REPUBLIC OF LITHUANIA

State Nuclear Power
Safety Inspectorate (VATESI)

NUCLEAR ENERGY IN LITHUANIA: NUCLEAR SAFETY

Annual Report 2005

Vilnius 2006

CONTENTS

2005 was the first year when Unit 1 at the Ignalina Nuclear Power Plant was not operated as it had been shut down on December 31, 2004, in compliance with the protocol of Lithuania's EU accession. Nevertheless, some 70 percent of electricity generated in Lithuania came from the nuclear power facility. The documents of Unit 1 decommissioning were being developed intensely, and radioactive waste management was being upgraded.

The safety assessment of the Maišiagala radioactive waste repository was basically completed and an effort was made to select a site for a repository of low- and intermediate-level short lived radioactive waste in the vicinity of the Ignalina Nuclear Power Plant.

Discussions were held on the prospects of Lithuania's nuclear energy, the construction of a new reactor, extension of the operation of Unit 2, and the security of power supply.

Not a single event of higher than level one on International Nuclear Event Scale (INES) scale was recorded at INPP, not a single employee was subjected to exposure exceeding permissible levels, and radioactive emissions were lower than allowed.

VATESI received no information about violation of safe operation limits at INPP. The level of safety at the Ignalina nuclear power facility met nuclear safety requirements effective in Lithuania. VATESI did not have to impose sanctions, i.e. to shut down the unit or reduce its power, due to safety violations. However, delays in operations, inadequate technical documentation, the decreasing motivation to improve safety cause certain concern as regards assurance of nuclear safety in the future.

The mission and objectives of VATESI were the same as during previous years. Basically, we managed to implement the strategic plan approved by the Government of the Republic of Lithuania and the working plans of individual divisions. Unfortunately, delays did occur.

The specialists of our institution took a more active part in the activities of the EU and EC structures. VATESI representatives are members of two safety standards committees of the IAEA. We participated in projects of regional and national technical cooperation. Efforts were made to use the funds allocated by the EC for nuclear safety upgrading in a more rational manner.

Head of VATESI **Saulius KUTAS**

1. VATESI OBJECTIVES AND STRUCTURE

Establishment of the system of nuclear safety, whose objective consists in ensuring that the level of safety requirements set by the Republic of Lithuania meets international standards began after the country regained independence. The State Nuclear Power Safety Inspectorate set up on October 18, 1991, by the resolution of the Government fulfills these functions of regulation by the state. The Head of VATESI is appointed and discharged by the Prime Minister of Lithuania. VATESI is independent of other institutions and is answerable for its activities to the Government of the Republic of Lithuania.

The Ignalina NPP came under the jurisdiction of Lithuania in 1991, when Lithuania became independent again. Lithuania thus became the world's 31st country to use nuclear energy for generating electricity. It pledged itself, while operating Ignalina NPP, not to cause nuclear threat to mankind or the environment, and to use nuclear substances and technologies for peaceful purposes only.

To address nuclear safety issues functions were clearly divided between the operating and supervising institutions. In Lithuania it is Ignalina Nuclear Power Plant State Company that has the status of the operating organization. VATESI sets national nuclear safety standards, controls compliance with these at nuclear power facilities, other enterprises and organizations engaged in nuclear activities, takes appropriate enforcement measures, and, in case of flagrant violations of requirements, is entitled to suspend or discontinue altogether operation of the nuclear power facility.

An extremely important function of VATESI is to issue, after analyzing the documents submitted in accordance with the set procedure and examining the state of installations or a facility, licenses for nuclear activities, to establish the conditions of their validity and to control how the conditions are complied with.

VATESI issue, specify and approve in accordance with the set procedure documentation pertaining to nuclear energy, and supervise compliance with the requirements that ensure nuclear power safety.

In accordance with the Law on Nuclear Energy of the Republic of Lithuania, the Convention on Nuclear Safety, and recommendations of the International Atomic Energy Agency, the system of regulation of nuclear safety in the country is being continuously upgraded.

VATESI consists of five principal divisions.

Nuclear Material Control Division organize state accounting and control of nuclear substances, set the rules of accounting, supervise the physical protection of nuclear materials and nuclear facilities, participate in controlling export, import, and transit of commodities used in nuclear activities, cooperate with the IAEA and other international organizations and counterparts in other countries in the area of accounting and control of nuclear materials, maintain contacts with the Comprehensive Nuclear Test Ban Organization, and coordinate the activities of Lithuanian governmental institutions related with this Organization.

Decommissioning and Radiation Protection Division coordinate implementation of state regulation of nuclear power facilities decommissioning, control radioactive waste management, license spent fuel storage facilities, control INPP preparedness for emergencies, and notify international organizations and neighboring countries about nuclear accidents.

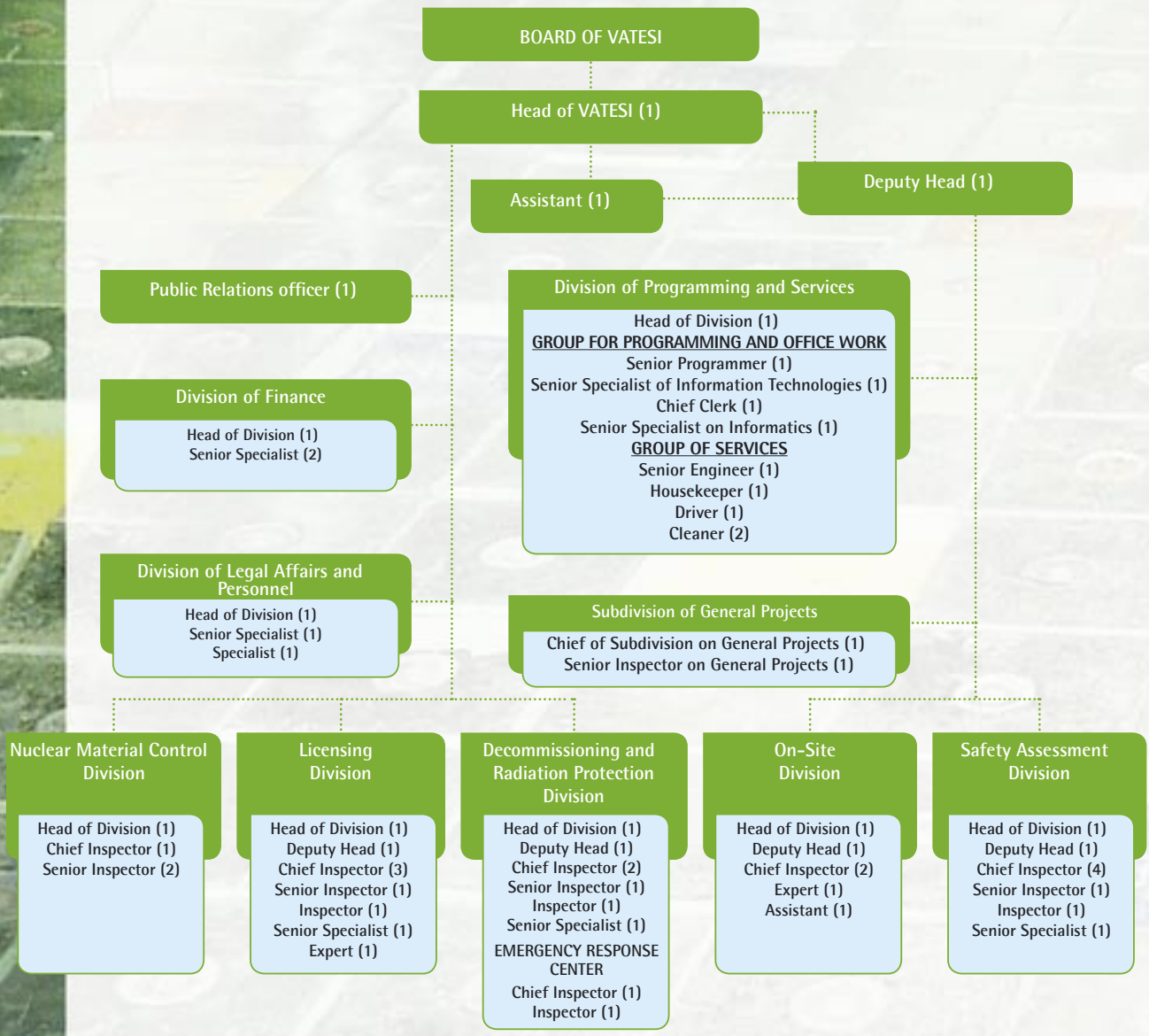
Licensing Division set the conditions for licensing Ignalina NPP and its safety systems, develop rules and regulations that govern INPP safety, assess the reliability of the safety-related systems, establish the operation conditions for INPP, elaborate conditions for licensing other nuclear activities.

On-Site Division at INPP carry out direct supervision at INPP, inspect safety systems, control personnel training, technological processes and repairs.

Safety Assessment Division assess design decisions, produce reviews of safety analysis reports, check the adequacy of the computer software used for safety assessment, and analyze the physical issues of the reactors.

VATESI also has divisions that carry out information, legal and financial activities, and provide economic services.

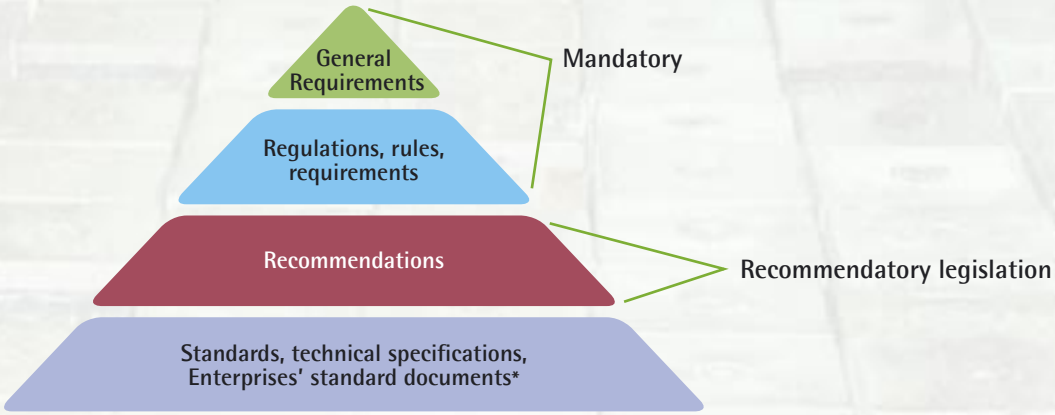
In all VATESI had 52 employees in 2005, including three doctors of sciences. 48 specialists have higher education diplomas. There are 15 in the 20-30 years category, 14 are between 31 and 40 years old, 11 and 6 fall into the 41-50 and 51-60 categories, respectively, another six are between 61 and 70 years old (as of 31 December 2005).



2. ADMINISTRATIVE REGULATION BY VATESI

In compliance with the Law on Nuclear Energy of the Republic of Lithuania, the provisions approved by resolution No. 1014 by the Lithuanian Government, dated July 1, 2002, and other legal documents VATESI performs public administration in the area of nuclear energy. One of the key areas of administration is regulation, i.e. setting nuclear safety requirements through rules, regulations and other legislation. In accordance with Article 4, part 2, of the Law on Nuclear Energy, safety standards and regulations are mandatory to all legal and natural persons.

Hierarchical diagram of VATESI legislation:



**The documents become mandatory after an organization chooses them and advises VATESI about it..*

In 2005, Head of VATESI approved the following legislature:

- General requirements for physical safety of nuclear power facilities and nuclear materials (P-2005-01).
- Requirements for analysis of impact of explosion and plain crash on nuclear power facilities (P-2005-02).

3. STRATEGIC PLANNING AND FINANCIAL ACTIVITY

VATESI activities are long-term and continuous. Priorities set by the Government of the Republic of Lithuania are always taken into consideration when planning them.

A single program, 04 *Public and Internal Administration of Nuclear Safety*, was being implemented in 2005 with a view to achieving the principal objective of the strategic plan of actions for the years 2005-7 that consists in ensuring a high level of safety of nuclear power facilities.

The objectives of the program are as follows: controlling compliance with nuclear safety standards and licensing conditions at nuclear power facilities; upgrading the systems of nuclear safety assurance and licensing at nuclear power facilities with international practice taken into consideration; conducting and enhancing internal administration. These tasks are being implemented and a common legal normative system of nuclear safety regulation and supervision is being developed with a view to reducing the probability of events and accidents at nuclear power facilities. The quality management system that is continuously being upgraded will improve the quality of VATESI internal administration and reduce the probability of errors or delays in making decisions.

The program is being implemented with funds from the state budget. In accordance with the *Law on approving the financial indicators of the state budget and municipality budgets* No. IX-2550 (Valstybės žinios, 2004, No. 171-6303), VATESI was allocated LTL 4,430,000 from the state budget. The funds from the state budget were used in an economical manner when implementing the program in 2005, and the articles of economic classification confirmed in cost estimates were adhered to. Therefore in many cases factual expenses were less than planned.

Book keeping at VATESI is conducted in accordance with *The Accounting Law of the Republic of Lithuania* and other legal documents related to book keeping as well as the accounting policy of VATESI.

In 2005, fixed assets of VATESI decreased by LTL 1,631,000.1, because three Technical Support Organizations (Vilnius Gediminas University of Technology, Kaunas University of Technology, and The Institute of Physics) were transferred for management, usage and disposal assets worth LTL 1,672,300. Fixed assets worth LTL 52,700 were written off as no longer suitable for further use. Computer hard- and soft-ware was purchased for LTL 75,000 with funds from the state budget. VATESI received as financial aid LTL 20,700 in 2005.

VATESI has no long-term credit or debit liabilities.

4. VATESI QUALITY MANAGEMENT

The decision to establish VATESI quality management system (QMS) was made on October 5, 2000, by order No. 21 of Head of VATESI. The general principles of QMS implementation and plans for preparation of documents were approved at the same time.

The implementation of VATESI quality management system is aimed at:

- Enhancing the efficiency of the Inspectorate's management;
- Optimizing the planning and use of the Inspectorate's resources;
- Assuring adequate licensing, safety assessment and supervision of nuclear power facilities;
- Assuring efficiency and control of the ongoing EU support projects;
- Assuring adequate training of VATESI staff;
- Assuring efficient management and use of information.

In 2005, the following VATESI QMS Level 2 documents were finalized and approved:

- Safety assessment procedure.
- Procedure for managing documents received and sent by VATESI.
- Accounting policy.
- Manual for assessing the results of certification of safety-related systems and elements at Ignalina NPP.

In addition to that, the following documents were reviewed and updated taking into consideration new requirements and with a view to defining in a more accurate manner the set procedure:

- The provisions for public information.
- EU support projects management procedure.

At present VATESI QMS comprises the following principal documents of Levels 1 and 2:

1. VATESI Mission.
2. VATESI Quality Manual (KU-I-01).
3. Safety assessment procedure (KU-II-0I).
4. Provisions for strategic planning of VATESI activities (KU-II-02).
5. Provisions for preparation of nuclear safety regulatory documents (KU-II-03).
6. Provisions for the training of VATESI staff (KU-II-04).
7. Provisions for governing public information (KU-II-05).
8. Procedure of VATESI inspection activities (KU-II-06).
9. Licensing procedure (KU-II-07).
10. Rules of financial control (KU-II-08).
11. EU support projects management procedure (KU-II-09).
12. VATESI internal procedure for coordinating EU matters (KU-II-10).
13. VATESI procedure for management of received and sent documents. (KU-II-11).
14. Manual for assessing the results of certification of important to safety systems and elements of the Ignalina NPP (KU-II-12).
15. Accounting policy (KU-II-13).

The list of VATESI QMS Level 3 documents is given in Appendix IV of Quality Manual. These documents set forth detailed requirements for carrying out specific tasks or activities.

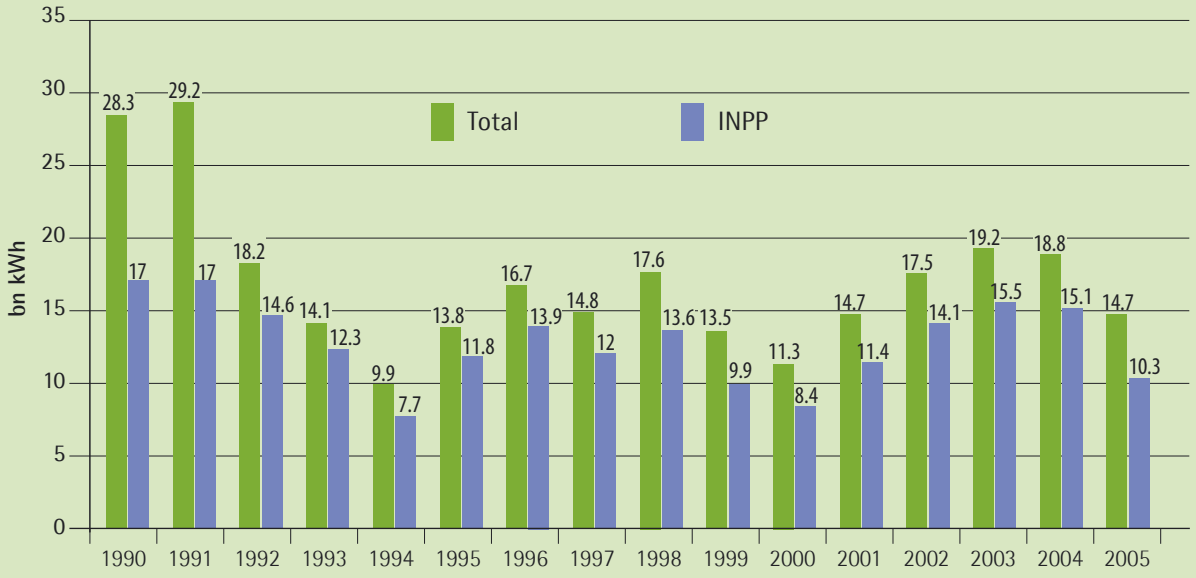
In 2006 VATESI QMS is to be further enhanced by developing new and updating the already approved quality management documents.

5. TECHNICAL AND ECONOMIC INDICATORS OF IGNALINA NPP

As of January 1, 2006, Ignalina NPP produced since the beginning of its operation 267.9 bn. kWh of electricity, 136.9 bn. kWh and 131.0 bn. kWh by Units 1 and 2, respectively.

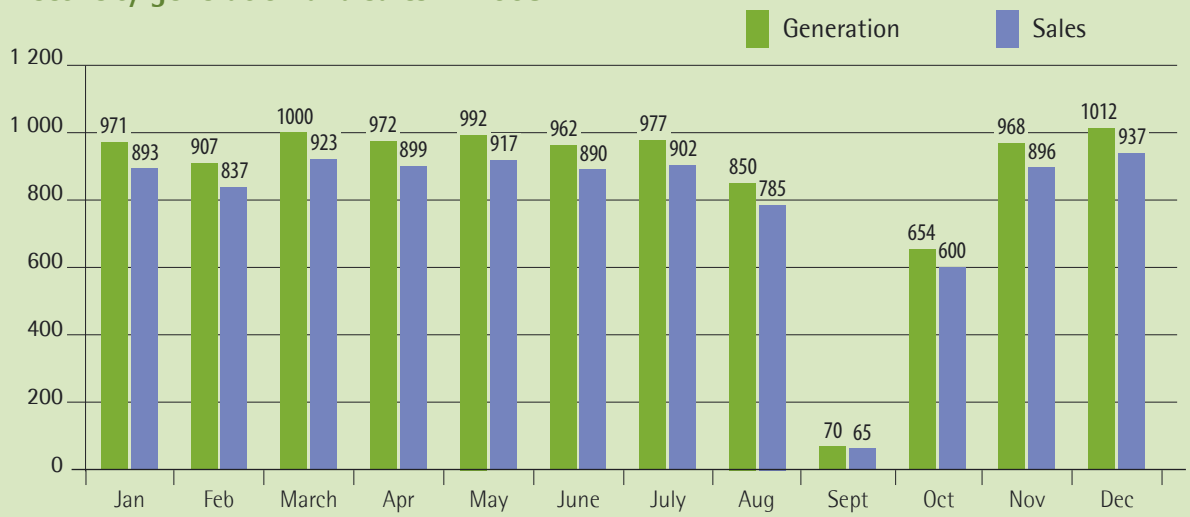
Although a single Unit (No. 2) was in operation since the beginning of the year, Ignalina NPP supplied in 2005 70.1% of electricity produced throughout Lithuania.

Electricity generation in Lithuania



Since the commissioning, 234.1 bn. kWh has been sold to consumers.
In 2005, Ignalina NPP produced 10,337.7 mn. kWh of electricity, or 4,763.9 mn. kWh less than in 2004.

Electricity generation and sales in 2005



9,544.1 mn. kWh was sold to AB Lietuvos energija in 2005, of which 5,635.4 mn. kWh was consumed in the domestic market, and 3,908.7 mn. kWh was exported to other countries. The exports decreased almost twice (7,439.3 mn. kWh was exported abroad in 2004).

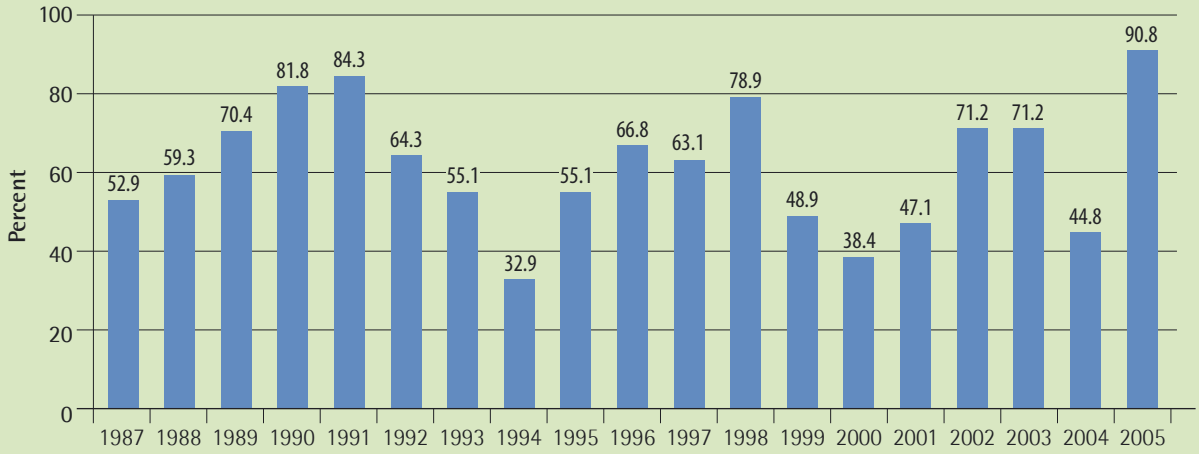
A high level of loading accounts for the stability of technical and economic indicators at INPP in 2005. There were much fewer dispatchers' limitations in 2005.

7.68% of the electricity generated was consumed for the facility's own needs (7.84% in 2004).

The capacity factor of INPP was 90.8% in 2005.

Capacity factor of INPP

(N_{inst} = 1300 MW)



The amount of electricity not generated because of plant deficiencies (emergency outings and capacity reduction) in 2005 was 133.75 mn. kWh or 1.2% of nominal electricity generation. Losses occurred due to a minor outing of the Unit resulting from a short circuit in the 330 V distributor of the Unit (August 5, 2005).

In accordance with IAEA rules, capability factors, the use of gross capacity and the amount of electricity that was not generated have been calculated for a Unit's gross capacity of 1300 MW.

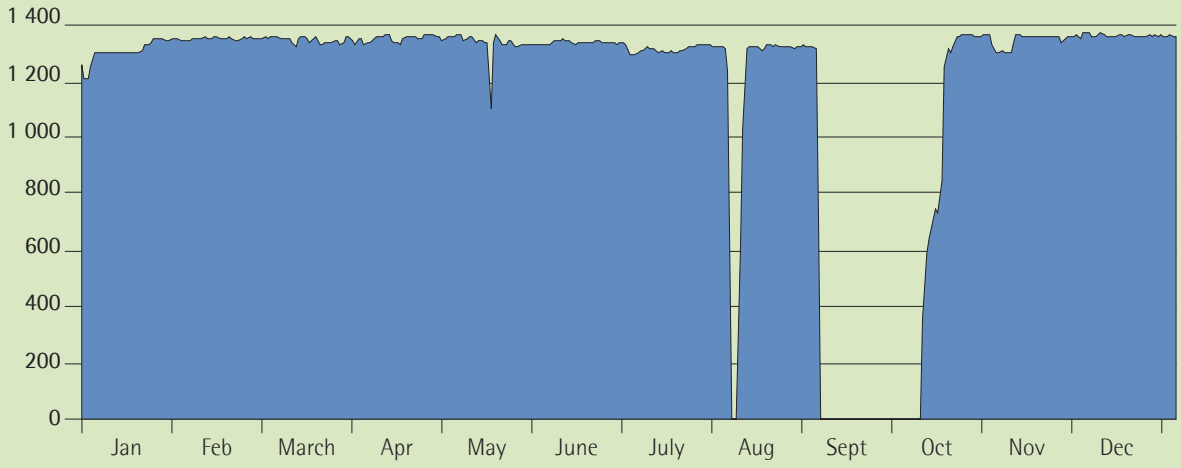
Electricity that was not generated

($N_{unit\ inst.}$ = 1300 MW)

Indicator	mln. kWh
Annual maintenance	1,171.6
Plant deficiencies (emergency outings)	133.8
Dispatchers' load limitations (reserve outage)	103.2
Total not generated	1,408.6

The stability and reliability level of Ignalina NPP was sufficiently high. Electricity losses (electricity that was not generated) were mainly due annual maintenances.

Unit 2 Load in 2005



May 17: Generator No. 3 tripped when the personnel were performing operations in the operational excitation circuit.

August 5: The Unit tripped when Generators Nos. 3 and 4 switched off as a result of an external short circuit in the transformer of Unit 2.

September 4–October 8: The Unit did not operate due to the annual maintenance.

Indicators of Unit 2 Operation in 2005

	Item	Unit	Reactor	G–3	G–4
1.	Gross capacity, MW	1500 (el.)	4800 (thermal)	750 (el.)	750 (el.)
2.	Licensed gross capacity, MW	1300 (el.)	4200 (thermal)	750 (el.)	750 (el.)
3.	Gross electricity generation, G Wh	10,337.7	–	5,327.8	5,009.9
4.	Net electricity generation, GWh	9,544.1	–	–	–
5.	INPP needs, %	7.68	–	–	–
6.	Relative heat consumption per kWh	2839 kcal	–	–	–
7.	Average load, MW	1321 (el.)	4042 (thermal)	694 (el.)	641 (el.)
8.	On-line hours	7826	7888	7679	7812
9.	Time availability factor, %	89.3	90.0	87.7	89.2
10.	Number of outages, of which • For annual maintenance • Unplanned • Reserve	2 1 1 –	2 1 1 –	3 1 2 –	2 1 1 –
11.	Number of startups	2	2	3	2
12.	Number of unplanned automatic scrams	–	1	–	–
13.	Capability factor, %	88.5	90.0	87.7	89.2
14.	Load factor N_{inst}=1500 MW, %	78.7	75.8	81.1	76.3
15.	Ditto, N_{inst}=1300 MW, %	90.8	86.7	–	–

6. IMPLEMENTING SAFETY IMPROVEMENT PROGRAM (SIP-3) AT IGNALINA NPP

It is stated in license validity conditions for Ignalina NPP Unit 2 operation that the operating organization is to implement on time safety improvement measures and to submit an implementation report to VATESI on a quarterly basis. It is stated in another condition of validity of operation license for INPP Unit 2 that based on the results of SAR-2 and RSR-2, the organization operating the Ignalina NPP is to prepare and submit to VATESI for approval the new safety improvement at INPP program SIP-3 by December 2004. The Ignalina NPP submitted the draft SIP-3 in December 2004, and on April 8, 2005, VATESI approved it.

Aleksandr Alejev (left) and Kęstutis Sabas, specialists of Licensing Division of VATESI, participated at the inspection of SIP-3 measures related to improvement of fire safety implemented at Ignalina NPP.

One hundred and fifteen SIP-3 measures are to be implemented at INPP in 2005-2008, 80, 24, and 7 measures in 2005, 2006, and 2007-2008, respectively, whereas 4 measures are being implemented continuously (Fig. 1).

In 2005, items were being implemented of SIP-3 that had not been accomplished when implementing SIP-2 in 2004 and envisaged in VATESI requirements and statements of inspections. The recommendations of safety case for the single Unit 2 operational at INPP, those of SAR and RSR for INPP Unit 2, the plan of measures of INPP Unit 1 decommissioning program, the recommendations of the International Physical Protection Advisory Service (IPPAS) mission, instructions of INPP police team of the State Border Guard Service, technical decisions by INPP, statements, plans of measures, safety upgrading modifications, etc. were also taken into consideration when producing SIP-3.

In 2005, INPP implemented and approved with VATESI 46 safety improvement measures, VATESI had comments on 9 and analyzed another 4. Twenty-seven measures were not implemented on time. INPP requested to have these measures included in SIP-3 for 2006. Due to technological reasons, a decision was made to delete three measures from SIP-3 (Fig. 2).

Fig. 1 **Implementation of SIP-2 measures by period**

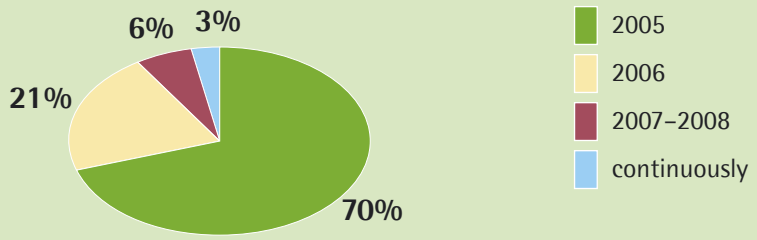
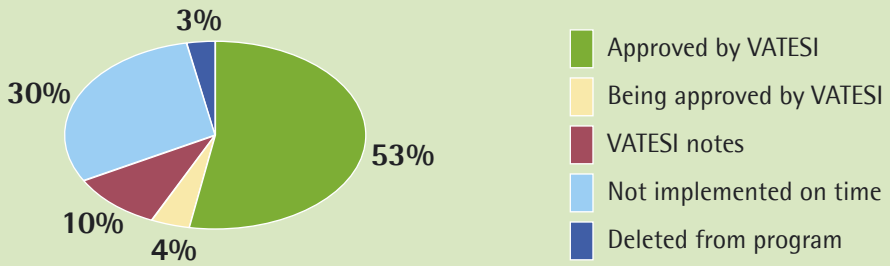


Fig. 2 **Implementation of SIP-2 measures in 2004**



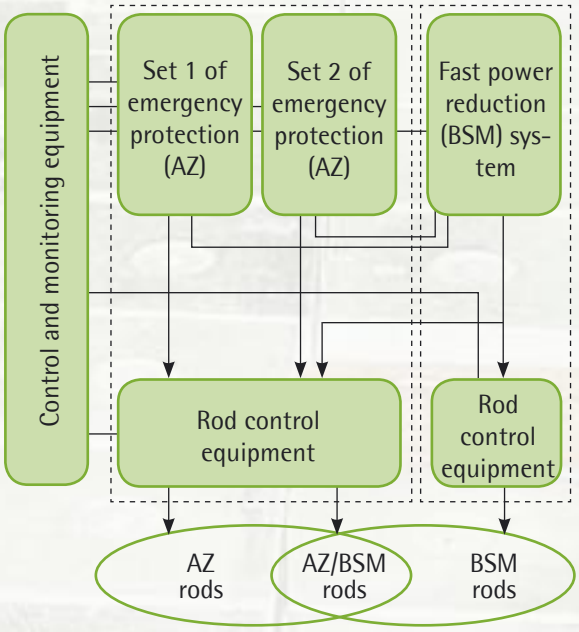
The following major SIP-3 measures for safety upgrading at INPP were implemented and approved in 2005:

- The safety parameter display system at Unit 2 was commissioned.
- The system of remote measuring and remote indication of electric parameters of circuit condition was modified.
- Valves of service water pumps and circulation pumps were manufactured and installed.
- Diagnostic software was installed in the information computing system for operative reactivity margin in the Emergency Protection System.
- Devices were replaced for recording technological parameters.
- Methodologies were developed for ultrasonic inspection of water piping welds in the emergency core cooling system and group distribution header.
- The procedure was prepared for testing the functions of the intermediate cooling system.
- Assessment criteria and permissible values of vibration were determined of feed water piping.
- Electric feed pumps were tested.
- Noise levels were measured in working rooms of the plant.
- Safety analysis of compacting device was performed.
- Analysis was performed of a container drop onto the lid of the transfer canyon in the central hall.
- Analysis was performed of computer codes of the thermal-hydraulic behavior of the Accident Confinement System.
- Analysis was performed of computer codes on the basis of calculation of heat conductivity of construction elements of the Accident Confinement System.
- Measures were implemented related to storage of spent nuclear fuel and management of radioactive waste.
- Measures aimed to improve fire safety at INPP were implemented.
- Measures of upgrading physical protection at INPP were implemented.

In the course of one of the inspections VATESI specialists checked implementation of INPP SIP-3 measures aimed at improving fire protection at INPP. Fireproof valves were examined in the compartments of block G2 of INPP building 101/2. As scheduled, floor covering was replaced with nonflammable material and an automatic audible fire-alarm was installed in building 120/2 and block B2 of building 101/2 as required in the recommendations of RSR of Unit 2.

7. INSTALLATION OF A DIVERSE SHUTDOWN SYSTEM (DSS) AT INPP UNIT 2

Shutdown systems of INPP Unit 2



The year 2005 was extremely important in the history of the operation of Ignalina NPP as two sufficiently redundant protection systems independent of each other and based on different principles ensured the safety of its single operational Unit (No. 2). After a detailed analysis of safety justification documents, permission was given in October 2004 for starting trial commercial operation of emergency protection sets 1 and 2, as well as the fast power reduction system.

In order to ensure additional protection against common cause failures, 49 new design actuators (servo drives)[1] for reactor control rods of emergency protection and fast power reduction system (AZ/BSM) are to be installed at INPP Unit 2 in 2006. In all, there are 211 control rods in the reactor. After installation of the new servo drives, the recommendation regarding introduction of a DSS in reactors of RBMK type given in the safety analysis for INPP Unit 1 of 1997 will be implemented.

In 2005, VATESI analyzed the final justification report of DSS. The presented information was based on "as built" DSS configuration, the test results and relevant conclusions were also included. This is the principal document of the project based on which a permit will be issued for operating the protection systems in industrial operation mode. INPP preparedness to operate DSS in industrial operation mode was also checked during an inspection. In the course of the inspection, application of DSS technical documentation, introduction of changes, and the procedure of familiarizing the personnel with updated information were examined. The progress in rectifying the non-compliances revealed in the final justification report of DSS was also checked.

Another area of work is related to the monitoring of design, manufacture and installation of new servo drives of AZ/BSM system. Analysis was conducted of the preliminary safety justification documents of new servo drives. In 2005, INPP contractors manufactured pilot samples of the drives and tested these at a plant. Specialists from VATESI and its TSOs participated at the trials. In the course of the testings, they gained more knowledge and information concerning the progress in the design and specific features of the project. They also submitted their recommendations as regards the ways of conducting the testings and their scope. Four servo drives were installed during the annual maintenance and their operation was tested in the operational unit. INPP drafted and submitted to VATESI for approval the testing programs. VATESI set additional conditions for ensuring safety.

AZ/BSM servo drive of new design.

During previous stages of DSS installation, i.e. when analyzing the preliminary safety justification, it was established that in the event of certain initial events

[1] A CPS drive is a device intended for changing the position of a CPS rod (see the photo).

protection systems would be actuated from different technological parameters and with a corresponding delay. Therefore it was recommended to conduct comprehensive analysis and to submit proposals for rectifying the situation. INPP submitted to VATESI technical specifications as regards installing into set one of emergency protection a protection signal in the event of flow decrease in distribution headers. After the documents were analyzed, the specifications were approved.

A detailed review of the preliminary safety justification of servo drives and other documents was envisaged in the new agreement of EU support program with TSOs that had taken part in the DSS project. Unfortunately, due to certain reasons mainly not dependent on VATESI the agreement was only signed in late November. Therefore the work on reviewing of the documents of DSS in 2005 was carried out within the framework of bilateral agreements with these organizations. GRS, Germany, and SercoAssurance, the United Kingdom, provided most assistance in doing the work.

Calendar of DSS installation in 2005

February	VATESI submits to Central Project Management Agency a technical task for initiating a project of support to VATESI in assessing and licensing the design of new servo drives and their commissioning in INPP Unit 2.
March	The technical decision analyzed regarding the procedure of keeping and using of emergency protection sets bypass keys. Lithuanian Nuclear Safety Advisory Committee (NSAC) meeting.
May	Technical specifications analyzed as regards installing in set one of emergency protection a protection signal in the event of flow decrease in distribution headers.
June	The final safety justification of DSS analyzed.
July	INPP submits the report on final justification of DSS.
August	INPP submits to VATESI for approval the preliminary safety justification of servo drives of AZ/BSM system. Specialists from VATESI and TSOs took part at the factory acceptance testing of the main sample of servo drive of AZ/BSM system at the factory in Pilsen (the Czech Republic).
September	VATESI approves the technical specifications as regards installing into set one of emergency protection a protection signal in the event of flow decrease in distribution headers. The programs of testing AZ/BSM servo drives analyzed and approved. VATESI approves the technical decision regarding the procedure of keeping and using the bypass keys. VATESI specialists take part at trials of a test batch at the factory in Pilsen (the Czech Republic). Announced special inspection *Checking the results of trial operation of DSS at INPP Unit 2 and the preparation for commercial operation conducted at INPP.*
October	Documents analyzed and comments submitted concerning commercial operation of DSS. Meeting of VATESI International Cooperation Group. Lithuanian Nuclear Safety Advisory Committee (NSAC) meeting.
November	VATESI signs an agreement with the Central Project Management Agency and Riskaudit within the framework of EU Transition Facility project regarding support to VATESI in assessing and licensing the design of new servo drives and their commissioning at INPP Unit 2.

As has already been mentioned, all the work related with the final installation of DSS is to be completed in 2006. Therefore the implementation of the project will be further controlled, the relevant documents will be analyzed and inspections conducted. After EU support agreement is signed, specialists from TAKO, Sweden, IRSN, France, and Itecha, Lithuania, will take part in the process of DSS analysis in 2006.

8. SUPERVISION OF OPERATION SAFETY AT IGNALINA NPP

Supervision by the State Nuclear Safety Inspectorate (VATESI) is being carried out through:

- Controlling of compliance by the personnel of organizations, enterprises and institutions, in the course of fulfilling their official duties, with requirements of technical standards;
- Controlling whether or not systems, elements and plant of nuclear power facilities meet the requirements of technical standards through ensuring supervision at all stages of design, operation, and closure.

Nikolaj Poluškin (right), expert of VATESI On-site Division, during the so-called cold tests of cementation facility conducted in June 2005.

Containers with radioactive waste are being loaded for transportation to the storage facility.

The principal task of the Inspectorate is to ensure that state regulation and supervision of nuclear and radiation safety at Ignalina NPP is carried out. Therefore the main activities of all divisions of VATESI are aimed at achieving this task.

The On-Site Division of VATESI at Ignalina NPP, while closely cooperating with other divisions of VATESI, is carrying out supervision of INPP operation and activities associated with it. The On-Site Division of VATESI is its structural unit that is continuously working at Ignalina nuclear power facility.

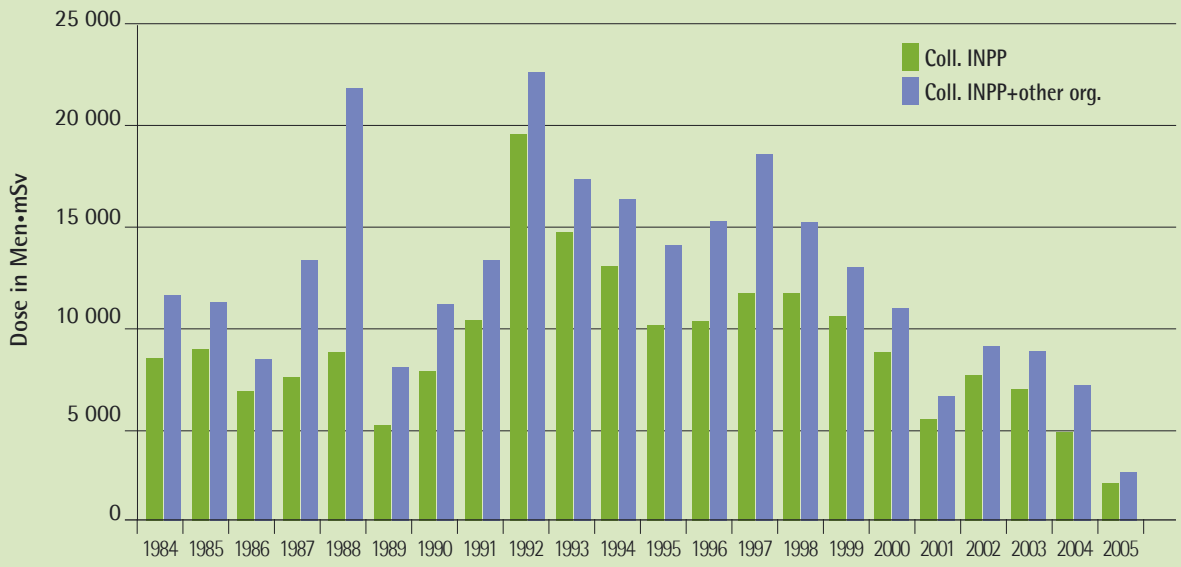
VATESI is carrying out supervision in accordance with the laws of the Republic of Lithuania, resolutions of the Government of the Republic of Lithuania, and nuclear safety standards (NUSS).

Supervision by VATESI is focused on control/preventive efforts, i.e. prevention of violation of NUSS requirements at all stages of licensed activities of the facility under control.

The areas of control/preventive work of VATESI:

- Systematic checks on compliance with NUSS requirements at all the stages of operation of nuclear power facilities.
- Issuing licenses for designing, constructing, manufacturing, adjusting, and repairing safety-related systems of nuclear power facilities, and supervision of compliance with license conditions.
- State supervision of registration and operation of pressurized components and airtight compartments of the Accident Confinement System.
- Approval of permits for operating pressurized components and piping at Ignalina NPP.
- Control of the personnel training and examination of their knowledge.

Fig. 1 **Collective annual exposure dose of Ignalina NPP and other organizations**



- Participation at examining the knowledge of senior and technical staff of facilities under control.
- Control of investigations of the causes of accidents and incidents as well as failures of safety-related systems at the plant; control of implementation of corrective measures.

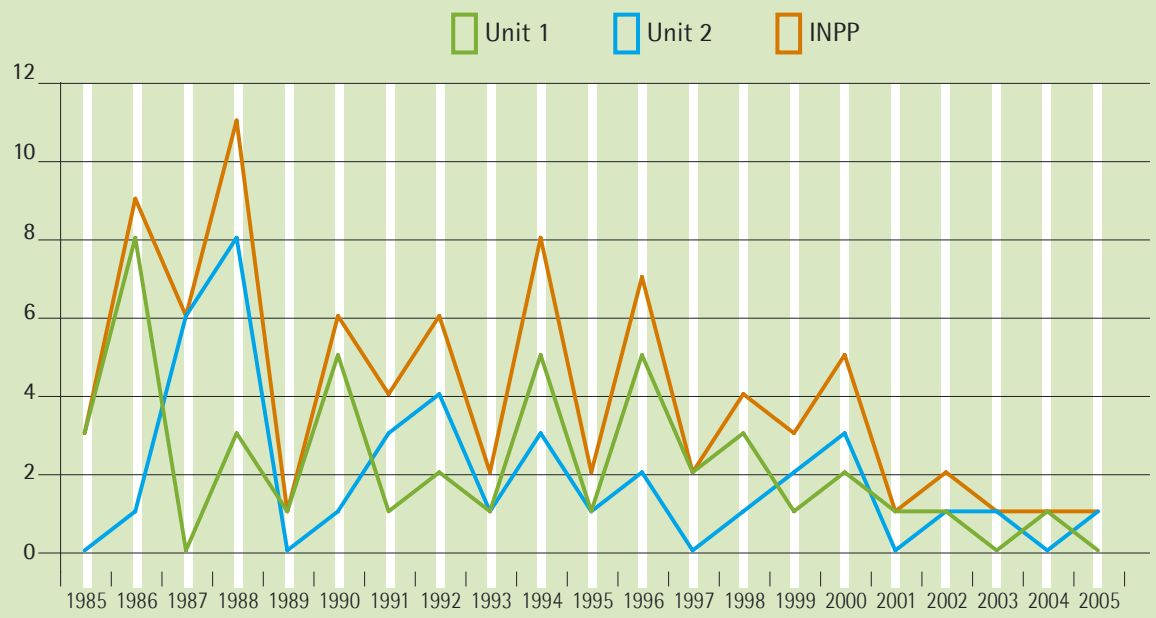
Inspections at INPP were conducted in accordance with a plan approved in advance. The results were recorded in reports, with requirements laid down to INPP management to eliminate the revealed deficiencies. Based on that, appropriate administrative and technical measures, including long-term, were developed and implemented. Also in accordance with the schedule technical inspections were carried out of pressurized vessels and piping, official reports were drawn up and entries made in passports.

The inspectors of the VATESI On-Site Division took part in the work of the panel that examined the knowledge of operational staff of Ignalina NPP. In 2005, the inspectors of the On-Site Division examined the knowledge of 133 high- and medium-level specialists of INPP.

In 2005, INPP Unit 2 was started up twice. In both cases comprehensive examination of the units was carried out, with appropriate authorizations being issued for each stage of starting up and the progress of their implementation being controlled through direct participation in the process.

In accordance with technical specification requirements, inspectors of the On-Site Division during operation and outages of INPP Units controlled execution of operations posing nuclear hazard, including identification of subcriticality of nuclear reactors after shutting them down, and testing efficiency of fast-acting scram rods. After Unit 1 was shut down, the required subcriticality was confirmed. In addition to that, control of measurements of physical-dynamical parameters of INPP Unit 2 reactor was carried out prior to shutting it for maintenance and after loading in accordance with an approved program into the core nuclear fuel of a new type containing erbium poison (8 checks).

Year	Unit 1	Unit 2	INPP
1984	32	0	32
1985	3	0	3
1986	8	1	9
1987	0	6	6
1988	3	8	11
1989	1	0	1
1990	5	1	6
1991	1	3	4
1992	2	4	6
1993	1	1	2
1994	5	3	8
1995	1	1	2
1996	5	2	7
1997	2	0	2
1998	3	1	4
1999	1	2	3
2000	2	3	5
2001	1	0	1
2002	1	1	2
2003	0	1	1
2004	1	0	1
2005	0	1	1



VATESI, when supervising operation safety of INPP, in 2005 reviewed and analyzed 53 technical decisions regarding modifications of safety-related systems.

VATESI specialists considering the compliance of the modified systems with design requirements and the results of checks on preparation for operation as well as the development of technical documentation and the personnel training, took decisions regarding the possibility of operating the systems.

In spite of shortcomings that still occur the results of INPP in terms of safety in the year 2005 are viewed positively. No cases were recorded of violations of conditions and limits of safe operation or unacceptable exposure of the personnel. The indicator of collective exposure dose decreased in comparison with 2004, mostly due to the fact that a single unit was operational.

The number of unplanned outages of nuclear power units is one of the most informative indicators of safe operation. In 2005, just as in 2004, the unit was only stopped once for an unplanned outage. The fact allows to conclude that safety improvement measures that are being implemented at INPP over the recent years, including upgrading of safety culture and quality assurance system, have been efficient and adequate.

Nerijus Rakštikas, chief inspector of VATESI On-site Division, is watching the testing of the device for automated closing of containers.

9. INSPECTION

VATESI like in previous years paid special attention to inspection of the controlled nuclear power facilities. The objective of inspections is to check the way organizations are complying with or planning to comply with nuclear safety requirements.

The General Procedure of VATESI inspections approved by the Order of VATESI Head on April 4, 2000, the quality system document of VATESI *The procedure of VATESI inspection activities*, KU-II-06, etc. are followed while conducting inspections.

The 2005 plan of inspections was approved after experience gained in inspection activities was assessed, the operational experience of the organization operating nuclear power facilities, the results of safety improvement program analysis, and conclusions regarding the control of compliance with license validity conditions as well as other documents were analyzed.

After an inspection is completed, the inspection team leader registers a signed statement at the Licensing Division, which is responsible for coordination of VATESI inspections. Twenty-nine statements of inspections were recorded in 2005.

On December 31, 2004, INPP Unit 1 was shut down and it no longer generates electricity. Nevertheless, as long as nuclear fuel remains in the reactor and storage ponds, the Unit is supervised in accordance with the license issued in 2004. VATESI specialists conducted two inspections in 2005 to check the way the operating organization had been supervising the shut down Unit 1. The inspections did not reveal any major deficiencies.

Most of the inspections were conducted in INPP Unit 2. VATESI specialists checked the results of trial operation of the diverse shutdown system, they wanted to know how maintenance was performed, how integrity of the Accident Confinement System was assured, how fire safety requirements of safety-related systems were being complied with, how modifications were introduced of the full-scope training simulator. They were also interested in the progress in analysis of design-basis and beyond-design-basis accidents, in operation of seismic warning and monitoring systems, and how measures envisaged in the program of management of aging of safety-related systems were being implemented.

Four inspections of nuclear material control and IAEA safeguards were conducted jointly with IAEA experts at INPP and its interim spent nuclear storage facility of dry type. In 2005, like in previous years, physical protection inspections were conducted at the INPP. Operations of radioactive waste management, upgrading of probabilistic safety assessment, transportation of nuclear material and other issues were examined.

VATESI sends a registered statement of inspection to the organization that was inspected and the latter draws up a plan of measures aimed at putting right the indicated shortcomings. VATESI specialists control the way the shortcomings are rectified. If VATESI reveals flagrant violations in the activities of the inspected organization, it is entitled to impose appropriate sanctions. No violations of this kind were identified in 2005.

In the course of IAEA expert mission that took place in August 2005, organization and execution of inspection activities by VATESI were examined. The results of the mission will be presented in the report of IAEA expert mission.

VATESI understands the importance of inspection activities. Therefore in 2005 the Inspectorate submitted a proposal to the IAEA as regards arranging a training course in inspection issues in Lithuania. The IAEA approved the proposal. The course is to be held in late 2006.

10. ASSESSMENT OF THE USE OF OPERATIONAL EXPERIENCE

Potential flaws in the design, procedures or operation of nuclear power facilities cause unusual events at NPPs. The objective of analysis of events and operational experience as a whole consists in learning from experience gained and using this information for improving safety at a nuclear power facility, most importantly, for preventing accidents and recurrence of similar events with severer impacts.

The Ignalina NPP notifies about unusual events, analyzes them and submits reports to institutions concerned in accordance with *General Requirements Concerning Notification about Events at NPPs* set by VATESI.

VATESI has a permanent Commission of Unusual Events Analysis which assesses events recorded at nuclear power facilities. The Commission analyzes reports on unusual events and their importance to safety, and submits recommendations and additional requirements to the operating organizations.

In 2005, INPP Unit 2 was stopped for unplanned reasons once when on August 4 generators 3 and 4 tripped due to actuation of differential protections. The protections were actuated as a result of a short circuit caused by the personnel error when switching on the Unit's transformer after repairs. It should be noted that Unit 2 operation was disrupted when repairs were being made of Unit 1 equipment.

Twenty-one unusual events were recorded at INPP in 2005, 7, 10 and 4 in Unit 1, Unit 2, and facilities common to both Units, respectively.

The number of unusual events in Unit 1 in 2005, in comparison with that in 2003 and 2004 when the Unit was still operational, remained stable. The analysis of events at the Ignalina NPP allows to conclude that although Unit 1 no longer generates electricity, its safety control merits the same attention as before. The number of events in Unit 2 in 2005 was virtually the same as in 2004 (10 and 9, respectively).

In accordance with the International Nuclear Event Scale (INES), 13 of the total of 21 events of 2005 were out of the scale, and another 8 were rated as level 0. Not a single event was recorded of level 1 and upwards. Limits of safe operation of INPP were not exceeded as a result of the events.

Most of the events in 2005 were caused by malfunctioning of equipment and the personnel errors. The number of events due to equipment malfunction grew stable (9 in 2004 and 2005). The number of events due to the personnel errors decreased in 2004 but then increased considerably (9 in 2005 against 5 in 2004). Three of the events were caused by deficient procedures.

The Commission of Unusual Events Analysis of VATESI held 11 meetings in 2005, at which 17 reports on unusual events at the Ignalina NPP were analyzed and comments were submitted to INPP.

The introduction of the system of safety indicators at INPP was continued in 2005. When trial operation of the indicator system was completed and experience gained in its course was assessed, changes were made in the *Methodology of calculating safety indicators* and in the *Instructions on collecting and processing data for calculating safety indicators*. Therefore the values of safety indicators of the previous period were recalculated (Figs. 6-8).

As principal and special safety indicators are identified somewhat conventionally, their values describe safety condition in qualitative manner only and are used for analyzing trends. Safety indicators alone should not be used for assessing safety at the Ignalina NPP. They can only be applied efficiently together with other safety assessment measures, such as inspections, audits, probabilistic safety assessment, self-assessment, etc. The analysis of trends in changes of all the abovementioned indicators in 2005 showed the level of safety at INPP to be acceptable.

In late 2005, a special inspection took place at INPP to check whether the system of the use of operational experience met the requirements set by VATESI and procedures effective at the nuclear power facility. Attention was focused on the process of introduction of the safety indicator system in INPP. The commission conducting the inspection stated that a lot had been done in developing the system, however, the success of its introduction will largely depend on whether or not the management and specialists of INPP divisions will be interested in the process, approve of it and allocate the necessary manpower. The system of safety indicators will be further improved at INPP in 2006.

Fig. 1 **Emergency shutdowns of INPP Unit 2 in 1992-2005**

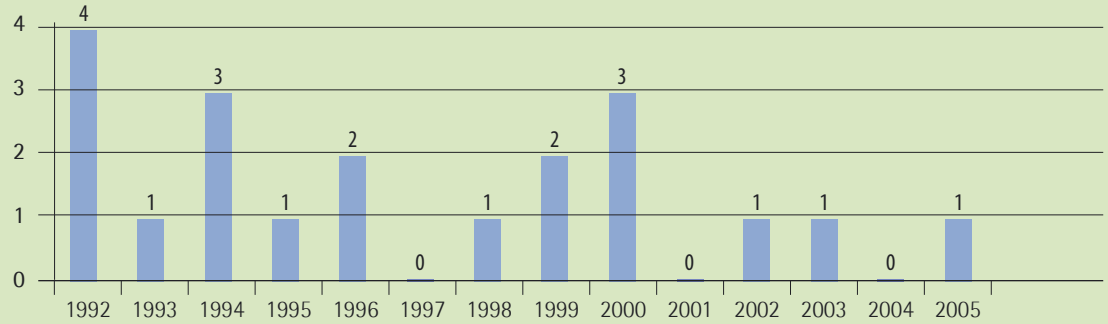


Fig. 2 **Unusual events in 1990–2005**

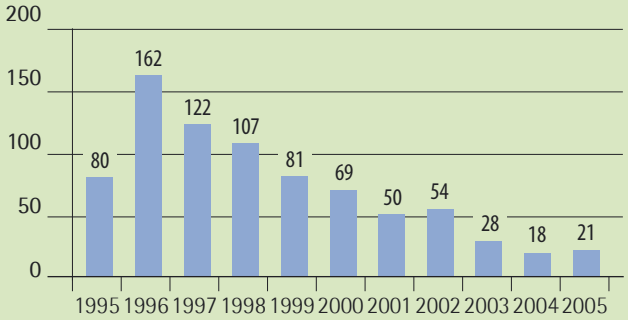


Fig. 3 **Distribution of unusual events by Units**

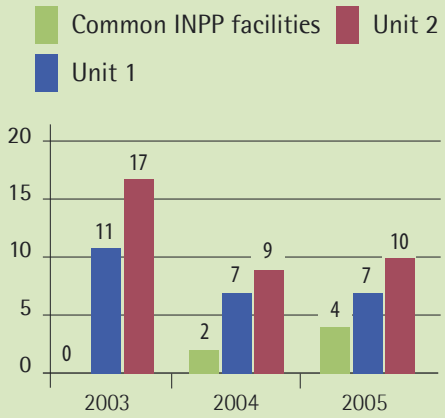


Fig. 4 **Causes of unusual events in 2005**

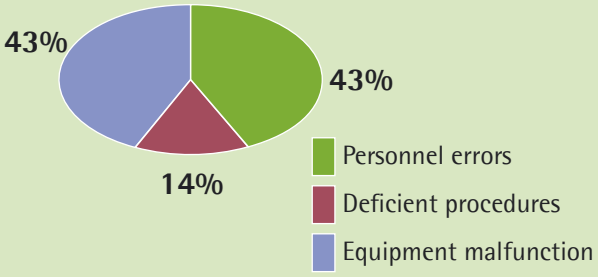


Fig. 5 **Distribution of events according to INES**

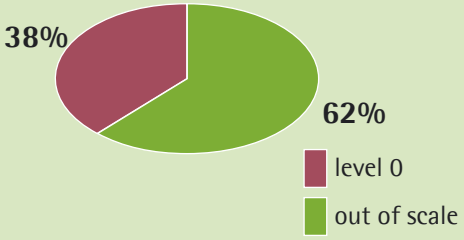


Fig. 6 **Trends in changes of principal safety indicators in 2005**

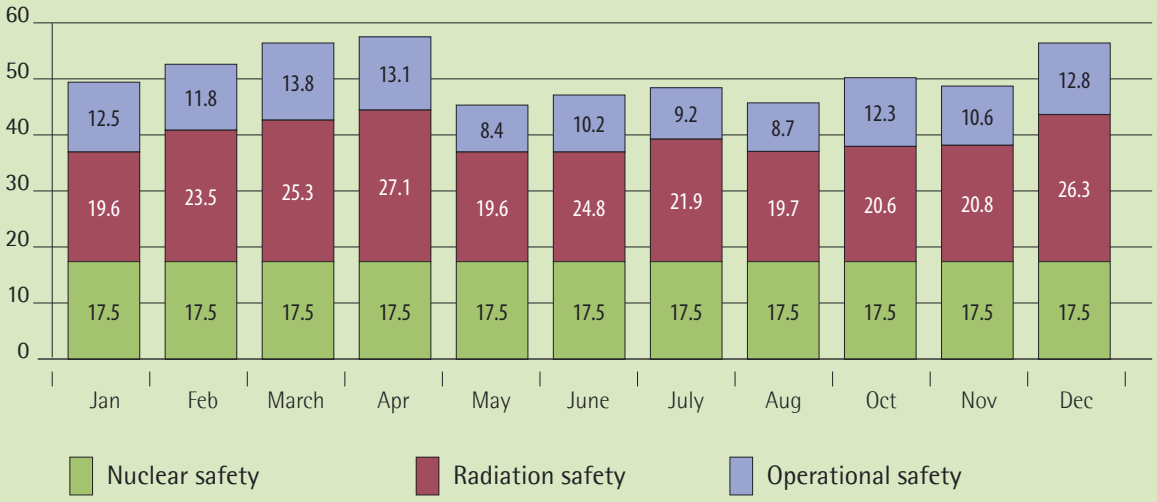


Fig. 7 **Trends in changes of special safety indicators in 2005**

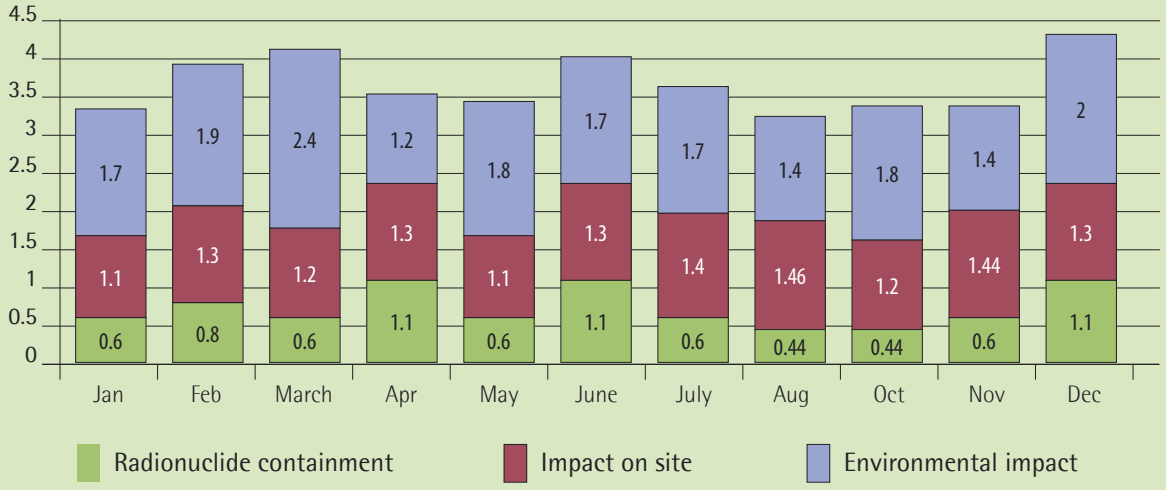
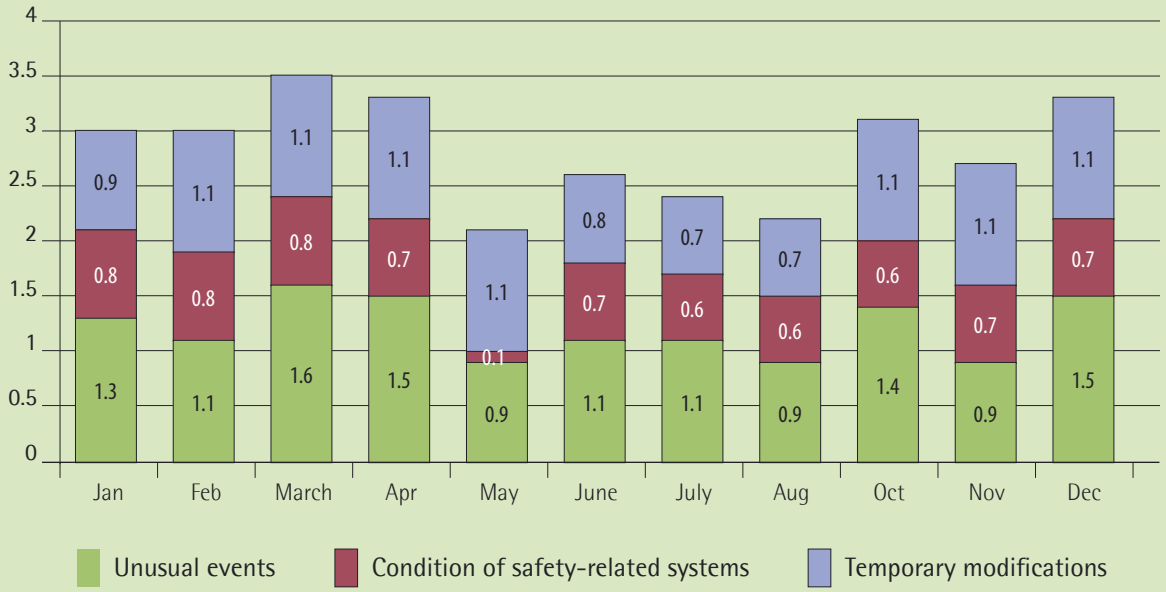


Fig. 8 **Trends in changes of special operational safety indicators in 2005**



Note: In September INPP did not operate due to annual maintenance.

11. SAFETY CULTURE AT IGNALINA NPP

In accordance with Article 27 of the Law on Nuclear Energy of the Republic of Lithuania, the organization operating the nuclear power facility must ensure adequate safety culture.

Safety culture comprises specific features and characteristics of the organization's activities as well as human behavior ensuring that the issues of a nuclear power facility's safety will be given attention consistent with their importance.

To ensure adequate level of safety culture, Ignalina NPP has been following IAEA recommendations. The INPP draws up and implements plans of safety culture assurance every year. The Director General meets with IAEA personnel on a regular basis and discusses issues that hold most interest for them.

In 2005, INPP management reviewed and approved on September 30 the new policy of safety and quality assurance. The document differs from the policy approved in 1995 in that priorities are set for INPP decommissioning. It is emphasized that INPP Unit 2 operation must be terminated in the most efficient and safest manner, with adequate social security of the personnel assured and effective management system of the facility maintained.

The work commenced in 2004 at the Ignalina NPP on identification and application of safety culture indicators was continued in 2005.

Table 1. **Results of calculations of safety culture indicators**

Indicator of safety culture		Maximum positive value	2004 3rd qr.	2004 4th qr.	2005 1st qr.	2005 2nd qr.	2005 3rd qr.	2005 4th qr.	Trend of change
$И_{1.1}$	Training process at INPP	1	0	1	1	1	1	1	unchanged
$И_{1.2}$	External training process	1	0	0	0	1	1	1	unchanged
$И_{2}$	Implementation of recommendations of Safety Committee	1	0.625	0.778	0.4	0.500	0.333	0.333	unchanged
$И_{3.1}$	Implementation of corrective measures developed on the basis of audit results	1	0.333	0.129	0.216	0.216	0.333	0.486	favorable
$И_{3.2}$	Implementation of corrective measures developed on the basis of safety inspection results	1	0.207	0.604	0.601	0.609	0.735	0.883	favorable
$И_{4}$	Recurrence of events	1	1.0	1.0	1.0	1.0	1.0	1.0	unchanged
$И_{5.1}$	Trends in wrong actions by personnel in case of unusual events	1	0.833	0.625	0.333	0.500	0.500	0.750	favorable
$И_{5.2}$	Trends of personnel actions	1	0.736	1.0	1.0	1.0	0.319	1.0	favorable
$И_{6.1}$	Taking into account proposals submitted to management by personnel	1	0	0	0	0	0	0	unchanged
$И_{6.2}$	Taking into account personnel's proposals regarding modifications	1	1.0	1.0	1.0	1.0	0.905	1.0	favorable
$И_{6.3}$	Taking into account personnel's proposals to use own and operational experience	1	0	0	0	0.118	0.285	0.042	unfavorable
$И_{К Б}$	Safety culture level indicator for quarter under consideration	100%	43.0%	55.8%	50.4%	63.1%	58.3%	68.1%	favorable

In accordance with agreement reached between VATESI and INPP, the latter is to prepare on a quarterly basis and submit to the former reports on decommissioning safety culture issues. The information comprises:

- progress in implementation of decommissioning projects;
- events at INPP;
- management of INPP personnel (personnel turnover, incidence of disease, application of encouragement and/or disciplinary measures);
- implementation of the planned safety culture improvement measures;
- informing the personnel.

VATESI, whilst assessing safety culture at INPP, analyzes regular safety culture reports and the data of safety culture indicators. In VATESI's opinion, INPP must continue upgrading the parameters of safety culture monitoring with a view to identifying potential safety culture problems and taking appropriate measures on time.

During the safety culture inspection conducted by VATESI on November 16-18, 2004, INPP activities in the area of safety culture basically were viewed favorably. However, certain non-compliances with valid requirements were also identified. INPP management approved on January 17, 2005, the plan of corrective measures and has been implementing it.

In 2005, VATESI completed the PHARE project Support to VATESI for safety culture and organizational issues specific to the pre-shutdown phase of Ignalina nuclear power plant. In the course of the project implementation Western European experts in nuclear safety together with VATESI specialists:

- Identified critical safety culture and organizational areas that may affect the decommissioning of the nuclear power facility;
- Assessed the key safety culture and organizational problems at INPP; they participated in the 2004 safety culture inspection at INPP;
- Produced *Guide for management of safety culture issues specific to the pre-decommissioning phase of Ignalina Nuclear Power Plant.*

VATESI specialists have been improving the above document. A joint meeting was held of VATESI and INPP specialists where the draft document was discussed and INPP representatives presented their comments and proposals. VATESI is planning to approve a regulatory document in 2006.

To assess safety culture at INPP, VATESI specialists have been analyzing various areas affecting safety culture (see the Fig. below).

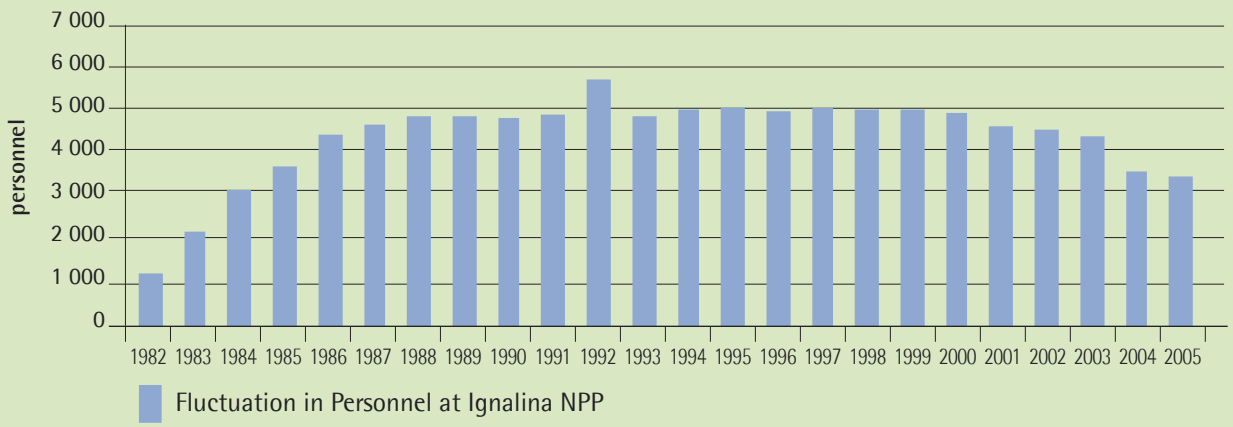
The importance of none of the areas can be underestimated, however, attention should be focused on the significance of human resources and knowledge management in light of INPP decommissioning.

Now that INPP Unit 1 was shut down and preparations are under way for the facility's decommissioning, its personnel is continuously being reduced and it is planned to increase the number of personnel dropped every year.

Table 2. **INPP personnel turnover in 2004 and 2005**

Number of INPP personnel	Quarters of 2004		Quarters of 2005			
	3rd	4th	1st	2nd	3rd	4th
Hired by INPP	13	9	7	17	11	14
Dropped by INPP	17	23	24	40	43	65
Total	3531	3517	3500	3477	3445	3394

Changes in INPP personnel in 1982–2005



The decommissioning process of INPP and the resultant decreasing number of its personnel cause additional earthly concerns to those working at the facility as many may lose their jobs in the nearest future and thus be left without a constant source of income. Therefore motivation for working at the power facility decreases, and some employees find jobs not related to INPP. Motivation problems are hard to assess, yet they may affect workmanship. That's why while reducing INPP personnel adequate social security of the personnel made redundant needs to be assured and they ought to be thoroughly informed about other job opportunities, first of all in the area of INPP decommissioning.

In accordance with the data on migration from Lithuania by the Department of Statistics, in 2005, the largest number of population emigrated from Visaginas – 16.3 per thousand residents, or 500 persons in a single year. Most of them were young, professionally active people.

The continuous reduction of INPP personnel, its aging, minimal opportunities for young specialists to be hired at the facility, the nearly-absent interest of young people in nuclear energy and the current trends of emigration in the town of Visaginas may bring about a shortage of skilled personnel at INPP in the nearest future. Therefore INPP management should take additional measures to assure human resources and knowledge management, given the future demand for skilled specialists as long as Unit 2 remains in operation and decommissioning operations are ongoing. The founder of the nuclear power facility and institutions responsible for social security issues should provide considerable assistance in coping with the topical issues of personnel management at INPP.

12. SAFETY ASSESSMENT AT IGNALINA NPP

As recommended by the International Atomic Energy Agency (IAEA), safety assessment, as well as identifying requirements, licensing, inspection activities and application of coercion measures were the principal functions of the state institution implementing nuclear safety regulation. The objective of safety assessment is to analyze throughout all the stages of nuclear facilities' service life the documents submitted by the operating organizations and the information gained during inspections conducted with a view to ascertaining that:

- The available information makes it possible to determine the safety of the facility or proposed activity;
- The information submitted is accurate and sufficient to confirm that the set nuclear safety requirements are being complied with;
- Technical and organizational decisions, new ones in particular, are based on experience or trials and ensure the necessary level of safety.

All specialists of VATESI participate one way or another in review of safety analysis and justification reports, technical decisions, work programs, instructions and other documents submitted by INPP. To organize this work and to fulfill the functions of nuclear safety regulation in certain areas, the Safety Assessment Division was set up at VATESI in 1996. At present it has on its staff specialists in reactor physics, mathematical simulation and analysis of transients and accidents, assessment of operational safety and industrial experience, control and management systems, and probabilistic safety assessment. Whilst performing its functions, the Division coordinates the work on nuclear safety assessment at VATESI, organizes reviews of safety analysis reports of INPP, as well as reviews of documents related to the installation of the Diverse Shutdown System, modifications of the reactor core, and other safety justification documents.

(Left to right) Employees of Safety Assessment Division, Dr. Evaldas Kimtys, Saulius Švirmickas, Rimantas Semėnas, Division Head Michail Demčenko, Deputy Division Head Dr. Emilius Vanagas, chief inspector Dainius Brandišauskas and senior specialist Laima Bružaitė, at the technical meeting.

Relatively few specialists in nuclear safety are on the staff of VATESI, therefore it would be impossible to carry out this important work adequately without the assistance that is being provided by Lithuanian Technical Support Organizations (TSOs), including the Lithuanian Energy Institute (LEI), the Institute of Physics (FI), Kaunas University of Technology (KTU), and other institutions. Part of the work is being done with the assistance from the support projects of the EU and the UK. Of extreme importance is assistance from the IAEA that helps to address issues related with the staff training and familiarizing with the most recent international experience.

The document of quality assurance system *The Procedure of Safety Assessment* was approved in 2005. Responsibilities of VATESI staff, the aims and results of safety assessment, the types of documents being analyzed are set forth in the document, and safety assessment activities are described. They comprise acceptance of documents, preparations for carrying out safety assessment, execution of assessment, the way a decision on assessment results is to be taken and documented, and the application of experience gained in the course of assessment.

Work on safety assessment and the results achieved by the specialists of the Safety Assessment Division are described in more detail in the chapters *Installation of a Diverse Shutdown System (DSS) at Ignalina NPP Unit 2, Assessment of the Use of Operational Experience, Analysis and Upgrading of Reactors' Physical Properties, Analysis of Design-Basis and Beyond-Design-Basis Accidents, Probabilistic Safety Assessment (PSA), Safety Case for Single Operating Power Unit 2 of INPP,* and *The Project of Utilization of INPP Unit 1 Fuel in Unit 2.*

13. ANALYSIS AND UPGRADING OF REACTORS' PHYSICAL PROPERTIES

Since 1995, upgrading of neutron-physical properties of INPP reactors has been carried out along two main lines, viz. through introduction of higher enrichment fuel with burnable neutron absorbers, and the introduction of control rods of a new design.

In 1997, the design uranium oxide fuel of 2 percent enrichment was replaced with uranium oxide fuel of 2.4 percent enrichment containing burnable erbium poison. Later on, the enrichment was increased to 2.6 percent. During the second half of 2005 they started loading into INPP Unit 2 a pilot batch of uranium-erbium fuel of 2.8 percent enrichment. It is planned to use this fuel on a regular basis later on. Introduction of uranium-erbium fuel has made it possible to give up additional neutron absorbers that maintain void reactivity coefficient within safe limits, as the absorber is in the fuel proper. Therefore, with nuclear safety characteristics remaining the same or even improving, the reactor core structure is optimized and thus economic indicators are considerably improved. The transition to uranium-erbium fuel and withdrawal of additional absorbers from the core has been gradual. As a result, average burnup of the unloaded spent nuclear fuel increases noticeably, and the amount of fuel consumed decreases.

The main objective of introducing control rods of the new design consists in reducing the reactivity effect related to the voiding of the cooling circuit of the Control and Protection System in the event of a potential accident. By 2004, most of the manual control rods of the old design (131 and 127 at Units 1 and 2, respectively) were replaced with those of type sb. 2477. The planned replacement has been completed. A pilot batch (4 control rods) of even more advanced control rods of the so-called cluster type was installed in Unit 2 in 2004. In 2005, another 24 rods were installed. In all, 61 rods of this type are to be installed by 2008.

The modification of the reactor core greatly improves certain safety-related characteristics: the reactivity effects of voiding of the Primary Circuit and of the cooling circuit of the Control and Protection System decreases, the neutron flux becomes more uniform, and as a result the reactor becomes easier to operate and more proof against potential accidents.

The new fuel is being introduced, additional absorbers are being given up, and new control rods are being installed simultaneously. This is a challenging task, therefore it is necessary to plan and forecast changes in neutron-physical properties in a thorough and detailed manner.

Specialists of the Nuclear Installations Safety Laboratory (NISL) of the Lithuanian Energy Institute (LEI), and the Institute of Physics (FI) have been rendering considerable support to VATESI in analyzing the programs of switching over to the new fuel and the use of control rods of the new design. To enhance the competence of specialists of VATESI TSOs in this area, the project by the Department of Trade and Industry of Great Britain of nuclear safety program of support to VATESI L16 *Reactor core integrity surveillance* was started in 2005.

Although INPP Unit 1 has been shut down, its reactor's physical properties will be monitored until all nuclear fuel has been removed from it.

Progress in modification of INPP reactor core (data as of the end of the year)

Power unit	Year	Part of fuel in the core				ANA	Average burnup, MWd/FA	Control rods of new design, pcs.	
		2%	Uranium-erbium						
			2.4%	2.6%	2.8%			sb. 2477	CRO
1-asis	2004	5%	35%	60%	0%	1	1320	131	0
2-asis	1995	94%	6%	0%	0%	53	851	24	0
	1996	81%	19%	0%	0%	41	919	48	0
	1997	54%	46%	0%	0%	17	1038	71	0
	1998	36%	64%	0%	0%	5	1148	71	0
	1999	12%	88%	0%	0%	8	1247	96	0
	2000	9%	91%	0%	0%	4	1247	96	0
	2001	6%	91%	3%	0%	4	1229	96	0
	2002	7%	69%	24%	0%	4	1248	127	0
	2003	8%	44%	48%	0%	4	1294	127	0
	2004	8%	33%	60%	0%	4	1308	127	4
	2005	6%	8%	79%	7%	2	1378	103	28

ANA – additional neutron absorbers; CRO – cluster regulating organ (rod)

14. ANALYSIS OF DESIGN-BASIS AND BEYOND-DESIGN-BASIS ACCIDENTS

In 2005, state-of-the-art deterministic safety analysis and assessment technologies were being intensely mastered. VATESI specialists extended their knowledge of physical and chemical processes taking place in the reactor core, in the Main Circulation Circuit (MCC) and the Accident Confinement System ACS) in case of design-basis and beyond-design-basis accidents.

On January 17-21, representatives of VATESI, TSOs and the Ignalina NPP participated at the workshop on severe accident phenomenology. The phenomenology and simulation of the reactor core degradation at the early and late stages, peculiarities of hydrogen and fission products release from damaged fuel elements, specific properties and simulation of transfer of fission products and chemical reactions in the MCC and ACS were analyzed at the workshop. The participants were given information about the Phebus FPT1 experiment. Dr. W. Plumecocq and Dr. M. Zabiego from IRSN (Cadarache, France) delivered lectures at the workshop.

On January 24–February 4, representatives of VATESI and the Lithuanian Energy Institute (LEI) participated in the course on the job training on preparation of input decks and application of the coupled best-estimate code ATHLET-QUABOX/CUBBOX for RBMK-1500 reactor at GRS (Garching, Germany). During the course GRS specialists, Prof. S. Langenbuch, Dr. M. Clemente, Dr. K. Velkov, Dr. G. Lerchl, Dr. H. Austregesil and Dr. K. Trambauer gave lectures on the structure of ATHLET-QUABOX/CUBBOX code, its improvement, validation and application in safety assessment of reactors. The lecturers presented information about the methodology of coupling of the codes, the structure of input data, peculiarities and capabilities of computations. In the course of practical sessions, the participants learned to install the code. Test calculations of the reactor's steady state and accident process were performed with the preliminary RBMK reactor model. As GRS staff have developed ATHLET and QUABOX/CUBBOX code, the questions and uncertainties that arose during lectures were solved directly with the specialists working at the Center. Therefore the process of questions and answers was very efficient and productive. The developed ATHLET-QUABOX/CUBBOX version has not yet been completely validated. The views expressed by specialists of both countries in the course of the visit regarding the extension of the coupled code coincided, therefore the decision was made to look for ways of initiating mutual cooperation in development and validation the RBMK-1500 reactor model for numerical analysis with the coupled version.

On February 14-18, representatives of VATESI, TSOs and the Ignalina NPP participated in ASTEC code course. Recently the code has been intensely developed and validated at IRSN, France, GRS, Germany, and other scientific research centers of the EU. The code is intended for forecasting the radiological source-terms in the event of severe accidents in PWR and BWR. The participants familiarized themselves with the structure of ASTEC code, its modules and their interaction. The possibility of applying ASTEC code for simulating physical and chemical processes in the reactors of INPP and its compartments was discussed.

On February 28–March 4, representatives of VATESI and TSOs took part in the IAEA regional workshop *Deterministic best-estimate analyses including uncertainties* held in Slovenia. The following issues were addressed at the meeting: simulation of thermohydraulic processes, best-estimate analysis and evaluation of uncertainties, the methodology of verification and validation of mathematical models, and calculations of safety margins.

On March 1-4, in Kaunas and March 7-11, in Vilnius a seminar on the physics of reactor core was held. The fundamental theory of nuclear physics and reactor core neutronics was analyzed at the seminar. Prof. Paul Reuss and Dr. Michel Chouha from ISRN (Paris, France), specialists in neutronics, delivered lectures to the participants.

On May 9-13, representatives of VATESI and INPP participated at the IAEA regional workshop *Safety analyses in support of event evaluation* held in Slovenia. Notification about events and their classification, deterministic analysis of transients and probabilistic safety assessment were the issues discussed at the meeting.

Participants of the seminar on the physics of reactor core with the lecturers, Dr. Michel Chouha (fifth from left) and Prof. Paul Reuss (sixth from left).

On June 20-24, VATESI and LEI representatives improved their skills by participating in the training course *Scaling, uncertainty and 3D coupled code calculations in nuclear technology* that took place in Zagreb University, Croatia. Specialists from scientific research centers of the EU presented the latest methodologies of safety assessment and calculations of uncertainties, as well as the results of the best-estimate safety analyses.

On October 17-21, representatives of VATESI and TSOs took part at the IAEA regional workshop *Analysis support to emergency operation procedures and beyond design basis accidents for accident management* held at the Ignalina NPP, Visaginas. The following issues were addressed at the meeting: development of accident management program, the phenomenology of severe accidents, computer codes used for analysis of beyond-design-basis and severe accidents, and the results of analysis of severe accidents.

After the information received at the abovementioned workshops and meetings was assessed, it was used in 2005 for updating the following documents of nuclear safety regulation governing the analysis and management of anticipated operational occurences, design-basis and beyond-design-basis accidents: *Requirements for the Ignalina NPP transient and accident analyses, Recommendations for the Ignalina NPP transient and accident analyses*, etc. The documents were also modified to take into account the recommendations submitted by the IAEA in September 2005 regarding analyses of accidents of RBMK reactors and the issues raised at the meetings of the WENRA working group on reactor safety harmonization. The Instructions for a specialist in accident analysis of the VATESI Emergency Response Center were updated. The document is to be used for forecasting the progress of an accident and assessing its consequences should a design-basis accident occur at INPP.

In 2005, beyond-design-basis accidents were further analyzed at the Ignalina NPP. The analysis is performed in compliance with project NSP/L10 funded by the Department of Trade and Industry of the United Kingdom. In early 2005, the INPP submitted to VATESI for assessment a list of beyond-design-basis accidents and documentation substantiating it, the first report of the analysis. Having conducted a review of the submitted report on analysis, VATESI expressed comments to the nuclear power facility. The replies to the comments were given in March. In June, conclusions were drawn up as regards the replies of INPP to the review comments and submitted to the INPP. Five working meetings were arranged at VATESI in the second half of 2005 where representatives of the INPP and LEI who are rendering assistance to the former familiarized VATESI and its TSOs with the results of beyond-design-basis accident analysis and presented the projects of strategies of management of beyond-design-basis accidents being developed. The Ignalina NPP is planning to finish drawing up a manual on managing beyond-design-basis accidents based on the results of the analysis performed and submit it to VATESI for review and assessment.

On November 30, work began on PHARE project No. 5812.04.02 *Support to VATESI and its TSOs in assessment of beyond design basis accidents for RBMK-1500 reactors*. Whilst implementing the project, the behavior of fuel matrix, fuel elements, the MCC, the ACS and the ponds of spent nuclear fuel at INPP in case of BDBAs is to be studied. The

main objective of the project is to provide data for the Instructions for a specialist in accident analysis of the VATESI Emergency Response Center (for computing of the radiological source-terms) that will be used for forecasting the accident progress and assessing its consequences should a BDBA occur at INPP. SCALE5, TESPA-ROD, RELAP5/SCDAP, ASTEC, COCOSYS and ATHLET-CD codes are to be used for the computations. The work within the framework of the project is being done by RISKAUDIT, GRS, IRSN, LEI and FI.

In late 2005, the description of the Transition Facility project *Support to VATESI in assessment of safety at the Ignalina NPP* was produced. In view of the RSR-2 comments, modification of the coupled code ATHLET-QUABOX/CUBBOX is to be made in the project. A model of heat exchange between graphite blocks and three-dimensional fuel burnup model are to be introduced. The validation of the coupled code will be made with the results of measurements being conducted at INPP of reactivity coefficients (void, power and graphite reactivity) used. The code will be used for performing reliable regulatory audit analysis of INPP safety and different modifications continuously ongoing at the facility, as well as for assessing changes in thermohydraulic and neutron-dynamic characteristics of INPP reactors and identifying the tendencies of the changes.

To assure an exchange of information between VATESI and TSOs while implementing safety assessment projects, state-of-the-art internet technologies have been used. Electronic document/data catalogs have been produced and continuously supplemented. Specialists of VATESI and TSOs involved in the projects use the catalogs. Information about the computer codes used for analyzing DBA and BDBA processes and the validation of the codes is stored in the database.

In 2005, specialists of the Accident Analysis Group of the Safety Assessment Division of VATESI arranged several inspections at INPP and participated in them. On June 1-3, jointly with representatives of the Decommissioning and Radiation Protection Division and the On-Site Division at INPP, they conducted an inspection of emergency preparedness. In the course of the inspection the preparedness for accidents of the Ignalina NPP and its contractor organizations, as well as their technical means were checked. On November 3-4, an inspection of modifications of the full-scope training simulator (FSTS) of INPP was conducted together with representatives of the On-Site Division at INPP. During the inspection the FSTS modification process and the modified FSTS were examined, the operational documentation of the FSTS was checked, as well as the processes of verification, validation and support of the FSTS software. On November 28-29, an inspection was conducted jointly with representatives of the On-Site Division at INPP to check implementation of DBA and BDBA analysis measures envisaged in the Ignalina NPP safety improvement program SIP-3/2005. During the inspection compliance with nuclear requirements was checked at the INPP in implementation of safety analysis measures. The Ignalina NPP was obligated to put right the non-compliances with safety requirements revealed during the inspections.

Dr. E. Vanagas (left) and A. Bieliauskas, specialists of VATESI SAD Accident Analysis Group, at ATHLET-QUABOX/CUBBOX coupled code training course arranged by GRS in Garching, Germany, on January 22–February 4.

15. PROBABILISTIC SAFETY ASSESSMENT (PSA)

The risk posed by nuclear facilities can be assessed quantitatively with the use of probabilistic safety assessment (PSA). This kind of analysis makes it possible to assess the effect on the risk of the systems designated to protect facilities against accidents and to mitigate the impacts of accidents that did occur, as well as on the risk of auxiliary safety systems. Information obtained in the course of PSA can be used both when designing nuclear facilities and operating them.

The results of PSA can be widely used when addressing licensing, safety management, and other issues relating to nuclear power facilities. PSA can be used alongside deterministic methods, and the principles of the two must complement each other. The main advantage of PSA consists in that it helps to identify the main risk factors and to compare the ways of reducing risks. PSA is based on a consistent and integrated safety model of a nuclear facility. Therefore PSA together with deterministic methods is one of the tools in making decisions related to safety. Changes in design and engineering decisions or the choice of one or another decision can be assessed by a common criterion, quantitative risk assessment resulting from PSA. The uncertainties in these decisions can also be determined through PSA.

In 2003, implementation of the project funded by the Department of Trade and Industry of the UK began in accordance with which four regulatory documents in the area of PSA were drawn up in early 2005: Requirements for risk assessment and management at nuclear power facilities, *Recommendations regarding level 1 probabilistic*

safety assessment at nuclear power plants, Recommendations regarding level 2 probabilistic safety assessment at nuclear power plants with RBMK-1500 type reactors, and *Recommendations regarding risk management with the use of probabilistic safety assessment.*

Requirements for risk assessment and management at nuclear power facilities are intended for defining minimal requirements for risk assessment and management when using PSA technologies. The document was drawn up based on the world's best practices with IAEA recommendations taken into consideration. The requirements set forth in it must be followed for conducting PSA at nuclear facilities as well as for producing safety analysis reports, in licensing process, when introducing modifications or planning repairs, and in other cases. The document defines the objectives of PSA level 1 and level 2 objectives and scopes, and sets the requirements for PSA documentation, as well as for the management and updating of PSA model. In addition to that, the principal criteria and the key areas of PSA application are identified in the document.

The main objective of *Recommendations regarding level 1 probabilistic safety assessment at nuclear power plants* consists in describing methods acceptable to VATESI used to perform level 1 PSA at nuclear facilities (this level is intended for assessing events that determine identified conditions of damage to a facility). The scope and the level of detail of PSA depend on the way it is to be applied. However, the minimal level of detail is necessary to ensure that design dependencies (e.g. those of auxiliary systems or human errors) have been taken into account and that PSA models are adequate for a nuclear facility that is being designed or operated.

Recommendations regarding level 2 probabilistic safety assessment at nuclear power plants with RBMK-1500 type reactors set forth the main methods of level 2 PSA applicable to nuclear reactors of RBMK type. The scope of PSA more often than not depends on the purpose the results will serve for. When performing PSA, the most important dependencies (those of auxiliary systems, containment, human errors, etc.) must be taken into account, and PSA model must be adequate for the nuclear facility in question.

The document *Recommendations regarding risk management with the use of probabilistic safety assessment* describes the methods applicable at NPPs for identifying major vulnerabilities and for efficiently managing risks in view of operation hazards posed by changes in equipment or procedures at a NPP.

VATESI specialists will review all these draft documents. Before they are approved, their texts will be given to the main users (INPP, TSOs) so that they can submit their comments. After the four documents have been approved, a system will be created at VATESI offering a legal basis for risk management and for taking integrated decisions. If necessary, more detailed recommendatory documents can also be drawn up that would describe individual areas of PSA application.

In late 2004, three reports were submitted to VATESI on implementation of recommendations of IPSART missions aimed at improving the quality of PSA: on updating of common cause failure analysis, on elimination of PSA model errors, and computation of PSA model parameters based on statistics of failures of safety-related systems. In 2005, the documents were reviewed. The report on updating of common cause failure analysis was reviewed jointly with representatives of TSOs. During the review, attention was paid not only to implementation of IPSART recommendations, but also to the issues of simulation methodology and suitability of output data that were not analyzed during IPSART mission. It was established during the review that the Ignalina NPP had implemented all the relevant recommendations of IPSART mission. However, some additional recommendations that INPP will have to take into consideration were also proposed as a result of the independent review of the reports. One of the most important of these is regarding comprehensive analysis of data and uncertainties of the model. It was established that considerable changes in results occurred due to certain changes in the model. During the review attention was also called to the fact that initial data used in common cause failure analysis and based on different sources recognized in the world can significantly affect the results of the analysis. The importance of analysis of uncertainties in PSA models thus becomes obvious.

In 2005, *The updated procedure for PSA implementation* was also modified by INPP with recommendations of VATESI's previous inspections taken into consideration. The new procedure has already been analyzed by VATESI specialists, and, based on information received, in late 2005 an inspection was conducted to check implementation of the procedure's provisions. It was established in the course of the inspection that the new procedure was being implemented. Some minor shortcomings were revealed in documentation management, but these were put right soon after the inspection.

16. SAFETY CASE FOR SINGLE OPERATING POWER UNIT 2 OF INPP

Following the decommissioning of Unit 1 at INPP, the necessity arose of substantiating safety of the single operational Unit. Therefore the Ignalina NPP submitted to VATESI *Safety case for single operating power Unit 2 of INPP* (hereinafter referred to as the Safety Case) in which assessed the safety level of Unit 2 with Unit 1 shut down, conducted the analysis of the factors that may negatively affect Unit 2 safety, and identified corrective measures

aimed at mitigating negative effects of the factors.

To this end, a list was made of all the systems of Unit 2 and systems common to the NPP. After all the systems of Unit 2 had been analyzed, a list was drawn up of the systems of Unit 2 having technological links with Unit 1 and NPP systems of common use, and another one of the systems having transit communications to common use elements via Unit 1. After all the systems on the lists were analyzed, the effect of Unit 1 on Unit 2 safety was assessed in compliance with the *Guide on safety case preparation for single operating power Unit 2 of INPP* approved with VATESI. Based on this document, human factors and aspects of physical protection were also analyzed.

VATESI reviewed in 2004 the Safety Case and submitted their comments to the Ignalina NPP. The INPP took into consideration the comments and in early 2005 submitted to VATESI the second version of the Safety Case and its addendum *Analysis of consequences of stopping single operating power Unit 2 in wintertime in view of the potential of the existing and newly commissioned boiler houses*. VATESI reviewed the documents by the end of 2005 and stated the safety level of single operating INPP Unit 2 following the final closure of Unit 1 to be acceptable.

The Ignalina NPP is to correct and submit to VATESI the final version of the Safety Case in 2006.

Lithuanian and foreign specialists rendered expert assistance to VATESI in analyzing the Safety Case within the framework of PHARE project LT2003/5825.02 *Support to VATESI and Lithuanian TSOs in licensing activities related to decommissioning of Ignalina NPP*.

17. THE PROJECT ON UTILIZATION OF INPP UNIT 1 FUEL IN UNIT 2

Now that Ignalina NPP Unit 1 is decommissioned, first of all spent nuclear fuel needs to be removed from the reactor core. A large part of this fuel is still suitable for use, therefore implementation began of the project on transporting fuel from Unit 1 and using it in Unit 2.

In accordance with the project, after fuel assemblies from Unit 1 are checked, they are to be taken in a special container to Unit 2 and loaded into the reactor. The project will not only allow Ignalina NPP to save some 500 new fuel assemblies, but will also considerably facilitate solving the problem of spent nuclear fuel storage, as smaller amounts of radioactive waste will be generated.

In 2005, the Ignalina NPP submitted to VATESI for review and approval the safety case for the fuel transportation facility and the relevant documents of the detail design. VATESI jointly with TSO experts analyzed the documents and submitted their comments. The safety case is still in the stages of approval. The Ignalina NPP are planning to begin transporting the fuel from Unit 1 and using it in Unit 2 in mid-2006.

18. PREPARATION FOR DECOMMISSIONING THE IGNALINA NUCLEAR POWER PLANT

In 2005, the Ignalina NPP continued work related to preparation for decommissioning. An agreement was signed in the beginning of the year concerning the construction of a spent nuclear fuel storage facility. VATESI continued work associated with the safety case of single operational power Unit 2, Unit 1 final shutdown and defueling phase decommissioning project and its safety analysis report. The safety of the facility for cementing liquid radioactive waste and its storage has basically been assessed, and VATESI is getting ready for issuing a license for operating the facility. Experts from Lithuania and other European countries were also involved in the work on this PHARE project.

Intense consultations were held between the Ignalina NPP, VATESI and the Ministry of the Environment in the second half of 2005. The contents of the projects of dismantling INPP Unit 1 were discussed and the procedures for approval of the projects were agreed on.

To date, Unit 1 has been supervised in accordance with the technological regulations and other operation requirements that were valid prior to its shutdown. By the end of 2005, the defueling schedule was not drawn up and its safety case was not produced, the Unit was not finally shut down. Furthermore, the projects of spent nuclear fuel storage and upgrading of solid radioactive waste management were postponed. Owing to protracted discussions on the sources of funding, the process of purchasing a project of a repository of very-low-level radioactive waste (landfill) and the implementation of the project were not begun. Hitches occurred in selecting the site for a repository of short-lived low- and intermediate-level radioactive waste: when in early 2005 most of the state institutions approved the environmental impact assessment report, work began on producing an addendum analyzing another alternative site for the repository. Therefore VATESI cannot efficiently plan its activities and financial resources, especially when organizing the projects of international support funds.

19. LICENSING ACTIVITIES

Analyzing license applications

In 2005, the Ignalina NPP submitted VATESI two license applications, for designing a spent nuclear fuel storage facility, and for operating a storage facility for solidified liquid radioactive waste. VATESI will take a decision as regards issuing licenses after it receives and analyzes all the relevant documents. AB *Lietuvos geležinkeliai* submitted an application requesting to include spent nuclear fuel into the license for transporting nuclear material. Having analyzed the application documents, VATESI submitted its comments to AB *Lietuvos geležinkeliai* as regards the request to be allowed to transport by rail SNF within the territory of the Republic of Lithuania.

Licensing for spent nuclear fuel storage facility

Licensing began in June, when the Ignalina NPP submitted VATESI a license application for designing a storage facility for spent nuclear fuel and the schedule of submission of application documents. VATESI specialists analyzed the documents and presented their comments in early July. INPP submitted VATESI in late July the amended schedule of submission of application documents. VATESI approved the schedule in August.

INPP submitted VATESI in early September the first set of relevant documents. After analyzing the documents, VATESI specialists presented their comments in late September. INPP submitted the second set of documents in December. Licensing in accordance with the schedule is to continue in 2006.

Licensing storage facility for solidified liquid radioactive waste

The Ignalina NPP submitted VATESI in early October 2005 a license application for operating a storage facility for solidified liquid radioactive waste. Having analyzed the application and relevant documents, VATESI specialists presented in November comments to INPP and received replies in early December. Licensing is to continue in 2006.

Licensing the closed repository at Maišiagala

In May 2004, the Radioactive Waste Management Agency (RATA) submitted VATESI an application that would entitle the former to carry out supervision of the closed radioactive waste repository at Maišiagala with a schedule of document presentation attached. The safety analysis report was one of the principal documents RATA had to produce and submit to VATESI. The report was submitted in May 2005. Specialists of VATESI and TSOs in late August submitted their comments regarding the SAR. The repository's licensing is to continue in 2006.

VATESI will take the decision whether or not to issue a license for supervising the closed repository at Maišiagala only after it has received and analyzed all the relevant documents.

Supervision of compliance with validity conditions of issued licenses

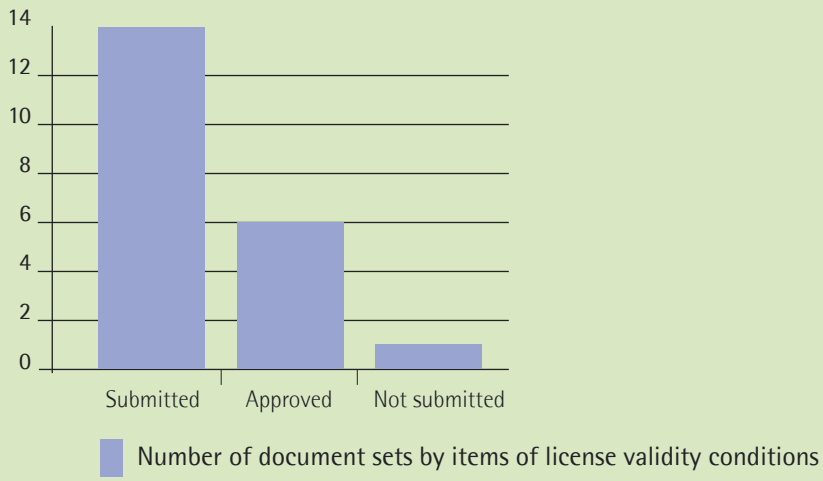
Like in previous years, in 2005 VATESI specialists controlled compliance with validity conditions of issued licenses. To this end, they conducted inspections, analyzed reports and other documents submitted by licensees.

Licenses issued by VATESI

License No.	Licensee	Area of activity
12/99(P)	Ignalina NPP	Operating INPP Unit 1
3/2000(P)	Ignalina NPP	Operating interim spent nuclear fuel storage facility of dry type at INPP
2/2003	Ignalina NPP	Constructing at INPP storage facility for solidified liquid radioactive waste and waste cementation facility
1/2004	AB *Lietuvos geležinkeliai*	Transporting nuclear material
2/2004	Ignalina NPP	Operating INPP Unit 2

The Quality Assurance Program of nuclear material transportation was analyzed while controlling compliance with license validity conditions by AB *Lietuvos geležinkeliai*. Sets of report documents submitted in accordance with 14 items of license validity conditions were reviewed in the course of supervision of compliance with license validity conditions for operating INPP Unit 2. Six of the items were found to have been implemented. The Ignalina NPP failed to submit on time report documents on item 1 of license conditions.

Supervision of compliance with license conditions for operating INPP Unit 2



Supervision of nuclear material transportation

The following was done while supervising transportation of nuclear material:

- Package design and shipment certificate RU/3030/B(M)F-96T(Rev.0) for INNP fuel assemblies was approved by multilateral validation.
- Draft EU guidelines regarding supervision and control of radioactive waste and spent nuclear fuel transportation were analyzed.
- The provisions of *The Law on Radioactive Waste Management*, *The Law on Nuclear Energy*, and *The Joint Convention on Safe Management of Spent Fuel and Radioactive Waste* were compared.

20. ACCOUNTING FOR AND CONTROL OF NUCLEAR MATERIALS, APPLICATION OF SAFEGUARDS

A positive conclusion regarding Lithuania was repeated in the IAEA safeguards implementation report for 2005 that declared nuclear material had been used for peaceful purposes only ant that no undeclared nuclear activities had been found. Lithuania's activities had first been assessed in the same way in the Report for 2003.

This kind of conclusion by the IAEA about the transparency of nuclear activities is the grounds for starting applying in the country under consideration integrated safeguards whose manner of implementation is different from that of the so-called traditional safeguards. High-ranking specialists of the IAEA visited in February 2005 VATESI and the Ignalina NPP to discuss implementation of the new integrated safeguards. Although basically Lithuania is ready for the integrated safeguards, the IAEA did not start their implementation in 2005.

The transition from the bilateral agreement with the IAEA for the Application of IAEA Safeguards and its Protocol Additional to trilateral ones between the IAEA, the European Atomic Energy Community (EURATOM), and the non-nuclear-weapon EU countries did not take place in 2005. This in part was due to restructuring in application of EURATOM safeguards. Nevertheless, it did not negatively affect the efforts of the IAEA and the European Commission in the area of safeguards application in Lithuania.

Table 1. **Summary of the IAEA, EC and VATESI inspection activities in Lithuania in 2004 and 2005**

	2004	2005
Total number of IAEA inspectors and technicians' working days in Lithuania	178	188
Number of EC inspectors' working days in Lithuania	20	8
Number of working days at facilities of VATESI inspectors engaged in the area of safeguards	25	25
Number of IAEA inspectors designated to conduct inspections in Lithuania	325	324
Number of EC inspectors designated to conduct inspections in Lithuania	191	190
Number of VATESI inspectors engaged in the area of IAEA safeguards	2	2

Table 2. **Data of nuclear materials accounting**

	2004	2005
Number of reports	24	25
Number of entries	19,380	18,924
Amount of depleted uranium (tonnes)	20.3	20.9
Amount of enriched uranium (tonnes)	2211	2272
Amount of U^{235} (tonnes)	27.7	28.5
Amount of plutonium (tonnes)	7.18	7.42

A meeting of integrated safeguards working group of European Safeguards Research and Development Association (ESARDA) was held in Vilnius on June 27-30, 2005. The Association comprises different organizations of EU member countries whose activities are related to control of nuclear material and application of safeguards.

On October 17, 2005, VATESI became an official member of ESARDA.

Physical protection of nuclear materials and nuclear facilities

In 2005, the world took a huge step forward in strengthening the international regime of physical protection of nuclear material. On July 5, IAEA member countries approved amendments to *The Convention on Physical Protection of Nuclear Materials*. They will become effective when 2/3 out of 112 Convention members ratify them. Lithuania hopes to ratify the amendments by the end of 2006.

Another matter of great importance in strengthening national physical protection of nuclear material is the fact that Head of VATESI approved on June 13, 2005, *General requirements for physical protection of nuclear power facilities and nuclear materials*. General requirements are set in the document for the organization operating the nuclear power facility, as well as other legal and natural persons who have nuclear material at their disposal.

VATESI specialists controlling physical protection at INPP conducted two inspections in 2005. During one the updating of the physical protection system of INPP perimeter was assessed. A physical protection exercise was held at INPP on September 26-27 to examine how officials of Emergency Headquarters organize actions and guide physical protection forces in case of unusual and extreme situations. In the course of inspections VATESI revealed some non-compliances and obligated INPP to put them right.

Following the shutdown of Unit 1, considerable attention was paid to implementation of technical physical protection measures associated with physical separation of the two power units of INPP.

The IAEA arranged in Lithuania on October 3-5, 2005, a workshop on the subject of design-basis threat. Specialists of Lithuania's different institutions responsible for physical protection of INPP participated in the workshop. Several specialists from Lithuania improved their skills in different international courses organized by the IAEA.

Comprehensive Nuclear Test Ban Treaty (CTBT)

After *The Comprehensive Nuclear Test Ban Treaty* was announced in 1996, 176 countries signed and 125 ratified it. For the Treaty to come into force, 44 countries listed in Annex 2 must ratify it. However, only 33 countries from the list have ratified the Treaty to date. Two nuclear states, China and the USA, are among the

countries that have not ratified the CTBT, as well as Columbia, the Democratic People's Republic of Korea, Egypt, India, Indonesia, Iran, Israel, Pakistan, and Vietnam.

In September 2005, during the UN General Assembly, the 4th CTBT Conference according to Article XIV was held on facilitating the Treaty's entry into force. Measures were discussed at the Conference that could be taken in order to facilitate the ratification process and CTBT entry into force, and the countries that had not signed or ratified it were encouraged to do so in the nearest future. It was emphasized in the final declaration of the Conference that *The Comprehensive Nuclear Test Ban Treaty* was extremely important for the goal of nuclear disarmament and non-proliferation. Significant results had been achieved since the 3rd CTBT Conference according to Article XIV: 21 countries, including two from Annex II, ratified the Treaty, and another 8 signed it.

In 2005, the member countries jointly with the CTBT continued preparing and improving the *On-Site Inspections Manual*. The submitted comments are included in the Manual. The CTBT, assisted by member countries, organized numerous training courses and exercises.

At the Working Group B meeting that took place in September 2005, the decision was taken to produce a *Test On-Site Inspections Manual* to be used in the joint field exercise in 2008.

The National Data Center (NDC) of Lithuania established in accordance with the Treaty's provisions maintained contact with the International Data Center, received data on radionuclides and produced monthly reports on the checks of the data. The NDC did not record a single case of unusual events in 2005.

Control of illicit trafficking of nuclear materials

In 2005, 123 reports were received from the IAEA Illicit Trafficking in Nuclear and Radioactive Materials data base on the recorded cases of illicit trafficking in nuclear and radioactive material worldwide. Thirty-two of these contained updated and additional information about previously reported cases.

Lithuania submitted in 2005 four notifications on events associated with nuclear or radioactive substances. A device with a sealed source of ionizing radiation (Sr-90 +Y-90) was found at a Klaipėda scrapyard in February. A depleted uranium container without registration numbers was found in April when putting in order the area of the Medininkai border checkpoint. The container did not have a radioactive source. A car was stopped at the checkpoint on the Lithuanian-Latvian border. A measuring device was found in it whose illuminated indicator panel was coated with Ra-226. Fine wire made of depleted uranium and weighing some 2 kg was found among the debris of a fighter of the Russian Federation that crashed in Lithuania in September. Later on, the wire was returned to Russia.

In the spring of 2005, the United Nations Interregional Crime and Justice Research Institute (UNICRI) arranged the third working meeting *Strengthening International Cooperation to Combat Illicit Traffic and Criminal Use of Chemical, Biological, Radiological and Nuclear (CBRN) Substances and Weapons*. Eastern European countries and international organizations, such as the IAEA, UNICRI, Europol, Interpol, the Organisation for Prohibition of Chemical Weapons (OPCW), World Customs Organization (WCO), etc., were represented in the event. The aim of the meeting was to improve the countries' potential in preventing and combating illegal traffic of chemical, biological, radioactive and nuclear materials, as well as to encourage cooperation between countries and international organizations working in this area.

The Nuclear Research Institute of the Czech Republic in mid-2005 held a meeting of member countries' International technical working group engaged in the field of combating illicit trafficking of nuclear material. Representatives of the IAEA, the Institute for Transuranium Elements of the EC Joint Research Center, the FBI, and Europol participated in the event. The aim of the meeting was to discuss the ways to improve the examinations of the discovered illegal nuclear material and to perfect the member countries' legal basis. The nuclear material database still being developed was presented at the meeting. It will help to identify the country of origin of the seized illicit material and its potential use. Laboratories working in the area of nuclear research shared the latest research methods.

Control of strategic commodities designed for nuclear use

In 2004, Lithuania became a member of the Nuclear Suppliers Group (NSG) and its representatives for the first time participated at NSG annual meeting in Oslo, Norway, on June 20-24. NSG guidelines set conditions under which materials designed for nuclear use and dual-use materials, equipment and technologies can be transferred from one country to another.

In late 2005, VATESI conducted an inspection at INPP to check the utilization of strategic goods designed for nuclear use, for whose peaceful use the supplier's country had been issued a state guarantee. Several shortcomings were identified during the inspection. They were recorded in the inspection statement. INPP envisaged measures that would enable to make stricter the control of goods imported with a state guarantee.

When INPP dismantling starts in the future, it is likely that in some cases equipment suitable for use will be sold to other countries. Therefore the issue of control of strategic goods designed for nuclear use will become particularly important.

21. RADIOACTIVE WASTE MANAGEMENT

After the Law of the Republic of Lithuania was passed on Radioactive Waste Management on May 20, 1999, much more attention is being given to the disposal of this kind of waste in our country and especially at Ignalina NPP, the facility that generates most of it. The key principle of radioactive waste management is to manage it in such a manner that it would pose no danger to the public and the environment, and would not become an additional burden to future generations. This principle is followed in managing radioactive waste in Lithuania too.

Considerable amounts of solid radioactive waste generates from the operation of Ignalina NPP. The volumes of this type of waste accumulated by 2006 are summed up in the table below.

Amount of waste, m^3	Group 1 com-bustible	Group 1 incomb.	Group 2 com-bustible	Group 2 incomb.	Group 3	Total
Accumulated as of January 1, 2006	11,087	7751	2020	2544	775	24,179

On July 29, 2004, a license was issued for operating Unit 1 at the Ignalina NPP. It is stated in the license conditions that the storage facilities for solid and bituminized RW at INPP can be operated until January 1, 2011. Solid RW will have to be taken out of the storage facilities, re-sorted and finally processed with state-of-the-art technologies being used in compliance with the currently valid requirements. In accordance with the license conditions, Ignalina NPP will have to assess the possibilities of turning the bituminized waste storage facility into a repository by October 31, 2006.

The following projects were implemented in 2005 within the framework of Safety Improvement Program (SIP-3/2005) at the Ignalina NPP:

- Repairs of the access road to solid RW storage facilities.
- Purchasing a new vehicle for transporting RW.
- Safety assessment for a pressing device.

In 2002, the Ignalina NPP produced and coordinated with institutions concerned a project on cementation of spent ion exchange resins and pearlite filters. VATESI specialists reviewed the preliminary SAR of the project aided by the SIP/RISKAUDIT consortium and Technical Support Organizations in accordance with the PHARE Project *Support to VATESI and Lithuanian TSOs in licensing activities related to decommissioning of Ignalina NPP*. VATESI issued a license for construction of the necessary facilities in 2003. In 2004, the storage and cementation facilities were constructed, and the final safety analysis report was produced, reviewed by VATESI specialists. VATESI conducted several inspections to check how the trials of equipment had been carried out and the preparation for operating the facility for cementation and for operating the cemented waste storage facility. On March 10, 2006, a license was issued for operating the facilities.

The Radioactive Waste Management Strategy approved by the Government of the Republic of Lithuania on February 6, 2002, provides for conducting investigations and submitting recommendations on constructing a near-surface repository for short-lived low- and intermediate-level radioactive waste. In 2004, RATA produced an environmental impact assessment program and a report for the RW repository. VATESI specialists reviewed the documents and submitted their comments. Based on the results of the report a decision will be made regarding the repository site. In 2005, The program of engineering-geological studies of the site in Stabatiškė village of Visaginas Municipality proposed for a radioactive waste repository was drafted. VATESI specialists reviewed the document and submitted their comments. The site is new, it was not analyzed in the environmental impact assessment report.

On May 20, 2004, RATA submitted VATESI an application for a license for post-closure surveillance of the Radioactive Waste Disposal Facility of Radon Type situated in Bartkuškis forest near Maišiagala. In 2004, some of the documents necessary for obtaining the license were reviewed and approved. On May 5, 2005, RATA submitted the safety analysis report of the facility. VATESI specialists jointly with experts reviewed the report and expressed their comments.

By the end of 2005, 20 CASTOR RBMK-1500 and 60 CONSTOR RBMK-1500 containers with spent nuclear fuel were transported from SNF storage ponds of INPP to the interim nuclear fuel storage of dry type (SNFS). There is no room left in the facility, but it is to be expanded by mid-2006, which will enable to store another 14 containers there.

In 2005, preparatory work for the construction a new SNF storage facility was begun. The construction site is being prepared, the environmental impact program and report are being drawn up, and the design and safety documentation produced. The first containers are planned to be taken to the new storage facility in late 2008.

22. EMERGENCY PREPAREDNESS

International commitments

VATESI, as Lithuania's competent authority in the ECURIE system of urgent exchange of information about critical radiological situations of the European Union, installed a CoDecS communication station at its Emergency Response Center in 2005. CoDecS station is the main instrument of exchange of information within the ECURIE system. The station's software performs in a similar manner as electronic mail, however, all the messages are encoded and thus can only be sent from a registered station that has an appropriate program installed. After the station was installed at VATESI, it was officially tested on May 24, 2005, and declared as operational part of the CoDecS system. Any EU member country wishing to submit information through the CoDecS system sends it to one of the central node stations in Brussels or Luxembourg. The competent authority of the EC (TREN H4) confirms the authenticity of the message and retransmits it to all the CoDecS stations of EU member countries. Not all the countries have the stations as yet, therefore the messages are sent by fax too. An audible or light signal, an SMS, e-mail message or another method convenient to one or another institution are used to notify about the messages received at a CoDecS station. The CoDecS system can be used not only for notification about radiological accidents but also for exchange of information about lost or found radioactive sources, other events of minor importance, as well as for controlling rumors. VATESI made use of this opportunity on May 26, when information spread in Lithuania's press, on the internet and other sources of information about an accident that had occurred at some Russian nuclear power plant. The CoDecS system made it possible to obtain in a very short time valuable information and copies of official documents refuting the rumor from other EU countries where similar rumors had circulated a day or two ago. VATESI thus could very promptly submit correct information to the media and reassure the public that the rumors were unfounded.

In 2005, the IAEA circulated information about two events, only one of which had radiological consequences. It was an event in Chile related to a lost source of a gamma radiography equipment that resulted in overexposure of 3 persons. Information concerning the explosion in a smelter near Leningrad NPP was provided basically because in many countries, including Lithuania, great interest was displayed in the importance of the event to nuclear safety. In addition to these messages, information was received from the ECURIE system about a truck stolen in Italy with an Ir-192 source for industrial gammagraphy. This piece of information was circulated among concerned institutions of Lithuania.

The third meeting of representatives of national competent authorities identified under the *Early Notification and Assistance Conventions* was held in Vienna in July. Its participants represented 63 countries and international organizations. The meetings take place at the IAEA on a biennial basis. To improve the countries' preparedness for radiological accidents, the progress in preparation for accidents was assessed at the meeting, the problems that arise were identified, and the guidelines were drawn up for the Secretariat's work.

Inspection of INPP emergency preparedness

In June 2005, an emergency preparedness inspection was conducted at the Ignalina NPP to check how the plan of corrective measures identified in the course of the previous inspection was implemented and to examine emergency preparedness of the INPP and contractor organizations as well as the condition of technical means. Eight category 2 non-compliances and five category 3 non-compliances were identified during the inspection. In the inspection's conclusions attention is called to the shortcomings of emergency preparedness of the contractor organizations working in the INPP area, viz. the personnel is not sufficiently supplied with individual means of protection, the process of training and instructing as well as control of responsible units are inadequate. The commission that conducted the inspection also noted shortcomings in the training of the managing staff of the INPP, the system of updating the documents in the Protected Emergency Response Center, and the reliability of the system of data transmission to VATESI.

Emergency preparedness exercises at VATESI

In 2005, the training program of specialists of VATESI Emergency Response Center (ERC) went on. Twenty-four communication tests were arranged for VATESI duty personnel that year. Specialists of the ERC took part in 12 international exercises, including nine international communication tests organized by the IAEA and the EC, as well as exercises in exchange of information between the Baltic States. Specialized ARGOS PHARE exercises were held in October within the framework of a PHARE project upon the initiative of the Ministry of the Environment with support from Danish specialists. Specialists from Lithuania, Latvia and Estonia participating in the exercises trained to work together with the ARGOS NT code for forecasting transfer of radioactive emissions.

The international exercise CONVEX-3, undoubtedly, the most important one, was held on May 11-12. The objective of the exercise consisted in examining the ability of competent authorities to exchange information and to collaborate in compliance with the provisions of the Early Notification Convention. The IAEA organize this exercise once in four years. In 2005, it was organized by Romania's National Commission for Nuclear Activities Control (CNCAN) jointly with the Inter-Agency Committee for Response to Nuclear Accidents (IACRNA). Eight international organizations and 57

VATESI took an active part at CONVEX-3 international exercise.

countries participated in the exercise. The Cernavoda NPP in Romania was chosen for the event. In accordance with the scenario of the exercise, on May 11, 2005, at 9.19 AM Lithuanian time, a message was received from the EC and, later on, from the IAEA, to the effect that an accident had occurred at Unit 1 of the Cernavoda NPP at 6.02 AM. It was said in the information that the residents in a 5-km radius were recommended protective countermeasures – sheltering and iodine prophylaxis. In subsequent information it was specified that the accident was related to loss of coolant and damaged integrity of containment. The accident was rated as level five on INES scale. From 6.15 to 7.06 AM an unknown amount of radioactive substances was released into the atmosphere. The meteorological conditions showed that the radioactive cloud would be blown in the northwestern direction and may reach Lithuania. At 3 PM more accurate data about the source term and height of the release were supplied. On May 12, at about 4 AM, the information was circulated to the effect that within the next 6 hours a second controlled release of radioactive substances is planned. The release occurred from 8.00 AM to 12.05 PM, and the cloud moved towards the south-southwest, as the wind direction had changed. The exercise finished at 8 PM Lithuanian time. The Ministry of the Environment, the Department of Civil Protection and the Radiation Protection Center participated in the exercise in Lithuania. When the exercise was already under way, the Hydrometeorological Service of Lithuania contacted the ERC and very successfully joined in.

VATESI ERC, as envisaged in the exercise schedule, worked in shifts throughout the event and, for the first time, around the clock. Twenty-two specialists of VATESI ERC had an opportunity of checking their preparedness and improving skills. Work was very intense at the ERC during the first two hours of the exercise. On the second day, the work load was somewhat lighter. In the nighttime information was sent to the ERC almost as incessantly as during working hours. Somewhat unexpected was the warning sent after midnight by the IAEA that the radioactive cloud was moving towards Lithuania and the request to submit data on the protective actions being taken. The ERC reacted to the message without delay, and in 20 minutes the requested information was sent.

During the exercise the ERC received 79 messages from the EC and 29 from the IAEA. In all, 179 sent and received messages were recorded at the ERC. For the first time the new CoDecS system, not yet official at the time, making it possible to exchange information between EU member countries, was used in the exercises. Twenty-five messages, including 5 from VATESI, were sent via the system. Messages about the environmental monitoring (EURDEP) and forecasts (ENSEMBLE) were shown on the password-protected internet pages. Certain issues were solved by telephone. The Public Information Group prepared 3 messages.

When summarizing the results most of the participants emphasized that in comparison with previous exercises considerable progress was noticed in the performance of the ERC. All those involved in the exercise knew who was expected to do what and how. Additional measures and sources of information were used, and the participants were quite willing to interpret things. This was yet another proof that not only theoretical knowledge but also practical skills are of great importance for the quality of emergency preparedness.

23. CONTRIBUTION OF LITHUANIAN SCIENCE TO IMPROVEMENT OF NUCLEAR SAFETY, COORDINATION OF ACTIVITIES OF TECHNICAL SUPPORT ORGANIZATIONS

In 2005, VATESI continued successful cooperation with the Department of Thermal and Nuclear Energy (DTNE), the Institute of Energy Technologies (IET), the Strength and Fracture Mechanics Center (SFMC) and Prof. K. Baršauskas Ultrasound Scientific Institute (USI) of Kaunas University of Technology (KTU); the Nuclear Installations Safety Laboratory (NISL) the Laboratory of Nuclear Engineering Problems (LNEP) and the Materials

Research and Testing Laboratory (MRTL) of the Lithuanian Energy Institute (LEI); Materials Strength Department (MSD), the Institute of Welding and Material Research Problems (IWMRP), the Laboratory of Strength Mechanics (LSM), the Laboratory of Numerical Simulation (LNS) and the Department of Labor and Fire Safety (DLFS) of Vilnius Gediminas University of Technology (VGTU); the Institute of Physics (FI); the State Institute of Information Technologies (SIIT); UAB ITECHA, and other organizations.

The main areas of co-operation between VATESI and Lithuania's technical support organizations (TSOs) are as follows:

- INPP safety analysis and justification.
- Expert services provided for VATESI.
- Development of new normative documents and review of the valid safety normative documents.
- Participation in various international projects.

The Coordination Council of VATESI TSOs has been set up with a view to using more efficiently the country's scientific and technological potential for solving nuclear energy safety issues and coordinating technical support by TSOs. The Coordination Council has on its staff two representatives from Kaunas University of Technology, the Lithuanian Energy Institute, Vilnius Gediminas University of Technology, and one from the State Institute of Information Technologies (SIIT) and UAB ITECHA. A VATESI observer participates at the Council's sittings. R. Kačianauskas, Head of Department of Material Strength of VGTU, was elected the Chairman of the TSO CC. On October 11, 2005, the statute of the Coordination Council was updated.

The Institute of Physics (FI) in 2005 was implementing the program funded from the state budget *Radionuclide dynamics and balance in an ecosystem's components, and nuclear spectrometry development in material research and radiation safety*, the programs funded by the Lithuanian State Science and Studies Foundation *The studies of radioactive waste generation, its spread, impacts on the environment and humans, and their applications, Harmful effects of ionizing radiation on biomolecular systems, The effects of photochemical transformations and metabolism of 131I in human body on inhalation doses*, and the joint Lithuanian-French project funded by the Ministry of Education and Science *Waste characterization following reactor decommissioning*. Specialists of the Institute of Physics also participated in EU projects funded by PHARE, *Support to VATESI for important tasks relevant to the licensing activities of Ignalina Nuclear Power Plant* (LI01.18.03) and *Support to VATESI and Lithuanian TSOs in the area of Ignalina NPP decommissioning licensing* (LT/2003.5825.02). In addition to the above activities, the FI was engaged in the following tasks related to nuclear and radiation safety:

- Conducting an expertise of documents in relation to the project being implemented at INPP *Safety case of Burning Fuel of INPP Unit 1 in the Reactor of Unit 2* (jointly with specialists from KTU and VGTU.
- Drawing up the program of radiological studies of INPP plant and equipment (jointly with the LEI).
- Drafting instructions on analysis of data provided by the International Center of the Comprehensive Nuclear Test Ban Treaty.
- Developing methodology of nuclide composition analysis and assessment of activity of bitumen compound waste.
- Developing methodology of measuring tritium in the ground water of a near-surface repository of radioactive waste (ordered by RATA).
- Conducting comprehensive radiometric studies and developing methodology of scientific analysis of the results obtained (ordered by RATA).
- Radioecological monitoring in the zone affected by the Ignalina NPP (ordered by the Agency of Environmental Protection).
- Radiological monitoring in Vilnius town (ordered by the Agency of Environmental Protection).
- Studies of equivalent dose rate of ionizing radiation with the use of AGIR system (ordered by the Agency of Environmental Protection).
- Identifying acceptability of leak-tightness failure of the partition between the reinforced leak-tight compartment and accident confinement tower of Unit 1. Check calculations of exposure dose of the population (ordered by KTU).

The divisions of **Kaunas University of Technology (KTU)** in 2005 rendered expert services to VATESI. The DTNE, IET and SMFC checked implementation of measures envisaged in items 19, 34 and 35 of SIP2/2004 program related to recommendations given in the safety case of the Accident Confinement System (ACS). They also reviewed other reports relevant to the safety of the ACS. In view of previous experience, scientists from other divisions of KTU and the Institute of Physics were also invited to participate when addressing certain issues.

The Institute of Energy Technologies of KTU analyzed the issues of upgrading Maišiagala radioactive waste repository and the facility's safety, rendered assistance to VATESI in assessing the project of burning fuel of INPP Unit 1 in Unit 2 in accordance with a subcontracting agreement with the Institute of Physics.

The Center of Strength and Fracture Mechanics (SMFC) of KTU assessed the process of certification of the equipment of safety-related systems indicated in INPP license No. 12/99(P) conditions, items 22.1 and 22.2, and the progress in implementation of aging management program. In late 2005, the SMFC started conducting the review of safety analysis of Du-300 pipes with cracked welds left for further operation. Specialists from the Institute of Welding and Material Research Problems (IWMRP VGTU) are also participating in the task.

IAEA workshop arranged by the SMFC was held in KTU on December 6-8 in which the issues of aging management of channel-type reactors were addressed. Representatives of the IAEA, Romania, Russia, Canada, and Lithuania participated and delivered reports at the workshop.

The scientists of the Ultrasound Scientific Institute (USI) of KTU assessed the methodology developed by the Ignalina NPP for ultrasonic non-destructive testing.

Scientists from KTU and the Institute of Physics were involved in the PHARE project *Support to VATESI and Lithuanian TSO's in licensing Ignalina NPP decommissioning activities* (LT/2003.5825.02).

One of the main lines of activity of the **Nuclear Installations Safety Laboratory (NISL)** of the Lithuanian Energy Institute **(LEI)** in 2005 was rendering expert services related to review of documents submitted to VATESI. The Laboratory's staff reviewed the Ignalina NPP documents pertaining to the configuration of the reactor core, changes in and control of physical parameters, as well as other issues of reactor physics and storage and management of nuclear fuel. They also analyzed documents relating to common-cause failures of INPP safety-related systems and their components. In the course of the review independent calculations were made based on which conclusions of the expertise were drawn.

The NISL was engaged in three top priority projects supported by the Lithuanian State Science and Studies Foundation. Ample information base necessary for developing methodologies of accident analysis in the operational and shut down reactors, as well as in spent fuel storage facilities was accumulated whilst implementing the project *The Methodology of analysis of beyond-design-basis accidents at the Ignalina NPP Units 1 and 2*. In the course of implementation of the project *The effects of external events on safety of the Ignalina NPP and other nuclear facilities*, criteria were formulated for identifying and analyzing external events important for the NPP's safety, for developing the methodology of their assessment, for establishing key safety parameters, and the formulae and methods of calculating their values were given. While working on the project *The studies in the process of aging of RBMK fuel channels and identification of safe operation criteria*, initial simulation of disintegration parameters was performed with the use of the finite element method considering the effects of hydrogen concentration, and changes were analyzed in thermohydraulic parameters of fuel channels with RELAP5 code for INPP.

In 2005, the NISL of the LEI continued work jointly with INPP within the framework of agreement *Burning fuel of Ignalina NPP Unit 1 in Unit 2*. A safety case report was prepared of the fuel-burning facility of INPP, detail designs of reconstruction of equipment, buildings and auxiliary systems were developed, a training course was arranged for the personnel that will operate and technically supervise the new facility's equipment being designed. Specialists of the NISL continued work on safety justification of the servo drives of the rods of the recently installed diverse shutdown system of INPP Unit 2. In 2005, the following tasks of improvement and justification of nuclear safety were completed: *Developing the software and methodology for hydroprofiling the core of RBMK-1500, Calculating ambient conditions in the event of design-basis accidents in compartments housing the elements of safety-related systems that need certification, Rejection of sensors based on results of the 2005 diagnostics in Unit 2, Analysis of radiation consequences of design-basis accidents in Ignalina NPP Unit 2 after loading uranium-erbium fuel of 2.8% enrichment* and *The assessment of probability of graphite-pressure tube gap closure in individual reactor cells in INPP Unit 2 and forecast of gap changes.*

In 2005, LEI specialists began several new projects: *Upgrading 3D calculations of distribution of energy release, Investigation of the parameters of hydride cracking and preparation of the realisation of the analysis of 'leak before break' concept for the pipings of fuel channels with TMO-2,* and *Development of a set of equipment intended for picking of spent fuel debris in the hot cells of Ignalina NPP*. To implement the latter, a facility for picking spent fuel debris will be designed and installed in the hot cells of the Ignalina NPP.

In 2005, six draft regulatory documents were drawn up jointly with experts from Jacobsen Engineering Ltd., the UK, and submitted to VATESI: *Requirements for risk assessment and management, Requirements for level one probabilistic safety assessment at nuclear power facilities, Requirements for level two probabilistic safety assessment at nuclear power facilities, Requirements for application of probabilistic safety assessment at nuclear power plants, Requirements for assessing operational experience system of NPP,* and *Requirements for assessment of human factor at nuclear power facilities*. Selected beyond-design-basis accidents were analyzed in 2005 in collaboration with Jacobsen Engineering Ltd. and SCIENTECH, the USA. This is necessary in order to improve strategies for managing beyond-design-basis accidents (BDBAs) at the Ignalina NPP.

The Institute's specialists jointly with GRS Research Center, Germany, started work on analysis of the ACS at INPP. At the first stage of the project, hydrogen distribution in ACS compartments was analyzed in the event of a beyond-design-basis accident at the Ignalina NPP. The project is to be completed in 2006.

Specialists of LNSI in 2005 continued their active participation in ES BP6 competence network SARNET, devoted to phenomenology of severe accidents and integration of European research on their management. The LEI also participated in the activities of the European networks ENIQ and NESC III, and took part in the projects BEQUAR, ISP-47 and IRIS. Experts of the laboratory in 2005 started to participate in international research programs PHEBUS FP (safety of water-cooled nuclear reactors and studies of severe accidents) and FUSION (research on thermo-nuclear synthesis).

The Laboratory of Nuclear Engineering Problems (LNEP, LEI) in 2005 implemented or participated in implementation of the following projects:

- Safety assessment and upgrading of Maišiagala radioactive waste repository (contract with THALES ENGINEERING & CONSULTING, France).
- Preparing the program of radiological research of INPP and equipment (contract with INPP).
- Identifying preliminary waste acceptability criteria for a repository of landfill type (contract with INPP).
- Temporary storage of spent nuclear fuel from Units 1 and 2 (contract with RW NUKEM GmbH, Germany).
- Studies and application of radioactive waste generation, scattering, impact on the environment and humans (funded by the Lithuanian State Science and Studies Foundation).
- Analysis of effects of potential climate changes on the safety of a deep repository (contract with RATA).
- Designing a facility for picking spent fuel debris in the hot cells of INPP (contract with INPP).
- Analysis of INPP Unit 1 decommissioning and radioactive waste management (funded from the state budget).

Specialists of the LNEP also participated in the international projects coordinated by the IAEA, *The aspects of disposal of low- and intermediate-level decommissioning waste, Solutions of radioactive waste management, Safety assessment of decommissioning of nuclear facilities*, as well as in the activities of IAEA Technical Group of Decommissioning (TEGDE) and of the organization committee developing an international database of graphite subjected to radiation. The Laboratory's scientists took an active part in the programs of ES BP6 SAPIERR (Support Action: Pilot Initiative for European Regional Repositories) and EURATOM research and training CCE-FU program.

Experts from **UAB ITECHA** in 2005:

- Participated in the project *Support to VATESI in assessing and licensing the design of new servo drives and their commissioning in INPP Unit 2.*
- Implemented tasks within the framework of PHARE project *Support to VATESI for important tasks relevant to the licensing activities of Ignalina Nuclear Power Plant* and prepared the document *Manual on assessment of implementation of certification program of safety-related systems and elements at nuclear power facilities.*
- Participated in the project *Review of documents related to BDBAs at the Ignalina NPP* (contract with the FI).

The activities of the **State Institute of Information Technologies (SIIT)** in 2005 were mostly related to practical tasks of Ignalina NPP safety improvement. SIIT experts implemented the following safety improvement projects and their safety cases:

- The diverse shutdown system.
- Modernization of AKRB-06 and GORBACH radiation monitoring system.
- Reliability analysis of continuous power supply aggregate ABP-1500 aimed at extending its service life.
- Developing a safety code for the diverse shutdown system AZ/BSM for INPP Unit 2.
- The system for detecting leaks in TG-4 lines of INPP Unit 2 and reconstruction of TG-3 steam lines.
- The system for detecting coolant leaks in the reinforced compartment of INPP Unit 2.
- Designing the erection of lower water communication compartments of exhaust ventilation 2WZ56 of bypass piping in INPP Unit 2.

Specialists from **Vilnius Gediminas University of Technology (VGTU)**, the LEI, KTU and the Institute of Geology and Geography participated in implementing the PHARE project Assistance programme to VATESI and its TSOs in structural dynamics analysis (LI01.18.02) that was completed in early 2005.

Specialists of VGTU conducted a pilot study of dynamic analysis of the building of INPP Unit 2 reactor. Scientists from the Material Strength Department (MSD) of VGTU and the Laboratory of Numerical Simulation (LNS) of VGTU

in collaboration with representatives of the Institute of Geology and Geography conducted seismic analysis with the building's interaction with soil taken into consideration and not taken. The document *The requirements of analysis of seismic impact on nuclear power facilities* was drafted in the course of the project implementation.

Specialists from VGTU, KTU and FI performed a review of the documents relating to the project ongoing at the Ignalina NPP regarding burning of INPP Unit 1 fuel in Unit 2. Scientists and experts from the Material Strength Department (MSD) and the Department of Labor and Fire Safety (DLFS) of VGTU and other units of the university were involved in the project. They assessed whether the design was in compliance with the most advanced know-how in safety analysis and designing of structural elements and documents effective in Lithuania, and analyzed the documents related to the report on safety justification of burning INPP Unit 1 fuel in Unit 2. The documents were mostly viewed from the viewpoint of the analysis of the condition of structural elements and fire hazard analysis.

Specialists of the Institute of Welding and Material Research Problems (IWMRP VGTU) and FI continued research on the subject *Review of documents related to analysis of BDBAs at INPP*.

Specialists of the IWMRP VGTU rendered expert and consultation support to VATESI on issues relating to welding of elements operated in nuclear power facilities. They participated in drafting of documents related to operation and welding of elements in accordance with the provisions of the EU and were involved in legitimization of the documents in Lithuania.

Scientists from the Laboratory of Numerical Simulation and the Laboratory of Strength Mechanics of VGTU participated in the project *Development of analysis methodology of BDBAs in INPP Units 1 and 2* on seismic impacts on buildings and systems. In the course of the project, a review was conducted of documents addressing the issues of seismic analysis of the Ignalina NPP. The main objective of the project is to develop methodology for assessing the strength of buildings under seismic loads. Earth movements during an earthquake, the interaction between the soil and building, the methods of static and dynamic analyses of structures and peculiarities of computation models were analyzed while implementing the project.

24. TRAINING AND IMPROVING SKILLS OF VATESI SPECIALISTS

Fifty-two employees, 18 women and 34 men, were working with VATESI as of late 2005, 41 of them were civil servants.

One specialist was accepted to civil service with the Decommissioning and Radiation Protection Division of VATESI in 2005. One employee left VATESI.

In 2005, 42 VATESI employees improved their skills at different training events in Lithuania and abroad. VATESI employees, and nuclear safety specialists in particular, enjoy excellent opportunities for improving skills and making use of the support provided by international organizations, EU institutions and foreign countries.

The IAEA is the main international organization providing assistance in extension of knowledge of specialists in nuclear power. Twenty-five VATESI specialists took part at 27 training events related to regulation of nuclear safety arranged by the IAEA in 2005. Eight training events were arranged with support from the EU; 7 VATESI specialists improved their skills there.

25. PUBLIC INFORMATION

In 2005, the media and public were mostly interested in the future of nuclear energy in Lithuania, the possibility of constructing a new nuclear power facility, and the issues relating to radioactive waste management. These were the subjects on which most publications appeared in the country's press, and radio and TV programs were focused on. Topical information on issues that concern the public was continuously presented on VATESI website.

The seminar for the media representatives *Well managed radioactive waste means safe environment* was arranged jointly with RATA in November. Journalists of the national and regional press, radio and TV, as well as representatives of *Atgaja* Green Association, the mayors of Visaginas and the Ignalina District participated at the seminar. The objective of the event was to inform journalists about radioactive waste management, siting of a near-surface repository for short-lived radioactive waste and its construction in Lithuania, environmental impact assessment, etc. Prior to the seminar the media representatives together with specialists visited two sites at Galilaukė and Stabatiškė, the most suitable for a near-surface repository.

Representatives of Greens and the District's mayors expressed their views and the journalists' questions were answered at the seminar.

Specialists and the media representatives at Galilaukė site.

Journalists were interested in information presented at the seminar on radioactive waste management in Lithuania.

Radioactive waste management is an extremely sensitive subject to residents of neighboring countries. Therefore a Lithuanian delegation headed by the Secretary of the Ministry of Economy of Lithuania, Artūras Dainius, visited Minsk in November 2005. The delegation comprised Head of VATESI, Saulius Kutas, Director of Radioactive Waste Management Agency, Dainius Janėnas, and his deputy, Algirdas Vaidotas, and Dr. Jonas Satkūnas, Deputy Director of the Geological Survey of Lithuania. Belarusian journalists flocked to the press conference held at the Embassy of the Republic of Lithuania where the plans of construction of a near-surface repository for radioactive waste in Lithuania and the results of environmental impact assessment were presented, and numerous questions were answered.

Belarusian journalists flocked to the press conference. A. Dainius (right), the Secretary of the Ministry of Economy, S. Kutas, Head of VATESI, and other representatives from Lithuanian institutions are answering journalists' questions.

The EU is providing considerable assistance to Lithuania in nuclear safety improvement in Lithuania through PHARE projects. A special booklet in Lithuanian, English and Russian was published with a view to informing the public about the PHARE project *Support to VATESI for safety culture and organizational issues specific to the pre-shutdown phase of Ignalina Nuclear Power Plant*. Information on specific safety culture issues at INPP in preparation for the facility's decommissioning, as well as about the activities within the framework of the PHARE project is given in the publication.

Another special publication is to be produced on the decommissioning of the Ignalina NPP and the PHARE project *Support to VATESI and Lithuanian TSOs in the area of Ignalina NPP decommissioning licensing*.

VATESI specialists participated at the meetings of the National Nuclear Safety Advisory Committee (NNSAC) and delivered reports on important issues of INPP safety.

Two meetings of the Committee were held in 2005, on March 17 and October 21. Among other things, issues associated with the progress in INPP Unit 1 decommissioning operations, safety assurance of Unit 2, radioactive waste management, developing activities of the country's TSOs for dismantling of the nuclear power facility, etc. were discussed at the meetings.

26. NUCLEAR SAFETY REGULATION IN THE EU. THE ROLE OF THE EUROPEAN COMMISSION AND MEMBER COUNTRIES

EURATOM treaty provides certain competence to the European Commission in the area of regulation of nuclear energy and nuclear safety. However, the final and sole responsibility for nuclear safety lies with the operator of the nuclear facility who ensures compliance with national, legally binding nuclear safety requirements.

In 2005, working groups functioned under the auspices of the European Council and European Commission, including the European Group of Concentration on European Regulatory Tasks (CONCERT), Nuclear Regulators Working Group (NRWG), the Regulatory Assistance Management Group (RAMG), the Atomic Questions Group (AQG) and its Working Party on Nuclear Safety (WPNS). VATESI participated in their activities.

VATESI specialists S. Kutas, K. Žilys, S. Švirmickas, A. Vinskas, M. Davainis and Ž. Patašius took part in preparing information, as well as analyzing and discussing draft documents by the European Union.

The Atomic Questions Group, in view of the conclusions of the European Council, jointly with specialists from EU member countries, worked out an action plan for ensuring safety of nuclear reactors and radioactive waste management. Whilst implementing the plan, a questionnaire was prepared in 2005 on the requirements of safety for nuclear reactors operated in member countries and implementation of those requirements in Europe's NPPs. VATESI prepared answers and submitted them to the European Commission. In 2005, VATESI also received a questionnaire on the state of radioactive waste safety management in the EU. VATESI prepared replies and submitted them to the European Commission at the set time, in early 2006.

The Atomic Questions Group many times discussed application of documents governing EURATOM safeguards in the area of non-proliferation of nuclear weapons and nuclear materials, transition from bilateral (the IAEA – country) to trilateral (the IAEA – EURATOM – country) agreement as regards the Protocol Additional, and proposals concerning a new procedure of EURATOM inspections. It should be noted that progress has been slow in this area, as it is difficult to bring in line the positions of the European Commission and member countries, old EU member countries in particular.

As Lithuania has joined the EU, and instruments of EU support to nuclear safety have been changing, VATESI's interest in the RAMG activities has changed. A representative of VATESI became a member of the RAMG. The RAMG is currently analyzing nuclear safety support projects within the framework of TACIS program to Russia, Ukraine, Armenia and other countries, as well as PHARE program to Bulgaria and Romania.

The Working Party on Nuclear Safety of the AQG has been analyzing the new draft directive as regards EU support to nuclear safety upgrading of third countries. VATESI supports the project by submitting comments.

The European Group of Concentration on European Regulatory Tasks (CONCERT) and Nuclear Regulators Working Group (NRWG)

The CONCERT group comprises representatives of nuclear safety regulatory authorities of EU Member countries of Central and Eastern Europe, and countries of the Commonwealth of Independent States. Its objective is to create conditions for multilateral cooperation. To date, 27 meetings of the Group have taken place.

The aim of the NRWG is to generalize experience in the key areas of nuclear safety. The Group analyzes the management of plant aging, safety assurance during annual outages of reactors, risk-informed in-service inspections, develops indicators of safety assessment, etc. Sixty-five Group meetings have already been held.

During the CONCERT 27th meeting in Riga, the Organisation for Economic Co-operation and Development (OECD), NRWG, EuropeAid Co-Operation Office (AIDCO), Commission for External Relations (RELEX), Joint Research Centre (JRC), RAMG delivered their reports on their activities and the results achieved. The directions of safety regulation of the research reactors under consideration were analyzed in detail. Representatives of Latvia, Italy, the Czech Republic, Hungary, France, Bulgaria, Kazakhstan and Poland delivered reports on the subject. Discussions were completed at the meeting on the issue of the regulator's approach towards safety improvement of nuclear power facilities constructed in compliance with the previously valid safety standards, and CONCERT conclusions were drawn.

An interesting report was delivered by a representative of the group of municipalities having nuclear power facilities on their territory. The group comprising municipalities of different countries seeks to call the attention of EU institutions not only to the economic issues of nuclear energy, but also to social problems. The members of the group demand comprehensive information, safety assurance and benefits to community members.

The NRWG 65th meeting was held in Luxemburg. A common view on licensing of soft-ware very important for safety, the management of NPP aging, the practice of safety assurance during annual outages, the regulators' position and initiatives as regards prevention of filter clogging were discussed at the meeting. Finland's representative informed about the licensing process of Olkiluoto NPP Unit 3. VATESI delivered a report on licensing of Ignalina NPP Unit 2 and the practice implemented in Lithuania in accordance with which all nuclear power facilities are licensed on the basis of comprehensive safety assessment confirming their safety.

The NRWG uses in its activities technical expertise methods and working groups while publishing EU documents approved through consensus.

At the meetings of the CONCERT, NRWG and AQG, the issues of rationalizing the CONCERT and NRWG groups' activities were discussed. It was emphasized that the groups had basically achieved their objectives, nevertheless they should continue their activities.

It was agreed in principle that the groups could be joined together and a new group, European Group of Nuclear Regulation Experts (ENREG) formed instead. The following problems became evident when the proposed organizational restructuring was discussed:

- If the group is given the status of an advisory institution of the European Commission, it must be chaired by representatives of member countries;
- It is difficult to act as advisor to the EU and at the same time to participate in activities of a nuclear safety group working for the European Council;
- It is difficult to select the group members as they must deal with technical issues and simultaneously act as politicians;
- It is unacceptable that the group's role is narrowed to advisor status and the opportunity is lost for regulators' discussions;
- The group's areas of activity merit discussion.

CONCERT and NRWG members expressed comments on the draft Terms of References of the new ENREG group drafted by the European Commission. The EC ignored the key proposals of member countries and in early 2006 circulated a new draft that is basically identical to the previous ones urging to appoint representatives to the ENREG.

Due to the ongoing changes only one CONCERT and one NRWG meeting took place in 2005 instead of two envisaged in the ToR's.

When CONCERT meetings are held in member countries, the participants are given an opportunity to visit nuclear power facilities. The organizers of the event in Riga arranged a tour of Salaspils Research Reactor.

27. VATESI PARTICIPATION IN ACTIVITIES OF WESTERN EUROPEAN NUCLEAR REGULATORS ASSOCIATION (WENRA)

WENRA in its activities is striving to achieve the main aims of the Association approved in Paris on March 14, 2003.

Two WENRA meetings, in the Hague and Stockholm, were held in 2005. Issues of harmonization of safety approaches for nuclear reactors, radioactive waste management, and NPP decommissioning were discussed there. Differently from previous years, representatives of countries that do not operate nuclear power facilities were not invited to either meeting in 2005. The decision to this effect was taken because the work on harmonization of reactor safety regulations was coming to an end, the schedule was very tight, and preparations were being made for the workshop that was due to be held in Brussels in early 2006. The final report on harmonization of reactor safety in WENRA member countries was presented at the event and is given on WENRA website. Everybody, including specialists of atomic industry and nuclear power facilities, is thus given an opportunity to familiarize himself with the set safety reference levels, to find out whether or not they were included in national nuclear safety regulation requirements and are complied with at NPPs. It is very important that operators of atomic industry and nuclear power facilities can express their comments on the work done.

Working Group on Waste and Decommissioning (WGWD) drafted two reports, on safety reference levels for radioactive waste and spent nuclear fuel, and on safety reference levels for decommissioning. The reports were discussed at WENRA meetings and it was recommended to complete the work.

The future of the harmonization working groups was discussed at the Stockholm meeting. It was recognized that the groups had done a great and useful job, and had gained considerable experience. They would continue coordinating harmonization activities. However, new proposals regarding widening of activities and analysis of topical subjects would also be discussed. WENRA members were unanimous in that the knowledge gained and experience of the working groups must not be forgotten and need to be applied in the future too, even in the activities of other areas associated with assurance of nuclear safety.

At the Hague meeting a statement was prepared (and later on signed in Stockholm) by the heads of nuclear safety regulatory authorities of WENRA countries on the issue of nuclear safety assurance in Europe. The statement was included in the report on harmonization activities.

It is emphasized in the statement that the operator's direct responsibility is the key principle assuring safety. Regulators must see to it that the responsibility is guaranteed with all safety requirements complied with. WENRA

undertook to develop harmonized nuclear safety assurance approaches including safety reference levels. At a later stage member countries will draw up harmonization plans so that the work on harmonization is completed in 2010.

WENRA's activities are open, it informs EU institutions about the work done. Two harmonization working groups have been set up, the Reactor Harmonization Working Group and the Radioactive Waste Harmonization Working Group. The latter, in view of the intensifying process of decommissioning and the common character of the problems of radioactive waste management and decommissioning, included issues related to harmonization of decommissioning safety approaches into its field of activities.

WENRA is not an exclusive club. Information about its activities is accessible to everyone. Not only WENRA members, but also heads of nuclear safety regulatory authorities of other countries and specialists from other institutions working in nuclear are invited to its meetings.

The decisions of nuclear safety regulatory authorities of WENRA member countries, Belgium, Bulgaria, the Czech Republic, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the UK, are based on consensus.

In addition to other functions, WENRA assesses the level of nuclear safety in EU candidate countries prior to their joining the EU.

VATESI representatives participated in the activities of two WENRA harmonization working groups in 2005, but the Inspectorate did not produce any special reports for WENRA meetings.

28. WENRA SAFETY REQUIREMENTS HARMONIZATION PROGRAM

To achieve the aims of Western European Nuclear Regulators Association (WENRA), two working groups were set up, the Reactor Safety Harmonization Working Group (RHWG), and the Working Group on Waste and Decommissioning (WGWD). VATESI is represented in both.

Activities of Reactor Harmonization Working Group (RHWG)

The aims of RHWG set up in 1999 consist in:

- To identify major differences in reactor safety in the valid requirements of WENRA countries.
- To suggest, if necessary, the ways of harmonizing reactor safety.

The working group began its activities by conducting a pilot study within the framework of which six selected areas of reactor safety were analyzed. At the time, six countries participated in the study. In 2002, the pilot study was completed, and the decision was made to continue the work. The RHWG was instructed to identify the areas of reactor safety that needed harmonization.

Eighteen topic areas of reactor safety were selected. At the first stage, safety reference levels were set for these areas, and in 2004, the second stage of the study began. At the latter stage national standards were compared with the set safety reference levels. Lithuania also joined the study. Seventeen countries were represented in the working group. Safety reference levels of 8 areas were analyzed in 2004, and all the remaining reference levels were reviewed in 2005. Shortcomings were revealed in the safety reference levels while reviewing the national regulatory documents, therefore all the comments received from member countries were thoroughly analyzed.

A report of the working group was produced and presented at the main meeting of WENRA in late 2005. To sum up the results of the study, it can be stated that the bulk of Europe's national requirements have already been harmonized, as the countries that participated in the study whilst developing national requirements more often than not take into consideration international experience as well as IAEA standards and recommendations. Implementation

Fig. 1 **Compliance of national requirements of European countries**

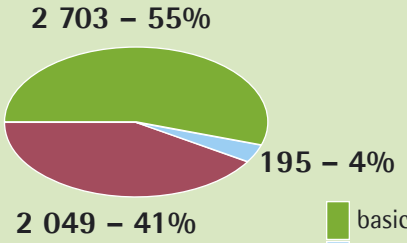
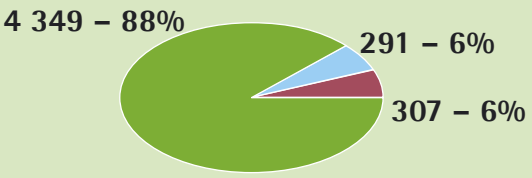


Fig. 2 **Implementation of recommendations at Europe's NPPs**



basically harmonized
differences exist, yet they are inessential in terms of safety
differences exist that must be taken into consideration during harmonization

of WENRA recommendations at Europe's NPPs for the most part has been harmonized too. Therefore although some countries still do not have formalized requirements in certain areas, the operating organizations comply with informally set requirements that were not taken into consideration in the study or standards and recommendations set forth by the IAEA.

A commitment was made to draw up plans of measures to put right non-compliances identified in the course of the study. For more information on the study see the group's report on WENRA website at www.wenra.org. Information about Lithuanian results is given on VATESI website at www.vatesi.lt.

Activities of Working Group on Waste and Decommissioning (WGWD)

In late 2001, WGWD launched a project aimed at harmonizing requirements effective in WENRA member countries in the area of decommissioning and operation of radioactive waste storage facilities. The aim of the project is to identify safety reference levels that WENRA members will have to comply with. If necessary, national requirements will be adjusted. Safety reference levels are set considering the currently existing legislations and international recommendations.

Three meetings of the working group were held in 2005. The group developed safety reference levels for decommissioning and operation of radioactive waste storage facilities. The information was published on the internet in early 2006. The WGWD analyzed legislation of member countries with regard to the identified safety levels and submitted proposals concerning harmonization of the documents by indicating in what areas of decommissioning and operation of radioactive waste storage facilities changes need to be made so that legislation complies with the safety reference levels.

29. INTERNATIONAL CONVENTIONS, LAWS AND SECONDARY LEGISLATION

One of top priorities for Lithuania after it has become a EU member is improving nuclear safety. To ensure nuclear safety, every country must create effective infrastructure and legal basis.

The key principles and requirements governing nuclear safety are set forth in international conventions. Lithuania has joined the following international agreements and conventions directly related with safe use of nuclear energy:

1. **The 1968 Treaty on the Non-Proliferation of Nuclear Weapons.** Lithuania joined it by Resolution No. I-1492 of the Seimas on 23 September 1991.
   In 1992, **The Agreement between the Lithuanian Government and the IAEA on Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons** was signed, and in 2000, the Seimas ratified **The Protocol Additional to the Agreement between the Lithuanian Government and the IAEA on Application of Safeguards** (Law No. VIII-1578 of 21 March 2000) and **The 1959 Agreement on Privileges and Immunities of the International Atomic Energy Agency** (Law No. IX-78 of 14 December 2000).
2. **The 1963 Vienna Convention on Civil Liability in the Field of Nuclear Energy,** and **The 1988 Joint Protocol Relating to the Application of the Vienna Convention and Paris Convention.** On 30 November 1993, the Seimas declared these having the force of law in Lithuania (Law No. I-314).
3. **The 1986 Convention on Early Notification of a Nuclear Accident.** The Government of the Republic of Lithuania joined the Convention on 13 October 1994 (Government Resolution No. 972).
4. **The 1979 Convention on Physical Protection of Nuclear Materials.** Lithuania joined the Convention on 16 November 1993 (Order of Prime Minister of Lithuania No. 778p).
5. **The 1994 Convention on Nuclear Safety.** Ratified by the Seimas on 17 October 1995. (Resolution No. I-1063).
6. **The Comprehensive Nuclear Test Ban Treaty.** Ratified by the Seimas on 28 October 1999 (Law No. I-1372).
7. **The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency,** ratified by the Seimas on 20 July 2000 (Law No. VIII-1882).
8. On 18 December 2003, the Seimas ratified **The 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management** (Law No. IX-1921).

In 1997, the following conventions were signed: **The 1997 Convention on Supplementary Compensation for Nuclear Damage,** and **The Protocol Replacing the Vienna Convention.** These, however, have not been ratified to date.

Amendments to The Convention on Physical Protection of Nuclear Materials were signed in 2005. Lithuania will seek to ratify these in 2006.

Ratification documents of trilateral Agreements between EU member states, the IAEA and EURATOM were prepared in 2005. The Agreements are to be ratified in 2006. After they come into force, **The Agreement between**

the Lithuanian Government and the IAEA on Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons and **The Protocol Additional to the Agreement between the Lithuanian Government and the IAEA on Application of Safeguards** will lose validity.

International organizations such as the IAEA, NEA/OECD, and EU organizations have been rendering support to Lithuania in creating and developing the national infrastructure and legal basis. The IAEA generalizes the best practices of countries worldwide and prepares recommendations (Safety Fundamentals, Standards, Guides), thus making it easier to countries to implement general nuclear safety requirements. Lithuania is following recommendations of international institutions and perfecting its national legislature in the area of nuclear safety.

National legislature in the field of nuclear safety

The main legal document governing nuclear energy in Lithuania is the **Law on Nuclear Energy** passed by the Seimas in 1996. There are some other laws directly relating to safe operation of nuclear energy, such as the **Law on Radioactive Waste Management,** the **Law on Radiation Protection,** the **Law on Control of Import, Export and Transit of Strategic Commodities,** the **Law on Civil Protection,** the **Law on Construction**, etc.

After planning began of Ignalina NPP decommissioning operations, the following laws were passed:

- **The Law of the Republic of Lithuania on Decommissioning of Unit 1 of the State Enterprise Ignalina Nuclear Power Plant** (2000).
- **The Law of the Republic of Lithuania on Decommissioning Fund of the State Enterprise Ignalina Nuclear Power Plant** (2001).
- **The Law of the Republic of Lithuania on Additional Employment and Social Guarantees for the Employees of the State Enterprise Ignalina Nuclear Power Plant** (2003).

In accordance with the Convention on Nuclear Safety, a country operating nuclear reactors must have an operating organization (operator) and an institution regulating nuclear safety. Ignalina Nuclear Power Plant State Enterprise has been granted the status of the operating organization and therefore it bears responsibility for nuclear safety. VATESI is responsible for safe operation of nuclear installations and safe use of nuclear material as well as state regulation of the radioactive waste that forms at the nuclear power facility.

30. REPORTING FOR IMPLEMENTATION OF OBLIGATIONS UNDER THE CONVENTION ON NUCLEAR SAFETY

Lithuania signed the Convention on Nuclear Safety on March 22, 1995, and submitted the ratification papers on June 12, 1996. Fifty-five countries have joined the Convention to date. The aims of the Convention on Nuclear Safety consist in achieving and maintaining a high level of nuclear safety worldwide, encouraging participants to develop and implement at nuclear facilities efficient safety measures with a view to preventing radiological hazard, protecting population and the environment from dangerous effects of ionizing radiation, to prevent accidents with radiological impacts, and to mitigate their effects if they do occur.

According to the rules of the Convention on Nuclear Safety each Contracting Party shall prepare and present its national report and take part in the consideration of the national reports of other Contracting Parties.

Meetings of the Contracting Parties under the Convention on Nuclear Safety are held every three years. Lithuanian delegation participated at the meetings of 1999, 2002 and 2005.

The Ministry of Economy and VATESI, obligated by the Government of the Republic of Lithuania, coordinated production of the first two national reports. The Lithuanian Government obligated VATESI to coordinate production of the third national report.

In 2004, VATESI, the Ministry of the Environment, the Ministry of Health (the Radiation Protection Center), the Ministry of Economy, the Ministry of Internal Affairs (the Civil Protection Department), and the Ignalina NPP jointly produced and submitted the third Lithuanian National Report.

During the review process of the Convention Contracting Parties' national reports, 61 questions were asked about Lithuania's report. Lithuanian representatives had 66 questions to other Contracting Parties' national reports. The IAEA created expressly for the purpose the Nuclear Safety Convention page on the Internet on which countries asked each other questions and received answers to them. It was the first time this practice was used.

Lithuanian delegation of 12 specialists from the abovementioned institutions that were involved in the production of Lithuania's National Report was set up by the order of the country's Prime Minister. The delegation with VATESI Head, S. Kutas, in charge represented Lithuania in the third review meeting held in Vienna on April 10-22. Representatives of 50 countries participated in the event.

The participants were divided into 6 groups and worked in sessions during which they presented abstracts of

respective national reports. Lithuania formed group 2 together with France, Belarus, Armenia, Mali, Spain, Poland, Slovakia and Cyprus. It presented its report on April 16.

Lithuanian delegation was asked additional twenty-odd questions. In preparation for the fourth review meeting, Lithuania was suggested submitting information about safety assurance after shutting Ignalina NPP Unit 1 down, as well as about implementation of the safety improvement program, about safety assurance with the single Unit operational, and about effectiveness of implementation of bilateral agreements with neighboring countries.

Plenary meetings were held on 19-20 April at which abstracts of national reports of every participant of the six groups were delivered and discussed. Another two days were spent preparing, discussing and adopting the final report of the third review meeting of the Contracting Parties under the Nuclear Safety Convention.

Lithuanian delegation at the 3rd review meeting of the Contracting Parties under the Convention on Nuclear Safety (left to right): R. Voronov (INPP), M. Demčenko and S. Kutas (VATESI), V. Skaržinskienė (the Fire and Rescue Department), R. Gagienė (the Ministry of the Environment), A. Bieliauskas (VATESI), G. Klevinskas (RPC), V. Greičiuvienė (Nuclear Energy Attache of the Permanant Mission of the Republic of Lithuania to the IAEA), B. Purlienė (the Ministry of Economy).

31. REPORTING FOR IMPLEMENTATION OF OBLIGATIONS UNDER THE JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Lithuania signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management on September 30, 1997, and ratified in on December 18, 2003. The Convention came into force in Lithuania on June 14, 2004.

Lithuania like other Contracting Parties in accordance with provisions of the Article 32 of the Convention must submit a report on implementation of obligations undertaken.

In 2005, VATESI coordinated the production of Lithuania's first National Report. VATESI specialists prepared the document jointly with representatives of the Ministry of Health (the Radiation Protection Center), the Ministry of the Environment, the Ministry of Economy (the Radioactive Waste Management Agency), the Ministry of Internal Affairs (Fire and Rescue Department) and the Ignalina NPP in compliance with the provisions of *Guidelines regarding Form and Structure of National Report* approved by Contracting Parties. In early 2006, the Contracting Parties submitted one another comments and questions.

A second review meeting of the Contracting Parties under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management is due to take place in Vienna on May 15-24, 2006. Lithuania in the course of preparation for the event has submitted in advance in its national report information about legislation governing spent nuclear fuel and radioactive waste management, the existing facilities, the practice of managing SNF and radioactive waste, and the planned measures of improving safety in this area.

32. INTERNATIONAL COOPERATION GROUP OF VATESI

The International Cooperation Group (ICG) of VATESI was set up on March 18, 2005, with a view to continuing mutually useful collaboration initiated by the Licensing Assistance Project.

The ICG is a working group in whose activities representatives of VATESI, foreign regulatory institutions, TSOs and other organizations take part on a voluntary basis. The Group's main objectives are as follows:

- Coordinating bilateral and multilateral projects of VATESI;
- Advising VATESI on major issues of nuclear safety;
- Exchanging information and sharing experience in the area of nuclear safety and regulation.

Experts from the Swedish Nuclear Safety Regulatory Authority (SKI), the French Institute of Nuclear Safety and Radiation Protection (IRSN), the German State Nuclear Reactor Safety Consulting Association (GRS), the State Department of the USA (DoS) and other institutions participate in the activities of VATESI ICG.

VATESI Head, S. Kutas, was elected ICG Chairman at the constituent meeting, and SKI expert Per Bystedt his deputy.

At the meeting of VATESI International Cooperation Group.

Two ICG meetings were held in 2005 to discuss EU support projects prepared and implemented by VATESI, IAEA projects of technical cooperation, as well as other bilateral projects. Technical issues of installation of additional accident protection at INPP, the safety assessment of the single operational INPP Unit 2, Lithuania's first report under the Joint Convention on Safe Management of Spent Fuel and Radioactive Waste as well as other topical issues were analyzed at ICG meetings.

33. INTERNATIONAL TECHNICAL COOPERATION PROJECTS

IAEA REGIONAL PROJECTS IN THE AREA OF NUCLEAR SAFETY AND NUCLEAR POWER

In 2005, Lithuania participated in the following eight IAEA European regional technical cooperation projects in the area of nuclear safety and nuclear power:

- RER/4/025 – *Optimisation of NPP performance and service life.*
- RER/4/027 – *Strengthening capabilities of NPP performance and service life including engineering aspects.*
- RER/9/061 – *Enhancement of nuclear safety authority effectiveness.*
- RER/9/076 – *Strengthening safety and reliability of nuclear fuel and materials in NPPs.*
- RER/9/078 – *Safety assessment and regulatory control of waste management and disposal facilities.*
- RER/9/082 – *Improvement of design basis and configuration management documentation.*
- RER/9/083 – *Strengthening safety assessment capabilities and risk-informed decision-making.*
- RER/9/084 – *Effectiveness of regulatory authorities and advance training in nuclear safety.*

Participation of representatives of Lithuanian organizations in the work on the projects is coordinated by the Safety Assessment Division of VATESI. To this end, a special database has been developed and used.

In 2005, representatives of Lithuania participated in 26 events held abroad related to implementation of the above-mentioned projects, including 16 workshops, 4 training courses, and 6 technical meetings. Forty-seven specialists from Ignalina NPP, VATESI and their TSOs participated in the events abroad. They got acquainted with advanced experience and requirements in different areas of nuclear safety assurance and analysis, and established contacts with their foreign counterparts.

On October 17-21, 2005, IAEA workshop *Support in preparing emergency operation instructions and managing beyond-design-basis accidents* was held at the Ignalina NPP. Specialists from Lithuania, Armenia,

Bulgaria, Croatia, Hungary, Romania, Russia, Slovenia, Ukraine, Italy, and the IAEA participated in the event.

Thirty international events, including many meetings, courses and consultations important and interesting to Lithuania's specialists are planned within the framework of the abovementioned projects in 2006. Two workshops, on RBMK safety issues (project RER/9/083), and on the subject of regulators' requirements for NPP decommissioning (project RER/9/084), as well as a training course to regulators *The practice of nuclear safety inspections* (project RER/9/084) are due to take place in Lithuania.

EU support projects

VATESI implemented, prepared and planned the following eight EU support projects in 2005:

- implementation of four projects was ongoing, and three of these were successfully implemented in 2005;
- agreements were signed on two new projects and their implementation began;
- two new projects of the Transition Facility and the Ignalina NPP program were being prepared and the project descriptions were prepared.

Project implementation by VATESI in 2005 by year

Srl. No.	Project No.	2003	2004	2005	2006
1.	LI01.18.02				
2.	LI01.18.03				
3.	5812.04.01				
4.	LT/2003.5825.02				
5.	2004/016-925-05-01-01				
6.	5812.04.02				

1. Assistance Program to VATESI and its TSOs in Structural Dynamics Analysis, LI01.18.02.

The service contract was signed and implementation of the project began on November 19, 2003. The project was completed on January 19, 2005.

The principal objectives of the project:

- assessing the capabilities of Lithuanian TSOs in the area of structural dynamics analysis and proposing recommendations to improve the situation;
- providing the software required for structural dynamics analysis;
- producing a report on seismic analysis of INPP reactor building;
- producing a report of analysis of explosion effects and of aircraft impact and its consequences to the structure of INPP reactor building;
- developing draft national requirements for structural dynamics analysis of INPP structures.

2. Support to VATESI for Important Tasks Relevant to the Licensing Activities of Ignalina Nuclear Power Plant, LI01.18.03.

The service contract was signed and implementation of the project began on November 27, 2003. The project was completed on January 27, 2005.

The principal objectives of the project:

- Improvement of the skills of VATESI and TSO staff in reviewing of safety-important systems of INPP;
- Support in developing VATESI requirements for implementation of ENIQ methodology in Lithuania;
- Support in developing VATESI regulatory guide on the implementation of requirements for Ignalina NPP accident analysis;
- Support in developing VATESI requirements on BDBA assessment and management for RBMK-1500 reactor, gaining specific scientific knowledge related to issues of severe accident physics;
- Procurement of necessary software and equipment. VATESI will be advised in the preparation of a relevant technical specification.

3. Support to VATESI for Safety Culture and Organizational Issues Specific to the Pre-shutdown Phase of Ignalina Nuclear Power Plant, 5812.04.01.

The service contract was signed and implementation of the project began on June 1, 2004. The project was completed on August 1, 2005.

The principal objectives of the Project:

- Analysis of specific safety culture and organizational problems related to preparations for INPP decommissioning, transfer of Western experience and know-how;
- Identification of critical safety culture and organizational elements affected by decommissioning of the nuclear power facility;
- Monitoring the key problems of safety culture and organizational aspects in preparation for decommissioning;
- Preparing recommendations regarding critical safety culture and organizational issues in preparation for INPP decommissioning.

4. Support to Licensing Activities Related to Decommissioning of Ignalina Nuclear Power Plant to VATESI and Lithuanian TSOs (Stage three), LT/2003.5825.02.

The service contract was signed on October 26, 2004. The implementation of the Project began on November 1, 2004. The project is to be completed by November 1, 2006.

The principal objectives of the Project:

- Analyzing licensing documents of INPP and RATA submitted to VATESI in relation to INPP decommissioning;
- Improving capabilities of VATESI and TSOs in activities related to decommissioning;
- Drafting new quality management and personnel management regulating documents.

5. Support to VATESI during Review and Licensing New Servo Drives Design and Commissioning at INPP Unit 2, 2004/016-925-01-01.

The service contract was signed and its implementation began on November 30, 2005. The project is to be completed by September 30, 2007.

The principal objectives of the Project:

- Providing support to VATESI in assessing safety justification documents and licensing the recently installed automatic shutdown system during initial operation, assessing the experience gained and rendering support to VATESI in supervising should changes become necessary in the Diverse Shutdown System (DSS);
- Providing support to VATESI in reviewing and licensing the designing of the new drives of the DSS, and assuring that the rod control drives of the DSS meet the most stringent requirements.

6. Support to VATESI and its TSOs in Assessment of Beyond Design Basis Accidents for RBMK-1500 Reactors, 5812.04.02.

The service contract of the project was signed and its implementation began on November 30, 2005. The project is to be completed by November 30, 2006.

The principal objectives of the project:

- To assess the amounts of irradiated radionuclides in RBMK-1500 reactor fuel;
- To analyze the behavior of RBMK-1500 reactor, its fuel rods and the Accident Confinement System, as well as processes taking place in the SNF storage ponds in the event of a beyond-design-basis accident;
- To draft new procedures for the Emergency Response Center of VATESI.

The following new EU support projects were being prepared in 2005:

1. The 2006 Transition Facility project *Support to VATESI in Safety Assessment of Ignalina NPP.* The project's objective is to perform simulation of RBMK-1500 reactor operation meeting state-of-the art requirements.
2. *Support to VATESI Licensing Activities Related to the Decommissioning of the Ignalina Nuclear Power Plant (Stage four).*

Bilateral cooperation between VATESI and Swedish Nuclear Safety Regulatory Authority (SKI)

The Kingdom of Sweden and its Nuclear Safety Regulatory Authority's (SKI) support to VATESI began in late 1991, just a few months after the Inspectorate was established. The assistance went on until Lithuania joined the EU in 2004. The cooperation greatly contributed to enhancing VATESI competence in conducting state regulation of nuclear safety.

During the process of Lithuania's EU accession a decision was made to the effect that support by SKI should gradually grow into mutually beneficial bilateral collaboration. At the meeting held on May 4-5, 2004, VATESI and SKI shared experience in state regulation of nuclear safety, and discussed the topical issues of nuclear safety.

The second meeting of the two institutions' specialists took place in Stockholm on May 10, 2005. SKI presented the requirements set forth in recently approved regulatory documents, informed about the decommissioning problems of Barsebäck NPP, environmental impact assessment, operation experience, radioactive waste management and other topical issues. VATESI specialists shared experience in INPP decommissioning and licensing, safety assessment of installation of the Diverse Shutdown System, and other issues. General principles governing safety assessment performed by regulatory institutions and the use of scientific/technical support in the area were discussed at the meeting. Also, a plan of cooperation between VATESI and SKI was signed for the year 2006.

Cooperation between VATESI and the Department of Trade and Industry (DTI), the UK

The following projects of support to VATESI within the framework of nuclear safety program by the Department of Trade and Industry of the UK were being implemented in 2005:

- **DTI Project L8. Severe Accident Management.**

The objective of the project *Severe Accident Management* is to train specialists of VATESI and Lithuanian TSOs to conduct a review of the management guide of beyond-design-basis accidents at INPP, including severe accidents. Representatives of Serco Assurance, the UK, and Westinghouse Electric Belgium arranged a five-day training course in Vilnius in October 2004 on issues of preparation and review of a guide on managing beyond-design-basis accidents. It took more time for INPP specialists to prepare documents than initially planned therefore it was proposed holding a workshop to discuss the results of the review planned for 2005 in 2006 instead, and to extend the project implementation until March 2007.

- **DTI project L9. Preparation of Regulatory Documents.**

The Project providing for preparation of regulatory documents was completed. The draft documents *Requirements for Assessment of Human Factor at Nuclear Power Facilities* and *Recommendations on Risk Management with the Use of Probabilistic Safety Assessment* were produced. The former draft document was presented at the workshop that took place at VATESI on May 25-26 where representatives of Scientech, the USA, VATESI, INPP and TSOs participated.

- **DTI Project L16. Surveillance of Reactor Core Integrity.**

The objective of the project Surveillance of Reactor Core Integrity is to make it possible to perform independent calculations of RBMK-1500 neutronics with the new WIMS8 code by Serco Assurance. At DTI's suggestion modification of VATESI's electronic document management system was also included in the project tasks (VATESI had submitted a separate project proposal for this task). An initial meeting on the project was held at VATESI on October 5-6, 2005, during which the report on project description and work schedule were approved, and the executors divided the tasks among themselves. Work on the project is due to be completed by late August 2006.

- **DTI Project NSP/03-L7. Support in Licensing Issues Associated with Structural Integrity of Ignalina Nuclear Power Plant.**

In accordance with the Project, DTI offers support for solving nuclear power problems in the former Republics of the Soviet Union. The British Nuclear Fuels (BNFL) company concluded a contract with Serco Assurance to the effect that the latter arranges a training course and renders support to VATESI. The project was being implemented from September 2003 to the end of February 2005.

After training needs of VATESI and TSOs were assessed, material for training was supplied, and training courses and workshops were held in Lithuania and the United Kingdom within the framework of the project. Advanced

recommendations of international practice were presented during training intended for VATESI and TSOs performing independent technical assessment of structural integrity at INPP. The following areas were analyzed during the training courses:

- Review of SAR.
- Risk-based Inspection.
- Inspection Qualification.
- Cable Aging.
- Aging of Diesel Generators.
- Intergranular Stress Corrosion Cracking.
- Simulation of Crack and Residual Stresses with Finite Elements, Analysis of Stresses in Pipes.
- Designing and Assessment Standards.
- Defect Assessment.

- **DTI Project NSP/04-L23. Support to VATESI on Issues of Nuclear Material Transportation.**

The service contract of the Project was signed in September 2005. Serco Assurance was offered the project. In accordance with the project VATESI is to be rendered support in the area of regulation of nuclear material transportation through implementation of the following tasks:

- Analyzing and assessing the current system of regulation of radioactive and nuclear material transportation.
- Developing methodologies of combining packaging and transportation of radioactive and nuclear material and safety assessment.
- Providing support in developing the regulation system of and requirements for transportation of radioactive and nuclear material.

The procedure of regulation of radioactive and nuclear material transportation in Lithuania, as well as the role and responsibilities of different institutions were assessed whilst performing task one of the project. The procedure currently valid in Lithuania was compared to international standards, agreements and EU guidelines, as well as experience of other EU countries.

The initial meeting with representatives of Serco Assurance engaged in the project was held in October 2005. The issues of task one were discussed in November, with the Ministry of Communication of the Republic of Lithuania and the Radiation Protection Center being represented, and a working meeting with experts from Serco Assurance and Gesellschaft für Reaktorsicherheit GmbH (GRS), executors of project task one, took place in December. Representatives of GRS familiarized with the procedure of radioactive and nuclear material transportation in Germany.

Cooperation in the DTI projects of the nuclear safety program has been smooth. The contractors selected by the DTI and their subcontractors have shown good workmanship. The support is being provided skillfully, with changes in problems and interests important to VATESI taken into consideration.

Cooperation between VATESI and Nuclear Regulatory Commission (US NRC)

Cooperation between VATESI and US NRC began in April 1994, when an agreement was signed regarding exchange of technical information and cooperation in the area of nuclear safety. The agreement was renewed on September 22, 2000, and then on September 28, 2005.

Three main lines of cooperation were envisaged in the agreement:

- Exchange of technical information.
- Cooperation in the area of safety research.
- Cooperation in the area of skill improvement.

The parties agreed to exchange technical information associated with safety regulation, safeguards, waste management, environmental impacts of certain nuclear devices, and nuclear safety research programs, including information in the areas of nuclear safety, accounting for, control and physical protection of nuclear material, licensing, as well as information in the area of confirmed safety research, reports on operation experience including reports on nuclear incidents, events and reactor outages, and copies of regulatory standards the Parties recommend or demand to comply with.

Specialists of regulatory institutions of Lithuania and the USA collaborate in the area of scientific research in accordance with joint programs and projects. The Parties agree as to specific studies in each concrete case.

The agreement also provides for support to VATESI inspectors and employees in improving skills with assistance from US NRC. Opportunities were envisaged for VATESI inspectors to take part in joint inspections with counterparts from US NRC and in skill improvement courses, and to gain experience during in-service training at US NRC.

LIST OF ABBREVIATIONS

AQG	– Atomic Questions Group
ARGOS	– Radiation Monitoring and Radioactive Material Transfer Forecasting System
BDBA	– Beyond Design Basis Accident
BNFL	– British Nuclear Fuels Company
CONCERT	– Concentration on European Regulatory Tasks
COREPER	– EC Committee of Permanent Representatives
DSS	– Diverse Reactor Shutdown System
ENAC	– Early Notification and Assistance Conventions
ERC	– Emergency Response Center
ESARDA	– European Safeguards Research and Development Association
FSTS	– Full-Scope Training Simulator
FI	– Institute of Physics
GRS	– German State Nuclear Reactor Safety Consulting Association
IAEA	– International Atomic Energy Agency
INES	– International Nuclear Event Scale
INPP	– Ignalina Nuclear Power Plant
IPPAS	– International Physical Protection Advisory Service
IPSART	– International Probabilistic Safety Assessment Review Team
IRRT	– International Regulatory Review Team
IRSN	– French Institute of Nuclear Safety
KTU	– Kaunas University of Technology
LEI	– Lithuanian Energy Institute
NRC	– U.S. Nuclear Regulatory Commission
NRWG	– Nuclear Regulators Working Group
NSG	– Nuclear Suppliers Group
OECD	– Organisation for Economic Co-operation and Development
OPCW	– Organisation for Prohibition of Chemical Weapons
PSA	– Probabilistic Safety Assessment
RAMG	– Regulatory Assistance Management Group
RATA	– Radioactive Waste Management Agency
RELEX	– Commission for External Relations
RHWG	– Reactor Harmonization Working Group (WENRA)
RSR	– Review of Safety Analysis Report
RW	– Radioactive Waste
SAR	– Safety Analysis Report
SIIT	– State Institute of Information Technologies
SIP-1, SIP-2	– Safety Improvement Programs 1 and 2
SKI	– Swedish Nuclear Safety Regulatory Authority
SNF	– Spent Nuclear Fuel
SNFS	– Interim Spent Nuclear Fuel Storage of Dry Type
TACIS	– Technical Aid to the Commonwealth of Independent States
TSO	– Technical Support Organization
VGUT	– Vilnius Gediminas University of Technology
WANO	– World Association of Nuclear Operators
WENRA	– Western European Nuclear Regulators' Association
WGWD	– Working Group on Waste and Decommissioning (WENRA)
WPNS	– Working Party on Nuclear Safety

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