EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY

DIRECTORATE D - Nuclear Energy
D.4 Radiation Protection

TECHNICAL REPORT

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35 OF THE EURATOM TREATY

URANIUM MINING AND PROCESSING AND NATIONAL MONITORING NETWORKS

ROMANIA

18 to 26 AUGUST 2008

Reference: RO-08/06

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35
OF THE EURATOM TREATY

FACILITIES:	Uranium mine; uranium milling and processing; national environmental radioactivity monitoring network; laboratories
SITES:	Crucea, Feldioara, Braşov, Sibiu, Târgu-Mureş, Suceava, Bucharest
DATE:	18 to 26 August 2008
REFERENCE:	RO-08/06
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DATE OF REPORT:	15/12/2009
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TECHNICAL REPORT

1 ABBREVIATIONS

ANDRAD	*Agenția Națională pentru Deşeuri Radioactive* (National Agency for Radioactive Waste)
ANSVSA	*Autoritatea Națională Sanitară Veterinară şi pentru Siguranța Alimentelor* (National Sanitary, Veterinary and Food Safety Authority)
ANV	*Autoritatea Națională a Vămilor* (National Customs Authority)
ASP	*Autoritatea de Sănătate Publică* (Public Health Authority)
CANDU	CANadian Deuterium Uranium (nuclear power reactor design)
CD-ROM	Compact Disc Read Only Memory
CNCAN	*Comisia Națională pentru Controlul Activităților Nucleare* (National Commission for Nuclear Activities)
CRFM	*Cercetare, Radioprotecție, Factori de Mediu* (Research, Radiation protection and Environmental conditions; unit at Feldioara plant)
CRL	*CNCAN*'s Reference Laboratory for radioactivity
DEL	Derived Emission Limits
DG	Directorate General
DG ENER	Directorate-General for Energy (of the EC)
DG TREN	(former) Directorate-General for Energy and Transport (of the EC)
DUA	ammonium diuranate
EC	European Commission
EU	European Union
EURDEP	European Radiological Data Exchange Platform
EWS	Early Warning System (environmental radiation monitoring system)
FWHM	Full Width Half Maximum (measure for detector energy resolution)
GEM	Gaseous Effluent Monitor
GM	Geiger Müller (radiation detector)
GPRS	General Packet Radio Service
HPGe	High Purity Germanium (gamma radiation detector)
IAEA	International Atomic Energy Agency
IFIN-HH	*Institut național de cercetare-dezvoltare pentru fizică şi inginerie nucleară – Horia Hulubei* (Horia Hulubei National Institute of Research and Development in Physics and Nuclear Engineering)
IPH	Institute of Public Health
IR	Infra Red
JRC	(European Commission) Joint Research Centre
LSC	Liquid Scintillation Counter (radiation detector)
LEPA	Local Environmental Protection Agency
MAAPDR	*Ministerul Agriculturii, Alimentației, Pădurilor şi Dezvoltării Rurale* (Ministry of Agriculture, Forests and Rural Development)
MCA	MultiChannel Analyzer
MDA	Minimum Detectable Activity
MMDD	*Ministerul Mediului şi Dezvoltarii Durabile* (Ministry of Environment and Sustainable Development)
MH	Ministry of Health
NaI(Tl)	Sodium iodide, thallium activated (gamma radiation detector)
NCC	Network Coordination Centre (at NRL)
NCU	National Uranium Company S.A.
NEPA	National Environmental Protection Agency
NERSN	National Environmental Radioactivity Surveillance Network
NORM	Naturally Occurring Radioactive Material
NPP	Nuclear Power Plant
NRL	NEPA's Reference Laboratory for radioactivity
OG	Official Gazette
OJ	Official Journal
PC	Personal Computer

PM10	Particulate Matter of diameter less than 10 micrometers
QA / QC / QM	Quality Assurance / Quality Control / Quality Management
REM	Radioactivity Environmental Monitoring (European radioactivity data bank at JRC-Ispra)
RENAR	*Asociatia de Acreditare din Romania* (Romanian Accreditation Association)
RP	Radiation Protection
SNCFR	*Societatea Națională a Căilor Ferate Române* (National Society of Romanian Railways)
SSRM	Survey Station for Radiological Monitoring within NERSN (radiological sector of LEPA laboratories)
TARIC	*Tarif intégré des Communautés européennes* (EC online customs tariff database)
TLD	ThermoLuminescence Dosimeter/Dosimetry (radiation detector)
TREN	TRansport and ENergy
UPS	Uninterruptible Power Supply
USSR	Union of Soviet Socialist Republics

2 INTRODUCTION

Article 35 of the Euratom Treaty requires that each Member State shall establish facilities necessary to carry out continuous monitoring of the levels of radioactivity in air, water and soil and to ensure compliance with the basic safety standards [(1)].

Article 35 also gives the European Commission (EC) the right of access to such facilities in order that it may verify their operation and efficiency.

For the EC, the Directorate-General for Energy (DG ENER; formerly Directorate-General for Energy and Transport - DG TREN) and in particular its Radiation Protection Unit (at the time of the visit: TREN.H.4) is responsible for undertaking these verifications.

The main purpose of verifications performed under Article 35 of the Euratom Treaty is to provide an independent assessment of the adequacy of monitoring facilities for:

- Liquid and airborne discharges of radioactivity into the environment by a site (and control thereof).
- Levels of environmental radioactivity at the site perimeter and in the marine, terrestrial and aquatic environment around the site, for all relevant pathways.
- Levels of environmental radioactivity on the territory of the Member State.

On 4 July 2006 the Commission published a Communication in the Official Journal (OJ 2006/C 155/02) with a view to define some practical arrangements for the conduct of Article 35 verification visits in Member States.

From 18 to 26 August 2008 a verification team from DG TREN.H.4 visited the Crucea uranium mining site, situated in northern Romania, the Feldioara uranium milling and processing plant, situated in central Romania and several environmental radioactivity monitoring and measuring sites located in the above-mentioned parts of Romania (Transylvania and Moldova regions). A re-verification of the NEPA central radiological laboratory in Bucharest was also carried-out. This laboratory has a major role in the national environmental radioactivity monitoring, and provides data for the continuous radiological control under normal conditions as well as the coordination of the monitoring stations and the national environmental radioactivity surveillance network, in routine and radiological emergency conditions.

The visit included meetings with representatives of various national authorities having competence in the field of radiation protection. Progress in food import control was discussed with authorities in charge of this issue such as the Ministry of Health, the National Sanitary, Veterinary and Food Safety Authority, the Institute of Public Health, Bucharest, the Institute of Hygiene and Public Veterinary Health, Bucharest and the National Customs Agency. A closing meeting was held, with all parties involved during the visit, at the premises of the National Commission for Nuclear Activities (*CNCAN*).

The present report contains the results of the verification team's review of relevant aspects of the radiological environmental surveillance on and around the nuclear sites of Crucea and Feldioara, as well as of the regional radiological surveillance in the central and northern part of Romania.

The report is based on the verification findings, on information collected during the verification including documents received and on discussions with various persons during the visit.

1 Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the health protection of the general public and workers against the dangers of ionizing radiation. (OJ L-159 of 29/06/1996 page 1).

3 PREPARATION AND CONDUCT OF THE VERIFICATION

3.1 PREAMBLE

The Commission's decision to request the conduct of an Article 35 verification was notified to the Romanian Permanent Representation to the European Union by letter TREN.H4 CG/cd D(2007) 301324 dated 13 June 2008.

Practical arrangements for the implementation of these verifications were made with the Romanian competent authorities.

The present report covers these verifications on and around the nuclear sites of Crucea and Feldioara, as well as those performed concerning the regional radiological surveillance in the central and northern parts of Romania.

3.2 PROGRAMME OF THE VISIT

On 18 August 2008 an opening meeting was held at the *CNCAN* premises in Bucharest where, in conjunction with the Romanian competent authorities and representatives of the site operators, the programme of verification activities was discussed and finalised.

The agreed programme comprised:

- The verification of liquid and gaseous radioactive discharges from the Crucea uranium mining site and from the Feldioara uranium milling and processing site (sampling and monitoring systems, analytical methods, quality assurance and control aspects, reporting);
- The verification of the site-related environmental radiological monitoring programmes as implemented by the operator and by the regulator for the Crucea uranium mining site and the Feldioara uranium milling and processing site. Technical aspects of monitoring and sampling activities, analytical methods used, quality assurance and control, archiving and reporting were addressed.
- Re-verification activities at the NEPA central radiological laboratory in Bucharest, addressing among others the infrastructure, monitoring and sampling provisions, analytical methods, quality assurance and control aspects and reporting.
- A verification of parts of the national environmental radioactivity monitoring/sampling networks.
- Discussions with the national authorities on progress in food import control.

An overview of the programme of verification activities is provided in Appendix 1.

The verifications were carried out in accordance with the programme.

3.3 DOCUMENTATION

In order to facilitate the work of the verification team, a package of information was supplied in advance by the Romanian authorities. Additional documentation was provided during and after the visit. All documentation received is listed in Appendix 2. The verification team notes the comprehensiveness of all presentations made and documentation provided.

The information thus provided has been extensively used for drawing up the descriptive sections of the report.

3.4 REPRESENTATIVES OF THE COMPETENT AUTHORITIES AND THE OPERATORS

During the verification visit, the following representatives of the national authorities, the operators and the other parties involved were met.

National Commission for Nuclear Activities Control (*CNCAN*), Bucharest

Ms. Mihaela Ion	Head of International Affairs Division
Ms. Oana Velicu	Head of the Radiation Protection and Radioactive Materials Transport Section, Division of Radiation Protection and RadioactiveWaste
Ms. Adriana Baciu	Acting Head of the Section for Radiation Emergencies, Division of Radiation Protection and Radioactive Waste
Mr. Nicolae Dumitrescu	Adviser - Safeguards, Transport, Physical Protection and Radioactive Mining Section
Ms. Raluca Nadoliu	European Affairs Expert
Ms. Camelia Liutiev	Senior Expert
Ms. Roxana Banu	Councellor

National Environmental Protection Agency (NEPA), Bucharest

Ms. Elena Simion	Head of National Radioactivity Laboratory (NRL)

Local Environmental Protection Agency (LEPA), Braşov

Mr. Ciprian Băncilă	Director
Ms. Ioana Benga	Head of monitoring department
Ms. Mihaela Apan	Head of the Environmental Radioactivity Surveillance Station

Regional Agency for Environmental Protection (LEPA), Sibiu

Mr. Ionel Naicu	Director
Ms. Adriana Morariu	Head of Monitoring Department
Mr. Radu Bătrâna	Technician
Ms. Izabela Crăciun	Chemist

Local Environmental Protection Agency (LEPA), Târgu Mureş

Mr. Dănuț Ştefănescu	Director
Ms Gabriela Boca	Head of monitoring department
Ms. Maricica Bica	Head of the Environmental Radioactivity Surveillance Station

Local Environmental Protection Agency (LEPA), Suceava

Mr. Vasile Oşean	Director
Ms. Gina Ursul	Head of Monitoring Department
Ms. Renata Croitoru	Technician

Institute of Public Health (IPH), Bucharest

Ms. Alexandra Cucu	Head of the Department of Health and Ionizing Radiation, IPH
Ms. Daniele Patache	Counsellor, Public Health Authority Ministry of Health

Institute of Hygiene and Public Veterinary Health, Bucharest (*Institutul de Igiena şi Sănătate Publică Veterinară*)

Ms. Cristina Şulea	Physicist, Radioactivity Control Laboratory

National Sanitary, Veterinary and Food Safety Authority, Bucharest (*Autoritatea Națională Sanitară Veterinară şi pentru Siguranța Alimentelor*, *ANSVSA*)

Ms. Teodora Ionescu	Advisor, Directorate for Technical Co-ordination of Reference Institutes, Sanitary Veterinary and Food Safety Laboratories, Pharmacovigilance and Animal Nutrition

National Customs Agency, Bucharest (*Autoritatea Națională a Vămilor*, *ANV*)

Ms. Georgeta Mitroi	Head of IPR Department

Ms. Gabriela Ene	Senior Advisor

National Uranium Company, Bucharest

Mr. Moise Cotrău	Inspector SSM,Radioprotection and Environment

Uranium Milling and Processing Plant, Feldioara

Mr.Henrich Lorencz Terme	Radiation protection and labour inspection chief inspector
Mr. Ovidiu Leahu	Head radiation protection research section and of environmental laboratory
Ms. Marilena Andrei	Engineer, radiation protection research section and environmental laboratory

Uranium Mining site, Crucea

Mr. Nicolae Biea	Director
Mr. Adrian Muraru	Technical Director
Mr. Adrian Posa	Chief Inspector
Ms. Mihaela Bordeanu	Radiation protection engineer
Ms. Anica Păvăleanu	Engineer – Environmental Protection Section
Ms. Silvia Cozan	Chemist – laboratory for water quality

Railway uranium loading unit, Vatra Dornei – Argestru

Ms. Rodica Simionescu	Technician for Radiation Measurement, NCU
Ms. Lăcrămioara Ştefanel	Technician for Radiation Measurement, NCU

4 LEGISLATION RELEVANT IN CONTEXT WITH THE VERIFICATION

4.1 LEGAL PROVISIONS FOR DISCHARGES FROM AND FOR ENVIRONMENTAL RADIOACTIVITY MONITORING AT NUCLEAR SITES

The discharge and monitoring of radioactive effluents resulting from the operation of a nuclear installation is regulated by *CNCAN* in accordance with the provisions of:

- Law no. 111/1996 on the safe deployment, regulation, authorisation and control of nuclear activities, republished;

and

- Fundamental Norms for Radiological Safety, approved by *CNCAN* President Order No. 14/2000;

as well as the specific provisions of:

- Norms regarding the limitation of the radioactive effluents discharges to the environment, approved by *CNCAN* President Order No. 221/2005;
- Norms regarding the monitoring of radioactive emissions from nuclear or radiological facilities, approved by *CNCAN* President Order No.276/2005;
- Norms regarding the monitoring of environmental radioactivity around nuclear and radiological facilities, approved by *CNCAN* President Order No.275/2005.

These norms set up the following:

- Requirements concerning the assurance of radiological safety of occupational exposed workers, population and environment, in accordance with the provisions of Law no. 111/1996 and in accordance with the Council Directive 96/29/EURATOM of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation.
- Requirements for the calculation of the Derived Emission Limits (DEL) and for the monitoring of radioactive discharges, at the source of emission and in the receiving media, in routine conditions and also in emergency situations.

4.2 LEGISLATION RELATED SPECIFICALLY TO URANIUM MINING AND MILLING

With regards to the uranium mining and milling, the Romanian nuclear legislation takes into account three objectives:

- To ensure that workers, the public and the environment are adequately protected against the radiological hazards resulting from the exploitation of the uranium mining and milling industries;
- To provide protection during the period of exploration and after the closure of uranium mines or mills;
- To ensure that wastes resulting from the operation of uranium mines and mills tailings are treated as radioactive waste.

Based on Art.5 (1) provisions of Law no. 111/1996 on the safe deployment, regulation, authorisation and control of nuclear activities, republished in 2006, *CNCAN* issued a group of Radiological Safety Norms for uranium and thorium mining and milling as following:

- Radiological Safety Norms on occupational radiation protection in uranium and thorium mining and milling;
- Radiological Safety Norms on the management of the radioactive waste resulting from uranium and thorium mining and milling;
- Radiological Safety Norms on decommissioning of uranium and thorium mining and milling facilities;
- Radiological Safety Norms – Authorisation Procedures for Uranium and Thorium Mining and Milling.

4.3 LEGAL PROVISIONS FOR NATIONAL ENVIRONMENTAL RADIOACTIVITY MONITORING

4.3.1 Environment

Legislative acts establishing the responsibilities in the field of environmental monitoring of radioactivity in sensu strictu are:

- The Environmental Protection Decree no. 195/2005;
- Ministerial Order 338/2002, Rules for National Environmental Radioactivity Surveillance Network;
- Law no. 265/2006 approving the Government Emergency Ordinance no. 195/2005, regarding the environmental protection;
- Governmental Ordinance 21/2004 regarding the National System for the Management of Emergencies.

4.3.2 Foodstuffs

Legislative acts establishing the responsibilities in the field of radioactivity in foodstuffs and feeding stuffs are:

- Regulation 178/2002 – laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety;
- Ministerial Order no. 1805/286/314 on approving instructions for the legal framework for implementation of the regulation regarding foodstuff and feeding stuff for radioactive contamination, published in the Official Journal of Romania (OG), 2007;
- Ministerial Order no. 570/2007 of the Ministry of Health (MH), regarding the technical norms for implementing, evaluation and financing of national programmes, (Programme 1, national programme of prophylaxis, sub programme of public health, objective 4, preventing diseases related to environmental and occupational risk factors, published in the OG, 2007);
- Order no. 381/15.04.2004 of the MPH approving the "Sanitary norms for safe deployment of nuclear activities", published in the Official Journal of Romania no. 527/11.06, 2004;
- Order no. 1050/97/1145/505 of the Ministry of Agriculture, Forests and Rural Development (*MAAPDR*), National Sanitary, Veterinary and Food safety Authority (*ANSVSA*), MPH, National Environmental Protection Agency (NEPA) for the approval of the sanitary, veterinary and food safety Norms regarding certain contaminants from food of animal and non-animal origin, published in the OG no. 1056/26.11, 2005;
- Order no. 855/98/90/2002 of the MPH, *MAAPDR*, NEPA for the approval of the norms regarding foods and food ingredients treated with ionizing radiation, published in the OG no. 218/25.04, 2002;
- Order no. 1805/286/314/2006 of the MPH, *ANSVSA*, *CNCAN* for the approval of instructions regarding the creation of a legal framework for the application of the Council and European Commission Regulations regarding the establishment of maximum levels for radioactive contamination for food and feeding stuffs, after a nuclear accident or in a radiological emergency, for special conditions for export of food and feeding stuffs, following of a nuclear accident or other radiological emergencies as well as conditions that are governing imports of agricultural products from other countries following the Chernobyl nuclear power-station accident, published in the OG no. 41/19.01, 2007;
- Related European Community legislative acts(2).

2

- Commission Regulation (EC) No 1609/2000 of 24 July 2000 establishing a list of products excluded from the application of Council Regulation (EEC) No 737/90 on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power station. (OJ L-185, 25.7.2000, page 27);
- Commission Regulation (EC) No. 1661/1999 of 27 July 1999 laying down detailed rules for the application of Council Regulation (EEC) No. 737/90 on the conditions governing imports of agricultural products originating in third countries following the accident at the Cernobyl nuclear power station. (OJ L 197, 29.7.1999, p. 17–24);
- Commission Regulation (EURATOM) No. 770/90 of 29 March 1990 laying down maximum permitted levels of radioactive contamination of feedingstuffs following a nuclear accident or any other case of radiological emergency. (OJ L 83, 30.3.1990, p. 78–79);
- Commission Regulation (EURATOM) No. 944/89 of 12 April 1989 laying down maximum permited levels of radioactive contaminants in minor foodstuffs following a nuclear accident or any other case of radiological emergency. (OJ L 101, 13.4.1989, p. 17–18);
- Directive 1999/2/EC of the European Parliament and of the Council of 22 February 1999 on the approximation of the laws of the Member States concerning foods and food ingredients treated with ionising radiation. (OJ L 66, 13.3.1999, p. 16–23);
- Directive 1999/3/EC of the European Parliament and of the Council of 22 February 1999 on the establishment of a Community list of foods and food ingredients treated with ionising radiation. (OJ L 66, 13.3.1999, p. 24–25);

4.4 GUIDANCE DOCUMENTS

The environmental radioactivity monitoring and the radiological surveillance of foodstuffs follow international guidance documents from EU, IAEA and Canada[(3)]. ICRP's recommendations are applied as well.

Concerning uranium and thorium mining and milling, *CNCAN* issued the following guidelines:

- Guidelines on recommended parameters to be used for the estimation of effective doses concerning exposure paths:
- Guidelines on criteria for release from *CNCAN*'s authorisation regime, i.e. for use for other purposes of buildings, materials, facilities, dumps and lands contaminated by mining and milling of uranium and thorium ores;
- Guidelines on technical requirements for design, siting, construction, operation , closing and decommissioning of uranium ore facilities, for the storage of uranium ore and the decomissioning of the uranium and thorium milling waste disposal ares.

5 ROMANIAN COMPETENT AUTHORITIES

5.1 INTRODUCTION

According to the legislative framework in Romania, *CNCAN* is the only authority having responsiblility with regard to radioactive discharges.

The main ministries and organizations having different responsibilities in the field of environmental radioactivity monitoring (including the surveillance of food stuffs) are:

- *CNCAN*;
- Ministry of Environment and Sustainable Development (*MMDD*), through NEPA;
- Ministry of Health (MH), through the public health authorities and the network of ionizing radiation hygiene laboratories co-ordinated by the Institute of Public Health;
- Ministry of Agriculture, Forests and County Development;
- National Sanitary Veterinary and Food Safety Authority (*ANSVSA*);
- National Agency for Radioactive Waste (*ANDRAD*).

3

- Council Directive 96/29/EURATOM of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation;
- IAEA Safety Guide No. RS-G-1.8 “Environmental and Source Monitoring for Purposes of Radiation Protection” (2005);
- IAEA Safety Guide no. WS-G-2.3 “Regulatory Control of Radioactive Discharges to the Environment” (2000);
- Canadian Standard CAN/CSA-N288.4-M90-Guidelines for Radiological Monitoring of the Environment (1990);
- Commission recommendation of 8 June 2000 on the application of Article 36 of the Euratom Treaty concerning the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure of the population as a whole (2000/473/Euratom);
- Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption (transposed by Law no. 458/2002 for the quality of drinking water as modified by Law no. 311/2004, published in the Romanian Official Journal no. 582/2004);
- Commission recommendation of 20 December 2001 on the protection of the public against exposure to radon in drinking water supplies (2001/928/Euratom);
- Guidelines for drinking water quality (WHO Recommendations), Chapter 9 - Radiological aspects;
- Measurement of radionuclides in food and environment (IAEA Guidebook – Technical reports series no. 295);

Additionally, there is another governmental body, the Nuclear Agency, a specialised body of the central public administration, under the subordination of the Ministry of Economy, Trade and Business Environment. The agency provides technical assistance to the Government, by elaborating strategies for national programs in the nuclear domain. It draws up and monitors the implementation of research, development and innovation policy in the nuclear field.

The agency can ask *CNCAN* to supply information regarding the safety of nuclear installations in order to issue their own report. The elaboration of the national nuclear safety strategy is a task of *CNCAN*.

5.2 NATIONAL COMMISSION FOR NUCLEAR ACTIVITIES CONTROL (*CNCAN*)

The National Commission for Nuclear Activities Control (*CNCAN*) is a national public institution, acting as a legal entity. It is the national competent authority in the nuclear field and functions under the direct coordination of the Prime Minister.

Since its creation in 1961, *CNCAN* faced various reorganisations.

The first regulatory organisation in the field of nuclear practices occurred in 1961, imposed by Ministerial Order 741/1961. The body was called Committee for Nuclear Energy of the Council of Ministers. In the same year, within the National Atomic Physics Institute, the Commission for Guidance and Control of the Nuclear Units was created, thought to be a control organism regulated by the Commission of Nuclear Energy.

The Commission changed the name to *CNCAN* in 1990 by Decree no. 29/1990. In that period *CNCAN* was under the subordination of the Ministry of Environment. In 1998 *CNCAN* became an independent body (Law 16/1998).

In 2001, *CNCAN* moved back under the responsibility of the Ministry of Environment. From 1998 until 2001, *CNCAN* coordinated the National Environmental Radioactivity Surveillance Network (NERSN). By the Governmental Decision no. 894/2003 and Law 193/2003, *CNCAN* entered under the direct jurisdiction of the Prime Minister and it became, again, an independent body.

According to the Law no. 111/1996, on the safe deployment, regulation, authorisation and control of nuclear activities (republished), *CNCAN* is the national competent authority in the nuclear field, with duties in regulation, licensing and control of nuclear practices. It has the following tasks, in particular in the field of environmental radioactivity monitoring:

- to issue regulations for the detailed specification of the general requirements for protection against ionizing radiation, including the procedures for licensing and control activities in the nuclear field;
- to establish, whenever deemed necessary, dose constraints for practices or for certain radiation sources within a certain activity area;
- to examine and approve the siting and construction of nuclear facilities, from the radiation protection point of view;
- to accept the commissioning of nuclear facilities with a potential for contamination outside of their own perimeter, only if the appropriate measures on radiation protection have been taken according to the demographic, meteorological, geological, hydrological and ecological conditions;
- to assess and approve, during the licensing process, the derived emission limits and monitoring programmes of radioactive effluents, proposed by the applicant and to verify their observance, during the practice;
- to assess and approve, during the licensing process, the environmental radioactivity monitoring programme proposed by the applicant;
- it may deploy its own environmental radioactivity monitoring programme in the vicinity of the nuclear / radiological facilities that may have a significant environmental impact, in order to verify the validity of data reported by the licensee.

CNCAN has specific responsibilities in radiation emergency situations. According to *Governmental Ordinance 21/2004* and *Governmental Decision 2288/2004*, *CNCAN*'s main support functions in emergency situations are:

- Monitoring of specific dangers and risks, together with their associated negative consequences, and
- Informing, notifying, measuring and alerting via *CNCAN*'s Emergency Response Centre and its laboratory "*CNCAN*'s Reference Laboratory for radioactivity, CRL" where the necessary environmental radioactivity measurements are performed. This laboratory is part of the Emergency Response Centre and belongs to the Section for Radiation Emergencies which – within *CNCAN* – is the responsible section for radioactivity monitoring and control programmes. The Emergency Response Centre acts as support centre performing technical analysis and prognosis of emergency situations with focus on nuclear safety, radiation protection and radiological consequences.

CNCAN's head office is located in Bucharest. *CNCAN* is headed by a President who is also Secretary of State, under the direct coordination of the Prime Minister (see figure 1).

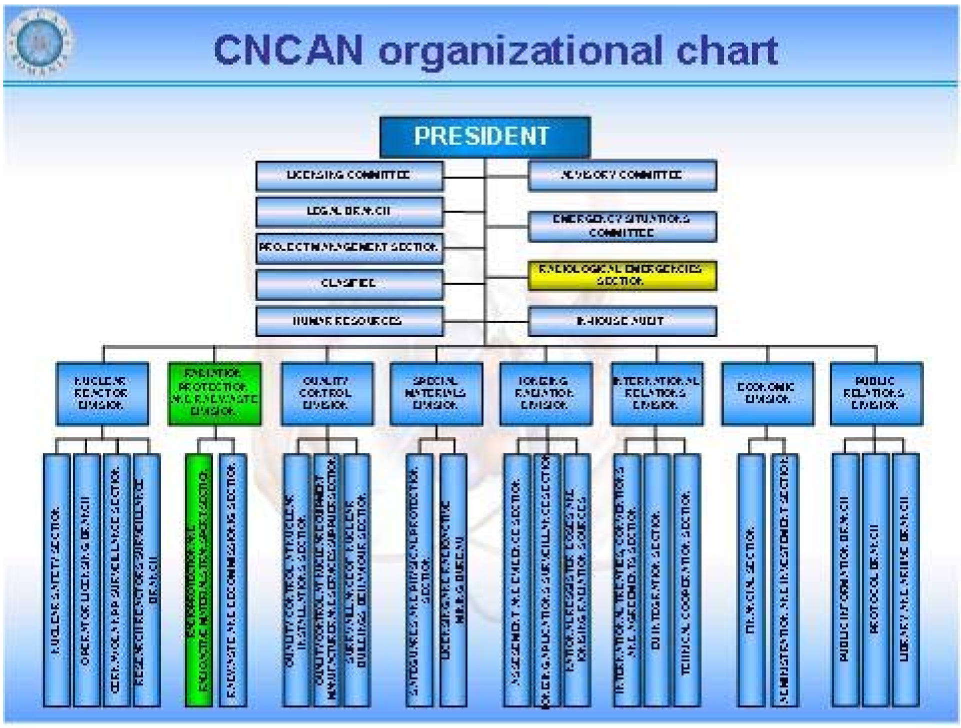

Fig. 1: *CNCAN*'s organizational structure

CRL, *CNCAN*'s laboratory for environmental radioactivity measurements in the context with nuclear facilities, is situated in the village of Afumați, 6 km north-east of Bucharest.

5.3 MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

The legislative framework empowers the Ministry of Environment and Sustainable Development (*MMDD*) to license practices and activities resulting in a release of radioactivity into the environment. The environmental permit issued by *MMDD* is based on environmental impact assessment studies and several prerequisite licenses issued by other authorities, such as: *CNCAN*, the Ministry of Health, and the Ministry of Labour, Family and Equal Opportunities.

According to the Environmental Protection Decree no. 195/2005 (Art. 47), and approved by Law 265/2006, the Ministry of the Environment, as central authority for environmental protection, is responsible for the monitoring and surveillance of environmental radioactivity all over the national territory, with the general purpose of ensuring compliance with regulations, and protecting the population and the environment against harmful exposure to radiation.

In order to fulfil its legal obligations regarding monitoring of environmental radioactivity and off-site emergency planning and response, *MMDD* organises and operates under its authority the National Environmental Radioactivity Surveillance Network (NERSN; see figure 2), which is a part of the National Environmental Integrated Monitoring System.

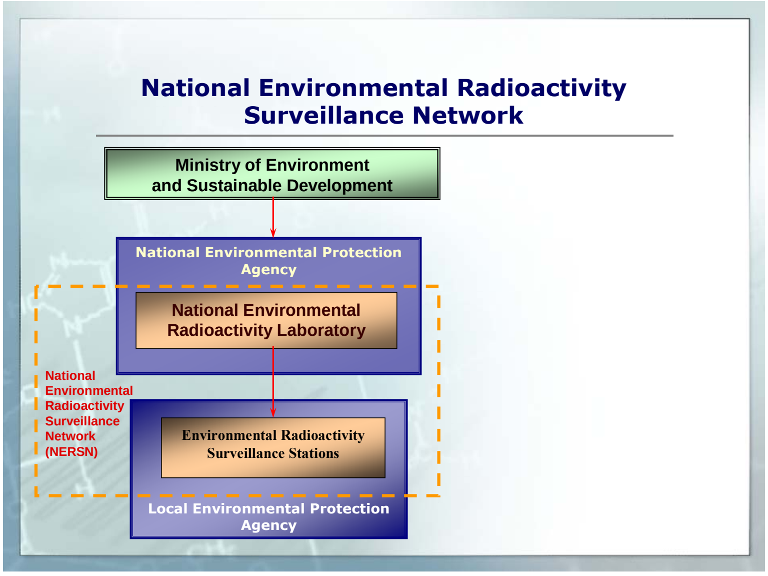

Fig. 2: National Environmental Radioactivity Surveillance Network (NERSN)

According to the above mentioned law, *MMDD* has responsibilities in emergency situations and co-operates with the General Inspectorate for Emergencies, the specialised organization within the Ministry of Interior and Administrative Reform, empowered to co-ordinate at national level the prevention and management of emergency situations. *MMDD* has representatives in the technical expert groups and also in the National Committee for Emergencies, the top-level decisional structure in case of emergencies.

Both the environmental monitoring stations and the meteorological network operate under the authority of the *MMDD*, which has the responsibility of providing the radiological data and the meteorological prognosis in case of a nuclear accident or radiological event with a real or potential release of radioactive material into the environment.

Specific provisions for environmental monitoring are established in Law no. 111/1996, on the safe deployment, regulation, authorisation and control of nuclear activities. The main institutions under the coordination of the ministry of environment that play important roles in environmental radiological monitoring and research are described below.

5.3.1 National Environmental Protection Agency

Within the Ministry of Environment and Sustainable Development, the National Environmental Protection Agency (NEPA), was created as the central environment protection authority in order to ensure technical support and to coordinate the National Integrated Monitoring System, including the National Environmental Radioactivity Surveillance Network (NERSN). In this respect, NEPA operates a reference laboratory for radioactivity (NRL). This laboratory ensures the scientific and methodological coordination of NERSN.

NEPA shall notify *CNCAN* and the Ministry of Interior and Administrative Reform on its findings in the monitoring activity exercised by it, and shall collaborate with these in order to set up any necessary measures to be taken.

5.4 MINISTRY OF HEALTH

In accordance with Law 95/2006, the Ministry of Health (MPH) is the central authority for public health, coordinating public health assistance.

In Romania, responsibility is established according to the provisions of the Nuclear Law 111/1996, on the safe deployment, regulation, authorization and control of nuclear activities. According to Art. 39 of this Law, the Ministry of Health is responsible for organising the surveillance network of the radioactive contamination of food products, over the whole food chain, including drinking water, as well as other goods designated to be used by the population.

Its main responsibilities in addressing environmental monitoring and public health issues are:

- Environmental health monitoring;
- Issuing health regulations or advising on regulations with public health impact;
- Coordinating controls and inspections for regulation enforcement;
- Acting as regulatory body for goods with potential health impact;
- Elaboration of public health programmes, financing and coordination of implementation.

For the accomplishment of these tasks MH is supported by a network of:

- Four Public Health Institutes (IPH) in Bucharest, Iaşi, Cluj, and Timişoara;
- Two Centres in Târgu Mureş and Sibiu, with activities covering regional areas;
- The national network of 42 local Public Health Authorities (*ASP*), responsible for local implementation of national policy and programmes for public health. Nineteen of the *ASP*s include in their structure laboratories for radiation hygiene dealing with ionizing radiation measurements for specific districts.

The Ministry of Health shall inform *CNCAN* and other interested ministries of its findings within its monitoring activities, and collaborate with these in order to establish the joint actions called for.

5.5 NATIONAL SANITARY VETERINARY AND FOOD SAFETY AUTHORITY

According to the Governmental Decision no. 130 of 29.01.2006 on the organisation and functioning of the National Sanitary Veterinary and Food Safety Authority (*ANSVSA*), as published in the Romanian Official Gazette OG no. 90, 31.01.2006, this is a specialised institution of the central public administration, and the regulatory authority in the area of sanitary, veterinary and food safety. *ANSVSA* is under the Government subordination and under the coordination of the Ministry of Agriculture, Forestry and County Development.

ANSVSA has the following competences:

- Strategy, with the view to ensure and guarantee the health of animals, public health, animal protection, environmental protection and food safety;
- Regulation, for the setting-up of the juridical framework and elaboration of regulations (specific for the activities in the areas of sanitary-veterinary and of food safety);
- Administration of structures in subordination, to coordinate and manage the services of sanitary-veterinary and food safety area all over the country;
- Official surveillance and control of the market.

The activities of *ANSVSA* are illustrated in several annual programmes approved by the *ANSVSA*'s President, such as:

- Strategic Programme for Sanitary Veterinary Surveillance;
- Programme for surveillance actions, prevention and control of animal diseases, diseases transmissible from animals to humans, animal and environment protection;
- Programme for surveillance, prevention and control in the field of food safety.

ANSVA has the following structure:

- The main body within *ANSVSA* is the Institute for Hygiene and Veterinary Public Health, located in Bucharest, which includes the Laboratory of Nuclear Analysis Techniques;
- Sanitary Veterinary and Food Safety Directorates have been installed at county level. Within these, 14 territorial laboratories operate, spread over the Romanian territory, to perform radioactivity analysis;
- Sanitary veterinary and food safety units ("*circumscripţie*") are functioning at local (zonal) level.

5.6 NATIONAL AGENCY FOR RADIOACTIVE WASTE

The National Agency for Radioactive Waste (*Agenția Națională pentru Deşeuri Radioactive – ANDRAD*) was established in 2004 by Governmental Ordinance No. 11/203, republished in 2007. *ANDRAD* is a public institution under the subordination of the Ministry of Economy, Trade and Business Environment. By law, this body is the national authority in charge of coordination of the activities for the safe management of radioactive wastes, including those resulting from decommissioning of nuclear and radiological installations (also uranium mining and milling). It develops a strategy on this item, which is part of the national strategy for the energy sector in Romania that has to be approved by the Ministry of Economy, Trade and Business Environment.

The budget of *ANDRAD* is established at ministerial level. *ANDRAD*'s activities are financed by the waste producers.

5.7 NATIONAL URANIUM COMPANY

The National Uranium Company S.A. was set up by the Government's Decision no. 785 of 2 December 1997, modified by Government Decision no 729/2004. It is directly financed by the Ministry of Economy, Trade and Business Environment. The Company administers the uranium mineral resources of Romania and deals with geological research and exploitation activities of uranium ores, ore processing and refining of concentrates, including transportation and marketing of these materials.

The National Uranium Company focuses its activities on two branches: one regarding the mining activities mainly in three regions of Romania: the Banat - (western Romania), the Bihor - (north-western) and the Suceava - (north) regions; the second branch concerns uranium milling and processing activities in the Feldioara plant (central Romania).

The company also aims at restoring the areas affected by uranium exploitation and milling, and at promoting efficient means for environmental protection in the zones under exploitation. Quality conditions are in accordance with international standards concerning the final product. The company ensures the necessary supply of UO_2 powder in a form that can be sintered, to produce the nuclear fuel for the Romanian Nuclear Power Plant Cernavodă.

Presently, the mines from Suceava County are the only uranium ore producer in Romania, and ensure enough uranium supply for the Cernavodă NPP for another eight to ten years. The mines in the Banat County were proposed to be closed in 1997; the monitoring of the final closure of all their branches is still ongoing. The closure of the mine at Baița Bihor is planned in 2009.

Ore from the uranium mines is not milled at the mining locations themselves, but transported by railway to the Feldioara milling plant. After processing, the resulting uranium oxide is transported from Feldioara by authorised trucks under safeguards control to Piteşti, where fuel elements are produced.

6 MONITORING OF RADIOACTIVE DISCHARGES AND ENVIRONMENTAL RADIOACTIVITY AT THE URANIUM MINING SITE AT CRUCEA

6.1 URANIUM MINING IN ROMANIA - HISTORY

Around 1950, (like in other East-European countries), uranium exploration was subject of a joint venture between the Soviet Union and the National Uranium Company. Large geological surveys were performed in the south-western (Banat county) and north-western (Bihor county) regions of Romania.

In 1952, uranium mining commenced as an open-pit excavation, in the Bihor region (Băița Plai). Around 1960 the exploitation of uranium continued by opening underground excavation mines at two other important sites in the Bihor region (Avram Iancu mine) and in the Banat region (Dobrei, Natra and Ciudanovița mines).

All uranium ore of this exploitation had to be delivered to the Soviet Union. The total amount estimated to have been transmitted until 1963 to the then USSR, was about 20 000 tons.

The Romanian-Soviet Union joint venture ended in 1963, all transport of uranium outside the country's borders was stopped. From then onward, "*Organizația Expediția Geologică*" was responsible for uranium exploitation in Romania.

After 1963, Romanian authorities expanded the geological exploration and discovered new uranium deposits in northern Romania, in the Moldova region (Crucea, Botuşana and Tulgheş-Primatar mines).

In 1976, the Feldioara plant was built for the extraction of uranium from the ore (using the depression alkaline leaching technique).

Uranium transfer from the Bihor and Banat mines to the processing plant at Feldioara started in 1977. First samples of uranium yellowcake ammonium diuranate were produced.

Between 1983 and 1985 the Crucea – Botuşana mines were commissioned as well as the uranium ore delivery to Feldioara.

In 1996 the first genuine Romanian batch of uranium dioxide powder was used in the CANDU-6 type Unit 1 reactor at the Cernavodă NPP.

Currently, the uranium needed for the normal life cycle of the two CANDU reactors presently in operation at the Cernavodă NPP is ensured by the U_3O_8 and ammonium diuranate (DUA) stocks produced and stored at the Feldioara processing plant.

Recently, a new uranium deposit containing a few thousand tonnes of uranium ore was identified in the Tulgheş – Primatar area (Harghita and Neamț counties), in the central part of the Eastern Carpathians. A possible mining exploitation is still under negociation.

6.2 URANIUM MINING ACTIVITIES AT THE CRUCEA SITE

The verification team received extensive information about the uranium mining activities at the Crucea/Botuşana site.

The Crucea/Botuşana site represents two underground mines separated by 4 km. From Botuşana, the uranium ore is hauled to Crucea, where all further uranium transport is combined. To allow mine water to be piped from the Botuşana mine to the Crucea mine, a tunnel has been driven. Tunnels that are not used anymore are backfilled with waste rock. An overview of the mine's location is shown in Appendix 3.

The whole mining site employs about 760 people. The radiation protection staff is composed of four persons plus an administrator.

The Crucea mine administration sends annual reports to *CNCAN*, to the Ministry of Environment (including LEPA-Suceava), to local public bodies, and to the Radiation Hygiene laboratory of the Ministry of Health. Every semester intermediate reports are sent to public administrations. For every new working procedure Crucea has to inform *CNCAN*. Operating authorisations are revised yearly and frequently updated. The above mentioned bodies are entitled to inspections of the site.

In order to ensure the authorities and the public of the safety of the site, every five years a big risk-analysis study is contracted by the National Uranium Company to an accredited expert in radiation protection. The last such study was conducted in 2007. These studies are public documents and are part of the technical material provided to *CNCAN* with a view to obtain or to prolong the exploitation authorisation[4].

[4] The study can be downloaded from: www.apmsv.ro (LEPA Suceava).

The uranium ore originating from the Crucea and the Botuşana mines is transported by truck from Crucea about 30 km to the dedicated freight terminal Vatra Dornei Argestru (see chapter 6.6). The trucks belong to the National Uranium Company S.A.. The trucks and the transport route are authorised by *CNCAN*. At Argestru the material is stored intermediately in silos until the uranium is finally transported to Feldioara by train. The train station is radiologically monitored.

At national level, *CNCAN* has autorised the National Uranium Company (NCU) to use 160 specially designed waggons for the uranium ore transport, and the National Society of Romanian Railways (*Societatea Naţională a Căilor Ferate Române*, *SNCFR* = "*C.F.R Marfă*") to use its locomotives. Any uranium transport route has to be authorised by *CNCAN*. Trains circulate on the national railway network within special itineraries previously approved by *CNCAN*.

The National Uranium Company S. A. monitors loading and discharging of the uranium ore, the radiological decontamination of the wagons, and the personnel involved in handling the train wagons. It also intervenes in case of radiological emergency during transport of the uranium ore by railway.

6.3 MONITORING OF RADIOACTIVE DISCHARGES FROM THE CRUCEA MINING SITE

6.3.1 General

The verification team visited the Crucea mining site up to the level of the main entrance tunnel and shaft of the underground mine ("*PUŢ*" Crucea). The above ground mine area is not fenced-in but the access road is well guarded. A barrier exists at the entrance to the mining site.

The storage of explosives used for mining purposes is situated in a tunnel in the vicinity of the mining site entrance under safe conditions.

Since 2007 mine waters from the Botuşana site are piped to the Crucea mine in the connecting tunnel. Before, mine water run-off from the Botuşana mine went directly to the small stream called *Pârăul lui Ion* that feeds into the river Bistriţa. From the Crucea mine all mine waters are collected in a 23 m deep and 4 m wide concrete storage shaft that leads to a mine water reception basin. If necessary mine waters could be led to a cavity in deeper parts of the mine for intermediate storage.

The verification team was shown the mine water outlet from the Crucea mine main entrance tunnel, from where it is led into the storage shaft.

The verification team witnessed the Crucea mine water reception basins. From there mine waters are piped to the water decontamination building (see chapter 6.3.2). Sedimentation in the water reception basins is by gravitation. Water is piped out when necessary, two to three times per day. The sediment is collected periodically and disposed of in the mine.

The low uranium content waste rocks (which are stored in dumps in the mining area) are monitored for uranium content and gamma dose rate.

The team was informed that the radiation measuring devices used in the underground mine for determination of the uranium content of the ore in boreholes are calibrated using concrete blocks containing layers of different, known uranium content. Holes in the blocks allow placing the measuring devices. The team acknowledged that the location containing these concrete blocks is fenced in and secured with an alarm device.

6.3.2 Liquid discharge monitoring

The verification team visited the liquid discharge decontamination station and received an explanation about its operation.

The station building houses both, the old (now unused) and the new decontamination stations, as well as the mine operator's environmental control laboratory. Decontamination is done using a specific ion exchange resin with very high efficiency to remove uranium. The efficiency of removing radium is lower.

The new decontamination unit comprises two parallel lines of three resin columns, of which at any time two are in function, the other one being regenerated. A pipe system with regulation valves connects all columns to allow flexible operating conditions. A flow meter is situated at the exit of the discharge chain. Each column is charged with 3.2 m^3 of resin; each line cleans about 1500 m^3 of mining water per day. The team was told that operation of one column would suffice to handle the current cleaning volume.

Regeneration of one column lasts about one week after which it is put back into operation and another column is regenerated.. The resin filters are cleaned in the laboratory on a monthly basis.

After the decontamination treatment the mining waters are discharged to the small river that runs just in front of the building and is a tributary of the river Bistrița. The discharge point into that river is close to the decontamination station. The water from the treatment station is sampled weekly at the discharge point and analysed in the mine's laboratory. The team was shown the sampling points and was informed that this small river was affected by a flood that had hit northern Romania just a few weeks before the verification visit. At the moment of the verification staff from the mine was fixing the river banks, in particular at the discharge point, and the discharge pipe system.

The old station comprises three small resin columns; none of them operating any more. The team was informed that this station will be repaired to function as a back up when necessary.

After regeneration of a resin column, the extracted uranium is filled in 40 litre plastic drums, which once per year are sent to the Feldioara uranium processing plant for recycling by a special car. This transport needs special authorisation by *CNCAN*. For this purpose, *CNCAN* receives information on the foreseen route, the driver, etc..

Verification does not give rise to specific remarks.

6.3.3 Gaseous discharge monitoring

Two distinct aerial discharge controls are performed, one at the Crucea mine, and the other one at the Botuşana mine. Non-continuous monitoring for Rn is done daily using a *Pylon* radon monitor.

The verification team acknowledged the logbook where the calculations for the aerial discharge of radionuclides are noted (including radon daughter measurements, which are done bi-annually). The logbook contains values of Rn expressed in Bq/m^3 and of the equilibrium factor (a measure of the degree of radioactive equilibrium between radon and its short-lived radioactive decay products) which ranges between 0.4 and 0.45; this factor is verified twice a year. The logbook is signed off by the validator.

The ventilation point itself where three ventilators are operating and the discharge relevant samples are taken could not be visited because it is located approximately 1 km from the mine entrance and thus could not be reached in a reasonable time.

Verification does not give rise to specific remarks.

6.4 CRUCEA MINING SITE: OPERATOR'S ENVIRONMENTAL RADIOACTIVITY MONITORING PROGRAMME

6.4.1 Surface water, sediments

The verification team was told that surface water sampling is performed at several places on site (daily) and in the vicinity of the site, including river Bistrița. Up to two litres of water are sampled. Sample analysis is done in the mine's laboratory.

The team acknowledged the sampling points for river water up and down stream of the discharge point. The sampling points were very well marked. Sampling of surface water off-site is done on a monthly/quarterly basis.

Sampling sites are:

- Bistrița Basin – Crucea (10 sampling points);
- Ostra River – Botuşana (8 sampling points);
- Bistrița River (6 sampling points);
- Bistricioara basin –Tulgheş – Primatar (11 sampling points).

The team was shown the sampling point for surface water and sediment at river Crucea near the mine's administrative building in Crucea village. It was told that sediment samples have a grain size of 0.2 – 2 mm. The team noted that all sampling points were well marked.

The verification team was informed that the rivers in the vicinity of the mine were affected by a flood that had hit northern Romania just a few weeks before the verification visit. At the moment of the verification staff from the mine was fixing the river banks.

Within the environmental monitoring programme the waters are analysed for uranium and radium.

Sampling is performed according to the hydrographical network surrounding the two mines Crucea and Botuşana. The collection is done four times a year, the first, the third and the fourth trimester being done by the Feldioara staff and the second trimester by the Crucea mine employees. Sediment is collected annually by Feldioara staff at the same sampling locations as for water.

6.4.2 Vegetation and soil samples

The verification team was informed that several points have been defined for vegetation and soil sampling:

- The truck road between Crucea and Argestru (at 4 locations, annual collection);
- Argestru railway station ore loading facility (10 sampling points for soil and vegetation);
- The truck road Grințeş – Crucea (at 8 locations, annual collection).

The team was shown the sampling point for soil and vegetation located near the mine's administrative building in Crucea village, on the river bank. One hundred grams of soil are taken from a depth of 0 to 5 cm. The upper parts of the vegetation are cut until this amounts to between 500 g and 1 kg. All the sampling points were well marked.

The samples are taken by both Feldioara and Suceava staff.

6.4.3 Dose rate and dose

Gamma dose probes (TLDs) are mounted on the lower parts of some high voltage pylons situated along the truck road between Crucea and Argestru (at the villages Crucea, Chiril, and Rusca and the entrance of Vatra Dornei).

Reading is done quarterly by the Suceava branch and annually by Feldioara staff.

Additionally, there are ten other points at the Argestru railway station ore loading siding. There, the reading is done twice a year.

With regard to (on-site and off-site) environmental monitoring by the operator the verification does not give rise to specific remarks.

6.5 OPERATOR'S ENVIRONMENTAL CONTROL LABORATORY

The verification team visited the Crucea mine's environmental control laboratory which only performs measurements of uranium in water. All other analyses are done in Feldioara.

Laboratory staff comprises one chemist, two technicians, and four additional workers. One supervisor is available.

The laboratory has two different sample registration books; one for liquid effluents and a second one for surface water samples.

Sampling procedures including sketches of the sampling locations are in place on site.

Each incoming sample is attributed a code, indicating the sample type, sampling location number, and date. The samples are also encoded in the computer, giving their full description.

The laboratory has a small analytical balance room. A desiccant and an incinerating furnace, type, *Gallenkamp* were situated in another small room.

Preparation of liquid samples for uranium analysis was explained to the verification team: a one litre sample is evaporated to dryness, then re-dissolved in nitric acid, in a 2000 ml glass flask.

For uranium measurements the laboratory has a new *Varian Cary 50 Scan* spectrophotometer . It is calibrated by the National Metrological Service Institute from the Iaşi region. The measurements are automatically transferred into the computer and the results are calculated in *Excel* forms.

The verification team noted that the laboratory has no UPS. Due to the short measuring times securing electric power seems not to be necessary.

The verification does not give rise to specific remarks.

6.6 ORE LOADING FACILITY AT VATRA DORNEI, ARGESTRU

The verification team visited the ore loading site at Argestru, near Vatra Dornei. It received a full explanation of the relevant procedures.

The site is fenced-in and the access gate locked. At the time of visit (vacation period) no operational work was performed at the site, but some personnel was present.

At the station, before unloading, the trucks transporting uranium ore are measured and weighed. For the purpose of measuring ten detectors are placed under the roof of the measuring station, five on each side; contamination protection is done by covering the most exposed detectors with plastic bottles cut accordingly. An old *MM-IMR* high voltage device and rate meter are used for radiation measurement; a modern *Sartorius* heavy weight scale is used for weighing the trucks.

The team was informed that every morning background measurements are done by the personnel.

The verification team witnessed the log sheets, and noticed that these data are backed-up in the Argestru station's PC. The paper sheets contain the name of the responsible operator at the Crucea mine, his signature, the drivers name etc. These registers are archived in the Crucea mine's administration building.

After measurement, the truck proceeds to the discharge station building and empties its load into a hopper. From there the ore is transported by a conveyor belt to silos. The building has a ventilation system to recover dust. The filters from this system are sent to Crucea and from there to Feldioara, for analysis and ore recovery.

Before its return to Crucea each truck is decontaminated by washing. For this purpose a special liquid is available. The washing liquid is collected in a tank, together with rain water from (contaminated) surfaces. Solid residues go back to the mine to be used as backfill. Liquids are measured; if a certain limit is not exceeded they can be discharged directly to Bistrița River.

For further transport to Feldioara the uranium ore from the silos is dumped into the wagons of the special train convoy. Before and after filling the wagons are measured using a similar system as for the trucks, but having more detectors. Each convoy is composed of a locomotive and 15 closed wagons carrying 50 to 55 tons of uranium ore each. The transport frequency is about four to five trains per month.

The team was told that every three months a special 'calibration' wagon (filled with a known amount of uranium ore) is used to calibrate the measurement system at the railway station. This wagon usually is stationed at Feldioara.

The verification does not give rise to specific remarks.

7 MONITORING OF RADIOACTIVE DISCHARGES AND ENVIRONMENTAL RADIOACTIVITY AT THE FELDIOARA URANIUM MILLING AND PROCESSING SITE.

7.1 INTRODUCTION

The Feldioara uranium milling and processing plant is situated in the center of Romania, in Braşov County. It is located 8 km west of the town of Feldioara and approximately 2 km northeast of the village of Crizbav. It covers an area of 583 hectares. The plant was commissioned in 1978.

Several criteria were applied for placing the site in this area: the relatively isolated neighbourhood; the presence of forests (which was seen as an advantage regarding security); the harmonious morphology and geohydrology.

The main activities at the Feldioara site concern the milling and processing of the natural uranium ore extracted from Romanian mines and the refining of the uranium concentrate with a view to producing uranium dioxide, which is the main component to produce CANDU 6 fuel elements for the Cernavodă NPP. The nuclear fuel elements are produced at the Piteşti nuclear fuel plant FCN (Fabrica de Combustibil Nuclear), which is the authorised Romanian CANDU fuel element manufacturer. Since 1997 all nuclear fuel for the Cernavodă NPP is produced in Romania.

The Feldioara site processes uranium ore from two mines, Botuşana and Crucea. The ore arrives by train at the uranium receipt station where a qualitative and a quantitative check is performed, including measurement of the uranium content of the ore.

The transport of the uranium ore from the receipt station to the milling site is done by a conveyor belt.

At the milling station the ore is crushed in a wet process to 50 mm chunks and then milled to 0.1 mm size particles. This powder is further processed to leach out the uranium; the substance remaining after drying and filtering ("Yellow cake") is transported in drums by truck to another building situated in the neighbouring area. There it is dissolved in nitric acid, calcinated and reduced chemically to produce uranium dioxide. The UO_2 is delivered in form of a powder to *FCN* Piteşti for further processing.

The Feldioara site has been accepted for its uranium quality by the CANDU technology supplier in Romania.

The construction of a new production plant using new technology to improve the uranium dioxide production is under discussion.

From a radiation protection point of view the Feldioara site is split into two zones (together forming the "sanitary protection zone"):

- The **controlled zone**, delimitated by a concrete fence. The radiological surveillance of the environment is done via dose rate probes situated at different points on the perimeter and by measurement of the degree of contamination of surfaces, tools, equipment and people. Accumulated solid and liquid radioactive discharges are monitored as well.
- The **surveillance zone**, reaching out between the concrete inner fence and the barbed wire fence forming the outer border of the site. In this zone, a radiological environmental monitoring is performed especially for the settling ponds, wells, soil and vegetation. This zone contains several forests which include ponds. The area is guarded-off.

The uranium leaching process leads to liquid wastes, which are piped to tailings ponds situated in the surveillance zone for sedimentation. From the final tailings pond the liquids are piped to a purification station. After removing most of the uranium and some of the Ra-226 using ion exchange resins the liquids are discharged into the river Olt.

In total, 500 persons work on the Feldioara site (including all auxiliary tasks). The verification team was told that production is organised in campaigns.

The environmental control laboratory shares its equipment with another structure at the site that analyses also samples from other uranium sites in Romania.

7.2 MONITORING OF RADIOACTIVE DISCHARGES

7.2.1 General

The verification team inspected the Feldioara site, in particular the production area, the laboratory, the settling ponds, and the discharge purification installation. At the time of the visit most of the staff of the site was on vacation, thus no production and no work in the laboratories took place. The team was told that the radiation protection section at the site employs 15 staff. The National Uranium Company's chief inspector for radiation protection at Feldioara was available to the team for information and explanations.

At the time of the visit some dismantling and repair work was ongoing at the site. The site gave the impression to urgently need renovation, at least with respect to building structures.

7.2.2 Liquid discharge monitoring

The verification team received a full explanation of the discharge monitoring facilities at the site.

The plant operates very much (20 – 30%) below the originally foreseen capacity, thus currently the liquid waste release volume is low.

All waters, including rain water and waters coming from various uses such as toilets, after conventional purification go to one liquid discharge system. The liquids are piped to a pond (Cetățuia 2 lake) that contains all contaminated waters. The lake is divided into two compartments, the first compartment was completely full with sediments whilst the second compartment was in operation.

Cetățuia 1 lake is an artificial pond at a somewhat higher altitude with non-contaminated water that serves feeding the plant with clean water for "industrial" purposes.

After a first sedimentation in Cetățuia 2 the remaining liquid is piped to another pond (Mitelzop pond) for further settling. The waters from this pond are "decontaminated" in the decontamination building by ion exchange treatment to remove most of the uranium. Radium is also removed to a certain extent. From there the waters are piped to the Olt River that flows several kilometres east-northeast of the Feldioara plant. The discharge limits are defined by the Ministry of Environment and were renewed in 2006 for a period of six years.

All lakes/ponds mentioned above are located near the plant in the surveillance zone.

Samples of liquid waste are taken on site and off site before release to the Olt River. At the river Olt there are two sampling points, one at 1 km upstream and one at 1.2 km downstream of the discharge point (Rotbav village).

Tailings ponds

The verification team was shown the large tailings ponds. At the time of the visit security staff were patrolling the area. Access to the location is possible only using a 4-wheel drive car. The pond area is owned by the National Uranium Company S.A.. Part of the land in the surveillance zone belongs to the Feldioara municipality.

The bottom of the ponds is made of a clay layer, sealed with bitumen.

At the moment of the verification, one of the compartments of Cetățuia 2 was full, and the second one was partially filled. Apparently a first remediation concept for this pond including covering of the area has been drafted, however, no details were given to the verification team. The team was informed that this project has been submitted to the Ministry of Environment and the local administration for authorisation.

The pond for final sedimentation has a maximum depth of 12 m. It has a high density 1.5 mm polyacrylamid foil liner. The pond is filled via several tubes with outlet points at various levels. At the time of the verification the pond was filled to the 10 metre level.

From this pond the liquid is pumped with a constant flow into a 100 m^3 intermediate reservoir ("*Bazinet*"). Any overflow is led back to the pond by gravity. From this basin the liquid is led by gravity to the purification plant. Control samples are taken either at the exit point of the intermediate reservoir or at the entrance point to the purification plant. At the time of the visit the reservoir was empty. Several flow meters record liquid flow rates. The team was told that water flow rate fluctuations are small.

Two similar additional systems are in place at the site for piping discharges to the purification plant. The team was told that due to the low production rate they are not in operation.

Decontamination building

The team verified the decontamination building of the plant. It is locked for physical protection. Generally, operating times are three months per year; apparently the natural evaporation of water in the discharge pond does not necessitate a higher frequency. In the building four lines with four ion exchange columns each are installed, each column is 2.5 m in diameter and 10 m in height. The columns can be operated in parallel or in series; usually eight colums are working in series. Decisions on ending a purification process are based on checks of the purification capacity. According to a specific order, valves are set such that after termination of a purification task the last column in the purification process is bypassed and set for regeneration. The column that has been recently regenerated is set as first column, receiving fresh input from the pond.

Regeneration of the resin is done with NaCl solution. The process takes some 8 hours. The regeneration residues are kept in basins. Four basins of a 80 m^3 each are available for this purpose. At a certain salt concentration the material is transported by truck back to the factory to remove the uranium.

The verification team noticed some signs of deterioration of the building. The team was informed that a new treatment station for decontamination is already in project status and will start construction after 2012.

At the southeast point of the building the verification team was shown one of the sampling points for liquids to be discharged from the purification plant. The water is taken with a bucket and a cord.

Olt River discharge point

The verification team performed a visit in Rotbav village where the liquid discharge point into the river Olt was seen.

Originally a basin for mixing with river water was built. However, studies showed that the activity discharged to the river stayed the same. Thus, the mixing process was stopped. Now the basin is only used for sampling purposes.

The pipe leading underground to the river has a length of 1 km. The Olt River flow rate is 85 to 300 m^3/sec according to information supplied by the water authority. Discharge flow rates are between 40 and 240 m^3/h, depending on operating conditions and/or the authorisation. The pipe has a valve in order to facilitate shutting off of the pipe in case of repair work. The team was told that *CNCAN* asks the operator to test full discharge capacity once per year.

CNCAN has established maximum limits for the uranium and radium content in liquid waste before being discharged to Olt River at 0.600 mg/litre for uranium and 0.250 Bq/litre for radium.

The verification team urgently recommends finding a stable solution for long term restoration and remediation of any unused tailings ponds. It encourages any improvement work on structural deficiencies.

7.2.3 Gaseous discharge monitoring

The Feldioara plant is in operation 10 months per year (except July and August) and monitoring of gaseous discharges is done only when the installation is running.

Before any releases to the environment the air at the production sites is filtered. These filters are scrubbed with water (that goes into the liquid discharge system).

The team was told that for technical reasons aerial discharges are only relevant in case of extraordinary events. Even in such a case, all radioactivity would be deposited in the near surroundings, the area furthest away being the forest surrounding the site. The sampling schemes currently available for aerial discharge and on-site deposition sampling are listed in table 1. All the exhaust samples are measured by SSRM Braşov; the deposition samples are taken by and measured at the Radiation Hygiene laboratory at Braşov (the Feldioara plant being informed about the results.). An emission limit for uranium has been defined by *CNCAN* (44 kg annually). The team was told that due to the procedure applied stopping discharges in case of high concentrations in an exhaust is not possible. Since at the time of the visit the site was not in production the team could not verify an operating sampling device.

Table 1: Sampling points for aerial discharges and deposition

Sampling point	Uranium concentration		Total alpha and beta concentration
	Mg/l	Mg/m^3 month	
Exhaust drying stack ("*R*")	weekly	monthly	monthly
Exhaust ventilation stack (level 5 m)	weekly	monthly	monthly
Exhaust ventilation stack (level 10 m)	weekly	monthly	monthly
Exhaust ventilation stack (level 15 m)	weekly	monthly	monthly
Exhaust stack UO_2	weekly	monthly	monthly
Exhaust stack U_3O_8	weekly	monthly	monthly
Exhaust mixing chamber	weekly	monthly	monthly
Exhaust filtering stack	weekly	monthly	monthly
Exhaust drying stack ("*E*")	weekly	monthly	monthly
Deposition on radioprotection terrace	monthly	monthly	monthly
Deposition at the ponds	monthly	monthly	monthly

Online monitoring of aerial discharges does not exist. The team was informed that this is due to technical problems that would be expected in setting up such a system, and the demand of having expensive devices for radioactive emissions with very low probability and radiological relevance.

7.3 OPERATOR'S ENVIRONMENTAL RADIOACTIVITY MONITORING PROGRAMME

7.3.1 On-site monitoring

7.3.1.1 Air

The verification team was informed that the monitoring of radon concentrations and dry deposition on site is done according to the procedures in place and according to the local monitoring programme for working areas in force at the Feldioara plant. With regard to environmental effects all impact estimates are based on the gaseous emission monitoring (see chapter 7.2.3).

7.3.1.2 Dose rate and dose

Gamma dose probes (TLDs) are placed on several high voltage pylons placed along the roads crossing the Feldioara site. The probes are situated at one meter height from the ground and measurements are performed once per year.

7.3.1.3 Waters

Altogether there are 19 wells located in the sanitary protection zone and its proximity. The sampling scheme for various waters on site the Feldioara plant is described in table 2.

Table 2: On-site water sampling scheme for the Feldioara plant

Sampling point	Type of water	Frequency
"Bazinet"	Residual water	Daily
Settling pond Cetățuia 2 lake	Residual water	Weekly
Supply treatment station	Residual water	Weekly
Disposal treatment station	Residual water	Weekly
Tap at sanitary unit	Drinking water	Monthly
Well 21	Ground water	Monthly
Well 1	Ground water	Monthly
Well 2	Ground water	Monthly
Well 3	Ground water	Monthly
Well 11	Ground water	Monthly

Sampling point	Type of water	Frequency
Well 12	Ground water	Monthly
Well 13	Ground water	Monthly
Well X	Ground water	Bi-monthly
Well 4	Ground water	Bi-monthly
Well 5	Ground water	Weekly
Well 5 bis	Ground water	Bi-monthly
Well 6	Ground water	Bi-monthly
Well 6 bis	Ground water	Monthly
Well 7	Ground water	Quarterly
Well 8	Ground water	Quarterly
Well 9	Ground water	Quarterly
Cetățuia lake	Surface water	Quarterly
Well 207 (waste storage)	Ground water	Quarterly

7.3.1.4 Vegetation and soil samples

The verification team was informed that there are two soil and vegetation sampling points on-site which are sampled twice a year.

For soil sampling a frame of 30x30x5 cm is used; for vegetation samples the same area is cut with a sickle.

7.3.2 Off-site monitoring

7.3.2.1 Dose and dose rate

Gamma dose probes (TLDs) are placed on several high voltage pylons placed along local streets and national roads in the surroundings. The probes are situated at one meter height from the ground and measurements are performed once per year.

7.3.2.2 Drinking water

The verification team was told that currently in Rotbav Village there are four wells selected by the Feldioara plant to sample drinking water monthly. At the time of construction of the Feldioara site all drinking water supplies were from individual wells; however, now a municipal water supply system pumps water from the mountains in the east.

7.3.2.3 River water and sediment

There are four surface water and sediment sampling points established. Two are along the Olt River, the main river in the area, one upstream (at Feldioara) and one downstream (at Măieruş) of the discharge pipe from the decontamination plant. One sampling point is at the river Rotbăşel, one at river Crisbăşel, two small brooks in the area. Sampling is performed quarterly; samples are analysed by the Feldioara laboratory.

Sampling locations and the corresponding programme have to be agreed by LEPA Braşov. *CNCAN* has established maximum limits for the uranium and radium content in river waters at 0.01 mg/litre for uranium and 0.04 Bq/litre for radium.

7.3.2.4 Soil and Vegetation

There are some 10 sampling locations for vegetation and soil outside the plant, situated between the main buildings of the Feldioara plant and the river Olt. Sampling is done twice a year.

For soil sampling a frame of 30x30x5 cm is used; for vegetation samples the same area is cut with a sickle. Agricultural soil is sampled to a depth of 20 cm.

The team was informed that – in addition – once a year at fifteen points soil and vegetation samples are taken with a view to check the transport route for uranium ore. The respective sampling locations are situated at the Feldioara train station and along the railroad connecting the station with the plant.

With regard to the on-site and off-site environmental monitoring programme as performed by the operator the verification does not give rise to remarks.

7.3.3 Operator's environmental control laboratory

General

The verification team was informed that at the Feldioara plant two groups have been set up dealing with samples from the site and also from other uranium production related areas: the section "research, radiation protection and environmental conditions" (*Cercetare, Radioprotecție, Factori de Mediu*, *CRFM*) and the plant's local control laboratory. These groups use the same devices and apply the same procedures but have different staff. At the time of the visit due to vacation the laboratories were not operating.

The local control laboratory is responsible for the monitoring of the Feldioara plant.

The research section ensures the analysis of most of the environmental samples taken at all mining branches of the company in order to cover the annual monitoring programme of each mine. This part of the work programme includes also sampling once per year at the Crucea uranium mine in parallel to the mine's own programme, at the same places that are used by the mine. In addition, with regard to the local monitoring at Feldioara the group analyses one sample per month.

In case the research section and the local laboratory arrive at different results for the same sample the measurements have to be repeated. For this purpose the local laboratory keeps a witness sample until a reasonably similar result is achieved.

Another task of the research section is development and testing of procedures before implementation in the local laboratories.

Fifteen persons are working in the research section, of these two scientists, four engineers and a medical doctor. The Feldioara local radiation protection laboratory employs four persons.

Annually, *CRFM* handles

- 410 analysis of uranium in waters,
- 410 analysis of Ra-226 in waters,
- 90 analysis of uranium in sediments,
- 90 analysis of Ra-226 in sediments,
- 145 analysis of natural uranium in soil,
- 145 analysis of Ra-226 in soil,
- 145 analysis of natural uranium in vegetation,
- 1545 analysis of Ra-226 in vegetation,
- 232 gamma dose rate readings.

Quality assurance

The laboratory and the research section do not have RENAR accreditation. Feldioara has periodical internal audit sessions for QC.

The verification team acknowledged the QC system manual of the National Uranium Company S.A., made for its Feldioara branch. The manual contains all procedures for the local laboratory and the research section. These procedures are developped by the research section. After agreement by the company's QC department, the QC inspector, and the directors, the procedures are sent to *CNCAN* for approval.

In particular, the verification team was shown the procedures for Ra-226 determination in water, soil, sediment, and vegetation.

The verification team was informed that the laboratory has calibration sources manufactured by *IFIN-HH,* Bucharest; *New England Nuclear*, USA; *Radiochemical Amersham*, UK; *New Brunswick Laboratory*, USA; as well as some from the former Soviet Union and the Czech Republic.

The Feldioara laboratory takes part in inter-comparison exercises with laboratories from the Public Health Authority but not in international ones.

Archiving and reporting

The laboratory has an archive for soil, vegetation and sediment samples (ashed) at the Feldioara research sector.

All data are kept on paper. The local mining zone reports are sent monthly to the National Uranium Company. Consolidated reports are sent monthly to the National Uranium Company, to LEPA Brasov, to the regional public water authority, and to Feldioara City Hall.

An annual report containing local and sector results is sent to *CNCAN* via the company headquarters.

Every two years an evaluation of the radiological risk factors is commissioned by the plant from an accredited company. This includes the radiological impact, an occupational study, etc.. The reports are handed over to the Feldioara plant administration.

Equipment

For uranium determination (in waters) currently a photo colorimetric method with an old Russian device is used. A new apparatus, a *Varian Cary 50 UV-Vis Bio spectrophotometer*, is currently being tested.

For water evaporation, a new sand bath is used in a small *Asalair Carbo 900* exhaust unit.

For ashing of samples, an old furnace with an old external power supply, and new equipment is available.

The verification team noted a new *Kern ALT 220-4NM* balance.

For contamination measurement the laboratory has several *Thermo Electron Corporation FHT111M* contamination monitors (one of them new) and an old *Frieseke& Höpfner CONTAMAT* available. The counting gas butane is supplied by *Canberra Romania*.

The team also noted the presence of several new *Pylon AB-5* portable radiation monitors, some with *WG101* water degassing units, calibrated in April 2008 by *Pylon*. The devices were bought from *Mecrosystem*, Romania, which also has been given a service contract. Six of the devices are used for radium and two for radon determinations.

For radon measurements a *Genitron Alpha Guard* monitor is also available.

Gamma dose rate measurements are performed using a *Thermo Electron Corporation FH40G-L10* survey meter.

To measure the content of uranium in air, an old air sampler type *F&J*, activated by a *GAST* pump with a *F&J* rota meter is used. Within 5 minutes 100 litres of air are pumped through a filter. The last calibration witnessed by the team in the documents dated from 1997. The team was informed that recently a re-calibration of the device was performed but this was not marked on the device. The team was informed that the equipment will soon be replaced.

The verification team acknowledged the intention to modernise the Feldioara laboratory.

The verification team encourages all efforts to modernise the laboratory. With a view to facilitating quality controls it suggests marking all measuring devices with the latest calibration date.

8 INDEPENDENT CONTROL BY THE REGULATOR IN THE URANIUM MINING AND MILLING INDUSTRY

8.1 INTRODUCTION

Romanian authorities exercise an environmental radiological control and monitoring of all uranium mining and milling installations and of their surrounding territories.

Within the authorisation process *CNCAN* approves discharge limits, derived from annual dose limits; it assesses and approves the plans for discharges of radioactive substances. In cooperation with the local Environment Protection Agencies *CNCAN* also establishes the monitoring locations and maximum allowed concentrations for radioactive pollutants such as uranium and radium in environmental media.

Environmental authorisations are issued by the central authority for environmental protection on the basis of the criteria defined by the laws in force. In consultation with *CNCAN* and the Ministry of Health they are completed with specific authorisation and control criteria.

In practice, the regulator runs his own monitoring programme including the controlled area of the mines and their surroundings, using mostly the same sampling points as those used by the operator (including for food and vegetation).

Between 1998 and 2000 *CNCAN*'s General Directorate for Environmental Radioactivity Surveillance initiated several programmes in the area of the Crucea site. A quarterly sampling campaign was conducted by SSRM Piatra Neamţ. Surface water, ground water, river sediments, meat, vegetation and uncultivated soil were sampled. Some tailing samples where collected as well.

The preparation of samples and gross beta measurements were done by the SSRM station in Piatra Neamţ, whilst gamma spectrometry was performed by the central laboratory of *CNCAN* in Bucharest.

Milk sampled in 'uranium' areas originates mostly from small private farms and is monitored by the local milk producers (e.g. *Dorna Milk* for the Crucea uranium mine site).

8.2 OCCUPATIONAL HEALTH ASPECTS

CNCAN, from a radiological point of view continuously follows the personal health monitoring of all workers in the uranium mining, uranium processing and fuel fabrication industries regarding the application of legal requirements. Similar attention is given to environmental protection.

CNCAN also assesses the radiological risks of uranium mining. In some cases, these risks constitute the technical basis to close uranium mines which presently are still in a conservation state.

8.3 NEPA'S PROGRAMME

With regard to uranium production related activities the SSRMs (the radiological laboratories of the LEPAs) – besides their routine programmes with regard to national environmental radioactivity monitoring – have specific monitoring programmes in place. These programmes are elaborated by the regional LEPA laboratory in close collaboration with NEPA. They are streamlined to the local conditions.

With regard to the Crucea uranium mining site the relevant SSRM is that of Suceava (verification see chapter 9.3.2.4). The sampling and analysis programme as defined by NEPA is shown in Appendix 4.

With regard to the uranium milling and processing site at Feldioara the responsible body is the SSRM of LEPA Braşov (verification see chapter 9.3.2.1). Its programme takes into account that the network of water bodies in the Braşov region is very dense and many rivers cross the land in the vicinity of the Feldioara site. Thus, on the river Olt (the main river of the region) nine sampling points have been installed upstream and downstream of the Feldioara site discharge pipe. Two other small rivers and one lake are also sampled.

8.4 CONTROL ACTIVITIES BY PUBLIC HEALTH AUTHORITIES

With regard to some areas (e.g. foodstuff monitoring, occupational health aspects) the local public health authorities play an important role.

For example, at the Feldioara uranium milling and processing site, the Public Health Authority of Braşov samples and measures the deposition on one of the buildings' roofs and near the ponds. The plant operator is informed about the results of these measurements.

Another example is fish from the rivers in the area of the Crucea mine that is sampled and measured by the Radiation Hygiene laboratory of the Ministry of Health.

The programmes and the laboratories of these authorities were not part of this Article 35 verification.

9 NATIONAL MONITORING OF ENVIRONMENTAL RADIOACTIVITY, DESCRIPTION AND VERIFICATION

9.1 GENERAL

Continuous monitoring of environmental radioactivity on the Romanian territory is carried out by several organisations. A major part of the national monitoring is performed by the National Environmental Protection Agency (NEPA) and the Local Environmental Protection Agencies (LEPA). NEPA has a reference laboratory for radioactivity (NRL), which ensures the surveillance through a national environmental radioactivity surveillance network (NERSN), consisting of ten '24 hour', one '16 hour' and twenty-six '11 hour' radiological laboratories[5] (Surveillance Station of Radioactivity Monitoring - SSRM) of the LEPAs (see figure 3) and through the automatic early warning system for radiation in the environment (EWS). EWS supports routine radiological surveillance and provides monitoring data needed in emergency situations. Data from EWS are provided also to the EURDEP system managed by JRC-Ispra.

The NERSN standard monitoring programme of these 37 laboratories includes measurements of air, water, vegetation, uncultivated and cultivated soil.

Currently NEPA is in a process of modernisation and upgrading the capabilities of the NERSN network and the NRL laboratory.

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5 '24 hour' programme means four measurement series per day; '16 hours' means three per day; and '11 hours' signifies two per day.

The NEPA laboratory in Bucharest (NRL) organises training for the LEPA-SSRMs; for this task it has technical assistance from Liverpool University, through an EU Phare project.

In the laboratories the samples are stored in special storage rooms. The storage conditions and periods (approximately two years) are determined by the activity of the sample according to the lab's QA/QC procedures. There are still historical samples from 1986 in storage.

In the NERSN laboratories each day four background measurements are performed with regard to the air filter analysis devices; a visual quality control chart allows efficient quality management. When 'higher' values than expected occur the sample has to be re-measured.

Fig. 3: NERSN network of 37 SSRM laboratories in local LEPAs

Within the Phare project some LEPA-SSRM laboratories received new equipment. *Sarad RTM 1688* radon/thoron monitors were delivered to several laboratories dealing with the uranium industry related surveillance. Generally, for air sampling and measurement 'old' and 'new' systems are available in parallel. The project also included some large Pb shields, and *Thermo Scientific FHT1100* devices for total beta and alpha measurement.

Each laboratory bought its own calibration source (with certificate). Strontium sources were mostly supplied by *IFIN-HH* and are old. 17 out of 37 SSRMs have received new strontium calibration sources with certificates through a Phare project, others bought their own strontium calibration sources with certificates.

9.2 AUTOMATIC SYSTEMS

Romania operates automatic systems for the monitoring of ambient gamma dose rate all over the country and particularly at locations close to NPPs (Cernavodă in Romania and Kozloduy in Bulgaria).

9.2.1 Ambient gamma dose rate monitoring networks

Altogether, the automatic ambient dose rate monitoring system comprises 88 stations, spread over the national territory and close to NPPs, all with real time data transmission.

Data from 49 of those ambient gamma dose rate measurement stations (early warning system) are sent daily to the EC through the EURDEP platform; an additional 39 ambient gamma dose rate measurement stations ('new' system) are still in the installation phase.

All data from the automatic ambient dose rate monitoring stations around NPP Cernavodă are transmitted to the Network Coordination Centre (NCC) of NRL; they are checked, validated, stored and forwarded to the Cernavodă NPP operator, the Cernavodă Town Administration and to the laboratories of the National Environmental Radioactivity Surveillance Network (NERSN), responsible for the monitoring of the NPP's influence area. Validated data from automatic ambient dose rate monitoring station around NPP Kosloduy are sent to the SSRM responsible for the monitoring of that area. NPP related monitoring did not form part of this verification.

9.2.1.1 For the national territory – 'old' system

All of NERSN's laboratories still operate dose rate monitoring devices of the 'old' system, based on detectors produced by *IFIN-HH* (type *TIEX*, using GM tubes; connected to a base station). Each base station displays instant data (four second intervals) and hourly averaged data. Data transmission to NRL Bucharest is daily, by manually sending the values (thus the system is not completely automated). The system is planned to stop operation when the new system proves to be working reliably.

9.2.1.2 For the national territory – 'new' system

The 'new' system is composed of 39 ambient dose rate monitoring stations. The dose rate probes are from *Umwelt- und Ingenieurtechnik GmbH* (*UIT GmbH*), Dresden, Germany, model *HNQ24*.

The verification team was informed that – due to problems with the supplier – the 'new' system is not yet in routine operation. A detailed analysis is given in chapter 10.2.

Each detector consists of two GM tubes and has a measuring range of 0.03 µSv/h – 10 Sv/h. For dose rates of 10 Sv/h up to 100 Sv/h the monitor will show a minimum of 10 Sv/h.

The operating temperature range is -40 to +70°C.

The device also registers some meteorological data.

The detectors can store up to 4096 gamma dose rate values. The values and meteorological data are sent to NRL, the network coordination centre, by using GPRS as the main data link, and by satellite (*Orbcomm System*) as back-up. The gamma dose rate values are sent every 30 minutes under normal conditions and every 5 minutes in case of an alarm.

For routine and alarm situations the data are sent in real time. Furthermore, they are stored in the local data base on the SSRM's PC in the local LEPA.

A solar panel provides electric power for the detector devices.

Automatic stations at LEPA Braşov

The verification team acknowledged both, the 'old' *TIEX* device from *IFIN-HH*, Bucharest, Romania, and the 'new' system from *Umwelt- und Ingenieurtechnik GmbH* (*UIT GmbH*), Dresden, Germany.

The 'old' dose rate monitoring system is installed in the premises of the SSRM, with the probe mounted on a guard rail on the roof platform and the ratemeter device located in a room of the laboratory. Maxima and averages of the hourly measurement results are manually introduced in *EXCEL* files that are sent by e-mail to NEPA as daily reports. Monthly, an interim report is also provided by the laboratory to NEPA. The team was informed that this system is still used because of problems with the 'new' system.

The 'new' measuring device is located in a school yard (belonging to the *Liceul Unirea*), at a distance of some 200 m from the laboratory. The location was selected by LEPA Braşov. Initially it was foreseen to choose another location but the city's public authorities – for historical reasons (Braşov is a very important national heritage city) – did not allow digging a suitable hole for the base plate needed at that place.

The team witnessed that the schoolyard is protected by a 2 m high wall. The corner of the part where the devices are situated is separately fenced-in, to avoid vandalism. An extra grated fence protects the devices. Several trees stand close-by, towards the street, somehow shading the device. The team had the impression that the solar panel and the electronics cabin shield the detector tubes that are mounted 1 m above ground, which does influence measurement; however, LEPA considers that there are no shielding effects based on the Contractor's statement. The team noted that the equipment had the Phare project support number RO2003/005-551.04.11.01, lot nr. 1.

The 'new' weather mast provides data from the rain gauge, the wind and the temperature sensor. An 'old' weather mast is situated outside the inner fence. It does not belong to LEPA Braşov.

Data transfer from the measuring device to the laboratory (where the devices for data transmission to NRL Bucharest are located) is done via radio link. The team was told that for meteorological data a different solution is used than for gamma dose rate data. Weather data arrive at one place, gamma dose rate data at another. *UIT* could not combine the methods. Thus, apparently quite often now, there are problems in communication of the data to NRL.

The verification team acknowledged the display device for the 'new' EWS system. The team was told that nearly all LEPAs and NRL have the same presentation layout, there are only differences in the functionality. Various time trend diagrams and tables were demonstrated. Obviously some of the meteorological data displayed were erroneous (e.g. temperatures of -40°C, in summer!). Also this device had a Phare support project number. The team was informed that the system was not yet officially accepted.

The team saw a UPS system with sufficient battery backup for the device.

> *The verification team suggests improving the installation of the 'new' gamma dose rate probes to avoid any shielding effects. It recommends finding efficient solutions for all current technical problems (such as the data link between the measurement location and the laboratory).*

Automatic stations at LEPA Sibiu

The verification team saw both, the 'old' dose rate monitoring system from *IFIN-HH*, Bucharest, Romania, and the 'new' system from *Umwelt- und Ingenieurtechnik GmbH* (*UIT GmbH*), Dresden, Germany, that had recently been received and installed.

For the installation of the 'new' gamma dose rate monitoring system, the laboratory had to place the devices, including the fence which has a lockable gate and the meteorological mast, outside the fenced-in orchard surrounding the LEPA building, close to the pedestrian footpath of the street. The team was told that the land does not belong to LEPA but to air traffic control that did not allow cutting of any of the fruit trees in the orchard necessary for placing the device. All other sampling devices operated by LEPA are placed in the orchard. The team noted that the system has the 'standard' set-up, thus the GM tubes are shielded by the solar panel and the electronics cabinet. Although outside the orchard itself, one tree is located close to the measuring equipment, thus probably leading to a significant shielding effect. Data transmission to the weather data logger is provided by a radio link, and for dose rate by a cable.

The team was shown the data presentation device for the 'new' system with *Heavy Weather Pro 3600* software for meteorological data and *UIT*s *EWSMonitor* software for gamma dose rate data. The dose rate curve presented showed several data gaps, some from a single GM tube, some for both detectors.

The 'old' dose rate system still operates in parallel with the 'new' one. The 'old' gamma dose rate system has a *IFIN-HH TIEX-2*; detector situated at about 2.5 m above ground, and 0.75 m above the cabin containing pumps for the air sampler. Data are manually read from the device, input on a PC (*EXCEL* file) and then once per day sent by e-mail to NRL in Bucharest. A monthly interim report is also provided by the lab to NEPA.

The verification team suggests improving the installation of the 'new' gamma dose rate probes to avoid any shielding effects. It recommends finding efficient solutions for all current technical problems (such as gaps in the data from the two detector tubes).

Automatic stations at LEPA Târgu-Mureş

The verification team saw both, the 'old' dose rate monitoring system from *IFIN-HH*, Bucharest, Romania, and the 'new' system from *Umwelt- und Ingenieurtechnik GmbH* (*UIT GmbH*), Dresden, Germany.

The 'new' gamma dose rate system is situated at some 7 m from the bridge over the river Mureş that is towering some 5 m above the measuring station, and at 15 m from the 10 m high LEPA building. Originally, the system was located better, in a small garden behind the building, more removed from any obstacles, near the soil sampling site. Due to problems with the weather data radio link to the laboratory (gamma dose rate data are transmitted by cable), a compromise for the location of the system had to be found. The place is additionally fenced-in to protect it against vandalism. The team noted that the system has the 'standard' set-up, thus the GM tubes are shielded by the solar panel and the electronics cabinet.

The team was shown the standard data presentation system, *UIT*s *EWSMonitor*, for gamma dose rate and meteorological data. Only few data gaps were seen.

The team acknowledged also the 'old' gamma dose rate device, *IFIN-HH TIEX-2*. The detector is mounted on the balustrade of the roof terrace of the laboratory building, at about 1.8 m above the terrace floor. For data collection and transmission to NRL Bucharest the standard routine is used. The verification team was told that this device will be taken out of use as soon as the 'new' system operates reliably, thus a change in the setup does not seem reasonable.

The verification team suggests improving the installation of the 'new' gamma dose rate probes to avoid any shielding effects, e.g. by the solar panel.

Automatic stations at LEPA Suceava

The verification team saw both, the 'old' dose rate monitoring system from *IFIN-HH*, Bucharest, Romania, and the 'new' system from *Umwelt- und Ingenieurtechnik GmbH* (*UIT GmbH*), Dresden, Germany.

Both systems are set-up and operated in the 'standard' way as described above, e.g. for LEPA Sibiu.

The 'new' gamma dose rate system (*UIT* Dresden), is situated relatively close (5 m approximately) to the three storey building where the laboratory is situated.

The verification team suggests improving the installation of the 'new' gamma dose rate probes to avoid any shielding effects, e.g. by the solar panel or by the building.

9.2.2 Water monitoring

The automatic water radioactivity monitoring network of Romania comprises five submersible "intelligent" probes installed along the Danube River. They are manufactured by *UIT GmbH* and use a 2"x2" NaI(Tl) detector for measurement. An Am-241 source is embedded to allow energy stabilisation (avoiding energy drifts due to temperature fluctuations). The nominal measuring range is 0.01 to 100 MBq/m^3. Data storage in the device is up to 10 years, in a local computer with 40 GB storage capacity; data are sent to the network coordination centre at NRL by GPRS. The frequency of data transmission is programmable; in normal conditions it is twice daily, under emergency conditions every hour.

No station of the automatic water radioactivity monitoring network was included in the verification visit.

9.3 LABORATORY BASED NETWORK

9.3.1 Sampling and measurement programme

9.3.1.1 Air

In 2006, through a EU Phare project Romania received 18 new aerosol samplers (max. capacity 30 m^3/h) which have been installed in SSRM stations. If technically possible, the old devices are used as backup samplers.

The 'new' devices (type *VOPV-10*, made by *VF s.r.o.*, Slovakia) use a centrifugal pump with a processor controlled high-speed induction motor, a flow meter, a control unit, and a keyboard. A 2x16 character alphanumeric display that can show the current airflow, the total sampled volume from the start of the system, the sampled volume in a selectable time interval, the total number of operating hours from the start, temperature and pressure of the sampled medium, the status and error messages, and the current sampling time. After a power supply failure the device automatically restarts when power supply is restored.

The connection to an external PC via an RS-485 interface is possible. The operational temperature range is from -20°C to +50°C. The device uses glass fibre filters (retention coefficient 90%). The frequency of filter change is 5 hours; there are 4 filters/day for SSRM stations with 24 hour programme, 3 filters/day for the SSRM station with 16 hour programme and 2 filters/day for SSRM stations with 11 hour programme.

The filters are analysed in the local laboratory (total alpha and total beta). Beta measurements are performed at intervals of 3 minutes, 20 hours and 5 days after the end of sampling. This method allows to take into account the radioactive decay of radon and its decay products and to have a rough idea about the presence of long half-life radionuclides. Gamma spectrometric analysis is performed on all the filters from each month (if the local laboratory does not have the capability the filter material is sent to a LEPA laboratory suitably equipped, e.g. Constanța, Craiova, Iaşi, Baia Mare, Arad).

Beta measurement results are reported separately in *Excel* format and stored centrally at NEPA Bucharest. The results are transmitted daily to EURDEP and yearly to the REM Data Base at JRC Ispra.

9.3.1.2 Precipitation (wet and dry deposition)

Precipitation (dry and wet deposition) collectors are situated in the SSRM (LEPA) yards. The samples are taken daily. When it does not rain, the collector is washed with 1 litre of distilled water according to written procedures.

In the case an analysis of tritium is foreseen 250 ml of the original rain sample (avoiding the distilled water) are separated and specially treated. This sample has higher priority than the ones for total beta and gamma spectrometric analysis.

For total beta analyses the remaining sample is evaporated and the residue is measured on the same day for 1000 seconds and again after 5 days for 3000 seconds.

For gamma spectrometric analyses all samples collected in one month are combined, the evaporation residue is measured at the end of the month.

9.3.1.3 Ground water

A one litre sample is collected every day. After evaporation, the residue is measured for total beta the same day, for 1000 s.

9.3.1.4 Surface water

NERSN performs surface water monitoring for the whole territory, including the Danube River. Water is collected daily at different locations all over Romania. All the sampling points are situated on the rivers in the vicinity of cities.

One litre samples are collected daily. For gross beta analysis the water is evaporated and the residue is measured on the same day, for 1000 seconds; after 5 days the sample is measured again for 3000 seconds.

For gamma spectrometric analyses the daily samples of a month are combined.

9.3.1.5 Drinking water

National monitoring for drinking water is carried out by the Ministry of Health (MH) network of ionizing radiation hygiene laboratories, according to provisions of art 38, 39 of Law no. 111/1996 based on the methodology elaborated by the Institute of Public Health (IPH) Bucharest. Three to five litres of drinking water are sampled on a quarterly basis. For screening purposes gross alpha and beta activities are measured. In cases where gross activity levels are higher than the accepted levels, K-40, Cs-137, Sr-90, Ra-226, natural uranium and in certain cases Po-210 are measured.

For nuclear facilities related monitoring, the radioactivity of drinking water is assessed monthly. For water sampled in the sourroundings of the NPP, gross alpha and beta as well as tritium are measured monthly; in cases where annual gross activity levels are higher than the accepted levels, Cs-137 and Sr-90 are determined. For water coming from a mining or a nuclear fuel processing zone, gross alpha and beta are measured on a quarterly basis; in cases where gross activity levels are higher than the accepted levels, natural uranium, Po-210 and Ra-226 are measured.

9.3.1.6 Soil

In the Standard monitoring programme, at the NERSN stations uncultivated soil is sampled weekly; sample size is 10 cm x 10 cm x 5 cm. The samples are dried. After 5 days a beta measurement of 3000 seconds is performed. Gamma spectrometric analysis is performed on a yearly basis (the sample from July).

9.3.1.7 Vegetation

In the Standard monitoring programme, sampling of vegetation is done in the network's SSRM yards. Between 1st of April and 31st of October, once every week, vegetation on one square meter is collected and dried. After 5 days a gross beta measurement of 3000 seconds is performed. Gamma spectrometric analysis is performed on a yearly basis (the sample from July).

9.3.1.8 Foodstuffs

National monitoring of foodstuffs is carried out by the Ministry of Health (MH) through the network of ionizing radiation hygiene laboratories, in accordance with the requirements of Law no. 111/1996. Details on methodological issues such as type of foodstuff, frequency of sampling and source of food sampled are set up by the surveillance methodology elaborated by IPH Bucharest, responsible for technical coordination according to provisions of the ministerial order for the national programme for public health. Additionally, according to the *Joint Ministerial Order no. 1805/286/314/2006* of the Ministry of Health on the implementation of the regulation regarding radioactive contamination of foodstuff and feeding stuffs, MH via the public health authorities and *ANSVSA* are responsible for:

- Monitoring the level of radioactivity of food and feed after a nuclear emergency or accident,
- Checking imported food at the borders,
- Designating the network of specialised laboratories,
- Publishing the information on those designated laboratories in the Official Journal.

9.3.1.9 Milk

For the national monitoring programme MH's laboratories measure 10 litres of milk quarterly from the local dairies of each district in the country for gross beta and K-40 measurements. Yearly a gamma spectrometric analysis is performed and the content of Sr-90, Ra-226, and in some cases Po-210 is determined.

For nuclear facilities related monitoring 10 litres of milk from local farms, markets or dairies are taken on a quarterly basis. Gross alpha, gross beta and K-40 are measured. On milk collected in the surroundings of the NPP a quarterly analysis with regard to e.g. Cs-137 and Sr-90 is performed. For mining or nuclear fuel processing areas, natural uranium, Po-210 and Ra-226 is measured every three months.

9.3.1.10 Mixed diet

For the national monitoring programme MH's laboratories sample daily 2 – 3 meals served in schools, kindergartens and some other canteens. On quarterly bulked samples gross beta and K-40 are determined. Yearly the content of Cs-137, Sr-90, Ra-226, and in some cases Po-210 is measured.

For nuclear facilities related monitoring the quantity and the sampling procedure is the same as above, however the origin of the foodstuff differs. Gross beta, gross alpha and K-40 determinations are performed quarterly on the bulked samples. In the NPP area Cs-137 and Sr-90 is measured quarterly. For mining or nuclear fuel processing areas, natural uranium, Po-210 and Ra-226 are measured quarterly.

9.3.1.11 Individual foodstuffs

For the national monitoring programme, the following products are sampled quarterly: 7 kg meat, 5 kg fish, 3 – 5 kg cereals, flour or bread, 10 kg carrots, 5 kg cabbage, 6 kg potatoes, 5 kg tomatoes, 5 kg peppers, and 10 kg apples.

The radionuclides assessed annually are: K-40, Cs-137, Sr-90, Ra-226 and in specific cases Po-210.

For nuclear facilities related monitoring the quantities are the same as above, however sampling is quarterly, mainly from local producers. Gross alpha and beta and K-40 are assessed. Cs-137 and Sr-90 are measured in the NPP's area. For mining or nuclear fuel processing areas natural uranium, Po-210 and Ra-226 are measured.

Mushrooms are sampled not as part of the routine programme but as part of some research studies on the Cs-137 impact after Chernobyl and with regard to heavy metal contamination.

9.3.2 NEPA co-ordinated laboratories

After the Chernobyl accident in 1986 the monitoring network (NERSN) consisted of 47 laboratories all over the country. In 2000 it was reduced to 37.

NEPA's reference laboratory, NRL, gathers the results of all the gross beta measurements from the local LEPA-SSRM laboratories that are co-ordinated by NRL.

NRL transmits daily reports to the MMDD and other governmental organisations.

Other results e.g. on gamma spectrometry, radon and thoron are compiled by the laboratories and a monthly report is sent to NRL.

Based on the monitoring data, NRL prepares an annual report and distributes it to the relevant national authorities. Data are also transmitted to the EC REM database.

9.3.2.1 SSRM at LEPA Braşov

General

The verification team visited the local LEPA laboratory in Braşov, about 200 km north of Bucharest. Altogether, LEPA Braşov employs 50 persons, two of those form the basic staff for performing the the radioactivity measurements in the SSRM laboratory. Three other staff members are trained for radiological work when needed.

Within the NERSN system, SSRM at Braşov is an '11 hour station' handling environmental radiation monitoring samples according to the national monitoring programme for the region. In addition, it has a Feldioara uranium processing plant related special work programme which is defined together by NEPA and LEPA, based on the results of the measurements in the preceeding year. The verification team was informed that with regard to tasks related to Feldioara the sampling points (for water, soil and vegetation) of SSRM Braşov are completely independent from the ones of the Feldioara plant operator.

Drinking, surface and ground waters, after sampling, are evaporated in the laboratory and measured for beta analysis. For gamma spectrometry, water samples, as well as soil and vegetation samples are sent by mail to the SSRM laboratory in Constanța where they are prepared for gamma spectrometry and measured.

All beta measurements are performed locally in Braşov.

Sample reception, registration and preparation

Samples taken by LEPA staff are delivered to the laboratory with LEPA's own car

The evaporation of water is done in ceramic bowls, placed in sand baths, using infra red lamps.

A small *Caloris L1003* muffle furnace is used for ashing vegetation samples. Drying of vegetation and soil samples is done in a *Memmert* drying cabinet.

The verification team acknowledged the availability of manuals and procedures at the work places. The keeping of a daily logbook including all sampling and beta measurement data reflects the good accountancy of daily tasks.

The team notes that staff performs routine tasks very efficiently.

Measuring Equipment

The laboratory is equipped with an 'old' gross beta measurement system consisting of a *Nuclear Enterprise SR5* scaler ratemeter with an external GM tube mounted in a shield consisting of several lead rings. This measuring system ("chain 2") is used as a backup.

The 'new' system ("chain 1") is a *Thermo Scientific FHT 1100 counter* with the GM tube built in. It is used for gross alpha / gross beta measurement, in particular for measurements of filters from the new aerosol sampler. The verification team was told that the new aerosol sampling device is already used in a routine way.

The new devices were received within a Phare project.

Calibration of the devices is done as a daily routine. All values are documented in *Excel* spreadsheets.

The laboratory has a UPS available that ensures sufficient battery back-up to the measuring devices.

The team was told that any technical repair and maintenance is provided by a local specialised company, *Beta Ray*, Braşov. There is no maintenance contract between the laboratory and this firm; work is performed on demand.

Roof platform

On the roof platform of the laboratory building the verification team were shown a white wet/dry deposition sampler; a steel precipitation sampler for tritium analysis; as well as a small precipitation sampler for "conventional" pollutants' analysis.

The head of the 'new' aerosol sampling system is mounted horizontally on the banister of the platform..

A PM10 aerosol sampler is available for conventional pollutant analysis tasks.

Reporting

The verification team was told, that, currently, NEPA is working on a technical specification for a Phare project for developing an information system able to share environmental data in the whole country. This approach will no longer use *Excel* files for data transfer to NEPA Bucharest.

> *With regard to laboratory tasks and equipment the verification does not give rise to any specific remarks.*

9.3.2.2 SSRM at LEPA Sibiu

General

The verification team visited the SSRM unit at LEPA Sibiu.

LEPA Sibiu is accommodated in a large modern building. Altogether, LEPA Sibiu employs 50 staff, 14 of whom work in the monitoring department. From those 14, two (one chemist and a technician) are working in the radiological unit, the SSRM. One other staff member of the department acts as back-up for the laboratory technician if needed.

The monitoring department also operates the electronic database of the agency.

SSRM Sibiu is an '11 hour station' which handles environmental radiation monitoring samples according to the national monitoring programme in the region. Yearly, the laboratory samples and analyses around 3500 samples (air, wet/dry deposition, precipitation, surface water, drinking water, soil and vegetation). Gross beta measurements are performed at the SSRM; samples for gamma spectrometric analysis are sent to NEPA Bucharest (from where they are further sent on to LEPA Craiova); any tritium measurements are done at NRL in Bucharest.

Sample reception, registration and preparation

The verification team visited the reception and sample preparation room, where the various water and vegetation samples are prepared for gross alpha/beta analysis.

Evaporation of water samples is done using IR lamps, in an extractor hood.

Drying of sampled vegetation is done in a *Memmert* drying cabinet, ashing is done using a *C4.3*furnace , made by *ITRD Pascani S.R.L.*, Romania.

Laboratory samples (e.g. filters) are kept very orderly by the staff. Sample identification codes are written on the planchets used for beta measurements to avoid mix-up.

The verification team acknowledged the availability of all manuals and written procedures used at the work place.

Measuring Equipment

For routine measurements the laboratory is equipped with a new, GM tube based gross alpha/beta counter. At the time of the visit this device was under testing. The verification team was informed that the device showed quite high background counts. Due to this, the values of the measured samples are often "below the detection limit". Thus, the laboratory still uses the 'old' *IMH CMR-ß-03* counting device with a GM tube mounted in a shield consisting of several lead rings.

Calibration of the devices is done as a daily routine. Background is measured three times a day.

The laboratory has a 1000 VA UPS available for electric power back-up.

Archiving, Quality assurance

Data archiving since 1991 (when the laboratory was established) is done on paper and since 2002 also in electronic format (on CD-ROM). In 2006 a computer database was created.

Aerosol filters are kept very orderly on small shelves for a month; then they are sent to NEPA Bucharest.

The *Sartorius* analytical balances are periodically checked by the personnel and calibrated yearly by the national calibration body.

Outside yard

LEPA Sibiu installed several sampling and monitoring devices in the large orchard behind the building. There, the verification team noted the presence of air samplers. One system uses an old pump: manufactured by *Electro Bucuresti*. The gas counter was produced in Germany by *Ernst Heitlandt*. Recently, LEPA bought a new digital air sampler, *F&J*, Ocole, FL, USA, which at the time of the verification visit was being tested.

The verification team was shown that – in order to be able to use the old filters on the new measuring device (the glass fibre filters are smaller) – the laboratory developed an adapter to be mounted on the sampler head.

Within its standard programme, LEPA Sibiu also has a wet/dry deposition sampler. Sampling is done daily.

Soil and vegetation samples are taken from a selected spot in the orchard. Soil sampling is done from a of 10 cm x 10 cm x 5 cm square surface, once a week from April to October each year. The verification team noted that the sampling locations are well indicated.

The samples are sent to the SSRM station laboratory in Craiova where they are prepared and analysed by gamma spectrometry.

> *With regard to laboratory tasks and equipment the verification does not give rise to any specific remarks.*

9.3.2.3 SSRM at LEPA Târgu-Mureş

General

The verification team visited the regional LEPA's SSRM laboratory, in Târgu-Mureş, some 200 km north of Sibiu. LEPA Târgu-Mureş employs 52 persons, six of them in the monitoring department. Two persons are employed in the radiological unit; one staff member of the department acts as back-up for the laboratory technician if needed.

Within NERSN, the SSRM Târgu-Mureş acts as an '11 hour station' handling environmental radiation monitoring samples according to the national monitoring programme in the region (including drinking water; vegetation and soil).

Gross beta measurements are performed at the SSRM; samples for gamma spectrometric analysis are sent to NEPA Bucharest (from where they are further sent to LEPA Iaşi which recently started gamma spectrometric analyses using a HPGe detector – participation at an IAEA inter-comparison exercise showed good quality; any tritium measurements are done at NRL in Bucharest.

Sample reception, registration and preparation

The verification team acknowledged the sample preparation laboratory which is very spacious. Water sample evaporation is done in ceramic bowls using strong light and infra-red sources.

The drying of sampled vegetation is done in a *Memmert* drying cabinet.

The verification team acknowledged the existence of the manuals and written procedures in place. The daily logbook with sampling and beta measurement reflects the good execution of the daily tasks.

Staff does routine tasks very efficiently.

Measuring Equipment

The laboratory has a spacious measuring room equipped with a new total alpha/beta proportional counter, just recently put in function (*Protean MPC2000*). The old beta measuring device of the laboratory is from *Nuclear Enterprise* using a type *ST6* scaler/timer and a GM tube mounted in a shield consisting of several lead rings. The measuring tasks are distributed between the latter two according to the programme decided centrally, by NEPA Bucharest (one chain measures the potable water and the other chain the rest).

For electric power backup the systems have a UPS with 24 h autonomy.

The verification team was informed that no radiological devices, (except the 'new' gamma dose rate system) were received with Phare support. Within the Phare project not enough money was available to supply all LEPA-SSRMs with new equipment. Thus, some LEPAs had to buy equipment from their own budget.

Quality assurance

The laboratory that performed the gamma spectrometric measurements (i.e. SSRM Iaşi) has participated in IAEA intercomparisons. The verification team was shown the good results of the laboratory.

All the data and the measurement results are kept on paper format and on computer in *Excel* files. Since 1996, the laboratory also has electronic archiving, on CD-ROM's, with data since 1986.

The analytical balances are old, but the personnel keeps them calibrated.

Roof terrace

The verification team were shown a *Becker VT6* (1976) aerosol sampling device equipped with an *Actaris Gallus 2000* gas counter. The equipment has not yet been replaced with a new device (as it is the case in other SSRMs). A large surface stainless steel wet/dry deposition sampler is also installed on the roof. The verification team was told that for the moment for the collection of precipitation samples for tritium analysis the laboratory uses a plastic bucket.

Outside yard

The team was shown the location in the garden behind the LEPA building, where vegetation and soil is sampled. The area is larger than usual (some 3.5 x 3.5 m) and well marked.

River water samples are taken from the Mureş River, near a bridge about 1 km downstream of the laboratory (which is upstream of the town centre, thus according to the standard sampling procedures).

> *With regard to laboratory tasks and equipment the verification team suggests to replace the old aerosol sampling system with a new one, in a similar way as was done in other stations. This remark seems to be valid also for other SSRMs that were not part of this verification visit. The team also suggests replacing the plastic bucket used for collection of precipitation for tritium measurements with a more suitable device.*

9.3.2.4 SSRM at LEPA Suceava

General

The verification team visited the regional LEPA's SSRM laboratory, in Suceava, some 100 km north-east of the Crucea uranium mining site. The LEPA employs altogether 52 staff, 14 of them in the general laboratory, and three in the SSRM, the radiological unit. One of the SSRM staff members works 8 hrs per day only for sampling tasks and as a reserve for the other departments.

SSRM Suceava is a '11 hour' type station, performing environmental radiation monitoring, sampling and measurements according to the national monitoring programme for the region. It also has a special work programme with regard to regulatory monitoring for the Crucea uranium mine site. This programme is defined together by NEPA and LEPA Suceava.

The Crucea related programme contains among others analysis of surface water of several rivers around Suceava town, of used and underground water, soil and vegetation (see Appendix 4).

Gross beta measurements are performed at the SSRM. Since 2007 gamma spectrometric analysis is done at the LEPA Iaşi (at Constanța before).

For the samples coming from the special programme for the Crucea site beta measurement at the SSRM laboratory in Suceava and gamma spectrometry at SSRM Iaşi is required. The sampling programme contains water, vegetation, soil, and waste rock from the Crucea mining waste tips. Such rock samples are taken in the form of fine grains or are crushed to allow preparation of representative samples for an area. Many springs and small rivers are sampled within the programme. With regard to the surface waters around the Crucea site, the sampling is performed upstream and downstream of the mine's discharge location (outside of the mine area). Sampling frequency depends on the importance of the location and is defined by NEPA. No individual food or mixed diet samples are taken by the SSRM within the Crucea specific programme, this being responsibility of the Ministry of Health.

The sampling from Suceava River is done daily (about 1 litre). For other rivers (e.g. Bistrița, Moldova) sampling frequency is monthly, 20 l. One litre is used for beta measurements.

Vegetation from Crucea (only grass) is collected from a surface of 1 m^2; 100 g of dried material is sent to SSRM Iaşi, for gamma measurements, and 2 g (calcinated) are kept for beta measurement at Suceava.

For uncultivated soil samples, 1 g is kept for beta measurements.

Sample preparation

The verification team verified the sample preparation laboratory. Water samples are evaporated by infra-red light in ceramic bowls. The sand bath used is a *Caloris BNC 8.1*.

For the special Crucea mine related programme, soil samples are dried using a *WTB Binder* dryer.

Crucea uranium mine rock samples are generally 400 to 800 g fresh weight. The sample is homogenised and a subsample of 100 to 200 g is prepared for gamma spectrometry; a subsample of 1 g (the calibrated geometry) is taken for gross beta analysis.

For ashing of samples, a new *Caloris srl L 1206* furnace is available.

The verification team acknowledged the existence of manuals and procedures at the working places. The daily logbook with sampling and beta measurements reflects the good execution of the daily tasks. The samples for measuring are arranged very orderly on small shelves in the laboratory. There is a colour code attributed to each type of sample, e.g. red for the standard programme and blue for the Crucea programme, that makes identification and setting of priorities easy.

The team noted that staff does routine tasks very efficiently.

Measuring Equipment

The laboratory has a new alpha/beta counter bought from the LEPA budget. The device comes from *Protean Instrument Corp.*. At the time of the verification visit, it was electrically connected, but was not yet linked to the PC because the laboratory could not yet buy the necessary software. Thus, currently the data transfer and the calculations are done manually by the staff.

An old beta measuring system, *Nuclear Enterprise NE-SZ6*, is still available for gross beta measurements.

The laboratory is equipped also with several portable dosimeters acquired through the Phare programme.

Quality assurance, Reporting, Archiving

The monthly reports on beta measurements of the Crucea mining area surveillance are sent to NEPA in the form of *Excel* sheets containing values, uncertainties, calibration data, etc.. A report with average values is addressed to the local authority for public use, e.g. for presentation on a web site.

Air filters are kept in plastic boxes (pink cover), they are well labelled. Batches of 30 filters are sent to SSRM Iaşi for gamma spectrometry.

The calibration standards solutions are kept in a locked place. There is one Sr-90 standard for the new device and another Sr-90 for the old beta measurement apparatus.

Data archiving by the laboratory began in 1999. Recently, the personnel started to store all the documents and data on CD-ROM. There were also data (even before the Chernobyl accident) available in the paper archive of the laboratory but unfortunately these could not be recovered due to damage by rats. A new and safer location was found for the paper archive.

The verification team found one of the analytical balances calibrated by the National Institute of Metrology. The second balance did not have a calibration mark on it, due to the fact that it was a field balance, received through the Phare project. According to NERSN internal procedures, all samples weighed in the field, with a field balance, must be reweighed with a laboratory balance.

Outside garden area

The verification team noted the existence of a dry/wet deposition sampler and a precipitation sampler (for H-3 analysis).

The laboratory collects soil and vegetation samples from a one square meter surface. They cut small quantities daily in order to obtain 2 g of calcinated grass samples for beta measurements.

In the garden a new aerosol sampler from *Hi-Q Environmental Products Company*, San Diego, CA, USA, model *VS23-0523CV-DFMC230* is installed. The verification team noted that on the electronic display of the device the last calibration shown was for 2007, the next calibration being due in October 2008. The device was bought from LEPA's budget.

> *The verification team encourages the acquisition of suitable software for transmitting raw measurement data from the counting device to the PC and for analysis, with a view to avoid manual handling of data and errors associated with that.*

9.3.3 Ministry of Health laboratories

According to the *Ministerial Order no. 570/2007* of the Ministry of Health (MH), regarding the technical norms for implementing, evaluation and financing of national programmes, a *national programme of prophylaxis* is in place.

In accordance with the Ministerial Order no. 1688/2004 of MH on national public health the responsible body for technical coordination and drafting the surveillance methodology for foodstuff and drinking water is the Institute of Public Health (IPH) in Bucharest.

The national public health network consists of 19 laboratories covering the entire national territory, technically coordinated by the four regional Institutes of Public Health.

Ministry of Health laboratories were not part of this verification visit.

9.3.4 Food safety laboratories

The Laboratory of Nuclear Analysis Techniques of the Institute of Hygiene and Public Veterinary Health performs measurements of radioisotopes in almost all food and feed products such as: products of animal origin: milk and dairy products, as well as meat, fish, honey; feeding stuffs; forest fruit; cultivated or wild mushrooms; water used in the technological process of food processing or in animal farms; dehydrated products (additives, ingredients for food industry).

The sampling frequency is quarterly or twice a year. The samples are analysed for Cs-134 and Cs-137 in an *ANSVSA* controlled laboratory (e.g. Laboratory of Analyses through Nuclear Techniques belonging to the Institute for Hygiene and Veterinary Public Health in Bucharest). These laboratories are notified by *CNCAN* to perform such measurements, through *Notification No. LI 07/2006* (expiry date 2. April 2009).

A determination of the radioactive contamination level can also be performed at the express request of an individual. The laboratory analyses are performed by official veterinary surgeons or by state inspectors authorised for this purpose.

The radioactivity tests for food and feed (Cs-134 and Cs-137) are accredited by the Romanian accreditation body, RENAR, according to ISO 17025:2005 (accreditation certificate No. *190-L*).

In 2006 over 20 000 samples were analysed, of which 9 700 were checked within the framework of the “Strategic program for sanitary veterinary surveillance”.

Food safety laboratories were not part of this verification visit.

10 NEPA-NRL RE-VERIFICATION

As a consequence of the Article 35 verification in Romania in 2007, several recommendations and suggestions with regard to NEPA-NRL were formulated (see report "Verifications under the Terms of Article 35 of the EURATOM Treaty – Cernavodă NPP and the National Network from the South-eastern Romania"; Reference: RO-07/4). During the current visit the verification team paid special attention to the actions set by the Romanian authorities after that visit.

10.1 GENERAL

During the visit of the premises of NRL at NEPA Bucharest the verification team was informed that the NEPA building still was under renovation. The financial basis had been blocked; only recently the renovation work had started again.

The Phare training programme that foresaw training for all tasks relevant to operate the equipment acquired within the Phare project was blocked in 2007; it was going to restart in 2008.

10.2 AUTOMATIC MONITORING SYSTEMS

In relation to the automatic monitoring systems in Romania the verification of 2007 stated:

> *"The verification team recommends completing and setting-up the 'new' system in an efficient and speedy way."*

The verification team was informed that – due to problems with *UIT*, the supplier, – the 'new' system is still not in routine operation. For example, the validation of data from the EWS system is not possible. Thus, sending validated data from this system to EURDEP cannot be done. Some specific items are listed below.

The team was told that – as a consequence – since September 2007 10% of the sum due to be paid is being witheld and that the warranty has been 'frozen'.

The team was told that – for problems with a USP system – the German supplier blames the unstable Romanian electric power network.

Due to the fact that the project is not yet approved also the foreseen service contract is not yet in force. For the case of malfunction this service contract would foresee checks within 24 hours and replacement of equipment within 24 hours. Currently however, the supplier comes every four months to fix problems.

With regard to the automatic water monitoring system that was set up by *UIT* the verification team was informed that only one was working reliably. One device was damaged, sending raw data (counts per second) instead of calculated values (Bq/l or Bq/m^3). Three stations do not send data at all.

Obviously there are also problems with meteorological data: some stations transmit rain data even if there is no rainfall at all.

NEPA also states that some tasks with regard to setting up the communication for rain "yes/no" data at some weather stations in the NPP related system are not yet finished. Supplying the sensors had been part of the *UIT* contract, however, *UIT* did not connect the sensors to the data transmission module.

Details with regard to the equipment status and the English copy of a letter of complaint by NEPA are given in Appendix 6.

The verification team was shown the presentation devices for the automatic systems (one large screen for the dose rate monitoring and the meteorological data, the other one for the water monitoring system). It noted that quite a number of data were missing, leading to gaps in the graphical display. The team acknowledged the various telecommunication devices on the roof of the building.

The verification team has the impression that the German supplier does not participate seriously in solving the above mentioned problems in order to get the systems fully functional.

> *The verification team strongly recommends finding an effective and sustainable solution to put the automatic monitoring systems in full operation. In particular, reliable data communication to the EURDEP system should be guaranteed.*

10.3 NEPA LABORATORY NRL

In relation to the NEPA laboratory NRL the verification of 2007 stated:

> *"The verification team strongly recommends getting the laboratory fully operational as quickly as possible. This includes fixing the laboratory rooms and preparing all necessary procedures. ... "*

The team was told that at the end of 2007 / beginning of 2008 some new equipment was bought for the NRL (e.g. hoods, furnace, evaporation systems, alpha spectrometry device, electro deposition system for alpha spectrometry, microwave digester, balances). However, some chemicals that are needed for specific sample preparation are not yet available.

The team was informed that NRL has *CNCAN* authorisation as a 'nuclear unit' for closed radioactive sources but not yet for open radioactive sources. The necessary waste water treatment device is present but not yet installed.

Sample preparation

The verification team acknowledged various new devices used for sample preparation (e.g. a *Retsch SK 100*cross beater mill, a small diameter filter press, a *Berghof Speed Wave MWS3+* microwave digestion system, *Mettler Toledo Excellence Plus* balances with auto-calibration, a *Retsch ZM200* ultra-centrifugal mill. A *Packard 307* sample oxidiser is not yet in operation because for this purpose the building reinforcement has to be finalised in order to put the new gas cylinder line outside the building in compliance with the national regulation. Two *Heidolph Laborota 4010* digital rotational evaporators had just been delivered and were not yet in routine use.

The team was shown the containers for transporting water samples for H-3 analysis from the local SSRMs to NRL.

LSC and alpha spectrometry

The verification team was shown an 'old' *TriCarb 2770TR SSL* liquid scintillation counter. It was told that when a new PC will be installed; the system will be operational.

At the time of the visit a *Perkin Elmer Quantulus* LSC counter was operated by a staff member.

A *Canberra Alpha Analyst* alpha spectrometry system with eight chambers with 600 mm^2 detectors was not yet in operation.

Gamma spectrometry

The team was shown the gamma spectrometry room. A coaxial HPGe detector is mounted in a 10 cm Pb shield with Cu lining. It is connected to a PC via a *Canberra DSA1000* device.

A well type detector mounted in a large 15 cm Pb shield and connected to a PC via a *Canberra DSA1000* device could not be operated due to problems related to the ongoing construction work.

An in-situ detector with a provisional small shield and a *Canberra Inspector 2000* device combined with a notebook is available for off-laboratory measurement tasks.

The laboratory does not use sample centering devices; it uses plastic cling film for contamination protection. All manuals were available at the work place.

The team was told that currently gamma spectrometry is performed only for NRL own samples due to lack of staff: posts are available but staff leaves due to the low wages.

Alpha, beta

For (gross) alpha measurements NRL has a *Nuclear & Vacuum* device available, for (gross) beta measurements a *Thermo Scientific FHT1100* counter. *Sarad* radon monitors are available both, for measuring purposes and as reference equipment for the whole country. The team witnessed also a *Silena EX-AM06* measuring device with external detector.

> *The verification team strongly recommends intensifying all efforts to make the laboratory fully operational.*

11 FOOD IMPORT CONTROL FACILITIES, FOLLOW-UP

In a meeting with representatives of *CNCAN*, the Ministry of Health, the Institute of Public Health, the Institute of Hygiene and Public Veterinary Health, *ANSVSA*, and the Customs Authority the EC verification team was informed that imported foodstuffs must have a certificate concerning radioactivity levels.

Responsibilities are split between the various bodies, the *Ministerial Order 1805* of 2005 being the basis. Meetings took place with a view to draft a protocol and to standardise formats.

The current operational mechanism is the control of documents for all imports according to customs law. If the item is included in a special TARIC (*Tarif intégré des Communautés européennes*) category, customs has access to data from the sanitary authority.

Customs is entitled and able to carry out sampling of imported products; analysis of samples may include also radioactivity measurements. Qualitative radiation measurements are performed by the Sanitary Veterinary and Food Safety Directorate laboratory in Constanța; the customs officials at the harbour have hand-held dose rate measurement devices for alerting. Sampling can be initiated for example by a notification through the customs early warning system. Laboratory analysis takes one or two days; containers are not delayed at the harbour during the laboratory analysis. If radioactivity is found the receiver of the shipment is notified and an alert is issued to the customs rapid alert system. The procedure has been agreed and documented, but in practise Constanța customs has so far not carried out any samplings based on suspected radioactivity.

The verification team was told that the Sanitary and Veterinary laboratory is represented at eight border inspection posts. After the results of the Sanitary Veterinary inspector customs concludes the results of the control. As an example, a mushroom transport from Ukraine was given. The paper documents are checked at the border by customs. The veterinary Medicine official takes a sample using a written procedure and transfers it to the designated Sanitary Veterinary laboratory (e.g. Constanța). The results are sent back to the inspector who has the responsibility for accepting the import and to inform customs accordingly. If yes, the transport is allowed to move on. Theoretically, such a process may last 15 days, real delays are two to three days. Documents supplied by the foreign (e.g. Ukrainian) laboratory are not accepted.

The team was informed that for such control measurements 15 laboratories are available, using NaI(Tl) detectors, verified by the National Institute of Metrology. Since 2007, the laboratory in Constanța operates a HPGe detector. Calibration sources come from *IFIN-HH* and are certified. The laboratories are run by one to two persons, with replacement staff available. In 2007 there were 650 samples (mushrooms, meat, preserves) checked. The procedures have been developed centrally. Annual training is organised for staff; supervision exists. Within the control procedure, for dried mushrooms, the activity concentration limit (that refers to fresh weight) is adapted by a factor of 10.

The team was told that the national monitoring programme includes wild food products and that such data are now added to the system to be reported to the REM database at Ispra.

12 CONCLUSIONS

All verifications that had been planned by the verification team were completed successfully. In this regard, the information supplied in advance of the visit, as well as the additional documentation received during and after the verification, was useful.

(1) The verification activities that were performed demonstrated that the facilities necessary to carry out continuous monitoring of levels of radioactivity in the air, water and soil around the uranium mining site at Crucea and the uranium milling and processing site at Feldioara as well as the verified parts of the national monitoring system for environmental radioactivity are adequate. The Commission could verify the operation and efficiency of these facilities.

(2) A few perrtinent suggestions and recommendations are formulated. These aim at improving some aspects of discharge monitoring from, and environmental surveillance with regard to uranium production sites and the national monitoring system. The recommendations do not discredit the fact that environmental monitoring around uranium production sites as well as the verified parts of the national monitoring system for environmental radioactivity are in conformity with the provisions laid down under Article 35 of the Euratom Treaty.

(3) The verification findings and ensuing recommendations are compiled in the 'Main Findings' document that is addressed to the Romanian competent authorities through the Romanian Permanent Representative to the European Union.

(4) The Commission services ask the Romanian competent authority to inform them of any progress or significant changes with regard to the situation at the time of the verification. In particular, they will closely follow up the progress made with respect to point (2) above.

(5) The present Technical Report is to be enclosed with the Main Findings.

(6) Finally, the verification team acknowledges the excellent co-operation it received from all persons involved in the activities it performed.

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APPENDIX 1

VERIFICATION PROGRAMME

Monday 18/08

Opening meeting at *CNCAN* headquarters with: representatives of *CNCAN* (national competent authority), Uranium National Company and National Agency for Environmental Protection (national monitoring network)

Tuesday 19/08

Verifications at the LEPA laboratory Braşov

Verifications at the Feldioara uranium milling and processing site – discharge and environmental monitoring by the operator and the regulator

Wednesday 20/08

Verifications at the Feldioara uranium milling and processing site – discharge and environmental monitoring by the operator and the regulator (continued).

Verification of LEPA laboratory in Sibiu.

Thursday 21/08

Verification at the LEPA laboratory in Târgu Mureş

Friday 22/08

Verifications at the Crucea uranium mine – discharge and environmental monitoring by the operator and the regulator

Verification at the LEPA laboratory in Suceava.

Monday 25/08

Re-verification at NEPA laboratory in Bucharest.
Discussion with national authorities on progress in food import control.

Closing meeting at *CNCAN* headquarters: presentation of preliminary verification findings to representatives of *CNCAN* (national competent authority), Uranium National Company and National Agency for Environmental Protection (national monitoring network).

APPENDIX 2

DOCUMENTATION

See Art. 35 Technical Report, Romania 2007 "Verifications under the Terms of Article 35 of the EURATOM Treaty – Cernavodă NPP and the National Network from South-eastern Romania"; Reference: RO-07/4, Appendix 2, "Documentation received and consulted"

In addition:

1. Legislation

Laws:

- Law no. 111/1996 on the safe deployment, regulation, authorisation and control of nuclear activities, published in the Official Journal of Romania part I, no. 552/27.06.2006.

Norms:

- Norms regarding the limitation of the radioactive effluents discharges to the environment (NDR-04), approved by *CNCAN* President Order No.221/2005 and published in the Official Journal of Romania, part I, no. 820/09.09.2005

Decrees and Orders:

- The Environmental Protection Decree no. 195/2005, approved by Law 265/2006
- Ministerial Order no. 880/2006 of the Ministry of Health, regarding the organization and functioning of the district authorities for public health, and their structure, published in OG, part I, 656/2006 (Article 5, paragraph 5.3)

2. Documents:

FELDIOARA

- PowerPoint presentation at the opening meeting held at *CNCAN* premises of 18 August 2008, Bucharest

CRUCEA

- PowerPoint presentation during the verification visit, on 22 August 2008, at Crucea site, Romania

CNCAN

- Reply to European Commission preliminary information questionnaire in view of preparing the verification activities, 2006.

ANDRAD

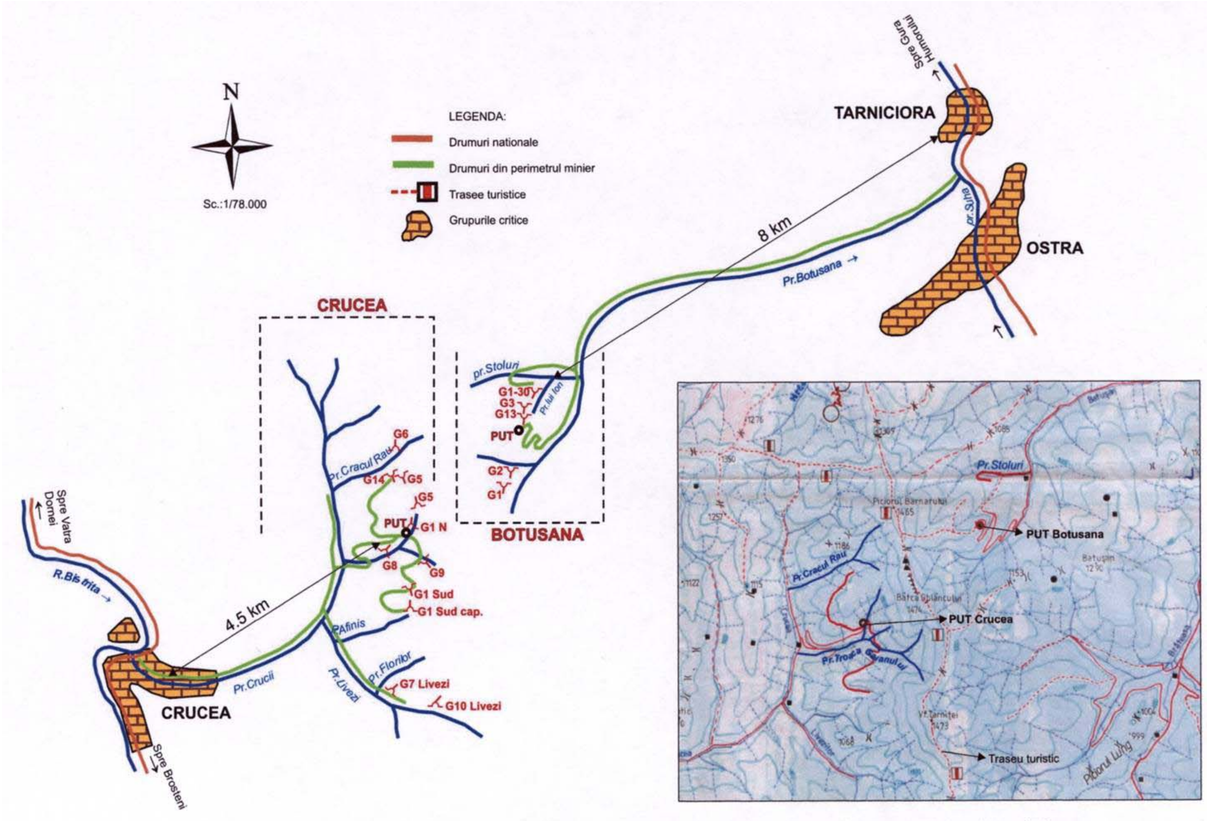
- PowerPoint presentation during the verification visit

3. Web sites consulted

- National Commission for Nuclear Activities Control (*CNCAN*) www.cncan.ro
- Environmental protection Agency (NEPA) www.anpm.ro
- Institute of Public Health www.ispb.ro
- National Agency for Radioactive Waste www.andrad.ro

APPENDIX 3

CRUCEA AND BOTUŞANA URANIUM EXTRACTION SITES



Crucea and Botuşana mining areas

Legend:

red …	national roads
green …	roads within mine site enclosure
red dashed …	touristic paths
"brick" …	critical group settlements

APPENDIX 4

MONITORING PROGRAMME FOR ENVIRONMENTAL PARAMETERS FROM AREAS WITH MODIFIED NATURAL RADIOACTIVITY – SUCEAVA COUNTY (REVISION 2008)

Programme as defined by NEPA

Media	Area	Sampling place/ Area	Total beta			Gamma spectrometry	
			Sampling	Measurement	Report	Sample	Frequency
1. Surface water	Bistrița Valley		1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
			1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
			1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
			1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
	Suhei Valley		1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
			1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
			1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
	Suceava Valley		1 l / year	1 l after 5 d	Yearly	20 l	Yearly
2. Waste water	Bistrița Valley			1 l after 5 d	Quarterly	20 l	Quarterly
				1 l after 5 d	Quarterly	20 l	Quarterly
3. Underground water	Suhei Valley	Botușana area (1 well)	1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
	Bistrița Valley	Crucea area (1 well)	1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
	Argestru-Vatra Dornei loading station		1 l / Q	1 l after 5 d	Quarterly	20 l	Quarterly
4. Uncultivated soil	Bistrița Valley		10*10*5 cm^3/Q	1 g / Q	Quarterly	10*10*5 cm^3	Quarterly
				1 g / Q	Quarterly		Quarterly
	Suhei Valley			1 g / Q	Quarterly		Quarterly
				1 g / Q	Quarterly		Quarterly
	Other			1 g / Q	Quarterly		Quarterly
				1 g / Q	Quarterly		Quarterly
	CET *) Suceava		10*10*5 cm^3/year	1 g / year	Yearly	10*10*5 cm^3	Yearly
5. Vegetation (1st Apr.-31st Oct.)	Bistrița Valley		1 m^2 / quarter	2 g / Q	Quarterly	Vegetation from a surface of 1 m^2	Quarterly
				2 g / Q	Quarterly		Quarterly
	Suhei Valley			2 g / Q	Quarterly		Quarterly
				2 g / Q	Quarterly		Quarterly
	Argestru-Vatra Dornei loading station			2 g / Q	Quarterly		Quarterly
				2 g / Q	Quarterly		Quarterly
	CET Suceava		1 m^2 / year	2 g / year	Yearly	Vegetation from a surface of 1 m^2	Yearly
6. Waste Rock	Bistrița Valley		10*10*5 cm^3/Q	1 g / Q	Quarterly	10*10*5 cm^3	Quarterly
	Suhei Valley			1 g / Q	Quarterly		Quarterly
7. Slag	Suceava Valley		10*10*5 cm^3/year	1 g / year	Yearly	10*10*5 cm^3	Yearly

*) CET … Thermoelectric Power Plant

APPENDIX 5

NATIONAL ENVIRONMENTAL PROTECTION AGENCY AUTOMATIC STATIONS – STATUS

AIR STATIONS

LOCATION	CHECK				ISSUES/REMARKS
	Weather data on console	Weather data on PC	Approx. dist. PC-station	Position of console – station in the building	
Braşov	yes	no	40 m	On a corner	Constant weather data
Giurgiu	yes	yes	50 m	In site	Intermittent weather data
Babele (high altitude)	no	no	40 m	In site	No weather data
Sibiu	no	no	35 m	In site	Incorrect data for R24h
Suceava	yes	yes	12 m	In site	
Târgu Mureş	yes	no	30 m	In site	No weather data
Tulcea	yes	yes	25 m	In site	
Tulcea Sfântu Gheorghe	yes	yes	30 m	In site	No transmission since 31.07.2007

WATER STATIONS

LOCATION	NO TRANSMISSION	ISSUES/REMARKS
Bechet Harbour	x	No transmission since 12.10.2007
Cv. Canal Ecluză		Constant and incorrect weather data
Cv. Canal Seimeni		Intermittent transmissions
Giurgiu Harbour	x	No transmission since 02.08.2007
Tulcea Harbour – Sf. Gheorghe	x	No transmission since 27.04.2008

WEATHER STATIONS

LOCATION	NO TRANSMISSION	ISSUES/REMARKS
LEPA Constanţa		
Cernavodă SSRM station	x	No outdoor weather data
Bechet SSRM station		
LEPA Slobozia		Incorrect R24h values
LEPA Călăraşi	x	No outdoor weather data

APPENDIX 6

AUTOMATIC STATIONS – COMPLAINT LETTER BY NEPA

According to the Phare project agreement, NEPA sends the Contractor (UIT GmbH, Dresden, Germany) weekly, by e-mail, a report on all malfunctions related to the automatic stations.

The following is a copy of NEPA's complaint letter to UIT GmbH, covering the time period between 04.08.2008 and 11.08.2008.

"Automatic air stations

1. Babele – broken mast, local PC is working but it has no software installed after the repairing; the support for meteorological sensors is broken
2. Toaca – one steel cable is broken, the software application EWS Monitor from the local PC is not starting although the passwords are introduced correctly; the support for weather sensors is broken
3. Alba Iulia – the UPS is not working properly; the Rain Sensor is defective; sometimes the temperature and the humidity from the automatic weather station is missing
4. Bacau – the UPS is not working
5. Iaşi – from 05.08.2008 there is no weather data; the UPS from local PC indicates "Replace Battery"
6. Vaslui – the UPS from local PC indicates "Replace Battery"; the local PC is shutting itself down occasionally
7. Focşani – the UPS from local PC indicates "Replace Battery" from time to time and is shutting down the program
8. Tulcea – Sf. Gheorghe – the air and water automatic stations are not working Ploiesti – between data for R24h are incorrect; the UPC from the local PC is making a noise even when the power supply exist
9. Botoşani – the meteorological data is missing between 07 – 18 hours
10. Zalau – the local PC is not working
11. Baia Mare – The UPS is not working
12. Satu Mare – the data is missing on Local PC, the data can be seen (except weather data) on NCC *)
13. Targu Mureş – the UPS from local PC indicates "Replace Battery"

14. Automatic Water stations: Bechet Harbour – one leg is broken.

15. NCC software is not making any data validation, so no local station can see its validated data.
16. NCC – One of the UPS from the workstation indicates "Replace Battery". "

*) … NCC = Network Coordination Centre at NRL/NEPA