

R&D POLICY OF THE HUNGARAIN ATOMIC ENERGY AUTHORITY

Tamas Berki; Geza Macsuga; Istvan Neubauer

Abstract

The Hungarian Atomic Energy Authority (HAEA) is authorised by the prescriptions of the law on Atomic Energy to support research and development activities in those scientific and technical areas, which primarily contribute to performing the nuclear safety regulatory responsibility and improving effectiveness and efficiency of licensing, inspection and assessment activities. HAEA's Research and Development program is an essential one: it is run on significant financial resources and with the involvement of a wide range of Technical Support Organisations (TSO). Therefore appropriate priorities have to be applied and directions have to be followed when decisions are made on activities to be supported by the HAEA. These priorities and strategic directions for the R&D activities are defined in the Research and Development Policy of HAEA, which was lastly revised in 2008.

The report introduces the summary evaluation and major results of R&D activities sponsored by the HAEA in the previous 2005-2008 cycle and the directions and general elements of the R&D Policy of the ongoing period 2009-2012.

1. Legal background

The use of atomic energy raises a higher class of safety requirements than as it is usual in conventional industry. According to the Hungarian act on atomic energy it is the task of the nuclear regulatory body to set up these requirements and to supervise their fulfillment. This law prescribes that financing of specific R&D activities that contribute to perform the regulatory body's responsibility and to improve effectiveness and efficiency of licensing, inspection and assessment are the tasks of the HAEA as well.

2. Partnership

During the R&D activity of previous years a network of TSOs has been developed. The HAEA's Nuclear Safety Directorate has been concluded a cooperation agreement with some of these organizations. Under these agreements TSOs carry out some urgent, short term tasks, which occur in the responsibility of the regulatory body, without charge. A main advantage of the TSO framework for all stakeholders is that competent and committed institutions are available for larger volume of work in a contractual framework.

In the summer of 2005 a knowledge-profile survey has been carried out among the TSOs of the HAEA. The record of experts has been updated in 2009.

The survey was grouped around 10 themes contain a total of 48 skill areas. The leaders of the partner institutions were asked if they consider themselves competent in the given skill area and if they are ready to undertake contract with the HAEA on that given field. According to the answers, the record of experts has been compiled. The aim of that record is to get a more precise view of the available skills at our TSOs. The record of experts makes the coordination of the R&D program more effective and it provides an opportunity to choose the suitable institute when a new research area arose.

3. R&D policy of the HAEA

Aims, priorities and research fields of the R&D activity have been laid down at the organizational policy level. This so called R&D policy has been revised in 2008 and it has been harmonized with the conception of our TSO partners. It is important to note that this policy applies to all of the HAEA but in this paper only those R&D activities are presented that were initiated by HAEA.

3.1 Aims of the R&D activity

Aims of the R&D activity set out in the policy remained practically unchanged after the revision. The goals are continuity, balance of meeting short term and future needs, international cooperation, effective use of research results, preserve stable background and broadening institutional framework.

Continuity as a goal arises in two aspects. First, it may be necessary to continue researches that began in the previous period, on the other hand an opportunity should be provided for partner institutions to engage themselves over one year period on a given topic. It was already possible to start multiyear R&D projects but in the period 2009-2012, setting and implementation of longer-term concepts are specifically encouraged.

The authority may face technical problems for which it is unprepared to solve immediately, but it has to find a solution in a short term. In such case of short term tasks TSO agreements provide flexible capability to handle them. However, tasks requiring several months of work shall be initiated only with the existence of sufficient financial resources and with conclusion of individual contracts. Therefore, a fundamental objective is that the non-predictable, but short-term problems should be an integrated part of the R&D activity as well as one, two or more year long projects requiring greater resources and in-depth research.

An important objective is to incorporate the increasingly greater volume of research results into the work of the regulatory body. To achieve this aim both the TSO partners and the HAEA pursue a purposeful activity by organizing trainings and seminars, and by updating of related databases regularly, etc. TSO seminar is organized annually since 2006, where partner institutes present their most important results achieved in the R&D program. The seminar provides an opportunity for the HAEA's staff to make better acquaintance with the R&D activity and with its results.

3.2 Priorities

Priorities are new elements in the revised R&D policy. The authority has to face several challenges in these days that come e.g. from the effects due to changes in administration system and from the technical and scientific development. Serious challenges are the need of modernization coming from the feedback of international experience and the initiatives of the nuclear industry such as lifetime extension, construction of new nuclear units, transportation of spent fuel to abroad, etc. These initiatives compel the regulatory body to get ready for new, previously not practiced activity.

Responding to these challenges it is essential to determine priorities for managing our activity. The R&D activity can be set into service of regulatory work with highest efficiency if these priorities are enforced. Priorities set out below are in order of precedence.

3.2.1 1st priority: Direct support of the work of the authority

Submitted applications that intend to directly support regulatory work take precedence during the evaluation. Related work involves, for example, such topics as providing expert review on substantiating documentation of a concrete case, doing background analysis and

assessments, developing tools and methods for the authority or modernizing the regulatory framework.

3.2.2 2nd priority: Tasks initiated by the authority

Topics initiated by a HAEA's staff member are placed to higher priority, which provides a direct and efficient utilization of the R&D activity.

3.2.3 3rd priority: Regulatory tasks related to new nuclear facility

In the period 2009-2012 it is expected that the HAEA has to face with licensing of one or two new nuclear power plant units. Therefore, technical analyses and expert opinions supporting decision-making related to licensing new nuclear units, development of legislative background and analysis tools, upgrading regulatory expertise may be important R&D topics.

3.2.4 4th priority: Maintaining TSO expertise

Topics purposing to maintain the expertise of our TSO partners are still important but they are graded into a lower priority. For example, such topics as research initiated by our TSO partners and development of expert's capabilities of our partners, which can be used for regulatory support, are included in this category.

3.3 Most important research directions in 2009-2012

We have collected the main areas of the research and development activities which are necessary during 2009-2012 period. The listed areas are very wide; within the areas the special topics could have different weight, importance. Under the main areas the list of the topics is not necessarily exhaustive; moreover sometimes they are elaborated under several contracts.

3.3.1 Improvement of the regulation system

Legal documents are an essential part of HAEA's resources. In consequence of joining the EU, and the continuously changing requirements, the primary activity is to continuously improve the regulation system. Under this framework the following topics are covered: improvement of the regulatory requirements, harmonization of safety requirements with the EU, elaboration of technical documents for the support of the inspectors work, elaboration and review of guidelines and technical background documents.

3.3.2 Support and improve the level of the regulatory work,

For maintaining the regulatory activity up-to-date and at a high professional level, there is a need for elaboration of certain professional topics in details, and for clarification of new questions:

- a) Preparation of safety analysis,
- b) Development and validation of alternative code systems,
- c) Fuel behavior,
- d) Application of new regulatory methods and tools,
- e) Development of the methods and tools of public communication,
- f) Inspection of the chemistry activities,
- g) Answering the questions in radiochemistry arising during regulatory work.

3.3.3 *Regulatory activities regarding lifetime extension*

HAEA has to be prepared for the professional review of the permission requests related to lifetime extension; therefore several questions have to be clarified:

- a) Regulatory requirements of the exploration of the design bases,
- b) Establishment of the regulatory control of aging program,
- c) Establishment of the regulatory control of the equipment qualification,
- d) Estimation the effect of the lifetime extension to the safety,
- e) Revision of the regulatory control of maintenance activities.

3.3.4 *Establishment of new reactors*

Both the EU's and Hungary's energy politics supports the enlargement of the atomic energy production with modern nuclear power plants of new generation. The political decision of 2009 opened this new opportunity that will challenge the nuclear regulatory body; therefore research and development areas have to be extended with the following:

- a) Collection and assessment of information regarding the possible new reactor types in Hungary.
- b) Independently form the contractors, development and introduction of modern safety analysis methods for the safety assessment of the new reactors.
- c) Specification of the regulatory requirements and criteria regarding the lifecycle of the new reactors.
- d) Establishment of advanced regulatory methods which are suitable with the type of the new reactors and with the modern requirements.

3.3.5 *Decommissioning, and radioactive waste management*

According to the atomic act this is the duty of the HAEA to develop and review the legal rules regarding the decommissioning and radioactive waste management. In the near future it is not expected to decommission any nuclear facility in Hungary, but it is an important task to prepare for, to collect data about decommissioning and to get acquainted with the international experiences.

3.3.6 *Operational safety*

High level regulatory work can be maintained if the regulatory body is also fully aware of questions of safe operation similarly to the operator. To achieve this aim, with the employment of independent experts the regulatory body continuously follows the national and international issues. Operational safety includes the following areas: assessment of effects of human factors to the safety, the role and influence of the organization and management in assuring safety, development methods for the assessment of safety culture.

3.3.7 *Development of tools of risk informed regulation*

Regarding the modern safety principles there is no absolute safety, the decisions should be made considering the ALARA principle. This means that before each decision qualitative and quantitative risk assessment has to be made. Before the introduction of this decision making process, numerous problem has to be sold:

- a) Elaboration of the method of risk informed decision making.
- b) Establishment of risk informed regulatory procedures.
- c) Development of PSA applications.
- d) Determination of probabilistic safety requirements, criteria and performance indicators

3.3.8 Analysis of beyond design bases and severe accidents

In Hungary and also in other nuclear countries it is getting general to prepare adequately for managing very rarely possible beyond design bases (BDBA) and severe accidents (SA). In these cases the processes are sophisticated, the preparedness requires detailed scientific analysis. The most important research areas of the next period are:

- a) Establishment of BDBA and SA regulatory requirements
- b) Assessment the effects of external events
- c) Determination the design criteria of the preparedness for accident situations
- d) Development of severe accident analysis codes, maintenance the ability of the application of these codes

3.3.9 Nuclear Emergency Preparedness

Based on the Governmental Decree 248/1997 on the Hungarian Nuclear Emergency Response System is within the competence of the HAEA, to carry out the nuclear emergency preparedness tasks in the fields of international cooperation, scientific research and the technical development. The most important research areas are the followings:

- a) To provide personal and material conditions for carrying out the nuclear emergency preparedness tasks of the HAEA (enlargement of the knowledge, development of nuclear and radiological analysis tools and methods)
- b) Determination the circumstances of the urgent protective actions, method for the implementation of the urgent protective actions.
- c) Determination the circumstances of the longer term protective actions which are affecting the agricultural activities and the food chain, method for the implementation of the longer term protective actions.
- d) Elaboration of methodical procedures, guidelines, which are out of the scope of the National Emergency Response Plan.

4. R&D activities from 2005 to 2009

In the period from 2005 to 2009 a total number of 281 R&D was contracted with about 1.2 billion HUF. Key topics were thermal hydraulics calculations, severe accident analysis, probabilistic safety assessment, preparation of regulatory guidelines. Our most important TSOs are: Hungarian Academy of Sciences KFKI Atomic Energy Research Institute, NUBIKI Nuclear Safety Research Institute, Institute of Nuclear Techniques of the Budapest University of Technology and Economics. We have contracted about the two-third of our available funds with these three institutes, but a significant number of other institutions have been in contact also. Over the past four years, 30 different partner institutions signed R&D contract.

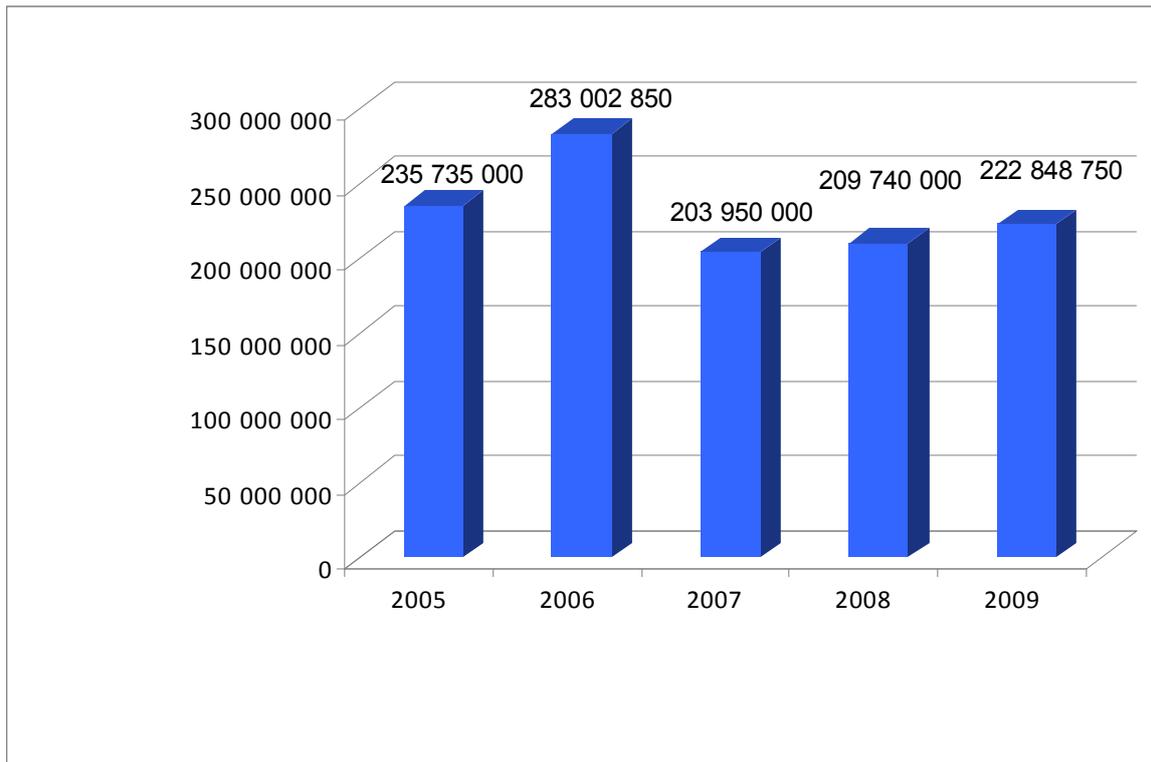


Figure 1 HAEA R&D contract trends from 2005 to 2009 (HUF)

The number of various performances described above are different from year to year, because during the R&D period several topics have become obsolete for example, the analysis of the first service shaft of the second unit, in this case the analysis of summary of the results have been carried out by the TSOs by the end of the period. In case of other topics we contracted at the end of the period (Nuclear Safety Regulation review, the development of associated new guidelines and rules of internal procedure and preparation for official duties incurred in establishment of new units). The workload of TSOs is variable, that's why we tried to contract on the basis of long term concepts and contract ad hoc assignments.

Significant part of the technical staff of the HAEA participated in the contract-related tasks (taking proposals, assess, evaluate proposals, received partial and final performance criticism). Accordingly, the R&D process was evaluated on the basis of opinion of our user-reviewer colleagues. As a result it we can say that during the R&D period the proportion of performances approved without any remark showed stable at above 80%, the overwhelming majority of remained performances were accepted with completion and only 1-2 % of all the performances had to be rejected. The R&D process serves well both the official utilization and the maintenance of our most significant TSOs knowledge base, the proportion of the directly (in short or medium term) utilized contracts exceed 80%, and the remaining 15-20% contracts provides maintenance of the expert knowledge of the TSO.

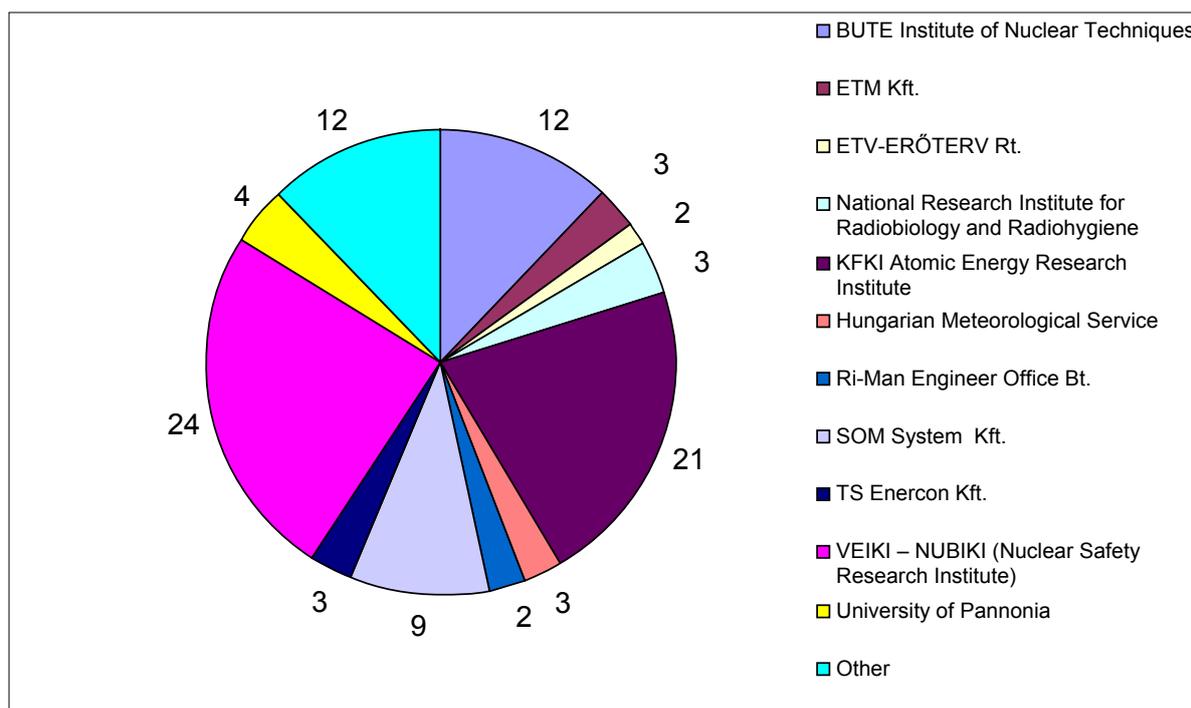


Figure 2 Distribution of number of HAEA R&D contracts by institution (%)

The creation and revision of knowledge profiles in 2006 proved to be useful. In the tested R&D period, only one case was that despite the expertise, one partner refused the requested TSO help.

5. Further aims and tasks

The most important task for 2010 is to reorganize the coordination of R&D activity, and to enhance the effective utilization of the R&D results. Expert groups have been working at the HAEA to enhance the utilization of R&D reports and to intensify the co-operation and the exchange of experience between colleagues of different generations. Their task is to review and comment the topical proposals and studies which are produced in the framework of HAEA's R&D mission.

It is also emphasised to see the tasks in larger units, therefore large extent of the R&D work is performed under for several years lasting plan. With this planning there is a lot of advantage:

- a) development of topics with great importance,
- b) analysis of topics in details,
- c) better balance of financing,
- d) better planning of R&D process,
- e) effective handling of human resources.

Our aim for the future is to enlarge the TSO network with other institutes for example universities and research institutes.