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INTRODUCTION

This Annual Report gives an overview of activities of the State Office for Nuclear Safety ("Státní úřad pro jadernou bezpečnost", SÚJB) in the supervision of nuclear safety of nuclear facilities and in the supervision of nuclear safety in the Czech Republic in 1998.

Among the most important nuclear facilities that are currently operated in the Czech Republic and which are covered by state supervision of nuclear safety and radiation protection are the four VVER 440/213 reactor units of the Dukovany nuclear power plant (NPP), two research reactors (LVR-15 reactor with a maximum power of 10 MW and LR-0 zero-power reactor) operated by the Nuclear Research Institute in Řež (ÚJV Řež a.s.) and a teaching reactor, VR-1P, operated by the Czech Technical University in Prague.

Supervision by the SÚJB also concerns nuclear safety and radiation protection of the construction of the Temelín nuclear power plant. In this case, inspection activities are primarily centred on the quality of installation work and building activities, personnel training, safety documentation reviewing, and overall preparedness of the plant for commissioning and start-up.

Apart from nuclear facilities, there are nearly 7000 workplaces with over 8200 simple and significant radiation generators and approximately 6200 facilities handling sealed sources and over 320 facilities handling unsealed simple, significant or very significant radionuclide radiation sources; all of these fall under the radiation protection supervision responsibility of the SÚJB as well.

In addition, the SÚJB supervises the radioactive waste storage facility at the Dukovany site, radioactive waste repository in the abandoned „Richard“ mine near the town of Litoměřice, and high level radioactive waste storage facility run by the Nuclear Research Institute in Řež.

Major SÚJB's attention was centred on safety assessment of nuclear facilities and on the radiation protection assurance standard in the Czech Republic. This was based on an analysis of documentation and information regarding the operation of the nuclear facilities and workplaces handling ionizing radiation sources, SÚJB's own inspection activities and checking of how the requirements imposed by the supervisory (regulatory) authority are satisfied. Where necessary, the SÚJB – based on results of its own analyses and inspection results – laid down requirements and conditions for continuing performance of the facilities or workplaces concerned. Due attention was also paid to the physical protection and security of nuclear facilities and nuclear materials. Within its responsibility in the inspection regimes to strengthen the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the SÚJB performed periodical inspections of nuclear material and complied with other commitments under the Agreement between the Czech Republic and the International Atomic Energy Agency (IAEA) for the application of safeguards in connection with the NPT, as well as other international agreements to which the Czech Republic is committed.

Based on the results of its activities, the SÚJB concluded that no major failure bringing about radioactivity release into the environment and/or radiation endangerment of personnel and/or the public above regulatory limits and/or increase in the monitored contamination of the components of the environment or the food chain by artificial radionuclides in comparison to the previous period occurred in 1998.

None of the facilities or workplaces falling under SÚJB's regulatory authority exhibited such deficiencies as would require suspension or withdrawal of a licence granted by the SÚJB.

STATE OFFICE FOR NUCLEAR SAFETY

The State Office for Nuclear Safety is a governmental body with its own budget. The SÚJB is headed by SÚJB Chairman who is appointed by the Government of the Czech Republic.

The SÚJB is a regulatory body responsible for governmental administration and supervision in the fields of uses of nuclear energy and ionizing radiation and of radiation protection. The authority and responsibilities of the SÚJB, as laid down by Act No. 18/1997 on Peaceful Uses of Nuclear Energy and Ionizing Radiation (Atomic Act), include, but are not limited to, the following issues:

- State supervision of nuclear safety of nuclear facilities, nuclear items, physical protection of nuclear facilities, radiation protection, and emergency preparedness of nuclear facilities and workplaces handling ionizing radiation sources.
- Licensing of activities as specified by Act No. 18/1997, e.g. for the siting and operation of nuclear facilities and workplaces handling very significant ionizing radiation sources, for handling ionizing radiation sources and radioactive wastes, transportation of nuclear material and radionuclide emitters.
- Reviewing and approving documentation related to nuclear safety and radiation protection as laid down by the Atomic Act, Limits & Conditions for the operation of nuclear facilities, ways to ensure physical protection, emergency rules for transport of nuclear material and selected radionuclide sources, and internal emergency plans of nuclear facilities and workplaces handling ionizing radiation sources.
- Specifying conditions and requirements for radiation protection of the public and personnel handling ionizing radiation sources (e.g. laying down limits and defining controlled zones), specifying emergency planning zones and licensees' emergency preparedness requirements under the Atomic Act.
- Monitoring the status of exposure of the public and personnel handling ionizing radiation sources.
- Coordination of activities of the Radiation Monitoring Network in the Czech Republic and international exchange of radiation situation data.
- Maintaining the national system of nuclear materials accountancy and control, national record-keeping systems for licensees, for selected import and export items, ionizing radiation sources, and exposure of the public and personnel handling ionizing radiation sources.
- Professional cooperation with the International Atomic Energy Agency.
- Providing relevant information regarding radioactive waste management to the communes and district administration bodies concerned, and providing relevant information regarding the results of activities of the SÚJB to the public and to the Government of the Czech Republic.

In accordance with the responsibilities, the Office is divided into three Sections, headed by SÚJB Deputy Chairmen, and an independent Department:

Nuclear Safety Section, which includes the Department of Nuclear Safety Assessment, Department of Components and Systems, Department of Temelín NPP Licensing, and Department of Nuclear Materials;

Radiation Protection Section, which includes the Department of Sources and Nuclear Power, Department of Regulation of Exposure, Department of Environmental and Wastes Management, and an independent Division for Licensing;

Management and Technical Support Section, which includes the Department of International Cooperation, Department of Financial Management and Administration, and Office Bureau.

Independent Emergency Preparedness Department (reporting directly to the SÚJB Chairman), which fulfils the function of the Emergency Response Centre and coordinates the Radiation Monitoring Network.

The average number of SÚJB personnel was 146 employees in 1998, in this 40 nuclear safety inspectors and 45 radiation protection inspectors.

The cost of running the SÚJB is fully covered by the national budget. The budget funds allocated to the SÚJB were 154.9m in 1998.

The SÚJB also incorporates its **Regional Centres** in Prague, Plzeň, České Budějovice, Ústí nad Labem, Hradec Králové, Brno, and Ostrava, and two local offices at the Dukovany and Temelín nuclear power plants.

The SÚJB is the managing authority of the **National Radiation Protection Institute** ("Státní ústav radiační ochrany", SÚRO) in Prague.

STATE SUPERVISION OF NUCLEAR SAFETY

DUKOVANY NUCLEAR POWER PLANT

No event resulting in intolerable radioactivity leaks into the environment occurred at the Dukovany nuclear power plant in 1998. The operation of all reactor units was rated by the SÚJB as safe and reliable. From among the events recorded, 36 were categorized on the INES scale, viz. 3 events as level „1“ (against 2 such events in 1997), the remaining 33 as level „0“, i.e. deviations of no safety significance (against 58 such events in 1997).

The Dukovany units were run in the baseload mode or in the primary frequency control mode, as required by the load- dispatching centre. Planned outages for refuelling and annual maintenance and repair were accomplished at all of the 4 reactor units.

The long-run process of assessment of the use of new type nuclear fuel at the Dukovany reactors was finalized in mid-1998. Based on operator's application, a licence was granted in 1998 for the use of this type of fuel at reactor units 1 and 2. The deployment of this new fuel had no adverse impact on the operation of the two reactor units.

Licences for a continued operation of Dukovany units 1, 2, and 4 were also granted in 1998. The licences are of limited validity with regard to a number of ongoing and planned changes which will affect the nuclear safety assessment.

Reactor scram was triggered by the **HO-1** reactor protection system once in 1998, as against the three interventions in 1997 and six interventions in 1996. The event was rated as level "1" on the INES scale in view of the repeated human factor failure: improper shut-down of the main circulation pump, violation of the Limits and Conditions, and violation of the operating rules.

The **HO-2** reactor protection system never intervened 1998, the **HO-3** reactor protection system intervened three times, which is four events less than the previous year.

The **HO-4** reactor protection system, which locks the power increase in the automatic as well as manual mode of reactor power control, was activated 11 times, which is 8 times more than in 1997. In one event the protection system did not intervene in accordance with the design. The number of recorded HO-4 actions increased due to change in the recording method in 1998.

Dukovany nuclear power plant
(Photo: ČEZ a.s.- Dukovany NPP archives)

Intervention of reactor protection systems (HO) in 1998

No.	Date	Power	Type	Cause
Unit 1				
1	24 April	100%	HO-4	CRDFC* backup intervention
2	9 September	100%	HO-4	spurious action of HO-4
3	9 September	100%	HO-4	spurious action of HO-4
4	12 December	100%	HO-4	spurious action of HO-4
Unit 2				
1	9 July	98 %	HO-4	CRDFC* backup intervention
Unit 3				
1	21 May	12,5%	HO-3	water level decrease in 2 of 6 steam generators
2	27 June	98%	HO-4	CRDFC* backup intervention
3	18 July	100%	HO-4	CRDFC* backup intervention
4	24 August	99%	HO-4	CRDFC* backup intervention
5	4 September	100%	HO-3	activation of HO-3 from shutdown of MCP**
6	4 September	83,6%	HO-1	activation of HO-1 during resetting of HO setpoints
7	26 October	100%	HO-3	failure of electricity high voltage supply
Unit 4				
1	30 January	100%	HO-4	loss of control rod position signal
2	18 June	51%	HO-4	adjusting of a misaligned control rod
3	5 September	0,5%	HO-4	CRDFC* backup intervention

*Control rod drive frequency converter; **main circulation pump

Events rated as INES level "1"

The first event *rated as level "1" on the eight-level international IAEA-INES scale occurred on 6 March: it was found that periodical control of the protective and locking systems of the aftercooling pumps failed to be carried out at any of the reactor units because of improper time shifts in the testing schedule which is part of the operating rules. As a consequence of this modification of the guidelines and insufficient coordination of activities, the Limits and Conditions for Normal Operation of the Nuclear Power Plant ("Limits & Conditions", "L&C") were violated. Although not associated with any nuclear safety disturbance, the event was rated as INES level "1" because it was due to human factor failure and to deficiencies in the maintaining of documentation.*

The second event *rated as INES level "1" occurred on 19 May at Unit 3. This event was immediately related with the event of 3 May, when the secondary steam line and associated equipment were stressed by a shock wave due to improper action by the reactor unit control room personnel during pressure testing, and with the event of 17 May, when a premature opening of the steam generator safety valve took place for the first time. Although the Event Commission identified a relation between the premature opening of the steam generator safety valve and the overpressure in the secondary steam line which occurred on 3 May and ordered remedial provisions to be taken in order to prevent such events from repeating, the safety valve of the steam generator opened prematurely again on 19 May. In accordance with the design, the safety valves closed immediately after the initiating events ceased to act. With regard to the repeated occurrence, where the human factor played a role, and since the remedial actions implemented appeared to be insufficient, the State Office for Nuclear Safety re-classified the event as INES level "1".*

The third event *classified as INES level "1" was the intervention of the HO-1 reactor protection system mentioned above.*

Limits & Conditions

Based on operator's application and following review of the relevant documentation submitted by the operator, two short-term changes in the Limits & Conditions for the normal operation mode were permitted for the necessary repair work. When reviewing the documents, the SÚJB came to the conclusion that the changes would not bring about any risk higher than as associated with reactor shutdown, which causes rapid temperature changes affecting the equipment. Two short-term changes in the L&C had also been permitted by the SÚJB the year before.

Three L&C violations were detected in 1998 (there were also three violations of the L&C in 1996 as well as in 1997).

Violation of Limits & Condition

No.	Date	Cause
Units 1- 4		
1	6 March	Due to improper changes in the testing schedule, periodical in-service inspection of the protective and locking system of the aftercooling pumps failed to be performed
Unit 3		
2	4 September	Operator's failure to reset protective system setpoints after intervention of HO-3
Unit 4		
3	19 February	Ionization chambers of the source zone were found to have been incorrectly slid out at the emergency control room

Supervisory activities at the Dukovany NPP

Under Act No. 18/1997 and related regulations, the supervisory activities can be divided into reviewing/assessment activities and inspection activities. The latter can be classed as routine inspection visits and special inspection visits. Reviewing and assessment activities include operator performance assessment by the modified SALP system (Systematic Assessment of Licensee Performance, applied by the US regulatory body), assessment of the safety indicators, and review of documentation. Information extracted from periodical (daily, weekly and monthly) operating reports is also exploited within the supervisory activity.

SÚJB's supervisory (regulatory) activity regarding nuclear safety at the Dukovany NPP in 1998 is documented by a total of 120 Protocols and 149 Decisions. Through the Decisions, the SÚJB granted licence for a continuing operation of the reactor units, licensed nuclear safety-related changes, granted licences to selected personnel for nuclear equipment handling, approved documentation submitted, and approved changes in the L&C.

Dukovany NPP control room
(Photo: ČEZ a.s.- Dukovany NPP archives)

Routine inspection activity, *performed by local resident SÚJB inspectors as specified by the "Periodical Inspection Plan", concentrated on the limiting and safety parameters. The results of the inspection activities gave evidence that the selected operating guidelines had been adhered to and the parameters matched the design values. Apart from the exceptions described earlier, the safety limits and setting of the protective safety systems were consistent with the Limits & Conditions. The routine inspection activities also included reviewing of the operability tests of the protective safety systems of the four reactor units along with the automatic start-up of the stand-by diesel-generators, secured through Category 2 power supply. The review of the tests of systems demonstrated that the criteria had been met, and that the tests were rated as successful.*

Special inspection activities

- *The procedures by which the events were handled by the Dukovany Event Commission were reviewed.*
- *Review during periodical integral testing of hermetic compartment leaktightness (PERIZ) of the reactor units, which took place at the end of refuelling outages, examined how the L&C and the approved methodology of leaktightness measurement were adhered to.*

- *The Dukovany licensee's procedures during the testing of electromagnets of the impulse relief valves of the pressurizer at Unit 4 in relation to the modifications implemented for earth connection signalling were examined.*
- *Major attention was devoted by the SÚJB inspectors to the shutdown of the units for refuelling, the refuelling process, and inspection activities before restarting the units after refuelling. The inspection visits concentrated particularly on the following issues:*
  - *procedures of unit shutdown for refuelling and start-up after refuelling;*
  - *implementation of planned modifications of and changes in the machinery part of the technological equipment during annual maintenance and repair of the reactor units;*
  - *operation of the reactor units during the previous refuelling period, review of the neutron physical characteristics for the refuelling period to follow, reactor start-up plan and scope of physical start-up;*
  - *preparedness of the staff, especially control room personnel, for reactor unit start-up after refuelling;*
  - *review of performed inspections of electric power systems and instrumentation & control systems;*
  - *Compliance with the requirements of previous SÚJB Decisions regarding the operation of the reactor units.*

The results of the inspection and review activities are discussed in detail below.

Inspection activities of SÚJB inspectors at the Dukovany NPP
(Photo: SÚJB archives)

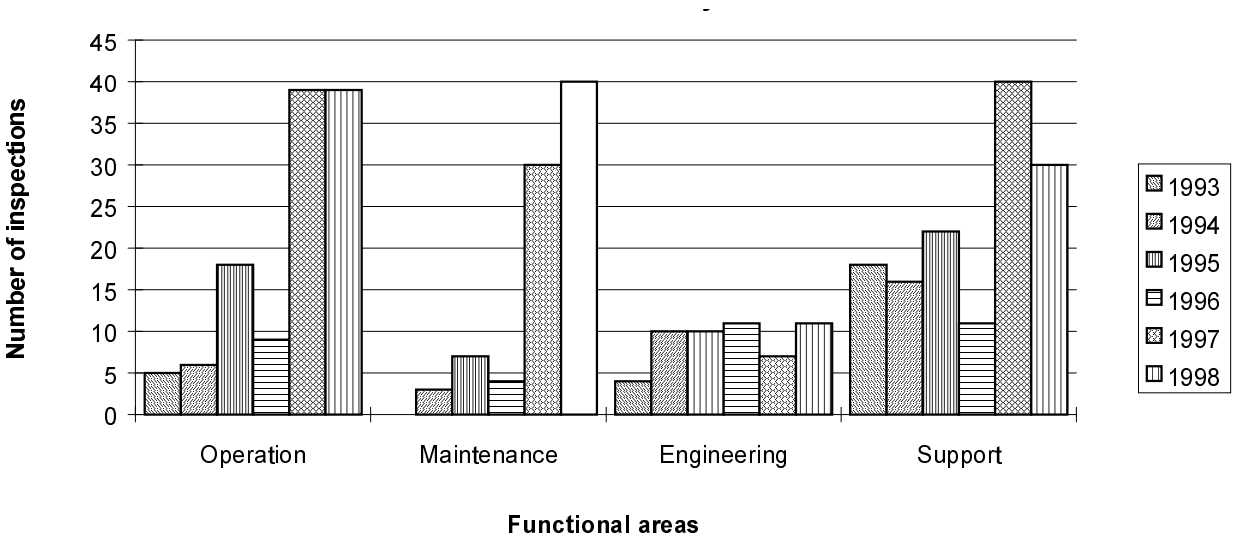
Assessment by the modified SALP system

A modification of the SALP system, initiated in 1997, is used by the SÚJB in reviewing the inspection activities. The inspection activities are classed in 4 basic categories, viz. operation, maintenance engineering, and support, while the nuclear facilities are rated as grade 1, 2, or 3 based on the findings and conclusions of the inspection visits and reviews: grade 1 is the most favourable rating, category 3, the least favourable rating where the condition of the facility is still acceptable but remedial provisions must be implemented by the licensee. The qualitative assessment of the results of inspection activities and categorization help the supervisory body in planning its inspection activities and making them more efficient, while the licensee's attention is drawn to issues requiring special care when implementing nuclear safety and safety culture principles.

The results of assessment of the Dukovany NPP by the modified SALP system during the two halves of 1998 are shown below.

1998	**Operation** 1st/2nd half.	**Maintenance** 1st/2nd half.	**Engineering** 1st/2nd half.	**Support** 1st/2nd half.
Dukovany NPP	2/2	2/2	2/2	1/1

The number of inspections/reviews accomplished in 1993 – 1998, broken down by the areas in the SALP system, is shown below:



Operation

A total of 39 in-service inspections were carried out, covering all of the activities falling in this scope. In this, 13 inspections were associated with reactor shutdown and start-up, 11, with reactor operation, 10, with the investigation of failure events, and 5, with other areas of reactor operation, such as safety culture, extraordinary failure events, and events due to the human factor.

Based on the routine and special inspection visits in the field of reactor operation it can be concluded that nuclear safety is among the licensee's top priorities. The procedures and operating guidelines largely comply with regulatory requirements. The operating guidelines, however, failed to be fully harmonized with the Limits & Conditions (L&C), and as a consequence, the latter were violated occasionally. With a view to eliminating the deficiencies, the licensee and SÚJB officials held a series of discussions in order to precise and complete the text of the operating guidelines and procedures so that the human factor should not play any adverse role provided that the guidelines and procedures are duly adhered to. Since no major deficiencies were detected in the remaining operating activities, and in view of the specificity of the personnel failure issue (to which the licensee is going to pay special attention in order to gain a deeper insight into the problem), the SÚJB rates the Operation issue as grade 2.

Maintenance

A total of 27 inspection visits were accomplished in the field of maintenance. The inspections dealt with scheduled preventive maintenance, test results after maintenance and repair work before reactor start-up following refuelling (21 inspections in total), 3 inspections of the periodical PERIZ tests, and 3 inspections of the testing and monitoring of systems after implementation of changes in them. The structure of the series of inspections was such as would enable all fields of activity in the area of maintenance to be covered. This aim was reached except for the review of personnel training.

The inspections gave evidence that in the field of maintenance, the licensee pays due attention to the nuclear safety issue. Inspections dealing with the preparedness of the reactor units for restart after refuelling identified no non-compliances with the provisions of the Atomic Act such as would prevent the reactors from start-up to reach the minimum controlled power after refuelling. Leak testing of the hermetic compartments complied with the L&C. Shortcomings were identified in documentation-keeping and in equipment status records. Some failures analyzed by the Event Commission were found to be associated with deficiencies partly involving inadequate maintenance. Never, however, had the reactor start-up after refuelling to be suspended due to improper or lacking maintenance. Overall, this category was rated as grade 2.

Engineering

A total of 12 inspections dealing with the engineering issue were accomplished. These were mostly based on the licesee's planned activities and on the results of inspections during the previous period. Seven inspections were aimed at licensee's activities related to the control and management of modification projects, i.e. project design, implementation and testing of the changes; one inspection regarded special processes, two inspections examined compliance with the Quality Assurance Programme for the Operation of the Dukovany NPP and related standards during implementation of reconstruction work or other changes in nuclear safety-related facilities, one inspection was related to supplies, and one inspection was related to the technical support of plant operation. On the whole, the inspection activities covered the vast majority of activities in the "Engineering" category.

In this area, the problem persists of non-existence of regulations relating to the basic system standard 05/1 dealing with the methodology for preparation of the various types of documentation, working procedures regarding problems of procurement of spare parts for the instrumentation & control system, including associated documentation. Planned methodologies, such as for the development and updating of safety reports, are lacking; insufficient review of control documentation by the Quality and Organization Control Department at workplaces included in the distribution list of the document in question was identified in several cases. Problems addressed in the field of operation within the evaluation of events indicate that insufficient technical support (disharmony between the

operating guidelines and the L&C, persisting ambiguous provisions in the L&C, insufficient feedback) was among factors contributing to the development of the events. Therefore the SÚJB rated this category as grade 2.

Support

In the field of support, 23 inspections were accomplished; these dealt with physical protection, transports of nuclear material, record-keeping and accountancy of nuclear material, spent nuclear fuel storage, and emergency preparedness. In this manner, SÚJB's supervisory activity covered all areas concerned.

No deviations or deficiencies were identified by the inspections except for requirements that documentation in the sub-area of emergency planning should be completed; no other corrective measures were imposed. The procedures and guidelines are consistent with regulatory requirements. The support category was rated by the SÚJB as grade 1.

Safety indicators assessment

The SÚJB monitors 34 indicators in 6 areas of nuclear power plant operation. The input data for calculation of the indicators are given in the internal SÚJB document "Safety Indicators". In view of the large extent of the document, the results are presented in a summary form in this report.

The majority of indicators continued to exhibit favourable trends which existed in 1997 and 1996. It should be noted that the results obtained the years before also demonstrated that the Dukovany plant had been operated safely. No hazardous aspects of plant operation were revealed by the assessment of selected areas through the set of safety indicators.

The indicators relating to the area of "Safety-Related Events" mostly lay at the same level as in 1997, although three events classified as INES level 1 occurred in 1998, which is one more than in 1997. On the other hand, there was only one reactor scram due to intervention of the HO-1 protective system, as against 3 the year before.

As a new item, the effect of the human factor on the failure rate of the plant operation was assessed separately. Although the contribution of the human factor to the causes of the total failure rate has a decreasing trend in the large, its role in the violation of the L&C and in events rated as INES level 1 continues to be considerable. From this it follows that the licensee should continue to pay major attention to the culture of operation and personnel training and education.

The most marked favourable changes in the indicators were seen in the inoperability of the safety systems. The inoperability value dropped most for the diesel-generators (roughly by 69% as compared to 1997), and a reduced inoperability value was also found for the spray systems. The inoperability value of the low-pressure emergency spray system decreased in 1998 as well.

Although one leaking fuel assembly was removed from the reactor core of unit 4 in 1998, the index value documenting the overall reliability of the fuel did not increase. The values of the index pertaining to the leaktightness of the hermetic compartments validate a sufficient leaktightness of the compartments.

Documentation assessment and review

The long-run process of assessment of the new type of fuel at the Dukovany unit 2 was finalized in June 1998 and the corresponding licence was granted.

The new type of fuel incorporates all elements of the fuel hitherto used, including the use of zirconium spacer grids and a thinner fuel assembly can . New elements include: fuel enrichment profiling in the assembly so that the average fuel enrichment is 3.82%, and a larger gap between the assemblies due to the thinner fuel assembly can, implemented in the past. The profiled enrichment combined with the applied "in-in-in-out" low leakage pattern will contribute to a more equable power distribution within the reactor core, with the maximum average assembly burnup as high as 45 MWd/kgU in the four-year-cycle of fuel operation and with a roughly 16% reduction in the level of mean fast neutron fluxes as compared to the typical Russian refuelling pattern, implying reduction in the fluence on the reactor pressure vessel and thus prolongation of the service life of the vessel.

This new type fuel was also refuelled in the Unit 1 reactor in July 1998. Regarding the differences of the four reactor units, the licensee submitted a separate application for use of this fuel in Unit 1; this approach will also apply to the use of the new fuel in each of further reactor units.

So far, the operation of the two Dukovany reactors with the new fuel has exhibited no anomalies caused by the different fuel design. The licensee accomplishes in-service inspections of the reactor cores more frequently and submits the results periodically to the SÚJB.

In 1998, the SÚJB paid considerable attention to the safe operation of nuclear facilities in relation to the advent of the new millennium, that is, to the Year 2000 ("Y2K") problem.

The SÚJB is going to review the licesees' approach to the Y2K issue. As yet, no substantial problems in this field have been identified.

Apart from the inspections and reviewing, the licensee's activities in the field of work on the Dukovany Plant Equipment Qualification programme were also monitored and assessed. This concerned, in particular, the resistance of some parts to the effects of high temperature, pressure, radiation, and (for the majority of electrical equipment), the electromagnetic compatibility issue.

In response to the needs of Dukovany plant operation and to SÚJB requirements, the owner – ČEZ a.s. – is preparing renewal of significant parts of the Instrumentation & Control (I&C) system at the NPP. The "Dukovany I&C Renewal Project" is aimed at preparing and implementing renewal of specified parts of the I&C system so as to ensure reliable performance of the system during the entire lifetime of the nuclear power plant. In this context, the licensee developed and the SÚJB approved, as stipulated by Regulation No. 214/97, the Quality Assurance programme for the licensed activity within the "Dukovany I&C Renewal Project".

The replacement of the VK-3 system by the SCORPIO-VVER system for monitoring the reactor cores was commenced in 1998. The latter system has been installed at Dukovany Units 1 and 2 within the planned reconstruction of the I&C system. Data collection and intercomparison is implemented, after completing the relevant testing and reviewing programme, in parallel to the operation of the old VK-3 monitoring system. Final evaluation of the tests will be made after one year of parallel run of the SCORPIO-VVER and VK-3 systems. During that period, it will be possible to compare the two systems both in normal operation and at the end of the cycle and start-up of the reactor to the full power after refuelling. The fact that the test period covers the change over to the new nuclear fuel and to new Limits & Conditions adds to the value of the testing process. The activity of the SÚJB in this context was aimed at reviewing the technological documentation and nuclear safety requirements and conditions in relation to the modification of the Hindu-Kush Intra-Reactor Control System.

Electricity generation losses at Dukovany Unit 1 in 1998

1 Shutdown of turbo-generator 12 (required by the load dispatching centre)
2 Shutdown of turbo-generator 12 for repair
3 Operation on the temperature and power effect
4 Dephasing of turbo-generator 11 (required by the load dispatching centre)
5 Annual maintenance
6 Elimination of defects on the primary circuit
7 Elimination of repeating defects on the primary circuit

Electricity generation losses at Dukovany Unit 2 in 1998

1	Measurement check at turbo-generator 21
2	Earth connection on the penetration of main circulation pump 3
3	Shutdown of turbo-generator 21 for repair
4	Operation on the temperature and power effect
5	Annual maintenance
6	Heat transfer to meet the needs of Unit 1
7	Power reduction due to defects on the secondary circuit
8	Heat transfer to meet the needs of Unit 1

Electricity generation losses at Dukovany Unit 3 in 1998

1 Operation on temperature and power effect
2 Failure of turbo-generator 32
3 Annual maintenance
4 HO-3 due to the level being reduced by 200 mm in 2/6 steam generators
5 Shutdown of turbo-generator 32 (required by the load dispatching centre)
6 HO-3 after mis-shutdown of main circulation pump 4 followed by HO-1 due to improper resetting of setpoints
7 Failure of electric line serving to lead power out of the reactor unit, intervention of HO-3

Electricity generation losses at Dukovany Unit 4 in 1998

1	Unit maintenance
2	Dephasing of turbo-generator 42 (required by the load dispatching centre)
3	Vacuum reduction at turbo-generator 41
4	Operation on the temperature and power effect
5	Shutdown of turbo-generator 41
6	Annual maintenance
7	Elimination of defects on the primary circuit
8	Elimination of defects on the primary circuit
9	Repair of main circulation pump 6

Temelín nuclear power plant
(Photo: ČEZ a.s.- Temelín NPP archives)

TEMELÍN NUCLEAR POWER PLANT

Construction and licensing process

Generally speaking, from the viewpoint of plant construction and start-up, Unit 1 along with the majority of buildings which are common to the two units has progressed from the construction and installation stage to the stage of preparatory start-up work (the majority of auxiliary systems located in the common buildings run already).

At Unit 2, major progress concerned the installation of lines for the technological equipment and preparatory work for cable laying and for the installation of the Instrumentation & Control system.

UNIT 1

*Major work performed on the **primary circuit** included post-installation cleaning operations, which were completed on the decisive part of the technological systems during the year. In late 1998, provisional equipment was dismantled and some components of auxiliary systems of the primary circuit were subjected to pressure tests. Installation of the sampling piping and impulse lines of the control system progressed as well. Cleaning shots through the steam generator heat transfer tubes were completed, and a complete non-destructive testing of the tubes by the eddy current method was accomplished.*

Preparatory start-up activities included inspection, tuning-up, and running-in of the majority of pumps within the auxiliary systems of the primary circuit, including pumps of the safety systems.

In late 1998, the primary circuit and associated auxiliary facilities were prepared for containment integrity testing. This testing was commenced on 15 December and finished in January 1999.

*In the **reactor hall**, activities were commenced as specified by the Pre-Complex Reactor Testing Programme; these culminated during the year by filling the reactor core with fuel dummies Simultaneously, start-up tests of the fuelling machine were started, to be continued in 1999.*

*All major components of the Westinghouse (WELCO) **control system** were installed, a part of this system was put in operation and used with success during the identification measurement of one of the turbo-feeding pumps. This measurement was the main start-up activity on the secondary circuit. The **main unit control room** was partly activated within the installation of the control system. The control system of Unit 1 is largely ready for autonomous testing.*

*Work on the **electrical systems** mainly included cable laying, which was nearly completed in 1998; the connection of the distribution boards continued and was tested.*

*Work on the **secondary circuit** included modifications of the turbo-generator oil systems, installation of the control system impulse piping was nearly completed, and the above-mentioned test of the turbo-feeding pump was carried out. The secondary circuit was in the air drying mode for most of the year.*

Testing of one diesel-generator safety system in late 1997 failed and the diesel engine shaft was damaged. This event was analyzed thoroughly by all parties involved. Corrective actions were taken, and the testing of additional diesel-generator safety systems was commenced and is under way.

Primary tests of transformers were implemented successfully, which allowed to switch the power supply for the construction work as specified by the unit design project.

UNIT 2

Installation work at Unit 2 progressed to the stage of completion of the safety systems, ***primary circuit*** *auxiliary systems, and installation of smaller-diameter pipes.*

In the ***reactor hall****, the check installation of reactor internals was started, cleaning shots of the steam generator heat transfer tubes were accomplished, and non-destructive testing of the heat transfer tubes by the eddy current method was commenced.*

Simultaneously, preparatory work for cable laying (drilling of holes for cables and installation of supporting steel structures) continued in the ***reactor hall*** *and* ***on the secondary circuit****. Installation of the main pipelines and smaller-diameter pipelines was also in progress on the secondary circuit.*

Activities aimed at checking the existing technological equipment were started with a view to achieving the required quality before commencing the tests.

Civil engineering work was under way in rooms designed to accommodate the control system cabinets; installation of the control system itself has not been commenced so far.

Supervisory activities at the Temelín NPP

Apart from the periodical **routine supervisory activity** practised by the resident inspectors, 31 **special inspection visits** were accomplished at the Temelín site in 1998, reviewing the civil engineering, installation and start-up work. In comparison with the previous years, attention was centred on Unit 1 start-up tests.

The SÚJB issued 50 decisions in 1998, largely addressing and approving pre-complex and complex testing programmes. A new revision of the partial programme of the builder's Quality Assurance system for the stage of preparation for start-up was also approved. The decision through which SÚJB's approval is granted includes an updated list of pre-complex and complex testing programmes to be gradually submitted for approval.

Major attention was paid by the SÚJB to activities performed by following the approved programmes of pre-complex and complex testing. With respect to compliance with the programmes and the related Quality Assurance documents, the tests of the safety system pumps, linear step drives of the clusters, fuelling machine, turbo-feeding pump, and a segment of the control system supplied by Westinghouse/WELCO were reviewed. In connection with the start-up activities, no major non-compliances with the approved documents were identified. A few cases were found, however, where the criteria of test successfulness, as specified by the design and by the approved programme, failed to be met (e.g., some of the safety system pumps exhibited excessive vibrations; the fuelling machine control system software failed to be implemented in compliance with the design requirements). The operator – ČEZ a.s. utility – mostly addressed the non-compliances by following its own internal rules, and so it was not necessary for the SÚJB itself to order corrective measures. In the field of compliance with the technical requirements for installation work and for order-keeping at the installation sites, substantial improvement of the situation was observed particularly at the beginning of 1998.

Maintaining the quality of selected equipment had always been a problem, particularly at Unit 2 where the inspectors had multiply detected non-compliances with the approved Quality Assurance programme. In late 1998, ČEZ a.s. launched a process of signing with the individual contractors such contracts as would eliminate this persistent problem in the future. During the most recent review, the SÚJB identified a few minor deficiencies in this context, rather omissions than true non-compliances.

SÚJB inspection visits dealing with the quality of welded joints and with the welding process quality assurance were accomplished using assistance from external expert organizations. In 1998, the SÚJB continued by implementing a set of inspections of technological nodes following up partial results of inspection visits accomplished in 1997. Attention was paid to non-destructive testing of welded joints performed within the installation work (whose scope had been specified by the SÚJB), to the re-assessment of the initial results of non-destructive testing of welded joints performed by the review work suppliers, and to the destructive testing of welded joints of the impulse piping.

The results of review of the welded joint quality demonstrated that the majority of welded joints, which were reviewed by re-assessing their non-destructive testing records, is satisfactory. The other reviews (such as of the destructive testing and of the welded joint quality documentation) show that some of the welded joints of the impulse piping fail to comply with the quality requirements. The documentation relating to the passive emergency core cooling system piping and to the welded joints of the stainless steel lining of the spent fuel storage pool also fails to sufficiently demonstrate the demanded quality.

The SÚJB ordered the builder to analyze the non-compliances and to put forward a proposal as to how to address this issue. The proposal can be expected to be submitted in early 1999.

In view of the licensee's inefficient approach to the corrective measures imposed, repeatedly experienced non-cooperativeness in the field of inspections and reviews, and non-existence of procedures to prevent the identified non-compliances in the area of welded joint quality from repeating, the SÚJB started in November 1998 administrative proceedings with the operator (ČEZ a.s) which should result in the imposing of a fine.

Special attention was paid by the SÚJB to one of the most important start-up tests, viz. the containment integrity test which was performed in late 1998. Designed to demonstrate the strength and leaktightness parameters of the primary circuit containment, the test was successful and complied with the prepared procedures as well as with the approved programmes, and its results were excellent.

In late 1998, the SÚJB also started inspection dealing with compliance with the Quality Assurance system in relation to the examination of the failure associated with the damage of the diesel engine shaft. For organizational reasons, the diesel engine was only repaired in late 1998, and so the issue had not been finalized by ČEZ by the end of the year. Therefore, the review by the SÚJB was going to continue in 1999. The remedial actions which have been implemented allow the testing of the remaining diesel-generator systems to be continued.

Assessment by the modified SAP system

Assessment in the 1st and 2nd halves of 1998

1998	**Operation** 1st/2nd half	**Maintenance** 1st/2nd half	**Engineering** 1st/2nd half	**Support** 1st/2nd half
Temelín NPP	N/N*	3/2	3/3	1/1

*N – not assessed due to lack of sufficient documents

The number of inspections/reviews accomplished in 1993 – 1998, broken down by the areas in the SALP system, is shown below:

Operation

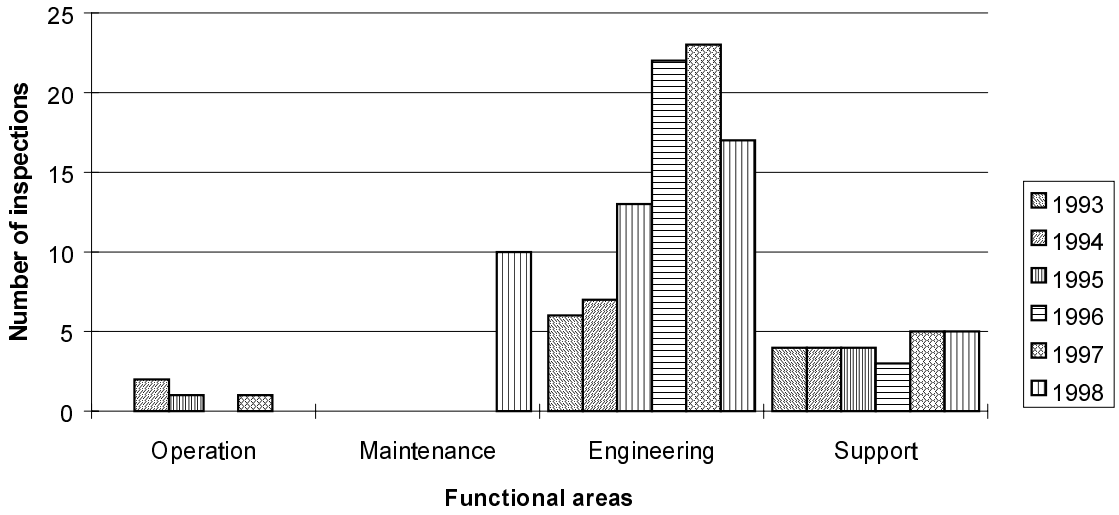
The Temelín NPP is only in the construction stage, therefore assessment in this area is not applicable.

Maintenance

In the construction stage, the maintenance category and the engineering category have so many points in common that they are difficult to separate. Overall, 6 dedicated inspections and 6 inspections within the resident inspectors' routine activity fall in this area.

During the 1st half of 1998, instances were identified where the licensee failed to have in-depth insight into the condition of the nuclear safety-related equipment. The review and tuning-up schedule for Unit 1 failed to guarantee that the quality of selected equipment would be maintained at an acceptable level, and for Unit 2 such a schedule failed to exist altogether. In view of this, the SÚJB rated the Maintenance category in the 1st half of 1998 as grade 3.

In the 2nd half of 1998, the licensee started to create and implement the reviewing and tuning-up schedule for Unit 2. Programmes and procedures were developed for conservation and re-conservation of selected equipment of Unit 2, which are necessary for maintaining the required equipment quality should the time of construction of the nuclear power plant be extended. In view of this, the rating in this category for the 2nd half of 1998 is grade 2.



Engineering

The total number of inspections/reviews in this category, concluded by protocols, was 16 (in fact, two of the inspections fall in this category in part only and are partly included in the Maintenance category).

Implementation of provisions to ensure demonstrable maintenance of quality of selected equipment particularly at Unit 2 was only started after the SÚJB had pushed for this for a long period of time. Valid documentation failed to unambiguously specify activities to be completed before starting operation of the facility for post-installation cleaning procedures. In some cases – such as the impulse piping supplied by WEC company – the licensee failed to have detailed knowledge of how the standards included in the WEC contract are being observed. In addition, the requirements of the standard for qualification of the welding procedures and for welders' qualification failed to be met. In view of these facts, the Engineering category was rated as grade 3.

Support

In the Support category, 4 inspections were accomplished, covering all sub-areas: physical protection, nuclear materials, nuclear material transport, and emergency planning.

The inspections detected no deficiencies, and no corrective measures were imposed. So, this category is rated as no-problem, grade 1.

Documentation review and assessment

In 1998, SÚJB's activities associated with the licensing process of the Temelín plant and concentrating on reviewing the Preliminary Safety Report Supplements were virtually completed; this applies both to the parts developed by Czech organizations and to those prepared by WELCO company. Currently, the SÚJB reviews supplements which it requested, as well as other documents.

The SÚJB has been making efforts, through its comments on the Preliminary Safety Report to enable the operator, ČEZ a.s., to prepare a high-quality Pre-operational Safety Report and thereby to minimize any risk of unnecessary delay that would be caused by requirements for corrections and amendments of the report and ultimately could result in postponement of the date of start of physical start-up of the plant. In December 1998, ČEZ a.s. submitted to the SÚJB several draft sub-sections of the Pre-operational Safety Report.

Programmes of pre-complex testing constituted another important set of documents which were reviewed within the licensing process. Furthermore, the SÚJB monitored and assessed continuously activities associated with the independent verification and validation of the nuclear power plant control system software.

Fresh fuel storage facility at the Temelín site

On 30 September 1998 the SÚJB issued a Decision whereby the trial operation period of the fresh fuel storage facility at the Temelín site was extended. This Decision was issued based on a favourable assessment of experience from the trial operation with respect to nuclear safety. A total of 166 fuel assemblies were stored in the facility as of 31 December 1998. In 1998, the fresh fuel storage facility was fitted with equipment for fresh fuel inspection and repair.

In addition to one inspection of fuel assembly transport to the storage facility, SÚJB inspectors accomplished two inspections to check how the requirements for the trial operation were met. The inspections revealed no deficiencies or deviations from the approved documentation.

Core of the Temelín-1 reactor which is under construction
(Photo: ČEZ a.s.- Temelín NPP archives)

Fuel assembly (dummy) pro the Temelín reactor
(Photo: ČEZ a.s.- Temelín NPP archives)

NUCLEAR RESEARCH FACILITIES

LVR-15 reactor at the Nuclear Research Institute in Řež

The LVR-15 reactor provided energy of 21,890 MWh in 1998. The total energy provided by the reactor since the start of operation after reconstruction in 1989 was 145 156 MWh. The operation of the reactor was safe and reliable. All experimental work was implemented as planned. The reactor served primarily the needs of foreign customers, mainly in the field of materials examination of nuclear power facility components.

A significant nuclear safety improvement was achieved by passing to reactor fuel with a considerably lower degree of U 235 enrichment than hitherto used (36% as against 80%). Implementation of this fuel enrichment reduction programme was in line with international commitments of the Czech Republic in this respect.

SÚJB's supervisory activities in combination with a good cooperation by the licensee contributed to the rectification of deficiencies identified in 1997. The revised and approved version of the Limits & Conditions for a Permanent Operation of the LVR-15 Reactor is also an outcome of the activities. Overall it can be concluded that the current condition of the facility and the monitored nuclear safety parameters of the reactor match the standards which are usually applied in European Union countries.

Other nuclear research facilities

The operation of the two other nuclear reactors in the Czech Republic, viz.

- the LR-0 reactor operated by the Nuclear Research Institute in Řež, and
- the VR-1P teaching reactor operated by the Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague,

was safe and reliable and complied with the approved Limits & Conditions. No deficiencies in their operation were identified within the SÚJB inspection visits. The VR-1P teaching reactor continues to be used very efficiently for educational purposes and also plays a significant role beyond the educational sector under the responsibility of the Ministry of Education. The LR-0 reactor at the Nuclear Research Institute in Řež has a very special designation and therefore is used to a low extent only.

OTHER NUCLEAR FACILITIES

In 1997, the new Atomic Act (Act No. 18/1997) extended the scope of facilities defined as nuclear facilities so that currently this category encompasses the Uranium Concentrate Storage Facilities within the National Material Reserves and the Uranium Concentrate Storage Facilities of the DIAMO company and its GEAM subsidiary.

The above nuclear facilities are undergoing a process of harmonization with the new legislation, for which a transition period of 5 years has been specified by the Atomic Act.

SPENT FUEL MANAGEMENT

Interim spent fuel storage facility at the Dukovany site

During 1998, selected physical quantities were monitored, especially the surface temperature of the storage casks, pressure between the primary and secondary lids of each cask (indicators of the leaktightness status of the casks), and the dose equivalent rate, in order to map the radiological situation within the storage facility and in its surroundings. The observed data did not exceed the maximum permitted values specified by the SÚJB in the Limits & Conditions for Permanent Operation.

SÚJB inspection visits also examined how the requirements were met as laid down by the SÚJB Decision whereby the use of CASTOR 440/84 type casks had been licensed; this concerned mainly the conditions of filling the casks with helium and compliance with the conditions for permanent operation of the storage facility. No deficiencies were identified within the inspection visits.

In order to enable the SÚJB to take an unbiassed decision regarding the use of the CASTOR-440/84 casks for transport after the storage period, the SÚJB Decision on the permanent operation of the interim spent fuel storage facility at the Dukovany site includes a requirement that a conception should be submitted to demonstrate that the quality of selected equipment – the CASTOR-440/84 cask in this case – specified for its use is being maintained during the entire period of its use. Following assessment of the document "Study of a Storage Programme for Samples of Materials Taken from the Body of the CASTOR-440/84 Cask, Including Technical Solution of the Storage", the SÚJB requested from the operator that samples be taken from each cask body and a programme of handling the samples be prepared. This requirement has not yet been duly satisfied.

Following a Decision of the Government of the Czech Republic whereby the condition limiting the maximum storage capacity of the facility (600 tonnes) was lifted, the operator – ČEZ a.s. – started preparatory work to extend the capacity of the interim spent fuel storage facility. In compliance with the Environmental Impact Assessment Act No. 244/1992, documentation concerning assessment of the environmental impacts of the facility was developed; SÚJB's statement regarding this document was favourable, although some comments were added. In June 1998, ČEZ a.s. submitted application for licence permitting the spent fuel storage facility to be sited at Dukovany and a central spent fuel storage facility to be sited at Skalka as a backup alternative for storage of spent fuel from the Dukovany and Temelín nuclear power plants. In both instances the administrative proceedings were suspended because of deficiencies and discrepancies in the safety documentation submitted.

The number of CASTOR-440/84 casks stored in the Dukovany interim spent fuel storage facility as of 31 December 1998 was 29, containing a total of 2436 spent fuel assemblies.

Dukovany spent fuel storage pools

A total of 2408 spent fuel assemblies were stored in the spent fuel storage pools of all Dukovany reactor units as of 1 December 1998.

High level radioactive waste storage facility at the Nuclear Research Institute in Řež

In April 1998, an inspection visit was accomplished examining how the Limits & Conditions imposed by the SÚJB Decision on Permanent Operation of the High Level Radioactive Waste Storage Facility were met.

Dukovany interim spent nuclear fuel storage facility
(Photo: ČEZ a.s.- Dukovany NPP archives)

An excessive chloride ion concentration was found in the Nuclear Research Institute's spent fuel storage pool, and corrective measures were ordered. Inspection visit in December 1998 found that the corrective measured had been implemented.

NUCLEAR MATERIALS TRANSPORT

The following transports, approved by the SÚJB, were implemented in 1998:

- 5 transports of spent fuel within the Dukovany NPP area;
- gradual transportation of 53 spent fuel assemblies from the area of the LVR 15 reactor to the high level radioactive waste storage facility on the premises of the Nuclear Research Institute in Řež;
- 7 international transports of fresh fuel from Russia to the Dukovany nuclear power plant;
- 1 international transport of fresh fuel from the USA to the Temelín nuclear power plant;

- 3 international transports of nuclear fuel for research reactors from Poland to the Nuclear Research Institute in Řež, from Řež to Russia, and from Russia to Řež;
- 11 transports of uranium concentrate: international transports from DIAMO s.p. company twice to France and once to Russia, and 8 domestic transports from the nuclear fuel institute ŠKODA-ÚJP Praha a.s. to glass works;
- 2 transports of samples for analysis from Seibersdorf, Austria, to the Nuclear Research Institute in Řež .

In 1998, the SÚJB accomplished 8 inspections of nuclear material transports. The results demonstrate that requirements for nuclear safety, radiation protection and physical protection of nuclear material were met during the transports.

The SÚJB assessed the documents submitted and issued 10 Decisions – type licences for transport casks whose terms of validity of the previous SÚJB Decision had expired or for which the licensees had applied for amendment. Furthermore, the SÚJB validated 6 transport casks which had been certified abroad, and issued 2 new type licences for Czech transport casks. For two new casks, viz. ŠKODA 440/84 and CONSTOR 1500, the licensing process is in progress.

In 1998, the SÚJB issued licences for 4 domestic transports of high-activity radionuclide emitters under special conditions and 1 international transport of high-activity radionuclide emitters from the United Kingdom.

PHYSICAL PROTECTION OF NUCLEAR FACILITIES AND NUCLEAR MATERIAL

Inspections performed in 1998 with regard to the assurance of physical protection of nuclear materials and nuclear facilities, including physical protection of nuclear material transports, demonstrated that the relevant regulatory requirements as specified by Act No. 18/1997, implementing regulation No. 144/1997, and SÚJB Decisions, were met. An IAEA-IPPAS (International Physical Protection Advisory Service) Mission took place in August 1998 on SÚJB's invitation. Experts from the US, France, Canada and Finland took part in the mission. The mission discussed problems of legislation, commitments associated with Czech Republic's accession to the Convention on the Physical Protection of Nuclear Material, and implementation of physical protection provisions at selected nuclear facilities in the Czech Republic. Preliminary conclusions of the mission included statements confirming a good level of legislative support to physical protection in the Czech Republic, as well as compliance with commitments specified by the Convention and with IAEA recommendations for physical protection of nuclear facilities.

STATE SYSTEM OF NUCLEAR MATERIALS ACCOUNTANCY AND CONTROL

Sixty-three inspections relating to compliance with the Agreement between the Czech Republic and the IAEA for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons (Safeguards Agreement) were made in 1998. Thirty-seven inspections were performed jointly with IAEA inspectors. All inspections reached their objectives, and IAEA statements regarding the inspections also confirmed data of the state system of nuclear materials accountancy and control.

In the context of transport of highly enriched nuclear fuel from the Nuclear Research Institute in Řež to Russia, the problem of IAEA seals that had been torn down from the transport casks was addressed. Based on results of this inspection, the operator took remedial action to prevent such event from repeating again. Following repeated inspection in the

Ovčáry Sugar Factory, completed in April 1998, the SÚJB imposed a fine on the company for unauthorized fuel materials handling.

In 1998, the SÚJB issued 73 new licences for acquiring nuclear material and, in relation to control regimes to strengthen the Treaty on the Non-Proliferation of Nuclear Weapons, a total of 116 importing/exporting licences, in this 11/13 for nuclear material, 7/10 for selected items, 61/8 for dual use items, and furthermore 2 licences for import and re-export and 4 licences for the use of nuclear material abroad.

Overview of inspection activities in 1998

MBA code	Number of IAEA inspections	Number of SÚJB inspections	IAEA inspection efforts[1] (man-days)
CZ-Z	4	27	0 (9)
CZ-Y	0	0	0
CZ-X	0	1	0
CZ-W	0	1	0
CZ-V	1	1	2 (1)
CZ-T	1	1	2 ([2])
CZ-L	4	4	7 (7)
CZ-K	10	10	18 (42)
CZ-J	8	8	18 (26)
CZ-G	1	1	2 (3)
CZ-F	1	1	1 (3)
CZ-E	0	1	1 (1)
CZ-D	1	1	2 (5)
CZ-C	1	1	2 (3)
CZ-B	5	5	10 (6)
T O T A L	37	63	65 (106)

[1)] Inspection efforts permitted by the relevant facility supplement in 1998
[2)] Inspection efforts not specified so far

Overview of material balance areas (MBA) in 1998

MBA code	MBA name	Type of nuclear material inventory[1)]	Amount after PIT[2)] (SQ[3)])
CZ-B	LVR-15 research reactor, NRI[4)] Řež	HEU, LEU, N	2.0
CZ-C	LR-0, research reactor, NRI Řež	LEU, N, D	4.2
CZ-D	Research laboratories, NRI Řež	all types	0.8
CZ-E	Škoda JS s.r.o., Plzeň	HEU, LEU, N, D, P	0.1
CZ-F	ŠKODA-ÚJP, Praha a. s.	LEU, N, D	1.0
CZ-G	HLRW[4)] storage facility, NRI Řež	HEU, LEU	0.8
CZ-J	Dukovany –1 NPP, ČEZ a. s.	LEU, D, P	262.6
CZ-K	Dukovany –2 NPP, ČEZ a. s.	LEU, D, P	231.1
CZ-L	ISFSF[4)] Dukovany, ČEZ, a.s.	LEU, P	338.0
CZ-T	Temelín NPP, ČEZ a. s.	LEU, D	24.6
CZ-V	VR-1P, FNSPE[4)] Praha	HEU, LEU	0.2
CZ-W	DIAMO s.p., NMR[4)] storage facilities	N	([5])
CZ-X	DIAMO s.p., Stráž pod Ralskem	A	([5])
CZ-Y	DIAMO s.p., GEAM plant Dolní Rožínka	N	([5])
CZ-Z	Total: 242 organizations	all types	0.7
Material exempt from inventory-keeping due to non-nuclear uses			1.5
Total: 242 organizations			ca 867.6

[1)] HEU – highly enriched uranium, LEU – low enriched uranium, P – plutonium, D – depleted uranium, N – natural uranium, T – thorium
[2)] PIT – physical inventory taking
[3)] SQ – safeguards significant quality: for plutonium, l SQ = 8 kg (with respect to total weight of the element); for HEU, 1 SQ = 25 kg total weight of the ^{235}U isotope; for LEU, N, and D, 1 SQ = 75 kg total weight of the ^{235}U isotope; and for thorium, 1 SQ = 20 t total weight of the element
[4)] NRI – Nuclear Research Institute in Řež; HLRW – high level radioactive waste; ISFSF – interim spent fuel storage facility; FNSPE – Faculty of Nuclear Sciences and Physical Engineering; NMR – National Material Reserves
[5)] Confidential data

STATE SUPERVISION OF RADIATION PROTECTION

OVERVIEW OF IONIZING RADIATION SOURCES AND WORKPLACES HANDLING IONIZING RADIATION SOURCES

The scope and demanding nature of work associated with the execution of state administration and supervision in the field of radiation protection can be illustrated on figures describing the numbers of ionizing radiation sources and workplaces where such sources are handled.

Based on Act No. 18/1997, ionizing radiation sources are divided into 5 classes with respect to the increasing extent of possible endangerment of human health and the environment: insignificant sources, minor sources. simple sources, significant sources, and very significant sources. The higher source class, the more stringent and extensive requirements are placed on radiation protection provisions; the licensing procedure is more complex and requires deeper professional knowledge. Supervisory activities are also primarily aimed at the potentially most hazardous sources, for which the inspections should be more frequent, extensive, and detailed.

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*The following institutions are classed as **workplaces with very significant ionizing radiation sources**:*

- *Institutions operating nuclear reactors and related technologies, notably the Dukovany nuclear power plant with its 4 power reactors, Nuclear Research Institute in Řež with 2 research reactors, and the Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague with 1 teaching reactor.*
- *Institutions operating large industrial irradiators, notably a workplace for food irradiation (spices in particular) belonging to the company Artim Praha s.r.o., and a workplace for radiation sterilization of medical material, owned by the company Biostér Veverská Bitýška a.s.*
- *Institutions handling major quantities of radioactive substances (very significant unsealed radionuclide sources), notably workplaces of the companies Cesio Praha s.r.o. and Isotrend Praha s.r.o.*

*Overview of **significant and simple ionizing radiation sources** as of 31 December 1998:*

Workplaces handling unsealed radionuclide sources

	institutions handling significant ionizing radiation sources (Category III workplaces under Regulation 184/97)	*institutions handling simple ionizing radiation sources (Category I and II workplaces under Regulation 184/97)*
Medical and veterinary applications	*16*	*130*
Industry	*0*	*16*
Other applications (research, etc.)	*11*	*146*
Total	***27***	***292***

The hazard of radioactive substances being dispersed at the site or leaking into the surroundings/environment exists at workplaces handling unsealed radionuclide emitters. The potentially possible maximum activity at the site is thus a significant parameter with respect to the endangerment as weel as to record-keeping. Therefore, the category of workplaces handling significant ionizing radiation sources ("significant workplaces") includes such workplaces as fall in Category III under Regulation No. 184/1997, whereas workplaces in Category I and II handling unsealed sources are classed as workplaces with simple ionizing radiation sources ("simple workplaces").

Sealed radionuclide sources

	significant ionizing radiation sources	*simple ionizing radiation sources*
Medical and veterinary applications	*74*	*1422*
Industry	*250*	*3527*
Other applications (research, etc.)	*20*	*909*
Total	***344***	***5858***

In sealed radionuclide sources, the radioactive substances are well encased, and the sources have been tested so that dispersion at the site and/or leak into the surroundings/ environment should be virtualy impossible under predictable conditions. Sealed radionuclide sources can be handled as units which are countable and fall under mandatory accountancy and record-keeping schemes. The figures representing the numbers of individual simple sealed radionuclide sources are not identical with those representing the numbers of devices where such sources are handled (a facility can handle more than one source, and the number of sources handled by an institution can even be variable; this is typical, e.g., of brachytherapy).

Radiation generators

	significant ionizing radiation sources	*simple ionizing radiation sources*
Medical and veterinary applications	*1546*	*5993*
Industry	*204*	*346*
Other applications (research, etc.)	*23*	*148*
Total	***1773***	***6506***

Radiation generators are facilities generating ionizing radiation through their operation (X-rays for instance). Only such facilities as use voltage higher than 5 kV are classed as radiation generators, in line with the definition contained in Act No. 18/1997.

Numbers of registered minor ionizing radiation sources

Application field	*Prague*	*České Budějovice*	*Plzeň*	*Ústí nad Labem*	*Hradec Králové*	*Brno*	*Ostrava*	***Total***
Ionization smoke detectors	*18000*	*4500*	*21000*	*12000*	*14441*	*33000*	*40000*	***142941***
Other	*111*	*10*	*76*	*30*	*46*	*162*	*26*	***461***
Total	*18111*	*4510*	*21076*	*12030*	*14487*	*33162*	*40026*	***143402***

Obtaining licence is not mandatory for the use of minor sources of ionizing radiation, particularly in ionization smoke detectors: under Act No. 18/1997 it is sufficient to notify the SÚJB, which keeps records of such sources.

The notifying duty does not apply to the use of ***insignificant ionizing radiation sources*** *because such sources do not pose any health or environmental hazard. Therefore, such sources are not included in the national registry either.*

EMERGENCY EVENTS INVOLVING IONIZING RADIATION SOURCES

Twenty-six events involving ionizing radiation source handling were reported and examined during 1998:

- 5 were false alarm events (suspected workplace contamination, anonymous terrorist threat, empty containers or source casing);
- 5 events were due to human mistake (work while the source cover was open, mechanical damage of the source cover, contaminated liquid drained into inactive sewage, contaminated matter disposal into municipal waste) and did not result in intolerable exposure of humans or endangerment of the environment by radionuclide releases; remedial actions taken by the licesees were found adequate by SÚJB inspection;
- 10 events involved contaminated matter, objects (such as a car with a leaf spring contaminated by Co 60), equipment components, or "discovered" radionuclide sources (i.e., lying beyond the controlled zones) in the environment (contamination of soil by uranium on a municipal landfill site), in buildings (abandoned Cs-137 sources in a lead container), or in transported cargo (Co 60 emitter, objects contaminated by natural radionuclides); in none of the events, the personnel, public, or the environment were in danger of exposure;
- 1 event involved examination of air contamination based on reports of Cs-137 release from a melted cesium source in Spain; a slight increase in the volume activity of the radionuclide in air, which did not exceed 15 $\mu Bq/m^3$, was detected, posing no radiological risk to the public;
- 6 events were more serious from the radiation protection aspect and the SÚJB paid increased attention to their examination.

- *On 12 January, the Rail Transport Research Institute reported loss of two Ra-226 reference standards at an activity of 370 kBq due to the workplace being moved to another place. The event was reported to the police and has not yet been concluded. Since the institution was unable to explain the loss, it was imposed a fine of Kč 10,000.*

- *On 14 February, the Radiation Safety Department of the Dukovany nuclear power plant reported that the 2nd alarm level for radionuclide leak into the air of the working area had been exceeded (maximum volume activity of aerosols 83 Bq/m^3); this increase occurred repeatedly till 15 February. No personnel exposure or endangerment of the public or the environment took place. The event was examined by the Dukovany Event Commission.*

- *On 29 May, 5 level and position gauges containing Co-60 at an activity of 250 MBq each were stolen from the storage facility of the BESTA Přestanov company. The case is being examined by the police and by the SÚJB Regional Centre in Ústí nad Labem, which commenced administrative proceedings concerning a fine to be imposed and issued a decision whereby the remaining sources should be disposed of (the disposal has been accomplished by LITES Liberec company).*

- *On 29 May, an elevated beta activity at a total level of 52 Bq/l was detected at the waste water drain from the area of the Nuclear Research Institute in Řež into the Vltava (Moldau) river. The SÚJB found by examination that approximately 10 MBq of the radionuclide Sm-153 had been drained into the inactive sewerage at the Department of Radiopharmaceuticals. No personnel exposure or endangerment of the public or the environment took place. In view of the cause of the event – human factor failure and non-compliance with ionizing radiation source handling rules, administrative proceedings regarding the imposing of a fine were initiated. The licensee adopted remedial provisions which the SÚJB approved.*

- *On 10 August, check detectors at the exit of the Dukovany NPP identified an elevated dose rate on a truck leaving the plant with spent filters from the inlet ventilation systems. Examination performed by the plant management and subsequent SÚJB inspections revealed that the contamination may have occurred due to an improper ventilation regime during reactor outage. The plant management adopted corrective measures to prevent any repetition of such an event.*

- *On 3 September, 5 persons of SALLEKO firm personnel were contaminated when cleaning a polluted condensate tank at the Dukovany NPP. The event was examined in detail by SALLEKO company that was the licensee, as well as by the Dukovany NPP The contamination was due to stirring dust which arose from the drying matter inside the tank chambers II and III. Both technical provisions (humidity to be maintained) and administrative and organizational provisions (modification of the relevant operational guidelines) were taken promptly. Based on a detailed analysis, the SÚJB inspection concluded that the remedial measures taken were in line with radiation protection requirements.*

LICENSING OF IONIZING RADIATION SOURCES HANDLING

Very significant, significant, and simple ionizing radiation sources may only be handled and some related activities performed based on SÚJB licence issued under Act No. 18/1997 (till 1 July 2002, licences issued under previous legislation, notably Regulation No. 59/1972, retain their validity). In total, licences have been issued to over 8300 legal subjects in the Czech Republic, the majority (nearly 85%) being active in the medical sector. Since the licences apply to specific ionizing radiation source handling activities as stipulated by the law rather than to the sources or institutions themselves, there exist legal persons that are holders of more than one licence; on the other hand, cases exist where licences have been issued to each of several legal persons handling one and the same ionizing radiation source.

The SÚJB issued 1919 radiation protection decisions in 1998, apart from decisions granting special professional competence licences. In this number, 1429 and 490 decisions were issued by the SÚJB Regional Centres and by the SÚJB Headquarters, respectively. These figures represent a 25% increase against 1997. The documents were mainly ionizing radiation source handling licences under Act No. 18/1997, Article 9, Paragraph 1i) (mainly for using sources and acquiring radionuclide sources), whereas operating licences for workplaces handling significant or very significant ionizing radiation sources (and miscellaneous) constituted a minor fraction only. The figures also cover decisions regarding the type licences of sources (186 in total), decisions permitting special professional training of selected personnel handling ionizing radiation sources, and decisions permitting measuring activities of natural or legal persons that are active in the field of natural radiation sources.

As the transition period is approaching its end (1 July 2002), the number of administrative proceedings in the radiation protection field can be expected to increase.

INSPECTION ACTIVITIES

A new system enabling experts from all regions to be engaged was applied within SÚJB inspection activities in 1998. This system improved the efficiency of the activities even with the limited number of 45 radiation protection inspectors.

Inspections are divided into two classes: **inspections performed by the SÚJB Regional Centres** ("RCs"), where inspectors of the RC affected are only engaged, and **specialized inspections** performed by specialized inspection teams comprising inspectors from various regions. Inspections of this kind are carried out for such types of ionizing radiation sources and workplaces handling them where attaining a higher level of unification of the radiation protection practice within the whole country (e.g. for workplaces handling significant and very significant unsealed ionizing radiation sources) and the use of expertise of specialists in other regions are desirable. This system is complemented with **inspections performed by ad hoc inspection teams**, particularly for time-consuming and intricate inspections at workplaces handling very significant radiation sources.

The inspection assessment system uses four rating categories based on criteria as follows:

I radiation source handling procedures fully comply with legislative requirements,
II formal deficiencies exist, not affecting the radiation protection level,
III deficiencies exist, requiring corrective measures to be adopted or the activity to be limited or suspended,
N deficiencies exist such as call for licence withdrawal.

Inspections performed by SÚJB Regional Centres

The following facts can be summarized from the inspections performed by the Ragional Centres:

a) Although the total number of inspections in this field was about 40% lower in 1998 than in 1997, their scope was incomparably wider and the inspections were more time consuming.
b) In comparison to 1997, the percent fraction of inspected workplaces rated as level III increased in 1998 (12% vs 3 %), viz. on account of workplaces rated as level I or II (88% vs. 96%), while the number of workplaces rated as level N remained constant at 0,1%.
c) Harmonization of licensees' documentation with new legislative requirements is improving gradually, particularly for the monitoring and quality assurance schemes. In this

respect, the high demands and complexity of the inspections, with a permanent pressure pushing the licensees to develop and/or amend the documentation required by legislation, have a beneficial effect.

d) In the area of techniques for radiodiagnosis and radiotherapy in medicine, compliance with Quality Control requirements is improving gradually as the efforts to introduce long-term stability and performance stability tests are more and more successful. Obsolete instrumentation continues to pose a problem; replacement of old instrumentation by new one is rather rare. This problem is going to be much more pressing in the years to come because many of the ionizing radiation sources that are used now in the medical sector will apparently fail to comply with the type licensing requirements after 1 July 2002, when the current type licences will cease to be valid.

e) The overall radiation protection level with the licensees is also improving owing to the fact that the numbers of persons with the special professional competence statute is increasing; this personnel is active particularly in the supervision of compliance with radiation protection requirements, in the field of acceptance testing and long-term stability testing, and other regulatory measurements.

Overview of inspections performed by SÚJB Regional Centres in 1998

Ionizing radiation source application field	ionizing radiation source class*	number of inspections	percent fractions of inspections in the 4 rating categories			
Industry	A	104	I	II	III	N
	B	77	33	51	16	0
Human and veterinary medicine	A	337	20	78	1	1
	B	260	50	44	6	0
Other	A	25	23	56	21	0
	B	33	24	48	24	4
Total		836	34,4	53,3	12,2	0,1

A = simple sources; B = significant and very significant sources

Specialized inspections

Radioactive waste management and radionuclide releases into the environment

A total of 16 inspections were performed in this field; from among these, 1 inspection was carried out jointly with the Department of Nuclear Safety.

Deficiencies were found mainly in the prescribed documentation (existence, completeness) at the Richard mine repository, ZAMSERVIS Ostrava company, and CESIO Praha company, and in the record-keeping and completeness of radioactive waste pass bills.

From among the total number of inspections, 4 resulted in rating I, the others, in rating II.

Uranium industry

A total of 53 scheduled inspections and 4 unplanned inspections were carried out. Administrative proceedings resulted in the issuance of 35 SÚJB Decisions; 12 applications are under assessment (for 7 of them, the proceedings were suspended due to formal deficiencies). Seventy-five staff members were examined and obtained special qualification certificates. In

1998, inspection activities were extended to cover entities where underground uranium mining is being practised.

Eleven inspections granted the entities rating I, 43 inspections resulted in rating II. Three inspections gave rating III, viz. for the following reasons: the responsible staff failed to be familiar with the approved monitoring scheme; adequate response failed to be induced by the intervention level in drained water being exceeded; and metrologically non-tested gauges were applied to the working environment monitoring.

Nuclear medicine departments and workplaces handling Category II and III unsealed sources

The team performed 55 inspection visits in 1998; in this, 46 were visits at nuclear medicine departments.

At 12 institutions, the written monitoring programme failed to exist; the Quality Assurance programme was lacking at 19 institutions; updating of the internal emergency plan was required of 5 institutions. One institution failed to maintain records of periodical personnel training, 3 institutions, records of operational stability tests; one institution was unable to submit workplace monitoring records, and 2 institutions with significant ionizing radiation sources, draft workplace decommissioning scheme.

The Quality Assurance scheme is introduced to various extent at the institutions visited; 38 nuclear medicine departments have their approved Quality Assurance programme, and ionizing radiation source handling licences under the new legislation have already been granted to 30 nuclear medicine departments. Regulatory values for the application of radiopharmaceuticals in diagnosis are observed and are also supervised by health insurance companies. Personnel and workplace monitoring is applied at all nuclear medicine departments and other workplaces handling unsealed sources. The workplace monitoring instrumentation is of various standards, some of the instruments are very obsolete (new equipment was recommended to 6 institutions).

In the total number of 55 institutions visited, rating I was granted to 12 of them, rating II to 39 of them, and rating III to 4 of them.

Radiation protection at nuclear facilities

The team members participated in 4 inspection visits jointly with the Department of Nuclear Safety (2 at the Dukovany NPP, 2 at the Temelín NPP) and carried out 22 separate inspection visits (19 at the Dukovany nuclear power plant, 2 at the Nuclear Research Institute in Řež, 1 at the Temelín NPP).

The radiation protection level at both the Dukovany and Temelín nuclear power plants is a high standard. Both plants have progressed substantially in harmonization with the new legislation.

At Dukovany, major attention was paid to activities exerted by other entities handling ionizing radiation sources (contractors) and to the two events described earlier, viz. the detection of contaminated filter inserts and the contamination of SALLEKO personnel.

The inspection visits at Temelín concerned mainly the fresh fuel storage facility and the radioactive waste management issue.

At the Nuclear Research Institute in Řež, progress in harmonization with the new legislation was the main inspection target. Currently, the majority of departments handling ionizing radiation sources have their relevant licences.

Natural ionizing radiation sources

In 1998, inspection visits with building material manufacturers and/or suppliers and water suppliers to the public mains systems dealt with their compliance with the relevant

requirements of the new legislation, notably the entities' duty to systematically measure and evaluate the natural radionuclide contents of the building materials or water and submit the results to the SÚJB. Attention was centred on public waters where elevated natural radionuclide concentrations had been detected in the past, and on building materials used in the construction of dwellings and ash-containing building materials.

Based on record cards maintained by the building material manufacturers and water suppliers, the starting form of regional databases was defined and their central processing was carried out. The databases are not complete yet; their completion and updating pose problems due to the high variability of the series of entities involved.

Inspection activities in the field of natural radiation sources in 1998

Entities	**total inspectíons**	**percent fractions in the 4 rating categories**			
		I	**II**	**III**	**N**
Building material manufacturers	150	29	56	13	2
Water suppliers	180	36	46	17	1
Bottled water suppliers	5	100	0	0	0
Others (workplaces with elevated radon risk)	58	24	59	17	0
Total	393	33	51	15	1

Measuring instrument calibration in metrology
(Photo: archives of the National Radiation Protection Institute)

REGULATING PROFESSIONAL EXPOSURE

As in the previous years, personnel exposure at workplaces handling ionizing radiation sources was monitored by 5 dosimetric service bodies: National Personnel Dosimetry Service company, dosimetric service departments of the Dukovany and Temelín nuclear power plants, dosimetric service department of the Nuclear Research Institute in Řež, and dosimetric service of uranium industry (DIAMO company). Together the service bodies maintain records of nearly 20,000 personnel handling ionizing radiation sources.

The following conclusions follow from a tentative evaluation of effective doses of personnel working with ionizing radiation sources:

- a total of 2236 persons were monitored at Dukovany in 1998 (in this, 865 were direct employees of the Dukovany plant, 1371 were employees of Dukovany contractors); the total collective dose was 1.34 Sv (1.52 Sv in 1997), and the average individual annual effective dose was 0.60 mSv;
- a total of 1323 persons were monitored at the ground and underground workplaces of the uranium industry (in this, 428 people were employees of the single existing mine of the GEAM company); the annual collective effective dose was 4.09 Sv (against 8.25 Sv in 1997), with an average of 9.46 mSv (16.95 in 1997). The maximum annual effective dose for a person reached 38,9 mSv in one case; the derived limit of 20 mSv for personnel handling ionizing radiation sources was exceeded in 54 instances;
- 4500 people were monitored in other industries, the average individual effective dose lying within the range of 1 mSv to 2.5 mSv;
- at medical departments using ionizing radiation sources, the doses were evaluated for 9500 staff members; the average individual annual effective dose was 1.44 mSv (1.6 mSv in 1997); while the trend of increasing numbers of personnel with exposure below the record level persists, the number of personnel with higher exposure levels is increasing simultaneously;
- a group of approximately 600 persons at specialized workplaces (service, inspection) reached an average individual effective dose of 1.5 mSv.

Seventeen events (12 in the medical sector, 5 in the industry) where the dosimetric service bodies reported personnel dosemeter exposures higher than 20 mSv were examined by SÚJB inspections in 1998. Based on the examination, 9 instances were identified as true personal doses, all of them in the medical sector, the doses being recorded by dosemeters fastened to the protective aprons. In 2 cases, the limit of annual professional exposure of 50

mSv was surpassed: one was identified as a true personal dose obtained by the professional (physician specializing in internal diseases), the other was identified as a non-personal dose (non-destructive testing personnel – gown laid aside).

Four airlines companies which, according to data of the Civil Aviation Agency, run their aircraft at altitudes over 4000 m above sea level, were informed about their responsibility under Act No. 18/1997 and Regulation No. 184/1997 to monitor exposure of the crew and make provisions to limit their level of exposure.

CONTROLLING AND LIMITING PUBLIC EXPOSURE

Efforts made to reduce the radiation burden of the population concentrated on exposure to radon in buildings, which represents the vast majority of total public exposure in the Czech Republic, and exposure of patients in medical applications – X-raying in particular.

Medical exposure

The issue of public exposure in relation to the use of ionizing radiation source in the medical sector is addressed in cooperation with the National Radiation Protection Institute and the General Health Insurance Company, which has made accessible part of its databases providing information on the numbers of the various types of medical examination and on the patients' age and sex. Based on evaluation of those data, the exposure was assessed for nuclear medicine, with 21 examinations per 1,000 inhabitants annually: the average per capita dose was obtained at the level of 0.09 mSv, average dose per examination 4.8 mSv. The collective dose for the patients has increased roughly by 40 percent over the past decade owing to the increase in the average applied activities per examination associated with the introduction of new examination methods.

Exposure to natural radiation sources

The SÚJB, in cooperation with the National Radiation Protection Institute and District Administration bodies, continued in targeted screening of people exposed to an inadequately high radon risk. The screening statistics are evaluated annually. The house owners are informed currently about the measurement results, and where an enhanced radon risk is identified, they are also informed that they can apply for allowance to cover part of the remedial antiradon provisions from the national budget.

The database of results of the targeted screening process is being used on a routine basis now. In addition to the common applications, this database enables a map processing of the results down to the level of the individual communes, allowing the radon risk to be evaluated for the individual houses within the towns and villages concerned.

The SÚJB (on its own as well as through the National Radiation Protection Institute) also met its other responsibilities within the Radon Scheme of the Czech Republic, whereby the tasks imposed by the Ordinance of the Government of the Czech Republic No. 709/1993. are being fulfilled. Repeated discussions were held concerning the new scheme of participation of the governmental and local administration bodies in a more efficient implementation of the Radon Programme, and a draft governmental resolution was under preparation to make the changes effective.

MEDICAL ASPECTS OF RADIATION PROTECTION

The SÚJB examined 98 suspect cases of occupational disease in 1998. These included:

- 83 lung cancers and 5 other diseases (monocytic leukemia, aneurysma and basilaris, cancer of the stomach, 2 cases of chronic lymphatic leukemia) in uranium mine workers. For 22 of the lung cancers the probability of a causal nexus between the disease and the underground work in uranium mines was assessed as predominating, for 4 lung cancers, as boundary. The Occupational Disease statute under the Ordinance of the Government No. 290/1995 defining the Occupational Disease List was granted to 26 workers with lung cancer. In the remaining cases the probability of a causal nexus was not found to be predominating and the Occupational Disease statute was not granted.

- 10 diseases in other personnel: 5 lung cancers, 1 chronic radiation dermatitis, 1 rectal cancer, 1 plasmocytoma and 2 cases of blood formation malfunction. For one lung cancer (work in stale-clay mines) the probability of a causal nexus between the disease and work in the hazardous profession was assessed as predominating. Such a causal nexus was also found for the chronic radiodermatitis (X-ray medical personnel). Both diseases were granted the Occupational Disease statute under the Ordinance of the Government No. 290/1995 defining the Occupational Disease List; for the remaining diseases this statute was not granted.

Foetal dose assessment in relation to the radiodiagnostic examination of the mother was carried out in 24 cases. In 21 of them the estimate was lower than 5.0 mSv, in the 3 remaining cases the equivalent dose estimate was 19.7 mSv, 26.0 mSv, and 27.0 mSv, respectively. In all instances, reports were sent to the Genetic Advice Centre. Foetal dose assessment was also requested for one mother who had undergone nuclear medicine examination; the dose estimate was 8.2 mSv. Report was again sent to the Genetic Advice Centre, which had asked for the assessment.

Favourable statement was issued regarding the traumatological plan of the Temelín nuclear power plant, and preliminary statement was issued concerning the draft traumatological plan of the Nuclear Research Institute in Řež. The Třebíč hospital was inspected with respect to its preparedness to fulfil tasks following from the approved traumatological plan of the Dukovany nuclear power plant.

X-ray instrument used in metrology to calibrate measuring instrumentation at medical departments

(Photo: archives of the National Radiation Protection Institute))

CENTRAL REGISTRIES AND DATABASES IN RADIATION PROTECTION

Development of central registries of professional exposures and ionizing radiation sources continued in 1998 in line with the requirements of the new legislation. The registries will include records of the licensees, so that eventually a complete system of national record files containing all information necessary for efficient national radiation protection administration will emerge.

The Professional Exposure Registry has been filled completely with up-to-date data and now enables data of personnel handling ionizing radiation sources to be retrieved and statistical surveys of dose distributions to be created for defined professional groups. The final version of the source registry under ORACLE is at the stage of finalized data analysis; nevertheless, a provisional application tool has made it possible to obtain surveys from a simple database program provided by the IAEA.

RADIOACTIVE WASTE HANDLING

Dukovany nuclear power plant

A SÚJB Decision required of the Dukovany management introduction of a sorbent and sludge treatment technology whereby the waste will acquire a form suitable for final disposal; the deadline for this was set to 31 December 1999. The Dukovany management was to present information as to the selection of the treatment technology till 30 June 1998. The documents actually presented were too brief and failed to demonstrate that the technology was suitable from the radiation protection aspect. The requested timetable for introduction of this technology was not submitted. The SÚJB required that above Decision be met immediately.

Administrative proceedings concerning the Limits & Conditions for the radioactive waste solidification facility were finalized and, based on review of the relevant documentation and an inspection visit, the Limits & Conditions were approved.

Temelín nuclear power plant

Documentation dealing with the issue of disposal of material released from the operation for disposal at the Temelín site dumping ground was submitted for reviewing. The reviewing process has not been finalized yet. The review of operation regulations for radioactive waste handling was completed and some amendments were recommended.

Nuclear Research Institute in Řež

A SÚJB statement concerning the final report on the analysis of hazards emerging from the old environmental burden at the Nuclear Research Institute site was developed and submitted to the Environment Ministry for the needs of the National Property Fund.

"Richard" radioactive waste repository

Based on review of complete documentation submitted by ARAO a.s. company under Act No. 18/1997 as the basis of the ionizing radiation source and radioactive waste handling licensing procedures, the ionizing radiation source handling licence was granted, whereas the administrative proceedings regarding the radioactive waste handling licence were suspended and additional supplementary documentation was requested.

Documentation associated with the application for licence to operate the nuclear facility "Richard" is being reviewed in parallel.

Other repositories

The SÚJB ordered the ARAO a.s. company to submit application for operating licence regarding the Bratrství repository as a workplace with a very significant ionizing radiation source under Act No. 18/1997, Article 9, Paragraph 1d).

RADIOACTIVITY RELEASES INTO THE ENVIRONMENT

Decommissioning of nuclear facilities

The SÚJB issued a Decision approving the proposed procedure for decommissioning of the Dukovany NPP after expiration of its lifetime. Detailed variants were prepared for decommissioning without dismantling and with conservation of the plant after shutdown, decommissioning with partial dismantling and protective storage of the reactors for 50 years, and decommissioning with complete dismantling. All of the alternatives involve complete disposal of the plant. The term of validity of the Decision is limited to the date of 30 June 2003. This is due to a provision of the Atomic Act requiring that proposed decommissioning procedures be reassessed continuously and in a complex manner as activities associated with human exposure, particularly taking into account the operational history of the facility, attained technological progress in the decontamination and dismantling technologies, radioactive waste handling issues, as well as the specified requirements with respect to radionuclide releases into the environment.

Decommissioning of uranium industry facilities

Škoda-ÚJP, Praha a.s. – company whose business activities used to be in the field of nuclear fuel – applied for approval of its draft project of decontamination work at Stage 1 of decommissioning of a section of the plant. The SÚJB approved the project submitted: decontamination work should be performed as described in the submitted implementation plan within the scope specified by it; radioactive waste emerging from the work should be stored at the Bratrství repository, other contaminated material, at the lagoon of the DIAMO s. p. company. The SÚJB stipulates that in a period not exceeding 1 month after completion of the decontamination work, Škoda-ÚJP, Praha a.s. should submit a report on the decontamination work and results of dosimetric measurements of the personnel, workplace decontaminated, and its surroundings.

The SÚJB approved proposals for the way of decontamination of a workplace with a very significant radiation source operated by DIAMO s. p., o. z. company (chemical extraction, acid solution disposal station), with the proviso that changse in the scope of activity, implementation procedure, duration, and way of finishing this activity, if any, shall be incorporated into the documents. The process will involve decommissioning with complete dismantling and complete liquidation of the facility. The term of validity of this decision was limited to the period till 30 July 2008.

The SÚJB suspended administrative proceedings concerning the decommissioning licence for the K I and K III lagoons of the former MAPE Mydlovary Uranium Industry Chemical Treatment Facility, which is a workplace with significant and very significant ionizing radiation sources. The SÚJB requested that the documentation submitted be supplemented with safety analyses covering all decommisisioning work, information regarding the scope and procedure of measurement and evaluation of personnel exposure and pollution of the workplace and its surroundings by radionuclides and procedure for releasing metals as scrap, including procedures for measuring the activity of the contaminated metals.

Aerosol bulk sampling facility at the National Radiation Protection Institute in Prague (Photo: archives of the National Radiation Protection Institute)

NATIONAL RADIATION MONITORING NETWORK OF THE CZECH REPUBLIC

The National Radiation Monitoring Network (RMN) is coordinated by the SÚJB which acts as the National RMN Centre, backed up by the National Radiation Protection Institute. The monitoring results are included in the Annual Reports on Radiological Situation in the Czech Republic, which is submitted to the Governmental Emergency Commission on Radiation Accidents and to the public through district administration bodies, health stations and libraries.

The National Radiation Monitoring Network operates in two regimes: the normal regime, aimed at monitoring the actual radiation situation and at an early detection of radiation accidents, and the emergency regime aimed at evaluating the consequences of such radiation accidents. The normal regime is implemented continuously by permanent bodies engaged in the Network, the emergency regime includes, in addition, emergency bodies. The normal monitoring regime involves several sub-systems, encompassing selected or all permanent RMN bodies. The subsystems are as follows:

- **Early Warning Network**, which comprises 60 measuring points with automatic transmission of observed data. The measuring points are run by the SÚJB Regional Centres, National Radiation Protection Institute, Czech Hydrometeorological Institute, and Civil Protection of the Czech Republic;
- **Territorial network of 206 measuring points** equipped with thermoluminescent dosemeters. This network is run by the National Radiation Protection Institute and the SÚJB Regional Centres;
- **Local TLD networks with 90 measuring points in the surroundings of the Dukovany and Temelín nuclear power plants,** run by the Environmental Radiation Monitoring Laboratories of the two nuclear power plants and by the SÚJB Regional Centre in Brno, and with **3 measuring points** run by the Institute for Expert Reviews and Emergency Management at Kamenná.
- **Territorial network of 11 air contamination measuring points** run by the SÚJB Regional Centres, Environmental Radiation Monitoring Laboratories of the nuclear power plants, National Radiation Protection Institute, and the Institute for Expert Reviews and Emergency Management at Kamenná.
- **Network of 9 laboratories** (6 laboratories of the SÚJB Regional Centres, 2 Environmental Radiation Monitoring Laboratories of nuclear power plants, and 1 laboratory of the National Radiation Protection Institute) equipped with gamma-spectrometric and radiochemical analytical instrumentation to quantitate radionuclides in environmental samples (aerosols, fallout, foods, drinking water, animal food, ...).

No extraordinary radionuclide release into the environment occurred in 1998, nor has any of the investigation levels been exceeded. Variations in the dose rate values were due to natural background fluctuations.

ARTIFICIAL RADIONUCLIDE MONITORING IN THE ENVIRONMENT

The monitoring programme is aimed at examining the time and spatial distribution of radionuclide activities and ionizing radiation doses within the Czech Republic in order to infer the long-term trends and detect any deviation from them at an early stage. From among the artificial radionuclides, the following are measurable and are monitored by the RMN:

- in air: ^{137}Cs, ^{90}Sr, $^{239+240}Pu$, ^{85}Kr;
- in foods: ^{137}Cs, ^{90}Sr, ^{3}H;

- in human body: ^{137}Cs.

Air contamination

As in the previous years, no major deviations in the artificial radionuclide content of air occurred in 1998. The volume activities of ^{137}Cs due to the transport of this radionuclide from higher layers of the atmosphere and resuspension of the initial fallout from the soil surface were mostly in the order of units to tens of μBq/m^3.

A fraction of the ^{137}Cs activity in air arises from global fallout which is due to earlier atmospheric nuclear weapon tests. In addition to ^{137}Cs, the aerosols contain ^{7}B, which is cosmogenic, and ^{210}Pb, which is a decay product of ^{222}Rn. Those radionuclides are determined by semiconductor gamma spectrometry.

By way of example, the plots below show the time behaviour of volume activities of the three radionuclides in airborne aerosol and of their specific activities in fallout, as determined by the Air Contamination Measuring Points which are run by the National Radiation Protection Institute in Prague. The plots exhibit a long-term decreasing trend of the volume activity of ^{137}Cs and variations in the ^{7}Be and ^{210}Pb contents throughout the year. Increased ^{137}Cs levels were observed in late May and early June due to the melting of a ^{137}Cs source in a steel plant at Algeciras in Spain and its subsequent release into the environment.

Volume activity of radionuclides in airborne aerosol as measured by the Air Contamination Measuring Points of the National Radiation Protection Institute in Prague (monthly averages)

Specific activity of radionuclides in fallout on surface water level as measured by the Air Contamination Measuring Points of the National Radiation Protection Institute in Prague (monthly sampling)

Volume activity of ^{85}Kr in air in Prague

In 1996, ^{85}Kr was included among radionuclides monitored by the RMN with a view to eventually encompassing all artificial radionuclides detectable in the environment. Krypton 85 is a fission product and is also present in minor quantities in effluents released from nuclear power plants. The main sources of this radionuclide, however, include nuclear reprocessing plants; nuclear weapon tests contributed in the past as well. The measurement of volume activities of ^{85}Kr is a continuation of measurements performed in the past by the Radiation Dosimetry Institute, Academy of Sciences of the Czech Republic. The measuring site is the same, viz. premises of the institute mentioned (now Radiation Dosimetry Department, Nuclear Physics Institute, Academy of Sciences of the Czech Republic).

Contamination of foods

Food contamination by radionuclides has been monitored on a long-term basis following the relevant monitoring plan. This plan has been set up for the various commodities with particular respect to the significance of their consumption. Since no event bringing about increase in the amount of radionuclides in the environment occurred in 1998, there was no increase in the food contamination levels either.

The volume activities of ^{137}Cs in some basic foods, i.e. milk, beef, and pork, are in the order of tenths of Bq/kg. The values for ^{137}Cs and ^{90}Sr in drinking water are very low, viz. tenths to units of mBq/l or even below the detection limit. The tritium content of drinking water has also been nearly constant at units of Bq/l.

Average annual mass/volume activities of ^{137}Cs in pork, beef, and milk

Internal contamination of humans

Monitoring of internal ^{137}Cs contamination of a reference group of 34 persons (19 females, 15 males), largely Prague citizens 22 to 74 years age, using the whole-body counter at the National Radiation Protection Institute continued in 1998. In view of the very low ^{137}Cs content in the population, such measurements are performed once a year only, applying long measuring times to reach the lowest detection limits reasonably attainable. The average ^{137}Cs activity in the body of an individual so obtained was 35 Bq. A similar internal contamination value was obtained by measuring the ^{137}Cs volume activity in the urine of a selected group of population.

As to the development of internal contamination by ^{137}Cs in 1998, the changes were very small, as before, since a long time has elapsed from the atmospheric nuclear weapon tests.

Development of the ^{137}Cs content in Czech population after the Chernobyl accident

External exposure monitoring

The results of monitoring by the territorial TLD network in 1998 are given in the table below. As proved by its several years' performance, the territorial TLD network is capable of detecting any significant deviation from the steady state at the site under surveillance. The results obtained by the local TLD networks in 1998 will be detailed in the 1998 Annual Report on Radiological Situation in the Czech Republic.

Quarterly averages of the photon dose rate equivalent H_x (nSv/h), as determined by the territorial TLD network in the Czech Republic

Region	Prague	Central Bohemia	South Bohemia	West Bohemia
Run by	NRPI*	NRPI	NRPI/ České Budějovice RC	NRPI/Plzeň RC
No. of MP	13	25	30	25
	$H_X \pm s$	$H_X \pm s$	$H_X \pm s$	$H_X \pm s$
I/98	129.5 ± 13.5	138.2 ± 49.7	152.8 ± 22.7	127.6 ± 20.7
II/98	121.1 ± 12.5	130.4 ± 44.3	157.9 ± 12.9	125.2 ± 17.7
III/98	136.8 ± 12.8	134.4 ± 42.1	144.7 ± 24.7	125.9 ± 20.1
IV/98	133.3 ± 11.5	136.5 ± 42.37	151.6 ± 30.3	123.7 ± 19.3
Region	North Bohemia	East Bohemia	South Moravia	North Moravia
Run by	NRPI/Ústí nad Labem RC	NRPI/Hradec Králové RC	Brno RC	Ostrava RC
No of MP	23	21	26	21
	$H_X \pm s$	$H_X \pm s$	$H_X \pm s$	$H_X \pm s$
I/98	128.5 ± 27.1	122.4 ± 21.9	155.3 ± 27.4	104.6 ± 16.0
II/98	120.7 ± 24.2	123.3 ± 19.1	129.3 ± 24.5	105.6 ± 16.0
III/98	123.3 ± 24.7	122.0 ± 15.8	144.7 ± 25.8	126.4 ± 14.6
IV/98	123.3 ± 23.1	128.7 ± 21.0	136,6 ± 24,7	108.9 ± 13.1

NRPI = National Radiation Protection Institute, RC = SÚJB Regional Centre
H_X = average value, s = standard deviation
NRPI/ ... RC means that the National Radiation Protection Institute performs the measurements and data processing, whereas the SÚJB Regional Centre distributes and collects the dosemeters

Continuous dose equivalent rate measurement is performed by the Early Warning Network. The average values are recorded in 10-minute periods. In 24 h intervals the data are transmitted to the central RMN database at the National Radiation Protection Institute: from 10 measuring points of the SÚJB Regional Centres and the National Radiation Protection Institute through modems via telephone lines, and from 38 measuring points of the Czech Hydrometeorological Institute (ČHMÚ) through the ČHMÚ communication network to the central ČHMÚ computer and further on by a dedicated telephone line. The data transmission periods can be shortened if necessary.

MONITORING OF NUCLEAR POWER PLANT EFFLUENTS AND SURROUNDINGS

The total radionuclide releases from the Dukovany nuclear power plant continued to be very low in 1998. No extraordinary leak was detected. According to the quarterly and monthly reports „Radiological Situation in the Surroundings of the Dukovany Nuclear Power Plant“ issued by the operator, the total releases into the air were below 1% of the derived annual

limits and the releases into the surface waters were below 3% for the corrosion and fission products and below 70% for tritium.

The dose rate in the surroundings of the Dukovany nuclear power plant is monitored continuously by the teledosimetric system operated by the plant. In addition, at least one monitoring point of the national Early Warning Network is located near each power plant. The dose equivalents arising from external irradiation in the surroundings of nuclear power plants are monitored by the local TLD networks operated by the Environmental Radiation Monitoring Laboratories of the plants (in the case of Temelín, it is reference values that are being measured). Independently of the networks mentioned, measurements by means of TLDs are also performed by the appropriate SÚJB Regional Centres. The investigation levels were never exceeded in 1998.

Both the Environmental Radiation Monitoring Laboratories of the nuclear power plants and the appropriate SÚJB Regional Centres take samples of components of the environment near the plants and measure radionuclide activities in them periodically. As in the previous years, no differences in the radionuclide contents were found between the nuclear power plant surroundings and the remaining territory of the country.

Radioactivity measurement in the field
(Photo: archives of the National Radiation Protection Institute)

EMERGENCY PREPAREDNESS

EMERGENCY RESPONSE CENTRE

Preparation and operation of the Emergency Response Centre

Trial on-line transmission of selected technological, radiological and metrological data from the Dukovany nuclear power plant was implemented during 1998. Based on evaluation of experience so acquired it was concluded that the quality of processing of the transmitted data by software tools of the Emergency Response Centre should be improved. The following things were implemented in the second half of 1998: changes in the program to control the critical safety functions, a program for data conversion into the program for identifying the possible source term of radionuclide leaks, program for on-line input of data into the program of assessment of the consequences of radionuclide leaks into the environment, and programs for data transmission testing. Simultaneously, work was started on building up the Central Data Archives of the Emergency Response Centre.

On the premises of the Emergency Response Centre, the program for data collection from the Early Warning Network was extended to admit data from the SÚJB Regional Centres, and data transmission from the National Radiation Protection Institute and direct data transmission from the Czech Hydrometeorological Institute were tested. A new version of the Early Warning Network program is gradually put in operation with a view to improving the imaging and data interpretation procedures.

Activities of the Emergency Response Centre also covered the responsibilities of the Liaison Point for Emergency Reporting in relation to the operation of nuclear facilities and workplaces handling ionizing radiation sources. This field of activity was implemented in cooperation with the Headquarters of Civil Protection of the Czech Republic. In the second half of 1998, implementation was started of a project of technical and organisational provisions for the Liaison Point personnel to be reachable through the SÚJB within 24 hours. In this manner the requirement of the IAEA, demanding that the Liaison Point be reachable through a single body, was satisfied.

The performance of the Emergency Response Centre, including that of the Liaison Point for Emergency Reporting, SÚJB Emergency Staff, and the Radiation Monitoring Network of the Czech Republic, was tested through their activation in 27 – 28 May 1998 based on obtained information that an extraordinary radiation situation might evolve in south-eastern Europe.

Participation in emergency preparedness exercises

The SÚJB participated in the preparation and implementation of an international communication exercise between the Liaison Points of the West Group (joining, in the alphabetical order, the following countries: Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia) and the Liaison Point of the IAEA, accomplished within the Regional IAEA Project of Harmonization of the Emergency Preparedness. Performed 13 October 1998, the exercise demonstrated that all of the countries involved are able to communicate with each other within 30 minutes in the event of a radiation accident. The Headquarters of Civil Protection of the Czech Republic also played a favourable role in the success of this international communications exercise.

A next international exercise examined the response of countries to a simulated accident at the Paks nuclear power plant in Hungary. Thirty countries, including the Czech Republic, participated in the exercise, which took place 3 November 1998. The following Czech bodies were involved: SÚJB, National Radiation Protection Institute, Czech Hydrometeorological Institute, Headquarters of Civil Protection of the Czech Republic, and components of the Radiation Monitoring Network of the Czech Republic (SÚJB, Czech

Hydrometeorological Institute, and the Czech Army). During the exercise, the Czech Governmental Commission on Radiation Accidents, whose 14th Meeting was held on the occasion of this exercise, was kept informed about the course of the exercise (development of the simulated accident situation at Paks and the potential endangerment of the Czech Republic) by the Emergency Response Centre. The exercise has demonstrated that all of the Czech bodies and organizations involved are capable of responding adequately to a radiation accident which might occur abroad and pose danger to a part or the whole of the Czech territory. The results of activities of the Emergency Response Centre and the conclusions adopted by the SÚJB Emergency Staff as well as the weather forecasts prepared by the Czech Hydrometeorological Institute were consistent with those arrived at by the other participant countries involved. From experience gained during the exercise it follows that some modifications and completion of the Emergency Response Centre should be made in order to facilitate the performance of the SÚJB Emergency Staff, and furthermore, that the current and future legislation applicable to emergency management, covering the radiation accident issue including the emergency organizational structure of the state, should be amended

SUPERVISORY ACTIVITIES AT NUCLEAR FACILITIES

Dukovany nuclear power plant

The Internal Emergency Plant of the Dukovany nuclear power plant was approved by the SÚJB and became effective 1 July 1998. The relevant Decision took into account issues raised by the affected District Administration bodies during discussions regarding the links of the internal emergency plan of the Dukovany nuclear power plant to the external emergency plan.

In cooperation with the District Administration bodies, Headquarters of Civil Protection of the Czech Republic, and the Dukovany NPP management, the SÚJB participated in addressing the issue of the public warning system within the Dukovany emergency planning zone in case of failure or unwanted activation of the public warning system.

Temelín nuclear power plant

During 1998, the SÚJB addressed the emergency preparedness aspect of the following issues:

- leaktightness of the reactor containment (refinement of criteria and requirements by the SÚJB),
- accessibility of the containment during normal operation,
- nuclear safety assessment of the Temelín NPP – ISAR (international cooperation).

The SÚJB examined the status of work on the development of the Internal Emergency Plan and status of emergency preparedness of the Temelín plant. As found based on a tentative review, the first version of the Internal Emergency Plan of the Temelín Nuclear Power Plant respects the requirements following from the new legislation, i.e. Act No. 18/1997 and the related implementing regulation No. 219/1997.

Other activities

During 1998, the SÚJB reviewed 20 internal emergency plans submitted by the licensees, and approved 12 of them. The remaining 8 internal emergency plans failed to comply with the requirements laid down by Act No. 18/1997 and SÚJB Regulation No. 219/1997.

Within the IAEA technical assistance programme “Harmonization of Regional Emergency Preparedness in Case of Nuclear Accident”, the SÚJB prepared and organized a national workshop, which was held 19 – 23 October 1998 and where the approaches of the IAEA to emergency preparedness in case of nuclear accident were highlighted. The first series

of lectures was aimed at state administration staff and personnel of other organizations involved in emergency preparedness provisions, the second series was designed for experts of nuclear facilities in the Czech and Slovak Republics, with stress on the criteria and procedures of assessment of nuclear accidents, including impacts of such accidents on the facility itself and on its surroundings, and on links which are necessary to secure external emergency preparedness.

In view of the new legal arrangements in the field of emergency planning and the newly defined responsibilities of the Committee on Civil Emergency Planning as included in the Resolution of the Government of the Czech Republic No. 391/1998, the Chairman of the Governmental Committee on Radiation Accidents, the Environment Minister, was recommended to arrange for transfer of responsibilities from the Governmental Committee on Radiation Accidents to the Committee on Civil Emergency Planning and the Interministerial Emergency Staff; for this, the Governmental Resolution No. 391/1998 would have to be amended and the Governmental Resolution No. 496/1993, whereby the Governmental Committee on Radiation Accidents was established, cancelled.

Nuclear safety office room of the Emergency Response Centre
(Photo: SÚJB archives)

OTHER ACTIVITIES OF THE STATE OFFICE FOR NUCLEAR SAFETY

PERSONNEL QUALIFICATION AND TRAINING

Based on assessment of documentation submitted, the SÚJB approved the following materials in 1998:

- training syllabuses and scheme for selected personnel of the Nuclear Research Institute in Řež operating the LVR-15 a LR-0 reactors,
- review of the managerial scheme of ČEZ a.s.: “Professional Personnel Training for Work in the Field of Nuclear Activities ”.

Furthermore, the SÚJB updated and reviewed examination tests for selected personnel of the Dukovany nuclear power plant and for selected personnel of nuclear research facilities.

In view of the status of implementation of the simulator which makes it possible to simulate processes in the regime of normal reactor states as a "display simulator", the SÚJB granted approval for basic training of selected personnel on this facility. The training of selected personnel in the area of abnormal and emergency states of the reactor unit will be performed on the full-scale VVER 1000 simulator which mimics the Temelín reactor.

In compliance with the requirements of Article 18, Paragraph 3 of Act No. 18/1997, the SÚJB specified a list of medical and psychological institutions to carry out the mandatory health and psychic examinations of selected personnel.

Planned inspection visits were accomplished at the Dukovany nuclear power plant dealing with shift personnel preparedness prior to the reactor unit start-up to the lowest controlled power after refuelling. The documents submitted revealed no deficiencies indicating any non-compliance with Act No. 18/1997.

The State Commission for Examining Special Professional Competency of Selected Personnel of Nuclear Facilities met 14 times during 1998. From among the total of 87 persons examined, 5 failed in the oral part of the examination; hence, the success rate was 94.3%.

Examination by SÚJB Special Examining Boards of special professional competency for activities of high importance from the radiation protection aspect continued in 1998. A total of 1763 people were examined, out of whom 1624 passed and were granted Special Professional Competency Certificates, whereas 139 persons failed.

LEGISLATIVE ACTIVITIES

A new implementing regulation relating to the Atomic Act was prepared and issued as Regulation No. 106/1998 on Provisions to Secure Nuclear Safety and Radiation Protection of Nuclear Facilities During Their Start-up and Operation. Specifying the individual stages of start-up of nuclear facilities and laying down detailed organizational and, in particular, technical requirements for the start-up and operation of nuclear facilities, the regulation entered into force on 5 May 1998.

Simultaneously, work continued on the remaining implementing regulations relating to the Atomic Act. This concerns, in particular, the regulation laying down limits for concentrations and amounts of nuclear materials which are not covered by the nuclear damage clause of the Atomic Act, regulation on nuclear safety during the design and building of structures with nuclear facilities, and regulation on the decommissioning of nuclear facilities.

Harmonization of Czech legislation with that of the European Union represented a significant segment in the legislative activities: in fact, the SÚJB continued to be involved in Czech Republic's preparation for accession to the European Union. SÚJB representatives are members of the Working Committee for Integration of the Czech Republic into the European Union and working groups for harmonization of law, for the environment, for state administration, for power issues, and for harmonization of technical regulations

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- *A positional document in the area of "Nuclear Safety and Radiation Protection" was prepared in 1998 and approved by Governmental Resolution No.. 130. The chapter dealing with nuclear safety, radiation protection and safeguards based on the Treaty on the Non-Proliferation of Nuclear Weapons was prepared for the Czech Republic's National Programme of Preparation for EU Membership. The objectives of the tasks included in the Programme are as follows:*
- *support to the execution of state supervision of nuclear safety and radiation protection;*
- *securing a level of legislative arrangements and level of execution of state supervision of nuclear safety matching the corresponding levels in EU Member States which have their nuclear power programmes;*
- *completion of harmonization of Czech legislation with law of the European Community in the domain of radiation protection and safeguards system in relation to the Non-Proliferation Treaty;*
- *introduction of regimes (of control and transmission of information) required by the law of the EC in the domain of radiation protection and safeguards system in relation to the Non-Proliferation Treaty;*
- *preparation for cooperation between the SÚJB and Euratom in implementing the safeguards system in relation to the Non-Proliferation Treaty;*

In the second half of 1998, vigorous preparatory work for the screening negotiations was under way. SÚJB representatives were members of the delegation for multilateral as well as bilateral negotiations in the field of nuclear power (the negotiations encompassed, among other things, issues associated with the safeguards system) which were held in late-1998. Preparation for the screening negotiations in the field of the environment culminated at the same time (the radiation protection issue is included in this block). [N.B. The negotiations took place in January and February 1999.]

In addition to the activities related to the harmonization of legislative documents of the Czech Republic and the European Community, contacts between the SÚJB and European Commission bodies continued to be maintained. SÚJB Chairman attended meetings of representatives of regulatory bodies of the EU Member States and of invited candidate states, particularly within the CONCERT and NUSAC groups.

Representatives of the Emergency Preparedness Department participated in activities of the interministerial working group of the Ministry of the Interior and Ministry of Defence, notably in the development of a glossary of terms in the field of civil emergency planning and emergency control, and in the preparation of a bill dealing with emergency management and the integrated rescue system. Furthermore, this participation also concerned interministerial discussions on the issues of telecommunications support when addressing emergency situations, comments on a document for the Committee on Civil Emergency Planning, and other activities.

INTERNATIONAL COOPERATION

SÚJB's efforts in international cooperation were aimed particularly at maintaining and extending bilateral contacts with partner regulatory bodies and at coordination of technical cooperation which is organized by the IAEA, EU (PHARE), US DOE and UK HSE in the nuclear safety and radiation protection domain. Cooperation also continued within the Forum of Regulatory Bodies of Countries Operating VVER Type Reactors.

Bilateral cooperation

*Intensive **cooperation with the Federal Republic of Germany** continued in 1998. The particular activities included preparation of an information exchange agreement between the SÚJB and the German Environment Ministry (BMU). Progress was also achieved in cooperation with the GRS in the preparation of documents as agreed on previously within bilateral negotiations, viz. the publications "Temelín Nuclear Power Plan – Basic Information" (in Czech and German), " ISAR 2 Nuclear Power Plan – Brief Description" (in Czech), "Report on Nuclear Safety and Radiation Protection Provisions at the ISAR-2 Reactor Unit" (in English), and "Report on Nuclear Safety and Radiation Protection Provisions at the Temelín-1 Reactor Unit" (also in English). The documents were complemented with a common text describing the method based on which the two nuclear power plants have been compared. The material containing basic information is intended for both the professional community and the public.*

*Within **cooperation with Austria**, a regular bilateral meeting with representatives of the Austrian Government was held in December 1998. As well as by SÚJB representatives, the meeting was attended by representatives of the Ministry of Foreign Affairs, Ministry of Industry and Trade, and the utility ČEZ a.s. The Czech delegation presented information regarding SÚJB activities in the domain of legislation, state administration, and regulatory responsibilities. The Austrian party was made familiar with the results of radiation situation monitoring in the Czech Republic in 1997 and with some details concerning the emergency planning issue. Representatives of the Dukovany nuclear power plant informed about the preparation of retrofitting of the plant whose objective it is to maintain nuclear safety of the plant at a level matching that of the EU Member States. Furthermore, the Austrian party was provided information regarding progress in the construction of the Temelín NPP, the nuclear programme of the ČEZ utility, and statute and responsibilities of the newly established agency "Administration of Radioactive Waste Repositories" (SÚRAO) to control radioactive waste management in the Czech Republic*

The SÚJB participated in the preparation of additional bilateral agreements on nuclear safety and radiation protection information exchange, to be signed with the Ukraine a Slovenia.

Traditionally intensive bilateral contacts continued to be fostered with the Nuclear Regulatory Authority of the Slovak Republic.

Cooperation between the SÚJB and the UK Nuclear Installations Inspectorate (Health and Safety Executive) is governed by the agreement for the exchange of information between the two national agencies. Cooperation with WS Atkins company in the development of the equipment of the SÚJB Emergency Response Centre in case of accident continued in 1998.

A procedure for upgrading the "Risk Monitor – SAS" (Safety Advisory System), designed for monitoring of the actual nuclear safety status of all reactor units of the

Dukovany NPP, was proposed in 1998 in cooperation with experts of the US DOE, who visited repeatedly the Czech Republic

Cooperation within international organizations and technical assistance programmes

As the previous years, SÚJB's activities in the domain of international cooperation concentrated particularly on professional cooperation with the IAEA. The SÚJB was responsible for participation in meetings of the IAEA bodies and discussed the programme of technical cooperation between the Czech Republic and the IAEA.

Active participation of the Czech delegation in the IAEA Board of Governors was mirrored by the fact that the SÚJB Chairman, who is the IAEA Governor for the Czech Republic, had been elected Vice-Chairman of the Board; his two-year term of office expired at the 42nd IAEA General Conference in 1998.

In addition to the Czech representation in the Board of Governors, the Czech Republic was also represented in other significant advisory bodies of the IAEA, such as the NUSSAC (Nuclear Safety Standards Advisory Committee) and SAGSI (Senior Advisory Group for Safeguards Implementation).

The relationships between the Czech Republic and the IAEA culminated by the visit of Mr M. ElBaradei, IAEA Director General, in the Czech Republic in November 1998.

IAEA Director General Mr M. ElBaradei visiting the State Office for Nuclear Safety (Photo: SÚJB archives)

The implementation of several projects which had been approved in 1997 continued in 1998:

- *Investigation of corrosion processes of zircaloy alloys used in nuclear fuel assemblies.*
- *Characterization of radioactive wastes.*
- *Technology of sanitation of uranium milling plant lagoons by using waste materials and products of other mining activities.*
- *Introduction of Quality Programmes into radiodiagnosis and radiotherapy.*

Cyclotron for the manufacture of PET radiopharmaceuticals
(Photo: archives of the Nuclear Research Institute in Řež)

- *Model project of building up a centre for the manufacture of radiopharmaceuticals for positron emission tomography (PET) and their application in medical diagnosis. This project continued to be the core of technical cooperation between the Czech Republic and the IAEA in 1998. The budget of the project, to which the Czech party contributes a significant part through the Nuclear Research Institute in Řež and which is scheduled for 4 years, should approach a sum of USD 3m. In 1998, the IAEA organized a tender for the supply of the basic equipment for the diagnostic section of the Centre – the PET camera, and evaluated the bids in cooperation with experts of the Nuclear Research Institute in Řež and the "Na Homolce" hospital in Prague. After the building permit was obtained, the rooms for the Centre started to be built on the premises of the "Na Homolce" hospital. The manufacture of the cyclotron which forms the core of the manufacturing capabilities of the PET radiopharmaceuticals, was completed and subjected to successful acceptance testing in late 1998.*

Coordinated by the SÚJB, active participation of the Czech Republic in the IAEA technical assistance programme also occurred within the joint regional projects of Central and Eastern European countries. For instance, the following events were organized in 1998:

- *Regional training course in "Dosimetry in Radiotherapy"(1 week, organized by the Clinic of Oncology, Masaryk Hospital in Brno).*
- *Regional workshop on "Monitoring Operational Performance through Operating Experience" (1 week, organized by the Dukovany nuclear power plant).*
- *Regional workshop on " Upgrading and Modernization of Instrumentation and Control of WWER 440/213 NPPs" (1 week, organized by the SÚJB in Prague).*
- *IAEA Technical Committee Meeting on "Water Chemistry and Corrosion Control of Cladding and Primary Circuit Components" (1 week, organized by the Nuclear Research Institute, at the town of Hluboká nad Vltavou),*
- *Regional training course in "Safety of Research Reactor Facilities" (3 weeks, organized by the Nuclear Research Institute, held on the premises of the Institute in Řež),*
- *Coordination meeting of participants in the IAEA research programme "Application of Non-destructive Testing and In-service Inspection of Research Reactors" (1 week, organized by the Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague).*
- *Meeting of IAEA specialists on the "Behaviour of Core Internals" (1 week, organized by the Nuclear Research Institute, held on the premises of the Institute in Řež),*

Coordination of actions of the Czech Republic when satisfying commitments following from the Convention on Nuclear Safety was among important activities exerted by the SÚJB in the filed of international cooperation in 1998. The Convention is currently the only tool to address nuclear safety problems on an international scale. Sixty-eight IAEA Member Countries had acceded to the Convention as of 31 December 1998. The first evaluating meeting of the parties under Article 20 of the Convention will be held in April 1999. The parties to the Convention submitted to the Convention Secretariat (i.e., the IAEA) their national reports, prepared for this evaluating meeting, in late September 1998. Coordination of preparation of the national report for the Czech Republic was the responsibility of the SÚJB. For this purpose, the SÚJB Chairman established an interministerial commission comprising representatives of the Ministry of Industry and Trade, Ministry of the Environment , Ministry of the Interior, Ministry of Finance, Ministry of Foreign Affairs, and the SÚJB. Experts of the ČEZ a.s. utility and its Dukovany and Temelín nuclear power plants were also engaged. In its individual chapters, the report assesses the status of implementation of the various provisions of the Convention in the conditions of the Czech Republic, both at the general level (legislation) and at the practical level (Dukovany and Temelín). The assessment

of the degree of implementation of commitments following from the Convention in the conditions of the Czech Republic is favourable.

The IAEA IPPAS (International Physical Protection Advisory Service) mission, invited by the Czech party to inspect the degree of physical protection at the Dukovany and Temelín NPPs and the VR-1 teaching reactor at the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague, was an important event in 1998. The international advisory team concluded that physical protection of Czech nuclear facilities was at a good level.

The Czech Republic is engaged in the IAEA technical assistance programme not only as a beneficiary but also as a donor helping other countries implement their projects. In 1998, the Czech Republic contributed USD 50,000 to the IAEA technical assistance project for the Ukraine, whose objective it is, during the period of 1998-2000 to build up a facility for non-destructive testing of VVER-1000/320 pressure vessels. Apart from the financial contribution of the Czech Government to the budget of the IAEA technical assistance programme, experts of the Nuclear Research Institute in Řež are also engaged in the project.

The SÚJB also developed its cooperation with the IAEA within technical assistance projects of other countries by organizing for them professional training programmes financed by the IAEA (short scientific visits, scholarship visits). Twenty-eight experts from various countries of Europe (former USSR), Asia and Africa were invited to such visits to Czech institutions in 1998. The institutions included, for instance, the SÚJB, Tissue Centre of the Military Hospital in Hradec Králové and the Teaching Hospital in Brno, National Radiation Protection Institute in Prague, Nuclear Research Institute in Řež, Nuclear Physics Institute of the Academy of Sciences of the Czech Republic in Řež, Water Management Institute in Prague, Institute of Entomology of the Academy of Sciences of the Czech Republic in České Budějovice, and the Institute of Experimental Botany of the Academy of Sciences of the Czech Republic in Olomouc.

The SÚJB is a founding member of the Forum of Regulatory Bodies of Countries Operating VVER Type Reactors, established in 1993 in support of improvement of the level of nuclear safety and radiation protection through the use of common experience, information exchange, and mutual coordination of efforts to secure nuclear safety. In 1998, SÚJB representatives attended the periodical summit of the Forum, organized by Armenia within the country's one-year term of chairmanship.

Czech Republic's participation in the EU "PHARE – Nuclear Safety" programme, which is coordinated by the SÚJB, also represents a significant part of technical assistance received from abroad in the field of nuclear safety. This assistance programme addresses theree key items in the nuclear programme: support to regulatory bodies (RAMG projects), support to scientific organizations (TSO projects), and support to nuclear power plant operators.

Tasks of the first year of the PHARE RAMG project were completed in 1998, covering the transfer of the Western methodology and practices to the State Office for Nuclear Safety. Furthermore, the SÚJB participated in the preparation of the OECD/NEA publication "Status Report on Seismic Re-evaluation".

Cooperation between the SÚJB and OECD/NEA continued in 1998. SÚJB representatives attended periodical meetings of the Committee on Nuclear Regulatory Activities (CNRA), joining representatives of regulatory bodies, and participated in activities organized by other NEA standing committees, such as the Committee on Radiation Protection

and Public Health (CRPPH) dealing with the problems of creation of national registries of professional exposure. In cooperation with the OECD/NEA, the SÚJB organized a one-week workshop on "Regulatory Inspection Practices", which was attended by over 30 foreign participants.

The SÚJB also acted as the National Agency under the Comprehensive Test Ban Treaty. SÚJB representatives attended all meetings of the working bodies of the Treaty and, in cooperation with the Institute of Physics of the Earth in Brno, fulfilled tasks following from the Czech Republic's commitments under the Treaty.

The "Invitation Programme" of the Japanese Government continued the 6th year in 1998. Within this programme, training courses were held in Japan, dealing with the management of nuclear power plant operation and maintenance, automatic control systems at nuclear power plants, nuclear safety and radiation protection, and radioactive waste management. The programme is designed for the Czech Republic and other Central and Eastern European and Asian countries.

PUBLIC INFORMATION

In March 1998, the SÚJB submitted to the Czech Government its 1997 Annual Report ("Report on the Results of Activities of the State Office for Nuclear Safety in the Execution of State Supervision of Nuclear Safety of Nuclear Facilities in 1997").

From that report the SÚJB prepared the Czech and English versions of SÚJB Annual Report for the public and distributed it to all institutions interested or involved. The English version was sent to partner regulatory bodies abroad and to the contact points of bilateral agreements on nuclear safety. The content of the annual report for the public was the subject of a dedicated press conference which was held under the chairmanship of the SÚJB Chairman on 19 May 1998.

During the year, the SÚJB continued its contacts and discussions with representatives of civic initiatives, particularly in regard of the new legislation applicable to the nuclear safety and radiation protection issue, i.e., the Atomic Act and its implementing regulations.

The SÚJB has been keeping the Czech Press Agency and other media informed about facts within its responsibility; in particular, the SÚJB responded to news which aroused public attention.

As stipulated by the Atomic Act, representatives of the SÚJB informed the Heads of the District Administration bodies about radioactive waste management within the districts concerned.

The SÚJB has also been meeting its information role towards the professional and general public by issuing the bi-monthly journal „Bezpečnost jaderné energie" (Nuclear Energy Safety) and the non-periodical series „Bezpečnost jaderných zařízení" (Safety of Nuclear Facilities), publishing general information regarding nuclear safety and detailed requirements and guidelines in support of nuclear safety.