STRUCTURE OF BELARUSIAN EDUCATIONAL AND RESEARCH WEB PORTAL OF NUCLEAR KNOWLEDGE

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Abstract

The main objectives and instruments to develop Belarusian educational and research web portal of nuclear knowledge are discussed. Draft structure of portal is presented.

Keywords: portal, electronic document management system, nuclear knowledge.

1 Introduction

The United Nations Organization initiative "Atoms for Peace" presented by USA President Dwight D. Eisenhower in December 1953 was the first step in peaceful use of nuclear technology. Today, many countries of the world develop or begin to create their strong nuclear programs. There are more than 440 nuclear power plants (NPP) operating in 30 countries, more than 400 ships with nuclear reactors used as propulsion systems. About 300 research reactors operate in 50 countries. This kind of reactors produces

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radioisotopes for medical diagnostics and therapy of cancer, neutron sources for research and training. Approximately 55 nuclear power plants are under construction and 110 ones are planned.

The Republic of Belarus is a newcomer country in nuclear energy. There is no experience of the nuclear power plant construction but large scientific potential in the field of atomic and nuclear physics, radiochemistry and radiation chemistry. Hence the development of nuclear knowledge portal is one of the first step for the scenario of nuclear knowledge management. The objectives of the portal are considered as the preservation and enhancing of nuclear knowledge, assisting all the participants of national nuclear energy system development in accumulation of the international experience and competence needed for the effective and safe use of nuclear energy as well as popularization of nuclear knowledge for schoolchildren and the general public.

2 Nuclear knowledge

Since the beginning of the XXI century the International Atomic Energy Agency (IAEA) pays big attention to the nuclear knowledge management (NKM) [1]–[5]. Nuclear knowledge (NK) is the base stem of appropriate research and development as well as industrial applications of nuclear technologies and includes energy and non-energy applications.

Knowledge management (KM) [1]–[3] is an integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing and preserving knowledge, relevant to achieving specified objectives.

Basic KM concept by IAEA is depicted as a pyramid. On its foundation there is data. Data is presented as unorganized and unprocessed facts, a set of discrete facts about events. Over data there is the information as aggregation of data that makes decision making easier. Knowledge is the highest level of information. There is wisdom and enlightenment on the top of KM pyramid.

Approximate percentage of subject area of nuclear knowledge by the IAEA is as following:

- nuclear physics 11%,

- nuclear materials 9%,

- engineering and instrumentation 9%,

- elementary particle physics 16%,

- atomic, molecular and condensed matter physics 10%,

- life sciences 18%,

- chemistry 4%,

- nuclear power and safety 6%,

- nuclear fuel cycle and radioactive waste 3%,

- fusion research and technology 7%,

- environmental and earth sciences 3%,

- isotopes 1%,

- non-nuclear energy 1%,

- economic, legal and social fields 2%.

The strategy of the IAEA in NKM is as following: it is extremely important that the educational process involves the enterprises of nuclear industry [4]. Great attention is paid to the development of national, regional and international educational networks and portals. The IAEA developed detailed recommendations for the creation of portals with the formulation of purposes and principles of their design.

Taxonomy is the main KM concept [5]. Taxonomy (from Greek *'taxis'* meaning arrangement or division and *'nomos'* meaning law) is a hierarchical structure in which a body of information or knowledge is categorized, allowing an understanding of its various parts' relations with each other. Taxonomies are used to organize information in systems, thereby helping users to find it. The stages of taxonomy developing are:

- determination of taxonomy requirements;

- identification of its concepts (where is the content and what do the users think);

- developing draft taxonomy;

- its review by users;

- refining taxonomy;

- adaptation of taxonomy to the content;

- taxonomy management and maintenance.

3   Belarusian educational and research web portal of nuclear knowledge

Each developed country, forming its own nuclear industry, should independently create, establish and maintain the nuclear knowledge portal, integrated into the global nuclear knowledge management industry. Such portals will allow to manage information resources, knowledge and competencies of the nuclear industry of Belarus, as well as to preserve, maintain and develop the knowledge at the level that provides a safe, sustainable and efficient development of Belarusian nuclear industry.

Nowadays in Belarus there are several websites of selected organizations and institutions that are not related to the united portal, providing separate information on the subject far from completeness.

Creating of a full-fledged portal of nuclear knowledge is the multistage process. As the first step it is proposed to create educational and research portal of nuclear knowledge. It will not be a portal of NPP, which should be developed separately.

Prospective participants of educational and research portal of nuclear knowledge are: Ministry of Education of the Republic of Belarus, Belarusian State University (BSU), Research Institute for Nuclear Problems of BSU, universities, training specialists for nuclear power plant, Department for Nuclear and Radiation Safety of the Ministry for Emergency Situations of the Republic of Belarus (Gosatomnadzor), the Joint Institute for Power and Nuclear Research – SOSNY. All works should be executed by the monitor of the IAEA.

The first proposals for the development of educational and research portals of nuclear knowledge, which in the long term could be developed into a full-fledged national portal, are published in [6]–[8].

The portal will be developed on the basis of IAEA experience and methodological support. The development and support of the portal requires permanent governmental funding. For its development it is necessary to build infrastructure and to have the availability of a critical mass of basic science to support practical applications.

The portal is a system that integrates all available (in the country and abroad) openly accessible information resources (applications, databases, analytical systems, etc.), which allow the developers and users to interact with each other. The portal should provide users with secure access to information and virtual channels of communication, e.g. they can work together on documents from geographically spaced locations; access to all information resources of the portal through a single web-based mode with a strong collaborative personalization (right of access to certain resources: data, services, applications, documents).

The mission of the portal consists in formation of favorable information, socio-cultural, business and educational environment for the sustainable development of nuclear industry in Belarus.

Portal objectives are the following: acceleration of search and access to necessary data and information; creation of new knowledge; promotion of participation in research, education and training programs in the nuclear industry. It has to be an integration tool, an access tool for information resources and a communication tool.

Basic principles of the portal creation are the next:

- discussion the requirements of the portal with all stakeholders before development;

- developing a hierarchical taxonomy of the portal;

- constant testing the portal for compliance with technical requirements;

- maintaining transparency of the portal development;

- publishing a description of the portal;

- incorporation of representatives of all interested organizations to the group of developers.

Interface that provides a mechanism for interaction between applications and the users of the portal is the main element of the portal. Interface provides coordination between teams and individuals, with a convenient and

quick search and navigation. Other elements are the next: electronic document management system to ensure the preparation of the document with the required level of quality, intelligent search, categorization of information; project management, including project planning, establishing project objectives, project schedule control of resources, planning and allocation of human and financial resources; e-library (documents collection, knowledge repository) consisting of various electronic materials, reports, technical documentation, regulatory documents, training materials, etc.; learning content management system with a system of courses and distance learning and the ability to develop and improve the courses of studies; forums on the main areas of activity; news feeds and other applications that are integrated into the portal.

Thus, portal of nuclear knowledge will be simultaneously 1) a vertical portal (portal-niche) having a thematic focus and oriented on full coverage of stated themes; 2) public portal open for the general Internet public interested in nuclear subjects; and 3) enterprise collaboration portal [9]. Its main difference from the usual web site is availability of interactive services (mail, news, forums, tools for collaborative work and individual users including distance learning tools).

Draft structure of the portal is presented in Fig.1. Content of portal is divided by subjects and marked by labels. Portal content means all information forming portal. Main subjects are the next: nuclear physics, nuclear materials, engineering and instrumentation, elementary particle physics, atomic physics, molecular physics, condensed matter physics, life sciences, chemistry, nuclear power and safety, safeguards, isotopes, fusion research and technology, nuclear fuel cycle and radioactive waste, etc. Labels can be the following: image, photo, video, audio, archive, news, countries, organizations, etc. It is no need to place by copying all the information. It is enough to make the necessary links to corresponding portals and sites containing this information.

Distance learning system, which will be available within the on-line mode of portal should contain video lectures and animated lessons (perhaps, the last ones should be broken into short modules), online tutorials, interactive quizzes and other materials developed by the best professors of the country. Such systems are actively being developed worldwide last 20 years. Distance learning system in the framework of nuclear knowledge portal will enhance the prestige and quality of education in the field of nuclear science and technology.

Together, the e-library materials, training courses, databases, electronic documents (photos, videos, etc.) and other portal content will be organized in the NK base that contains knowledge in the field of nuclear technology, including nuclear and reactor physics, ionizing radiation, the application of nuclear methods in various fields of science and technology, radiation and radiochemistry, nuclear medicine, etc.

It is necessary to establish within the portal open areas, open and restricted areas and restricted areas depending on user access rights. Moreover, users with fewer rights should not even see a reference to restricted areas.

So, the structure of portal is a 4D matrix with the following layers: content, area, subject, label.

The main stages of the work on portal development consist of two parts. The first stage with duration of two years includes the next steps:

- identifying the source of the portal funding;

- determining the owner of the portal;

- defining the project team (responsibility, roles, functions);

- determining the structure and the platform of the portal;

- identifying the tools, techniques and sources for data collection / accumulation and storage of information (life cycle of documents);

- determining the necessary hardware and software;

- developing the taxonomy;

- developing a specification for the portal;

- creating a portal prototype based on selected technology;

- starting the collection of information;

- testing the portal in on-line mode.

Full implementation of the portal on the second stage consists of purchasing computer equipment, installation the software, and experimental implementation of the portal: testing and evaluation of response time and accuracy of data; checking the portal for the safety and effectiveness; refining the portal; developing a guide for users; supporting the portal and filling it with information.

4 Electronic document management system E-Lab

The novelty of the work presented can be formulated as creating the Belarusian educational and research portal of nuclear knowledge, taking into account the specific conditions of the Republic of Belarus on the basis of free software developed by Belarusian IT specialists: E-Lab electronic document management system [10], [11].

This system will be the basis of the interface, e-library, document management system, project management system, training materials, etc. In 2008, the computer program "Laboratory Information Management System E-Lab" received the certificate No. 051 of the National Intellectual Property Center of the Republic of Belarus. It is implemented in the educational process of leading Belarusian universities (BSU, Belarusian State Technological University, Belarusian National Technical University), introduced in the Chemical-Toxicological Laboratory of the Minsk Drug Treatment Clinic. E-Lab is on the basis of management of specimens, measurements and passports of fuels and lubricants of Belarusian Army (since 2012) and Belarusian branch of Russian company GazPromNeft (since 2013).

E-Lab is an electronic system of the client-server architecture designed on the basis of free software: Debian GNU/Linux, web server Apache, Firebird database server using the application server PHP. It runs under Windows and Linux. It gives web based multi-user operation with different rights of access through widely used browsers. E-Lab operates reliably without interruption, completely secure from unauthorized access and has a fast response to user requests. The system provides visibility and accessibility of information. Archival storage of materials on the site is provided by the close adjustment it to the place of storage with the control of the storage conditions. It is provided a single interface for a wide range of integrated applications. E-Lab is the system easily modifiable and adaptable to the conditions of the project.

The presence of adaptable to the conditions of the project document management system E-Lab based on free software is very important because the lack of the necessary software [12] is a serious problem in the development of web portals. However, it is now apparent that the existing E-Lab system must be radically revised and modernized in order to simultaneously ensuring the smooth operation of a large number of users, as well as providing opportunities for e-learning.

5   Conclusion

Development of Belarusian educational and research web portal of nuclear knowledge will provide quick access to necessary information and create conditions for its exchange, accumulation and integrity of knowledge at the level ensuring a safe, sustainable and efficient development of nuclear energy and industry of the country, as well as the promotion of nuclear knowledge to attract to this area the most able young people and to create a positive image of nuclear science. It is obvious that the portal development has no end especially in the part of its filling by information. It is necessary to accomplish persistent content inventory. In the future, on the base of the proposed portal it may be changing its themes and the development of educational and research portals with distance learning system of the various types.

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SUBJECT
- Nuclear Physics
- Nuclear Materials
- Engineering & Instrumentation
- Elementary Particle Physics
- Atomic Physics
- Molecular Physics
- Condensed Matter Physics
- Life Sciences
- Nuclear Medicine
- Chemistry
- Nuclear Power & Safety
- Safeguards
- Isotopes
- Fusion Research & Technology
- Nuclear Fuel Cycle & Radioactive Waste
- ...

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Policy
Procedures
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IT support
Forums
Videoconferences
Events
Resources
Photos
Video
Audio
Press about us
Reporting
Historical reviews
Announcements
Contacts
Useful links

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➤ Photo
➤ Video
➤ Audio
➤ Archive
➤ News
➤ Countries:
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    Belarus
    USA
    Germany
    France
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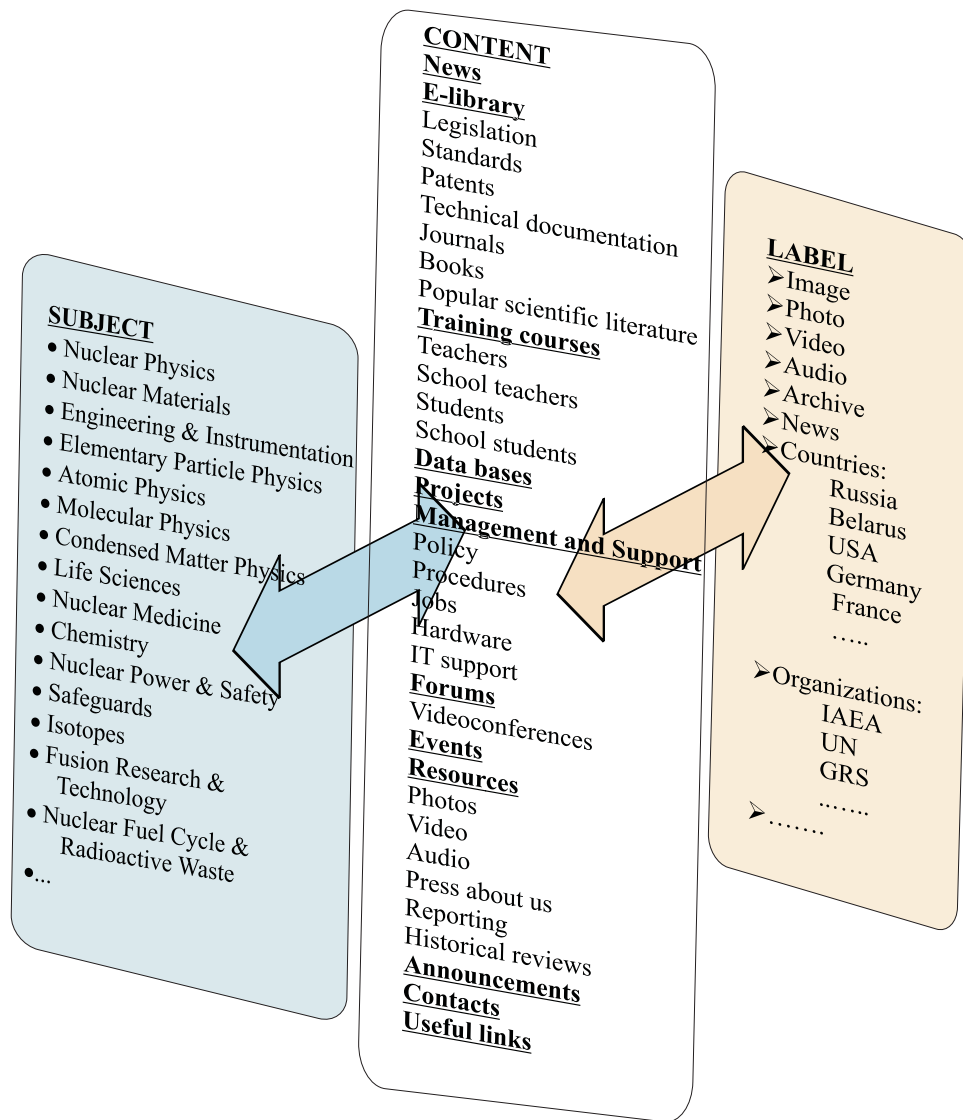
➤ Organizations:
    IAEA
    UN
    GRS
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Figure 1: Structure of Belarusian educational and research portal of nuclear knowledge

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