gov.by/ .

At present, in the Republic of Belarus at the level of the regulatory body, ***all accounting*** of sources of ionizing radiation, ***all accounting*** of nuclear material with reporting to the IAEA, and supervision of the construction of the Belarusian NPP are carried out with the help of the system.

Module No. 3 of accounting and control of nuclear materials, radioactive waste, spent nuclear fuel

The main tasks in the field of accounting and control of nuclear materials, spent nuclear fuel and radioactive waste are the next:

- timely determination of the amounts of such substances;
- preparation, registration and maintenance of accounting and reporting documents;
- control of authorized placement and movement of nuclear materials, spent nuclear fuel and radioactive waste.

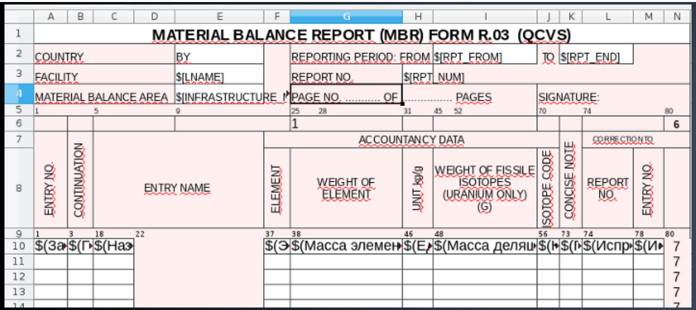
Main documents generated in the module:

- nuclear material inventory change report (ICR);
- material balance report (MBR);
- physical inventory listing (PIL);
- text report (TR);

There are implemented the following processes:

- automatically calculated based on PIL, ICR, MBR, the main ledger (General Ledger).
- preliminary calculation of data for PIL and MBR;
- a process for correcting an entry in accordance with IAEA regulations;
- import / export from / to the system of all types of reports in formats of fixed and labeled code 10.

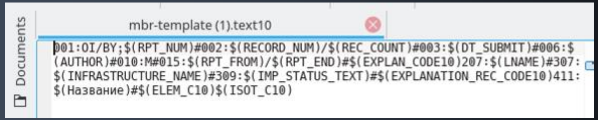
Module No 3 - import / export of reports

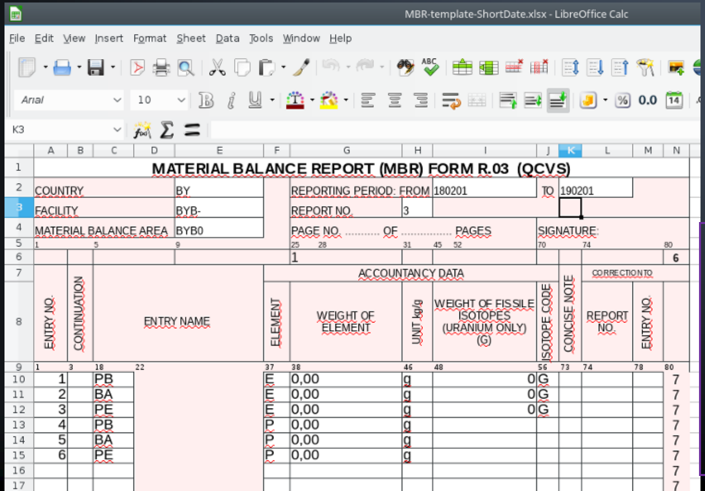


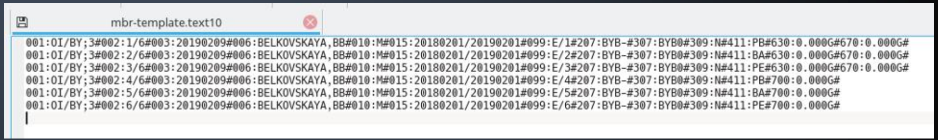
Accounting report templates:

<- Fixed format

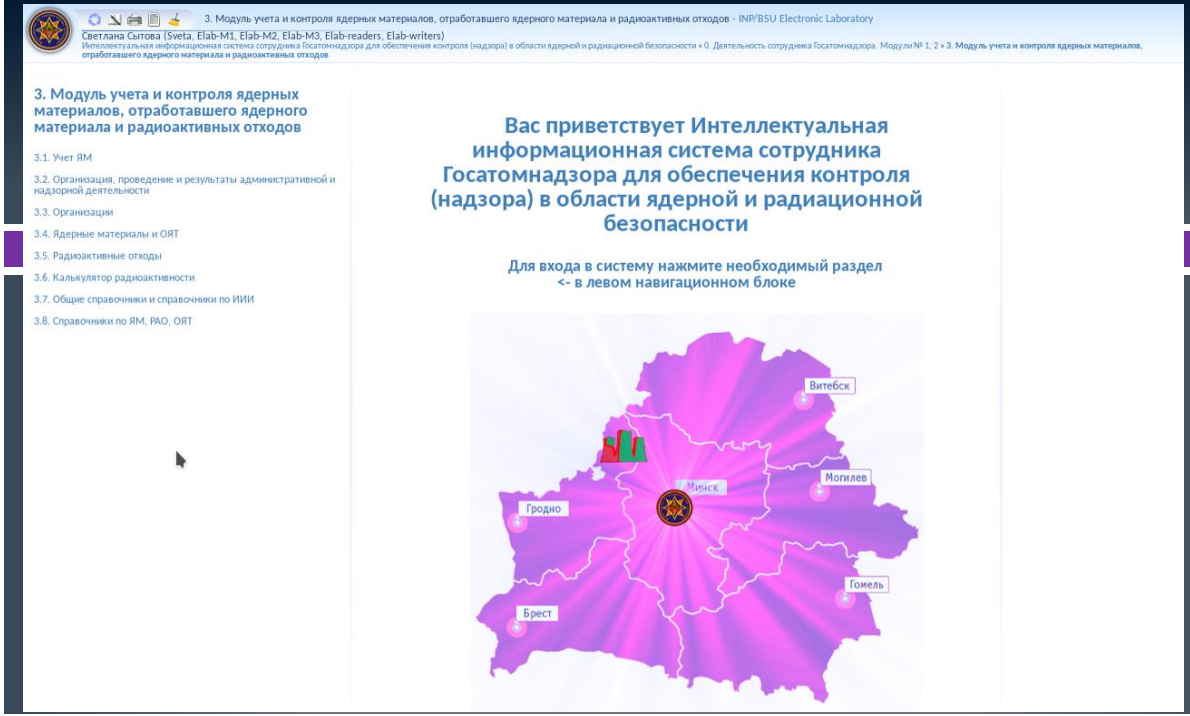
Labeled format







A declarative markup language has been developed for importing complex forms and data from Excel files, text files with special labels indicating coordinates for dynamic and static data.



Thank you for attention!

sytova@inp.bsu.by