Nuclear Knowledge Management System in the Republic of Belarus

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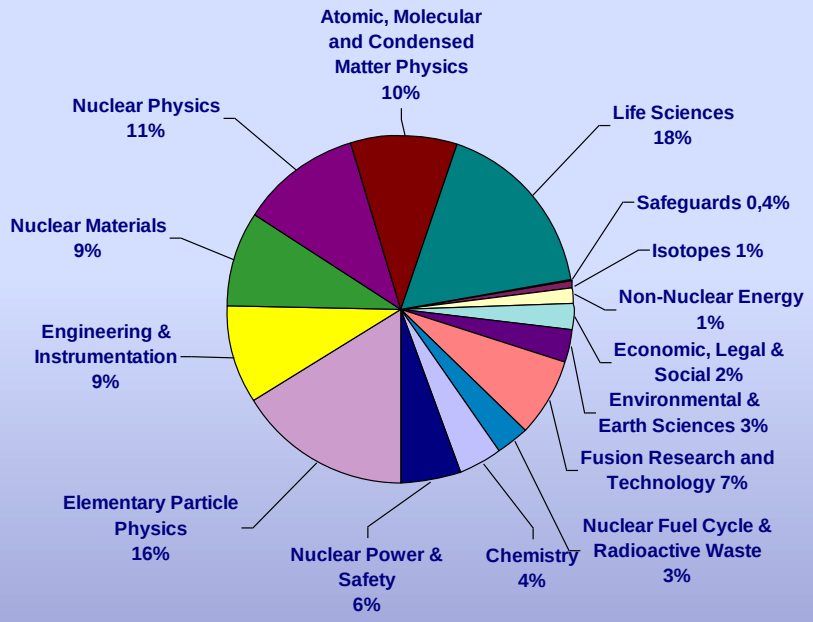
What is nuclear knowledge management?



Subject area of nuclear knowledge

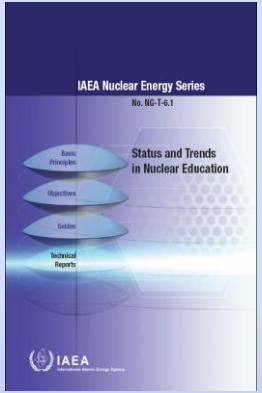
Nuclear knowledge (NK) base stems from both research and development and the industrial application of nuclear technologies, and includes both energy and nonenergy applications.

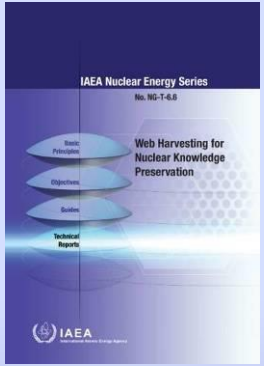
Knowledge management (KM) to be an integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing, and preserving knowledge, relevant to achieving specified objectives.

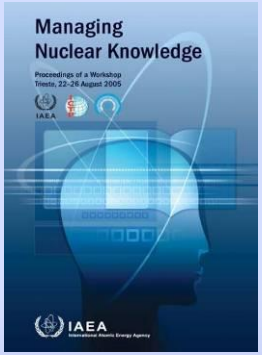
Recognizing the importance of *nuclear knowledge management (NKM),* the IAEA develops methodologies and guidance documents for planning, designing and implementing NKM programs and facilitates nuclear education, providing support, networking opportunities and experience exchange.

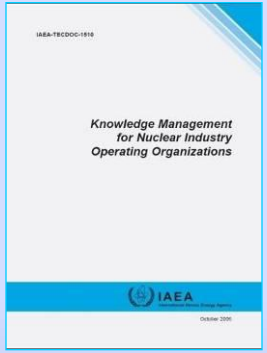
Development of NKM by IAEA

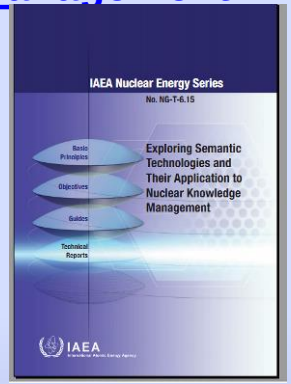
https://www.iaea.org/topics/nuclear-knowledge-management

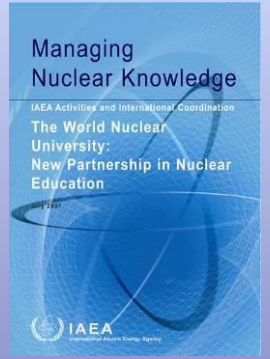


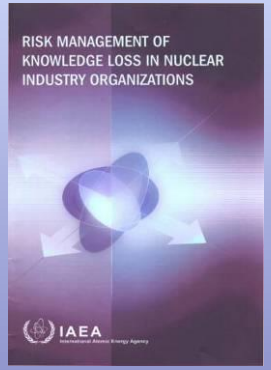


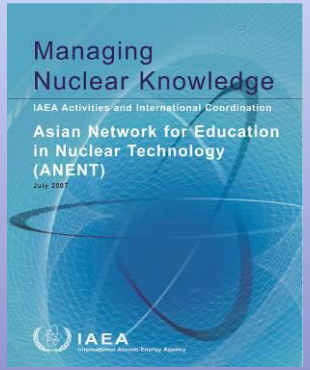


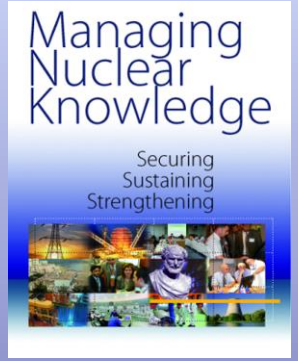


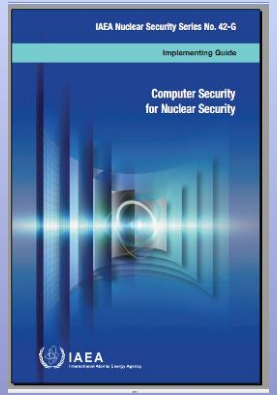












Objective:

Create an efficiently functioning nuclear knowledge management system in the Republic of Belarus, taking into account national specifics, and develop information technologies for intellectual support of the information and analytical activities of Gosatomnadzor, create and maintain a national electronic portal of practical nuclear knowledge of the Republic of Belarus, as well as specialized information archival online system for nuclear knowledge management.

Reasons for implementation:

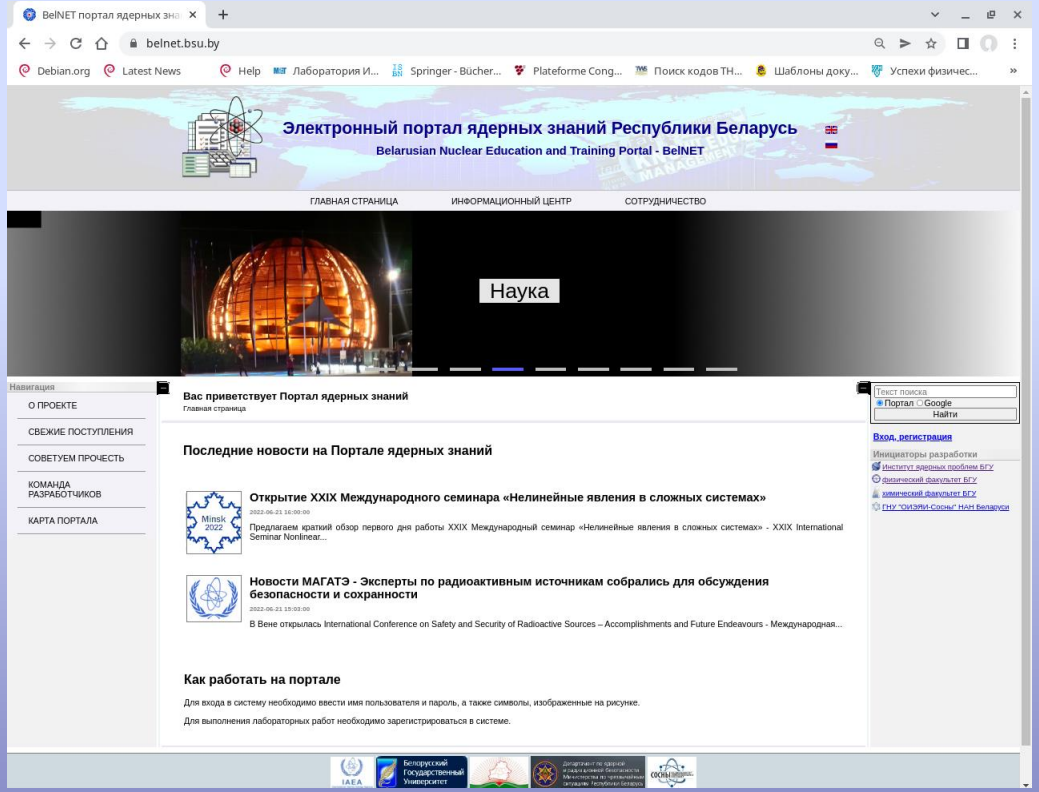
Activity 13 "Performance of work to provide scientific and technical support to the Ministry for Emergency Situations of the Republic of Belarus in the field of ensuring nuclear and radiation safety“, subprogram 3 "Scientific support for the efficient and safe operation of the Belarusian nuclear power plant and promising areas for the development of nuclear energy" of
the State Program "Science-intensive technologies and equipment" for 2021-2025.

“Specialized information archival online system for nuclear knowledge management based on the educational and scientific electronic portal of nuclear knowledge of the Republic of Belarus BelNET”
Activity 3.1 of the Consolidated list of scientific research and development on the development of the State system of scientific and technical information of the Republic of Belarus for 2021-2025.

Portal BelNET

***Bel**arusian **N**uclear **E**ducation and **T**raining*

https://belnet.bsu.by



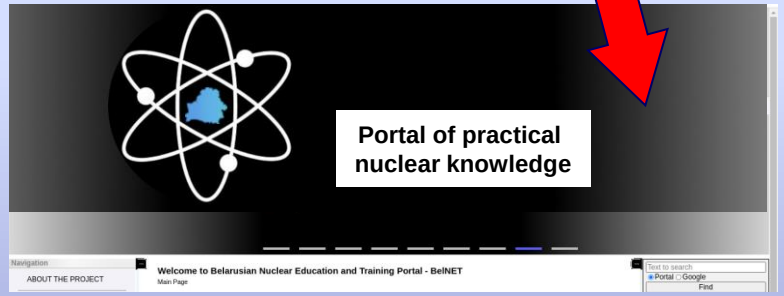
All the necessary functions of the portal have been implemented, including the ability to remotely edit the portal structure and enter documents, various sorting and filtering, as well as two levels of access to documents depending on user rights, an original testing mechanism when performing laboratory work.

The analysis shows that it is necessary to develop a new taxonomy on the basis of semantic technologies, to improve the system performance via the optimization of the system internal structure, to increase the portal visibility in search internet systems and to improve the user interface.

Stages in the creation of NKM system

1. Development of regulatory, methodological and administrative documents regulating KM activities, formation of a policy in the field of NKM.
2. Creation of the necessary infrastructure (hardware, software for content management system).
3. International cooperation in the field of NKM (seminars, meetings, joint projects);
4. Training specialists for functioning of NKM system.
5. Inventory, systematization and description of critical NK.
6. Development of procedures and organization of knowledge exchange.
7. Creation of new knowledge; placement of all acquired knowledge in DB; NKM system activities monitoring.

Transformation of BelNET



Priority tasks:

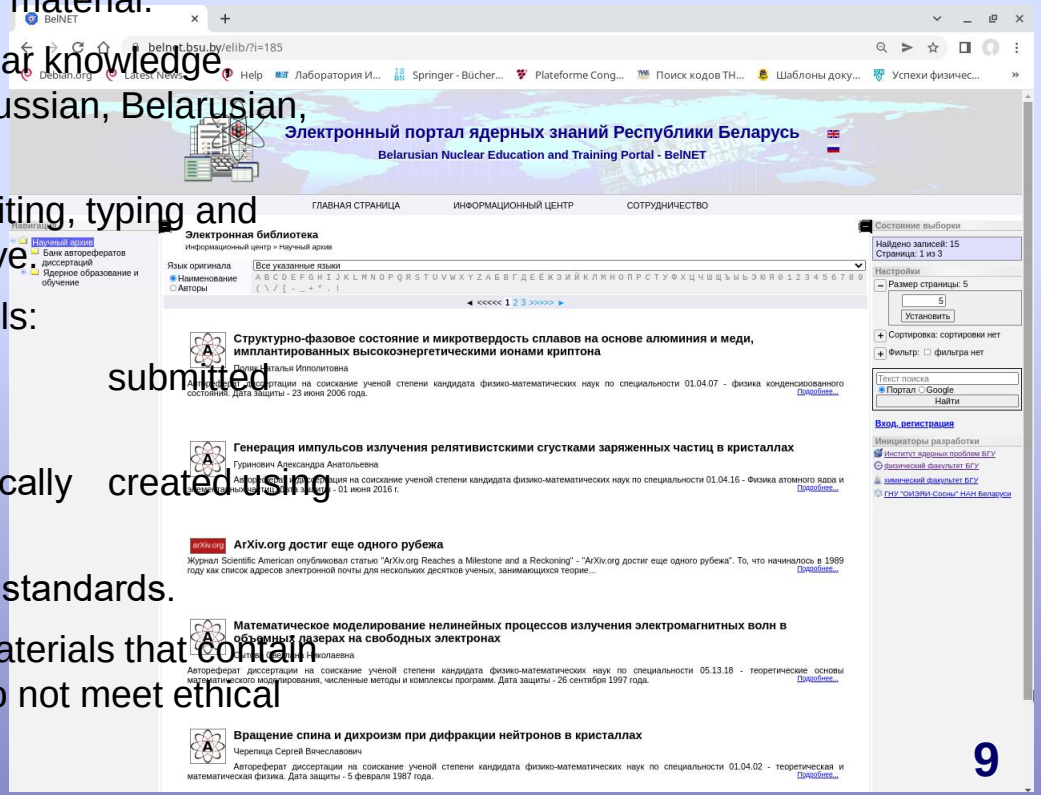
1. Digitization, recognition and indexing of archives, providing full-text search through th
2. Indexing by a specially developed thesaurus for automatic generation of keywords and assignment of a resource to a particular section of the portal taxonomy.
3. Development of thematic ontologies (data structures with objects, links and rules). Data and ontologies together make up the knowledge base.
4. Development of a special English version of the portal.

Concept of Portal of Practical Nuclear Knowledge

1. It presents scientific achievements and the accumulated post-Chernobyl experience of Belarus,
2. It is an information platform both for newcomer countries and for old residents of the nuclear club.
3. It is based on the IAEA NKM principles.
4. It uses modern information technologies, including semantic technologies and free software.
5. It is based on further development of software products –
   - Intellectual Information System of a Gosatomnadzor employee to ensure control (supervision) in the field of nuclear and radiation safety,
   - Electronic portal of nuclear knowledge of educational institutions of the Republic of Belarus BelNET https://belnet.bsu.by/ .
6. It is assumed the maximum possible placement of materials in the public domain.
7. It is planned to involve to cooperation people form belarusian organizations, research institutes and universities.
8. It develops the best world and Belarusian practices in the field of NKM.
9. It provides automation of processing of electronic appeals on administrative procedures.

Concept of online archival system

1. To ensure the operation of the system 24/7 based on free software.
2. To provide a user tool for uploading submitted manuscripts with the restriction of the user's access only to their own material.
3. To accept posting materials in the field of nuclear knowledge, created in office applications in pdf format, in Russian, Belarusian, English.
4. Submitted materials do not undergo review, editing, typing and layout of the text before publication in the archive.
5. To provide using the developed information tools:
   - implementation of a basic automatic check of submitted materials using the anti-plagiarism system;
   - automatic detection of artificial texts (automatically created using computer text generators);
   - automatic text checking for violation of ethical standards.
6. To reserve the right to identify and remove any materials that contain plagiarism, are artificial (pseudo-scientific) or do not meet ethical research standards.



Concept of online archival system

7. To place in the public domain all materials that meet the specified requirements: metadata entered by the author within the "user account" and a full-text manuscript in pdf format.

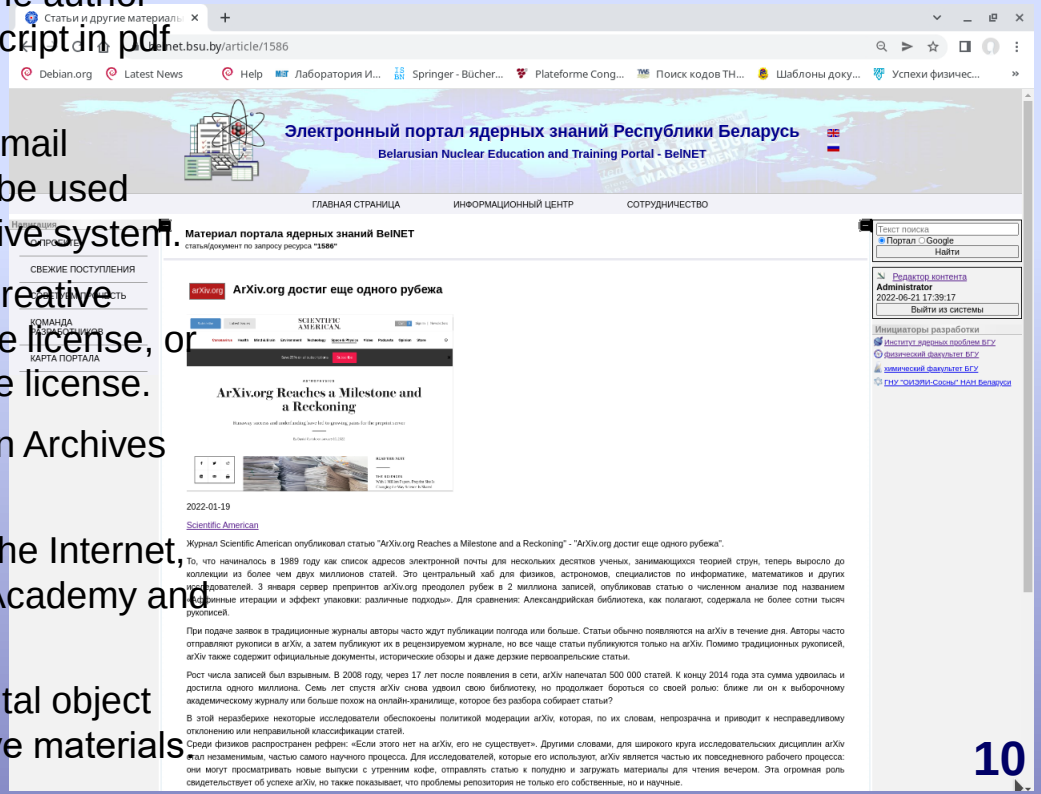
8. To provide a privacy policy that the names and email addresses entered on the archive website will be used solely for the purposes designated by the archive system.

9. To retain copyright for the author based on the Creative Commons CC BY-SA 4.0 Attribution-ShareAlike license, or invite the author to indicate his version of a free license.

10. To use the principles and protocols of the "Open Archives Initiative" to create an open access repository.

11. To ensure full indexing of archive materials on the Internet, including indexing of records through Google Academy and the Ranking Web of World's Repositories.

12. In the future, to ensure the assignment of a digital object identifier DOI (Digital object identifier) to archive materials.

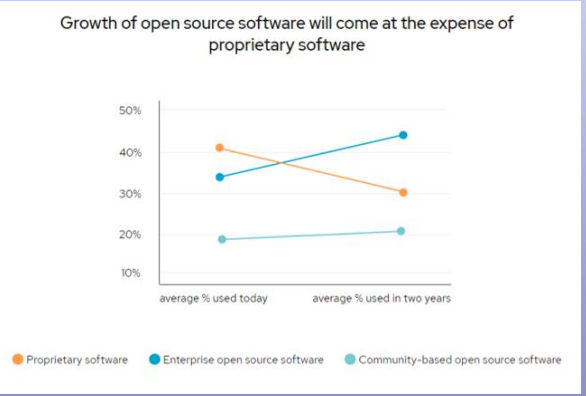


Free software

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 (*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

Free software

Advantages:

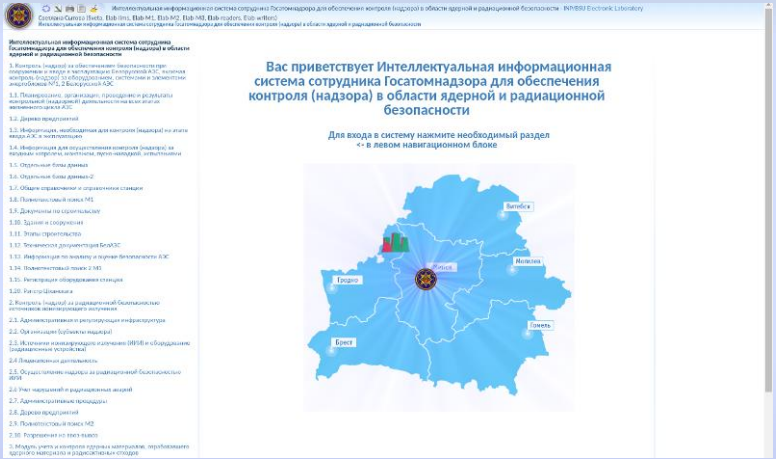
- Cheapness and anti-corruption.
- Free and open source software does not require license payments for each installed copy of the program.
- Safety. Many proprietary applications from well-known manufacturers contain undocumented features, which is a potential threat. Access to the source code of the program makes it possible to control this aspect.
- Adaptability. The large number of free applications available makes it easy to tailor them to the specific needs of users..

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

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

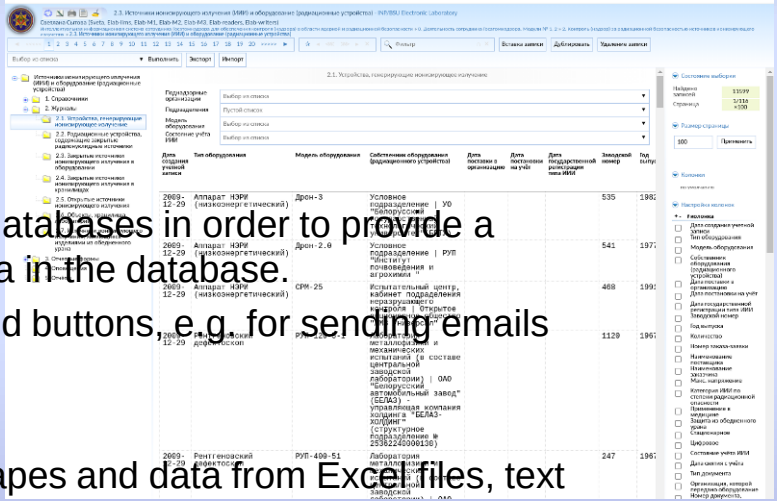
It works through the Web interface in multi-user mode with shared access rights through any browsers.

Implementation of the concept – Information system



It is designed to automate the work of Gosatomnadzor employees in terms of control (supervision) of ensuring safety during the construction and commissioning of the Belarusian NPP, including control (supervision) of equipment, systems and elements of power units No. 1, 2 of the Belarusian NPP and control (supervision) of radiation safety sources of ionizing radiation, licensing of activities in the field of the use of atomic energy and IRS, licensing activities, accounting of IRS and nuclear materials for all MBAs of the country with reporting to the IAEA.

Implementation of the concept – Information system



The following algorithms have been developed :

- 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.
- Own system of user interface controls, including dedicated buttons, e.g. for sending emails and checking data in the State Internet registries.
- Several levels of sorting and filtering records.
- 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.
- Module for processing incoming mail and attached files.
- The system for the formation of final documents according to the established samples with the ability for the user to make changes to templates.
- "Statistical" reports, notification system, change log.
- Enterprise tree tool.
- Full-text search in documents.

Implementation of the concept – Information system

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.

ИННОВАЦИОННОЕ РАЗВИТИЕ БЕЛАРУСИ В ДИНАМИКЕ

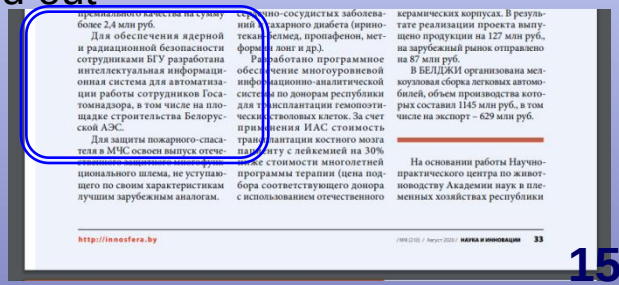
Для решения задачи повышения конкурентоспособности отечественной экономики на основе ее инновационного развития в стране реализуется комплекс взаимосвязанных мероприятий. Среди них особая роль принадлежит формированию и успешной реализации Государственной программы инновационного развития и 27 научно-технических программ, в выполнении которых задействовано более 17 тыс. ученых и исследователей. Следует отметить, что в результате значительно повысился вклад науки в экономику. Если в прошлой пятилетке доля белорусских разработок в Госпрограмме инновационного развития была 10%, то в текущей – уже 36%, а в следующей планируется довести этот показатель до 50%. Только в рамках этой программы за четыре года создано и модернизировано почти 10 тыс. рабочих мест и более 60 инновационных производств.

Александр Шумилин, председатель Государственного комитета по науке и технологиям, доктор экономических наук

К примеру, на Борисовском заводе медпрепаратов организован выпуск стерильной рассчитан 8 импортозамещающих антибиотиков (ципрабсфа, цефтриаксона, цефалонина, цефепима, цефотаксима, цефтазидима, цефтазитима, стика гепатита С и отторжения трансплантата печени, применение которых позволяет на ранних стадиях излечить необходимое лечение.

В компании «АДАНИ» организован кластер по выпуску систем ция данного предприятия превысил 270 млн руб., более 2/3 ее экспортируется на рынки США, Южной Кореи, Японии и Европейского союза.

Белорусская микроэлектроника восстанавливает свои позиции



преимущественного качества на сумму более 2,4 млн руб.

Для обеспечения ядерной и радиационной безопасности сотрудниками БГУ разработана интеллектуальная информационная система для автоматизации работы сотрудников Госатомнадзора, в том числе на площадке строительства Белорусской АЭС.

Для защиты пожарного-спасателя в МЧС освоен выпуск отечественного комплекта боевой одежды и национального шлема, не уступающего по своим характеристикам лучшим зарубежным аналогам.

сосудистых заболеваний и сахарного диабета (ирбесартан, велмед, пропафенон, метформин лонг и др.).

Разработано программное обеспечение многоуровневой информационно-аналитической системы по донорам республики для трансплантации гемопоэтических стволовых клеток. За счет применения ИАС стоимость трансплантации костного мозга пациенту с лейкемией на 30% ниже стоимости многолетней программы терапии (цена подбора соответствующего донора с использованием отечественного

керамических корпусах. В результате реализации проекта выпущено продукции на 127 млн руб., на зарубежный рынок отправлено на 87 млн руб.

В БЕЛДЖИ организована мелкоузловая сборка легковых автомобилей, объем производства которых составил 1145 млн руб., в том числе на экспорт – 629 млн руб.

На основании работы Научно-практического центра по животноводству Академии наук в племенных хозяйствах республики

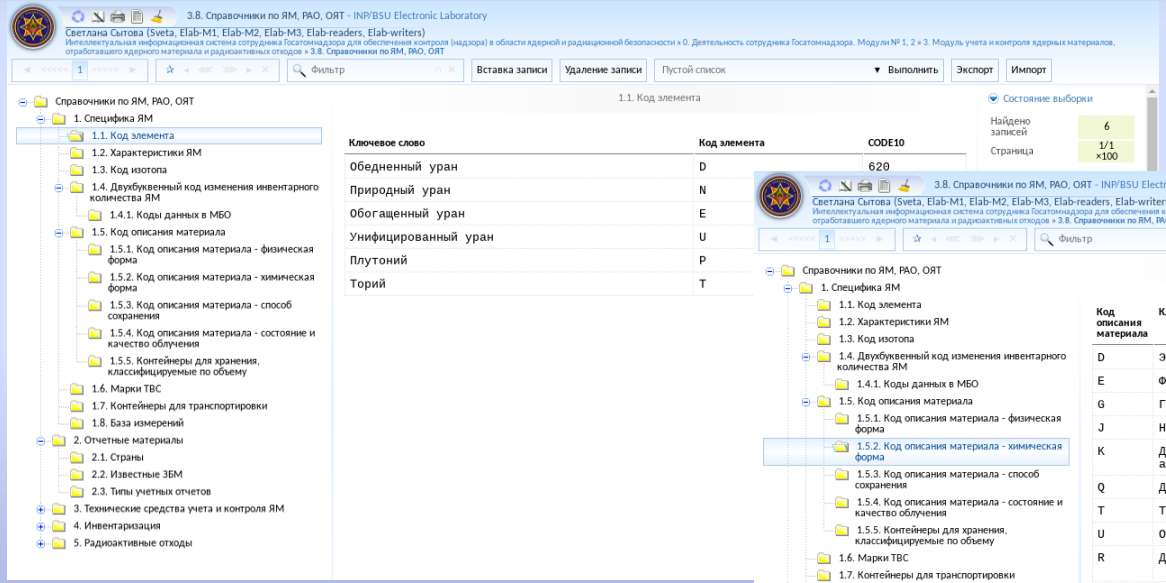
http://innosfera.by

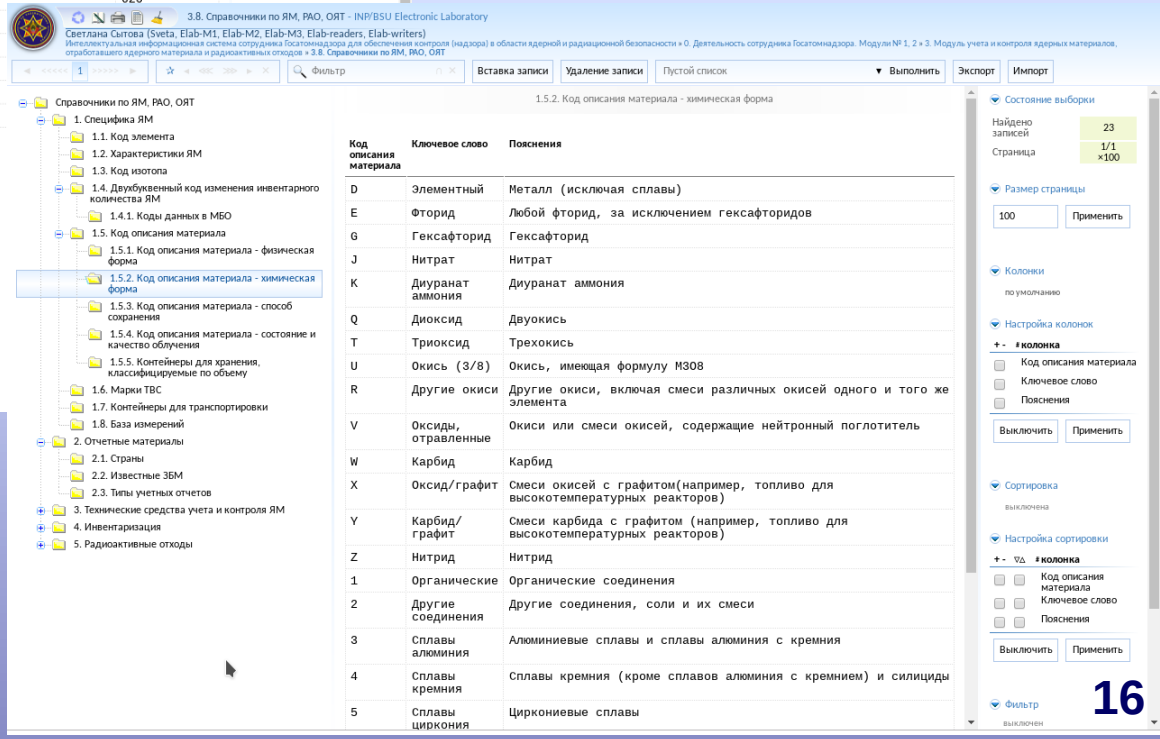
/ №8 (210) / Август 2020 / НАУКА И ИННОВАЦИИ 33

А. Шумилин. Наука и инновации, август 2020, №8 (210), с. 32-38

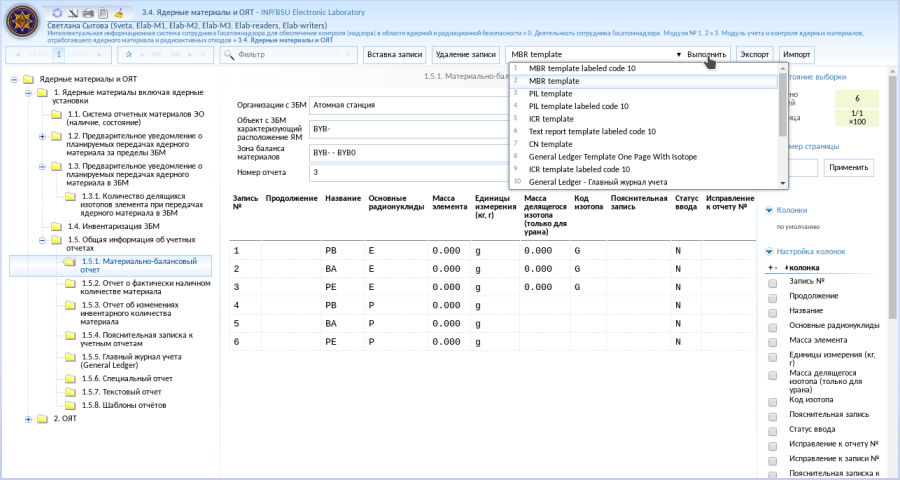
http://innosfera.by/

NM Accounting and Control Module - Handbooks





NM Accounting and Control Module - Templates



Templates:

1) MBR template labeled code 10;
2) MBR template fixed code 10;
3) PIL template fixed code 10;
4) PIL template labeled code 10;
5) ICR template fixed code 10;
6) ICR template labeled code 10;
7) Text report template labeled code 10;
8) CN template fixed code 10;
8) CN template labeled code 10;
9) General Ledger Template One Page With Isotope;
10) General Ledger.

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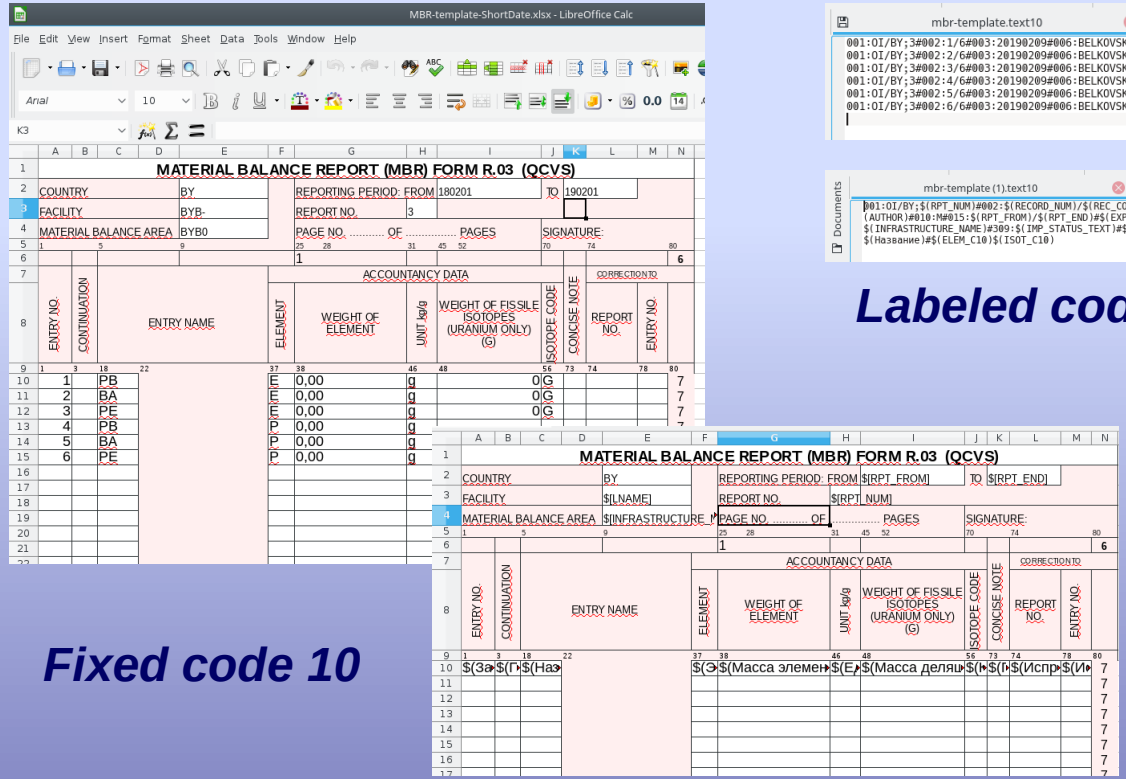
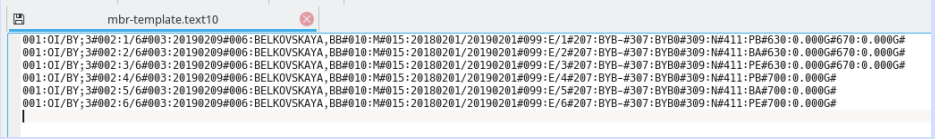
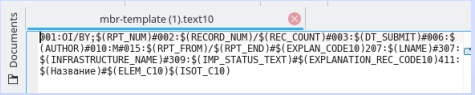
NM Accounting and Control Module - Templates



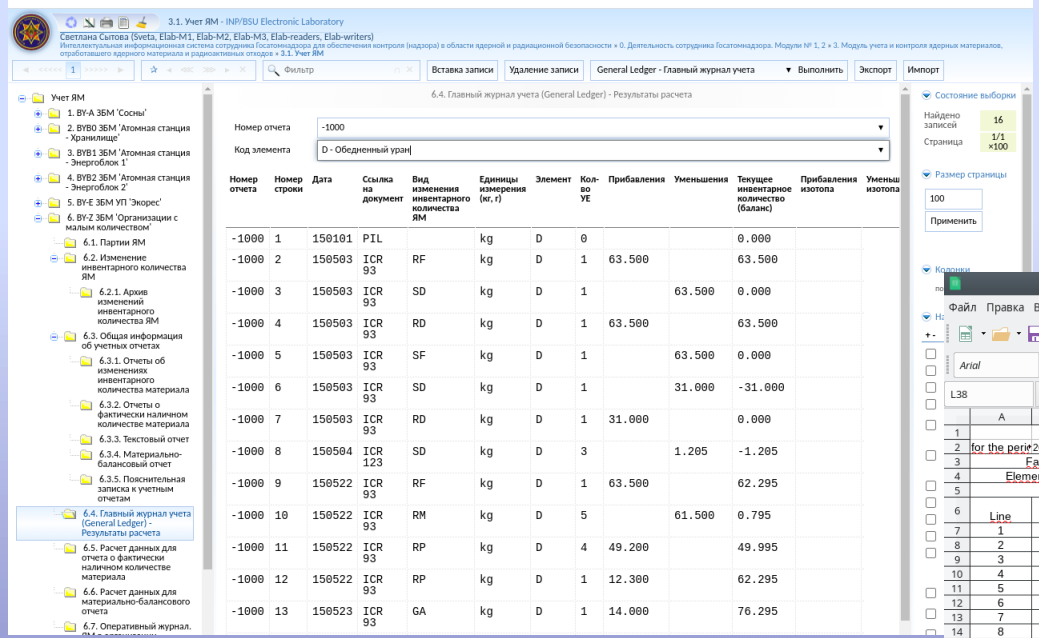
Fixed code 10



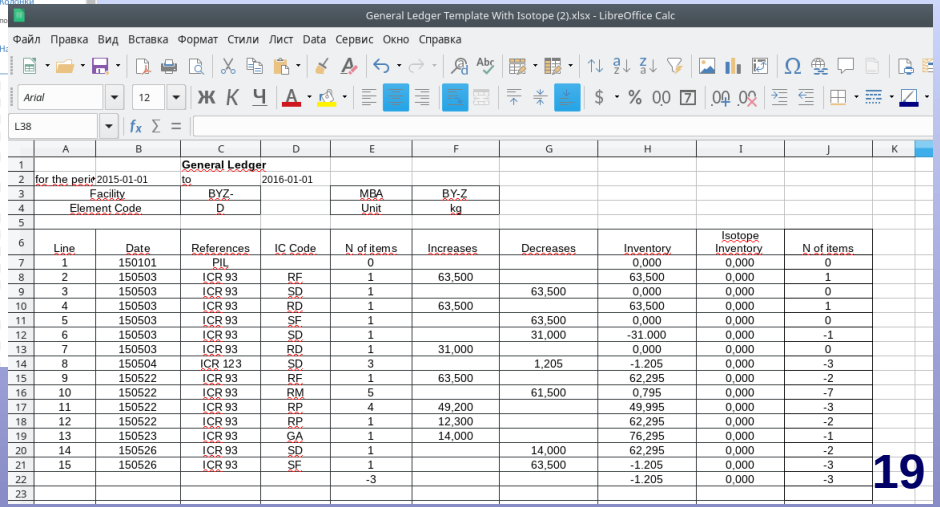


Labeled code 10

NM Accounting and Control Module – General Ledger

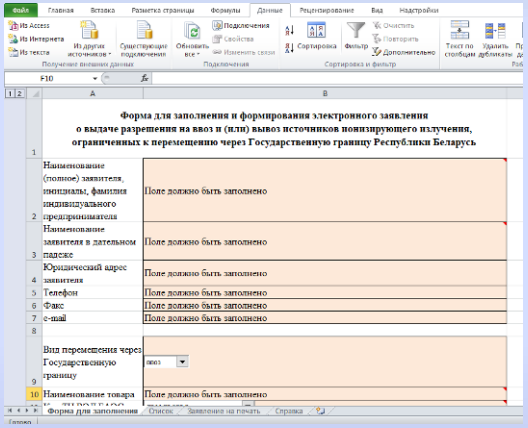


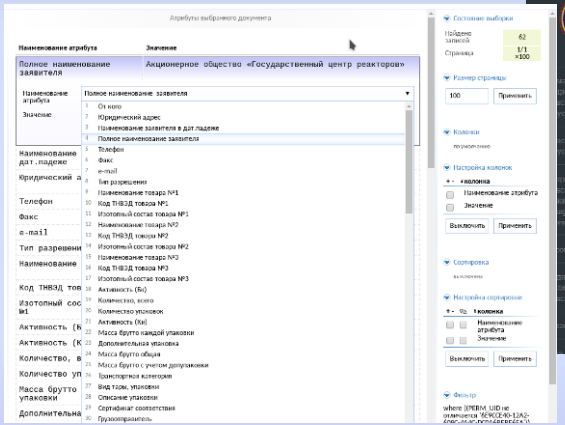
Номер отчета	Номер строки	Дата	Ссылка на документ	Вид изменения инвентарного количества ЯМ	Единицы измерения (кг, г)	Элемент	Кол-во УЕ	Прибавления	Уменьшения	Текущее инвентарное количество (баланс)	Прибавления изотопа	Уменьш изотопа
-1000	1	150101	PIL		kg	D	0			0.000		
-1000	2	150503	ICR 93	RF	kg	D	1	63.500		63.500		
-1000	3	150503	ICR 93	SD	kg	D	1		63.500	0.000		
-1000	4	150503	ICR 93	RD	kg	D	1	63.500		63.500		
-1000	5	150503	ICR 93	SF	kg	D	1		63.500	0.000		
-1000	6	150503	ICR 93	SD	kg	D	1		31.000	-31.000		
-1000	7	150503	ICR 93	RD	kg	D	1	31.000		0.000		
-1000	8	150504	ICR 123	SD	kg	D	3		1.205	-1.205		
-1000	9	150522	ICR 93	RF	kg	D	1	63.500		62.295		
-1000	10	150522	ICR 93	RM	kg	D	5		61.500	0.795		
-1000	11	150522	ICR 93	RP	kg	D	4	49.200		49.995		
-1000	12	150522	ICR 93	RP	kg	D	1	12.300		62.295		
-1000	13	150523	ICR 93	GA	kg	D	1	14.000		76.295		

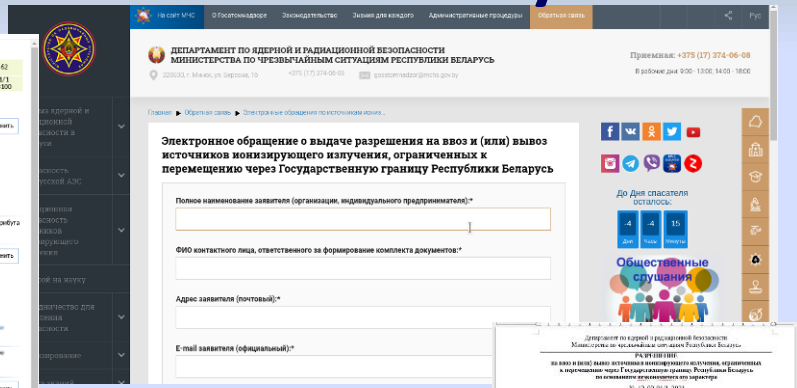


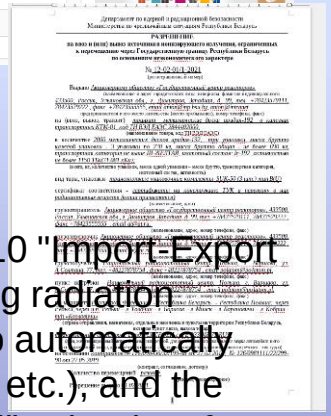
	A	B	C	D	E	F	G	H	I	J	K
1			General Ledger								
2	for the peri	2015-01-01	to	2016-01-01							
3	Facility		BYZ-		MBA	BY-Z					
4	Element Code		D		Unit	kg					
5											
6	Line	Date	References	IC Code	N of items	Increases	Decreases	Inventory	Isotope Inventory	N of items	
7	1	150101	PIL		0			0,000	0,000	0	
8	2	150503	ICR 93	RF	1	63,500		63,500	0,000	1	
9	3	150503	ICR 93	SD	1		63,500	0,000	0,000	0	
10	4	150503	ICR 93	RD	1	63,500		63,500	0,000	1	
11	5	150503	ICR 93	SF	1		63,500	0,000	0,000	0	
12	6	150503	ICR 93	SD	1		31,000	-31,000	0,000	-1	
13	7	150503	ICR 93	RD	1	31,000		0,000	0,000	0	
14	8	150504	ICR 123	SD	3		1,205	-1,205	0,000	-3	
15	9	150522	ICR 93	RF	1	63,500		62,295	0,000	-2	
16	10	150522	ICR 93	RM	5		61,500	0,795	0,000	-7	
17	11	150522	ICR 93	RP	4	49,200		49,995	0,000	-3	
18	12	150522	ICR 93	RP	1	12,300		62,295	0,000	-2	
19	13	150523	ICR 93	GA	1	14,000		76,295	0,000	-1	
20	14	150526	ICR 93	SD	1		14,000	62,295	0,000	-2	
21	15	150526	ICR 93	SF	1		63,500	-1,205	0,000	-3	
22					-3			-1,205	0,000	-3	
23											

Implementation of the concept – Information system









The mechanism for parsing emails and electronic documents, implemented in Submodule 2.10 "Import-Export Permits" to automate the process of preparing permits for the import and (or) export of ionizing radiation sources restricted for movement across the State Border of the Republic of Belarus, allows to automatically parse the sent archive by categories of documents (application, copies of passports, permits, etc.), and the application form in Microsoft Excel format - by attributes (distinctive parameter of an Excel cell). The data from it fall into the corresponding journal of Submodule 2.10 . As a result, based on the applicant's data, the system automatically generates a draft permission or a draft reasoned refusal in docx format, which are sent for the Gosatomnadzor management to sign.

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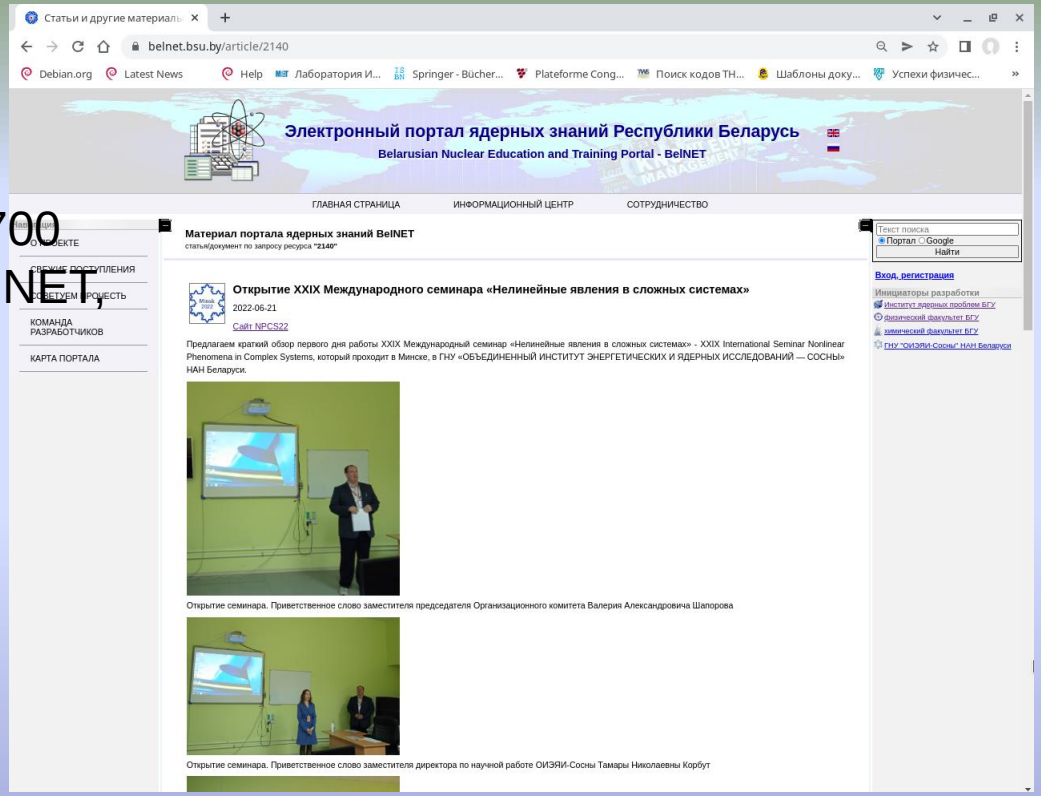
Conclusions

Over the past six months 2022, over 700 new entries have been created on BelNET, including over 250 news.

A new scientific direction is being created at the intersection of informatics, information technology and nuclear knowledge - the nuclear knowledge management system in the Republic of Belarus.

We must be active. Who if not us?



We are working to make the formula right:

BelNET = repository of nuclear knowledge of the Republic of Belarus

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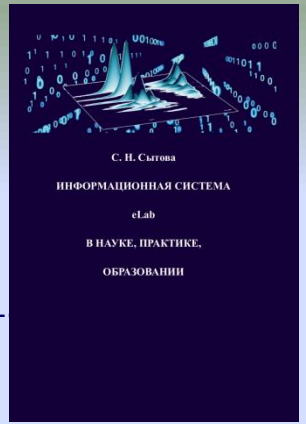

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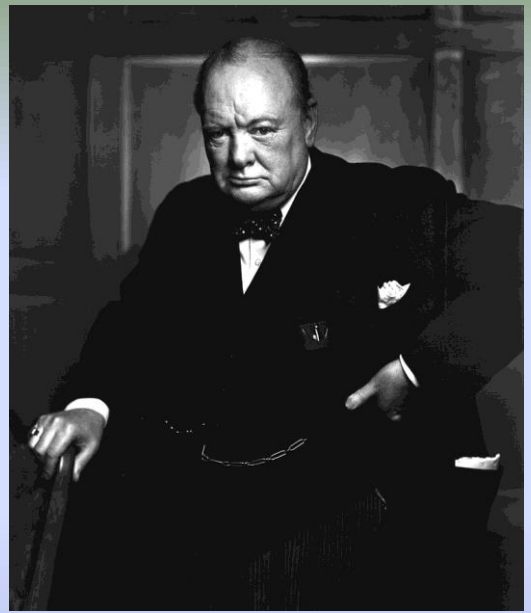

It is better to be making the news than taking it.

Sir Winston Leonard Spencer Churchill