R O M A N I A

JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

ROMANIAN NATIONAL REPORT
Second Edition
August 2005

Foreword

The Romanian National Report is prepared to fulfill the Romanian obligation as signatory of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

To do so, the report follows closely the Guidelines Regarding the Form and Structure of National Reports provided in the attachment to the IAEA document INFCIRC/604 of July 1, 2002.

This report is produced on behalf of Romania by the National Commission for Nuclear Activities Control (CNCAN) which was responsible for its coordination, whith contributions from the organizations belonging to the Ministry of Economy and Trade, as follows:

- SC "Nuclearelectrica S.A." as the National Company with Nuclear Power Production Subsidiary "CNE-Prod" Cernavoda (NPP Unit 1) Nuclear Power Development Subsidiary "CNE-Invest" Cernavoda (NPP Unit 2) and "Nuclear Fuel Plant" (FCN) Pitesti,

- "Autonomous Company for Nuclear Activities" with its Subsidiary for Nuclear Research Pitesti (SCN), and

- "National Uranium Company S.A. "(CNU). with "Feldioara Subsidiary" (Uranium Milling Plant), "Bihor Subsidiary" (uranium mines), "Banat Subsidiary" (uranium mines), and "Neamt Subsidiary" (uranium mines).

CNCAN received also contributions from:

- "Nuclear Agency" -AN- that provides technical assistance to the Romanian Government in devising politics in the nuclear area as well as to promote and monitor nuclear activities in Romania,

- "National Agency for Radioactie Wastes" –ANDRAD- the competent authority for the coordination , on national level, of the safe administration process of spent nuclear fuel and of radioactive wastes, including their disposal, and

- "National Institute for Physics and Nuclear Engineering- Horia Hulubei" (IFIN-HH Magurele).

The National Commission for Nuclear Activities Control would like to express its gratitude to all institutions and organizations which contributed to produce the Romanian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

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List of Abreviations and Selected Terms

AN	Nuclear Agency
ANDRAD	National Agency for Radioactive Waste
CMSU	Ministerial Committee for Emergency Situations
CNCAN	National Commission for Nuclear Activities Control
CNE PROD	Nuclear Power Plant - Production
CNE INVEST	Nuclear Power Plant - Investments
CNU	National Uranium Company
DFU	Used Filters Storage
DNDR Baita Bihor	National Repository For Radioactive Waste Baita – Bihor
FCN Pitesti	Nuclear Fuel Plant Pitesti
HEU Fuel	Heighly Enriched Fuel
IFIN-HH	National Institute for Physics and Nuclear Engineering “Horia Hulubei”
IGSU	General Inspectorate for Emergency Situations
LEU Fuel	Low Enriched Fuel
LEPI Pitesti	Post Irradiation Examination Laboratory Pitesti
NSRW	National Strategy on Medium and Long Term Regarding their Management of Spent Fuel and Radioactive Waste, Including the Disposal and Decommissioning of Nuclear and Radiological Facilities
SCN Pitesti	Subsidiary for Nuclear Research Pitesti (subsidiary of the Authonomus Company for Nuclear Activities)
STDR Pitesti	Radioactive Waste Treatment Station Pitesti
STDR Magurele	Radioactive Waste Treatment Station Magurele

SECTION A. INTRODUCTION

The issue of managing spent fuel and radioactive waste started to be considered in Romania in the nineteen fifties, when the first nuclear research reactor was put in operation, and the number of applications using radioactive sources rapidly increased.

The technical and social issues of safe management of spent fuel and radioactive waste were not sufficiently assessed at the beginning. As the radiation practices developed, and science and technology progressed, the awareness of the above mentioned issues increased in Romania as well. After 1996, the starting of operation of NPP Cernavoda Unit 1 - the first Romanian nuclear power plant, the spent fuel and radioactive waste management issue became more complex.

It should be noted that, due to economical difficulties met before the end of the former political regime and in the transition period which started in 1989, some delay occurred in establishing and implementing a national policy and strategy for spent fuel and radioactive waste safe management.

However, by ratifying the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, Romania has shown its willingness to undertake all the necessary steps for achieving the required level in the safe managing of the spent fuel and radioactive waste.

The report presents the situation of spent fuel and radioactive waste management activities in Romania, showing the existing situation, the safety issues of concern and the future actions to address these issues.

The presentation follows the content proposed by IAEA in scope of reporting the conformity with the provisions of Joint Convention on the Safety of the Spent Fuel Management and on the Safety of Radioactive Waste Management.

This report was produced by the National Commission for Nuclear Activities Control (CNCAN), which was responsible for its coordination.

The conclusions of the report show that generally, the spent fuel and radioactive waste are managed safely in Romania. However, there are issues of concern, which are summarized in Section K of this report.

The National Commission for Nuclear Activities Control in its capacity of Romanian regulatory body will continue to monitor closely the solving of the issues of concern identified in this report.

SECTION B. POLICIES AND PRACTICES

Article 32. Reporting, paragraph 1

i. Radioactive waste and spent fuel management policy

As Romania has decided to use the open fuel cycle, considering spent fuel as radioactive waste, the policy for spent fuel management is included in the policy for radioactive waste.
The objective of Romanian radioactive waste management policy is to assure safe management of radioactive waste, according to the principles stated in IAEA Safety Fundamentals SS No. 111-F "The Principles of Radioactive Waste Management".
The Romanian radioactive waste management policy and strategy are fully taking into account the general and radioactive waste management specific requirements presented in IAEA Requirements No. GS-R-1: Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety. The main general aspects of radioactive waste management policy are presented below:

- The radioactive waste management, including the transport, shall be authorized, and shall be performed according to the provisions of the applicable laws and regulations, assuring safety of facilities, protection of human health and environment (including protection of future generations).
- According to the law, the import of radioactive waste is prohibited.
- The Fund for Radioactive Waste Management and for Decommissioning shall be set-up in the next future, and the contributions to the Fund shall start to be collected as soon as the law regarding that fund will be approved by the Parliament.
- According to the Governmental Ordinance no. 11/2003, approved by the Law no. 320/2003 ANDRAD is responsible for the radioactive waste strategy at national level; after the establishing of ANDRAD in 2003, CNCAN has a more limited role in the establishing of radioactive waste and particularly spent fuel management strategy, mainly for verifying if the requirements for nuclear and radiological safety, safeguards, and physical protection are met by the strategy, according to the provisions of Romanian laws and regulations. Of course, the radioactive waste regulatory policy remains exclusively under responsibility of CNCAN.
- The national strategy for radioactive waste established by ANDRAD shall be approved by AN, which, according to the Governmental Ordinance no.7 approved by the Law no 321/2003, is responsible for elaboration of the Strategy for Developing the Nuclear Field, of Action Plan and of National Nuclear Plan
- According to the provisions of the Govermental Ordinance no.11/2003 any producer of radioactive waste is responsible for the management of that waste and for the decommissioning of its facility; he shall bear the expenses related the collection, handling, transport, treatment, conditioning, temporary storage and disposal of the waste he has produced, and shall pay the legal contribution to the above mentioned fund.
- In the authorization process, the minimization of radioactive waste shall be required.

- The timing for decommissioning and radioactive waste disposal shall assure, as far as applicable, the requirements for not imposing undue burden on future generations.
- According to international agreements signed with neighbor countries, the protection of human health and environment beyond national borders shall be assured in such a way that the actual and potential health effects will be not more detrimental that those accepted for Romania.
- The discharge of gaseous and liquid radioactive effluents from any nuclear facility shall be limited, according to derived emission limits approved by CNCAN, and further reduced, according to optimization principle.
- By conditions set in the operating authorization, and by regulatory dispositions, the holder of authorization is requested to send the radioactive waste (including the spent sources) for treatment and disposal or long term storage at dedicated facilities.
- Any waste management or spent fuel management facility shall have a decommissioning generic plan; for new facilities, this requirement applies from the design stage, when the application for the siting authorization is submitted to CNCAN.

ii. Spent fuel practices

a) NPP spent fuel management

Romania has only one nuclear power plant, Cernavoda Nuclear Power Plant, equipped with five PHWR - CANDU-6 Canadian type reactors - with a 705 MW(e) gross capacity each, in different implementation stages. Unit 1 is in commercial operation since December 2, 1996, Unit 2 is under construction and Units 3, 4, 5 are under preservation.

The legal representative of the nuclear power production sector in Romania (the utility) is Societatea Nationala “Nuclearelectrica” S.A. (SNN). SNN is a government owned company reporting to the Ministry of Economy and Trade. The company has its Headquarters in Bucharest and three subsidiaries:

- CNE-PROD Cernavoda, the operator of Cernavoda NPP - Unit 1;
- CNE-Invest Cernavoda, in charge with the completion of Unit 2 and with the preservation of Units 3,4,5;
- Nuclear Fuel Plant in Pitesti (FCN).

The CANDU-6 type reactor is a pressurized heavy water reactor, using natural uranium dioxide as fuel. A fuel channel contains 12 fuel bundles, zyrconium alloy cladded, of approximately 50 cm length. The fuel is cooled by heavy water coolant flowing through the fuel channels that are surrounded by heavy water moderator. The natural uranium fuel and the heavy water are produced in Romania. The CANDU-6 type reactor is fueled and defueled during operation. This allows quick replacement of a fuel bundle, if a fuel pin failure does occur. Systems are in place, that allow the early detection of a fuel leak and for localization of the channel that contains the leaking fuel. In the defueling process of that channel, the group of 2 bundles containing the leaking one is identified. These bundles are sent to the Failed

Fuel Bay. Latter, if the failure was important, and fuel leakage is continuing after the fuel was removed from the reactor, this fuel can be canned (till now, it was not the case). It has to be mentioned that the fuel failure rate is extremely low.

The current operations for management of spent fuel Cernavoda NPP are:

- Defueling of fuel from a channel (normal, or, in case of leakage, early);
- Sending of the failed fuel for storage in the Failed Fuel Bay;
- Sending of the normal fuel for storage in the Spent Fuel Bay;
- Storage of spent fuel for at least 6 years for cooling;
- Transfer of the fuel to the Spent Fuel Dry Storage (50 years designed period of dry storage).

It has to be mentioned that the first module of the Spent Fuel Dry Storage for Cernavoda NPP was put in operation in 2003, and the construction of modules 2 and 3 will start soon.

b) TRIGA spent fuel management

TRIGA reactor is owned by the Autonomous Company for Nuclear Activities through its Subsidiary for Nuclear Research Pitesti (SCN). The TRIGA reactor is a pool type reactor, with 2 cores: Steady State Reactor, operated at maximum 14 MW, and Annulus Core Pulse Reactor, that can give a pulse of 20,000 MW, or can be operated as a steady reactor at maximum 500 kW.
The fuel originally used for the Steady State Reactor was HEU type (93% enrichment). In present the conversion of the core to use LEU (20% enrichment) is taking place. The Annulus Core Pulse Reactor fuel is a LEU fuel (20% enrichment). All fuel is Incalloy cladded, and was delivered by USA. The reactor started to operate in 1979. The spent fuel is stored in the spent fuel storage pool, i.e. a lobe of the underwater transfer channel, between the TRIGA reactor and the Post Irradiation Examination Laboratory (LEPI) hot cells. It has to be noted that Romania has adhered to the US Government policy with respect to return to the country of origin of HEU type fuel spent in American research reactors abroad. According to the agreement signed by Romania, till 2006 all the HEU type fuel shall be spent and, till 2009, it shall be returned to USA. Already in 1999, a first shipment to USA of HEU spent fuel was performed.

c) LEPI spent fuel management

In the hot cells of this laboratory can be examined destructively and not destructively experimental fuel of CANDU type, but made of low enriched uranium, in order to reach the necessary burn-up during irradiation in TRIGA reactor. Consequently, some amounts of irradiated fuel roads and fragments were produced and are dry stored in pits sited in the hot cells of LEPI.

d) VVR-S reactor spent fuel management

The VVR-S reactor sited in Magurele is owned by the National Research & Development Institute for Physics and Nuclear Engineering “Horia Hulubei” (IFIN-

HH), subordinated to the Ministry of Education and Research. The tank type reactor was commissioned in 1957, and operated at a power of 2 MW. The reactor was permanently shut down in 1997, and a governmental decision for decommissioning was issued in 2002. The EK-10 type (10 % enrichment) fuel was used at the beginning of operation. After 1985 the new type of S-36 fuel (36,7 % enrichment) was used. Both types of fuel are aluminium cladded.
During the operation of the reactor, the spent fuel unloaded from the core, was stored for cooling for at least 2 years in the cooling pool sited at reactor hall. After the cooling period, the spent fuel was transferred in 3 of the 4 storage pools, sited close to the reactor building. At present, the fuel assemblies of the last charge from the core are still stored in the cooling pool, waiting for transfer, while the rest of spent fuel is stored in the storage pools.
During the operation history, a few minor incidents (resulting in mechanical deformation) did occur during the handling of the spent fuel. These incidents could explain the fact that at present in one of the storage pools, a moderate amount of Cs-137 concentration of activity was detected. However the relative long period of storage of the fuel raise the question of corrosion, and CNCAN imposed more stringent observance of the important water parameters (pH, conductivity, activity, Cl, O, etc.). In the same time, IFIN-HH is requested to perform the revision of the Safety Analysis Report for the spent fuel pools including th assessment of the fuel status, and if necessary, to take measures for canning of defective fuel.

e) National strategy for spent fuel management

The National Strategy on Medium and Long Term regarding the Management of Spent Nuclear Fuel and Radioactive Waste, including their Disposal and Decommissioning of Nuclear and Radiological Facilities, hereafter called NSRW (National Strategy for Radioactive Waste), was approved by Order no. 844 / 2004 and published in the Official Monitor of Romania no. 818/6 September 2004. NSRW was elaborated by ANDRAD and approved by the Nuclear Agency. As part of the National Strategy for the Development of Nuclear Field in Romania, which is currently under review, NSRW should be updated periodically. According to the NSRW and the current practice in Romania, the spent fuel management comprises:

- NPP spent fuel:
  - At least 6 years wet storage in the Spent Fuel Bay;
  - a minimum period of 50 years dry storage in the Spent Fuel Dry Storage (this period could be extended to 100 years, if necessary (if the the behaviour of the storage will be in accordance with the present suppositions);
  - deep geological disposal in a national repository, that has to be operational after maximum 45 years from now.

- VVR-S reactor spent fuel:
  - improvement of the chemistry of the water in the cooling and storage pools in order to extend the time for wet safe storage of the fuel;
  - characterization of the fuel cladding status, in order to determine if and when encapsulation is necessary;
  - return of spent fuel S-36 to the country of origin (Russian Federation);

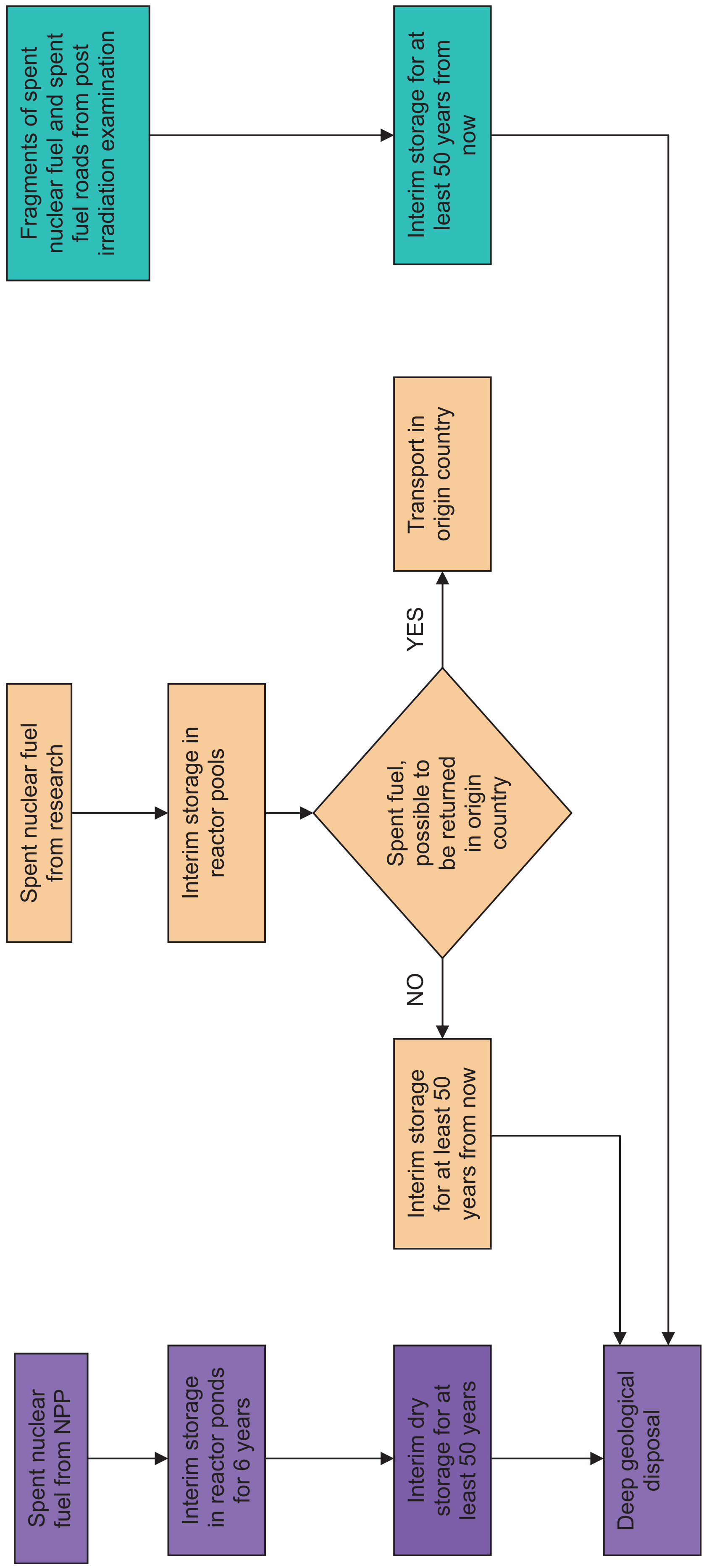
- exploring the possibility for sending the EK-10 spent fuel to the country of origin (Russian Federation), preferably as soon as possible, in order to avoid the need for prior encapsulation;
- if returning of EK-10 spent fuel to Russia is not possible, assuring the conditions for safe storage of the spent fuel till the conditions for final disposal are met;
- deep geological disposal in the future national repository, which, according to the strategy for NPP spent fuel, has to be operational after maximum 45 years from now

• TRIGA reactor spent fuel:
- wet storage in the storage pool, in LEPI building;
- return of HEU fuel to to the country of origin (USA)
- considering return to the country of origin of LEU fuel;
- if return of fuel is not possible, considering the need for dry storage to cover at least 50 years (using own built storage or the NPP dry storage);
- deep geological disposal in the future national repository.

• LEPI spent fuel fragments and spent fuel elements:
- dry storage inside of the storage pits existing in the hot cells;
- deep geological disposal in the future repository.

The strategy considered by ANDRAD for spent fuel management is summarized in Figure 1.

Figure 1. Current strategy for spent fuel management.



iii. Radioactive waste management practices

a) NPP radioactive waste management

Cernavoda NPP has all operational arrangements including special designated facilities for proper current management of its gaseous, liquid and solid operational radioactive wastes, in order to assure the protection of the workers, the public and the environment.

The gaseous wastes are collected by ventilation systems, filtered and released through the ventilation stack under a tight control to minimize the environmental impact.

The aqueous liquid wastes are collected and after a certain purification (if appropriate) are discharged into the environment by an approved “dilute and disperse” solution.

It can be concluded that at Cernavoda NPP, gaseous and aqueous liquid waste, after collection and purification, are safely discharged in accordance with international agreed standards for protection of public and environment.

The organic liquid wastes are packaged in stainless steel drums and stored in the basement of the Service Building, in the proximity of the Reactor Building.

The operational solid radioactive wastes including mainly compactable and non-compactable solid waste, spent filters cartridges and spent resins are safe managed within the plant facilities, designed, built and operated to meet internationally agreed standards.

The solid radioactive waste management at Cernavoda NPP includes the initial basic step of pretreatment of waste, as defined in the IAEA Safety Fundamentals No. 111-F “The Principles of Radioactive Waste Management”. It consists of collection, segregation, compaction (if appropriate), and safe storage.

According to the radioactive waste management strategy, to be presented at letter h), short-lived low and intermediate radioactive waste will be disposed in a near surface repository, planned to be built till 2014. In order to reach this target, main priorities in the next future at Cernavoda NPP are:

- radioactive waste characterization
- identification of safe and cost effective technologies for treatment of organic liquid wastes.

b) Nuclear Fuel Plant radioactive waste management

The Nuclear Fuel Plant (FCN) in Pitesti has operational and administrative arrangements for safe management of gaseous, liquid and solid wastes, offering protection to the workers, general public and environment.

The gaseous waste, containing dust and particles, are filtered and discharged in the environment in a controlled and approved manner.

The aqueous liquid wastes, including radioactive waste waters for uranium recovery and residual waters are collected, stored for a short period of time and based on administrative arrangements are sent to a licensed radioactive waste operator – SCN Pitesti– for appropriate treatment and discharge.

The combustible liquid waste, including spent solvent and contaminated oils, is collected and safely stored on site.

The combustible solid waste, containing uranium for recovery are collected, packaged and sent to SCN Pitesti for further treatment and/or conditioning.

The non-combustible solid waste, containing waste for which no any recovery is intended, are sent to the Feldioara repository for disposal based on administrative arrangements approved by CNCAN.

The plant is in process to put in operation an ecological incinerator for incineration of the combustible solid radioactive waste with uranium recovery.

The policy at the plant is to transfer the waste, as soon as posible, since its generation, to the waste operators.

c) SCN radioactive waste management

The Subsidiary for Nuclear Research Pitesti (SCN) of the Autonomous Company for Nuclear Activities is responsible for the management of its own radioactive waste. This include the treatment, conditioning and storage before disposal or long term storage of the radioactive waste resulted on the site of SCN. In order to perform this management, SCN has its own Radioactive Waste Treatment Plant Pitesti (STDR Pitesti). Among the most important practices that generate radioactive waste it shall be mentioned the operation of the TRIGA reactor, the operation of the Post Irradiation Examination Laboratory (LEPI), the secondary radioactive wastes from operation of STDR, and the radioactive wastes resulted from different research laboratories of SCN. In STDR are also treated, with uranium recovery, the liquid and burnable solid radioactive wastes resulted from the production of CANDU type fuel, in FCN Pitesti, which is sited in the same place as SCN Pitesti. Also organic liquid radioactive wastes produced in Cernavoda NPP can be treated in STDR Pitesti.

STDR has available the following facilities for the treatment and conditioning of radioactive wastes:

1. Installation for treatment, by evaporation, of liquid low - active beta - gamma radioactive waste;
2. Installation for conditioning in concrete of the radioactive concentrate obtained during the evaporation treatment of liquid radioactive waste; the installation is used also for conditioning in concrete the solid radioactive waste;
3. Installation for treatment and conditioning in bitumen of spent ion exchangers;
4. Installation for treatment, with U recovery, of liquid radioactive waste resulted from the fabrication of CANDU-type nuclear fuel;
5. Installation for treatment by incineration, with U recovery, of solid radioactive waste resulted from the fabrication of CANDU - type nuclear fuel;

6. Installation for treatment and conditioning of organic liquid wastes from Cernavoda NPP;
7. Installation for decontamination of sub-assemblies and spare parts.

STDR Pitesti has available a laundry for decontamination of individual protective clothes.

The radioactive wastes, treated and conditioned in long-lasting matrices are disposed of at the National Repository for Radioactive Wastes Baita Bihor provided that they are satisfying the maximum concentration of activity allowed for disposal in that facility.

In the LEPI facility are stored, supplementary to spent fuel fragments and spent fuel elements, short lived radioactive wastes with higher activity than allowed to be disposed in the National Repository for Radioactive Wastes Baita-Bihor (e.g. Co sources with high activity resulted from medical treatment practices). Also long lived radioactive waste resulted from the reactor TRIGA can be stored in the hot cells of LEPI.

Both STDR and LEPI, like each facility within SCN Pitesti, have their own ventilation system. The releases into the environment pass through HEPA filter batteries for radioactive aerosols retention. The releases from the ventilation systems are monitored. At STDR, the Installation for treatment by incineration, with U recovery, of solid radioactive waste resulted from the fabrication of CANDU-type nuclear fuel has its own local ventilation system composed by 2 cyclones, 2 bag type filters and a HEPA filter battery. The hot cells of LEPI have also their own local HEPA filtration battery.

d) IFIN-HH radioactive waste management

The management of the non-fuel cycle radioactive wastes from all over Romania is centralized at IFIN – HH in the Radioactive Waste Treatment Plant (STDR). Final disposal is carried out at the National Repository for Radioactive Wastes (DNDR) at Baita-Bihor.

Radioactive wastes, containing short lived radionuclides, including spent sealed sources are collected, treated and conditioned at IFIN – HH before final disposal, provided that they are satisfying the maximum concentration of activity allowed for disposal at Baita Bihor repository. The long lived radioactive wastes including spent sources, are stored on site at STDR Magurele.

Radioactive wastes treated at STDR Magurele arise from three main sources:

1. Wastes originated from the VVR-S research reactor during operation and the future decommissioning works.
2. Local wastes from other facilities operating on IFIN – HH site. These wastes include the own wastes generated during the normal activities of the STDR.
3. Wastes from non-fuel cycle practices all over the country (i.e. medical, biological, research and industrial applications)

The radioactive wastes treated and conditioned at STDR Magurele are both liquid and solid wastes.

The contaminated water from VVR-S reactor results mainly from the drainage of systems and equipment of the reactor and of the spent fuel pools. Other sources related to VVR-S reactor are from the active drainage and collecting systems which collect the used water from hot cells, showers, together with the leakage collected from the radioactive circuits.

From the operation of the STDR and other facilities sited at IFIN-HH internal, liquid effluents arise from drainage systems, from the individual protective clothes decontamination (laundry) and from equipment decontamination.

The Radioactive Waste Treatment Plant was commissioned in 1975 and it represents a fully import from Fairey Engineering Limited – England.
The STDR basically consists of liquid and solid waste treatment and conditioning facilities, a radioactive decontamination center, a laundry and an intermediate storage area.
The liquid treatment is performed in two steps: precipitation and evaporation.
The solid treatment includes the following methods: segregation, compacting, shredding, incineration.
After treatment the waste can be conditioned in drums by cementation. The short-lived spent sealed sources are also conditioned in drums by cementation.

Except the central building which contain installations for treatment and conditioning the waste, the laboratories and the offices, the plant includes five interim storage rooms used for the interim storage of radioactive waste and spent sources, and a building for two 300 m^3 tanks in which are collected the contaminated waters from the nuclear research reactor, radioisotope production department and nuclear medicine department.
A vault type storage with 4 cellules intended for storing used filters of VVR-S reactor, actually contains radioactive wastes originated from the operation of VVR-S reactor.

STDR Magurele has available the following facilities for the treatment and conditioning of radioactive wastes:

1. Installation for aqueous liquids treatment;
2. Installation for incineration of solid combustible radioactive waste;
3. Installation for solid non-combustible radioactive waste compaction;
4. Installation for cement conditioning;
5. Installation for decontamination of sub - assemblies and spare parts.

STDR Magurele has available a laundry for decontamination of individual protective clothes.

STDR Magurele has its own ventilation system. The releases into the environment pass through a filter battery for radioactive aerosols retention. The Installation for incineration of solid combustible radioactive waste has its own local ventilation system composed by 1 cyclone, 1 electrostatic separator, and a HEPA filter battery. The release from the incineration installation is monitored.

In 1985 was put into operation the National Repository for Radioactive Waste (DNDR) – Baita, Bihor county, sited in Apuseni Mountains, in an old exhausted uranium exploration mine. Using the existing concepts at '80 years' level concerning the final disposal of the low and intermediate level (institutional) radioactive wastes, and relying on internal standards and international recommendations, the underground constructions were dimensioned to dispose about 21.000 standard drums.
The repository, operated by IFIN-HH, is authorized in present for disposal of short lived radionuclides. According to the records, very few amounts of activity of long lived radionuclides were disposed off at Baita-Bihor repository, at the beginning of operation.

- After 1999, new waste acceptance criteria were established for Baita - Bihor repository. The maximum activity concentration per radionuclide is presented below. The summation criterion is applied for accepting the waste. The limits for disposal of the radioactive waste at Baita - Bihor are now in a review process, based on the preliminary safety assessment of the repository.

Table: Maximum content admitted for packages stored at Baita - Bihor Repository.

Radionuclide	Max. admitted activity [Bq/m^3]
C-14	$1*10^9$ (10^{11} Bq for all the repository)
Ni-59	$2*10^9$
Nb-94	$2*10^7$
Tc-99	$1,5*10^8$
I-129	$3*10^5$
Cl-36	$1,5*10^7$
H-3	$1.5*10^{10}$
Co-60	$3*10^{11}$
Ni-63	$1*10^{11}$
Sr-90	$5*10^9$
Cs-137	$1*10^{10}$
α-emitting radionuclides with a lifetime over 5 years	$1*10^7$
β and γ-emitting radionuclides with a lifetime over 5 years, not included in this table	$5*10^8$
Radionuclides with a lifetime below 5 years	$5*10^{11}$

e) National Uranium Company radioactive waste management

The National Uranium Company is responsible for uranium mining and milling activities. Its subsidiaries Bihor, principles Banat and Suceava are responsible for

uranium ore mining.
Feldioara Subsidiary is responsible for the Uranium Milling Plant.
The former Magurele Subsidiary was responsible for the geological field work and exploration for uranium and thorium. In May 2004 this subsidiary became a new company by the Government Decision no. 757 / 2004, and has a new name Radioactive Mineral Magurele Company .
Both the National Uranium Company and the Radioactive Mineral Magurele Company are responsible for the restoration of environment from the old uranium mining practices.
According to the new regulations the sterile rock dumps (i.e. with uranium content lower than 0.004%) have to be remediated like non radioactive rock dumps.

The liquid radioactive waste produced by the Feldioara Uranium Milling Plant is sent to two special insulated tailing ponds. The first tailing pond Cetatuia II was designed to be built in 3 stages. The first part is now filled and the second part was commissioned in 2001, while the third part is planned to be commissioned after 2012.

After first settling of tailings the liquid waste is transferred to the second tailing pond, named Mittelzop, for final settling of fines. The clear waters are pumped to the decontamination plant before being discharged in the Olt River.

Between the two mentioned tailing ponds there are three solid radioactive waste storage area. The first two storage areas are of trench type. The low level radioactive wastes were buried into existing clay layer and were covered by clay. The third storage area was also digged in the clay. The storage has the lateral walls made by concrete. The bottom of storage consists of compacted clay. The fourth wall will be build in the future, when the area will be filled.

By closure, the tailing ponds and the third solid radioactive waste storage area will become repositories, provided that the closure solution satisfies the regulatory safety requirements. For the first two solid radioactive waste storage areas that are closed and covered, it is also necessary to assess the safety prior to get the authorization for transforming the storage areas in repositories

f) Radioactive Mineral Magurele Company radioactive waste management

The Radioactive Mineral Magurele Company is responsible for the restoration of environment from the old uranium mining practices that are not under the responsibility of National Uranium Company (see above).

g)Geolex S.A. radioactive waste management

Geolex S.A. is a small company, dedicated for geological field work and exploration. The activities related to uranium and thorium are now closed, and the company shall bear the responsibility for environmental restoration.

h) National radioactive waste management strategy
As stated in the section regarding the national strategy for spent fuel management, NSRW was approved by Order no. 844 / 2004 and published in the Official Monitor

of Romania no. 818/6 September 2004. NSRW was elaborated by ANDRAD and approved by the Nuclear Agency. As part of the National Strategy for the Development of Nuclear Field in Romania, which is currently under review, NSRW has to be updated up to the end of 2005. The financial provisions for the implementation of the NSRW will be ensured by the future Fund for Radioactive Waste Management and for Decommissioning (the law regarding the Fund is in the approval process).
The current strategy for radioactive waste management comprises:

- Intermediate level waste is considered together with low level waste.
- Distinction is made between short lived and long lived intermediate and low level radioactive waste.
- The institutional short lived waste including spent sources is treated and conditioned, and finally disposed in the Radioactive Waste National Repository, at Baita - Bihor
- The long lived institutional and research reactors radioactive wastes (i.e. the wastes and spent sources that contain long lived radionuclides above the limits for disposal in Baita - Bihor repository) are stored at STDR Magurele and LEPI Pitesti.
- The long lived institutional wastes shall be conditioned and shall be stored for a period of minimum 50 years, prior geological disposal
- The short lived spent sources with activities above the limits for disposal at Baita – Bihor repository shall be stored for decay, and diposed latter in the same repository.
- All law and Intermediate level waste produced by NPP are stored on-site. For these wastes it is expected the construction of a near surface repository, equipped with an appropriate facility for waste treatment and conditioning.
- The strategy for construction of the surface repository shall consider the accommodation of institutional short lived radioactive waste, including spent sealed sources, after filling of Baita - Bihor repository.
- The NPP produced law and Intermediate level waste long lived not allowed to be disposed off in the near surface repository, shall be disposed in the geological repository. In the meantime, conditioning of such waste shall be realized as soon as practicable.
- The uranium milling tailing wastes are stored in tailing ponds, near the milling facility plant. The existing strategy consists in considering the ponds as repositories. After filling the ponds, closure works will be done for isolate the repository from environment.
- Also three storage areas for uranium milling and fuel fabrication solid radioactive waste are placed near the tailing ponds. The intention is to transform these storages in repositories for uranium and radium contaminated solids.
- For mining tailings, the existing strategy is in-situ capping combined with relocating of the most active wastes in the mines, during their decommissioning.

The strategy considered by ANDRAD for radioactive waste (spent fuel not included) management is summarized in Figures 2 and 3.

Figure 2. Current strategy for long lived radioactive waste management.

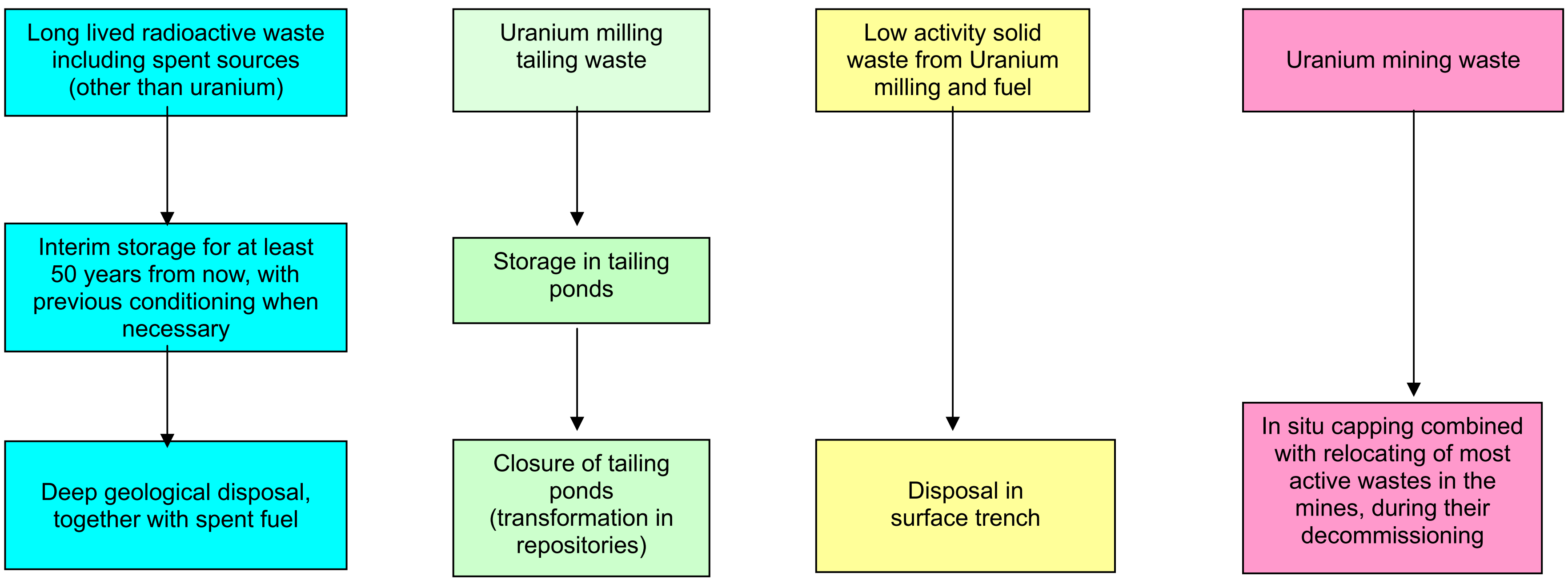
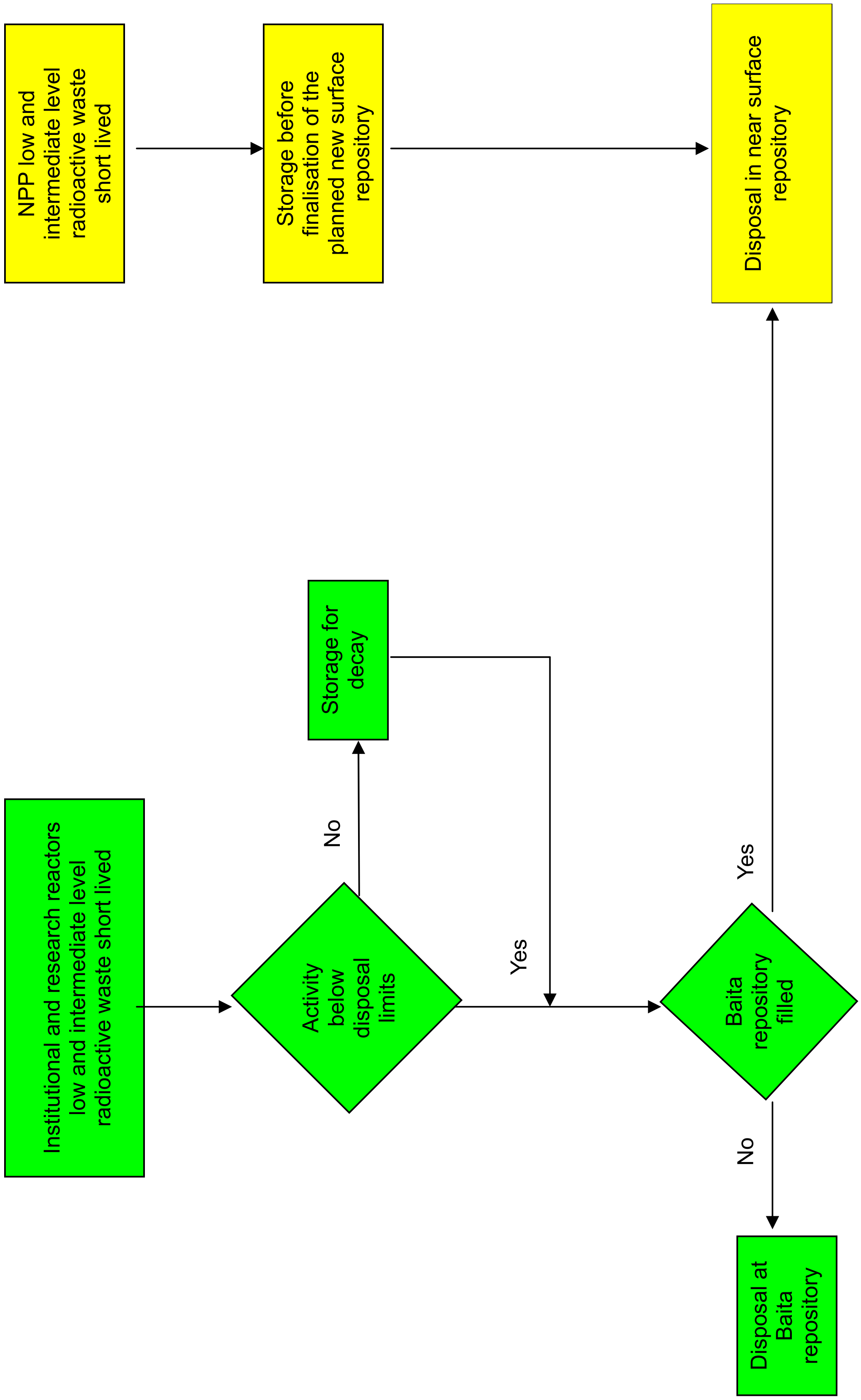


Figure 3. Current strategy for short lived radioactive waste management.



iv. Criteria to define and categorize radioactive waste

According to the definition presented in the Law no. 111/1996 on the safe deployment of nuclear activities, with subsequent modifications and completions, radioactive wastes are those materials resulted from nuclear activities for which no use was foreseen, and which contain or are contaminated with radionuclides in concentration above the exception limits. According to the spent fuel policy, spent fuel is considered radioactive waste.

In June 2005, CNCAN has issued the regulation: Norms for classification of radioactive waste. According to the regulation, the general classification of radioactive waste is the following:

- excluded radioactive waste
- transitional radioactive waste
- very low level radioactive waste
- low and interim level short lived radioactive waste
- low and interim level long lived radioactive waste
- high level radioactive waste

The general classification refers to the requirements for assuring the isolation from biosphere of the radioactive waste during its disposal.

The excluded radioactive waste is waste containing radionuclides with an activity concentration so small that the waste can be released from regulatory control (conditionally or unconditionally).

The transitional radioactive waste is waste having activity concentration above clearance levels, but which decays below clearance levels within a reasonable storage period (not more than 5 years).

The very low level radioactive waste is short lived waste in which the activity concentration is above the clearance levels, but with a radioactive content below levels established by CNCAN for defining the low level waste. The disposal of very low level waste requires less complex arrangements than the disposal of short lived low level waste.

The low and interim waste is radioactive waste in which the activity concentration is above the levels established by CNCAN for the definition of very low level waste, but with a radioactive content and thermal power below those of high level waste. Low level waste does not require shielding during handling or transportation. Intermediate level waste generally requires shielding during handling, but needs little or no provision for heat dissipation during handling or transportation.

The long lived radioactive waste is a waste containing radionulides with half life above 30 years in quantities and/or concentrations of activity above the values established by CNCAN, for which isolation from biosphere is necessary for more time than the institutional control duration.

The short lived radioactive waste is a radioactive waste that is not long lived.

The high level radioactive waste is:

a) liquid radioactive waste containing the most part of fission products and actinides existing initially in the spent fuel and forming the residues of the first extraction cycle of reprocessing;
b) the solidified radioactive waste of letter a) and the spent fuel;
c) any other radioactive waste with activity concentration range similar to the waste mentioned at letter a) and b).

According to the regulation, each producer and each processor of radioactive waste shall establish an operational classification of the waste that he produces or processes. Operational classification means the classification of radioactive waste having the purpose of conducting predisposal activities.

The regulation requires that in maximum 2 years each producer and each processor of radioactive waste shall comply with its requirements.
Mean time, the existing classification systems that are in place will continue to be applied.

CNE-PROD Cernavoda categorisation of radioactive waste

At present, the NPP has its own classification system of radioactive waste that was established for operational purposes.
During the operation of Cernavoda NPP the following categories of solid wastes are generated:
a) Spent resins;
b) Spent filters cartridges;
c) Low activity solid wastes, Type 1 (contact gamma dose rate < 2 mSv/h);
d) Medium activity solid wastes, Type 2 (contact gamma dose rate between 2 mSv/h and 125 mSv/h) and Type 3 (contact gamma dose rate higher than 125 mSv/h).

The liquid radioactive wastes generated at NPP Cernavoda are:
e) Aqueous;
f) Organic.

a) Spent resins

Spent resins are obtained from the various purification systems of the process fluids. When taking them out of these systems, the direct contact radiation dose is usually significant. Therefore, special protection and shielding measures have been provided for their transportation, handling and storage.

The characteristics of the spent resins handled within the plant systems are ranging within large limits. Both the activity and composition of the radionuclides retained in the ionic exchange resins, depend mainly on the function which the purification system performs within the plant, by using the respective resins. Thus, the resin activity developed in the purification system of the heat transport system, or of the water in the spent fuel bay is due mainly to Cesium 134 and 137, which originate from fuel elements. Resin activity developed in the purification system of the moderator is due mainly to Cobalt 60 and Chrome 51, which result from the activation of the structural material with neutrons.

b) Spent filters cartridges

The spent filters cartridges result from the following process systems: heat transport purification system, moderator purification system, spent fuel bay water purification system, heat transport pump sealing system, D_2O supply system for the fuelling machine, active drainage system.

The spent filter cartridges usually have, when they are discharged from the plant process systems, a radiation dose up to 5 mSv/hour and in severe situation, until 50 Sv/hour. (Highest dose rate reached till now was 12 mSv/h for a large filter cartridge from Spent Fuel Bay - Cooling and Purification System).

There are 5 types filter cartridges, having the overall sizes presented in the following table.

Table: Size characteristics of Cernavoda NPP generated spent filters cartridges.

Sizes	Type 1	Type 2	Type 3	Type 4	Type 5
Diameter (mm)	455	381	366	254	120
Height (mm)	1400	1173	1156	1143	1150

The spent filter cartridges of 1- 4 types are handled by means of a large flask, having a weight of 8.6 - 8.8 tons (including the cartridge).

Spent cartridges of type 5 are handled by means of a small flask, which has a weight of 2.7 tons (including the cartridge).

Protection wall thickness of the flasks have been calculated in order to provide a radiation dose reduction from 50 Sv/hour to 0.25 mSv/hour in case of a large flask and from 50 Sv/hour to 0.15 mSv/hour in case of a small flask.
The spent filter cartridges are unloaded from the process systems, are dried (H-3 < 5 μSv/h) and then carried to the Interim Solid Radioactive Waste Storage Facility.
Transfer of spent filter cartridges is performed by means of suitably shielded containers.
By acting the handling cable, the used filter is lifted inside a flask. The loaded flask is transported again on the carriage, and then the new filter is introduced inside the installation and the flask is transferred to the Interim Solid Radioactive Waste Storage Facility to be unloaded into the cylindrical pipes of the storage cells.

c) Low activity solid wastes

Solid low active wastes (type 1) are produced from various operations, which are daily performed in the plant. They consist mainly of materials from decontamination and maintenance operations, protection clothes and metallic parts, as well as contaminated materials and equipment. Waste is collected in bags, which are checked for tritium before compacting. If tritium is detectable the bags are dried.

The solid wastes are collected into 220L stainless steel standard drums, approved by CNCAN.

The radioactive waste collection points are established to assure that all the wastes are collected and a primary waste segregation is performed.
For each collection point specific container and label requirements are defined.

Solid radioactive wastes are collecting separately, as either compactable or non-compactable wastes.

- Compactable waste includes paper, textiles, plastics, rubber and other compactable materials.
- Non compactable waste include: general waste (tools, metallic parts, wood pieces, construction waste) and special waste (glass, iodine, particulate and tritium filters cartridges, molecular sleeve).

d) Medium activity solid wastes

Medium activity solid radioactive wastes (type 2 and 3) are produced in small quantities and only under special circumstances. They are remotely handled with suitable shields or additional containers.

- The medium activity solid wastes type 2 are classified as compactable and non-compactable waste.

Compactable waste includes: paper, textiles, plastics, rubber and other compactable materials.

Non - compactable waste are classified as follows:
- general waste: tools, metallic parts, wood pieces, construction materials;
- special waste: spent filters cartridges from plant purification circuits;

- The medium active solid wastes type 3 are only non-compactable. They consist of spent filters cartridges, activated reactor components or other highly-contaminated materials. These kind of waste are produced in small quantities and only under special circumstances. They are handled by means of special shielded containers.

e) *Aqueous radioactive wastes*

The aqueous liquid wastes collected by the Liquid Radioactive Waste System are categorised as follows:
- Level 1 low activity wastes, resulted from laundry, showers, some laboratories and drainages of Service Building, and having the gamma activity between 3.7×10^{-1} Bq/l – 3.7×10^{2} Bq/l;
- Level 2 medium activity wastes, resulted from the system of upgrading heavy water, decontamination of equipments and washing of plastic objects, other

laboratories and drainages of Service Building, and having the gamma activity between 3.7×10^{2} Bq/l – 3.7×10^{4} Bq/l;

- Level 3 medium activity wastes, resulted from the drainage system of the Reactor Building, and from the drainages of spent fuel pools, and having the gamma activity between 3.7×10^{4} Bq/l – 3.7×10^{6} Bq/l.

Generally, the Level 3 medium activity wastes are treated for decontamination before release.

f) Organic radioactive wastes

Organic liquid radioactive wastes consist of spent oils, spent solvents, liquid scintillate cocktails, flammable solids, sludge, which cannot be processed through Liquid Radioactive Waste System because of their environmental impact.
The sources of liquid organic wastes are as follows:

- *oils*: lubricating oils from pumps and motors used in Zones 1 and 2 contaminated mainly with tritium (at Cernavoda NPP there are three controlled zones; the level of risks and potential of contamination decreases as follows: Zone 1, Zone 2 and Zone 3);
- *solvents*: from the decontamination area and from the laboratories and maintenance activities spent solvents consist of: white spirit, ethylene glycol, alcohol ethyl, toluene, chloroform, acetone;
- *liquid scintillator* contaminated mainly with tritium and segregated by tritium content. Liquid scintillator from sampling of Moderator System, PHT Systems and their auxiliaries is segregated from liquid scintillator from sampling of Liquid Effluents Systems;
- *radioactive sludge*, from maintenance activities on the active drainage contaminated with gamma nuclides;
- *flammable solids* (solid – liquid mixture) from maintenance activities contaminated with gamma nuclides.

When sufficient volumes of such waste have been accumulated they will be treated according to the quantity and type of radioactivity they contain.
Lubricated oils and solvents are collected in metallic cans and transferred in the Service Building basement; they are stored in radioactive 220L stainless steel drums, authorized by CNCAN.
Flammable solids are stored in the Service Building basement in 220L stainless steel drums, authorized by CNCAN.
Organic liquid wastes are handled and stored as per NPP's Radiation Protection Procedures.

FCN Pitesti categorization of radioactive waste

The radioactive waste of the Nuclear Fuel Plant Pitesti is categorized in:

- Solid;
- Liquid.

The solid radioactive wastes are categorized in:

- Containing U;

- Low activity combustible;
- Low activity noncombustible.

The liquid radioactive wastes are categorized in:
- Recyclable;
- Non-recyclable;
- Combustible.

According to the provisions of the specific licensing documentation approved by CNCAN, the annual quantities of radioactive wastes generated from the operation of Nuclear Fuel Plant are given in the following table.

Table: Radioactive waste generated by the Romanian Nuclear Fuel Plant.

Solid wastes

Waste type	Description	Quantity	Specific radionuclide
Containing U	Ventilation filters	1 tone / yr	Natural Uranium
Low activity/ combustible	Rags, paper, plastics, wood, rubber	5 tone / yr	Natural Uranium
Low activity/ noncombustible	Metallic and non metallic components	10 tone / yr	Natural Uranium

Liquid wastes

Waste type	Description	Quantity	Specific radionuclide
Recyclable	Technological waters	600 m^3/ yr	Natural Uranium
Non-recyclable	Residual waters	2000 m^3/ yr	Natural Uranium
Combustible	Organic solvents	1-2 m^3/ yr	Natural Uranium

As previously mentioned in paragraph *iii*, subparagraph *b)* of this section, the Nuclear Fuel Plant transfers all types of generated liquid and solid radioactive wastes to different licensed waste operators for further treatment, conditioning and/or disposal. The policy principle here is to transfer the waste as soon as possible since it was generated. According to the administrative arrangements and approved by CNCAN, once the waste was transferred to the waste operator, the fuel plant and consequently SNN like legal representative of the plant has no more any responsibility for radioactive waste management including disposal of wastes.

The combustible liquid waste is represented by spent organic solvents (tri-butyl phosphate and kerosene contaminated with uranium).

By the end of 2004, there are about 9 m^3 combustible liquid waste stored on-site.

SCN Pitesti categorization of radioactive waste

At SCN Pitesti radioactive wastes are categorized in:

- Solid low-active radioactive waste;
- Spent ion exchangers;
- Solid combustible radioactive waste containing natural uranium (produced in the Nuclear Fuel Plant Pitesti);
- Liquid low - active radioactive waste;
- Liquid radioactive waste containing natural uranium (produced in the Nuclear Fuel Plant Pitesti);
- Organic liquid radioactive wastes from Cernavoda NPP.

It has to be mentioned that uranium wastes produced in the Nuclear Fuel Plant Pitesti are treated in STDR for uranium recovery; consequently, all the wastes resulted from the STDR activity are short-lived, and can be disposed at Baita-Bihor repository.

In the LEPI facility are stored:

- Short lived radioactive waste with high activity (spent sources);
- Long lived radioactive waste resulted from the reactor TRIGA.

IFIN-HH Magurele categorization of radioactive waste

At IFIN-HH Magurele the solid radioactive wastes are categorized in:

- Combustible;
- Compactable, non-combustible;
- Non-compactable, non-combustible type;
- Spoilage, putrefying type;
- Short-lived spent sources;
- Long-lived spent sources and radioactive waste;
- Operational waste from VVR-S reactor, not characterized, stored in the vault type storage with 4 cellules.

With the exception of the last 2 categories, all are short-lived radioactive waste. The liquid radioactive waste at STDR Magurele is only aqueous low level waste, short lived.

SECTION C. SCOPE OF APPLICATION

Article 3.

Article 3.1: Romania does not reprocess spent fuel, as it was decided to use open fuel cycle. By consequence Romania does not declare reprocessing to be part of spent fuel management.

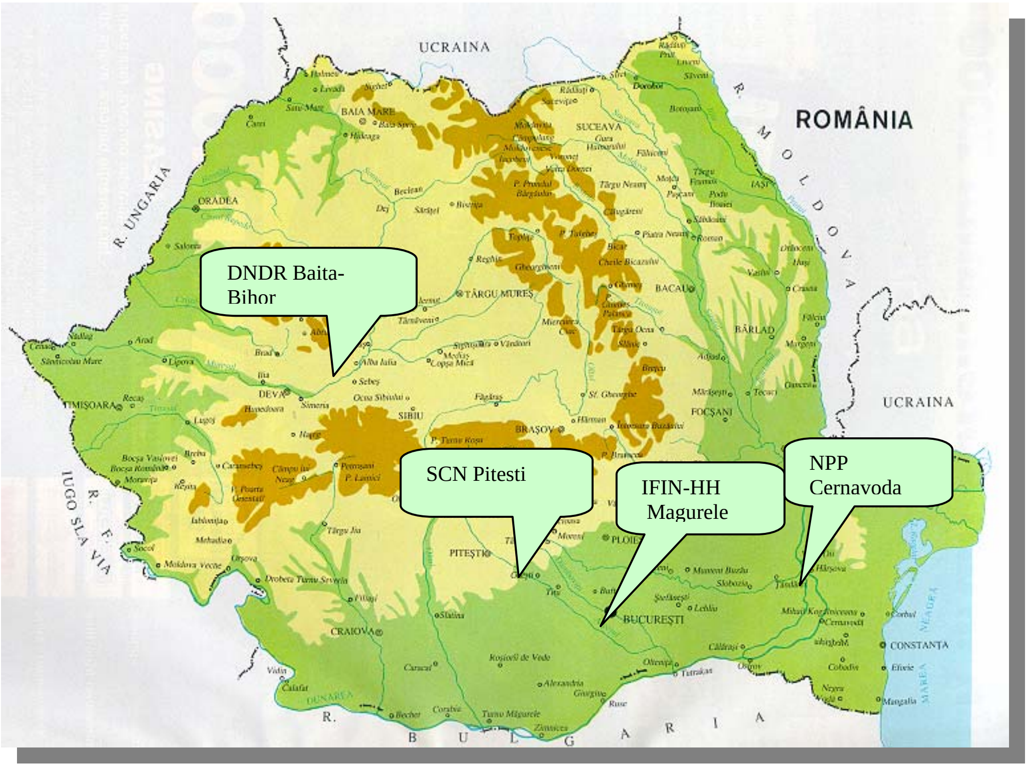
Article 3.2: Romania does not declare as radioactive waste for the purposes of the Convention any waste that contains only naturally occurring radioactive material and does not originate from the nuclear fuel cycle.

Article 3.3: Romania does not have military or defence programs that produce spent fuel. The very low amounts of radioactive waste that result from radiological practices in military area, are transferred permanently to and managed within exclusively civilian programs. By consequence Romania does not declare spent fuel or radioactive waste within military or defence programs as spent fuel or radioactive waste for the purposes of the Convention.

SECTION D. INVENTORIES AND LISTS

Article 32. Reporting, paragraph 2

i. List of spent fuel management facilities subject to the convention, their location, main purpose and essential features



1. Cernavoda NPP spent fuel management facilities

NPP Cernavoda is located at 1 km distance of town Cernavoda, close to Danube river.
CNE-PROD, the operator of Cernavoda NPP-Unit 1, has the following spent fuel management facilities:

- The Spent Fuel Bay;
- The Spent Fuel Dry Storage Facility.

The facilities are located at NPP site, Cernavoda.

a) The Spent Fuel Bay

Cernavoda NPP uses on - power continuous refueling method imposed by the use of natural uranium fuel.
A wet storage facility, specifically named Spent Fuel Handling System, was provided for each reactor as part of the NPP project. This system includes the following:

- Discharge and Transfer Equipment located in the Reactor Building;
- Spent Fuel Reception and Storage Equipment located in the Service Building;
- Spent Fuel Reception bay located in the Service Building;
- Main Storage Bay: Spent Fuel Bay and Defected Fuel Bay, located in the Service Building.

The transfer of spent fuel between Reactor Building and Service Building is underwater through a Transfer Channel.

According to design data, the Spent Fuel Bay has a capacity of 50,000 CANDU fuel bundles and the Defected Fuel Bay has a capacity to store for thirty years plant operation the canned defected fuel. Sixteen cans are initially provided, each with capacity of one bundle.

The Cernavoda Unit 1 Spent Fuel Bay

b) The Spent Fuel Dry Storage Facility

Due to a limited capacity of the wet storage facility, the first module of a dry spent fuel facility was constructed on Cernavoda NPP site. After at least six years in the Spent Fuel Bay, the spent fuel is transferred to the dry facility.

The Spent Fuel Dry Storage Facility is located at around at 700 m SW-W from the first reactor, closed to the envelope of the initially fifth planned reactor on-site. Its designed storage capacity will be expanded gradually from 12,000 to 324,000 spent fuel bundles. (It can accommodate the spent fuel inventory of two reactors).

The dry storage technology is based on the MACSTOR System. It consists of storage modules located outdoors in the storage site, and equipment operated at the spent fuel storage bay for preparing the spent fuel for dry storage. The spent fuel is transferred from the preparation area to the storage site in a transfer flask. The transportation is on-site.

Storage Module of Spent Fuel Intermediate Dry Storage Facility

2. SCN Pitesti spent fuel management facilities

SCN Pitesti, the operator of TRIGA reactor, has the following spent fuel management facilities:

a) The Spent Fuel Storage Pool;
b) The Dry Storage Pits.

The facilities are located at SCN site in Mioveni, near Pitesti.

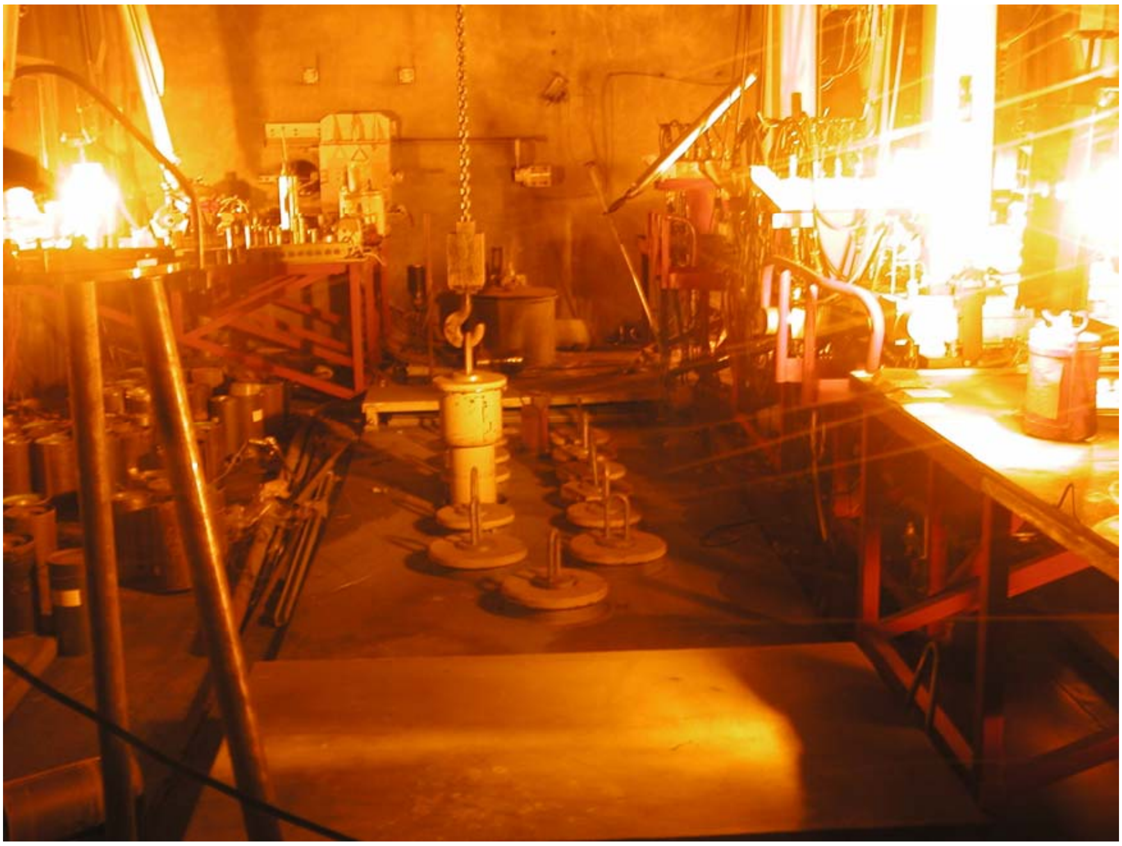
a) The Spent Fuel Storage Pool

The spent fuel removed from the TRIGA reactor can be stored for one year in the reactor pool, in 6-bundle racks. After this time delay the spent fuel bundles are transferred in the spent fuel storage pool, close to the underwater transfer channel between the reactor and the LEPI hot cells area. Storage conditions are similar to those in the TRIGA pool. The storage time can be 20 to 30 years. Meanwhile, the encapsulation technology in steel cans will be developed for the spent fuel. The defective fuel will be double-encapsulated and the interim storage will be ensured by the spent fuel storage pool. The dimensions of the transfer chhannel lobe representing the spent fuel storage pool are: $1 \times 4 \times 8$ m^3.

Spent fuel storage pool at the TRIGA Reactor

b) The Dry Storage Pits

The irradiated experimental fuel roads and fragments resulted after examination in LEPI are stored in five dry storage pits. These pits are located in the hot cell of the LEPI, in the cell floor, and are sealed by lids. They are cylindrical in shape, steel-coated at the inside, having a storage capacity of 5 fuel bundles each. The fuel fragments are canned, and stored in the same pits.



Storage pits at LEPI for irradiated experimental fuel rods and fragments

3. IFIN-HH spent fuel management facilities

IFIN-HH, the owner and former operator of VVR-S reactor, has the following spent fuel management facilities:

- The Spent Fuel Cooling Pool;
- The Spend Fuel Storage Pools.

The facilities are located at IFIN-HH site in Magurele, near Bucharest (at approx. 8 km distance).

During the operation of the reactor, the spent fuel unloaded from the core, was stored for cooling for at least 1 year in the Cooling Pool, sited in the reactor hall.

After cooling period, the spent fuel was transferred in 3 of the 4 storage pools (1 is still empty), sited in a separate building, close to the reactor building. At present, the fuel assemblies of the last charge of the core are still stored in the cooling pool, waiting for transfer, while the rest of spent fuel is stored in the storage pools.

The transport of the spent nuclear fuel assemblies from the cooling pool (placed in the reactor main hall) to the spent fuel storage pools is assured by using the special container for spent fuel removal.

IFIN-HH spent fuel transfer cask

Spent fuel storage pools at the VVR - S Reactor of IFIN-HH

ii. Spent fuel inventory

1. Cernavoda NPP spent fuel inventory

The CANDU – 6 fuel bundle used at Cernavoda NPP consists of 37 natural uranium fuel elements, arranged in three rings of 18, 12 and 6 elements, respectively, around one central element. Thirty-seven elements are held together at both ends by Zircaloy endplates.
The spent fuel mass parameters are:
Fuel bundle initial Uranium content: 18.9 kg U nat.
Nominal bundle mass 23.7 kg.

By the end of December 2004, the spent fuel stored in the Spent Fuel Bay of Cernavoda NPP Unit-1 accounted for 31,912 CANDU spent fuel bundles, and the spent fuel stored in the dry storage facility accounted for 8,400 irradiated bundles.

2. SCN Pitesti spent fuel inventory

The TRIGA storage pool contains:
- 180 TRIGA – HEU - type elements,
- 1 TRIGA – LEU - type element,
- 3 CANDU - type bundles,
- 1 CANDU - type experimental element.

The storage pits at the LEPI hot cell includes:
- approximately 21.64 kg uranium in LEU spent fuel elements and fragments, including approx. 0.1 kg unirradiated fuel,
- approximately 0.321 kg uranium in HEU spent fuel and fragments, including a few grams of unirradiated fuel,
- approximately 5.32 kg natural uranium in spent fuel elements and fragments, including 0.128 kg unirradiated natural uranium.

3. IFIN-HH spent fuel inventory

The total inventory of spent fuel in storage pools and cooling pool of IFIN-HH consists in:
- 153 EK-10 type assemblies (10% initial enrichment)
- 70 S-36 type assemblies (36,7% initial enrichment)

iii. List of radioactive waste management facilities subject to the convention, their location, main purpose and essential features

1. CNE PROD radioactive waste management facilities

At CNE-PROD, the radioactive waste management systems are, as follows:
a) Solid Radioactive Waste System
b) Organic Liquid Handling System

c) Spent Resins Handling System

Gaseous and liquid waste are managed within the following NPP's systems:
d) Gaseous Radioactive Waste System
e) Liquid Radioactive Waste System

a) The Solid Radioactive System

After pretreatment (collection, segregation, compaction and shredding, as appropriate) the solid wastes are confined in 220L stainless steel drums and sent to the Solid Radioactive Waste Storage Facility.

The Solid Radioactive Waste Storage Facility is located within the inner security fence of the plant site and is designed for storage of low and intermediate wastes has a storage capacity produced by the plant, except spent ionic resins, reactivity control bars and spent fuel.
It consists of three above ground structures with a designed life of 50 years, as follows:

- a warehouse
- two concrete structures

The warehouse which is a concrete building with a total storage capacity of 2,400 m^3. Inside this structure 220L stainless steel drums containing compactable and non-compactable low and intermediate level solid radioactive waste are stacked on four level. The occupied capacity is about 179,14 m^3 by the end of December 2004.

A concrete structure which consists of cylindrical concrete cells dimensioned to accommodate all low and intermediate level spent filter cartridges resulted from plant operation. Its designed storage capacity is of 57.77 m^3. Inside the concrete cells there are metallic cassettes with bottom and cover designed to avoid cell contamination.

The dimensions of concrete cells are presented in the following table.
Table: Size characteristics of the Cernavoda NPP spent filters cartridges storage facility.

Type of concrete cells	Number of cells	Diameter (mm)	Height (m)
Large	30	512	3
Medium	84	408	3
Small	28	308	3

The occupied capacity is about of 1.46 m^3 by the end of 2004.

The warehouse (inside view)

The Solid Radioactive Waste Storage Facility

Another concrete structure for large and highly contaminated pieces has a total storage capacity of 41 m^3. It consists of eight concrete cubes which can be removed together with the waste content. Currently, the structure does not contain any waste.

b) Organic Liquid Handling System
Organic liquid radioactive wastes consist of spent oils, spent solvents, liquid scintillate cocktails, flammable solids, sludge, which cannot be processed through Liquid Radioactive Waste System because of their environmental impact.

The organic liquid handling system comprise the handling of: oils, solvents, liquid scintillators, radioactive sludge, flammable solids (solid + liquid mixture). These wastes (32.78 m^3 by the end of 2004) are temporary stored in 220L stainless steel drums in the Radioactive Waste Storage Facility.

c) Spent Resins Handling System

CNE-PROD Cernavoda Spent Resins Handling System includes storage tanks for spent resins from the plant's purification circuits.
Storage of spent resins takes place in three vaults made of reinforced concrete lined with epoxy, located in the basement of the Service Building, in the proximity of the Reactor Building. The capacity of each vault is of 200 m^3.

d) Gaseous Radioactive Waste System

Potentially contaminated air is circulated through four ventilation systems:

- Central Contaminated Exhaust System
  The air from this system is filtered through a High Efficiency Particulate Air (HEPA) filter.
- Reactor Building Exhaust System
  The air from the Reactor Building is passed through a pre-filter, a HEPA filter, an activated charcoal filter (to retain radioiodine) and a final HEPA filter.
- Spent Fuel Bay Exhaust System
  Filtration of this air is similar to that of the Reactor Building.
- Upgrader Tower Exhaust System

The air from this system is unfiltered since it contains small tritium quantities, only.
In areas of the station where heavy water systems are located, a Closed Cycle Vapour Recovery System recovers the majority of released tritium vapours.
All potentially contaminated exhausted air is routed to the exhaust stack, which discharge it.

e) Liquid Radioactive Waste System

Radioactive liquid wastes (aqueous) are collected in five liquid effluent hold-up tanks. They are located in the basement of Service Building. Each tank has a capacity of 50 m^3. After a sever control, the content of any tank shall be discharged to the Danube River or to the Danube - Black Sea Channel (via Condenser Cooling Water Duct).
A decontamination unit is provided to minimize the radioactive particles in any effluents if necessary. It includes filtering and ionic exchange by means of a pre-coat type filter using as filtering material ionic microresins and a special fiber material adequate for the colloidal filtration since the main contaminants consists of a combination of colloidal particles and ionic materials within a deionized water medium.

2. Fuel Fabrication Plant radioactive waste management facilities

a) Gaseous Radioactive Waste System
Air from potential contaminated indoors (areas dedicated to the fuel manufacturing

and laboratories' rooms) is collected, filtered with high efficiency filters and discharged through the plant's stack.

b) Liquid Waste Temporary Storage Tanks

Storage of liquid radioactive wastes is made inside the basement of the plant building . Facilities for storage are: 3 stainless steel tanks of 10 m^3 each and 3 steel tanks of 60 m^3 each. They collect and store the different categories of liquid wastes.

c) Solid Waste Temporary Storage Platform

Storage of solid radioactive waste is realized on the Temporary Storage Platform for Low Contaminated Solid Waste. This is a platform on the ground located in the vicinity of the building of fuel manufacturing.
It is dedicated to temporary storage of different categories of solid waste collected in the plant and further, in short term, are transferred to different waste operators mentioned before in Section B.
The platform can store about 20 tones radioactive solid wastes.
It has a security fence with a physical protection system.

3. SCN Pitesti radioactive waste management facilities
a) Radioactive Waste Treatment Plant (STDR)
The Radioactive Waste Treatment Plant has the following facilities:
a.1) Installation for treatment of low - active β-γ liquid wastes
- treatment is done by evaporation.

Evaporator for treatment of low - active β-γ liquid wastes

a.2) Installation for conditioning in concrete of the radioactive concentrate obtained during the evaporation treatment of liquid radioactive waste; the installation is used also for conditioning in concrete the solid radioactive waste:

- conditioning container: 220 l drums

a.3) Installation for conditioning into bitumen of spent ion exchangers at the TRIGA reactor

- conditioning container: 70 l drums
- bitumen type: I60 / 70.

a.4) Installation for treatment, with uranium recovery, of liquid radioactive waste resulting from the fabrication of CANDU – type nuclear fuel

- max. U concentration in the waste: 5 g/l
- max. U concentration in the effluent: 1 mg/l
- uranium separation is done by selective precipitation.

a.5) Installation for the incineration of solid radioactive waste contaminated with natural uranium fromNuclear Fuel Plant

- incineration temperature: 900°C
- the plant includes a module for filtering off – gas comprising 2 serial cyclons, 2 bag type filters and 1 battery of HEPA filters.

Incinerator for solid radioactive waste contaminated with U-nat

a.6) Installation for treatment / conditioning for organic liquid radioactive waste with tritium content from Cernavoda NPP
- conditioning containers: 220 l drums

a.7) Installation for decontamination of sub-assemblies and spare parts.
Characteristics:
- decontamination vessel capacity: 1 m^3
- decontamination solution temperature: 93°C.

STDR Pitesti has also available an industrial-type laundry washing machine for decontamination of individual protective clothes:
- decontamination capacity: 40 kg/hour.

b) Post Irradiation Examination Facility

In the precinct and in the hot cells of LEPI facility are stored:
- Short lived radioactive waste with high activity (a few high activity spent sources);
- Long lived radioactive waste resulted from the reactor TRIGA.

4. IFIN-HH radioactive waste management facilities

a)The management of the non-fuel cycle radioactive wastes from all over Romania is centralized at IFIN–HH in the Radioactive Waste Treatment Plant (STDR).
b) Final disposal is carried out at the National Repository of Radioactive Wastes (DNDR) at Baita Bihor.

a) Radioactive Waste Treatment Plant

Radioactive wastes, containing short lived radionuclides, including spent sealed sources are collected, treated and conditioned at IFIN–HH before final disposal, provided that they are satisfying the maximum concentration of activity allowed for disposal at Baita Bihor repository. The long lived radioactive wastes including spent sources, are stored on site at STDR Magurele.

Radioactive wastes treated at STDR Magurele arise from three main sources:

1. Wastes originated from the VVR-S research reactor during operation and the future decommissioning works.
2. Local wastes from other facilities operating on IFIN–HH site. These wastes include the own wastes generated during the normal activities of the STDR.
3. Wastes from non-fuel cycle practices all over the country (i.e. medical, biological, research and industrial applications)

The radioactive wastes treated and conditioned at STDR Magurele were both liquid and solid wastes. The CNCAN authorization for the liquid waste treatment installation is suspended from 1999 due to mechanical and physical weathering. The installation was functioning at full capacity for almost 25 years. A technical expertise on the status of the pipes and tanks was conducted in 2002. In 2004, a study was elaborated regarding the refurbishment of the installation. The study concluded that it is too expensive to refurbish the installation, the acquisition of a mobile liquid treatment installation being more adequate.

The Radioactive Waste Treatment Plant was commissioned in 1975 and it represents a fully import from FEL – England. The central building contains the incinerator, the liquid effluents treatment installation, all the equipments for solid waste conditioning, the laboratories and the offices. The plant has also five interim storage repositories and a building for two 300 m^3 tanks in which are collected the contaminated waters from the nuclear research reactor, radioisotope production department and nuclear medicine department. The five cellular repositories are used for the interim storage of the conditioned drums until their transfer to Baita final repository.

The STDR basically consists of liquid and solid waste treatment and conditioning facilities, a radioactive decontamination center, a laundry and an intermediate storage area.

STDR Magurele has available the following facilities for the treatment and conditioning of radioactive wastes:

1. Installation for aqueous liquids treatment (authorization suspended);
2. Installation for incineration of solid combustible radioactive waste;
3. Installation for solid non-combustible radioactive waste compaction;
4. Installation for cement conditioning;
5. Installation for decontamination of sub-assemblies and spare parts;
6. Storage for radioactive waste;
7. Storage for Used Filters.

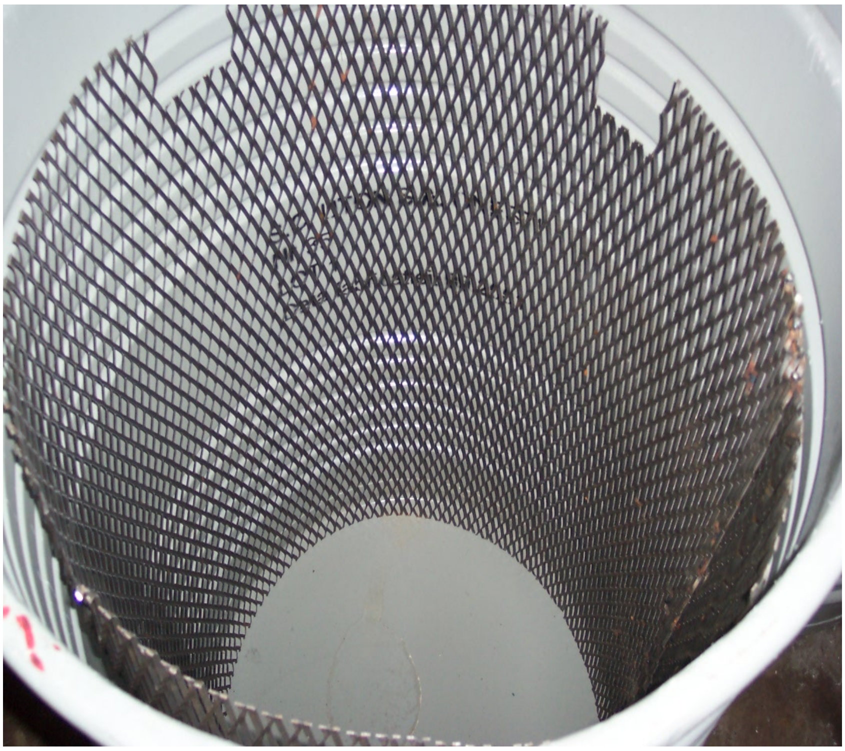
STDR Magurele has also available a laundry for decontamination of individual protective clothes.

Solid waste cementation installation at STDR Magurele

At IFIN-HH Magurele there is a temporary storage facility. The storage facility is a ground floor building, divided into 5 rooms. The storage building is not fitted with either a ventilation system or special systems for handling the containers.

Radioactive Waste Storage at STDR Magurele

The total storage capacity is about 3,000 drums. At present, in the storage facility there are stored approximately 800 drums with historical waste, more than 20 years old. The drums are damaged by corrosion. These 220-l drums will require repackaging in 420-l drums before being sent to the national repository.



420 l drum for reconditioning 220 l corroded drums

Also, at STDR is a Used Filters Storage (DFU). This is a construction with 5860 mm × 5000 mm × 3000 mm dimensions done by heavy concrete, build in 1957-1958 having as destination the long term storage of the filters from VVR-S research reactor, and other materials resulting from reactor processes. In DFU were stored aluminum devices with Pb used for radioisotope irradiation and irradiation devices from the reactor experiments. At DFU were not stored any used filters from primary cooling system (with ion exchange resins) either damaged fuel assemblies.

DFU is composed by a concrete platform on which are placed 4 closed wells with concrete corks.

Well no. 1, which was designed for disposal of solid wastes from hot cells, is lined on the whole internal surface with 5 mm thick iron plate.

Wells 2,3 and 4 were designated for disposal of filters from the primary cooling system and are lined also with 5 mm iron plate at the upper surfaces (1000 mm) and on the bottom part.

Initially, every well was connected to the reactor ventilation system by rubber hoses only when the cork is taken out. Also, DFU was equipped with a travelling crane, which is not in use anymore.

In present the wells are closed and are not in use for more than 25 years. The total stored activity is not known. The area is under radiometric surveillance performed permanent by STDR and periodically by the Radiological Security Department from IFIN-HH.

b) National Repository for Low and Intermediate Level Wastes Baita - Bihor

In 1985 was built and given in operation the National Repository for Low and Intermediate Radioactive Waste (DNDR) – Baita, Bihor county, sited in Apuseni mountains, in an old exhausted uranium mine. The repository is dedicated to institutional waste. Using the existing concepts at ’80 years level concerning the final disposal of the low and intermediate level radioactive wastes, and, rely on internal standards and international recommendations the underground constructions were dimensioned to dispose about 21,000 standard drums.

DNDR entrance

The experience gained by the countries that developed nuclear programs, which shows that a proper modality for radioactive waste disposal are the underground facilities in geological formations without water table or infiltrations in the vicinity of the emplacement, was used to choose the emplacement of DNDR.
The site selection was based on preliminary studies concerning the geology, hydrogeology, seismicity, meteorology and radioactivity of the area, and also on mining technical studies.
In present, in the DNDR galleries are finally disposed more than 6,000 standard drums, which means about 30 % of the repository capacity.

In the technological disposal process are used bentonite, wood and cement brick. Bentonite is used as backfilling material and engineered barrier, taking in consideration its very good plasticity and absorption capacity, which diminishes the radionuclide migration possibility from deposited drums. Between the drums ranges are placed wood shuttering. When a gallery is filled up, it is tighten with cement bricks. These materials are placed near the working area, inside the gallery.

Disposal Gallery at DNDR

5. National Uranium Company waste management facilities

The Uranium Milling Plant of the Feldioara Subsidiary is located at about 30 km from the Brasov town (250,000 inhabitants). Since the commissioning of the plant, the tailings resulted from the milling process were discharged in 2 special insulated tailings ponds, under a variable water strata, located at 600 m from the plant area.
The location and insulation system were realized taking into account the "National security standards for geological research, radioactive raw materials mining and milling", issued in 1975. The geographic criteria were the presence of a clay deposit within the area, enhancing the possibilities for a good insulation, and also the presence of the Cetãtuia natural valley, suitable for building a long and stable pond. The 2 tailings ponds are named Cetatuia II and Mittelzop.

The Cetatuia II have as aim the settling and storage of radioactive tailings, and was built in 3 pieces, due to high investment costs for insulation of the concerned surfaces. The present state of this pond is the following, in present:
- the first part, is now in a closing out process, being used for tailings discharging in the 1978 - 2001 period; the total estimated tailings discharged was about 4,500,000 tons; the total surface of this first part is 368,000 m^2; the closure of the pond will

transform it in a repository, provided that the closure solution satisfies the regulatory safety requirements;
- the second part of the Cetatuia II pond was commissioned in October 2001, after completion of complex insulation works; the discharging capacity is estimated at 880,000 tones of tailings, on a 133,000 m^2;
- the third part of the Cetatuia II pond, located upside the two other parts on the Cetatuia valley, is planned to be commissioned after 2011, after the closing of the part II - Cetatuia pond.

The Mittelzop pond has as aim the final tailings settling of fines, receiving the inflow from the Cetatuia pond waters. This pond was commissioned in 1978, at the same date with Cetatuia pond and the milling plant. The volume is about 300,000 m^3, on an 87,000 m^2 surface. The dam of this pond has 5 m height. From the pond the clear waters are pumped to the decontamination plant (where the remaining trace of uranium are removed) and then to the Olt river.

After closure, all the tailing ponds will be transformed in repositories, provided that the closure solution satisfies the regulatory safety requirements.

For the ponds the main insulation works were as follows:
- the bottom of ponds was insulated with two layers, 30 cm thick, of clay.
- the right slope of the ponds was protected by two layers of polyethylene (plastic) foil, and a sandwich of special bitumen - rubber materials;
- the left slope, being located on a clay deposit;
- it was built a rain water drainage system used also for draining the surroundings of the ponds.

In 1996, a channel was built between the Cetãtuia and Mittelzop ponds, enabling the natural flowing of pond water, without using pumps, possible because of higher level of water and tailings.

Between the two mentioned ponds there is a radioactive solid material discharge area, composed by 2 old trench type storages and 1 new storage that is surrounded by concrete walls.

On a 3 km area around the plant and tailing ponds there are no inhabitants to be exposed to radiological hazard due to radioactive materials discharge.
The new storage for contaminated solids is located between two older trench type storage areas, which were used and authorized in past according to the former law for nuclear activities within the country.
Within these older storage surfaces the radioactive waste were buried into the existing clay layer and also were covered by clay. Around the surfaces was built a wire fence.

The new solid radioactive materials (wastes, scrap) storage facility was located, projected, built, according to the new 111/1996 Law establishing the nuclear activities security standards, according to new Radiological Safety Fundamental Norms - 2000 edition, and to the new Norms for Physical Protection in Nuclear Field - 2001 edition.

The new storage area for radioactive waste has a trapezoidal shape, the useful surface being 1,640 m^2 protected by 3 concrete walls, 5 m high. The maximum storage volume is 6,560 $m^{3.}$ The fourth wall will be built in future, ensuring larger storage capacity when needed.

Uranium mining and milling low level radioactive waste storage

iv. Radioactive waste inventory

The inventories of radioactive waste are presented in section L.

v. Decommissioning

In Romania there is only one nuclear facility under decommissioning, namely the VVR-S research reactor from IFIN-HH Magurele. The reactor was shut down in 1997, being in present under a conservation authorization.
According to IFIN-HH, which has submitted to CNCAN till now a preliminary decommissioning plan, the future decommissioning strategy for VVR-S Research Reactor was defined as immediate dismantling.
CNCAN did not approved the decommissioning plan submitted, asking for improvements, as requred by the Norms for Decommissioning of Nuclear Objectives, issued in 2002.
IFIN-HH, under IAEA technical assistance, has under elaboration the detailed decommissioning plan; the plan should be submitted to CNCAN till September 2006.
IFIN-HH, under the existing conservation authorization of the reactor, is performing the clean-up activities (according to the schedule established together with DOE-Argonne National Laboratory)

SECTION E. LEGISLATIVE AND REGULATORY SYSTEM

Article 18. Implementing measures

Romania has ratified by the Law no. 105 / 1999 the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management.

By the provisions of Law no. 111/1996 on safe conduct of nuclear activities, with subsequent modifications and completions, CNCAN is the competent authority exercising the regulation, authorization and control in nuclear field.
CNCAN is in the process of establishing the new set of regulations related to spent fuel and radioactive waste management.

In order to fulfill its obligations under the Joint Convention, Romanian Government issued the Governmental Ordinance no.11/2003 on the management of spent nuclear fuel and radioactive waste, including final disposal. The ordinance was approved with modifications by the Law no. 320/2003.

By the provisions of the Governmental Ordinance no. 11/2003, it is established that the holder of authorizations for nuclear activities have the obligation to manage safely the spent fuel and the radioactive waste, in view of their final disposal, during all the useful lifetime of the nuclear installation and during its decommissioning.

The coordination at national level of the process of management of the spent fuel and radioactive waste and including their disposal falls under responsibility of ANDRAD, subordinated to the Ministry of Economy and Trade. ANDRAD is fulfilling its role based on the NSRW.

By the provisions of the Governmental Ordinance no. 7/2003, there are established the tasks of AN. The ordinance was approved with modifications by the Law no. 321/2003.
According to the law, AN is a specialized body subordinated to the Prime Minister, which provides technical assistance to the Government regarding the policy in nuclear field and promotes the nuclear activities in Romania. The main role of AN related to spent fuel and radioactive waste management is to approve the NSRW.

The first version of the NSRW was issued, according to the provision of the Law no. 320/2003 by ANDRAD, and approved through the AN ordinance no. 844/2004 by the Nuclear Agency. Recently, ANDRAD has initiated the process of revision of the strategy, which includes the consultation of the stakeholders.

The Govermental Ordinance no. 11/2003, approved by the Law no. 320/2003 establishes the attributions of ANDRAD and the obligations related to spent fuel and radioactive waste management of the holders of authorization.

The main tasks of ANDRAD are:

- to elaborate the NSRW and submit it for approval to AN;

- to conduct its activity based on Yearly Activity Plan, derivated from NSRW, and establish the necessary financial resources for coordination at national level of the management of spent fuel and radioactive waste;
- to setup and manage the activities of the national final repositories for spent nuclear fuel and radioactive waste;
- to create and maintain the national data base regarding the spent fuel and radioactive waste;
- to analyze the characteristics of spent fuel and radioactive waste in view of their management;
- to elaborate technical standards and procedures for the management of the spent fuel and of the radioactive waste, including disposal and decommissioning
- to coordinate the decommissioning process for the nuclear and radiological installations;
- to ensures, directly or by third parties, the physical protection of the repositories;
- to cooperate with similar foreign organizations to ensure the use of the best available technologies for disposal of spent fuel and radioactive waste.

Regarding the implementing measure of the Joint Convention it has to be mentioned that the National Commission for Nuclear Activities Control is in the process of establishing the new set of regulations related to spent fuel and radioactive waste management. This will strongly improve the regulatory process in the field of interest of the Joint Convention.

Article 19. Legislative and regulatory framework

19.1. Establishing and maintaining of legislative and regulatory framework

Romania has had laws in place governing nuclear activities since 1974. After the political changes occurred in December 1989, and subsequent to constitutional changes, the legislative system started to be revised. In December 1996 the new nuclear law was enacted (Law no. 111 / 1996 on safe conduct of nuclear activities).

Prior to December 1996, the regulatory activities were based on:
- Law no. 61 / 1974 for the development of nuclear activities in Romania;
- Law no. 6 / 1982 for the quality assurance of the nuclear facilities and nuclear power plants.

Besides the laws, regulations were in place starting with 1957. The first regulations were related to radiation protection. The system of regulations evolved and nuclear safety, radiation protection, quality assurance, physical protection, safeguards regulations were issued according to the provisions of the 2 laws.

Up to 1989, activities in nuclear area related to promotion, development, construction, commissioning, operation and regulation were performed by the State Committee for Nuclear Energy (CSEN).
The regulatory component was set up in 1972 as a division of CSEN, called State Inspectorate for Nuclear Activities Control (ISCAN). After 1982 the name of the regulatory component was changed in Inspectorate for Nuclear Activities Control and

Nuclear Quality Assurance (ISCANACN). This lack of independence of the regulatory body has created problems as the authority of regulatory body was diminished.

However, in spite of the difficulties, the regulatory body started to issue nuclear safety regulations. The regulations were based on IAEA-NUSS series of standards, and on the provisions of the US 10 CFR regulations, adapted to the specifics of CANDU reactors. The NRS prescriptive approach was endorsed, and the regulatory body was deeply involved in all the phases of Romanian nuclear program.
After 1990, the regulatory activities were separated from promotion, development, construction, commissioning, operation, and a new regulatory body was set up: National Commission for Nuclear Activities Control (CNCAN), under the Ministry of Waters and Environmental Protection. At present CNCAN is an independent body, reporting to the Prime Minister through the Chief of the Prime Minister’s Chancellery.

The Romanian legislative framework that govern safety of spent fuel and radioactive waste management includes the following:

- Law no. 111/1996 on safe conduct of nuclear activities with subsequent modifications and completions; the last amendment is in the process of approval by the Parliament.
- Law no. 137/1995 on environmental protection with subsequent modifications and completions
- Governmental Ordinance no. 11/2003 regarding the management of nuclear spent fuel and radioactive waste, including their disposal, approved with modifications by the Law no. 320/2003
- Governmental Ordinance no. 7/2003 regarding the peaceful use of nuclear energy, approved with modifications by the Law no. 321/2003
- Law no. 98/1994 on public health
- Governmental Urgence Ordinance no. 21/2004 on national system of emergency situation management, approved by the Law no. 15/2005
- Law no. 481/2004 on civil protection
- Law no. 105/1999 on ratification of joint convention on the safety of spent fuel management and on the safety of radioactive waste management
- Law no. 703/2001 on civil liability for nuclear damages

➢ Law no.111/1996 with subsequent modifications and completions establishes the regulatory framework for nuclear activities. According to this law, CNCAN is empowered with the regulation, authorization, and control of nuclear activities.

According to the law, any (non excepted) nuclear activity (including only possession) and any (non excepted) radiation source (within the activity) shall be authorized.

Beside the general requirements for nuclear safety, radiation protection, quality assurance, safeguards, physical protection, emergency planning, preparedness and implementation, Law no.111/1996 has also specific requirements regarding radioactive waste management (as spent fuel is considered radioactive waste, these requirements apply also to spent fuel):

- The holder of authorization is responsible for the management of radioactive waste generated by his own activity;
- The holder of authorization shall bear the expenses related to the collection, handling, transport, treatment, conditioning, temporary storage and disposal of the waste produced in its activity;
- The holder of authorization shall pay the legal contribution to the Fund for management of radioactive waste and decommissioning;
- On discontinuation of the activity or decommissioning of nuclear installation, as well as in case of transfer of sources or installations, the holder of authorization shall obtain an authorization to hold, decommission or transfer them, as applicable;
- An authorization for a nuclear activity shall be granted only if the applicant disposes of material and financial arrangements adequate and sufficient for the collection, treatment, conditioning, and storage of radioactive waste generated from his own activity, as well as for decommissioning the nuclear installation when it will cease its authorized activity, and has paid his contribution to the Fund for management of radioactive waste and decommissioning;
- The import of radioactive waste shall be prohibited, except situations in which import follows directly from processing outside Romanian territory of a previously authorized export of radioactive waste, including spent nuclear fuel.

According to the provisions of Law no.111/1996 with subsequent modifications and completions, CNCAN has started the process of establishing and reviewing regulations and internal procedures regarding the authorization, control and enforcement processes.

Till now, the following new regulations were issued:

- Radiological safety fundamental norms/2000 (transposing the Council Directive 96/29/EURATOM - the Romanian regulation has a supplementary chapter on the transfer in environment of the radioactive waste);
- Radiological safety norms on operational protection of outside workers /2001;
- Radiological safety norms – Procedures for agreement of external undertaking /2003;
- Fundamental safety norms on safe management of radioactive waste/2004;
- Norms for clearance from authorization regime of materials resulted from authorized nuclear practices/2004;
- Norms on clasification of radioactive waste/2005;
- Radiological safety norms –Authorization procedures /2001;
- Norms for designation of notified bodies in nuclear field /2000;
- Norms for authorization of the work with radiation sources outside the special designated precinct /2002
- Individual dosimetry norms /2002;
- Norms for issuing the work permits for nuclear activities and designation of radiological protection qualified experts /2002;
- Norms for decommissioning of nuclear objectives and installations /2002 (the regulation does not refer to NPPs);
- Radiological safety norms for operational radiation protection for uranium and thorium mining and milling /2002;

- Radiological safety norms for radioactive waste management from uranium mining and milling /2002;
- Radiological safety norms on the conservation and decommissioning of uranium and/or thorium mining and/or milling facilities – Criteria of release from CNCAN regulatory body in order to use for other purposes of the buildings, material, facilities, dumps and area, contaminated following the activities of uranium and/or thorium ore mining and/or milling/ 2003
- Radiological safety norms – Authorization procedures for the uranium and thorium mining and milling
- Fundamental norms for safe transport of radioactive materials /2002;
- Norms for international shipments of radioactive materials involving Romanian Territory /2002;
- Norms for international shipments of radioactive wastes involving Romanian territory /2002;
- Norms for transport of radioactive material – Authorization procedures /2002
- Safeguards norms for nuclear field /2001;
- Detailed list of materials, devices, equipment and information relevant for the proliferation of nuclear weapons and other explosive nuclear devices /2002;
- Norms for physical protection in nuclear field /2001;
- Norms on requirements for qualification of the personnel that ensures the guarding and the protection of protected materials and installations in nuclear field /2002;
- Norms on radiation protection of the persons in case of medical exposures /2002;
- Norms on radioactively contaminated foodstuff and feeding stuff after a nuclear accident or other radiological emergency /2002 (issued together with the Ministry of Health and Family);
- Norms on irradiated foodstuff and alimentary additives /2002 (issued together with the Ministry of Health and Family)
- Norms for the calculation of dispersion of radioactive effluents released by nuclear installations 2004;
- Norms on the meteorological and hydrological measurements performed for the nuclear installations;
- Norms on authorization of the quality management systems applied for the realization, functioning and decommissioning of nuclear instalations/2003;
- Norms on general requirements for the quality management systems applied for the realization, functioning and decommissioning of nuclear instalations/2003;
- Norms regarding the specific requirements for the quality management systems applied for the realization, functioning and decommissioning of nuclear installations/2003;
- Norms regarding specific requirements for the quality management systems applied for research and development in nuclear field/2003;
- Norms regarding specific requirements for the quality management systems applied for design of nuclear installations/2003;
- Norms regarding the specific requirements for the quality management systems applied for the supplying of the nuclear installations/2003;

- Norms regarding the specific requirements for the quality management systems applied for the fabrication of the products and the services supplying activities of nuclear installations/2003;
- Norms regarding the specific requirements for the quality management systems applied for the construction and assembling activities of nuclear installations/2003;
- Norms regarding the specific requirements for the quality management systems applied for the commissioning of nuclear installations/2003;
- Norms regarding the specific requirements for the quality management systems applied for the operation of nuclear installations/2003;
- Norms regarding the specific requirements for the quality management systems applied for decommissioning of nuclear installations/2003;
- Norms regarding the specific requirements for the quality management systems applied for the production and use of software designated for research, design, analyze and calculation of nuclear installations/2003;

From the old regulations, still in force till the new regulations will be issued, we mention, related to spent fuel and radioactive waste management:

- Republican nuclear safety norms for nuclear reactors and nuclear power plants /1975: part I: Safety criteria for nuclear reactors and nuclear power pants and part II: Authorization of operator personnel for nuclear reactors and nuclear power plants
- Republican nuclear safety norms – working rules with nuclear radiation sources /1975
- Norms for prevention and extinguishing of fire and for providing vehicles, installations, devices, apparatus, protection equipment and chemical substances for preventing and extinguishing of fires in nuclear field / 1978

Other regulations are issued by the Ministry of Health and Family:

- Norms for medical examination for hiring workers and for periodical medical examination / 2001;
- Norms for medical surveillance radiation workers / 2001.

It has to be mentioned that till now CNCAN has not issued specific regulations for siting, design, construction, operation, maintenance, inspection, and administration of spent fuel and radioactive waste management facilities.

In order to fill the gap, CNCAN intends to issue in the near future other norms for radioactive waste management. For 2005, 2 of these regulations are scheduled to be issued: Norms for predisposal of radioactive waste and Norms for siting of near surface repository for short lived radionuclides.

Till the new Romanian regulation will be issued, international regulations are used (e.g. AIEA regulations, Canadian Standards, and USNRC Regulatory Guides and NUREGs). The most recent case was the licensing of the siting, the construction and operation of NPP Cernavoda Spent Fuel Dry Storage where the review of the Initial Safety Analysis (required for siting authorization), the Preliminary Safety Analysis Report (required for construction authorization) and Final Safety Analysis Report (required for operation authorization) were performed using as a reference the applicable requirements of the following documents:

- Canadian Standard N292.2-96 Dry storage of irradiated fuel
- 10 CFR 72 Licensing requirements for the independent storage of spent nuclear fuel and high Level radioactive waste
- Regulatory Guide 3.48 Standard Format Content for the Safety Analysis Report (Dry storage)
- NUREG -1567 Standard review plan for spent fuel dry storage facilities

Taking into consideration the complexity of the problems, and the fact that there will be only a few spent fuel and radioactive waste storage, disposal, and treatment facilities, it is expected that even after issuing the set of norms for radioactive waste management, for detailing of the requirements, there will be used regulations of US and of other developed countries, together with IAEA recommendations.

Regarding the design guides, it has to be mentioned that, when it is decided to construct an installation, the design guides and safety design guides of the foreign designer are endorsed by CNCAN.

For example, all AECL design guides and safety design guides for Candu-6 NPP were endorsed by CNCAN.
Most of applicable industrial technical standards have been used during the licensing process of Cernavoda NPP Unit 1. CNCAN has endorsed the following number of technical standards:

- 98 for ASTM and ASME (sect. 2 for metallurgical items);
- 25 for chemical items;
- 341 for electrical and I&C items;
- 205 for mechanical items;
- 1 for nuclear fuel.

For pressure vessels, CNCAN and ISCIR (National Authority for Checking Approval for Pressured Vessels and Hoisting Equipment) have jointly established a set of technical standards by adopting the most ASME relevant codes applicable to CANDU reactor.
For pressure tubes the Canadian standards were accepted. Consequently the following Romanian Nuclear Codes were published by ISCIR:

- Requirements for design, manufacturing, installation, operation, maintenance and control of the pressurized vessels belonging to safety related systems (NC 1-81)
- Requirements for design, manufacturing, installation, operation, maintenance and control of the pressurized pipes and pipe elements of safety related systems (NC 2-83);
- Requirements for design, manufacturing, installation, operation, maintenance and control of the pumps of safety related systems (NC 3-86);
- Requirements for design, manufacturing, installation, operation, maintenance and control of the valves of safety related systems (NC 4-88).

Supplementary, the Romanian industry has produced within the frame of Romanian Institute for Standardization a set of technical/industrial standards.

A similar procedure has been followed for the electrical component standards, the result of which is very similar to American Standard IEEE 344.

➢ The Governmental Ordinance no. 11/2003 on the management of spent nuclear fuel and radioactive waste, including final disposal, aproved with modificatios by the Parliament through the Law nr. 320/2003, establishes the attributions of ANDRAD (see section: Article 18 Implementing measures).

The same ordinance establishes the following responsibilities of the holders of authorization:

- to report every year to ANDRAD the quantities and types of spent nuclear fuel and radioactive waste generated during the current year and those estimated to be produced in the next year, in order to allow the actualization of the data base for coordination at national level of the process of management of the spent nuclear fuel and of the radioactive waste, including final disposal and decommissioning;
- to bear (during entire lifetime and decommissioning of the installation) the direct responsibility for the management of the spent nuclear fuel and radioactive waste in view of their final disposal;
- to finance the own activities of collection, segregation, treatment, conditioning, intermediate storage and transport in view of final disposal of spent nuclear fuel and radioactive waste generated during operation, maintenance and repairing activities, including during decommissioning of the nuclear installation;
- to finance the own research and development activities regarding the management of the spent nuclear fuel and of the radioactive waste.

19.2. Provisions of legislative and regulatory framework

Analyzing in detail the existing legislative and regulatory framework, it can be clearly seen that it provides for:

i. the establishment of applicable national safety requirements and regulations for radiation safety (this is done by updating the existing system of regulations);
ii. a system of licensing of spent fuel and radioactive waste management activities (Law no.111/1996 requires the authorization of all nuclear activities);
iii. a system of prohibition of the operation of a spent fuel or radioactive waste management facility without an authorization (the system of sanctions establishes penal sanctions for such situations);
iv. a system of appropriate institutional control, regulatory inspection and documentation and reporting (Law 111/1996 establishes the regulatory inspection rules, while the regulations and authorization conditions establish the requirements for institutional control, documentation and reporting);
v. the enforcement of applicable regulations and of the terms of the authorizations (the CNCAN inspectors have the right to fill an inspection report and impose sanctions if they find violations of the legal requirements, in special cases CNCAN can suspend or withdrawn an authorization, and for some violations can ask the prosecution, as the violations are punished with imprisonment);

vi. a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management (Law no.111/1996 Governmental Ordinance no.11/2003 approved by law no. 320/2003 and of of the Government Ordinance no. 7/2003 approved by law no. 321/2003 establish the responsibilities of the bodies involved)

19.3. Consideration of the objectives of the Joint Convention

The provisions of Law 111/1996 with subsequent modifications and completions, of the Governmental Ordinance no.11/2003 approved with modifications by the Law no.320/2003, and of the Governmental Ordinance no. 7/2003 approved with modifications by the Law 321/2003 as well as the regulatory requirements established by CNCAN take due account of the objectives of the Joint Convention.

Thus it can be concluded that the obligations under article 19 of the Joint Convention are met by Romania.

Article 20. Regulatory body

20.1. Functions of National Commission for Nuclear Activities Control (CNCAN)

According to the provisions of Law no. 111/1996 with subsequent modifications and completions, CNCAN is the regulatory body, empowered with the regulation, authorization, and control of nuclear activities. At present, CNCAN is an idependent body, reporting to the Prime Minister through the Chief of the Prime Minister's Chancellery.

The organizational diagram of CNCAN is presented at the end of this section.

According to the provisions of Law no.111/1996, CNCAN is empowered to issue regulations for the specification in detail of the general requirements for nuclear safety, for protection against ionizing radiation, for quality assurance, for controlling the non-proliferation of nuclear weapons, for physical protection and emergency plans for intervention in case of nuclear accident, authorization and control procedures inclusive, as well as any other regulations needed for the authorization and control activity in nuclear field.
CNCAN can also issue regulations, in consultation with ministries and other interested factors, according to their specific responsibilities.
Other ministries and special bodies of the central public administration that have responsibilities for authorization and control specified under the provisions of the Low no. 111/1996, are empowered to issue regulations for their field of competency.
CNCAN, through the regulation issued and through the measures ordered within the framework of authorization and control procedures, shall ensure an adequate framework for natural and legal persons in order to safely conduct activities subject to the provisions of the law.
CNCAN shall revise the regulations whenever it is necessary for consistence with international standards and with ratified international conventions in the field, and shall order the measures required for their applications.

According to Law no.111/1996, CNCAN issues authorizations for all activities with radiation (non excepted) sources. For activities with significant nuclear or radiological risk, the authorization phases are as applicable, the following: design, siting, production, construction, commissioning, testing operation, operation and maintenance, repairing or modification, conservation, decommissioning.
The requirements for each authorization phase are established by CNCAN according to the applicable regulations, or in case that such Romanian regulations does not exist, according to regulatory dispositions that generally endorse some international or foreign regulations, and give the requirements for adapting those documents to Romanian framework..
The authorization process for starting the operation of spent fuel and radioactive waste management facilities includes four formal steps:

Siting authorization

The siting authorization is issued by CNCAN on the basis of an Initial Safety Analysis Report and of supporting documents. This document must ensure that the proposed site meets all safety and environmental requirements, and should include a description of facility design, and the assessment of site characteristics. The Initial Safety Analysis Report should include the estimation of radioactive releases and the radiological impact on the public and the environment in normal operation and in design basis accident conditions. A siting permit issued by the Public Health Authority is a prerequisite.

Construction authorization

The construction authorization is issued by CNCAN on the basis of Preliminary Safety Analysis Report and of supporting documents. This document should include a description of the design, including its major safety features, ant the operating characteristics. The report should contain a preliminary evaluation of the design and performance of the systems, structures and components of the facility, in order to assess the risk to public health and environment resulting from the facility operation. Other information required regards the quality assurance program, physical protection and safeguards. As prerequisite for this authorization, CNCAN require construction permits issued by the Environmental Protection Authority and by the Public Health Authority.

Commissioning authorization

The commissioning authorization is issued on the basis of the Final Safety Analysis Report, and of supporting documents.
The Final Safety Analysis Report should include:
- an updated technical evaluation performed in the Preliminary Safety Analysis Report
- the procedures for effluents and exposure control;
- organizational structures, responsibilities and personnel training;
- managerial and administrative controls;
- plans, programs and procedures for preoperational testing;

- emergency plans.

Probationary operation authorization

The probationary operation authorization is issued based on the reviewed Final Safety Analysis Report, which contains amendments derived from the results and conclusion of the commissioning period, and on the supporting documents. As a prerequisite for issuing the Probationary operation authorization CNCAN requires the issuing by the Public Health Authority of a probationary operation authorization.

Operating authorization

The operating authorization is issued based on the reviewed Final Safety Analysis Report, which contains amendments derived from the results and conclusions of the probationary operation period, and on the supporting documents.
An authorization has to be issued by the Environmental Protection Authority after the putting into operation of the facility.
It has to be mentioned that the operating authorization is granted by CNCAN only for a limited period of time (max. 3 years for spent fuel storage, maximum 5 years for radioactive waste management facilities). After this period the authorization shall be renewed. Periodically (generally at 10 years), the Final Safety Analysis Report has to be revised.

For at reactor spent fuel wet storage, the operating authorization is part of the authorization of NPP or reactor. Also the waste management at NPP is performed based on the authorization of the plant.
For the LEPI the operating authorization covers the storage of spent fuel elements and of fragments and of intermediate level radioactive waste.

CNCAN issues also work permits for the persons having responsibilities for the work with radiation sources, namely the reactor operators, and for the persons responsible for radiation protection (working permits are required for all the staff, but CNCAN issues only the mentioned ones, while the others are issued by the holder of authorization, in conditions described by specific regulations). In 2003 CNCAN has established the rules for designation of radiation protection qualified experts.
Law no.111/1996 establishes the control rules. According to those rules, the preventive, current-operative and posterior control of the observance of the provisions of the law and regulations shall be carried out at the applicants or holders of authorization, by the specially empowered representatives of CNCAN. The control shall be performed before authorization, periodically or unannounced during the period of validity of the authorization, or based on notification of the holder of authorization.
During the control, CNCAN inspectors have the following rights:

- to have access to any place where nuclear activities are conducted;
- to carry out measurements and install the necessary monitoring equipment;
- to request sampling and to take the samples of materials and products directly or indirectly subject to the control;

- to force the controlled natural or legal person to ensure the fulfillment of the above provisions and to mediate the extension of the control to his supplier of products and of services or to their sub-suppliers;
- have access to all information, technical and contractual data , in any form, required for carrying out the objectives of control, with observance of confidentiality, if requested by the holder of authorization;
- to request the holder of authorization to transmit reports, information, and notifications in the form required by the regulations;
- to request the holder of authorization to keep records, in the form required by regulations, of materials, of other sources and activities subject to the control, and to control these records;
- to receive from the holder of authorization the necessary protective equipment and clothing.

CNCAN inspectors shall observe, during the whole period of control, the applicable authorization requirements, as they are imposed to the staff of the holder of authorization.

After the conclusion of the control, the representatives of CNCAN shall have the following powers:

- to draw up a written inspection report recording the findings of the control, the corrective actions ordered, and the term of their fulfillment;
- to propose the suspension or withdrawal of the authorization or work permits according to the provisions of the law;
- to propose the information of the prosecution bodies in the cases and for the facts provided by the law;
- to order the holder of authorization to apply disciplinary sanctions to the guilty personnel under the terms provided by the law;
- to apply the contraventional sanctions provided by the law to the holder of authorization through the natural persons that represent him in relation with public authorities, according to his status;
- to apply the contraventional sanctions provided under the law to the staff guilty for these contraventions.

In order to discharge its legal responsibilities for assuring the compliance of the holder of authorization with radiological and nuclear safety requirements, CNCAN has developed a set of inspection practices.

The objectives of the inspection activities are:

- to ensure licensee compliance with regulatory requirements;
- to ensure licensee compliance with quality assurance programs and procedures;
- to ensure that the licensee has personnel with adequate competence for commissioning, operation or decommissioning, respectively;
- to ensure that deficiencies and unplanned events are reported, investigated and corrected in a timely fashion.

In order to reach these objectives, CNCAN had to define in detail the inspection and enforcement responsibilities of its staff and to ensure the competence of that staff.

CNCAN inspections can be categorized in 4 types, according to their depth and detail:

- rounds, performed by the resident inspectors on a routine basis;
- operating practice assessments of particular aspects of the practice (these inspections are generally conducted by specialists of head office, according to pre-planned inspection guides, and their results are recorded in a report that is sent to the licensee for follow-up action, and retained on file);
- audits, that are formal in-depth and detailed examinations of one or more topics related to a specific aspect of the practice; these inspections are pre-planned in detail with the acceptance criteria spelled in advance, are announced in advance, and their results are recorded in a report that is sent to the licensee for follow-up action, and retained on file;
- system inspections, that are in-depth and detailed examinations of the status of a chosen system of the nuclear installation; these inspections are pre-planned in detail and are performed according to check sheets. Results are transmitted formally to the licensee by letter, and, if necessary, follow-up actions with target date are spelled out.

The IAEA IRRT Mission for CNCAN

In May 2002, an IAEA team of ten experts visited the National Commission for Nuclear Activities Control (CNCAN) to conduct a full scope International Regulatory Review Team (IRRT) mission. The purpose of the mission was to review the effectiveness of the regulatory body of Romania and to exchange information and experience in the regulation of nuclear, radiation, radioactive waste and transport safety. The team carried out interviews with the staff of CNCAN the senior staff of NPP Cernavoda and met with staff of the Institute for Nuclear Research (ICN – Pitesti), Center for Nuclear Projects Engineering (CITON – Bucharest), National Institute for Physics and Nuclear Engineering “Horia Hulubei” – Bucharest – Magurele (IFIN-HH) and visited a number of radiation facilities in Bucharest and Ploieşti.

Since the IRRT Mission performed in 1998, CNCAN has made substantial progress in resolving the previous IRRT findings. The IRRT team was impressed by the amount of work performed by the small number of qualified, motivated and dedicated staff. In the opinion of the team the basic structures to regulate nuclear and radiation safety in Romania are in place e.g. there is a sound legal basis for the independence, authority, responsibilities and functions of the regulatory body consistent with best international practice.

The reviewers identified a number of good practices that have been recorded for the benefit of other nuclear regulatory bodies. They also made recommendations and suggestions that indicate where improvements are necessary, or desirable to further strengthen the regulatory body in Romania. Some of these recommendations refer to radioactive waste management. The findings of the IRRT mission are presented in section L of this report.

20.2. Independence of Regulatory Body

Law 111/1996 Law 320 / 2003 and Law no. 321 / 2003 establish the roles of CNCAN, ANDRAD, and Nuclear Agency respectively .

CNCAN reports to the Prime Minister, through the Chief of Prime Minister Chancellery, the status of the safety of the conduct of nuclear activities. The CNCAN is functioning as an independent, judicial decision-making body on a day-to-day basis. It makes licensing decisions for nuclear facilities and sets out policy directions on radiation protection, safety, security and environmental issues that concern the nuclear industry and the public.

In keeping with national policies on regulatory fairness, the CNCAN routinely consults with parties and organizations that have an interest in its regulatory activities. These include CNCAN licensees; the nuclear industry as a whole; governmental, local and municipal authorities, departments and agencies; special interest groups and individual members of the public.

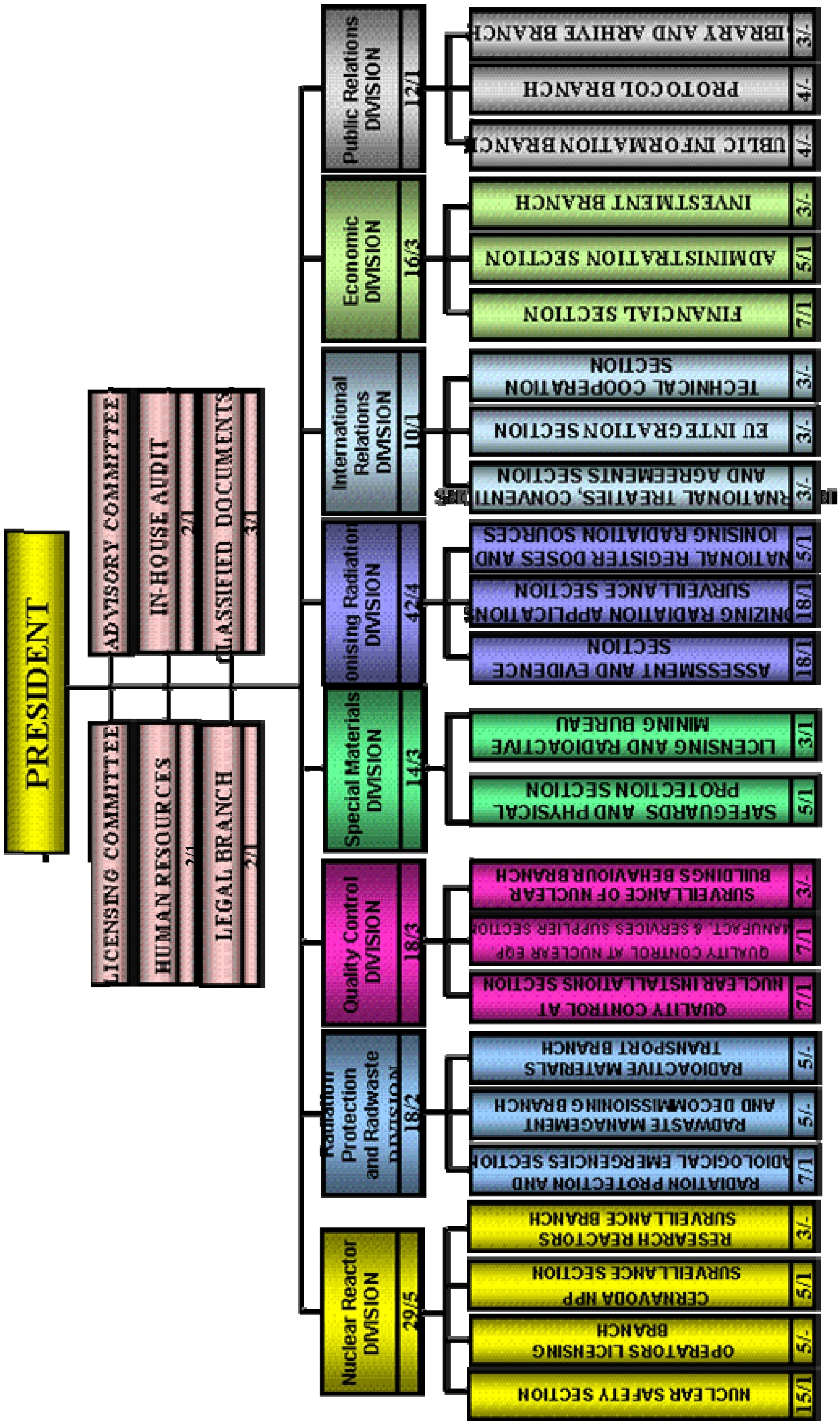


Figure: The organizational diagram of CNCAN.
(Note: the numbers in the brachets represent the number of positions for each division or section)

SECTION F. OTHER GENERAL SAFETY PROVISIONS

Article 21. Responsibility of the license holder

According to the Romanian Law no.111/1996 on safe conduct of nuclear activities, the prime responsibility for the safety of a nuclear or radiological installation rests with the authorization holder. This general responsibility includes the responsibility for the management of the spent fuel and of the radioactive waste generated within the practice, and the responsibility for decommissioning of the facility. The main responsibilities of the authorization holder for any spent fuel or radioactive waste management facility are the following:

- ensure and maintain nuclear safety, protection against ionizing radiation, physical protection, emergency plans in case of nuclear accidents, quality assurance for the licensed activities, and records of nuclear and radioactive materials;
- observance of the technical conditions and limits included in the authorization and reporting of any violation, in accordance with specific regulations;
- development of its own system of requirements, regulations, and instructions ensuring the implementation of the licensed activities without unacceptable risks of any kind;
- bear the expenses related to the collection, handling, transport, treatment, conditioning, storage and disposal of its wastes;
- ensure adequate staff to carry on the licensed activities.

CNCAN carries out preventive and operative control on the observance of laws and regulations, at the authorization holder's facilities. Any failure of the authorization holder to follow the requirements is followed by corrective actions, which may include sanctions or even authorization suspension.

Other means to ensure that the authorization holder meets its responsibilities is the reporting system. For NPP Cernavoda, CNCAN includes specific reporting requirements in each authorization, such as:

- Quarterly Reports;
- Environmental Monitoring Reports
- Event Assessment Reports
- Reliability Reports.

Similar requirements regarding operation annual report, environmental monitoring annual reports and event assessment reports are established by CNCAN for the research reactors, including their spent fuel management facilities, for the Nuclear Fuel Plant and for the radioactive waste management facilities. For the Uranium Milling Plant Feldioara and for uranium mining activities, CNCAN requires annual report for radiation protection, radioactive waste management and for the environmental monitoring.

According to the new Governmental Ordinance no.11/2003 on spent nuclear fuel and radioactive waste management, including final disposal, approved by the law no.320/2003, in case that a licensee cease to exist legally, or is unable to continue its activity, the responsibility for spent fuel and radioactive waste management rests with ANDRAD, till a new holder of authorization is established.

According to the Radiological Safety Fundamental Norms, for the activities from the past that have generated contamination or radioactive waste, CNCAN can impose intervention measures. The owner of the site has the responsibility to implement these measures.

Article 22. Human and financial resources

According to the Romanian Law no.111/1996 the authorization for any facility is granted only if the applicant meets the following requirements:

- can prove the professional qualification for each position of its staff;
- has insurance or any other financial guarantee to cover his responsibility for nuclear damages;
- have financial arrangements for safe management of its own radioactive wastes and for decommissioning of its installation.

The law mentioned above imposed a system of individual permits for each person employed for works with radioactive materials or in radiation fields. The permits are issued based on training and examination by the competent authorities or, by licensee, as approved by CNCAN.

The Final Safety Analysis Report for Cernavoda NPP-Unit 1 which is periodically updated during plant lifetime must contains special provisions with respect to plant organizational structure, experience and training for the key plant personnel, assurance that minimum plant complement (operations, technical, maintenance, etc.) is always in place; the plant training programs are also extensively assessed by CNCAN through periodic audits / safety assessments.

Adequate human and financial resources to support the plant safety are prerequisites to obtain and maintain the operating authorization.

Similar requirements for getting an operation authorization are established by CNCAN for reactors and for other facilities, including spent fuel and radioactive waste management facilities.

In addition, at present, the licensees for waste management including NPP Cernavoda NPP-Unit 1 have to pay an annual contribution for supporting the activity of ANDRAD and for deployment of activities mentioned in the Annual plan for waste management and decommissioning. The law regarding the Fund for Radioactive Waste Management and Decommissioning, to be issued, shall establish the annual contribution of licensees to the fund based on the total cost of spent fuel and radioactive waste management, including disposal.

i. Qualified staff availability as needed for safety related activities during the operating lifetime of a spent fuel and radioactive waste management facility

Romania has taken contact with Nuclear Technology before starting construction of its first Nuclear Power Plant, and regulations related to personnel Training and Qualification have been in place since 1975. These documents established the Training & Qualification Requirements for Licensed and Not-Licensed Nuclear Operators.

Meantime Romania has bought the CANDU technology and constructed its first NPP, a CANDU 600 MW design. Training issue have been considered during early phase of the contract negotiation, so that initial training for Management, Operation, Technical and Maintenance key personnel was provided in Canada. That means, around 100 persons were trained in an operational CANDU-600 MW (in Canada) prior to be assigned to any commissioning/operation activities, in order to allow them to fulfill their position responsibilities safely, effectively and efficiently.

Together with technical design Romania has bought the NPP personnel training concept and training and qualification programs for licensed / non-licensed operation staff, technical, maintenance and training staff as well. These programs have been adopted but continuously adapted based on IAEA Guides related to NPP Personnel Training & Qualification, and INPO/WANO recommendations related to Training Programs -Development. In this way the Systematic Approach to Training (SAT) has been implemented in Cernavoda NPP training activities. Reference Documents (RD) Station Instructions (SI) and Internal Department Procedures (IDP) have been put in place to establish a structural Training Concept for NPP Personnel.
However, because the organizational structure and position responsibilities at Romanian NPP are similar to those used at other CANDU stations, training needs derived from these functions have been used to prepare standard training programs & courses.

In addition, each NPP department performed a job and task analysis, identifying training needs required for effective job performance (the first SAT stage – Analyses).

Each NPP department must document its training needs by preparing a generic Job Related Training Requirements (JRTR) for each position, or group of similar positions. At this time any training program in the plant is based on positions JRTS's. The technical engineering may be considered an exception from the above. For each technical engineer is prepared a Qualification Guide which contains the training and qualification requirements for its duty areas.

Training Objectives for each Training program have been produced by application of the second stage (Design) of the SAT system. The third SAT stage has been applied (Development) and training materials have been produced, based on previous determined training objectives.

Having the JRTR's and Qualification Guides for each position, the training objectives have been established and the training materials developed. Based on this, it was possible to design and implement a career path for main positions. Based on generic JRTR of each chart organization position, a Training Qualification Index (TQI) can be calculated for each individual. The individual TQI is a performance evaluation criteria so all departments have the TQI value for a certain period of time as performance indicator.

A system of Individual Performance Evaluation has been put in place (recently revised and implemented) mostly for Personnel Performances Annual Evaluation. A better system for Training Effectiveness and Personnel Performance Evaluation at the work place is going to be established, based on the last recommendations and theories.

In addition to *standard* training described above, a *non-standard* training is considered for NPP personnel qualification. In this category is included the personnel training through the co-operation with other organization (IAEA, WANO, COG, Suppliers etc.). This is a very important part of key personnel development through courses, fellowships, workshop participation, and development programs participation, organized and sponsored by above-mentioned organization. Co-operation with these organizations didn't mean only participation of Romanian personnel in abroad training activities but also organizing courses in Romania. Here are to be mentioned the "ASCOT Seminar" sponsored by IAEA, the "Supervisor Development Course" sponsored by WANO, the "Liberty Technology" courses and "TG maintenance" contracted with suppliers etc.

In order to support the internal and external training activities and to ensure continue SAT application a Training Organization has been established and a Training Center has been constructed The Training & Authorization Department has 25 dedicated instructors, qualified according to IAEA / INPO guidelines.

Regulatory Authority is closely supervising the training activity in the plant. It is involved not only in the licensed staff training and evaluation process but also in other staff training and plant training policy as well. In this respect Regulatory Authority is periodically auditing plant training activity and it is directly involved in the licensing training programs approval and evaluation.

The regulatory authority ensures that the utility allows only high qualified, competent staff to perform the following functions and tasks which are critical to nuclear safety:

- Recognize if a proposed action, or any changes to equipment, procedures or staffing, is threatening a layer of defense;

- Monitor, operate and maintain safety and safety related systems;

- Identify incipient equipment failures, so that corrective action can be taken before.

- Properly execute emergency response procedures to mitigate and accommodate consequences of potential accidents.

Based on the qualification, training and retraining requirements for all operation positions, CNCAN required a similar training approach for the individuals performing tasks critical to nuclear safety and belonging to other plants' departments such as Station Health Physics, Station Engineering Support, Maintenance Support etc. These positions also have detailed qualification, training and retraining requirements, according to their duties.

Management Personnel must also be authorized by the regulatory authority before they are fully appointed to the job, as follows:

- Station Manager
- Production Manager
- Technical, Safety & Compliance Manager
- Health Physics Senior Superintendent
- Operation Senior Superintendent
- Safety & Compliance Senior Superintendent
- Training Senior Superintendent
- Quality Assurance Senior Superintendent

Continuing training and retraining for any chart organization position is also established.
Refresher training for any chart organization position is also established or at least is counted that is necessary to be established. At this time refreshing training is for sure established for Licensed Operation Staff. The other personnel are in general under continuous training to get their 100% qualification. Retraining for special skills or abilities is established and done as required.

The shift supervisors (i.e. main reactor operators), reactor operators and the senior staff with responsibilities in radiation protection (i.e. the qualified experts) have to pass a CNCAN examination in order to receive the permit to operate the reactor, respectively the practice permit.

Finally it could be considered that Cernavoda NPP has the nuclear world wide accepted training approaches and standards, ensuring a qualified, competent staff for Cernavoda NPP operation and maintenance.

Regarding the research reactors, a training system that assures the safe management of reactors operation, including spent fuel management, is in place. The reactor main operators and operators, and the staff with responsibilities related to radiation protection, including the qualified experts, are tested by CNCAN, in order to get the permit to operate the reactor, respectively the practice permit.

For all other facilities, the qualified experts and the staff with responsibilities related to radiation protection have to be trained and retrained and have to pass CNCAN examination in order to get the practice permit.

ii. Financial resources for operation of spent fuel and radioactive waste management facilities

At NPP Cernavoda, the costs of current spent fuel and radioactive waste management activities including the costs associated with the implementation of the Intermediate Spent Fuel Dry Storage Facility are included in the CNE-PROD operational costs.

For the costs associated to the long term management: disposal of spent fuel and radioactive waste management including here decommissioning costs, SNN/CNE PROD shall pay a financial contribution to the Fund for Radioactive Waste Management and Decommissioning (after approval of the law regarding that fund)

Regarding the funds for management of spent nuclear fuel of VVR-S research reactor and of institutional radioactive waste, in present they are assured by:

- a special fund created by the Ministry of Education and Research designated to support the operation of nuclear facilities of national interest;
- economic contracts with radioactive waste producers from all over the Romanian territory.

The funds for the spent fuel and radioactive waste originated at SCN Pitesti are provided by the Ministry of Economy and Trade.
After approval of the Law for the Fund for Radioactive Waste Management and Decommissioning, the financing of these activities will be regulated according to this law.

iii. Financial provision for institutional controls and monitoring arrangements after closure of disposal facility

After the issuing of the Law establishing the Fund for Radioactive Waste Management and for Decommissioning, the financing of these activities will be regulated according to this law.

Article 23. Quality assurance

CNE PROD, FCN Pitesti, SCN Pitesti and IFIN-HH have implemented quality management programs.
A quality management program is developed also in Uranium Milling Plant Feldioara.

Implementation of the QM System at CNE PROD Cernavoda together with regulatory aspects are further presented. The QM system at SCN Pitesti and IFIN-HH are quite similar. The next paragraphs describe the QA polices, the Life-cycle application and Methods used for implementation and assessment of QA programs at nuclear installations.

23.1. QA Policies

In 1982 under the directions of the Former State Committee for Nuclear Energy (CSEN) the law regarding Quality Assurance for Nuclear Objectives and Installations (Law 6/82) was published. In 1996 the Law on Safe Deployment on Nuclear Activities (Law 111/96) replaced Law No. 6.

The Romanian Quality Management Standards have been developed based on Canadian Standards series N286 and Z299, ISO 9000/2000 and IAEA 50-C/Q SG and cover all of the phases of a nuclear facilities, including sitting, design, procurement, construction, commissioning, operation and decommissioning.

Romanian QM standards in force today in Romania are mentioned at Art.19 section 19.1

Each participant in a nuclear project develops and implements a Quality Management System that must satisfy the requirements from these standards.
The Quality Management Systems developed by participants are:

- Owner Quality Management System that represents the Quality Management System developed and implemented by the owner of nuclear facilities in accordance with the Romanian “Norms on General Requirements for Quality Management Systems Applied to the Setting-up, Operation and Decommissioning of Nuclear Installations”. It describes the rules related to owner responsibilities in coordinating and control of activities associated with all phases of the project from design to commissioning and operation.
- Phase Specific Quality Management System represents the Quality Management System developed and implemented by participants involved in different individual phases of the project in accordance with the Romanian “Norms on General Requirements for Quality Management Systems Applied to the Setting-up, Operation and Decommissioning of Nuclear Installations” The owner is responsible for the effectiveness of the specific Quality Management System implementation and consequently retaining the audit function.

The Quality Management standards developed for different phases of a nuclear installation usually follows a core set of management principles that is established with important contributions of the regulatory organizations.

The remaining of this section illustrates the way these management principles are applied for one of the important phase of a nuclear facility, the design phase.

One important general principle in the Romanian Quality Standard is that the designs and associated design documents are to be verified to ensure that the design is correct and meets all specified requirements.

The design verification can be done by reviews (supervisory review, independent third party review, etc.) and / or by testing. Complexity, novelty, safety implication of the design, standardization degree, etc determine the extent of the design verification.

The verification requirements are identified in engineering quality plans implemented during manufacturing, construction commissioning or operating stages. These plans identify design activities to be verified, the dimension of verification, persons involved in verification, methods and location in the design cycle, etc. All the above requirements are covered by specific verification procedures. Any improvements in the existing design or redesign of the systems or components are subject to the same verification as the original design in order to confirm that all the existing analyses are valid and the design is correct.

The design activity can be performed only by organizations licensed by Regulatory Authority, CNCAN, on the basis on an approved Design Quality Management Manual.

When the design is subcontracted to other design organizations, the subcontractors shall obtain a QA license from CNCAN and the design work is verified in the same manner as mentioned above. When a supplier / manufacturer has the design responsibilities, the supplier / manufacturer is also responsible to develop a design Quality Management System in accordance with Romanian Regulations for design and to obtain a design QA license from CNCAN. The Design Authority (represented at Cernavoda NPP by the Design and Technical Department) has responsibility to verify that contractor has performed such design verifications and that the particular designer has used correctly the design inputs.

Verification or certification, where required, of design reports, stress reports, seismic or qualification report, usually are carried out by the supplier or other specialized and authorized organization including the utilities in accordance with applicable codes, standards and procedures. Test requirements, test procedures, test assumption, test data and test results are documented and filled for design history.

The design authority evaluates test results against acceptance criteria and conclusions of the test are recorded and filed in design history files. When tests are required to be performed by a contractor, test requirements are specified in the procurement documents.

Computer software used for design, design analysis, plant and safety system control, safety analyses, and computer-assisted design and drafting are verified, validated and documented. Such verifications, validations and documentation are controlled through appropriate procedures.

When selecting a manufacturer's standard product the design will be subjected to review and/or testing to demonstrate the satisfactory performance of the item. Alternatively, design authority to ensure satisfactory performance of the item may evaluate the manufacturer's evidence of verification.
The same sort of general principles are applicable to other phases involved by construction of a nuclear facility.

Also a supplier of goods and services designated to a Nuclear Safety System should have developed and implemented a Quality Management System which should meet the requirements of the “Norms on Specific Requirements for the Quality Management Systems Applied to the Manufacturing of Products and Providing Services Dedicated to Nuclear Installations”, and should be certified (authorized) by CNCAN.

23.2. Life-cycle application

In accordance with the Law on Safe Conduct of Nuclear Activities, the National Commission for the Control of Nuclear Activities has the authority to make QA regulations for design, construction, installation, operation, procurement, manufacturing and decommissioning of a nuclear facility, or part of a nuclear facility.

Based on new Quality Management norms issued by CNCAN in November 2003 all participants in a nuclear project can perform the activities in nuclear field only based on a QM license obtained from CNCAN, in accordance with the "Norms on Authorization of the Quality Management Systems Applied to the Setting-up, Operation and Decommissioning of Nuclear Installations".

According to the present licensing practice, when an owner of a nuclear facility prepares the safety analysis report for the nuclear facility, the CNCAN reviews it to determine which commitments the licensee is making regarding quality assurance during the life of the facility. The expectation is that the owner will commit to meet the requirements of the nuclear quality management standards referred to in 23.1 for the work involved during each phase of the project. The Safety Analysis Report should identify if the owner intends to meet these standards. In this way, all further work related to design, procurement, construction, commissioning, operation, and decommissioning will be governed by the corresponding Quality Management standards. The CNCAN ensures that these commitments are identified when its staff reviews the Safety Analysis Report (SAR). Later the CNCAN staff carries out reviews and audits to ensure that each participant in a nuclear project meet these commitments during each of the phases of application.

CNCAN requires to all participants in a nuclear project and which are involved in activities related to nuclear safety to establish and implement a quality management system. These quality management systems are applied during all phases of the facility life cycle from its design until it is decommissioned. Their main objective is to facilitate, support and preserve safety objectives in nuclear facility design, procurement, construction, commissioning, operation and decommissioning. Quality management system should focus on performance and emphasize the full responsibility of those who do the work, such as:

- designers
- installers / constructors
- manufacturers
- operators
- maintenance workers
- radiation protection personnel

The owner and the other organizations involved have to demonstrate the effective fulfillment of the quality management standards requirements to the satisfaction of the CNCAN and based on these, a QA license will be issued by CNCAN.

Nuclear safety is the fundamental consideration for identifying the items, activities and processes to which the quality management system requirements are to be applied during each stage of the life cycle of nuclear project. CNCAN requires the owner to identify the safety-related systems, activities and processes to be subject to quality management system requirements

The quality management system requirements include the controls and details of how the participants will manage, perform and assess the work they do in each life-cycle phase. This is fundamental since the life of projects crosses generations, making dependence on systematic processes for decisions, actions and results.

As per quality management system requirements everyone from one organization should be informed on how the organization is structured, which are the functional responsibilities, levels of authority, the methods of communication and decision-making tools to be used by those managing, performing and assessing the adequacy of work. It also includes management methods of control such as planning, training, resource allocations, and work instructions and practices.

As the project progresses from one phase to another, the organization involved and the methods to be used to process and control the performance of work will change. The owner must describe these variations and modify its management processes accordingly. The owner in accordance with the Romanian Quality Management Standards, must perform oversight activities of various disciplines of the project and to retain responsibility in all circumstances.

The owner quality management system includes the requirements related to controls and details of how each participant will manage perform and assess the work for which they receive responsibility on specific life cycle phase. This includes the work performed by organizations that have been delegated to implement part of the program for a certain phase. The quality assurance program ensures that the owner's ultimate accountability for safety is passed down the chain of command through senior managers and line managers to the working level.

Responsibilities at each level are developed, understood and exercised so that each individual takes responsibility for the quality of the work he or she performs. These arrangements must be in place through all phases of the project from design to decommissioning.

23.3. Methods used for implementation and assessment of QA programs

Separate from the internal reviews and audits carried out by the participants, the CNCAN staff reviews the Quality Management System documents of the authorized participants in a nuclear project. When these are acceptable, the CNCAN staff plans and carries out real-time audits to make sure that the licensee and other organizations are complying.

Relative to the impact on safety, there are assessed:

- work methods
- management processes and results
- compliance with Quality Management Norms for each particular phase of work of the facility.

When deficiencies are detected, the owner and addressed organization are notified and they are required to correct them. The CNCAN staff produces detailed reports of the audit findings and forwards them to the owner and addressed participant for action and reply. The CNCAN may decide an enforcement action when is appropriate.

The participant's Quality Management System are subjected to two levels of audit by its own management:

a) The first level - Internal Audits - oriented to assess the effectiveness of its own QA Program and compliance to the applicable standards requirements.

b) A second level - External audits - oriented to assess the effectiveness and efficiency of the contractor's Quality Management System to which it was delegated a part of the responsibilities.

When participants detect a deficiency, they must determine the extent of the problem, and the effect on safety.

They must identify the breakdown in the management process that was the underlying cause of the problem and correct it.

Similarly, when the owner has to rely on other organizations to carry out work, the owner makes sure that quality assurance requirements are passed on to them and are met. The licensee ensures itself that these organizations have an acceptable and licensed QA system before work can be contracted to them. Then as the work progresses, the owner conducts real-time reviews, audits, and inspections to make sure that the work being done meets applicable requirements. Their frequency is determined by factors such as safety significance of the work and the performance records of the contractor.

Article 24. Operational radiation protection

24.1. Exposures of workers and public

i. Optimization of exposures

For operational radiation protection CNCAN issued the Radiological Safety Fundamental Norms. This regulation is a Romanian transposition of the Council Directive 96/29/EURATOM laying down basic safety standards for the protection of the health of workers and the general public against the danger arising from ionizing radiation.

CNE-PROD, FCN Pitesti, SCN Pitesti, IFIN-HH, and National Uranium Company have developed policies, regulations and procedures for operational radiation protection, based on Romanian regulations and ICRP / IAEA recommendations. The policy of these licensees is to keep the radiation exposure of workers and the public as low as reasonable achievable.

ii. Exposure limits

The legal effective dose limits for the workers and for the public are 20 mSv / year and 1 mSv / year, respectively. In order to minimize exposure, CNE-PROD has established administrative dose limits, under the legal value (18 mSv / year). They also developed processes for dose control for radiation workers, using special work plans and procedures for high hazard works. For public, CNCAN has established the 0.1 mSv/year constrain for each Unit of the NPP.

iii. Control of releases

Both CNE-PROD and FCN are implementing procedures to control the gaseous and liquid releases to the environment, based on emission limits approved by CNCAN.

SCN-Pitesti and IFIN-HH have also established derived emission limits for their sites; these derived emission limits have to be approved by CNCAN.

For the clean-up activities at VVR-S Magurele reactor IFIN-HH is preparing the procedures for free release of materials; these procedures will be uses also in the process of decommissioning of the reactor.

For liquid discharges, the uranium mining and milling facilities have to comply with limits set up in their authorization.

CNE-PROD, FCN Pitesti, SCN Pitesti, IFIN-HH, and National Uranium Company have established environmental monitoring programs, in order to assess the effect of their activities on the environment.

24.2. Discharges

i. Optimization of discharges

According to Fundamental Norms on Radiological Safety, derived emissions limits (DELs) approved by CNCAN shall be used to quantify the relationship between releases of radioactivity and doses to critical groups (the most exposed) from the public.
Based on legal limit of 1 mSv/year for exposure of a member of general public, at CNE PROD Cernavoda (NPP-Unit 1) were calculated site specific DEL's for all representative radionuclides. These DEL's values both for liquid and gaseous emissions are presented in Section L. The values for either gaseous or liquid emissions are given in % DELs.
In order to assure optimization of discharges, CNE-PROD established an operational limit of 5 % DELs. These values assure a tight control of effluent releases. The results of the CNE-PROD effluent monitoring are presented in Section L.

ii. Limitation of doses in normal situations

It has to be mentioned that, for Cernavoda NPP – Unit 1 operation, CNCAN has established a constraint of 0.1 mSv / year for members of critical group. As Unit 2 and Near Surface Repository will be added at the same site, derived emission limits based on dose constrins will be established for each installation. For IFIN-HH and

SCN Pitesti as well as for uranium mining and milling activities, CNCAN have established constrains in the order of 0.1-0.3 mSv/year for the members of critical groups.

24.3. Uncontrolled releases and mitigation of consequences of unplanned and uncontrolled releases

In order to control the release, design features and emergency procedures are in place, according to the provisions of the laws and regulations.
According to the provisions of Law 703 / 2001 on civil liability for nuclear damages, the holder of authorization for a nuclear installation shall have an insurance policy covering the nuclear damages. This assures that in case of an unplanned or uncontrolled release funds are available for mitigate the effects.

Article 25. Emergency preparedness

25.1. Emergency planning for Romanian facilities

The Cernavoda NPP spent fuel and radioactive waste management facilities are operated in an integrated manner with the nuclear power plant by CNE-PROD. The on-site emergency preparedness for these facilities was treated as a part of emergency planning for Cernavoda NPP Unit-1.

Similar on-site emergency plans are in place for the site of the research reactors (TRIGA at SCN Pitesti and VVR-S at IFIN-HH Magurele). These arrangements covers the spent fuel management and radioactive waste management facilities at these sites.

The off-site emergency plans of the local and central public authorities, regarding emergencies at NPP and reactors sites and the General Emergency Plans related to each nuclear risk area, are in place, according to the provisions of Law no. 111/1996 on safe conduct of nuclear activities with subsequent completions and modifications, the provisions of the Government Urgence Ordinance no. 21/2004 on National System of Emergency Situation Management, endorsed by the Parliament by Law no. 15/2005, the provisions of the Law no. 481/2004 on Civil Protection, and the provisions of the Radiological Safety Fundamental Norms /2000 and of Republican Nuclear Safety Norms for Planning, Preparedness and Intervention for Nuclear Accidents and Radiological Emergencies / 1993.

For the other radioactive waste management facilities, i. e. the National Repository for Radioactive Wastes Baita Bihor, the Nuclear Fuel Plant Pitesti, the Uranium Milling Plant Feldioara and for mining activities, specific on-site emergency plans are in place. These on-site plans are in accordance with the norms, and are dimensioned in accordance with the risks associated with the respective practice.

For the scope of this report the Cernavoda NPP arrangements will be detailed below, together with information under the emergency national system.

a) Legal requirements for on-site and off-site emergency preparedness

"Republican Nuclear Safety Norms for Planning, Preparedness and Response to Nuclear Accidents and Radiation Emergencies" issued by CNCAN in 1993 are containing mainly the IAEA recommendations, included in IAEA standards and guides.
These norms are applied for planning, preparedness and intervention in the following cases:

- nuclear accidents at licensed installations;
- radiation emergencies as a result of authorized activities in nuclear field;
- radiological emergencies as a result of some transboundary effects or as a result of other cases, such as cosmic objects falling.

The laws and the norms provide that any nuclear facility has to make preparations, in conjunction with national, regional and local government and other organizations, to cope with nuclear accidents.

According to the laws and the norms, CNCAN controls, evaluates and approves the on-site emergency plans of the nuclear facilities.

According to the laws and the norms, each public authority has to prepare his own Emergency Plan that has to be approved by his leader, and shall be approved by the General Inspectorate for Emergency Situations (IGSU). The applicability of the public autorities plans is periodicaly controlled and evaluated by the Ministerial Committee for Emergency Situations (CMSU).
A General Emergency Plan has to be prepared for any area which may be threatened by a radiation emergency. This General Emergency Plan covers all activities planned to be carried out by all authorities and organizations involved in case of an emergency situation leading to, or likely to lead to, a significant release of radioactivity beyond the boundary of the nuclear facility. This general plan includes the co-ordinated emergency plans of the facility and of the public authorities. The General Emergency Plan is elaborated by IGSU, which is the permanent working body of the CMSU.
CMSU, which has county and local commandments, is led by the Minister of Administration and Internal Affairs. CMSU has the responsibility to approve the General Emergency Plan and to manage the intervention.

The Cernavoda General Emergency Plan covers all the emergencies likely to appear during the operational lifetime of its facilities including spent fuel and radioactive waste management facilities.

b) The implementation of emergency preparedness measures, including the role of the Regulatory Body and other entities

b.1) Classification of emergency situations

According to the National Nuclear Safety Norms for Planning, Preparedness, and Response to Nuclear Accidents and Radiological Emergencies, the NPP emergencies are classified as follows:

• station alert;
• station emergency;
• off-site emergency;
• general emergency.

b.2) General national emergency preparedness scheme

CNCAN has, in the field of preparing for radiation emergencies, the following responsibilities:
a) to review the conditions from nuclear facilities which may cause radiation emergencies;
b) to help public authority to elaborate intervention plans and to maintain their preparedness in co-operation with the nuclear facilities;
c) to determine the nuclear facilities to co-operate with public authority in establishing compatible intervention plans;
d) to analyze, to evaluate and to approve intervention plans elaborated by nuclear facilities;
e) to act as a technical counselor of nuclear safety and for radiation protection for public authority and for nuclear facilities during emergencies;
f) to assist and to support the actions proposed or performed by public authority or by the nuclear facilities during the emergency;
g) to inform the public about the emergency;
h) to give technical consultations to the nuclear facility regarding the end of emergency;
i) to support the authorities in adopting the protective measures for public;
j) to authorize the recovery or decommissioning of the installation which was affected by the accident.

The bodies of central and local public administration who will respond in case of a nuclear accident and take actions to protect the public in an area, which may be affected by a radiation emergency, have the following responsibilities:
a) to elaborate and maintain own updated intervention plan
b) to establish a proper body for intervention
c) to implement the emergency measures according to the intervention plan
d) to organize exercises, to prepare and to maintain an appropriate level of personnel's preparedness and of the material means requested for intervention
e) to inform the public and to provide instructions on taking protective measures
f) to establish the alarming levels for transboundary radiological emergencies.

b.3) On-site and off-site emergency plans of nuclear installations

The General Radiation Emergency Plan for an affected area first identifies the Emergency Planning Zones around a nuclear facility where advanced planning is needed to ensure that prompt and effective actions can be taken to protect the public in the event of a nuclear accident. There are two distinct zones: one for the short term "plume exposure pathway", and the other for the long term "ingestion exposure pathways". The size of the zones depends on the hazard posed by the nuclear facility.

Based on the Emergency Planning Zones, the Off-site Radiation Emergency Plan describes the external organizations and their responsibilities during an accident at nuclear facilities, which may have an off-site impact. This plan also contains a description of essential steps for off-site emergency response activation, the protective action levels, and the protective measures for the emergency personnel and population. The protective actions, and the organization in charge to implement these actions, are identified for each emergency-planning zone.

The Plan also contains a description of the protective actions for different stages of the emergency. In the final section, the Off-site Radiation Emergency Plan describes the recovery activities, the international assistance, the periodic exercises, and the up dating and revision of plans.

All the emergency response requirements of the plan are implemented by off-site emergency procedures, which describe detailed emergency actions.

The objective of an effective On-site Radiation Emergency Plan along with its supporting documents is to ensure effective emergency preparedness and response to emergency situations at the nuclear facilities in Romania.

The purpose of the On-site Radiation Emergency Plan is to identify the essential elements of a response to a radiological emergency and to describe in general terms the measures required to control and mitigate the radiological accident consequences within the site and to minimize the off-site effects.

The On-site Radiation Emergency Plan emphasizes the immediate on-site response actions.
However, it does cover the off-site emergency for the first few hours of the radiation accident, which has an impact on the public and the environment. The length of time necessary to set up the off-site organization to function effectively is estimated to be 2-4 hours.

The On-site Radiation Emergency Plan includes the classification of radiation incidents, the evaluation of on-site incidents and the response actions. It identifies also the material and human resources necessary to implement these actions, and defines the organization and the responsibilities for the personnel involved for every phase of an incident.

The On-site Radiation Emergency Plan is implemented through the On-site Radiation Emergency Procedures.
In order to develop adequate emergency arrangements for Cernavoda NPP, in line with best international practice and experience, many components of the NPP Emergency Preparedness and Response Program have to be amended.

This improvement process of the emergency response arrangements at Cernavoda NPP is realized within the framework of COSECC (Cernavoda On-site Emergency Control Centre) Project.

The COSECC Project mission is to build the On-Site Emergency Control Centers (main and alternative) and adjust all the component of the Emergency Preparedness and Response Program to multiunit NPP requirements.

The main objectives of the project are the followings:

- to develop adequate emergency arrangements for Cernavoda multiunit NPP according to best western standards and experience;
- to improve the material resources (facilities and equipment) as support of the emergency arrangements.

b.4) Measures for informing the public during a nuclear emergency

The On-Site Radiation Emergency Plan and the Off-Site Radiation Emergency Plan for the nuclear facilities establish the responsibilities, the resources and the interfaces required for informing the public in case of a nuclear emergency. Joint information centers, staffed by representatives of the nuclear facility and of the public authorities, are established at the local and national levels.

c) Training and exercises

The effectiveness of the response is tested and enhanced through carrying out periodical radiation emergency drills and exercises for all areas and facilities.

The general exercises will simulate an emergency, which results in radioactive releases outside the facility and which requires the intervention of county and / or national public authorities.

General exercises are organized by all nuclear facilities in collaboration with the public authorities and include mobilization of the emergency personnel and the appropriate resources and organizations in order to verify the response capability in emergencies.

The general exercises are organized, for example, at Cernavoda NPP at least once in three years and are based on various scenarios in order to verify and test various parts of the emergency plan.

The exercises are followed by a post-exercise report (Exercise Evaluation Report) in order to evaluate the ability of the various organizations involved and to recommend measures for improving the response. The nuclear facility organize annual exercises and quarterly drills in order to verify the On-Site Emergency Plan.

This year, in May 11-12, took place the “International Emergency Exercise CONVEX-3 (2005)”, organized by the International Atomic Energy Agency (IAEA) and Romania.
At this exercise have participated 62 states and the following 8 international organizations: International Atomic Energy Agency, European Commission, United Nation Office for the Coordination of Humanitarian Affairs, World Health Organization, World Meteorological Organization, Nuclear Energy Agency, Food and Agricultural Organization of United Nations, Euro-Atlantic Disasters Response Coordination Center.
The exercise purpose was to test the emergency plans of the Public Authorities, Cernavoda Nuclear Power Plant and the organizations and states participants.

25.2. Planning for radiation emergencies in the vicinity of Romanian territory

Romania is a signatory of the following international emergency response agreements:

- Convention on Early Notification of a Nuclear Accident
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
- Convention Regarding the Liability for Nuclear Damages

Concerning the liaison across national borders, Romania has signed the Agreements for Early Notification of Nuclear Accidents with Russian Federation, Bulgaria, Greece, Hungary, Slovakia, and Ukraine.
These agreements contain provisions for:

- taking all appropriate and effective measures to prevent, reduce and control adverse trans-boundary environmental impacts of major nuclear activities;
- ensuring that the Parties are notified in case of nuclear accidents which could affect them.

The Romanian General Emergency Plan includes provisions for transboundary emergencies according to the provisions of national norms.

Article 26. Decommissioning

26.1. General requirements related to decommissioning

According to the provisions of the Law no. 111/1996, the licensee shall:

- elaborate a program for preparing the decommissioning and to present it for approval to CNCAN
- pay the contribution to the Fund for Radioactive Waste Management and Decommissioning.

Based on these provisions of the law, CNCAN has issued till now the Norms for Decommissioning of Nuclear Objectives and Installations, that apply for decommissioning of: research reactors, subcritical assemblies, radioactive waste treatment installations, spent fuel intermediate storages, radioactive waste intermediate storages. The issuing of a norm for decommissioning of NPPs is expected latter.

Norms for Decommissioning of Nuclear Objectives and Installations contain the following:

- General considerations;
- The phases of decommissioning process;
- The authorisation requirements for decommissioning;
- The assessment and approval of the decommissioning plan by CNCAN;
- The final shut-down of the installation;
- The decommissioning stages;
- The implementation of decommissioning activities;
- Reporting and record keeping requirements;

- Modifications of the decommissioning plan;
- Finalising the decommissioning authorised stage;
- Release from the authorisation regime;
- Transitional dispositions;
- Annexes:
- Definitions
- The documents needed for getting the decommissioning authorisation of a nuclear installation;
- The decommissioning plan (i.e.: the content of the plan);
- The general content of the Final Radiological Assessment Report;
- The documents needed to be submitted to CNCAN for getting the possession authorisation for nuclear installations under decommissioning;
- The documents needed to be transmitted to CNCAN for getting the certificate for ending the nuclear activities and release from the authorisation regime;
- The general content for the Final Radiological Assessment Report of the Nuclear Fuel Storage

According to the Norms for decommissioning of nuclear objectives and Installations, the Decommissioning Plan shall be revised every 5 years.

According to the norms:

- for all future nuclear objectives and installations for which the regulation applies, the decommissioning plan shall be part of authorization documentation, starting with the siting authorization;
- for the nuclear objectives and installations for which the regulation applies that already are in the design, construction, or operation stage, the decommissioning plan (at various levels of detail, from conceptual to detailed) has to be submitted by the holder of authorization to CNCAN, in the next 3 years after the publication of the norms (norms were published in December 2002);

26.2. Fulfillment of the requirements of article 26 of Joint Convention

All the requirements of Art. 26 of the Joint Convention are detailed by the Norms for Decommissioning of Nuclear Objectives and Installations:

i. Qualified staff and adequate financial resources

According to the Norms for decommissioning of nuclear objectives and installations, in order to get the decommissioning authorization, the applicant shall prove in the decommissioning plan that qualified staff and adequate resources are available.
These requirements shall be mentioned in the following subparagraphs of the Decommissioning Plan:

- 1.2.2. “Cost Estimations”;
- 1.2.3. “Availability of Financial Funds”;
- 2.4. “Responsibilities for decommissioning”;
- 2.5. “Training program”;
- 2.6. “Assistance of the contractors”.

ii. Operational radiation protection, discharges, unplanned and uncontrolled releases

The requirements related to radiation protection shall be detailed in the Decommissioning Plan in Chapter 3 “Radiological Protection of Workers, Public and Environment”, according to the provisions of the above mentioned norms. The requirements for radiation protection, discharges, and for the unplanned and uncontrolled releases during decommissioning are similar to the requirements during the operation.

iii. Emergency preparedness

According to the provisions of the above mentioned norms, the applicant for a decommissioning authorization shall submit to CNCAN the emergency plan. If necessary, the General Emergency Plan and the local public authorities plans will take into consideration the decommissioning activities.

iv. Records of decommissioning operations

According to the provisions of the above mentioned norms the Decommissioning Plan shall present in Chapter 7 “Record keeping” the records to be kept related to decommissioning activities.

26.3. Design requirements related to decommissioning

The spent fuel and radioactive wastes facilities in operation or under construction of NPP owner (SNN) are designed taking into account recommendations for safe decommissioning.

26.4. NPP decommissioning plan

The preliminary decommissioning plan for NPP Cernavoda Unit 1 is under development.

The mains steps for development are as follows:
- Decommissioning concept study
- Unit 1 decommissioning strategy
- Define Unit 1 preliminary decommissioning plan
- Conservative decommissioning cost evaluation
- Unit 1 preliminary decommissioning plan development activities

The principal activity related to decommissioning of the spent fuel dry storage facility is the fuel removal process. The removal of fuel baskets from the storage module is made using inverse operations to loading. The fuel basket would be directly loaded into the transportation cask at the site.

Once all the spent fuel has been removed from module, the internal cavities of the storage cylinders are verified for contamination and decontaminated as necessary.

The storage module materials are then verified to have activation levels lower than clearance levels. The storage module is then demolished using standard wrecking equipment.
The same principles are applied for the radioactive waste management facilities.

Decommissioning costs for NPP Unit 1, will be covered by the Fund for Radioactive Waste Management and for Decommissioning.

26.5. Status of VVR-S reactor decommissioning

At this moment the research reactor VVR-S of IFIN-HH Magurele is permanently shut down, under a conservation authorization.
IFIN-HH has been submitted to CNCAN a preliminary decommissioning plan, and the decommissioning strategy for VVR-S Research Reactor.
The preparation of the detailed decommissioning plan of VVR-S research reactor is now ongoing, and CNCAN expects to receive it next year for approval.
Till that moment, under the VVR-S conservation authorization, IFIN-HH is performing the clean-up activities.

SECTION G. SAFETY OF SPENT FUEL MANAGEMENT

Article 4. General safety requirements

i. Criticality and removal of heat

In the authorization process for siting, construction and operation of NPP and of research reactors, CNCAN pays special attention to:

- criticality control (not applicable for spent fuel of NPP Cernavoda, because fuel is made of natural Uranium);
- assurance of adequate heat removal;
- control of water parameters in wet storages, and control of confinement and of the isolating air parameters for dry storage, in order to ensure optimum storage conditions (control of corrosion) and control of radioactivity levels.

ii. Minimization of waste

Generation of radioactive waste associated with CANDU spent fuel is minimized through

- the quality of fuel
- online fueling (this allows through the systems for detecting the failed fuel and immediate replacement)
- canning of the failed fuel (till now NPP Cernavoda did not find fuel that requires canning)

For all spent fuel, the control of water parameters in wet storages, and control of confinement and of the isolating air parameters for dry storage minimizes the generation of radioactive waste associated with spent fuel management.

iii. Interdependencies among different management steps

The Romanian strategy for spent fuel management takes into consideration both the present and future storage capabilities, and the actual status of the fuel cladding. Efforts are made by the regulatory body to enforce the observance of the storage conditions for the VVR-S aluminum cladding fuel, in order to extend the wet storage period.
In the licensing of the new NPP dry storage for spent fuel, the relations between the intermediate storage stage and the following stage, when the fuel will be removed for transfer in the geological repository, were taken into consideration.

iv. Effective protection of individuals, society and environment

In the authorization process, CNCAN pays due attention to the effective protection of workers, public and environment. The authorization is granted only if the internationally recognized criteria and standards are observed.
In order to protect adequately the public health and the environment during the normal operation of the spent fuel management facility, the offsite dose estimate and monitoring are based on the analysis of the external effective doses and of the (internal) committed effective doses for members of critical groups for all radiation pathways. These analyses are performed according to methods and procedures

recommended in IAEA and in other western regulations, like US regulations. The result of the analyses leads to derived emission limits for the effluents, and the monitoring program of the environment shall demonstrate that the derived emission limits are observed both in normal operation and during events with relative high probability of occurrence.

Regarding the assumed accident scenario and the scope of the emergency plan it shall be mentioned that the Initial Nuclear Safety Analysis Report, the Preliminary Nuclear Safety Analysis Report, and the Final Safety Analysis Report for a spent fuel or radioactive waste management facility have chapters regarding the assessment of natural effects (e.g. earthquakes, natural fire, flooding, snow) and of the man made effects (e.g. explosions, air plane crashes).
The above documents include accident analyses, according to the requirements of the IAEA applicable recommendations and to the applicable requirements of the other international regulations that are used in the licensing process, like US Regulatory Guides and NUREGs, as well as to the supplementary requirements issued by CNCAN. For the Design Basis Accidents, the doses shall remain below specified values, while, in order to prepare the emergency plan, Beyond Design Basis Accidents are analyzed. For example CNCAN asked that the Preliminary Safety Analysis Report for the authorization of the construction of the Spent Fuel Dry Storage of NPP Cernavoda addresses of an air plane crash on the storage.

v. Biological, chemical and other hazards

The criteria and standards mentioned in paragraph iv take into consideration biological, chemical and other hazards that may be associated with spent fuel management.

vi. Impact on future generations

The authorization process for transport and storage of spent fuel, and, when it will be the case, for its geological disposal requires the demonstration that the impact on future generations will not be higher than it is now accepted for the current generation.

vii. Avoidance of undue burdens on future generations

Regarding the principle of avoiding undue burdens of spent fuel management on the future generations, it shall be noted that even though Romanian authorities, fully accept and promote this principle; Law 111/1996 (as amended) asks for establishing of the Fund for Radioactive Waste Management and for Decommissioning, in order to ensure that all the costs for these activities will be covered in future.

Article 5. Existing facilities

5.1. Review of the safety of the wet spent fuel management facility of NPP Cernavoda

The general safety requirements implemented in design, construction and operation of the CANDU Nuclear Power Plant are applicable for the fuel handling system,

including spent fuel bay of Cernavoda NPP. The safety assessment reports prepared for nuclear licensing of the Nuclear Power Plant include specific safety assessment for the spent fuel management.
During the licensing process, CNCAN paid a special attention to evaluation of the following safety and safety related functions of the spent fuel bay:

- removal of the residual heat generated by the spent fuel;
- control of water chemical and physical parameters, in order to ensure optimum storage conditions and radiation levels control.

The spent fuel bay of Cernavoda NPP was designed to meet adequate safety standards used in Canada and in other six countries.
The Spent Fuel Bay of Cernavoda NPP – Unit 1 design meets the general requirements as described in the IAEA Safety Series 116 – Design of spent fuel storage facilities by including the following:

- measures to limit radioactive releases and radioactive exposures of workers and the public (including detection of leakage through the bay walls and floor);
- measures to prevent anticipated operational occurrences and accident conditions from developing into unacceptable severe accident conditions;
- provision for ease of operation and maintenance of essential equipment;
- provision through equipment and procedures for retrieving spent fuel from storage.

Even though it is generally accepted that the Fuel Handling and Storage Systems of Cernavoda NPP Unit 1 ensure required safety, it has to be noted that for the Unit 2, under construction, modifications for the fueling/defueling machine design were introduced by the designer, due to the application of new design requirements issued by Canadian Nuclear Safety Commission and endorsed by CNCAN, and due to feedback of operational experience. Part of these modifications was already implemented for Unit 1, and part of them will be introduced later for this Unit.

It has to be mentioned also that, prior the restarting of the construction of Unit 2, a review of the nuclear safety of the unit under construction was performed through a PHARE project. One of the ten tasks of this project, entitled Task 5 - Assessment of Nuclear Safety of On-Site Facilities regarding Nuclear Fuel and Radioactive Waste, concluded that the safety is assured according to western standards. However, recommendations were made for supplementary analyses. Also, in Task - 6 Evaluation of Adequacy of Engineered Provisions for Radiation Protection, it is recommended to review the suitability and application of the spent fuel pool surface finish and to consider the installation of a suitable metallic liner in lieu of concrete surface finish, to fulfill the secondary containment requirement. The recommendation was implemented for Unit 2 of NPP.

5.2. Spent Fuel Bay and dry storage of spent fuel elements and fragments at SCN Pitesti

The general safety requirements implemented in design, construction and operation of the TRIGA reactor are applicable for the spent fuel bay of SCN Pitesti. The safety

assessment reports prepared for nuclear licensing of the TRIGA reactor include specific safety assessment for the spent fuel bay.
During the licensing process, CNCAN paid a special attention to evaluation of the following safety and safety related functions of the spent fuel bay:

- criticality control;
- removal of the residual heat generated by the spent fuel;
- control of water chemical and physical parameters, in order to ensure optimum storage conditions and radiation levels control.

The revised Final Safety Analysis Report of LEPI has been submitted to CNCAN in 2003, and includes the review of the safety of the reactor spent fuel storage in the pool, that in fact is sited in LEPI building (actually the pool is sited between the reactor building and LEPI building, in an area belonging to LEPI). The revised Final Safety Analysis Report improves the chapters related to accident analyses.
The Final Safety Analysis Report of LEPI includes also the review of the safety of storage of spent fuel elements and fragments that resulted from destructive examination.

5.3. Spent fuel management at IFIN-HH Magurele

The spent fuel of IFIN-HH VVR-S reactor, under decommissioning, is actually stored in three of the four spent fuel storage pools, except the fuel assemblies of the last charge of the core that are still stored in the reactor cooling pool.
The spent fuel is old, and during the years, it was stored in conditions that were not fully observing the limits and conditions of the facility. Some Cs-137 activity was detected in the pools, resulting either from a few damaged fuel elements (damage occurred during handling of the spent fuel) or from corrosion.

In order to control the corrosion of aluminum-cladded spent fuel, a program to improve the water quality was issued and the main parameters were improved, pH between 5.5 and 6 and conductivity below 5 μS/cm were obtained.
An optimum management of aluminum alloys in water environments can result in satisfactory durability of irradiated fuel cladding and the functionality of the storage pools could be further extended.

CNCAN has asked the owner to assess the status of the fuel, to improve the storage conditions and to find solutions for long term storage or transfer of fuel to country of origin. Till now, a system for water filtering was put in place, and a contract regarding the shipping of the spent fuel S-36 back to Russia was signed. For the fuell EK-10, it is generally accepted that, if the transfer will be performed in 3-4 years, the actual condition of the fuel shall not create any problem, provided that the water parameters be kept under control. However, the situation is closely monitored, and supplementary control measures will be decided if the storage will continue in the future.

Regarding the safety assessment of the spent fuel storage pools, it has to be mentioned that during the last 10 years, the report was revised, more than once. The modifications, required by CNCAN, were related to water parameter limits and technical conditions, and to control of criticality.

The last revision was made in November 2002. The revised report contains information regarding:

- general presentation of the installation;
- characteristics of the site;
- status of the storage pools;
- cooling system;
- instrumentation and control;
- dosimetric control and assurance of the biological protection;
- ventilation system;
- utilities for distilled (demineralized) water supply and discharge;
- auxiliary systems;
- fuel handling system;
- control of operation;
- emergency plan;
- accident analyses;
- criticality control;
- deviations from the requirements of Preliminary Safety Analysis Report
- quality assurance;
- limits and technical conditions;
- records and reports;
- records and documentation management;
- physical protection.

Meantime, as a new regulation on decommissioning of research reactors and other facilities was issued, requiring the review of the Final Safety Analysis Report for spent fuel storage at reactor site, it was requested that IFIN-HH review that report for its spent fuel storage pools. The content required for the new report is similar to the content required in IAEA SS No. 118 “Safety Assessment for Spent Fuel Storage Facilities”. IFIN-HH is in the process of reviewing the report, according to CNCAN requirements. The submission of the report to CNCAN is scheduled for January 2006.

Article 6. Siting of proposed facilities

6.1. Procedures for safety evaluation, public information and neighbor countries consultancy

i. Site related factors likely to affect the safety of the facility

As mentioned before, any proposed facility needs a siting authorization issued by CNCAN based on Law no. 111/1996. The siting process for Cernavoda Interim Spent Fuel Dry Storage Facility was implemented based on IAEA guidance and NRC – 10 CFR Part 72.
The content of the Initial Safety Analysis Report is observing generally the requirements of US NRC Regulatory Guide 3.48 “Standard Format Content for the Safety Analysis Report”, adapted for the siting stage.

The following issues were addressed in the report:

- General description

- Characteristics of the site (these includes: geography and demography, nearby human activities - including man made events -, meteorology, surface and subsurface hydrology, geology, seismology, ecology, use of land and waters)
- Design criteria
- Description of the project
- Description of the functioning of the installation
- Waste management
- Radiological and nuclear safety
- Accident analyses
- Decommissioning
- Conclusions

The Initial Safety Analysis Report and its supporting documents are evaluating all the relevant site factors likely to affect the safety of the Spent Fuel Dry Storage Facility and the likely safety impact of the facility on individuals, society and environment, as presented in the paragraph on article 4.

The siting authorization was issued by CNCAN in August 2001, and contains the conditions related to the constructive solution, the confirmation of seismic entry data, the completitude of list of Design Basis Accidents. It was also required for the Preliminary Safety Analysis Report, requested in support of the application for construction authorization, to demonstrate the observance of dose constraint for the members of the public during normal operation (0.1 mSv/year) and to demonstrate the observance of Romanian regulations related to dose limits in case of Design Basis Accidents (the exclusion zone and the reduced population zone shall remain inside the area established for Cernavoda NPPs site). It was also required that the Preliminary Safety Analysis Report to present also the doses for Beyond Design Basis Accident.
For future siting of reactors, if it will be the case, the siting authorization process will cover in a similar manner the spent fuel management, as the requirements for NPPs or research reactors siting are covering the field of spent fuel handling and storage.

The siting of spent fuel deep geological repository was not yet addressed by Romanian regulations, as the existing strategy takes into consideration at least 50 years of dry storage.

ii. Safety impact of the facility on individuals, society and environment

The chapter on accident analyses of the Initial Safety Analysis addresses the safety impact of the facility on individuals, society and environment, in case of accident.
For normal operation, the safety impact is assessed in the chapter on radiological and nuclear safety.

iii. Public consultancy

When selecting a site, the future licensee has to consult the public. The Environment Agreement is issued by the Environmental Protection Authority, after analyse of the Environmental Impact Study. Public consultancy of this study is required, and the decision for issuing the Environment Agreement takes into account the opinion of the members of the public. The Environment Agreement is a prerequisite for issuing by CNCAN of the Construction Authorization. In fact, public consultancy starts at earlier stage, when the prefesability study is presented to the Environmental Protection Authority.

The above mentioned consultancy process is done based on the transposition of the Directive 85/337/EEC on Environmental Impact Assessment, amended by the Directive 97/11/EC. The transposition is realized through the Emergency Governmental Ordinance no. 91/2002 amending the Law no. 137/1995 on Environmental Protection, the Governmental Decision 918/2002, and the Orders of the Minister of Waters and Environment Protection no. 860/2002 and no. 863/2002.

iv. Consultancy of Contracting Parties in the vicinity of the spent fuel management facilities

Romania has ratified the ESPOO Convention. Consequently, any country (not only a Contracting Part), that could be affected by a spent fuel management facility sited on Romanian territory will be announced, and will receive, upon request, the general data relating to the facility to enable it to evaluate the likely safety impact of that facility upon its territory.

6.2. Avoidance of unacceptable effects on Contracting Parties in the vicinity of the spent fuel management facilities

The Initial Safety Analysis, as well as the latter Preliminary Safety Analysis Report and Final Safety Analysis Report, for any new nuclear facility (not only for spent fuel management facilities) shall prove that the national requirements, which are in line with the internationally endorsed criteria and standards, are met for individuals, society and environment, at the same level for national territory and for neighbor countries.

This requirement is obviously fulfilled for fuel handling and storage facilities. When siting a spent fuel deep geological repository, due consideration will be given to the assessment of the impact on neighbor countries.

Article 7. Design and construction of facilities

7.1. Construction of Spent Fuel Handling and Storage Systems at NPP Cernavoda Unit 2

The design and construction of the spent fuel handling and storage facilities at NPPs and research reactors is part of the design and construction of the plants, respectively of the reactors. As all of the requirements of Article 7 of the Joint Convention are required by the Romanian legislation for all nuclear installations (for all the installations, not only for spent fuel management systems), the authorization of construction of a NPP or research reactor is granted by CNCAN only if, inter alia:

i. the design and construction of the spent fuel handling and storage system provide for suitable measures to limit possible radiological impacts on individuals, society and environment;
ii. at the design stage, conceptual plans and, if necessary, technical provisions for the decommissioning of spent fuel management facility are taken into account;
iii. the technologies incorporated in the design and construction of spent fuel management facility are supported by experience, testing or analysis.

For NPP Cernavoda Unit 2, the construction was stopped in 1990, and the construction remained under conservation. The restart of the construction was decided in 2001.
As it was presented in the paragraph on article 6, the spent fuel system of Cernavoda NPP Units 1 and 2 were designed to meet adequate safety standards used in Canada.
The Spent Fuel Bay of Cernavoda NPP – Unit 2 design meets the general requirements as described in the IAEA Safety Series 116 – Design of spent fuel storage facilities by including the following:

- measures to limit radioactive releases and radioactive exposures of workers and the public (including detection of leakage through the bay walls and floor);
- measures to prevent anticipated operational occurrences and accident conditions from developing into unacceptable severe accident conditions;
- provision for ease of operation and maintenance of essential equipment;
- provision through equipment and procedures for retrieving spent fuel from storage.

Even though it is generally accepted that the Fuel Handling and Storage Systems of Cernavoda NPP Unit 1 and of the future Unit 2 ensure required safety, it has to be noted that in order to enhance safety, modifications for the fueling/defueling machine design were introduced by the designer, due to the application of new design requirements issued by Canadian nuclear Safety Commission and endorsed by CNCAN, and due to feedback of operational experience.
It should be mentioned also that, prior the restarting of the construction of Unit 2, a review of the nuclear safety of the unit under construction was performed through a PHARE project. One of the ten tasks of this project, entitled Task 5 - Assessment of Nuclear Safety of On-Site Facilities regarding Nuclear Fuel and Radioactive Waste, concluded that the safety is assured according to western standards. However, recommendations were made for supplementary analyses and for initiating design changes, if the results of the analyses show that design changes are recommended.
Also, in Task - 6 Evaluation of Adequacy of Engineered Provisions for Radiation Protection, it is recommended to review the suitability and application of the spent fuel pool surface finish and to consider the installation of a suitable metallic liner, to fulfill the secondary containment requirement. This design change was already applied for the construction of Unit 2.

7.2. Construction of Cernavoda Interim Spent Fuel Dry Storage Facility (including handling systems at Unit 1)

i. The design of Cernavoda Interim Spent Fuel Dry Storage Facility provides measures to limit the possible radiological impact on people and environment:

- double confinement barriers
- massive reinforced concrete construction
- low temperature on spent fuel cladding

ii. Decommissioning is adequately addressed by the Preliminary Safety Analysis Report.
iii. The Cernavoda Interim Spent Fuel Dry Storage facility use a well-proven technology that is in use since the mid 70's.
It has been licensed and is being used in Canada for the Whiteshell, Gentilly 1, Douglas Point, NPD (Chalk River), Point Lepreau and Gentilly 2 spent fuel storage needs. It has also been licensed in South Korea and is used at the Wolsong NPP.

The design of the Cernavoda facility specifically uses the best features of two operating dry storage facilities at Point Lepreau and Gentilly 2 in Canada. The dry storage system has proved to be safe, simple to use, and has successfully limited doses of radiation to workers to very low values at each of the above facilities.
No release of radionuclides has been observed up to now at operating facilities and no dose to the public has been measured.

The content of the Preliminary Safety Analysis Report is observing generally the requirements of US NRC Regulatory Guide 3.48 "Standard Format Content for the Safety Analysis Report", adapted for the construction stage. Physical protection and safeguards are addressed separately. Emergency planing is covered by the general NPP emergency plan, that integrate emergencies related to dry storage activities.

The following issues were addressed in the report:
- General description
- Characteristics of the site (these includes: geography and demography,
nearby human activities -including man made events-, meteorology, surface and subsurface hydrology, geology, seismology, ecology, use of land and waters)
- Design criteria
- Description of the project
- Description of the technological flux
- Waste management
- Radiological protection
- Conduct of operation
- Accident analyses
- Technical limits and conditions
- Quality Assurance
- Decommissioning program
- Conclusions

The construction of the first module of the facility was done under 2 different authorizations issued by CNCAN.

First authorization was given in the form of a "Modification of Plant Approval" in the area of the Spent Fuel Storage Bay, including the construction of an extension of the building. The modifications related to this area were approved only after

demonstration that construction work will not affect the safety of the operation of the plant.
The construction authorization of the first module of spent fuel dry storage was issued in May 2002, and contains conditions related to the constructive solution, and to the reconsideration of the air crash severe accident (it is requested that the Final Safety Analysis Report improve the scenario, justify the emission height, and presenting the support documentation for radionuclide concentrations and dose calculations, for all meteorological conditions and all distances and heights relevant for emergency planning).
Also it was requested to be analysed the situation of a critical group inside the exclusion zone, and to demonstrate that in normal operation, the dose constraint for members of the public is not exceeded, and, in case of Design Basis accidents, the doses for public will in principle not exceed the dose limits applicable for workers during normal operation).
All these requirements have been addressed in the Final Safety Analysis Report that was submitted to CNCAN in order to obtain the operating license of module 1 of the Spent Fuel Dry Storage Facility. This year (2005), the Preliminary Safety Analysis Report was revised to include the safety assessment of the modules 2 and 3 and was submitted to CNCAN in order to obtain the construction authorization for these modules.

Article 8. Assessment of safety of facility

i. Initial safety assessment

According to the Romanian laws and regulations, for sitting a nuclear facility, including a spent fuel management facility, a siting authorization shall be issued by CNCAN. This authorization is issued based on a Initial Safety Analysis Report, as it was presented in the paragraph related to article 6.

As it was presented in the paragraphs related to articles 6 and 7, before construction of any nuclear facility, including a spent fuel handling and storage facility, an environmental agreement issued by the Environmental Protection Authority and a construction authorization issued by CNCAN are required. The environmental agreement is issued based on an Environmental Impact Study while the CNCAN authorization is issued on the basis of a Preliminary Safety Analysis Report.

ii. Updated and detailed safety assessment

According to the Romanian laws and regulations, for issuing by CNCAN of a commissioning authorization for a nuclear facility, including a spent fuel handling and storage facility, a Final Safety Analysis Report is required. The amended Final Safety Analysis Report is then necessary for probationary operation authorization and for the operation authorization.

Operation requires also the issuing by the Environmental Protection Authority of an operating authorization. This last authorization is issued after starting of the operation, based on the Environmental Report, that includes measurements of environmental parameters.

The operating authorizations are issued by CNCAN and by the Environmental Protection Authority for a limited period of time and have to be renewed periodically. That requires the update of supporting safety and environmental assessments.

Systematic impact assessment according to internationally recognized criteria and standards are required for completion of the Environmental Impact Study and of the Environmental Report.

The Initial Safety Analysis Report, Preliminary Safety Analysis Report, Final Safety Analysis Report and their supporting documents are containing systematic assessment of the nuclear safety and of the environmental impact, in accordance with the internationally accepted criteria and standards. This is obviously the case for the spent fuel facilities inside the NPP or reactors, where the safety of the handling and storage of spent fuel are assessed in the general context of the safety of the entire installation.
As it was presented in the paragraphs related to articles 6 and 7, the content of Initial Safety Analysis Report and of Preliminary Safety Analysis Report for the Spent Fuel Dry Storage Facility (module 1) were prepared following the guidance provided in USNRC NUREG Guide 3.48, adapted for the siting and construction phases, respectively. The Final Safety Analysis Report for commissioning and operating authorization, also followed the content of this guide.
In fact some simplifications are operated, taking into account the characteristics of CANDU fuel (natural uranium, low residual heat, geometry and mass of the fuel assembly, etc.), the geographic and the climatic conditions.

CNCAN has and will continue to assess these authorization documents based on USNRC NUREG-1567 “Standard Review Plan for Spent Fuel Dry Storage Facilities”, adapted taking into account the characteristics of CANDU spent fuel, the local geographic and climatic conditions and the regulatory requirements. This approach was communicated to the utility from the beginning of the licensing process.

For the case of the VVR-S reactor under decommissioning, the content of the revised Final Safety Analysis Report as per November 2002 was presented in the paragraph related to article 5. According to the regulation on decommissioning of research reactors and other facilities, which requires the review of the Final Safety Analysis Report for spent fuel storage at reactor site, it was requested that IFIN-HH reviews that report for its spent fuel storage pools. The content required for the new report is similar to the content required in IAEA SS No. 118 “Safety Assessment for Spent Fuel Storage Facilities”. IFIN-HH is in the process of reviewing the report, according to CNCAN requirements; the report is scheduled to be submitted to CNCAN IN January 2006.

The handling of spent fuel in TRIGA pool, at SCN Pitesti, is covered in the Final Safety Analysis Report of TRIGA reactor. The revised Final Safety Analysis Report of LEPI covers the storage of the spent fuel in the spent fuel storage pool of LEPI and of the spent fuel fragments and experimental fuel elements in the dry pits of LEPI hot cells. The report covers handling and storage of spent fuel in LEPI, according to the requirements of IAEA SS No. 118.

Article 9. Operation of facilities

i. Licensing

The spent fuel bay operated by CNE-PROD Cernavoda is a nuclear power plant system. The Cernavoda NPP operation was licensed by CNCAN following the legal procedure and based on appropriate assessment of safety. All safety analyses to support the five-formal licensing stages (site authorization, construction authorization, commissioning authorization probationary operation authorization and operation authorization) were performed as parts of the safety analyses for U1.

The Probationary Operation Authorization was issued based on the amended Final Safety Analysis Report, which includes the commissioning test and control program results. The Operation authorization was issued based on the amended Final Safety Analysis Report (phase II) which was structured in accordance with the provisions of the NRC Regulatory Guide 1.70. The amended report contains information derived from the results and conclusions of the probationary operating period.
Until 2005, the operation authorization was renewed every 2 years. In May 2005 Cernavoda NPP Unit 1 has obtained a 3 years operating authorization.

The authorization for operation of the first module of the Spent Fuel Dry Storage was issued in 2003 based on Final Safety Analysis Report. The authorization shall be renewed this year.
Similar processes were in place for authorization of operation of the 2 research reactors. Also the authorization for operation of LEPI was issued in similar conditions.

For VVR-S spent fuel storage, the completion of a revised Final Safety Analysis Report is ongoing. The decommissioning authorization for the reactor will include the spent fuel storage activities. Prior to get CNCAN authorization to start the decommissioning, IFIN-HH shall assess the impact of these activities on spent fuel management. CNCAN also asked IFIN-HH to perform characterization of fuel cladding status and to take measures for upgrading measures for the spent fuel management, including for more strict observation of technical limits and conditions. Any modification of the spent fuel handling and storage systems shall be done only with the prior approval of CNCAN.

ii. Operational limits and conditions

CNE-PROD Cernavoda issued under CNCAN approval, the reference document “OPERATING POLICIES AND PRINCIPLES”. This document describes how the utility operates, maintains and modifies the safety-related systems in order to maintain the nuclear safety margins and consequential risk to the public acceptably low. This document defines the specific operating limits for safety related systems, which must be maintained all the time to ensure that the plant always operates within its analysed safe operating envelope. Other key boundaries for operation of Spent Fuel Facilities are included in their Operating Manuals.

The safe operating envelope is defined by the Final Safety Report. Specific operating limits as resulted from the “safe operating envelope” are added to the safety limits as defined by the safety evaluations.

A fundamental requirement of nuclear safety is to operate and maintain the spent fuel management facility within a defined “safe operating envelope” in accordance with the design intent and the licensing basis.

The “safe operating envelope” is defined by a number of safe operation requirements from which the most important are:

- Requirements on safety related systems or functions, (e.g. set point or other parameter limits, availability requirements);
- Requirements on process systems, e.g. parameter limits, testing and surveillance principles and specifications, including performance requirements under abnormal conditions;
- Pre-requisites for removing safety related systems or their stand-by equipment from service.

The technical basis for the safe operating envelope are found in the Final Safety Report which includes the description of the safety analysis that examines the facility response to disturbances in process function, system failures, component failure or human errors. Safety analyses predicts the consequences of the design basis accidents and compare them with the regulatory requirements.

In addition a set of nuclear safety topics are integrated into the assembly of the measures by which the station performance is to be judged. Safety performance shall be assessed against the safety-related topics. Where discrepancies are met, corrective actions shall be implemented.

For the new Cernavoda Spent Fuel Dry Storage Facility, a set of technical limits and conditions were proposed in the Preliminary Safety Analysis Report, and were finalized in the Final Safety Analysis Report and approved by CNCAN by issuing the operating authorization for the module 1 in the year 2003. These limits and conditions are replacing, as an exception, the reference document “Operating Polices and Principles” that are used for all the rest of NPP Cernavoda.

For TRIGA reactor and LEPI Pitesti facilities as well as for the spent fuel storage of the under decommissioning VVR-S reactor, technical (operational) limits and conditions are established, based on assessments, tests and operational experience. These technical limits and conditions are revised as necessary.
As an example, below are presented the technical limits and conditions for the spent fuel storage pools of VVR-S reactor:

1. water level in the pools: minimum 4.2 m
2. water temperature: 60º C
3. air depression (before removing the plugs of the pools) minimum 5 mm water column
4. the ventilation of the building shall function minimum ½ h before the entering into the storage area, and all the time during the presence of persons in the storage area

5. a reserve of at least 10 m^3 of distilled water for compensating in case of water loss
6. water characteristics: pH = 5.5 – 6, conductivity 2 - 3.3 μS/cm^2 fixed residuum = 1 mg/l, Cl = 0.02 mg/l, O = 8 mg/l
7. maximum activity in the water 25,000 Bq/l

These values will be revised, as the filtering of water allows lover limit for water specific activity.

iii. Operation, maintenance, monitoring, inspection and testing

As parts of CNE-PROD NPP, the spent fuel facilities operation, maintenance, monitoring, inspection and testing activities are performed according to Station regulations: Operating Policies and Principles, Maintenance Philosophy, Quality Assurance Manual.
All these documents include, directly or by reference to appropriate procedures, rules that must be followed in performing activities related to operation, maintenance, monitoring, inspection and testing.
As these documents are sustaining the operating authorization, the compliance with their requirements is mandatory for the Station and any deviation must be reported to CNCAN.
Similar requirements does exist for TRIGA reactor, for LEPI and for VVR-S spent fuel storage facility.

iv. Engineering and technical support

The station organisation chart for CNE-PROD Cernavoda NPP documents the general areas of responsibility. The structure of the organisation considers the needs for engineering and technical supports and for this reason it includes a strong Technical Unit covering System Performance Monitoring, Design Engineering and Safety & Compliance.

Also, it should be mentioned that a strong link is maintained with Romanian research institutes and with designer of the plant, Atomic Energy Canada Limited, Romania being member of CANDU Owners Group.
SCN Pitesti and IFIN-HH consider also needs for engineering and technical supports. Their organizational chart include also staff for operation, maintenance, monitoring, inspection and testing of spent fuel handling and storage systems.

v. Incidents reporting to CNCAN

Incidents significant to safety are reported in a timely manner by the holder of the authorization to the regulatory body, according to established procedures. These reports and procedures are requested by CNCAN according to authorization conditions.

CNE PROD has to submit to the regulatory body the following types of reports:
- Abnormal Condition Reports are prepared to report those events that could have significant adverse impact on the safety of the environment, the public or the

personnel, such as: serious process failures, violations of the Operating Policies and Principles, release of radioactive materials in excess of targets, doses of radiation which exceed the regulatory limits, events which interfere with the IAEA safeguards system. For each reportable event a notification is made to the CNCAN immediately after the discovery of the reportable event or within one working day depending on the gravity of the event and a report is prepared to document the event. For the events that are significant or complex, more detailed reports are prepared as Abnormal Condition Reports and submitted to CNCAN within the required time period.

- Quarterly reports are to be prepared to provide information regarding the safety systems reliability performance, dose statistics and radioactive emission, performance indicators, a review of process, safety and safety support systems including the design changes, a review of the nuclear fuel and heavy water management, the result of the chemistry control, radiation control, a review of the emergency planning a reactor core safety assessment, etc.
- Safety Analysis Report updates should analyse the design and procedural changes and include the new safety analysis. These updates should be submitted to CNCAN each two years from the last update, excepting the case when CNCAN takes an other decision.
- Annual radiological environment monitoring reports are to be prepared to provide information on the off-site radiological environmental monitoring program, the individual doses that are calculated as doses to critical group, a review of the radiological environmental monitoring quality assurance program, and any unusual event during the calendar year.
- Annual research and development reports should describe the planned research and development programs that address the unresolved safety questions.
- Periodic inspection reports are to be prepared to describe the results of any subject inspections in compliance with applicable standards.
- Annual reliability reports should include an evaluation of systems that has specific reliability requirements given in the licensing documentation. A review of updated documents should be provided with the focus on the design changes and their impact on the analysis results.

Similar reporting systems are established in the authorization conditions and are precised in internal procedures of the licensee, in the case of SCN Pitesti and of IFIN-HH.

vi. Collection and analysing of relevant operating experience

For CNE-PROD Cernavoda NPP the station goal for operating experience is to effectively and efficiently use lessons learned from other plants and station operating experience to improve plant safety and reliability.

Station events and human performance problems often result from weaknesses or breakdowns in station processes, practices, procedures, training and system or component design that were not previously recognised or corrected. This is the reason why CNE-PROD Cernavoda NPP consider, as the main topic of the Operating Experience Program, the Event Analysis System, comprising identification, evaluation and analysis of operational events (both internal and external) in order to establish and implement corrective actions to avoid re-occurrence.

The external information regarding operating experience proved to be a very important tool in improving station performance. Therefore, the second main topic of the operating experience program is the Information Exchange Program, with bi-directional use:

- collecting of external information and distribution to the appropriate station personnel;
- submitting the internal operating experience information to external organisations.

The basis for Operating Experience Program was set in place since the early stage of the commissioning phase (1993), with the objective to ensure:

- the reporting, reviewing, assessing of the station abnormal conditions and establishing of the necessary corrective actions;
- information exchange within CANDU Owner Group (COG), regarding abnormal conditions, technical problems, research and development projects, etc.

As a result, all the activities related to this topic were assigned to a new structure, an Operating Experience Group was created, and the program based on the ASSET philosophy-"prevention of incidents - the path to excellence operational safety" - is now developed in an integrated and centralised manner.

For this reason, the abnormal conditions assessment programs includes low level events analysis as precursors of the major events. The new created group together with technical units specialists analyses, using ASSET methodology, the external and internal abnormal conditions, and proposes to the station management an action plan, to improve the plant safety and to avoid the events reoccurrence.

For the information exchange program, the relation between CNE-PROD Cernavoda NPP and COG is covered by a COG contact officer, appointed by the station management, with the following general responsibilities:

- serving as a liaison between COG and the station;
- reviewing the incoming messages and distributing them to the appropriate persons;
- ensuring the transmittal of the required information/reports to COG;
- ensuring optimum participation by the station personnel.

Programs to collect and analyse relevant operating experiences are established also for SCN Pitesti and IFIN-HH.

vii. Decommissioning plans for spent fuel management facilities

According to the provisions of Law no. 111/1996 any NPP or research reactor needs to prepare decommissioning plans. This is valid also for the spent fuel management facilities that in Romania are sited at reactor sites. The requirements related to decommissioning plans from the design and construction phases are applied for the Spent Fuel Dry Storage Facility at Cernavoda site, as presented before.

Article 10. Disposal of spent fuel

After six years of cooling in the Spent Fuel Bay, the spent fuel generated in operation of Cernavoda Nuclear Power Plant will be stored on site for 50 years in the Interim Spent Fuel Dry Storage Facility. The capacity of this interim storage is adequate for lifetime operation of two CANDU plants.

The geological disposal of spent fuel will be addressed later, when the technology will be commercially available.
The financial arrangements for disposal of spent fuel will be legally solved by the law regarding the Fund for Radioactive Waste Management and Decommissioning.

SECTION H. SAFETY OF RADIOACTIVE WASTE MANAGEMENT

Article 11. General safety requirements

i. Control of criticality and heat generation

The requirements regarding the control of criticality and heat generation during radioactive waste management are generally related, in Romanian case, to the spent fuel management (spent fuel being considered as radioactive waste, no reprocessing is foreseen). The CNCAN requirements and the measures taken by the licensees were presented in Section G.

Regarding the sealed sources of high activity, the storage authorization requirements take into consideration heat dissipation. When the sources are stored in the dedicated transport, storage or operation container, the conditions related to heat removal are mentioned also in the type approval of the equipment.

ii. Minimization of waste

Waste minimization is considered in Romania as an important issue, having direct impact on radioactive waste management, especially on the costs.

- A main mean for reduction of the amount of the radioactive waste generated is the clearance of the waste. In 2004 CNCAN have issued the “Norms for clearance from authorization regime of materials resulted from authorized nuclear practices”.The above mentioned norm establish clearance levels, both for conditional and free release of materials from radiological zones.
- In order to minimize the waste the producer shall also consider the secondary radioactive waste when assessing the treatment and conditioning of radioactive waste. This requirement is considered by CNCAN in the authorization process.

iii. Interdependencies among different management steps

In the regulatory process, CNCAN requires that due attention be given to interdependencies among the different steps in radioactive management.
According to the Fundamental norms on safe management of radioactive waste/2004 The interdependencies among all steps in radioactive waste generation shall be appropriately taken into account. The fulfillment of this condition shall be checked by CNCAN while authorizing radioactive waste management activities. Also, while assessing the regulatory compliance of the national radioactive waste management strategy to be elaborated by ANDRAD, CNCAN shall verify if the interdependencies among different radioactive waste management strategy were correctly taken into consideration.

iv. Effective protection of workers, public and environment

In the authorization process of radioactive waste management facilities, CNCAN pays due attention to the effective protection of workers, public and environment.

The authorization is granted only if the internationally recognized criteria and standards are observed.

In order to protect adequately the public health and the environment during the normal operation of the facility, the off-site dose estimate and monitoring are based on the analysis of the external effective doses and of the (internal) committed effective doses for members of critical groups for all radiation pathways. These analyses are performed according to methods and procedures recommended in IAEA and in other western regulations, like US regulations. The result of the analyses leads to derived emission limits for the effluents, and the monitoring program of the environment shall demonstrate that the derived emission limits are observed both in normal operation and during events with relative high probability of occurrence. Of a particular interest is the assessment (based on the FEPs list) and the monitoring of the doses resulted from a repository during both the operation and the post closure (institutional control) period. For this purpose, depending on the characteristics of the radioactive waste, the immobilization matrix, the engineered barriers of the facility, and of the surroundings of the facility (near field and far field), various monitoring activities for radioactivity of air, water, soil, vegetal and animal organisms are performed. For a surface repository, accepting short lived radionuclides, the institutional control period is considered 300 years.
Regarding the radiation protection criteria for the workers and for the public, they are similar to the criteria defined in the 1990 publication of ICRP 60, as the Radiological Safety Fundamental Norms are transposing the Council Directive 96/29/EURATOM.
In the case of the radioactive waste disposal facility, altered evolution scenarios, including the intrusion scenarios are considered, according to IAEA recommendations. Also operation and transport accidents are considered for such facilities. The loose and the theft of radioactive waste are also considered. The emergency plan is dimensioned according to the maximum credible accident.

For the low level radioactive waste treatment plants and for the low and intermediate level radioactive waste and spent sources storages the operation and transport accident scenarios, including loose and the theft of radioactive waste, are also considered.

v. Biological, chemical and other hazards

The internationally accepted criteria and standards used for assessing and authorizing the radioactive waste management facilities take into consideration biological, chemical hazards.

vi. Impact on future generations

The authorization process for pretreatment, treatment and storage of spent fuel, and, when it will be the case, for its geological disposal requires the demonstration that the impact on future generations will not be higher than it is now accepted for the current generation. This is done for long term storage and disposal by requiring that the dose be assessed both for normal and altered scenarios of evolution of the facility, including the intrusion in the repository, for all the period of time for which the waste has significant radioactivity. The results shall be below the constraints established by CNCAN, that are expressed in terms of yearly dose, or dose/event, that are the same as for the current generation.

vii. Avoidance of undue burdens on future generations

Regarding the principle of avoiding undue burden of radioactive waste management on the future generations, it shall be noted that Romanian authorities, and particularly CNCAN, fully accept and promote this principle. The Law regarding the Fund for Radioactive Waste Management and for Decommissioning, to be enacted, will ask that all the licensees for activities in wich radioactive wastes are produced or managed pay fees in order to be sure that all the costs for such activities will be covered in future.
The Fundamental norms on safe management of radioactive waste/2004 require the radioactive waste to be managed in such a way that will not impose undue burdens on future generations. The radioactive waste management strategy to be revised by ANDRAD shall observe this principle.

Article 12. Existing facilities and past practices

i. Safety of radioactive waste management

a) Safety of radioactive waste management at CNE-PROD

The review of the safety of radioactive waste management systems at Cernavoda NPP is done periodically, as the authorization of the plant is renewed every 2 years.

The Cernavoda Nuclear Power Plant is provided with facilities for safe management of all radioactive waste arising from plant operation, from maintenance period, or from abnormal reactor operation.

The generation of radioactive waste resulting from plant operation is kept to the minimum practicable, both in activity and in volume. Station references documents and procedures are focused on waste minimization. Operational target for waste volume is 30 m^3 per year except spent resins.

Radiation exposure of the operating staff and members of public during processing and storage is maintained as low as reasonably achievable – ALARA (social and economic factors taken into account).
The contamination control, temporary accumulation and storage of radioactive waste within the plant are avoided by proper planning and scheduling. Temporary accumulations are prohibited except at locations designed for that purpose.

The whole set of procedures dealing with waste generation and waste management is under regulatory control.

Qualified and trained personnel operate facilities. Training is subject to periodically refreshment.

The plant has the capabilities to control, collect, handle, process, interim store wastes that may contain radioactive materials and are produced as a consequence of plant operation.

The design of the radioactive waste management facilities is such that radiological exposure of operating staff and the public is well within the limits recommended by the International Commission on Radiological Protection.

The solid radioactive wastes which result from either normal or ab-normal operation of the nuclear power plant are stored for a limited period of time. The wastes will be transferred for disposal at the moment when the disposal facility will be available.

The radioactive waste management facilities are located within Cernavoda NPP exclusion zone and security fence, with easy access of vehicles transporting radioactive wastes, minimizing the need for additional security mechanism to assure its integrity. No any off-site transportation is involved.

The origin of the radionuclides contained in the radioactive wastes from the CANDU NPP is the as follows:

- Fuel fission products
- System material activation products
- System fluid activation products

Radionuclides in all these categories remain predominantly at their place of origin, but may be transported and ultimately reach one or more parts of the radioactive waste management system.
The fission products, which may escape from defective fuel while in the core or in the fuel handling equipment, are filtered, trapped or removed in the heat transport system and its auxiliary systems. This leads to accumulation of the majority of the fission products in spent resin or filter elements as solid wastes. Radionuclides, which escape from the heat transport system boundary reach the building atmosphere. They are collected into the active ventilation ducts in the gaseous radioactive waste management system. If deposited and washed down they reach liquid radioactive waste facilities thorough the active drainage system.
Similarly, and as a specific feature of the CANDU pressurized heavy water plant, the tritium produced by activation of the heavy water in the heat transport system and moderator D_2O circuits may escape as DTO or T_2O. Unless retained in the D_2O collection or D_2O vapor recovery systems, it ultimately arrives in the liquid or gaseous radioactive waste management systems.
Components being serviced are subjected to decontamination procedures, either in-situ or in special decontamination facilities, for the removal of fission products or activation products. The residues from these activities are directed to the applicable radioactive waste management system.

Pre-treatment of waste is the initial step in waste management that occurs after waste generation. It consists of collection, segregation and includes a period of interim storage. This initial step assures a segregation of waste streams and also a segregation of radioactive waste from the non-radioactive ones.

Treatment of radioactive waste is the next step and consists at this moment only of a volume reduction by pressing waste inside drums using a Hydraulic Press with a volume reduction factor of 4:1.
The description of radioactive waste management at CNE-PROD is presented in section D.
The conclusions of the review of the safety of radioactive waste management at Cernavoda NPP are that the requirements of the Joint Convention are met. However, CNCAN asked for supplementary work, in order to characterize in detail the radioactive waste produced in the plant. This requirement is important, as it is intended to construct a surface repository for NPP radioactive waste, and it shall be clear which wastes can be accommodate in this repository, and what will be the maximum committed doses for the critical group.

b) Safety of radioactive waste at FCN Pitesti

The review of the safety of radioactive waste management at Nuclear Fuel Plant (FCN Pitesti) is done periodically, as the authorization of the facility is renewed. The description of radioactive waste management at FCN Pitesti is done in Section D.
The conclusions of the review of the safety of radioactive waste management at FCN Pitesti are that this is done properly, in accordance with the requirements of the Joint Convention.

c) Safety of radioactive waste management at SCN Pitesti

The review of the safety of radioactive waste management facilities at SCN Pitesti is done periodically, as the authorization of this facilities is renewed.
STDR Pitesti is provided with installations for safe management of all short lived radioactive waste arising from the operation of the institute facilities, including of the TRIGA reactor. Also there are installations for uranium recovery from the liquid and burnable solid wastes produced in the Nuclear Fuel Plant Pitesti.
LEPI facility is used for storage of long-lived radioactive waste and off the highly active short lived radioactive sources.

The generation of radioactive waste resulting from STDR and LEPI operation is kept to the minimum practicable, both in activity and in volume.
Radiation exposure of the operating staff and members of public during processing and storage is maintained as low as reasonably achievable – ALARA (social and economic factors taken into account).

The contamination control, temporary accumulation and storage of radioactive waste within the STDR are avoided by proper planning and scheduling. Temporary accumulations are prohibited except at locations designed for that purpose. The conditioned solid radioactive wastes are transferred to IFIN-HH for disposal at Baita-Bihor repository.

The whole set of procedures dealing with waste treatment and conditioning is under regulatory control.

Qualified and trained personnel operate facilities. Training is subject to periodically refreshment.

The design of the radioactive waste management facilities is such that radiological exposure of operating staff and the public is well within the limits recommended by the International Commission on Radiological Protection.

d) Safety of radioactive waste management at IFIN-HH

The review of the safety of radioactive waste management at STDR Magurele is done periodically, as the authorization of this facilities is renewed.
STDR Magurele is provided with installations for safe management of all short lived radioactive waste arising from the operation of the institute facilities, including the former VVR-S reactor, under decommissioning, as well as of the institutional radioactive waste produced in the country. The radioactive waste, including spent sources, are treated at STDR. Here are stored also long lived spent sources, waiting for treatment, in view of long term storage.
Due to ageing of the installation, problems are encountered regarding the liquid treatment; for that reason CNCAN has withdrawn the authorization for the liquid waste treatment plant.

The solid waste treatment plant was improved; a new device for cement mixing was put into operation.

CNCAN has required a program for refurbishment of STDR Magurele, as well as for creation of technologies for long term storage of long lived radioactive waste. In this respect, the waste management department of IFIN-HH has developed a program for reconditioning of Ra-226 sources, in accordance with IAEA recommendations.
Also a programme for the reconditioning the 800 existing corroded drums containing historical waste is scheduled. In this respect, it is mentioned that under a contract with the Department of Trade and Industry of Great Britain, STDR Magurele will be equiped with a complete modern characterization system and with 250 pieces of 420 l drums for reconditioning the 220 l drums containing historical waste.

The DNDR Baita-Bihor (the short lived radioactive waste national repository for institutional waste) was put in operation in 1985. Following the evolution of radioactive waste disposal concept, CNCAN has asked IFIN-HH to perform an Initial Safety Analysis, followed by a Preliminary Safety Analysis Report, and a Final Safety Analysis Report.
The first step was achieved in 2002, based of know-how transfer through a PHARE project. A continuation of the PHARE project is conducted in 2005-2006. As result, the Preliminary Safety Analysis Report will be produced in 2006.

In parallel, another PHARE project is under development: “Upgrading of the Baita-Bihor Repository for Institutional Waste in Romania”. Under this project, a number of urgent upgrading measures will be implemented (i.e. replacement of the electric, ventilation, drainage and transport systems, waterproofing of the galleries, a new and modern physical protection system, a technological building for the workers, improvement of radiological monitoring).

Also, under a contract with Department of Trade and Industries of Great Britain, the transport of the conditioned waste to the repository will be improved by the acquisition of a truck with special technical characteristics, able to transport larger packages (420 l drums)

e) Safety of radioactive waste management at CNU

As it was presented in Section D, CNU has 2 tailing ponds, and 3 solid waste storages (2 old, trench type, and 1 new, with concrete walls, realised according to a safety assessment approved by CNCAN.). After filling, the tailing ponds and the storages will be transformed in radioactive waste repositories, provided that they satisfy the CNCAN requirements.
The 2 tailings ponds are named Cetatuia II and Mittelzop.
The Cetatuia II have as aim the settling and storage of radioactive tailings, and was built in 3 pieces, due to high investment costs for insulation of the concerned surfaces. The present state of this pond is the following, in present:
- the first part, is now in a closing out process, being used for tailings discharging in the 1978 - 2001 period; the total estimated tailings discharged was about 4 500 000 tons; the total surface of this first part is 368,000 m^2; the closure of the pond will transform it in a repository, provided that the closure solution satisfies the regulatory safety requirements.

In present, gathering and storage of solid radioactive waste is done according with a specific procedure, agreed by the CNCAN authority, covering the following aspects:
- gathering radioactive waste from the Feldioara plant, sorting, transport for final storage;
- intervention in case nuclear accident during gathering radioactive waste from the Feldioara plant, sorting, transport for final storage;
- recording the radioactive waste stored, reporting of the stored quantities.

There are just a few personnel involved in the mentioned activities, a driver, dose measurement person, person for discharge and storage; all these persons are radiological monitored during their work with radioactive waste and medical controlled in accordance with the settlements of the Ministry of Health and Family.
The radiological safety manager within the Feldioara branch is a person agreed by the CNCAN authority, to ensure the following activities:
- radiological protection of the exposed workers, of the population and environment;
- the management in safe conditions of the radioactive waste; registered as quantity, type, storage location, activity, level of surface contamination);
- planning of urgent intervention in case of radiological accident occurring during storing of radioactive waste (as mentioned in procedures “Urgent intervention plan at radioactive waste storage facilities”).

In accordance with the new norms issues by CNCAN the Feldioara branch has decided new safety measures for the radioactive waste management:
- the entire area around both new and old radioactive waste storage surfaces was surrounded by wire fence to avoid people’s access;
- the surrounding area is radiologicaly monitored and ground and underground water samples are taken and analyzed within the plant laboratory;

- to avoid radionuclides migration around the storage area the stored radioactive waste is compacted and covered by a 10 cm thick layer of clay (according to the procedures "Location and storage of low activity radioactive waste" and "Conditioning of radioactive waste material easily removed by wind").

Having as aim the increasing of radioactive waste safety management, for the near future the Feldioara branch foreseen the following:
- improvement of the access road at the radioactive waste storage facility;
- supplementary drillings around the radioactive waste storage facility in order to ensure more underground water samples for contamination assessment;
- radiometric monitoring of the access road to the radioactive waste facility.

Remote access will be ensured to the storage area.

The storage activity at the mentioned site is estimated during a 10 years period.
After filling completely the radioactive waste storage facility, the stored material will be leveled and covered by a 50 cm thick compacted clay to avoid any radioactive contamination of the surrounding environment (according to the procedure "Insulating the area of the full capacity storage facility"). In this way, the storage will be transformed in a repository.

If required, a higher storage capacity may be developed in future, within the same area, after obtaining the necessary CNCAN authorization. For the first two solid radioactive waste storage areas that are closed and covered, it is also necessary to assess the safety prior to get the authorization for transforming the storage areas in repositories.

ii. Past practices

a) Former radioactive waste storage "Magurele Fort"

Regarding the past practices, it should be mentioned the Magurele fort, where IFIN-HH have stored in the past untreated radioactive waste. The fort, sited near the Magurele site of IFIN-HH, was closed at the beginning of eighties, the waste was recovered and treated, part of it was disposed at Baita-Bihor repository and part of it is stored at Magurele site. The waste that remained at Magurele needs to be repacked before being sent at the repository. The closure of the storage was realised as required at that moment, and the site remained under control. The clean up of the site was realized by IFIN-HH.

b) Sterile rock and low radioactive rock dumps resulted from geological research and mining activities for uranium ores production within the CNU sites

The uranium geological research and mining activities have produced sterile rock and radioactive rock dumps. This deposits shall be assessed, and where necessary, intervention shall be applied, in order to reduce the radiological risks. The sites and their actual status are presented below.

- ***CRUCEA – BOTUSANA mines , Suceava county***

There are 14 sterile rock dumps with a total volume of 524 183 m^3 on a 113 636 m^2 surface, on mountain slopes, having a 13 – 40 m height. The gamma dose rate at 1 m from surface is 0,11 – 0,80 µSv/h. Some dumps are covered by natural vegetationon 15 – 70 % of their surface.

- ***Objective TULGHES – GRINTIES , Neamt county***

The objective has 3 main areas. The Primatar area has 15 old sterile rock dumps covering a total surface of 46 300 m^2 and having a total volume of 160 370 m^3 . The Prisecani area has 5 old sterile rock dumps covering a total surface of 21 588 m^2 and having a total volume of 89 999 m^3 .The Bradu area has 6 sterile dumps with a 28 390 m^2surface and a 122 463 m^3 volume .All the sterile dumps are located on mountain slopes , in forest covered areas.

At 1 m heigt from the surface, the gama dose rate is 0,30 µSv/h with peaks to 0,70 µSv/h the mine waters flowing from few adits shows low concentration from uranium and radium, except one adit which has low water flowrate and concentration up to 2 mg/l.

G24 Primatar dump has a 3,900 m^2 surface and gamma dose rates vary from 0,10 to 0,60 µSv/h.

The G26 Primatar dump has a 12,000 m^2 surface , an inclination angle of about 30^0 , the measured gamma dose rates have 0.16-0.30 µSv/h.

The G27 Primatar dump has a 7,740 m^2 surface , an inclination angle of about 30^0 , and the measured gamma dose rates have 0.10-0.35µSv/h.

- ***Objective BAITA PLAI , Bihor county***

The Baita Plai open pit was the first mine in Romania for uranium ore exploitation.There 3 dumps of sterile and low grade roks , having a total volume of 2,800,000m^3 on a surface of 135,000 m^2. These dumps are located on low slopes and have a heigt of 20 to 100 m. The gamma dose rate measured at 1 m heigt from the soil is 0.26-0.46 µSv/h. radon exhalation was measured being 20-60 Bq/$m^{3.}$

- ***Objective AVRAM IANCU – Bihor county***

  There are 9 sterile rock dumps with a total volume of 1,245,500 m^3located on a 116,950 m^2 surface. The dumps contains hard rocks, 8 have a height under 30 m and one has 100 m. All dumps are located near old forests. The gamma dose rate at 1 m from soil up to 0,31µSv/h.

- ***Objective Ciudanovita mine – Banat county***

In the Ciudanovita area 7 sterile rock and low grade dumps are located on slopes having a height between 3 – 25 m. The total volume of rock is 564,500 m^3 on a 82,000 m^2 surface.

The gamma dose rate at 1 m from soil is 0,10 – 0,60 µSv / h.

Mine waters pumped from underground mine have uranium concentration up to 1.6 mgU/l and radium up to 0.4 Bq/l.

- ***Objective Dobrei mine – Banat county***

Within this mine there are 6 dumps having 1,269,000 m^3 located on a total surface of 81,800 m2. Gamma dose rate has a low average value of 0,25 µSv/h. Higher values are found for low grade rock on Dobrei South dump with peaks at 300 gU/t. Mine waters are pumped from underground works at a flowrate of 1,500 m^3 / day and are treated within a plant where the uranium is removed to a residual concentration of 0,1 mgU/l.

- ***Objective Natra mine – Banat county***

There are 2 dumps having 223,500 m^3 on a 81,800 m^2 surface.
Maximum gamma dose rate at 1 m from soil is 0,25 μSv / h.

c) Sterile rock and low radioactive rock dumps resulted from geological research and mining activities for uranium ores production within the Radioactive Mineral Magurele Company sites

The objectives are former geological sites searched by drilling and underground mining works during 1952 – 2002 period. All works are closed in present and proposed for final remediation.

- ***Objective MILOVA – ARAD county***

9 dumps located on slopes have a total volume of 104,490 m^3 on a 23,250 m^2 surface.

- ***Objective GRADISTE DE MUNTE – ALBA county***

5 sterile rock and low radioactive rock are located on slopes. The total volume is 182,700 m^3 on a surface of 40,000 m^2.

- ***Objective ZIMBRU Valley – BIHOR county***

2 sterile rock dumps located on mountain slopes have a 70,000 m^3 volume . On a 1,600 m^2 surface one can found some low grade ore.

- ***Objective PIETROASA PADIS – BIHOR county***

4 sterile and low radioactive rock dumps have a total volume of 17,200 m^3 . One dump is completely re-vegetated and naturally stabilized.

- ***Objective VACII Valley – LEUCII Valley – BIHOR county***

5 sterile rock dumps have a total volume of 250,000 m^3 on a surface of 43,400 m^2. Gamma dose rate a 1 m from soil gave values of 0.09 – 0.18 μSv/h.

- ***Objective RANUSA – ALBA county***

5 sterile rock and low radioactive raock dumps have a total volume of 283,000 m^3 and covers a 37,600 m^2 surface. The main dump have an average uranium content of 100 grams / ton. Studies for mine closing out and environmental remediation are completed.

- ***Objective ARIESENI – BIHOR county***

4 dumps with a 29,000 m^3 volume are located on a 6,395 m^2 surface. The larger dump have 42,000 m^3. The gamma dose rate is 0,33 - 1 μSv/h and radon exhalation is 20 – 104 Bq/ m^2.
Mine waters have 0.024 – 0.200 mgU/l but dilution is important downside the mine in the Arieseni River.

- ***Objective BICAZU ARDELEAN – NEAMT county***

4 low radioactive rock dumps have a total volume of 62,900 m^3 on a 20,932 m^2 surface.

- ***Objective MEHADIA – CARAS SEVERIN county***

A single dump with a 12,750 m^3 volume and 5,000 $m^2$is located on slope. A very low flow of mine water is flowing into Sfardin brook.

- ***Objective ILISOVA – MEHEDINTI CARAS county***

  There are small 18 sterile rock dumps with a total volume of 12,750 m^3 covering 8,500 m and 10 dumps having 71,500 m^3 and a 51,500 m^2 .

- ***Objective STOENESTI – DAMBOVITA county***

19 small dumps have a total volume of 43,640 m^3 with the largest one, G 5 Danis at 16,900 m^3

- ***Objective RAPSAG-Caras Severin county***

Within this mine , closed for 30 years , there is 1 dump having a 6,500 m^3 on a 700 m^2 surface and a 9 m heigt.
Gamma dose rate at 1 m heigt from the soil has an average value of 0.12 μ sv /h.

- ***Objective PUZDRA – LESU , SUCEAVA county***

The are here 3 sterile rock dumps having a total volume of 95,600 m3.The largest dump has 78,00 m^3 on a surface of 10,050 m^2 and a heigt of 15-50 m.
The average gamma dose rate , measured at 1 m from the soil , is 0.070-0.150 μsv/h.A very low mine water flowrate is present , with an average of 0.3 l/s.

- ***Objective HOJDA MAGURA , SUCEAVA county***

There are 2 series of small dumps , having a total volume of 87,000 m^3 on a 15 ,600 m^2 surface. The heigt is 10-35 m . The average gamma dose rate , measured at 1 m from the soil , is 0.070-0.120 μsv/h.

- ***Objective REPEDEA POIENILE , MARAMURES county***

The are 3 small dumps having a total volume of 11,250 m^3 on a 2,600 m^2 surface. The maximum gamma dose rate value is 0,290 μsv/h.

- ***Objective VENETIA , Brasov county***

3 sterile rock dumps having a total volume of 14,345 m^3.

- ***Objective BÂRZAVA , Arad county***

There is a single dump with a 20,000 m^3 volume, 3,000 m^2 surface and a maximum height of 13 m. The gamma dose rate vary from 0,20 to 0,67 μSv/h and radon exhalation is 36 – 110 Bq/m^3. The sterile rock dump is close to houses of the Bârzava village.

d) Sterile rock and low radioactive rock dumps resulted from geological research and mining activities for thorium ores production within GEOLEX Company

The Jolotca objective is sited at approximately 3 km distance from the village Jolotca.

The mining works were digged for research of rare earth mineralization associated with thorium.

During approximately 40 years, a number of around 40 galleries were digged, most of them of small dimensions.

The works, stopped more than 10 years ago, have produced approximately 40 rock dumps, most of them of small dimensions. From these dumps, only on 4 were found some areas where the dose rate measured at 1 m height was around 2 microSv / h.

These dose rates are produced by rocks with a content of maximum 0.02 % thorium. The thorium content in the mine waters is below 0.04 mg/l.

The radiological risk for the critical group is not significant. The approximately 300 m^3 of rocks with higher content of thorium will be used for filling the mine shaft.

Article 13. Siting of proposed facilities

13.1. Procedures for safety evaluation, public information and neighbor countries consultancy

i. Site related factors likely to affect the safety of the facility

As mentioned before, any proposed facility needs a siting authorization issued by CNCAN based on Law no.111/1996.
It has to be mentioned that till now, the siting of radioactive waste treatment, conditioning and temporary storage plants was realised according to the requirements for the siting of NPP or research reactors. This is coherent with the fact that actually, STDR Magurele, STDR Pitesti, LEPI Pitesti are sited at reactors site, so the requirements for reactor siting are covering the requirements for radioactive waste management facilities. Also the Nuclear Fuel Plant Pitesti was sited at the TRIGA reactor site.
For the siting of future treatment and conditioning plants, and for surface repositories, the new norms, to be issued till the end of 2005, will be in place.

It has to be mentioned that the siting process for a surface repository of short lived radioactive waste from Cernavoda NPP started in 1992. CNCAN asked that the requirements of 10 CFR Part 61 “Licensing requirements for land disposal of radioactive waste” be observed, with modifications related to dose constraints.
The new regulation regarding siting of near surface repositories, to be issued by CNCAN, intends to endorse the IAEA requirements no. WS-R-1 “Near surface disposal of radioactive waste” and the IAEA safety guides no. 111-G-3.1 “Siting of Near Surface Disposal Facilities” and no. WS-G-1.1 “Safety assessment for near surface disposal of radioactive waste”. According to these documents, the site characteristics shall be taken into account in the safety assessment and in the repository design. In determining the site characteristics that are important to the assessment of the site design and safety, the following shall be considered as a minimum: geology, hydrogeology, geochemistry, tectonics and seismicity, surface processes, meteorology, climate and impact of human activities. As the process for siting of the NPP short lived radioactive waste repository is continuing, the Initial Safety Analysis to be submitted as support for the application for siting authorization, shall observe the requirements of IAEA documents.

Also it has to be mentioned that CNCAN already issued in 2002 the Radiological Safety Norms for Radioactive Waste Management from Uranium Mining and Milling. These norms have requirements for siting radioactive waste management of radioactive waste originated from uranium mining and milling activities. It is required to be analysed the characteristic factors related to structural geology, geochemistry, mineralogy, geography and geomorfology, hydrography and hydrogeology of surface and underground waters, climatology, demography and use of land, flora and fauna, archeological aspects and cultural heritage, local population accept. It is stated that the characteristics of the site shall assure the confinement and retention of the radioactive waste.

ii. Safety impact of the facility on individuals, society and environment

The Initial Safety Analysis shall assess the likely safety impact of the repository on individuals, society and environment at any moment in time, till the radioactive waste will decay to a radioactivity that shall not put any significant radiological risk (both for normal and altered scenarious, including intrusion).

Siting process for a new near surface repository

The detaliation of siting activities for the surface repository for NPP short lived radioactive waste is presented below:
Since 1992 an investigation program have been started to select an appropriate site for a future near surface repository for disposal of LILW generated by Cernavoda NPP, both operational and decommissioning waste.
The siting process started with an area survey stage. The region of interest was Dobrogea, a large zone including the NPP site. It is an old historical region with a geological zoning and a semiarid climate, suitable for siting a surface repository. Almost 40 potential sites in Dobrogea region were evaluated. The screening phase reduced the number of candidate sites to two: Cernavoda at 2.5 km from NPP and Saligny situated in the exclusion zone of the power plant.

The criteria for geology, tectonics, seismicity, surface processes and protection of the environment were considered at that stage. IAEA recommendations and its technical support provided to our specialists, enabled us a proper approach of the siting process and assured the suitability of the selected sites.

Even if Cernavoda site seemed to be geologically adequate for a surface repository, social, economical and public acceptance factors prevailed in selection of Saligny site as favorite.
It has been considered that the Saligny site characteristics along with a proper design, waste packages, other engineered barriers and institutional control, would provide radiological protection in compliance with national requirements and taking into account IAEA standards and international recommendations and guidance.

The main geological characteristics of the site according to the investigation done by GEOTEC (a geological company) is the presence of a deep crystalline fundament consisting of a top layer of silty loess followed by three alternative layers of different qualitative clays.

The area is drained by the Danube river which flows at 10-11 meters above Black See level.

The hydrogeological zoning indicated a large unsaturated zone over the watertable. The site is located in an area with low tectonic and seismic activity.

Relevant data to describe site population, industrial activities, water and land transportation, air traffic, etc., have been developed for the Cernavoda NPP with a component of provisions for a longer period, since such a facility was considered for an institutional control period of 300 years.

Currently, field studies and preliminary safety assessments are performed by companies outside of SNN.

Starting with year 2005, ANDRAD has taken over the responsibility to setup the repository. For the year 2006 it is foreseen to continue the site characterization works and preparation of Environmental Impact Assessment and the Initial Safety Analysis Report.

iii. Public consultancy

When selecting a site, the future licensee has to consult the public. The Environment Agreement is issued by the Environmental Protection Authority, after analyse of the Environmental Impact Study. Public consultancy of this study is required, and the decision for issuing the Environment Agreement takes into account the opinion of the members of the public. The Environment Agreement is a prerequisite for issuing by CNCAN of the Construction Authorization. In fact, public consultancy starts at earlier stage, when the prefesability study is presented to the Environmental Protection Authority.

The above mentioned consultancy process is done based on the transposition of the Directive 85/337/EEC on Environmental Impact Assessment, amended by the Directive 97/11/EC. The transposition is realized through the Emergency Governmental Ordinance no. 91/2002 amending the Law no. 137/1995 on Environmental Protection, the Governmental Decision 918/2002, and the Orders of the Minister of Waters and Environment Protection no. 860/2002 and no. 863/2002.

iv. Consultancy of Contracting Parties in the vicinity of the radioactive waste management facilities

Romania has ratified the ESPOO Convention. Consequently, any country (not only a Contracting Part), that could be affected by a radioactive waste management facility sited on Romanian territory will be announced, and will receive, upon request, the general data relating to the facility to enable it to evaluate the likely safety impact of that facility upon its territory.

13.2. Avoidance of unacceptable effects on Contracting Parties in the vicinity of the radioactive waste management facilities

The Initial Safety Analysis, as well as the latter Preliminary Safety Analysis Report and Final Safety Analysis Report, for any new nuclear facility (not only for radioactive waste management facilities) shall prove that the national requirements, which are in line with the internationally endorsed criteria and standards, are met for individuals, society and environment, at the same level for national territory and for neighbor countries.

This requirement is obviously fulfilled for radioactive waste handling and storage facilities. Also, for surface repositories for short lived radioactive waste, it is relatively easy to demonstrate the fulfillment of the requirement. When siting a radioactive waste deep geological repository, due consideration will be given to the assessment of the impact on neighbor countries.

Article 14. Design and construction of facilities

The design and construction of a radioactive waste management facility at NPPs and research reactors is part of the design and construction of the plants, respectively of the reactors. As all of the requirements of Article 14 of the Joint Convention are required by the Romanian legislation for all nuclear installations, the authorization of construction of a NPP or radioactive waste management facility is granted by CNCAN only if, inter alia:
i. the design and construction of the radioactive waste handling and storage system provide for suitable measures to limit possible radiological impacts on individuals, society and environment;
ii. at the design stage, conceptual plans and, if necessary, technical provisions for the decommissioning of radioactive waste management facility other than a disposal facility are taken into account;
iii. at the design stage, technical provisions for the closure of a disposal facility are prepared;
iv. the technologies incorporated in the design and construction of spent fuel management facility are supported by experience, testing or analysis.

For NPP Cernavoda Unit 2, the construction was stopped in 1990, and the construction remained under conservation. The restart of the construction was decided in 2001.
It has to be mentioned that the radioactive waste management systems of Cernavoda NPP Units 1 and 2 were designed to meet adequate safety standards used in Canada and in other six countries.

As it was presented in the paragraph related to article 13 on siting of proposed facilities, for the construction of the future NPP short lived radioactive waste near surface repository, a Romanian regulation will be in place, transposing the IAEA requirements no. WS-R-1 “Near surface disposal of radioactive waste” and the IAEA safety guides no. 111-G-3.1 “Siting of Near Surface Disposal Facilities” and no. WS-G-1.1 “Safety assessment for near surface disposal of radioactive waste”. The Joint Convention obligations presented in Article 14 will be fulfilled also for the associated treatment plant, as the IAEA requirements no. WS-R-2 “Predisposal management of radioactive waste, including decommissioning” will be also transposed in a Romanian regulation.

Regarding the waste originated from uranium mining and milling, it has to be mentioned that the recently issued regulation “Radiological Safety Norms for

Radioactive Waste Management from Uranium Mining and Milling" has a chapter with requirements related to design and construction, covering the requirements of the Joint Convention.

In conclusion, as it was previously explained, the construction authorization for any radioactive waste management facility will be granted by CNCAN based on the Preliminary Safety Analysis Report, that shall demonstrate the fulfillment of the requirements of the Joint Convention presented in Article 14.

Article 15. Assessment of safety of facilities

i. Initial safety assessment

According to the Romanian laws and regulations, for sitting a nuclear facility, including a radioactive waste management facility, a siting authorization shall be issued by CNCAN. This authorization is issued based on a Initial Safety Analysis, as it was presented in the paragraph related to article 13.

As it was presented in the paragraphs related to articles 13 and 14, before construction of any nuclear facility, including a radioactive waste management facility, an environmental agreement issued by the Environmental Protection Authority and a construction authorization issued by CNCAN are required. The environmental agreement is issued based on an Environmental Impact Study while the CNCAN authorization is issued on the basis of a Preliminary Safety Analysis Report.

ii. Updated and detailed safety assessment

According to the Romanian laws and regulations, for issuing by CNCAN of a commissioning authorization for a nuclear facility, including a radioactive waste management facility, a Final Safety Analysis Report is required, while for issuing by CNCAN of a probationary operation authorization or an operation authorization, amended Final Safety Analysis Reports are required. These requirements will be presented in the paragraph on article 16.

Operation requires also the issuing by the Environmental Protection Authority of an operating authorization. This last authorization is issued after starting of the operation, based on Environmental Report, that includes measurements of environmental parameters.
The operating authorizations are issued by CNCAN and by the Environmental Protection Authority for a limited period of time and have to be renewed periodically. That requires the update of supporting safety and environmental assessments.

Systematic impact assessment according to internationally recognized criteria and standards are required for completion of the Environmental Impact Study and of the Environmental Report.

The Initial Safety Analysis Report, Preliminary Safety Analysis Report, Final Safety Analysis Reports and their supporting documents are containing systematic assessment of the nuclear safety and of the environmental impact, in accordance with the internationally accepted criteria and standards. This is obviously the case for the spent fuel facilities inside the NPP or reactors, where the safety of the handling and storage of spent fuel are assessed in the general context of the safety of the entire facility.

For NPP radioactive waste management systems, the Initial Safety Analysis Report, the Preliminary Safety Analysis Report and the Final Safety Analysis Report are realised for the whole facility.

As it was presented in the paragraphs related to articles 13 and 14, the content of Initial Safety Analysis Report and of Preliminary Safety Analysis Report for future radioactive waste management facilities shall reflect the content of IAEA requirements and guides. The same is true for the Final Safety Analysis Report.

Requirements related to the content of the radioactive waste management facilities from uranium mining and milling are included in the “Radiological Safety Norms for Radioactive Waste Management from Uranium Mining and Milling”.

For the case of existing radioactive facilities STDR Magurele, STDR Pitesti and LEPI Pitesti, periodical review of the safety assessment of the facilities are required. A revised Safety Analysis Report will be required soon for STDR Magurele, in order to establish refurbishment measures.

For DNDR Baita Bihor, it has to be mentioned that the siting and construction authorization, as well as the latter operation authorization were issued based on a documentation that was not at the level required by the new IAEA regulations. CNCAN required IFIN-HH to perform a new Initial Safety Analysis, that was submitted in 2002. A Preliminary Safety Analysis Report will follow before the end of 2006, to establish the construction improvements and higher activity concentration limits. At a latter stage a Final Safety Analysis Report will be submitted to CNCAN.

Article 16. Operation of facilities

i. Licensing

The radioactive waste management systems operated by CNE-PROD Cernavoda are nuclear power plant systems. The Cernavoda NPP operation was licensed by CNCAN following the legal procedure and based on appropriate assessment of safety. All safety analyses to support the five-formal licensing stages (site authorization, construction authorization, commissioning authorization, probationary operating authorization, and operating authorization) were performed for U1.
The Operating authorization was issued based on two succesive steps:

- Probationary operating authorization;
- Operating authorization.

The Probationary Operating Authorization was issued based on the amended Final Safety Analysis Report, which includes the commissioning test and control program results. The report is structured according to the provisions of the NRC Regulatory Guide 1.70.

The Operating License was finally issued based on the amended Final Safety Analysis Report (Phase II), which contains amendments derived from the results and conclusions of the probationary operating period.

Every 2 years the operation authorization is renewed, and appropriate assessments are requested in support of the application for issuing of the new authorization.

For any radioactive waste management facility the authorization to operate the facility is based on the Final Safety Analysis Report and is conditional on the completion of the commissioning program demonstrating that the facility, as constructed, is consistent with design and safety requirements.

ii. Operational limits and conditions

As mentioned previously for spent fuel systems, CNE-PROD Cernavoda issued under CNCAN approval, the reference document “OPERATING POLICIES AND PRINCIPLES”. This document describes how the utility operates, maintains and modifies the safety-related systems in order to maintain the nuclear safety margins and consequential risk to the public acceptably low. This document defines the specific operating limits for safety related systems, which must be maintained all the time to ensure that the plant always operates within its analyzed safe operating envelope. Other key boundaries for operation of radioactive waste management systems are included in their Operating Manuals.

The technical basis for the safe operating envelope are found in the Final Safety Analysis Report which includes the description of the safety analysis that examines the facility response to disturbances in process function, system failures, component failure or human errors. Safety analyses predict the consequences of the design basis accidents and compare them with the regulatory requirements.

In addition a set of nuclear safety topics are integrated into the assembly of the measures by which the station performance is to be judged. Safety performance shall be assessed against the safety-related topics. Where discrepancies are met, corrective actions shall be implemented.

For FCN Pitesti, STDR Pitesti, LEPI facility, STDR Magurele and DNDR Baita Bihor, technical (operational) limits and conditions are established, based on assessments, tests and operational experience. For DNDR Baita Bihor the limits and conditions include the waste acceptance criteria.
The technical limits and conditions are revised as necessary.

iii. Operation, maintenance, monitoring, inspection and testing

As parts of CNE-PROD NPP, the radioactive waste management systems’ operation, maintenance, monitoring, inspection and testing activities are performed

according to Station regulations: Operating Policies and Principles, Maintenance Philosophy, Quality Assurance Manual.
All these documents include, directly or by reference to appropriate procedures, rules that must be followed in performing activities related to operation, maintenance, inspection and testing.
As these documents are sustaining the operating license, the compliance with their requirements is mandatory for the Station and any deviation must be reported to CNCAN.

As an example is presented the Cernavoda NPP radioactive waste systems monitoring programs, which are part of NPP monitoring program

The Solid Radioactive Waste Interim Storage Facility monitoring program includes:

- Ground water sampling for beta-gamma and tritium activities
- Atmospheric radiation surveys including air samples and gamma dose rate at the site boundary
- Contamination surveys of the entire site and structures
- Structures watertight surveys

Status of constructions during operations is monitored as follows:

- by current observations, visualizing the general status of the three concrete structures;
- by special observations performed precision measurements on fixed points with the intent of survey external platform and buildings status;

Monitoring of radioactive organic liquids waste storage spaces is performed by means of gamma monitoring systems and monitoring of air contamination in accordance with radiation protection procedures.
Monitoring of spent resins storage vaults, as well as detection of excessive radiation levels in the room located in the neighborhood of the vaults is performed by means of gamma monitoring systems and monitoring of air contamination.

Similar requirements does exist for FCN Pitesti, LEPI and STDR Pitesti, STDR Magurele, DNDR Baita Bihor.

iv. Engineering and technical support

The station organisation chart for CNE-PROD Cernavoda NPP documents the general areas of responsibility. The structure of the organisation considers the needs for engineering and technical supports and for this reason it includes a strong Technical Unit covering System Performance Monitoring, Design Engineering and Safety & Compliance.
Also, it should be mentioned that a strong link is maintained with Romanian research institutes and with designer of the plant, Atomic Energy Canada Limited, Romania being member of CANDU Owners Group.
FCN Pitesti, SCN Pitesti and IFIN-HH consider also needs for engineering and technical supports. Their organizational chart include also staff for operation, maintenance, monitoring, inspection and testing of radioactive waste management facilities.

v. Procedures for characterization and segregation of radioactive waste

As it was presented in a previous paragraph of the section B “Policies and Practices” the radioactive waste are categorized and segregated at all radioactive waste management facilities. It shall be mentioned that at STDR Magurele and STDR Pitesti all radioactive waste conditioned packages are measured to comply with waste acceptance criteria at Baita Bihor. At NPP Cernavoda, based on origin, a radionuclide composition matrix is assigned for radioactive wastes. Special requirements for more detailed radioactive waste characterization and activity measurements were formulated by CNCAN. This process is required also in support for the Initial Safety Analysis for the siting of the future NPP short lived radioactive waste repository.

vi. Incidents reporting to CNCAN

Incidents significant to safety are reported in a timely manner by the holder of the authorization to the regulatory body, according to established procedures. These reports and procedures are requested by CNCAN according to authorization conditions.

CNE PROD has to submit to the regulatory body the following types of reports:

- Abnormal Condition Reports are prepared to report those events that could have significant adverse impact on the safety of the environment, the public or the personnel, such as: serious process failures, violations of the Operating Policies and Principles, release of radioactive materials in excess of targets, doses of radiation which exceed the regulatory limits, events which interfere with the IAEA safeguards system.

For each reportable event a notification is made to the CNCAN immediately after the discovery of the reportable event or within one working day depending on the gravity of the event and a report is prepared to document the event. For the events that are significant or complex, more detailed reports are prepared as Abnormal Condition Reports and submitted to CNCAN within the required time period.

- Quarterly reports are to be prepared to provide information regarding the safety systems reliability performance, dose statistics and radioactive emission, performance indicators, a review of process, safety and safety support systems including the design changes, a review of the nuclear fuel and heavy water management, the result of the chemistry control, radiation control, a review of the emergency planning a reactor core safety assessment, etc.
- Safety Analysis Report updates should analyse the design and procedural changes and include the new safety analysis. These updates should be submitted to CNCAN each two years from the last update, excepting the case when CNCAN takes an other decision.
- Annual radiological environment monitoring reports are to be prepared to provide information on the off-site radiological environmental monitoring program, the individual doses that are calculated as doses to critical group, a review of the radiological environmental monitoring quality assurance program, and any unusual event during the calendar year.

- Annual research and development reports should describe the planned research and development programs that address the unresolved safety questions.
- Periodic inspection reports are to be prepared to describe the results of any subject inspections in compliance with applicable standards.
- Annual reliability reports should include an evaluation of systems that has specific reliability requirements given in the licensing documentation. A review of updated documents should be provided with the focus on the design changes and their impact on the analysis results.

Similar reporting systems are established in the authorization conditions and are precised in internal procedures of the licensee, in the case of FCN Pitesti, SCN Pitesti and of IFIN-HH.

vii. Collection and analyze of relevant operating experience

For Cernavoda NPP the station goal for operating experience is to effectively and efficiently use lessons learned from other plants and station operating experience to improve plant safety and reliability.
Station events and human performance problems often result from weaknesses or breakdowns in station processes, practices, procedures, training and system or component design that were not previously recognized or corrected. This is the reason why Cernavoda NPP consider, as the main topic of the Operating Experience Program, the Event Analysis System, comprising identification, evaluation and analysis of operational events (both internal and external) in order to establish and implement corrective actions to avoid re-occurrence.

The external information regarding operating experience proved to be a very important tool in improving station performance. Therefore, the second main topic of the operating experience program is the Information Exchange Program, with bi-directional use:
♦ collecting of external information and distribution to the appropriate station personnel;
♦ submitting the internal operating experience information to external organizations.

The basis for Operating Experience Program was set in place since the early stage of the commissioning phase (1993), with the objective to ensure:
- the reporting, reviewing, assessing of the station abnormal conditions and establishing of the necessary corrective actions;
- information exchange within CANDU Owner Group (COG), regarding abnormal conditions, technical problems, research and development projects, etc.

As a result, all the activities related to this topic were assigned to a new structure, an Operating Experience Group was created, and the program based on the ASSET philosophy "*prevention of incidents - the path to excellence operational safety*" is now developed in an integrated and centralized manner.

For this reason, the abnormal conditions assessment programs includes low level events analysis as precursors of the major events. The new created group together with technical unit's specialist's analyses, using ASSET methodology, the external

and internal abnormal conditions, and proposes to the station management an action plan, to improve the plant safety and to avoid the events reoccurrence.
For the information exchange program, a COG (CANDU Owner Group) contact officer, appointed by the station management, with the following general responsibilities covers the relation between CERNAVODA NPP and COG:

- serving as a liaison between COG and the station;
- reviewing the incoming messages and distributing them to the appropriate persons;
- ensuring the transmittal of the required information/reports to COG;
- ensuring optimum participation by the station personnel.

Programs to collect and analyse relevant operating experience are in place also at FCN Pitesti, SCN Pitesti and IFIN-HH.

viii. Decommissioning plans for radioactive waste management facilities

According to the provisions of Law no.111/1996 any nuclear installation needs to prepare decommissioning plans. This is valid also for the radioactive management facilities, other than repository. The new Norms for Decommissioning of Nuclear Objectives and Installations require that for any radioactive waste treatment and conditioning facility, as well as for any radioactive waste intermediate storage, decommissioning plans be prepared and updated.

ix. Plans for closure of disposal facilities

Till now there were not issued the specific norms for repositories, except the “Radiological Safety Norms for Radioactive Waste Management from Uranium Mining and Milling” that have provisions regarding the closure of the waste management facilities for uranium mining and milling. The new norms will include requirements related to plans for closure of disposal facilities, from the design and construction stage.

Article 17. Institutional measures after closure

As presented above, except the closure of uranium mining and milling repositories, for other repositories there are not yet issued specific norms. However the authorization process for siting of the new surface repository requires demonstration of the post closure evolution of the repository. The new regulation for radioactive waste short lived repositories will require that:

i. records of location, design and inventory of the repository be preserved;
ii. active or passive institutional controls such as monitoring or access restrictions are carried out;
iii. in case of unplanned release during institutional control period, intervention measures be implemented, if necessary.

It has to be mentioned that for the uranium mining and milling repositories, such requirements are already implemented by the new “Radiological Safety Norms for Radioactive Waste Management from Uranium Mining and Milling”.

SECTION I. TRANSBOUNDARY MOVEMENT

Article 27. Transboundary movement

27.1. Steps to ensure that transboundary movements are undertaken in a manner consistent with the Joint Convention and binding international instruments:

i. Authorization of transboundary movement

According to Law no. 111/1996, import, export, and transit of radioactive materials, including spent fuel and radioactive waste, shall be authorized by CNCAN. It shall be noted that according to the above mentioned law, the import of radioactive waste (including of spent fuel, as Romania considers spent fuel to be radioactive waste) is prohibited. The only exception is when the import follows directly from the processing outside Romanian territory, of a previously authorised export of radioactive waste (including spent fuel), on the basis of the provisions of international agreements or of contracts concluded with commercial partners, under the terms of Law no. 111/1996.

According to the Romanian Norms for Transport of Radioactive Material – Authorization Procedures, the international shipment of radioactive materials can be performed only if the carrier get a transport authorization issued by CNCAN, and the carrier or consignor get a shipment authorization issued by CNCAN for that particular shipment.

Supplementary, for the shipment of radioactive waste, the Norms for International Shipments of Radioactive Wastes Involving Romanian Territory are also applicable. These norms are transposing the Council Directive 92/3/EURATOM on shipment of radioactive waste between Member States and into and out of the Community.

By the conditions stated in the authorization, CNCAN asks to be notified before the entry on Romanian territory of radioactive materials, including radioactive waste. For spent fuel transport special requirements for notification are in place as escort and emergency planning special arrangements are required. The transit or export can actually be conducted only if the licensee has all the authorizations from the countries involved, including of the country of destination.

ii. Subject of transit to relevant international obligations

As stated above in general for the transboundary movement, the transit on Romanian territory of radioactive waste and spent fuel is subjected to Romanian regulations, that are endorsing the IAEA regulation and international modal regulations (Fundamental Norms for Safe Transport of Radioactive Materials are endorsing IAEA TR-S-1 regulation, except that the authorization requirements, presented in the Norms for Transport of Radioactive Material – Authorization Procedures, are more stringent). It has to be noted that in Romania the modal regulations for transport of dangerous goods (RID, ADR, ICAO, IMDG) are in force.

As it was explained above, all international shipments of spent fuel/radioactive waste involving Romanian territory need to be authorized by CNCAN. Also the transport package for fissile materials, and the Type B (U) or B (M) packages need to receive Romanian validation of type approval. Insurance up to maximum level stated in Paris Convention on Third Part Liability in the field of Nuclear Energy, and Brussels Convention Supplementary to the Paris Convention, and arrangements for technical intervention following an accident are prerequisites for granting the Romanian shipment authorization for spent fuel.
In the authorization process, conditions are stated for presenting all the authorizations of the countries involved in the transport, and for harmonization of emergency plans and of escort arrangements of the countries involved in transport of spent fuel.

iii. Consent of transboundary movement by the State of destination

As presented above Romania does not allow the import of radioactive waste or spent fuel, so the requirement related to acceptance by the State of destination of the transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or radioactive waste in a manner consistent with the convention is not applicable.

iv. Authorization of transboundary movement by the State of origin

According to the provisions of the Norms for International Shipments of Radioactive Wastes Involving Romanian Territory, CNCAN shall not authorize radioactive waste shipments to a country which, in the opinion of CNCAN, does not have the technical, legal or administrative resources to manage radioactive waste safely.
As Romania considers spent fuel to be radioactive waste, the requirement is applicable also for spent fuel.

v. Re-entry into the territory of the country of origin in case the transboundary movement is not or cannot be completed in accordance with safety requirements

According to the provisions of the Norms for International Shipments of Radioactive Wastes Involving Romanian Territory, when an international shipment of radioactive materials (or spent fuel) cannot be performed, or the shipment does not fulfill the requirements imposed for the authorization (approval) of the shipment, the radioactive material (spent fuel) shall be returned to the initial holder.

27.2. Shipment of spent fuel or radioactive waste to a destination south to latitude 60º South for storage or disposal

According to the provisions of the Norms for International Shipments of Radioactive Wastes Involving Romanian Territory, CNCAN shall not authorize radioactive waste shipments to a destination south of latitude 60º south.
As Romania considers spent fuel to be radioactive waste, the requirement is applicable also for spent fuel.

27.3. Rights of contracting parties

As presented before, Romania has a legislative framework in accordance with international agreements and recommendations.

i. The Romanian transport regulations do not affect the exercise by ships and aircrafts of foreign countries, of maritime, river and air navigation rights and freedoms, as provided by international law.

ii. As presented above, import of radioactive waste shall be allowed, when the import follows directly from the processing outside Romanian territory, of a previously authorised export of radioactive waste, on the basis of the provisions of international agreements or of contracts concluded with commercial partners, under the terms of Law no. 111/1996.

iii. At this moment, Romania does not intend to export spent fuel for reprocessing. However, the Law no. 111/1996 establishes that this is allowed.

iv. If export of spent fuel for reprocessing will be performed, the radioactive waste and other products resulting from reprocessing will be allowed to be returned, according to the provisions of the Law no. 111/1996 presented above.

SECTION J. DISUSED SEALED SOURCES

Article 28. Disused sealed sources

28.1. Safe possession, remanufacturing or disposal of disused sealed sources

According to Romanian regulations, the radiation practices, including those involving sealed sources, shall be authorized. Excepted practices involve very low activity sources in consumer products, e. g. ^{241}Am smoke detectors of 1 µCi. According to Radiological Safety Fundamental Norms, even these excepted sources are required to be disposed as radioactive waste.

The authorization of a practice does include the list of radiological installations, and the list of sealed sources contained in these installations. Actually only the sources with half lives greater than one year are recorded. For the sources with shorter half lives, the internal system of recording of the transfer of the sources kept by the licensee and by the company which take the source for replacement, allows CNCAN to keep control of movement. The transfer of radiological installations and radioactive sources from one holder of authorization to other holder requires transfer authorization
The transfer of sources for remanufacturing is also performed according the above mentioned requirements.
The transfer of sources for treatment, conditioning and long term storage or disposal is performed without transfer authorization. In this case, the sources are transferred to STDR of IFIN-HH Magurele and STDR of SCN Pitesti. The two STDR have procedures for receiving the sources and for keeping records. Of course, if the source was recorded in the authorization of the user (i.e. the source has a half-live longer than one year), or if the source is transferred to STDR together with the radiological installation, the modification of the authorization of the previous holder is necessary.

Generally, CNCAN requires that the sources that are no longer used, be transferred to STDR Magurele, or to another user, if they are still able to be used.

The storage of the disused sources is inspected by CNCAN, and if the conditions are not acceptable, CNCAN can take actions to enforce observance of regulations.

28.2. Reentry into the territory of Contracting Party of disused sealed sources

As presented before, according to Law no. 111/1996, Romania does not allow the import of radioactive waste, i.e. reentry on Romanian territory of disused sealed sources is not allowed.

SECTION K. PLANNED ACTIVITIES TO IMPROVE SAFETY

1. A main issue is the establishing of the Fund for Radioactive Waste Management and for Decommissioning, in order to assure financial resources for spent fuel and radioactive waste management , including disposal.

2. Another important issue is the revision by ANDRAD of the strategy for the spent fuel management and for radioactive waste management, including their final disposal.

3. In order to improve safety of radioactive waste management ANDRAD shall establish and update the Yearly Activity Plan. Main issues to be addressed at this moment are:

a) The refurbishment of the Radioactive Waste Treatment Plant (STDR) Magurele and the establishing of technologies for long term storage of long lived radioactive waste, especially for long lived spent sealed sources. It has to be mentioned that an EC project for the investigation of STDR Magurele was performed in 2000. However, due to ageing, the liquid treatment installation needs at this moment major replacements of equipment and pipes, that were not recommended in the previous project. IFIN-HH has conducted an assessment regarding the liquid radioactive waste treatment installation and had concluded that the best solution is to provide STDR Magurele with a mobile installation.

b) The realization of the Preliminary Safety Analysis Report, for the Baita Bihor short lived radioactive waste repository. An Initial Safety Analysis for Baita Bihor repository was performed in 2002, based on the results of a PHARE project entitled Preparatory Measures for the Long Term Safety Assessment of the Low-Level Radioactive Waste Repository Baita-Bihor. At this moment a PHARE 2002 project, continuing the previous one is undergoing. The project purpose is to perform the Preliminary Safety Analysis and the drawing up of a report under international expertise. The report will be completed in September 2006.

c) The refurbishment of Baita-Bihor repository through the PHARE 2003 project “Upgrading of the Baita-Bihor Repository for Institutional Waste in Romania”. Under this project, a number of urgent upgrading measures will be implemented (i.e. replacement of the electric, ventilation, drainage and transport systems, waterproofing of the galleries, a new and modern physical protection system, a technological building for the workers, improvement of radiological monitoring).

d) Another safety issue is the decommissioning of the VVR-S research reactor Magurele. In order to assist this decommissioning, the IAEA project ROM/4/029 “Strengthening the Infrastructure for the Decommissioning of the Research Reactor at Magurele-Bucharest” is undergoing.

e) Regarding the spent fuel, the main issue is related to the corrosion of the old Aluminum EK-10 spent fuel of VVR-S reactor Magurele.

f) As Romania get assistance through Russian Research Reactor Fuel Return program, USDOE – IAEA – Russian Federation – Romania, dedicated to return of S-36 spent fuel to Russian Federation, the implementation of this arrangement is undergoing.

g) The reconditioning of IFIN-HH historical radioactive wastes in view of their disposal is another activity to be performed at Magurele site; the activity will start according to a project ongoing with DTI of Great Britain.

h) Improvement of the transport of radioactive waste to Baita-Bihor repository and of the environmental monitoring program at the repository through an other project with DTI of Great Britain.

i) Training of STDR Magurele personnel in radioactive waste management (from collection to disposal) through a third project with DTI of Great Britain.

j) Finalising the Initial Safety Analysis for siting the new surface repository for Cernavoda short lived radioactive waste is also necessary.

k) Closure of the first part of Cetatuia II tailing pond of the Uranium Milling Plant of the Feldioara Subsidiary of the National Uranium Company is also an issue to be addressed in the future. The solving of this issue shall require important financial resources.

l) Rehabilitation of the sites with sterile rock and low radioactive rock dumps resulted from geological research and mining activities for uranium ores production within the National Uranium Company shall be assessed and performed under intervention principles.

SECTION L. ANNEXES

a) List of Spent Fuel Management facilities

a1) List of Nuclearelectrica spent fuel management facilities
- CNE - PROD Cernavoda - Spent Fuel Bay
- CNE-PROD Cernavoda – Interim Spent Fuel Dry Storage

a2) List of SCN Pitesti spent fuel management facilities
- The Spent Fuel Storage Pool;
- The Dry Storage Pits.

a3) List of IFIN-HH spent fuel management facilities
- The Spent Fuel Cooling Pool;
- The Spend Fuel Storage Pools.

b) List of Radioactive Waste Management Facilities

b1) List of Nuclearelectrica radioactive waste management facilities
- CNE-PROD Cernavoda – Solid Radioactive Waste Interim Storage
- CNE-PROD Cernavoda - Spent Resins Handling System
- CNE-PROD Gaseous Radioactive Waste System
- CNE-PROD Liquid Radioactive Waste System
- Nuclear Fuel Plant Gaseous Radioactive Waste System
- Nuclear Fuel Plant - Liquid Waste Temporary Storage Tanks
- Nuclear Fuel Plant – Temporary Storage Platform for Low Contaminated Solid Waste

b2) List of SCN Pitesti radioactive waste management facilities
- Radioactive Waste Treatment Plant
- Post Irradiation Examination Facility

b3) List of IFIN-HH radioactive waste management facilities
- Radioactive Waste Treatment Plant
- National Repository for Low and Intermediate Level Wastes Baita - Bihor

c) List of nuclear facilities in process of being decommissioned

- VVR-S research reactor of IFIN-HH Magurele

d) Inventory of spent fuel

d1.1) Cernavoda NPP –Unit 1 Spent Fuel Bay inventory

Year/Month	Type	Number of fuel bundles
2004/ December	CANDU-37 elements	31912

d1.2) *Cernavoda NPP – Interim Spent Fuel Dry Storage Inventory*

Year/Month	Type	Number of fuel bundles
2004/ December	CANDU-37 elements	8400

d2) SCN Pitesti spent fuel inventory

The TRIGA storage pool contains:
- 180 TRIGA – HEU - type elements,
- 1 TRIGA – LEU - type element,
- 3 CANDU - type bundles,
- 1 CANDU - type experimental element.

The storage pits at the LEPI hot cell includes:
- approximately 21.64 kg uranium in LEU spent fuel elements and fragments, including approx. 0.1 kg unirradiated fuel,
- approximately 0.321 kg uranium in HEU spent fuel and fragments, including a few grams of unirradiated fuel,
- approximately 5.32 kg natural uranium in spent fuel elements and fragments, including 0.128 kg unirradiated natural uranium.

d3) IFIN – HH spent fuel inventory

The total inventory of spent fuel in storage pools and cooling pool of IFIN-HH consists in:
- 153 EK-10 type assemblies (10% initial enrichment)
- 70 S-36 type assemblies (36.7% initial enrichment)

e) Inventory of radioactive waste

e1) CNE-PROD (Cernavoda NPP–Unit 1) radioactive waste inventory

e1.1) Solid radioactive waste volumes segregated as compactable and non – compactable.

Cernavoda NPP. Compactable and non-compactable solid radioactive waste volumes generated between 1996-2004

Year	**Solid radioactive waste**			
	Compactable (m^3)	**Non – compactable (m^3)**		**Total (m^3)**
		Drums (m^3)	**Spent filters (m^3)**	
1996	2.86	0.44	0.01	3.31
1997	9.46	1.98	0.43	11.87
1998	14.96	1.32	0	16.28
1999	16.5	4.84	0.01	21.35
2000	12.1	3.96	0.26	16.32
2001	14.96	9.24	0.02	24.22
2002	19.14	10.1	0.13	29.39
2003	19.80	6.60	0.01	26.41
2004	19.58	9.68	0.52	29.78
Total	129.36	48.18	1.39	179.14

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e1.2) Solid radioactive waste volumes segregated by types: T1, T2 and T3.

Cernavoda NPP. Solid radioactive waste segregated by contact gamma dose rate

Year	Type T1 (m3)	Type T2 (m3)	Type T3 (m3)
1996	3.31	0	0
1997	11.73	0.14 (non-compactable, spent filters, 12 mSv/h)	0
1998	16.28	0	0
1999	20.91	0.44 (compactable, drums, 8.5 mSv/h)	0
2000	16.23	0	0
2001	24.21	0.01 (non-compactable, spent filters, 3.8 mSv/h)	0
2002	29.,04	0.22 (compactable, drums, 2.91 mSv/h)	0
2003	26.41	0	0
2004	29.78	0	0
Total	177.9	0.8	0
Maximum contact gamma dose rates	1500 µSv/h.	as specified above	N/A

e1.3) Spent resins volumes segregated by system source
Cernavoda NPP spent resins volumes generated between 1996-2004.

System / volumes / m^3	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total / system**
Moderator System	3.00	2.80	1.200	1.400	1.800	2.000	1.400	1.4	1.80	16.8
Heat Transport System	0.00	2.08	0.000	2.120	2.160	2.160	2.000	0	2.00	12.52
Fuelling Machine D_2O System	0.00	0.00	0.200	0.200	0.400	0.000	0.600	0.2	0	1.6
D_2O Clean-up System	1.20	2.33	1.800	1.800	1.400	0.600	1.200	2.00	1.60	13.94
End Shield Cooling System	0.00	0.20	0.200	0.000	0.200	0.200	0.000	0.40	0.80	2
Spent Fuel Bay	0.00	2.26	2.260	0.000	2.260	0.000	2.260	0	2.40	11.44
Liquid Zone Control	0.00	0.40	0.200	0.200	0.200	0.400	0.000	0.2	0.2	1.8
Liquid Radioactive Waste	0.025	0	0-	0.040	0	0	0	0	0	
Total / year/ m^3	4.225	10.07	5.86	5.76	8.42	5.36	7.46	4.200	8.800	60.165

e1.4.1) Organic Liquid Radioactive Waste: spent oils

Year	**Spent oils (m^3)**
1996	0.66
1997	0.22
1998	1.54
1999	4.18
2000	4.62
2001	0.44
2002	0.44
2003	2.20
2004	2.42
Total to date	16.72
Maximum contact gamma dose rate	$\leq$3 μSv/h

e1.4.2) Distribution of spent oils based on the order of magnitude of tritium content:

Tritium content (Bq/l)	10^3	10^4	10^5	10^6
Volumes (m^3)	1.32	2.46	11.0	0.44

e1.5) Organic liquid radioactive waste: spent solvent

Year	**Spent Solvent (m^3)**	**Tritium Bq/l**
1997-1998	0.66	10^5
2000	0.22	10^6
2001	0	N/A
2002	0.22	10^6
2003	0.00	N/A
2004	0.00	N/A
Total to date	1.1	
Maximum contact gamma dose rate	$\leq$3 μSv/h	

e1.6) Organic Liquid Radioactive Waste: liquid scintillator

Volume to date: 1.1 m^3

Contact gamma dose rates: < 3 μSv/h.

Maximum tritium content: 10^8 Bq/l.

Anticipated tritium content after liquid scintillator segregation by tritium content:

Sources	Dozimetry Lab. liquid effluents samples	Chemistry Lab. moderator and PHT samples	Chemistry Lab. other samples
H-3 (Bq/l)	10^2 - 10^3	10^9 - 10^{10}	10^4

e1.7) Organic Liquid Radioactive Waste: radioactive sludge

Year	Volume (m3)
1997	0.44
2000	0.22
2001	0.00
2002	0.22
2003	0.00
2004	0.44
Total to date	1.32
Maximum contact gamma dose rate	(40-110) μSv/h

e1.8) Flammable solids (solid –liquid mixture)

Year	Volume (m3)
1996	0.44
1997	1.10
1998	1.98
1999	1.10
2000	1.54
2001	1.54
2002	.154
2003	1.76
2004	1.98
Total to date	12.98
Maximum contact gamma dose rate	(50-200) μSv/h

e1.9) Derived Emission Limits for airborne releases and liquid releases

Derived Emission Limits for Airborne Releases		Derived Emission Limits for Liquid Releases	
Radionuclide/ Radionuclide Group	DEL (GBq/week)	Radionuclide/ Radionuclide Group	DEL (GBq/month)
H-3 (oxide)	1.01E+06	H-3	6.06E+06
C-14 (gaseous)	2.11E+03	C-14	2.45E+05
I-131 (mfp)	6.62E+00	Cr-51	2.26E+06
Noble Gases($GbqMeV \times week^{-1}$)	4.15E+05	Mn-54	1.01E+04
Particulate*	1.33E+00	Fe-59	1.92E+04
Cr-51	2.69E+04	Co-58	2.55E+03
Mn-54	2.96E+02	Co-60	5.72E+02
Fe-59	1.08E+02	Zn-65	5.75E+03
Co-58	9.54E+00	Sr-89	1.98E+04
Co-60	8.84E+00	Sr-90+	1.83E+02
Zn-65	3.20E+01	Zr-95+	1.53E+04
Sr-89	6.01E+01	Nb-95	1.27E+04
Sr-90+	2.77E+00	Ru-103	9.03E+04
Zr-95+	3.04E+02	Ru-106+	1.33E+04
Nb-95	6.29E+01	Sb-124	1.89E+04
Ru-103	6.47E+02	Sb-125	6.09E+03
Ru-106+	4.99E+01	I-131 (mfp)	2.90E+03
Sb-124	1.75E+02	Cs-134	1.47E+03
Sb-125	1.94E+02	Cs-137	4.63E+02
Cs-134	6.65E+00	Ba-140	5.99E+04
Cs-137+	1.33E+00	Ce-141	2.08E+05
Ba-140+	5.88E+02	Ce-144	2.36E+04
Ce-141	6.90E+02	Eu-152	5.79E+02
Ce-144+	6.43E+01	Eu-154	4.37E+02
Eu-152	2.68E+01	Gd-153	7.64E+04
Eu-154	1.95E+01		
Gd-153	1.09E+03		

* - the value is given for the most restrictive beta – gamma radionuclides.

Mfp - indicates that for conservatism, it will be assumed that at the recipient I-131 is an equilibrium mixture with the other fission radioiodines in a certain ratio.

e1.10) Gaseous Emissions for the period April 1996 – December 2004

Isotope	Annual DEL	%DEL								
	(kBq)	1996	1997	1998	1999	2000	2001	2002	2003	2004
C-14 (gas)	*1.1E+11*	*3.21E-02*	*1.63E-01*	*2.64E-01*	*1.55E-01*	*2.12E-01*	*1.50E-01*	1.13E-01	1.06E-01	1.75E-01
Cr-51	*1.4E+12*	-	-	-	-	*4.33E-08*				
H-3 (oxide)	*5.3E+13*	*2.61E-03*	*4.88E-02*	*9.67E-02*	*1.62E-01*	*3.97E-01*	*3.42E-01*	5.45E-01	3.25E-01	3.77-01
I-131 (mfp)	*3.44E+08*	-	*2.05E-03*	*2.19E-04*	-	-	*4.14E-04*	-	-	-
Nb-95	*3.3E+09*	-	-	-	-	*2.40E-06*	-	-	-	-
*Noble Gases **	*2.2E+13*	*2.79E-01*	*2.05E-03*	*8.12E-02*	*9.89E-02*	*3.22E-02*	*1.26E-01*	-	9.30E-03	1.06E-01
Total Releases		*3.14E-01*	*5.00E-01*	*4.42E-01*	*4.17E-01*	*6.41E-01*	*6.18E-01*	*6.58E-01*	*4.36E-01*	*6.58E-01*

* Noble Gases annual DEL are in kBq MeV

- mfp: indicates that for conservatism, it will be assumed that at the recipient I-131 is an equilibrium mixture with the other fission radioiodines in a certain ratio.

e1.11) Liquid Emissions for the period April 1996 - 31 December 2004

Isotope		Annual DEL (kBq)	% DEL								
		1996	1997	1998	1999	2000	2001	2002	2003	2004	
H 3	D	7.3E+13	5.85E-03	1.64E-02	1.13E-01	2.21E-02	7.59E-02	1.09E-01	1.52E-01	1.55E-01	2.98E-01
	C	7.3E+13	-	5.79E-04	1.93E-04	7.39E-03	3.07E-03		1.96E-02	1.69E-02	3.32E-02
Cr 51	D	2.7E+13	2.99E+08	2.57E-07	4.15E-09	2.96E-07	3.54E-07	1.07E-04	3.80E-07	4.15E-08	7.57E-07
	C	2.7E+13		4.03E-09		2.93E-07	3.89E-09		9.43E-08		5.01E-08
Mn 54	D	1.2E+11	-	-	4.98E-07	1.41E-06	-	-	-	6.36E-07	3.43E-06
	C	1.2E+11									0.00E+00
Fe 59	D	2.3E+11	1.51E-06	-	-	2.11E-06	-	-	-	-	-
	C	2.3E+11									
Co 58	D	2.55E+09	-	1.28E-04	-	1.01E-04	-	-	-	-	0.00E+00
	C	2.55E+09		-							2.18E-06
Co 60	D	6.9E+09	1.41E-05	5.96E-06	-	-	3.62E-04	1.07E-04	2.42E-04	1.19E-04	1.18E-03
	C	6.9E+09	-	-					2.13E-05	2.53E-05	3.72E-04
Zn 65	D	6.9E+10	-	2.38E-04	1.69E-04	6.46E-04	-	-	-	-	-
	C	6.9E+10		7.86E-06		1.08E-04					
Zr 95+	D	1.8E+11	-	4.73E-04	5.24E-04	1.48E-03	3.45E-04	4.63E-05	4.42E-05	1.67E-04	8.95E-04
	C	1.8E+11		2.30E-05		2.38E-04	1.78E-05		1.58E-06	1.26E-03	1.85E-05
Nb 95	D	1.5E+11	2.07E-07	3.38E-07	1.24E-07		9.92E-04	1.39E-04	1.20E-04	4.68E-04	1.83E-03
	C	1.5E+11	-	-			4.42E-05		5.76E-06	5.29E-04	5.34E-05
Ru 103	D	1.1E+11	7.52E-07	3.12E-04	1.93E-04	9.61E-06	-	-	-	-	4.17E-08
	C	1.1E+11	-	2.40E-05		1.44E-07					0.00E+00
Sb 124	D	2.3E+11	-	-	1.78E-05	-	2.33E-05	4.41E-06	6.70E-06	1.08E-05	1.09E-04
	C	2.3E+11	-	-			2.37E-07		9.13E-07	9.37E-05	2.26E-07
Sb 125	D	7.3E+10	1.05E-03	4.32E-02	1.80E-03	1.27E-05	3.29E-07	-	-	-	-
	C	7.3E+10	-	8.07E-05		1.73E-05					

Isotope		Annual DEL (kBq)	% DEL								
		1996	1997	1998	1999	2000	2001	2002	2003	2004	
I 131	D	3.5E+10	-	2.56E-05	3.70E-06	2.72E-06					
	C	3.5E+10									
Cs 134	D	1.8E+10	-	6.01E-04	3.12E-04	3.00E-04	-	-	-	-	-
	C	1.8E+10		5.71E-05							
Cs 137	D	5.6E+09	6.14E-08	4.19E-08	-	-	1.30E-04	2.52E-05	5.41E-06	3.24E-05	2.17E-04
	C	5.6E+09	-							3.66E-04	0.00E+00
Ce 141	D	2.5E+12	-	6.24E-06	6.00E-06	1.27E-05	-	-	-	-	-
	C	2.5E+12	-			1.97E-06					
Ce 144	D	2.8E+11	-	-	-	-	6.81E-07	-	5.27E-07	2.10E-06	5.49E-05
	C	2.8E+11								7.49E-06	0.00E+00
Gd 153	D	9.2E+11	-	-	-	-	6.54E-07	2.50E-07	6.39E-08	-	-
	C	9.2E+11									
Total releases	D		6.92E-03	6.1E-02	1.16E-01	2.47E-02	7.78E-02	1.09E-01	1.52E-01	1.56E-01	3.03E-01
	C		-	7.7E-04	1.93E-04	7.75E-03	3.13E-03		1.96E-02	1.92E-02	3.36E-02

D: release in Danube;
C: release in Danube – Black Sea Channel

e2) Nuclear Fuel Plant radioactive waste inventory

- 9 m^3 combustible liquid waste

e3) SCN Pitesti radioactive waste inventory

- long lived radioactive waste:

- 4000.56 kg depleted uranium (from ^{60}Co therapy units of hospitals);

- 0.4 m^3 solid radioactive waste (from post irradiation examination and TRIGA reactor maintenance activities);

- 0.2 m^3 metallic radioactive waste (fragments of irradiation devices and of sample holders activated in TRIGA reactor, fragments of fuel cladding and of CANDU pressure tubes samples irradiated in TRIGA reactor)

- 9 ^{60}Co sources with activities between 15.5 TBq and 75.4 TBq (6 in hot cells and 3 in LEPI precinct)

e4) IFIN – HH radioactive waste inventory

e.4.1) Sealed radioactive sources collected at STDR Magurele from 1987.

Radionuclide	Number of sources	Activity (mCi)	Disposed	Stored
Co-60	1909	475965.13	1435	474
Cs-137	233	239208.41	81	152
Ra-Be	12	92.55	1	11
Kr-85	322	4229.92	289	33
Po-210	21	0.00	18	3
Po-Be	31	0.00	28	3
Ir-192	112	0.00	87	25
Ra-226	197	569.54	93	104
Sr-90	171	751.72	39	132
Am-241 industrial	207	39072.00	3	204
Am-241 from smoke detectors	36.915	144.867	119	36796
Am-Pu from smoke detectors	5627	2813.50	0	5627
Am-Be	48	33815.00	3	45
H-3	58	46475.30	0	58
Ru-106	2	1.20	0	2
I-131	10	0.00	0	10
Cs-134	9	1.18	1	8
Cr-51	2	0.00	0	2
Ce-144	2	5.00	0	2
C-14	30	52.10	3	27
Ba-133	8	0.136	0	8

Ag-110m	17	120.00	0	17
Co-57	20	28.00	1	19
Eu-154	1	0.85	0	1
Pu-239	41	611.00	0	41
Pu-238	2	19.68	0	2
Pu-Be	4	3.00	0	4
Cd-109	7	7.00	1	6
Fe-55	3	24.71	0	3
Eu-152	5	1.6	0	5
Pm-147	50	0.05	1	49

The existing inventory at STDR Magurele is according to column 5. The inventory presented in column 4 represents sources disposed at Baita Bihor repository. Supplementary to this inventory, at STDR Magurele, there are approximately 800 corroded drums containing historical waste, including spent sources.

e.4.2) Solid radioactive wastes collected at STDR Magurele starting with 1994.

Radionuclide	**Qantity (kg)**	**Disposed**	**Stored**
I-131, Au-198, Tc-99m, P-32	5483,0	5478,0	5,0
U, Th-232	187,62	187,62	
I-131, Au-198, I-125,Tc-99m,Na-22	656,5	628,5	28,0
Co-60, Zn-65	70,0	70,0	
Na-24,I-131	31,00	26,00	5
Sr90, Am241, Pb220, Co60, Cs137, Ra226, Tl204	7,00	7,00	
I-131, Cr-57, Br-82, Co-60	28,0	28,0	
Cs137, Cs134, Co60	402	402	
Cr-51, I-131, Zn-65, Tc-99m	98,5	98,5	
Ra226, Eu152	10,0	10,0	
Ir192, Co60, Cs137	83,65	83,65	
Co60, Cd109, Ag110m	2.45		2.45
Lu177	12		12
Ba-131,Np-252	0,5	0,5	
Co-60, Am-241	21,0	21,0	
Zn-65, Co-60	100,0	100,0	
I-131,Au-198	504,0	504,0	
Am-241	53,0	53,0	
Ba-131, Zn-65	2,0	2,0	
Fe-55, Fe-59,Zn-65	4,5	4,0	0,5
I-125, Tc-99m,Se-75	91.4	85.1	6.3
Cs-137, Sr-90, Co-60	26,0	26,0	
I-125, Au-198, P-32	166,0	166,0	
C-14, H-3	5,0	5,0	

I-131, Tc-99m, Cs-137, Re-188	135,5	70,0	65,5
Ir-192, Co-60, Au-198,Cs-137	120,9	117,5	3,4
I-131, Au-198, Tc-99m, P-32, Co-60, Cs-137,Cs-134, Sr-90	742,0	512,0	230,0
H-3	57,0	57,0	
I131	77,0	73,0	4
I-131, S-35, Au-198, Tc-99m, I-125	423,0	370,0	53,0
Te-131, I-131, Au-198, Sb-122	228,0	228,0	
C-14, Sr-90, Co-60	40,5	30,0	10,5
Co-60, Cs-137, Ra-226, Th-232	123,0	123,0	
Co-60, Cs-137, Zn-65, Am241, I131	95,15	95,15	
I-125, H-3, Na-24, Co-60, Cs-137	36,0	2,0	34,0
Co-60, Ag-110	715,0	15,0	700,0
Ir-192, Mo-99, Tc-99m,I-131, In-113m	459,0	65,0	394,0
I131, Tc99m	13	13	0
Na-22, Sc-46, Mn-54, Co-60, Zn-65, Cs-134, Eu-152	5,4	5,4	
Sr-90, Ca-45, Fe-55, Fe-59, Co-60	1,4	1,4	
Tc-99m	620,80	620,80	
Tc-99m, H-3, I-125	9,5	9,5	
Tc-99m, I-131, Au-198, Cs-137, Co-60	15,0	15,0	
Am241, Cs134, Co60, Te123m, Te121m, Eu152, I131, Ag108m	197,20	197,20	
Am-241,Co-60,Te-123m, Cs-134, Sr-90	91,0		91,0
Am-241,Co-60, Ir-192, Cs-137, I-131	371,0		371,0
Ho-166m, Co-60	10,0	10,0	
Sb-124, Ag-112, Zn-65, Co-60	10,0		10,0
Th-232, I-131, Au-198, Co-60, Cs-134, C-14, H-3, Ra-226, Sr-90	10,0	10,0	
Am-241, Co-60, I-131, Cs-137, Sc-46, Na-22, Ir-192, Zn-65, Fe-59	167,0		167,0
Cs-137, Co-60, Ag-108m, Eu-152, Eu-154	2,0		2,0
V-48, Ga-67	7,0		7,0
Ir-192, I-131, Cs-134, Co-60, Fe-59, Sb-124, Eu-152, Cs-137, Am-241	807.3	803	4,3

Supplementary to this inventory, as mentioned for the previous table, at STDR Magurele there are approximately 800 corroded drums containing historical waste, including spent sources (see same comment in the previous table).

e.4.3) Radioactive liquid wastes collected from IFIN-HH (VVR-S Research Reactor, Radioisotope Production Dept., Nuclear Medicine Center, others, starting with 1987):

Radionuclide	**Quantity Collected (l)**
I-131, Cr-57, Br-82	1,0
Ba-131, Np-252	2,0
Ba-131, Zn-65	2,0
U, Th-232	17.5
H-3	88,0
Ba-131	0,5
Cs-137, Co-60	30132,0
Sr-90	5,0
I-131	43001,1
Ag-110, Au-198	80,0
I-131, Au-198, Tc-99m	263003,5
I-131, Sb-124, Sb-122, Te-131, Te-127	399265,0
Tc-99m, Au-198, Sb0122	66007,0
I-131, Tc-99m, Sb-122	233197,5
I-131, Co-60, Tc-99m, Cr-51	103585,9
I-131, Tc-99m	38510,5
Mo-99, Tc-99m, I-131	3506,6
I-131, Cr-51	17503,0
I-129, Sb-122, Te-131	8,0
I-131, Sb-122, Tc-99m, Te-129	203,5
I-131, Te-123	11,5
Tc-99m, I-129, Sb-122, Te-127	7,0
Tc-99m, Au-198, Sb-122	10,5
I-131, Te-131, Sb-122	6,5
I-125	53,5
I-125, Co-60, Cs-137	24
Na-24, I-125	5,5
I-131, Ru-108, Zr-95, Ag-110m	0,4
Ni-63, Na-22, Zn-65, Eu-152	0,0
Tc-99m, I-131, Re-188, I-125	0,6
V-48,Ga-67	2,0

The total liquid radioactive waste collected and treated at STDR from the beginning of operation of STDR is more than 26000 m^3. The sludge resulted from treatment was collected in approximately 900 drums of 220L capacity, disposed at Baita Bihor repository.

e.4.4) Conditioned drums disposed at DNDR from 1985 to 2004.

	From	Disposal years																				Total
		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
Total	IFIN	202	310	336	554	326	621	417	264	498	574	103	173	40	131	68	0	42	62	110	87	4919
	SCN	0	0	69	131	214	0	150	185	118	100	134	72	99	59	55	0	0	143	241	52	1822
Total per year	IFIN + SCN	202	310	405	685	540	621	567	449	616	674	237	245	139	190	123	0	42	205	351	139	6741
Total	IFIN + SCN	202	512	917	1602	2142	2763	3330	3779	4395	5069	5306	5551	5690	5880	6003	6003	6045	6250	6602	6741	6741

e5) National Uranium Company radioactive waste inventory

- Tailing pond Cetatuia II (first part, to be closed and transformed in repository): approx. approx. 4 500 000 tons radioactive wastes containing around 2000 Ci Ra-226.
- Tailing pond Cetatuia II (second part): approx. approx. 190 000 tons radioactive wastes containing around 11 Ci Ra-226.
- Solid wastes:

- two old trench storages (closed, to be authorized as repositories): approx.

17 827 tons radioactive wastes;

- new storage: approx. 2 617 tons radioactive wastes.

f) Findings of IRRT Mission in 2003

SYNOPSISOF RECOMMENDATIONS

Recommendations

R.1. The new legislative framework should effectively provide for an income regime for the staff of the Regulatory Body consistent with the incomes offered to staff of equivalent level in the NPP

R.2. Some formal arrangements exist to ensure that staff are aware the contents of the Quality Manual in relation to the function that they perform. These arrangements should be extended to all Directorates

R.3. CNCAN should take all necessary steps to ensure that the 11 vacant positions should be filled by suitably qualified and experienced persons as soon as possible.

R.4. To complement the policies already implemented by the Directorates, CNCAN should produce a written general policy on training and staff development.

R.5. CNCAN management should take urgent actions to fill the position of Director of Directorate of Nuclear Safety with a suitably qualified expert

R.6. CNCAN management should take actions to complete its review and assessment procedures, to establish priorities and prepare its own programme to manage these activities in the most effective way, taking into account the available limited resources.

R.7. CNCAN should take urgent action to fill the three vacant positions in the Directorate of Cernavoda NPP Surveillance.

R.8. CNCAN should establish the priority for development of different regulations taking into account the needs of the current authorization process.

Recommendations

R.9 CNCAN should consider in future the need for periodic review of its regulations and establish an appropriate mechanism and periodicity for updating the regulations.

R.10. CNCAN should pursue the possibility of formally reviewing / approving the local municipality’s emergency response plan.

R.11 CNCAN should ensure that all staff who are involved in, or could be involved in, an emergency role, receive appropriate emergency preparedness training.

R.12. CNCAN should develop guidance on the application of the exclusion levels, particularly for Ra-226 and Th-nat as applied to waste materials containing natural radionuclides.

R.13. CNCAN should develop and issue guidance on removing materials, containing elevated levels of natural radionuclides from regulatory control. This is linked to the recommendation on application of the exception levels to such materials.

R.14. Further consideration needs to be given by CNCAN to application of intervention principles, which result in materials being removed from regulatory control with levels of radioactive content, or contamination above both exception and exclusion levels.

R.15. CNCAN should establish a set of generic clearance levels for normal operations, together with guidelines for their application, which can be generally adopted by all licensed facilities including nuclear installations, mining and minerals processing facilities and facilities using radiation sources.

R.16. Legal provision for dealing with orphaned radiation sources and abandoned sites or facilities should be adopted as soon as possible. In this regard the specific roles and responsibilities of CNCAN should be addressed.

R.17. CNCAN should develop guidelines on the classification of radioactive waste on a national basis with a view to clarifying what types of waste can be disposed of in identified disposal facilities, particularly identifying waste which is not acceptable in near surface disposal facilities and also where waste containing naturally occurring radionuclides can be disposed.

R.18. CNCAN should give consideration to establishing requirements on the qualifications and experience necessary for personnel with defined responsibilities in waste safety.

R.19. The responsibility for institutional control over waste disposal facilities in the longer term should be addressed in legislation.

R.20. The quantum of funding to be paid into the Decommissioning Fund by different installations should be clearly identified in the legislation. This should be linked to an agreed liabilities assessment methodology.

Recommendations

R.21. The role of CNCAN in the determination of the amount of funds to be paid to the decommissioning fund needs to be set down and the periodicity of review of the adequacy of the amount.

R.22. CNCAN should established standard for the removal of sites and facilities from regulatory control under normal circumstances. CNCAN should also develop guidance on demonstrating compliance with such standards.

R.23. CNCAN should investigate mechanisms for a broader stakeholder access to and involvement in the licensing of waste management facilities in particular waste disposal facilities.

R.24. CNCAN should establish prescriptive requirements for small-scale users of radioactive material for the control of effluent discharges to the environment.

R.25. The safety assessment for the Baita Bihor disposal facility should be finalized and independently evaluated by CNCAN. The conditions of authorization revised to reflect operational controls, including waste acceptance criteria, derived on the basis of the assessment.

R.26. The safety assessment for the proposed disposal facility for Cernavoda low and intermediate level waste should be progressed without further delay.

R.27. CNCAN should establish, in line with international standards, requirements for the duration for which records should be kept for activities at waste management facilities

R.28. CNCAN should extend the existing waste management facility specific reporting requirements to include, not only reporting of licence or regulation violations, but also occurrences of a lesser nature which could be indicators of precursors to more incidents or of degraded performance.

R.29. The number of specialist staff in the area of waste safety and the matrix management arrangements for waste safety activities should be reviewed and upgraded accordingly.

R.30. CNCAN should further develop its existing guidance and requirements so that a systematic and consistent process is established for authorizing all the various different types of waste management related activities.

R.31. CNCAN should develop and adopt standards for safety assessment of waste management facilities, both predisposal and disposal taking into consideration relevant IAEA safety standards in this area i.e. DS 284 Draft Safety Guide “Safety Assessment for Predisposal Waste Management Facilities” and WS-R-1 “Safety Requirements for near Surface Disposal of Radioactive Waste”.

R.32. CNCAN should develop guidance on the application of the exclusion levels, particularly for Ra-226 and natural Th, as applied to materials containing natural radionuclides.

Recommendations

R.33. CNCAN should develop a set of generic clearance levels for normal operations, together with guidelines for their application, which can be used by licensed facilities.

R.34. CNCAN should proceed with completing a national registry of occupational exposure records.

R.35. CNCAN should continue to develop material, and methods of communication (conferences, news letters, website), on improving safety culture for users of radiation sources.

R.36. CNCAN should give consideration to the legal status and the interdependence of Law No. 111/1996 and the international agreements (ADR, RID, ICAO-TI, IMDG-Code) which were adopted by Romania, because there are conflicting requirements. A closer cooperation with the Ministry of Transport should be implemented.