EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY AND TRANSPORT

DIRECTORATE H - Nuclear Energy
Radiation Protection

TECHNICAL REPORT

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35 OF THE EURATOM TREATY

POLAND

13 to 17 November 2006

Reference: PL-06/7

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35
OF THE EURATOM TREATY

FACILITIES:	Installations for surveillance of environmental radioactivity on the territory of Poland.
SITE:	National Atomic Energy Agency (NAEA) in Warsaw, and the national radiological environmental monitoring network in the southern part of Poland. Piast coal mine at Bieruń (NORM industry)
DATE:	13 to 17 November2006
REFERENCE:	PL-06/7
INSPECTORS:	Mr C. Gitzinger (Head of team) Mr E. Henrich Ms A. Godeanu-Metz Mr J.-L. Frichet (national expert on secondment, France, as trainee)
DATE OF REPORT:	16/05/2007.

SIGNATURES:

E. Henrich **A. Godeanu-Metz**

C. Gitzinger **J.-L. Frichet**

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1. ABBREVIATIONS

ALMERA	Analytical Laboratories Monitoring Environmental RAdioactivity (IAEA organised network)
CA	Competent Authority
CCA	Centre of Contamination Analysis (Ministry of Defense)
CEZAR	CEntrum do spraw ZdArzeń Radiacyjnych (Radiation Emergency Centre, of NAEA), Warsaw
CLOR	Centralne Laboratorium Ochrony Radiologicznej (Central Laboratory for Radiological Protection), Warsaw
CoDecS	Coding DECoding Software (information exchange system for ECURIE)
CSI	Chief Sanitary Inspectorate, Warsaw
DG TREN	Directorate General Energy and Transport
DKD	Deutscher KalibrierDienst (German Calibration Services)
DRH	Department of Radiation Hygiene (at CLOR)
DU	Depleted Uranium
EC	European Commission
ECURIE	European Commission Urgent Radiological Information Exchange
EMERCON	EMERgency CONvention (IAEA emergency notification system)
EMRAS	Environmental Modelling for RAdiation Safety (IAEA programme)
EPA	(U.S.) Environmental Protection Agency
ERL	Environmental Radioactivity Laboratory (of the IFJ, Krakow)
EURDEP	European Radiological Data Exchange Platform
Ge(Li)	Germanium, Lithium drifted (gamma detector)
GIG	Główny Instytut Górnictwa (Central Mining Institute), Katowice
GM	Geiger Müller (radiation detector)
GPRS	General Packet Radio Service (telecommunication)
GSM	Global System for Mobile communications (cell phone technology)
HELCOM	HELsinki COMmission (governing body of the 'Convention on the Protection of the Marine Environment of the Baltic Sea Area' – more usually known as the Helsinki Convention)
HPGe	High Purity Germanium (gamma detector)
IAEA	International Atomic Energy Agency
IFJ	Instytut Fizyki Jądrowej (Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences), Krakow
IMGW	Instytut Meteorologii i Gospodarki Wodnej (Institute of Meteorology and Water Management)
ISDN	Integrated Services Digital Network (telephony)
LABINCO	LABoratory INter-COmparison
LLD	Lower Limit of Detection

JRC	Joint Research Centre
KWK Piast	Kompania Węglowa S.A. (Piast coal mine in Bieruń)
MCA	Multi-Channel Analyzer (electronic device for measurements)
MD	Ministry of Defence
MENV	Ministry of Environment
MEC	Ministry of Economy
MH	Ministry of Health
MT	Ministry of the Treasury
NAEA	National Atomic Energy Agency
NaI(Tl)	Sodium Iodide Thallium activated (low resolution gamma detector crystal)
NORM	Naturally Occurring Radioactive Material
PIPS	Passivated Implanted Planar Silicon (alpha and beta detector)
PTB	Physikalisch-Technische Bundesanstalt, Braunschweig, Germany
QA	Quality Assurance
RA	Regulatory Authority
REM	Radioactivity Environmental Monitoring (European database at JRC Ispra)
SCA	Single Channel Analyzer (electronic device for measurements)
SQL	Structured Query Language
TLD	ThermoLuminescence Dosimetry
UNEP	United Nations Environment Programme
UPS	Uninterruptible Power Supply
WSSE	Wojewódzka Stacja Sanitarno-Epidemiologiczna (Voyvodship – regional – Laboratories of Sanitary Inspection)
WUG	Wyższy Urząd Górniczy (State Mining Authority)
ZUOP	Zakład Unieszkodliwiania Odpadów Promieniotwórczych (Radioactive Waste Management Plant)

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 the right of access to such facilities in order that it may review and verify their operation and efficiency.

Within the Commission, the Directorate-General Energy & Transport (DG TREN) and more in particular its Radiation Protection Unit (TREN.H4) is responsible for conducting 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 (as far as applicable in the Member State):

[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).

- 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 on: 'Verfification of environmental radioactivity monitoring facilities under the terms of Article 35 of the Euratom Treaty. Practical arrangements for the conduct of verification visits in Member States'

For the purpose of such a review, a verification team from DG TREN visited sites located in Poland, which are part of the national monitoring system for environmental radioactivity as well as a coal mine near Katowice (NORM industry). The visit included meetings with representatives of the National Atomic Energy Agency (NAEA) and the State Mining Authority (WUG) who represented the Polish authorities. With due consideration to the scope of the verification mission and taking into account the relatively short time available for the execution of the programme, it was agreed that emphasis would be put on the:

- Structure of the national environmental radioactivity monitoring and sampling programme provided by NAEA and the coordination of the monitoring stations and units provided by the Radiation Emergency Centre (CEZAR-NAEA);
- Central and regional analytical laboratories, automatic on-line systems and coal mines' water discharges.

The present report contains the results of the verification team's review of relevant aspects of the environmental surveillance of radioactivity on the territory of Poland.

The report is also based on information collected from documents received and from discussions with various persons met during the visit.

The verification team acknowledges the co-operation it received from all participating individuals.

3. PREPARATION AND CONDUCT OF THE VERIFICATION

3.1 Preamble

The Commission's decision to require the conduct of verifications under the terms of Article 35 of the Euratom Treaty was notified to the Polish government on 1 September 2006 (letter referenced TREN/H4/CG/ab D 52006) 218058, addressed to the Permanent Representative of Poland to the European Union). The Polish Government designated the National Atomic Energy Agency (NAEA) of the Ministry of Environment to lead the technical preparations for this visit. Subsequently, practical arrangements for the implementation of the verification were made with NAEA.

3.2 Programme of the visit

A programme of verification activities under the terms of Article 35 was discussed and agreed upon with the Polish competent authorities (NAEA).

It comprised the verification of the environmental radiological monitoring programme as co-ordinated by NAEA on the Polish territory, and the verification of the radiological monitoring programme of the Piast coal mine.

A summary overview of this programme of verification activities is provided in Appendix 1. The verification activities were carried out in accordance with this proposed programme. At the locations listed in the programmed verification activities addressed technical aspects of monitoring and sampling, analytical methods used quality assurance and control, archiving and reporting of data.

On 13 November, an opening meeting was held at the Niewodniczański Institute (IFJ) in Krakow.

During the visit the team attended presentations on different topics relevant to the verification of:

- Several sites in southern Poland, including regional laboratories that were verified by the team as part of the national environmental radioactivity monitoring network;
- The environmental monitoring of radioactivity at the site of the Piast coal mine;
- GIG laboratory at Katowice, CLOR laboratory at Warsaw;
- CEZAR-NAEA, Warsaw.

3.3 Documentation

In order to facilitate the work of the verification team, a package of information was supplied in advance by the Polish authorities, in form of detailed answers to a questionnaire prepared by the Commission Services. Additional documentation was provided during and after the verification visit. A list of this documentation is compiled in Appendix 2. The verification team noted the quality and comprehensiveness of all presentations made and documentation provided. The provided information has been extensively used for drawing up the descriptive sections of this report.

3.4 Representatives of the competent authorities and the associated laboratories

1) National Atomic Energy Agency (NAEA)/Radiation Emergency Centre (CEZAR), in Warsaw

Prof. Jerzy Niewodniczański	President
Andrzej Merta	President's advisor for radiation monitoring
Andrzej Kowalczyk	Director of the Radiation Emergency Centre (CEZAR)
Ludmiła Wiszczor	Director of international relations and european integration
Rafał Dąbrowski	Head of division of monitoring and prognosis

2) Central Laboratory for Radiological Protection (CLOR), in Warsaw

Paweł Krajewski	Director
Małgorzata Biernacka	Head of Dosimetry Department
Paweł Lipiński	Physicist, Dosimetry Department
Zofia Pietrzak-Flis	Head of Radiation Hygiene Department
Maria Suplińska	Chemist, Radiation Hygiene Department
Ludwika Kownacka	Physicist, Radiation Hygiene Department
Irena Radwan	Physicist, Radiation Hygiene Department
Wojciech Muszyński	Physicist, Radioactive Contamination Department
Dariusz Grabowski	Head of Radioactive Contamination Department
Genowefa Smagała	specialist, Radioactive Contamination Department
Adam Ząbek	Technician, laboratory of spectrometry

3) Henryk Niewodniczanski Institute of Nuclear Physics (IFJ) / Environmental Radioactivity Laboratory (ERL), in Krakow

Jerzy Wojciech Mietelski	Head of ERL
Paweł Gaca	Chemist
Ewa Tomankiewicz	Chemist
Sylwia Błażej	Physicist
Renata Kierepko	Physicist, Ph.D; student

4) Regional Laboratory of Sanitary Inspection (WSSE), Krakow

Wojciech Cegła	Director
Cecylia Kowalik	Manager of laboratory
Edward Araszkiewicz	Head of Radiation Hygiene Department

5) Regional Laboratoriy of Sanitary Inspection (WSSE), Sanok

Stanisław Sabat	Manager
Jerzy Chytła	Deputy Manager
Maria Kowalewska	Manager of laboratory
Joanna Ziarko	Senior Assistant
Janusz Cecuła	Technician
Agnieszka Piotrowska	Assistant
Bernadetta Zielińska-Mackiewicz	Technician

6) Local Station of Institute of Meteorology and Water Management (IMGW), Lesko

Kazimierz Gajkowski	Manager
Zdzisława Lubińska	meteo observer
Barbara Piaskowy	meteo observer

7) Local Station of Institute of Meteorology and Water Management (IMGW), Zakopane

Michał Furmanek	Manager
Stanisław Nawrocki	Senior Assistant
Stanisław Wydra	meteo observer

8) State Mining Authority (WUG) / KWK-Piast coal mine in Bieruń

Cezary Kula	Vice-director of WUG, Department of working conditions
Andrzej Kulpa	Inspector
Lech Mielniczuk	Director of KWK Piast
Bogdan Dulęba	Engineer of ventilation
Sławomir Kasprzak	Inspector, Radiological protection
Elżbieta Molenda	Inspector of environmental protectionr
Kazimierz Grzechnik	Investment and Development Department

9) State Mining Laboratory (GIG), Katowice

Małgorzata Wysocka	Geologist, head of Laboratory of radiometry
Stanisław Chałupnik	Physicist, Laboratory of radiometry
Paweł Mierzwiński	Physicist, Laboratory of radiometry
Antoni Mielnikow	Chemist, quality system supervisor , Laboratory of radiometry

4. COMPETENT AUTHORITIES AND NUCLEAR LEGISLATION

4.1 Introduction

Poland has no nuclear programme, but the country has several environmental issues related to radioactivity. Poland has a legal framework, in line with the 'EURATOM acquis' and the IAEA standards for ionizing radiation control. It has the necessary basic administrative structure for efficient monitoring of environmental radioactivity throughout the country.

4.2 Authorities involved in radioactivity monitoring

4.2.1 Scope, history and current situation

On the basis of Article 87, paragraphs 1 and 2 of the Act of Parliament of 29 November 2000 –Atomic Law (Polish O.J. of 2004 N°161, Item 1689 and 1808), NAEA has been designated the main

responsible organisation for the Polish monitoring programme of radioactivity in the environment. NAEA is supervised by the Ministry of Environment (MENV).

NAEA, through its president, is co-ordinating the monitoring of environmental radioactivity in Poland and is the Competent Authority (CA). NAEA has the responsibility to enforce the above mentioned legislation, to ensure for environmental radioactivity monitoring and for regular reporting to the European Commission (EC-JRC/ISPRA) on the basis of Article 36 of the Euratom Treaty, to ensure for emergency preparedness and response in case of radiological accidents and to deal with all matters concerning the relations of Poland with the EU, with the IAEA and other international organisations in this field.

Other organisations involved in the national monitoring programme are:

- The Chief Sanitary Inspectorate (CSI): it supervises the basic units (see: 5.1.II) measuring radioactive contamination of the environment, agricultural products and foodstuffs. CSI reports to the Ministry of Health (MH).
- The Central Laboratory for Radiological Protection (CLOR): it supervises the basic ASS-500 aerosol stations (see: 5.1.I), performs the local monitoring of mixed diet, soil, water, radon, etc. by doing the measurements and – based on contracts from NAEA – organises the inter-calibration exercises for all basic units.
- The Institute of Meteorology and Water Management (IMGW): it supervises the basic stations (see: 5.1.I) under its responsibility (IMGW stations) and reports to the Ministry of Environment (MENV).
- The Centre of Contamination Analysis (CCA): it supervises auxiliary military stations and reports to the Ministry of Defence (MD).
- The Institute of Atomic Energy in Otwock-Świerk: it performs local site monitoring and reports to the Ministry of Economy (ME).
- ZUOP, the state-owned 'Radioactive Waste Management Plant': it operates the central radioactive waste repository of Poland located in Różan. ZUOP is the only Polish institution responsible for securing, handling and deposition of radioactive wastes. It reports to the Ministry of the Treasury (MT).

4.2.2 Statutory responsibilities

The statutory responsibilities of NAEA as represented by its president to be mentioned in the context of this report are:

1. Protection of radiation workers, the general public and the environment from the risks of the use of ionising radiation through implementation of, among others:
    - Monitoring environmental radioactivity by measuring air, water and soil samples;
    - Management of the personal dosimetry data of radiation workers in Poland (with the exception of workers of Roentgen apparatus used in medicine);
    - Recurrent inspections of all installations handling radioactive materials in the medical (except RTG apparatus), industrial, research, and educational sectors;
    - Licensing of medical (except Roentgen apparatus) and non-medical applications of ionising radiation in the industrial, research and educational sectors;
    - Licensing of import, export, transport, storage, use and disposal of fissile and non-fissile radioactive materials;
    - Licensing of the import and use of radiation producing equipment.
2. Implementation, in compliance with EC Directives, of radiation protection regulations, safety standards and codes of practice for ionising radiation installations;
3. Education and training of radiation workers on radiation protection issues;
4. Implementation of emergency preparedness and response plans.

For fulfilling some of its obligations NAEA may contract an institution which is experienced in radiation protection matters (e.g. CLOR).

The Ministry of Health has the overall responsibility of controlling and monitoring of radioactivity in foodstuffs and feeding stuffs.

4.3 Legal framework

4.3.1 Legal basis for radiation protection in Poland

Poland has comprehensive legislation in the area of radiation and nuclear safety. The main legal acts regulating the radiation protection topics are:

a) Act of Parliament of 29 November 2000 – Atomic Law (last amendment 14 April 2006); published in: Official Journal of Laws of 2004, no.161, item 1689, no.173, item 188; Official Journal of Laws of 2005, no 163, item 1362: Official Journal of Laws of 2006, no 53, item 378; Chapters X and XI.

b) Regulation of the Council of Ministers of 17 December 2002 on stations for the early detection of radioactive contamination and units which measure radioactive contamination; published in: Official Journal of Laws of 2002 no 239, item 2030.

Apart from legal documents specific to radiation and nuclear safety there is a set of other legal acts dealing with.

Nuclear/radiological emergency

c) Regulation of the Council of Ministers of 27 April 2004 on intervention level values for various types of intervention measures and also the criteria for revoking such measures; published in Official Journal of Laws of 2004 no 98, item 987.

d) Regulation of the Council of Ministers of 27 April 2004 on establishing the entities authorized to exercise control the food and animal feeding stuff of compliance with the maximal permissible levels for radioactive contamination, following a radiological emergency; published in Official Journal of Laws of 2004 no 98, item 988.

Radioactive waste/Exemptions

e) Regulation of the Council of Ministers of 3 December 2002 on radioactive wastes and spent nuclear fuel; published in Official Journal of Laws of 2002 no 230, item 1925.

f) Regulation of the Council of Ministers of 6 August 2002 on the instances in which practices involving the risk of exposure to ionising radiation are not subject to the licensing or reporting requirement, and instances in which the said practices may be conducted based on a report (Amended 27 April 2004); published in Official Journal of Laws of 2002 no 137, item 1153; Official Journal of Laws of 2004 no 98, item 980.

4.3.2 Legislative acts regulating radioactivity monitoring in foodstuffs

The applied legislation is the one described in chapter 4.3.1, paragraph a) and d).

4.3.3 Legislative acts regulating NORM issues

The applied legislation is the one described in chapter 4.3.1, paragraph a), d) and f). Besides that the following legal documents apply:

g) Act of Parliament of 4 February 1994 – Geological and Mining Law, published in Official Journal of Laws of 2001, no 110, item 1190; only Polish version available.2

[2] Organisations responsible for monitoring of occupational radiation risk and environmental radioactivity in the area of the mining industry are: National Atomic Energy Agency, State Mining Authority and relevant District Mining Offices

h) Regulation of the Council of Ministers of 3 December 2002 on the requirements imposed on the content of natural radioisotopes in raw materials and components applied in buildings for the accommodation of people and livestock, and in industrial waste applied in construction, and the control of radioisotope content; published in Official Journal of Laws of 2002 no 220, item 1850.

4.3.4 Guidance documents

i) ICRP 60/72 – BSS, IAEA BSS, EU Directive 96/29 EUROATOM, EC Publication Radiation Protection 112, Commission Recommendation 2000/473/Euratom.

5. THE ENVIRONMENTAL RADIOACTIVITY MONITORING PROGRAMME

Overview

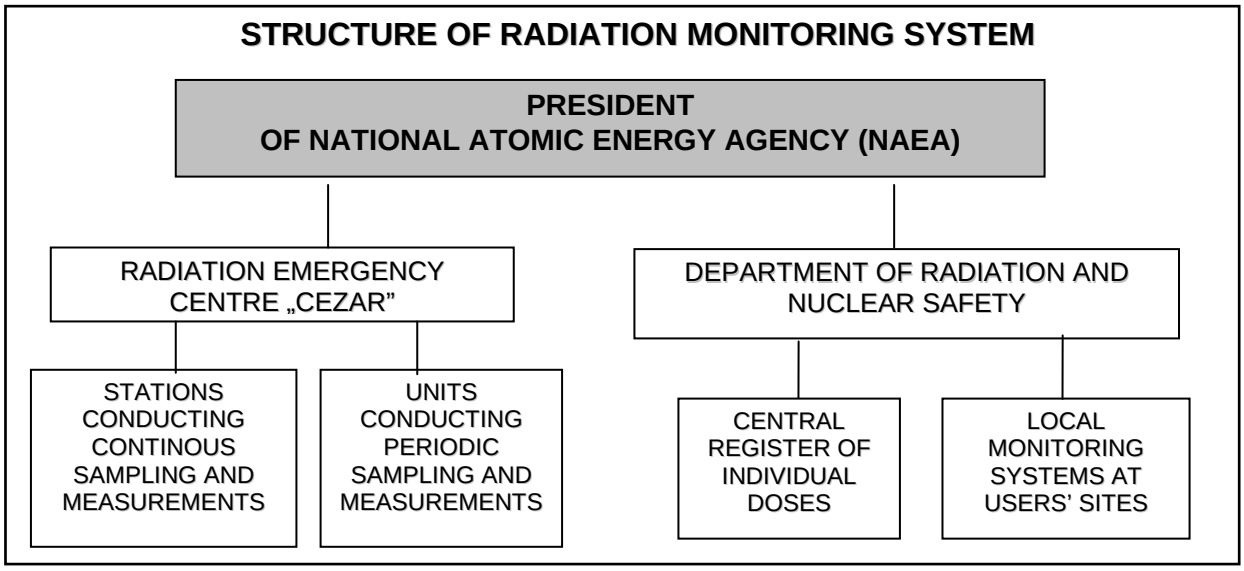
The radiological situation in Poland is monitored by systematic measurement of ambient gamma dose rate in specific places all over the country and measurements of the radionuclide content in primary components of the environment, food and feedstuffs. The system is divided into:

- A national monitoring, providing essential data for evaluation of the radiological situation all over the country under normal conditions and in emergency situations;
- A local monitoring, providing data from areas where activities causing a potential increase in radiation exposure of the local population are (or were) conducted. This refers to the Institute of Atomic Energy in Świerk, the National Radioactive Waste Repository in Różan and the former Uranium Mining Company.

Measurements within the national and the local monitoring system are performed by:

- stations (= measuring devices) for early detection of radioactive contamination (early warning stations);
- units (= laboratories) measuring radioactive contamination of environmental materials, food- and feeding stuffs;
- Specialized units (laboratories) of research & development organizations, universities and other institutions performing special measurements.

Fig. 1. Radiological monitoring system in Poland



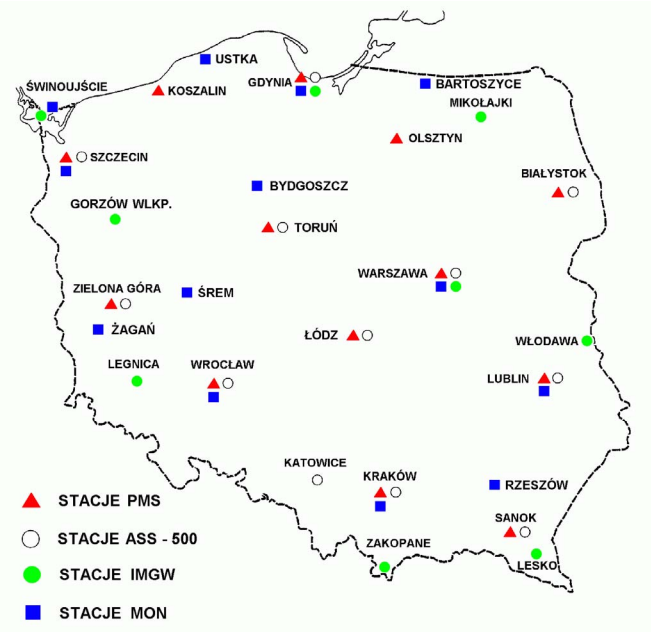
5.1 National Monitoring Programme

According to the Regulation of the Council of Ministers of 17 December 2002, radioactivity monitoring in Poland is performed by:

I. A system for the early detection of radioactive contamination, built of:

- **Basic stations**:
  - PMS (*Permanent Monitoring Stations*) - operating under control of the National Atomic Energy Agency (NAEA);
  - ASS-500 (*Aerosol Sampling Stations*) - operating in different organisations under control of the Central Laboratory for Radiological Protection (CLOR) ;
  - IMGW–stations, operating within the structure of the Institute of Meteorology and Water Management (IMGW) which reports to the Ministry of Environment (MENV);
- **Auxiliary stations (MON)**, which use relatively insensitive measuring devices and are operating in military organisations reporting to the Ministry of National Defense.

Fig. 2. Location of the stations for early detection of radioactive contamination



II. A network of units measuring with laboratory methods the content of radionuclides in samples of environmental materials, foodstuffs and feeding stuffs:

There are two kinds of units:

- **Basic units** – laboratories of the sanitary and epidemiological control system operating in the structure of the Chief Sanitary Inspectorate (CSI);
- **Specialised units** – operating in different governmental institutions, research, universities, etc.

The 48 basic units (of which 41 are operational at present) measure total beta activity in milk (monthly) and foodstuffs samples (quarterly). Some of them determine the content of specific radionuclides (Cs-137, Sr-90) in chosen agricultural products and foodstuffs as well (twice a year on average).

Within the network, 9 specialized units (laboratories) carry out complex analyses of environmental sample radioactivity (e.g. determination of tritium in water). They are the:

- Central Laboratory for Radiological Protection (CLOR) in Warsaw
- National Institute of Hygiene in Warsaw

- Institute of Atomic Energy in Otwock-Świerk
- H. Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences (IFJ) in Krakow
- Central Mining Institute in Katowice
- AGH University of Science and Technology in Krakow
- Institute of Meteorology and Water Management in Warsaw
- Military Institute of Hygiene and Epidemiology in Warsaw
- Military Institute of Chemistry and Radiometry in Warsaw

Fig. 3. Geographical distribution of the basic units.

Every year, the basic and the specialized units take part in inter-calibration exercises organized by the NAEA President.

5.1.1 Ambient gamma dose rate; the Telemetric Radioactivity Monitoring Network of Poland

Poland has established an ambient gamma radiation monitoring network, with local monitoring stations of different types and two control centres to monitor continuously gamma radiation in the air. One centre is located at CEZAR and the other at CCA (military centre). This network serves also as an Early Warning System (EWS) for the country by sending alarms in case of a radiological emergency when preset dose rate levels are exceeded.

5.1.1.1 Permanent Monitoring Stations (PMS-system)

Thirteen automatic PMS stations (Permanent Monitoring Station), which belong to NAEA and operate within EU and Baltic Sea States international systems, carry out continuous measurement of:

- Total ambient gamma dose rate (GM tube Rados Technology RD-02L);
- Low energy resolution gamma spectrum (3"x3" NaI(Tl) detector Canberra 802-3x3), to give an indication of the radionuclides leading to elevated dose rate levels;
- Precipitation;
- Temperature.

All data are transmitted twice a day to the Radiation Emergency Centre (CEZAR) at NAEA via public telephone lines. Modernisation is in process.

Nine of these thirteen stations have already been upgraded and transmit the data hourly; the others will be upgraded soon. In future it will be possible to collect the data in selectable time intervals; data transmission will be via GPRS. All data are stored at CEZAR-NAEA in a Microsoft® SQL database.

Quarterly and yearly reports on the radiation situation in Poland are issued by the NAEA and a daily map of the distribution of gamma dose rate in Poland is published on the NAEA web site (see Appendix 2).

Gamma dose rate data are also transferred to the EURDEP system at JRC-ISPRA.

5.1.1.2 IMGW automatic stations

Nine automatic stations are set up by the Institute of Meteorology and Water Management (IMGW) at different locations.

For continuous measurement of total ambient gamma dose rate (see 5.1.I) they are equipped with a proportional counter (ESM Eberline FHZ 621 G-L). All stations have an old device (SSU-70-2 connected to a Sapos 90-M Environmental Radiation Monitor) as backup.

Within the meteorological system data are transmitted daily to IMGW headquarters in Warsaw. There a daily report is produced containing the average, minimum, and maximum values from each station. This report is transferred to CEZAR at NAEA, where the data are stored in the Microsoft® SQL database. NAEA includes them in its quarterly and yearly reports concerning the radiation situation in Poland.

The IMGW data are not yet transferred to the EURDEP system (planned start of transmission in 2007).

5.1.1.3 Military stations

The Ministry of National Defense operates 13 automatic stations that measure continuously total ambient gamma dose rate using GM tubes. The values are registered automatically in the Centre of Contamination Analysis (CCA). The data are transmitted daily to the National Centre for Co-ordination of Rescue and Protection of Population (at Fire Brigades headquarters) and weekly to CEZAR-NAEA.

5.1.2 Airborne radioactivity: gases and particulates

5.1.2.1 ASS-500 system

CLOR has developed and produces high volume air sampling devices – ASS500. The devices are equipped with WPMA-12F blowers having a nominal flow of 500 to 800 m^3/h, infrared heaters (to avoid filter clogging during adverse weather conditions) and a VORTEX flow rate meter. The average air flow rate is 500 m^3/h.

Currently, thirteen stations of this type collect continuously airborne aerosols on a filter (Petrianov FPP 15-1.5) which is changed once a week. The radionuclide content in the samples is measured in the laboratory routinely using high high resolution gamma spectrometry.

A first measurement of 3000 s is performed immediately after collection. After 3 days (to allow decay of radon progenies) the filter is pressed into a disc and measured again for 80000 s thus offering high detection sensitivity.

Most of these measurements are performed by the institutions (laboratories) where the stations are located (usually, academic centres). Only the filters from a few stations are sent to CLOR (Central Laboratory for Radiological Protection) in Warsaw for measurements.

Furthermore, ten of these stations also measure directly gamma activity of airborne aerosols using a NaI(Tl) detector mounted directly above the filter plates. Routinely, 8 regions of interest are set in the low resolution gamma spectrum to give an indication for the presence of high values of Cs-137 and of I-131, and for natural isotopes. Generally, twice a day the data are transferred via public telephone lines to CLOR and from there to CEZAR-NAEA. These stations are located near big centers where technical experts are available for operation and interpretation of results.

Currently work is ongoing to expand the collection capability to gaseous iodines on an additional charcoal cartridge located below the Petrianov filter ('modified' ASS-500 stations). Before being usable for routine monitoring flow rate problems have to be resolved.

Twelve of the ASS-500 stations are the property of the Central Laboratory for Radiological Protection (CLOR) in Warsaw. One station belongs directly to NAEA.

5.1.2.2 IMGW automatic stations

Seven of the nine hydrological-meteorological stations that belong to the Institute of Meteorology and Water Management (IMGW) in Warsaw also operate automatic aerosol monitors (Eberline FHT 59Si). These devices have an average air flow rate of 8 m^3/h. They use a glass fiber step-filter band system with steps of 1/10 of the impact zone diameter every half hour and determine:

- Total alpha and total beta activity of aerosols during collection by a PIPS detector;
- Calculated natural alpha and natural beta activity (using an inbuilt algorithm).

Data are processed in the device using FHT 8000 measuring electronics and transmitted to the local data management PC. All data are sent to IMWG headquarters in Warsaw which daily reports to CEZAR-NAEA.

5.1.3 Precipitation/Rainwater samplers

All hydrological-meteorological stations (IMGW) operate precipitation (dry and wet deposition, 'fallout') samplers consisting of altogether 4 trays (size approx. 30W x 50L x 10H cm) per station. Three of these are for the collection of monthly samples, one is for daily samples.

Total beta measurement is performed at the station using a plastic scintillation detector and PC data processing with 'GammaBeta' software. A similar system using Sapos-90 electronics is available as backup.

The determination of the Cs-137 and Sr-90 content by the stations is done in Warsaw and Gdynia the summary monthly samples.

A 2 m^2 precipitation sampler is located at IFJ in Krakow. It was developed as a prototype by IFJ; its design could be used within the network if deemed useful.

5.1.4 Samples of milk produced in Poland

Cow milk is sampled quarterly by the basic units under the responsibility of the Sanitary Inspection (sampling unit locations see fig. 3 in chapter 5.1.II).

Generally, the samples are analysed for gross beta activity. In some units also Cs-137 and Sr-90 activity is determined.

The values are transmitted to the headquarters which send reports containing all data to CEZAR-NAEA.

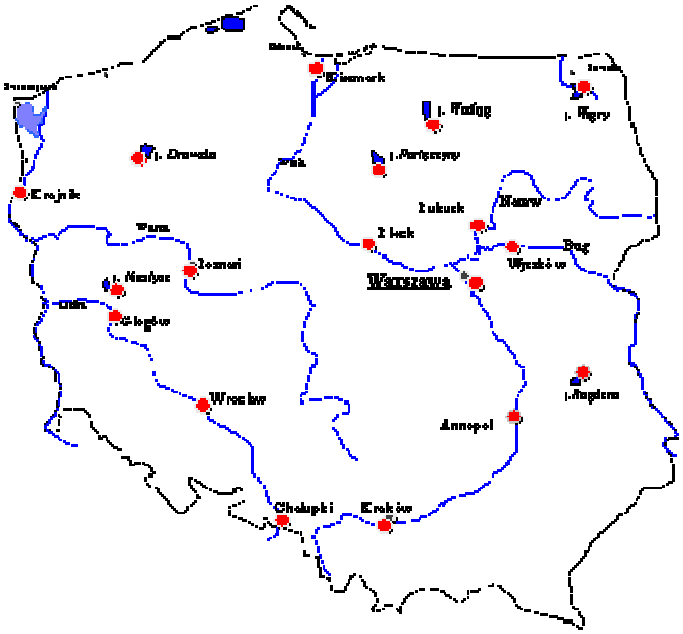
5.1.5 Water monitoring

5.1.5.1 Water from rivers and lakes

Samples of water are collected twice a year (in spring and autumn) from the River Vistula and its two tributaries (the Bug and the Narew rivers), from the River Odra and its tributary the River Warta and from six lakes located in various regions of Poland. Water samples of 20 l are taken from main streams of the rivers or from platforms of the lakes. The location of the sampling points is given in Figure 4. Sample analysis is performed by CLOR.

Cs-137 and Sr-90 in water is determined with radiochemical methods. Determination of Cs-137 involves selective absorption of caesium on a thin ammonium molybdophosphate layer and the measurement of beta activity. The determination of Sr-90 is carried out with the method by Volchok (via its progeny Y-90). Activities of Cs-137 and of Y-90 are measured with the low-level beta GM multicounter system Model Risø GM-25-5 having a background of about 0.2 counts per minute and an efficiency of about 40%.

Fig.4. Sampling locations for surface water and sediment



5.1.5.2 Drinking water

Currently for drinking water no sampling programme is defined. Responsibility would lie with the Ministry of Health. However, it is planned that during 2007 a drinking water programme will be implemented, financed by NAEA.

5.1.5.3 Sea water

Sea water is sampled and analysed within the HELCOM obligations.

5.1.6 Bottom sediments of rivers and lakes taken within the national monitoring programme

In bottom sediments of rivers and lakes Cs-137 and Pu-239,240 are determined by CLOR. Samples are collected twice a year from the same rivers and lakes in which determination of Cs-137 and Sr-90 is measured in water; sampling locations are given in figure 4.

Bottom sediments are taken using a Van Veen type device or, if the bottom is stony, with a shovel at a distance of two to five meters from the river bank. The sediment sample mass is about 1 kg.

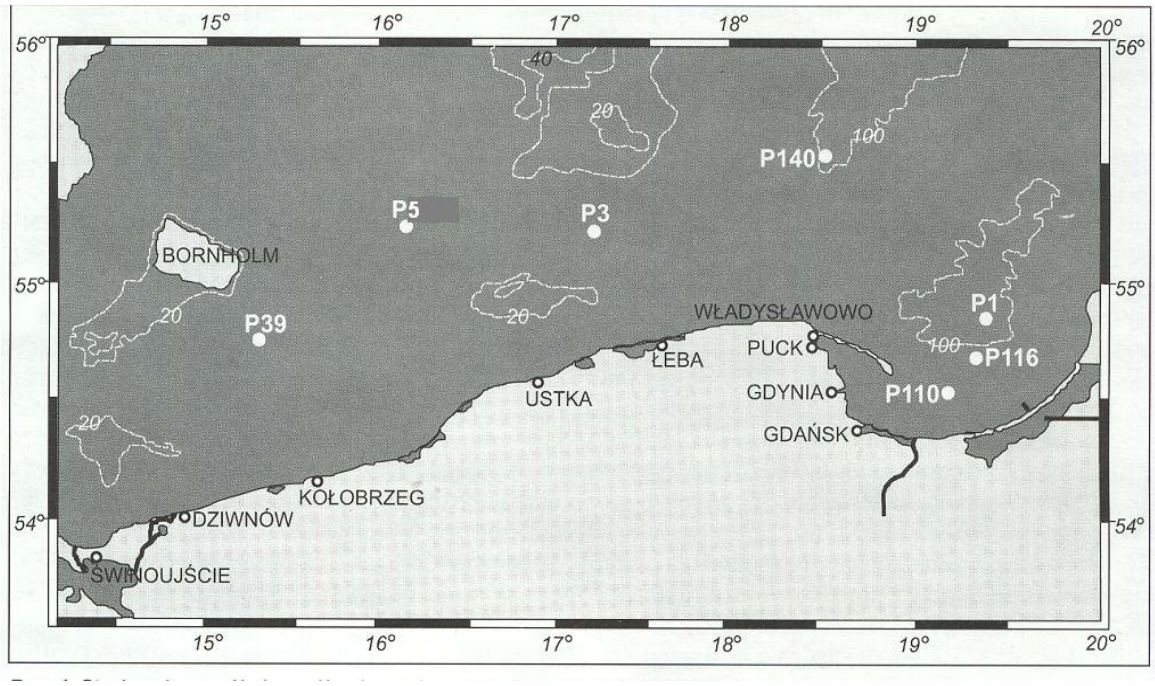
Cs-137 concentrations are determined by gamma spectrometry. The samples are dried at room temperature and then at 105°C for 16 hours, sieved through a 2-mm mesh to remove plants and stones and placed into a 500 ml Marinelli beaker. Sample volume for measurement is 450 cm^3.

Determination of Pu-238 and Pu-239,240 is performed using a radiochemical method with Pu-242 added as tracer. The procedure includes the separation of plutonium from a 50-g sample of sediment, its electrodeposition on a stainless steel plate and the activity measurement by alpha spectrometry. The detection limit of Pu-238 and Pu-239,240 for a counting time of 164000 seconds is 4 mBq/kg.

5.1.7 Bottom sediments from Southern Baltic Sea

In bottom sediments from the Southern Baltic Sea Cs-137, Pu-238 and Pu-239,240, Sr-90 and Ra-226 are determined. Bottom sediment core samples are collected (using a Niemisto corer) from various regions of the southern part of the Baltic Sea, during sampling cruises into the Baltic Sea, organised once a year.The locations of the sampling points are presented in fig. 5. Analysis is done by CLOR.

Fig.5. Sea sediment sampling locations



Cs-137 activity concentration is determined by gamma spectrometry. Plutonium is separated by ion exchange chromatography, followed by electrodeposition onto stainless steel disks and measurement by alpha spectrometry. Pu-242 is used as an internal tracer.

The concentration of Ra-226 is determined radiochemically, using an emanation method (measurement of Rn-222 in Lucas-type scintillation chambers) preceeded by separation of radium.

The activity concentration of Sr-90 is determined by means of radiochemical separation and measurement of its short-lived progeny Y-90 with a low-level beta counter. The reliability of the applied methods is checked by participation in inter-comparison exercises organised by IAEA and Risø National Laboratory, Denmark.

5.1.8 Foodstuffs (incl. mixed diet)

Individual foodstuffs:

Foodstuffs are collected at hypermarkets and local shops.

- milk products and poultry – twice per year,
- fish, eggs, cereals – once per year,
- fruit, vegetables – once per year during harvest,
- meat (different kinds) – once per quarter.

Vegetables, fruit, freshwater and sea water fish as well as feeding stuffs are measured by selected basic units of the Sanitary Inspection (WSSE).

Mixed diet:

Mixed diets originate from canteens preparing breakfast, dinner and supper. Meals from one day are gathered into one sample. Whole day samples are collected through 8 days, twice per year (during spring and autumn seasons).

Sampling is performed by CLOR.

In all of the above mentioned samples Cs-137 and Sr-90 activity concentration is determined at CLOR.

5.1.9 Meteorological parameters

Meteorological data that may be used in radiological emergency management such as wind speed, wind direction, atmospheric pressure, relative humidity and ambient temperature are obtained from the Meteorological Service of Poland.

Some meteorological parameters (rain intensity, outdoor temperature) are measured by PMS stations as well (see 5.1.1.1; locations see figure 2).

5.2 Laboratories involved in national monitoring

Accreditation is not required for environmental radioactivity monitoring in Poland. The acceptance is granted by the President of NAEA if standard methods authorised by NAEA are used and the laboratory successfully participates in NAEA's inter-comparison exercises.

5.2.1 Central Laboratory for Radiological Protection (CLOR)

5.2.1.1 General information

The Central Laboratory for Radiological Protection (CLOR), established in 1957, was until 2001 under the authority of the National Atomic Energy Agency. From August 2001 onwards, CLOR has been supervised by the Minstry of Economy. Presently CLOR works on contract basis, mostly annual contracts with NAEA. Approximatively 30% of its funds come from contracts with the Ministry of Education and are based on scientific studies and educational training in the field of radiation protection.

The statutory responsibility of CLOR is the protection of the general population, occupationally exposed persons, and of the environment against the hazards of ionizing radiation. CLOR fulfils this task by routine practical activities, preventive and operational tasks, mainly provided by its 13 stations and by providing sound advice to private and governmental organisations. As in former years, the efforts of CLOR were concentrated in 2005 and 2006 on operational and preventive actions, aimed to ensure the radiation safety of the country.

CLOR is responsible for the sampling of environmental samples from 500 sampling places in Poland. The main duties of CLOR within the statutory obligations of NAEA are:

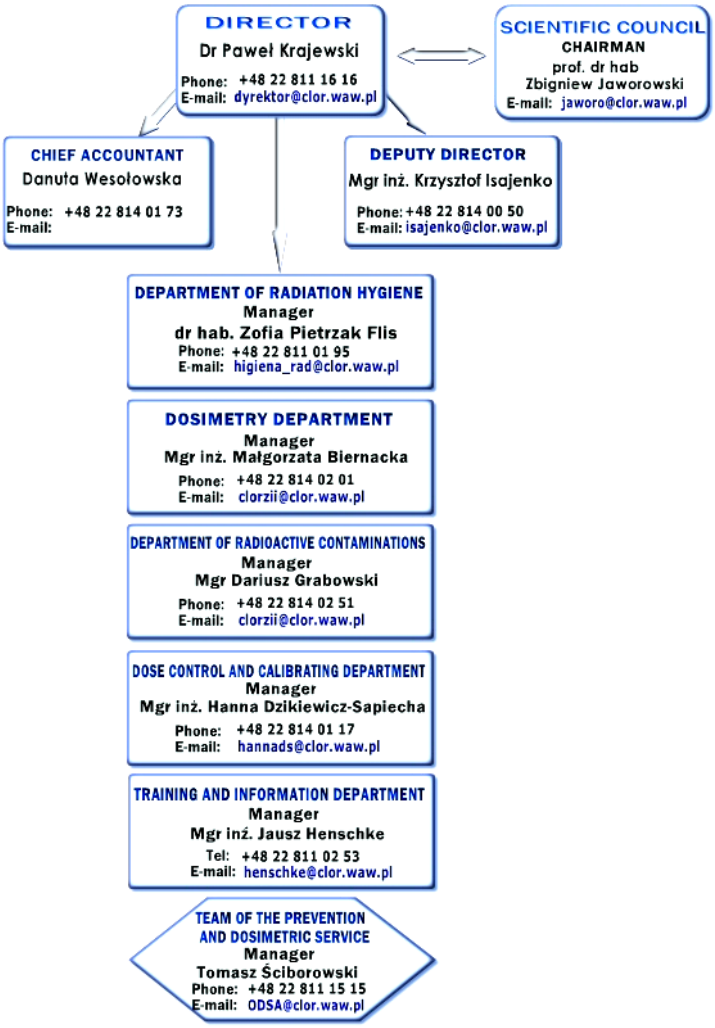
- monitoring of radioactive contamination in foodstuffs and environmental components;
- support countermeasures against illegal trafficking in nuclear and radioactive materials;
- monitoring of personal radiation doses;
- calibration and attestation of radiation measurement instruments;
- research on matters dealing with radiation, radiation protection, radiobiology and radioecology;
- professional training in radiation protection.

CLOR currently employs 60 persons, among them 29 scientists and 16 technicians.

Its statutory duties are fulfilled by several sub-laboratories, some of them haveing accreditation i.e.: Laboratory of Personal and Environmental Doses and Secondary Standard Dosimetry Laboratory – SSDL (both accredited to ISO 17025 in 2003), Radon Dosimetry Laboratory (recently accredited to ISO 17025 for radon and radon progenies standard concentrations). For the years to come, the accreditation of the gamma-spectrometry and the food monitoring laboratories as well as of the Building Materials Laboratory (already having ISO 9001 certification) is expected.

An organisation chart of CLOR is shown below.

Fig.6. Organisational structure of CLOR



A description of the specific laboratories included in the present verification is given below.

Projects and inter-comparison exercises

In 2004-2005 CLOR participated in several national and international research projects, such as: projects supported by the Sixth Framework Research Programme of the European Union, projects based on bilateral agreements between CLOR and the JRC/Institute of Transuranium Elements in Karlsruhe, Germany, and also projects within the IAEA-EMRAS programme. In the frame of HELCOM MORS-PRO, CLOR cooperates in monitoring of radioactive contamination in the Baltic Sea.

The institute participates regularly in inter-comparison exercises (foodstuff; plutonium; measurements in Baltic Sea samples, in 2005, organised by HELCOM). Activities with regard to the detection of internal contamination are supported by IAEA (ALMERA network). Milk monitoring inter-comparison is organised by CLOR in conjunction with NAEA each year for the basic units of Sanitary Inspection.

5.2.1.2 Dosimetry department (air and soil gamma spectrometry)

The laboratory measurement system consists of 3 germanium detectors (LeGe, HPGe; XTRA with reverse electrode; of 40%, 15%, and 10% efficiency). electronics is from Canberra and ORTEC. Accumulation and analysis of the spectra is performed using Canberra Genie 2000.

A back-up power supply system (UPS) provides autonomy in the event of a power cut. The laboratory has a ventilation system.

5.2.1.3 Department of Radiation Hygiene

The tasks of this department include in monitoring within the HELCOM system, national monitoring and research reactor related monitoring. Among others it analyses samples from the Baltic Sea bottom sediments, lakes and rivers.

Gamma spectrometry

The laboratory operates equipment by Canberra (HPGe detector of of 30% efficiency; Genie 2000 software).

Alpha spectrometry

For alpha masurement an old ORTEC 576 A alpha spectrometer as well as a new Canberra system is available. Genie 2000 software is used for spectrum acquisition. Chemical recovery is determined with internal traces such as: Pu-242 , U-232, Th-229 or Po-209, depending on determined radionuclide.

Electric power for gamma as well as for alpha spectrometry is guaranteed by a UPS.

Low activity beta measurements

For low activity beta measurements a beta counter Risø GM-25-5 comprising 5 detectors, with anticoincidence shield is available connected to a computer. For data analysis Risø MT software, version 1.50 is used. Argon-Propane for the counter tubes comes from a local supplier.

For Tritium measurements a liquid scintillation counter (Pharmacia, Wallac 1410) is available.

5.2.1.4 ASS station at the CLOR premises

At the premises of CLOR, an ASS-500 and a modified ASS-500 station are operated. CLOR was designer and co-producer of the ASS-500 devices and owns patent rights. It also certifies newly installed devices.

For a description of the ASS-500 stations see 5.1.2.1. Both devices have a NaI(Tl) detector built-in.

5.2.2 Environmental radioactivity laboratory (ERL) of the Henryk Niewodniczanski Institute (IFJ)

General

The Henryk Niewodniczanski Institute of Nuclear Physics of the Polish Academy of Sciences is a research institute employing 500 persons. It is divided into 5 divisions with 17 departments. The environmental laboratory consists of several sub-laboratories, one of which is the Environmental Radioactivity Laboratory (ERL).

ERL employs 5 persons (2 chemists and 2 physicists and a technician) and currently participates in studies such as:

- map of Sr-90 contamination in Poland (based on vaccinium myrtillus leaves)
- Pu, Sr-90, Cs-137 in Antarctic (lichens, mosses, penguins, seals; Poland has a station on King George's Island)
- Pu, Sr-90, Cs-137 in the Tatra mountains (soil, vegetation; some collaboration with Slovakia)
- Pu, Sr, Cs i -22 in air (relation to Be-7; using ultra low level gamma spectrometry system for measurement; air filters from Institute)
- Pu in air (ASS-500 retrospective filters)
- I-131 in endocrynological hospital (air above septic tank; potential inhalation)
- DU in lichen from former Yugoslavia
- In the past projects coveren mammals and birds of prey, insects (since 1998)

Natural Nad a. o. radiocesium determination in mushrooms (all Polish forests were sampled), and high altitude air samples taken on the Noth Atlantic route.

ERL has not yet ISO 17025 accreditation. Accreditation of the routine gamma spectrometry part of the measurement line is being pursued.

Laboratory equipment:

Alpha spectrometry:
The laboratory has several alpha spectrometers (two ORTEC 576A dual alpha chambers and one Silena Alphaquattro chamber) operating with Hungarian NIM electronics and connected to PCs for spectrum collection. Spectra are stored on diskette. Spectra analysis is performed on separate PCs offering higher performance.

Gamma spectrometry:
ERL operates several gamma spectrometry devices, one of them particularly designed and equipped for ultra low level performance.

Several germanium detectors are available, e.g. a 15% well type, a 11%, a 20% and a planar detector (own construction based on crystal from Belgium, for Pb-210 measurements, collaboration with PTB Braunschweig, Germany).

The routinely for general measurements used 'normal' shield consists of 5+5 cm Pb, 18 mm Cu and a Cd liner. A layer of some 10 cm paraffin wax on top of the shield serves for improving the liner efficiency (thermalisation of ambient neutrons leads to higher absorption in Cd liner). A plastic foil on the detector end cap helps to avoid contamination of the detector surface by a sample; there are no sample centering devices used.

The special shield which is mainly used for analysis of Na-22 in aerosol samples is of proprietary design and self-built; it consists of an active shield with a muon detector using $ArCO_2$ as counting gas in anticoincidence with the gamma signals. Electrolytically refined copper and special Etruschian old Pb are used as material for the passive part of the shield. The liner consists of 2 mm Cd. A paraffin wax layer above the lead top serves to enhance the absorption efficiency of the liner. Nitrogen evaporating from the cooling Dewar is piped into the measurement chamber with a view of purging by expelling any radon. The sample holder is made of specially selected material as well.

NIM electronic modules for the gamma spectrometry system are from Canberra and Silena. A Silena data buffer is linked to a standard PC via an IEE488 card. The gamma analysis software has been programmed within ERL (it was commercially distributed). An old Tristan 1024 MCA serves as backup for the system.

Beta measurements:
Strontium measurements are performed with a Wallac Guardian LSC connected to a PC with Wallac analysis software.

On-line monitoring and sampling devices
At the premises of IFE, a PMS, an ASS-500 and a modified ASS-500 station are operated (the latter for testing). A description of the PMS system is given in 5.1.1.1. For a description of the ASS-500 stations see 5.1.2.1. Both devices at IFE have a NaI(Tl) detector built-in.

At the same site a precipitation sampler with a collection area of 2 m^2 and a HVS-30 air sampler (with charcoal cartridge) used for hospital monitoring are available.

5.2.3 WSSE basic units

Generally, WSSE basic units are supplied with:

- Dose rate monitors;
- NaI(Tl) detectors for gamma spectrometry;
- Inter-Polon Tristan 1024 MCAs with manual peak setting;
- Polon electronic devices;
- Inter-Polon Sapos-90 high voltage supply / amplifier / SCA / counter devices (generally used with 3 channels for NaI(Tl) gamma measurements and for dose rate).

Some units also operate:

- PMS stations;
- ASS-500 stations;
- Liquid scintillation counters;
- HPGe gamma spectrometry systems.

5.2.4 IMGW stations

Generally, IMGW stations are supplied with:

- ESM FHZ 621 G-L proportional counters;
- SSU-70-2 detectors as backup;
- Inter-Polon Sapos-90M and Sapos-90 Environmental Radiation Monitors;
- Beta scintillation detectors;
- NaI(Tl) detectors;
- PCs for signal processing and data analysis;
- Precipitation samplers (description see 5.1.3).

Some units also operate:

- Automatic ESM FHT 59SI aerosol monitors (description see 5.1.2.2);
- Air pumps RAS-1 with iodium filters.

5.2.5 The CEZAR-NAEA data centre

General

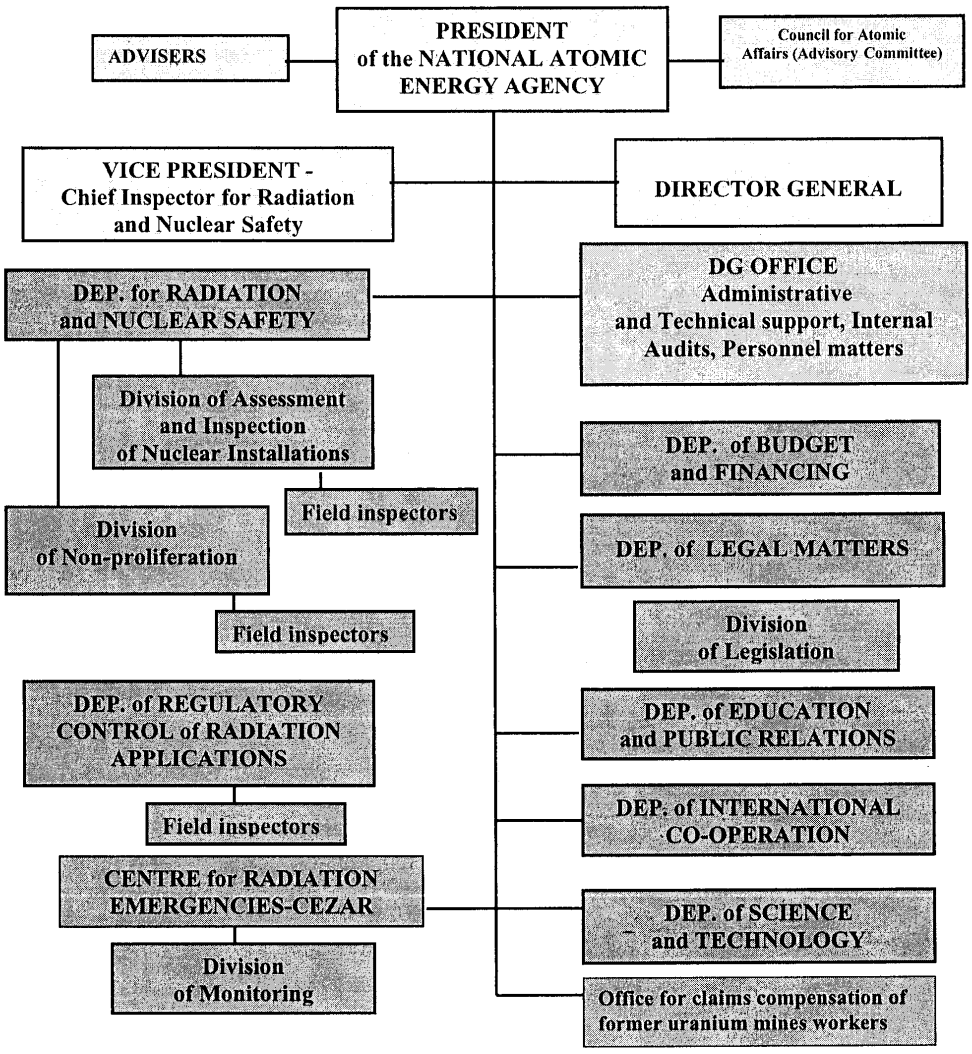
Poland has signed bilateral agreements on early notification of a nuclear accident and on co-operation in nuclear safety and radiological protection with Denmark, Norway, Austria, Ukraine, Belarus, the Russian Federation, Lithuania, Czech Republic and the Slovak Republic. Bilateral agreement with Germany is on the final stage of preparation.

NAEA's role in emergency arrangements is through the Radiation Emergency Centre 'CEZAR'.

Thus CEZAR has been established in 1995 as a body of NAEA designed to observe the radiation situation in the country and as international contact point (warning point and contact point for domestic and abroad as well as Competent Authority contact point) for EC (ECURIE) and IAEA (EMERCON) working on a 24 hours a day basis. It also serves as channel for exchanging information on radiation emergencies with neighbouring countries according to bilateral agreements.

The organisational setup of NAEA is shown below.

Fig.7. Structure of NAEA



Data centre

In the CEZAR data centre 7 persons are employed. The tasks are related to managing radiological data from automatic and laboratory based networks for normal situations as well as in emergencies. In particular, CEZAR manages data from the automatic monitoring systems, PMS and ASS-500 (on line NaI(Tl) detector). all the 13 PMS stations transmit data online (gamma dose rate, temperature, spectra,

background) and have an alarm system. Data from 11 of the ASS-500 stations are transferred by an internet line twice a day to CEZAR and are displayed on a 'big' computer screen. Results of laboratory spectrometric measurements (of filters) are prepared by CLOR each month and send to CEZAR-NAEA. CEZAR also receives – by fax - the data collected under the responsibility of the Ministry of Defence, once per week in paper form.

The following data systems are available at CEZAR:

- ECURIE system/CoDecS station (European emergency notification and information system)
- EURDEP (European on-line data communication system with main server at JRC/Ispra)
- Easy Proteo (European laboratory data transmission system for the REM data base at JRC/Ispra)
- METEO (Polish meteorological data communication system; data are sent to CEZAR/NAEA as text files once a day via a dedicated internet line using point to point connection).
- Danish data base (Argos)

Data are stored on several PCs (SQL servers). The company 'TD electronics' is in charge of the management of the stations and their maintenance (3 times a year). All data are saved weekly in electronic format.

Presentations and reports can be generated using dedicated software tools. Reports are generated 4 times per year or extra if it is needed.

Mobile measurement system

CEZAR-NAEA operates a radiation survey vehicle (4-wheel driven), which is equipped with a 4-litre Exploranium NaI detector and a measurement unit Envispec GR-320, coupled to a GPS positioning system. The system includes a built-in low activity Cs-137 source to control system stability.

The vehicle can be used for:

- continuous measurement of ambient gamma dose rate and gamma spectra along the vehicle's route,
- searching and identification of orphan radioactive sources,
- collecting environmental samples for laboratory measurements,
- other purposes.

6. NORM ACTIVITIES – COAL MINES

Poland has early discovered that also mines not dealing with uranium extraction may show enhanced levels of naturally radioactive substances, both in the air of the tunnels as in the liquid discharges. Thus, early studies were performed and guidance was given.

6.1 General description of the phenomenon of enhanced natural radioactivity in waters from Coal mines in Poland

In the coal mines of Upper Silesia, inflows of brines with enhanced natural radioactivity occur. The phenomenon was discovered in the 1960's. In some cases, in such waters the total dissolved solids concentration exceeds 200 kg/m^3, whilst the radium concentration may reach 400 kBq/m^3. Analysis of the radium isotopes in inflows showed that the input of Ra-226 was about 725 MBq per day, while the corresponding value for Ra-228 was roughly 700 MBq. Only 40% of the radium remained in the underground galleries, whilst 60% were transported in pumped waters to the settling ponds on the surface and later to rivers. Investigations demonstrateded that radium concentration in water was correlated to salinity. Two types of brine were distinguished in coal mines. In type 'A' waters ions of barium and radium are present, while in type 'B' waters, only radium ions and sulphate occur, but no barium. From type A waters, after mixing with waters rich in sulphate ions, radium is very easily precipitated out with barium carrier as sulphates. In type B waters there is no convenient carrier for radium, therefore no precipitation of radium scales occurs. Further investigations showed that discharge of radium-bearing waters from coal mines caused many cases of contamination of the

natural environment, especially small brooks and rivers in the vicinity of these mines. The highest levels of contamination were always connected with release of type A waters and precipitation of insoluble deposits with enhanced radium content. Such processes occurred in underground galleries and on the surface in settling ponds and small rivers.

In the past, concentrations as high as about 25 kBq/m^3 of Ra-226 in discharge waters from coal mines in Upper Silesia have been measured. The total discharge of radium isotopes into the natural environment has been assessed being some 900 MBq/day (Ra-226+Ra-228). However, in the past regulations waters, in which the content of Ra-226 was higher than 0.7 kBq/m^3, were treated as waste material with enhanced radioactivity. This value was defined by a Decree by the President of the Polish Atomic Energy Agency related to radioactive wastes from 1989; currently this limit has been replaced by a dose constraint system. In Poland, at the beginning of the 1990's in 10 out of 66 mines, radium levels in discharge waters exceeded this limit. Type A waters were discharged from seven collieries, and type B waters from three others. The total activity of Ra-226 in type A waters is only 30 MBq per day. Only two mines, including the Piast mine at Bieruń, are sources of type B waters; the total amount of Ra-226 in such waters is much higher, about 200 MBq per day. Additionally, the concentration of another radium isotope, Ra-228, is even higher than that of Ra-226 and the total amount of Ra-228 in discharged waters is slightly more than 280 MBq per day.

6.2 Environmental radioactivity monitoring of coal mining activities

The Act of Parliament of 29 November 2000 - the Atomic Law (Dz.U. 2004, no.161, item 1689, no.173, item 188; Dz.U. 2005, no 163, item 1362: Dz.U. 2006, no 53, item 378) appointed the Council of Ministers as the body responsible a.o. for NORM industrial activities (such as coal mines).

On the basis of the Council of Ministers regulation (mentioned in 4.3.1.b) the Laboratory of Radiometry of the Central Mining Institute (GIG) was appointed to be the unit performing the measurements of radioactive contamination related to coal mining activities. The above mentioned regulation specifies requirements for this laboratory and a list of radionuclides which should be measured by the laboratory on behalf of the concerned industry.

In the past, a formal surveillance system was set up to check compliance with the then valid legal limit for discharge activity concentrations (1.1 kBq/m^3 for Ra-226 plus Ra-228). At present there is no regulation or national programme that would oblige coal mine authorities to perform environmental radioactivity monitoring in the vicinity of mines. However, according to the Atomic Law the legal dose limit of 1 mSv/year for members of the general public applies also to NORM industries; in addition, by a Council of Ministers regulation (OJ 2002, no 220, item 1850; in force since 1 January 2003) there is a constraint for NORM waste uses (1 m above NORM waste material the dose rate shall be less than 300 nGy/hr).

Currently the local municipalities in the mining regions show considerable interest in discharge surveillance. Thus, as part of their environmental protection programme, some coal mine operators contracted GIG to perform analysis on liquid discharges.

Additionally, GIG performs measurements of radioactive contamination of the natural environment in the vicinity of coal-mines within the frame of scientific investigations supported by the Central Mining Institute, the Ministry of Education resp. by the European Community.

6.2.1 Monitoring of waters from coal mines

Liquid discharge samples of several coal mines are collected by mine staff once per year, e.g. at the exit part of the purification system tunnel if existing. The samples are transferred to GIG, the Ra-226 and Ra-228 content is determined and the results are reported by GIG to the concerned mine.

Additionally monitoring of Ra-226 and Ra-228 is carried out in rivers into which coal mine waters from settling ponds are discharged. In such waters also gross alpha and beta activity as well as tritium concentration may be measured.

Sampling points and frequency of measurements are determined by the responsible person for organising environmental surveys at the coal mine. When the Central Mining Institute is performing measurements in the frame of projects supported by the Polish Committee of Scientific Research, the local community, EC funds etc., procedures are determined by the Laboratory of Radiometry of the Central Mining Institute after discussion with the responsible coal mine employee.

If a specific coal mine has its own drinking water supply monitoring of natural radionuclides in such waters is done as well. Usually drinking water is controlled twice a year.

The above mentioned monitoring activities are not obligatory and not part of the national monitoring system.

6.2.2 Monitoring of natural radionuclides in waste from coal-mining industry, sediments and vegetation

Solid samples (deposits from settlement ponds, river beds, soil, solid waste, fly ash etc.) mainly contain radio-isotopes from the uranium and thorium decay series and K-40. Mostly samples are sent to the Laboratory of Radiometry of the Central Mining Institute for analysis.

Sampling of grass and other plants in the vicinity of coal mines (especially in areas of abandoned settling ponds) is performed within the frame of scientific projects of the Central Mining Institute (financially supported by the Polish Committee of Science and by the EC).

6.3 Laboratory of Radiometry of the Central Mining Institute

The most important institute involved in monitoring of environmental radioactivity for the hard-coal industry in Poland is the Central Mining Institute (GIG) in Katowice. The institute is supervised by the Minister of Economy and is divided into different departments for specific measurements and activities. It employs 530 persons and has full academic promotion rights (i.e. it can promote Ph.D. and professors). The annual budget is 20 – 22 million EUR (½ from the mining sector and ½ from SMEs, local authorities and abroad).

The **Laboratory of Radiometry** is dealing with problems of radiological hazards and is part of the Department of Technical Acoustic, Laser Technology and Radiometry. It employs 12 persons.

It has been involved in investigations of radiation hazards caused by natural radionuclides in the mining industry since the early 70's and developed large expertise in this area. The main goal of its work is the protection of mining crews as well as the protection of the natural environment. Investigation of the contamination of the natural environment in the vicinity of underground mines and in post-mining areas became one of the crucial items for land reclamation of brownfields.

6.3.1 Instrumentation of the Laboratory of Radiometry

Liquid scintillation (LS) laboratory
The laboratory owns an LKB 1220 and two QUANTULUS liquid scintillation counters (Wallac Oy; now Perkin Elmer; one Quantulus installed in March 2006). They are used for the measurement of Ra-226, Ra-228, Rn-222, Pb-210, Po-210, H-3 and Sr-90 in water samples and aqueous solutions.

Gamma spectrometry laboratory
The laboratory operates several germanium detectors (among them 2 HPGe, 1 Ge(Li) and one broad energy) manufactured by Canberra, Silena and PGT, most in 60 to 70 cm thick steel shields. NIM

electronics and gamma spectrum accumulation and analysis software (Genie 2000) is from Canberra-Packard.

The laboratory performs measurements of natural and artificial gamma emitting radionuclides in solid samples such as deposits from coal mines, coals, soils, ash, slag, construction materials. A portable gamma dosemeter and a low resolution gamma spectrometer Canberra InSpector 1000 are available as well.

Radon laboratory
The laboratory houses a radon chamber of 7.25 m^3 volume for calibration purposes. It operates so-called 'alpha probes' (measuring devices developed by the Laboratory of Radiometry), and mining ratemeters RGR-11 for radon progeny measurements, as well as AB-5 paratemeters (Pylon, Canada) and FP-10 ratemeters (Institute of Nuclear Chemistry, Poland) for radon gas measurements. Several instruments for measurement of the unattached fraction of radon progeny were constructed in co-operation with the University of Göttingen (Germany).

Radiochemical laboratory
The preparation of water samples for LSC and of samples for alpha spectroscopy etc. is done in a separate laboratory.

Alpha spectrometry laboratory
The laboratory is equipped with surface barrier silicon detectors, vacuum chambers, electronics and PC based software (Alpha Works, Canberra-Packard). Measurements of Po-210, Ra-226, radon progeny and other alpha emitting isotopes are possible.

In the nearest future the laboratory of radiometry will be equipped with additional instrumentation:
- portable liquid scintillator counter Hidex Triathler™,
- dosimeter UNIDOS,
- well-type gamma spectrometer with active anticoincidence shield,
- particle spectrometers for aerosols.

Data generated are stored in the data bases of the laboratory, results are available for the respective customer only (data pertaining to mining activities are also transferred to NAEA by the coal mine's person responsible for environmental monitoring). Results gathered in the frame of scientific projects are published in local and international journals.

For most of the measurement methods performed in the Laboratory of Radiometry a system of quality assurance has been implemented. Accreditation by the Polish Centre for Accreditation was granted on 1st of December 1993. The scope of accreditation is as follows:

- 1. measurements of concentration of radionuclides: Ra-226, Ra-228, Ra-224, Pb-210, gross alpha and beta activity in liquid samples, water and aqueous solutions;
- 2. measurements of concentration of gamma-emitting radionuclides in solid samples;
- 3. measurements of gamma doses and dose-rates;
- 4. measurements of potential alpha energy concentration of radon progeny in the air;
- 5. calibration of portable instrumentation for measurements of radon progeny.

6.3.2 Mobile Monitoring System of the Central Mining Institute

The Central Mining Institute owns a Nissan pick-up 4WD car adapted for simultaneous field measurements of chemical and radiological agents. In the field of radiological pollution the laboratory is able to collect samples of water, biota, soils, waste, sediments etc. for detailed laboratory measurements. At present the institute is equipped with a portable gamma dose meter and gamma spectrometer (Canberra InSpector 1000), dose meters (FAG) and a device for measurements of alpha particles in air. The foreseen portable liquid scintillation counter (Triathler™) will form part of the car's equipment.

6.4 The PIAST Coal Mine in Bieruń

6.4.1 General description and history

The Piast coal mine in Bieruń near Katowice (KWK Piast) started operation in 1975. Currently itemploys some 6600 persons, 5000 of which are miners in the production department. The mine is producing 5.2 million tons of hard coal annually.

With regard to radiation exposure two categories of workers have been defined: A (above 6 mSv/year) and B class (below 6 mSv/year). Good ventilation systems minimise both, the risk of high exposures to radon as well as methane problems.

In the past, waters with enhanced natural radioactivity from two hard coal mines – Piast and Czeczott, have been discharged into the Bojszowy settling pond. Total radium activity in discharged waters was up to 120 MBq per day. The Ra-226 and Ra-228 content in brines discharged into the settling pond reached values up to 10-15 kBq/m^3 and concentrations of these isotopes measured in the small river Gostynka, a tributary of the Vistula river, ranged from 0.5 to 1.5 kBq/m^3.

The Bojszowy settling pond area is of about 16 hectares and the thickness of sediments which accumulated over time, amounts up to 1 m. Results of the spectrometric analysis have shown that in the bottom sediments maximum Ra-226 and Ra-228 concentrations are 2.0 kBq/kg and 4.0 kBq/kg respectively.

In the 1990's the local authority in the Katowice Voyvodship issued a decision, that the Piast Colliery had to take measures in order to reduce the concentrations of natural radionuclides (radium isotopes) in its waste waters to values as low as possible before discharging them into the Gostynka river.

In addition, the long-term release of radium-bearing waters causing significant local contamination in settling ponds and small rivers required an assessment of the ecological impact of the radioactive pollution. The possibility of radium removal from mine waters had to be considered. Laboratory and field investigations on radium removal from mine waters were supported by the Polish Committee of Scientific Research. The results obtained during tests (also in underground galleries) were at the basis of the design of the purification station in the Piast Colliery. The construction of this station located some 650 metres below surface, near the main shaft, started in 1996. It was partly supported by the National Fund of Environmental Protection and Water Resources. The purification station was finished end of 1998 and testing started.

After initial tests with barium sulphate barium chloride was chosen as co-precipitation agent for radium nuclides.In May 1999 work started. Since July 1999 the installation is used in a routine way to purify 6 m^3/min, corresponding to 8600 m^3/day of brines with enhanced concentrations of radium isotopes. It consists of a steel funnel which gradually releases barium chloride into the discharge water stream. (The mine uses several hundred kilograms barium chloride per day.) This stream runs through settling galleries which stretch over some 12 km and are not accessible. In this part of the mine the precipitation process occurs and the precipitate deposits on the ground. The purified water flows out to the main water galleries near the up-cast shaft and is pumped out to the surface. Formerly discharges were to Bojszowy reservoir, now they are directly to the Gostynka river.

Purification leads to significant radium removal. In cumulative waters from the 650 metres level, the concentration of radium isotopes Ra-226+Ra-228 decreased from 15 kBq/m^3 to about 1.5 kBq/m^3. Thus the amount of radium, pumped to the surface was reduced by a factor of ten. The assessment of the radium balance showed that the amount of radium released into the settling pond was about 65% lower compared with previous values. As expected, the same pattern was observed at the outflow from the pond, but slightly retarded due to the retention time in the pond of roughly 8-9 days.

The radioactive contamination of waters, discharged into Gostynka River and from there to Vistula River (which coming from Krakow runs through Warsaw and opens out into the Baltic Sea near Gdansk) was significantly diminished as a result of the implementation of the purification method:

actual measurements show a reduction by 45 MBq/day for Ra-226 and 60 MBq/day for Ra-228. The decrease in discharge of both radium isotopes from the Piast Colliery into the natural environment by saline waters is above 100 MBq per day. (Since the beginning of 2006 a similar treatment installation has been installed in the Ziemowit Mine. Preliminary results indicate a total reduction of radium isotopes activity of about 100 MBq/day.)

6.4.2 Monitoring of radioactivity in waters discharged from the Piast coal mine

Samples of discharge waters are taken four times per year by staff from the mine after purification at the end of the settling gallery. The samples are then transferred to the measurement laboratory at GIG for determination of Ra-226 and Ra-228.

The analysis results are reported back to the mine administration which informs the municipal authorities and the State Mining Authority.

6.4.3 Settling pond related activities

Until several years ago all discharges of the Piast mine were piped to a settling pond, the Bojszowy reservoir, which covers an area of some 16 ha.

Since consolidation of the discharge purification process in the mine discharges go directly into the Gostynka river. Thus currently there is no input of radioactive contamination from the coal mine into the pond and the pond is drying out. Concepts have been developed with a view to use the land for other purposes. To prepare such site restoration, a study has been initiated with aview of efficient planning and resource allocation. Within this extensive study soil contamination and radon emanation measurements have been performed by GIG as well as radio-ecological investigations on the behaviour of radium.

7. VERIFICATION ACTIVITIES

Verification activities were focused on:

- In Krakow and its surroundings:
  - Stations responsible for monitoring the radiological situation in Poland as well as for the early detection of unusual contamination events, situated within the local laboratories of sanitary inspection (in Krakow and Sanok) and in the stations belonging to the Institute of Meteorology and Water Management, (in Lesko and Zakopane);
  - The analytical laboratory (Niewodniczanski Institute, Krakow) for environmental samples.
- In the Katowice region:
  - The Piast coal mine with respect to natural radioactivity of waters discharged by coal mines;
  - The analytical laboratory (Central Mining Institute, Katowice) for discharges of the coal mines and impact in the mine's vicinity.
- In Warsaw:
  - The national monitoring, providing the data for the continuous radiological control under normal conditions;
  - The coordination of the monitoring stations and units provided by the Radiation Emergency Centre (CEZAR), belonging to NAEA;
  - The analytical laboratory (CLOR – Central laboratory for Radiological Protection, Warsaw) for environmental samples.

The verification team was informed that for Polish routine monitoring the NAEA system of acceptance applies (QA/QC by NAEA president; participation in national inter-comparisons). Based on its participation in this system, each laboratory receives an acceptance letter from the NAEA president.

The verification team was informed that currently there is no programme in place for monitoring drinking waters and that NAEA and the Ministry of Health may be involved in the devolpment of such a programme for Poland.

The verification team strongly supports developing a national drinking water monitoring programme.

7.1 Environmental radioactivity laboratory (ERL) of the Niewodniczanski Institute

The verification team visited the Environmental radioactivity laboratory (ERL) of the Henryk Niewodniczanski Institute of Nuclear Physics of the Polish Academy of the Sciences (IFJ). It verified the presence and operability of the laboratory instruments. The team verified the adequacy of the analytical systems in place, including sample registration and preparation as well as various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The team noted that all the instructions and procedures are present and readily available at all workstations. The team noted the high level of expertise in the field of radioactivity measuremenmt and the high level of motivation of all staff involved. However, the verification team also noted the spatial restrictions for ERL, in particular in the radiochemistry area.

The verification team suggests giving reasonable priority to solving the spatial restrictions that currently apply to ERL if opportunity arises.

Reception and registration of samples

The team noted that environmental radioactivity monitoring programme samples are registered and tagged with unique identifiers upon receipt at ERL. The registration information includes data such as: sample type, sampling period, date and time of sample arrival, sampling location, sample volume (or mass) etc. and is recorded on paper log. Samples are directed to the sample preparation unit where they are treated physically and/or chemically. The parameters and results of the treatment are added to the sample registration document. Then samples are transferred to the radioactivity measurement area.

Verification activities with respect to sample reception and registration do not give rise to particular remarks.

Analytical measurement room

Alpha spectrometry

The team noted that at the time of the verification one of the two alpha spectrometers was not operational.The vacuum pump was installed in the neighbouring room for noise reasons. The laboratory uses old PCs for spectrum collection since the system would not work with new, 'fast' PCs. The spectra are transferred via diskette to other PCs for further analysis. ERL uses Pu-242 from ITU Karlsruhe as spike

Gamma spectrometry

The aerosol filters from the on-site ASS-500 station are changed once per week. First they undergo a rapid measurement (to detect any significant contamination) and after three days (decay of short-lived natural radon progeny radioactivity) a second measurement of one week is performed.

Calibration for air filter measurements is performed with calibration sources provided by CLOR. The verification team noted that all sources were locked in a cupboard safe. All persons from the laboratory have access.

For other samples (several container types and different filling heights) calibration sources are produced by ERL. For Marinelli beaker ERL uses SZM-3 standard produced by Polatom – Świerk.

Efficiency and energy checks are done every Monday before LN_2 filling. Background measurements are performed every second or third month.

The laboratory uses a Silena data acquisition system on PC but does not apply the corresponding analysis software. Measurement data are transferred by diskette to a PC in the neighbouring room for analysis with proprietary software (program by J. Mietelski, 87/89; commercially distributed).

The institute has its own LN_2 generation but for cost reasons uses LN_2 for gamma detector cooling from outside.

Verification activities with respect to measurements do not give rise to particular remarks.

Electrical back-up and air conditioning

The verification team was informed that no UPS and no generator is available the reason being that due to the delicate electronic setup a reliably operating UPS that would not disturb measurements would be extremely expensive. Thus, after power failures the personnel has to switch on electricity manually. Every weekend somebody has to check the status of all the devices. In general 5 or 6 times a year an electrical problem occurs. The lab has an air conditioning system to minimize e.g. energy drifts in spectra due to changes in temperature.

The verification team accepts the arguments raised against establishinmg a UPS device.

Quality assurance

The team was informed that ERL is in the process of ISO17025 accreditation for its gamma spectrometry. A first audit was foreseen for the week of the verification visit.

Based on its participation in the NAEA quality control system, the laboratory received an acceptance letter from the NAEA president for gamma spectrometry as well as for the analysis of radiostrontium, Pu, Cm, Ra-226 and Uranuim isotopes. The samples for the inter comparison exercises were prepared by CLOR. Very detailed procedures were available in Polish language. ERL participates also in IAEA inter-comparison exercises (i.e. in 2006 in an exercise for Cs-137 and Sr-90 measurements).

The verification activities with respect to quality control do not give rise to particular remarks. The team fully endorses future participation in national and international inter-comparisons. The team also encourages the foreseen accreditation of the radiological laboratory according to ISO 17025.

Archiving and traceability

ERL has archives since 1987 when data were stored on diskettes. No paper records are archived, except the alpha spectra, for which printouts are 'glued' into a book.

The verification team succeeded in tracing all measurements related to an air filter from 20 February 2003 (code: KR0307). The filter was archived as well as all measurement data and the spectrum.

Verification activities with respect to archiving do not give rise to particular remarks

Reporting

ERL reports the specific nuclides that it is asked for in procedures developed by NAEA and reports also any unusual nuclides that it would identify. All these measurement data are reported quarterly to CLOR and a yearly report is forewarded to NAEA

The verification activities with respect to reporting do not give rise to particular remarks.

Verification of the PMS, ASS and modified ASS stations, and the precipitation sampler outside the ERL building

The verification team visited the site that houses sampling and measurting devices near the fence of the premises. It verified the operationability of the PMS station (on-line connection to NAEA running; battery backup available). The ASS-500 station that belongs to NAEA was also fully in operation. The built in NaI(Tl) detector continuously measures gamma spectra that are also transferred to the NAEA centre. Another ASS-500 station has been modified by ERL in order to permit also determination of gaseous iodines (in particular I-131) collected on a charcoal cartridge. At the time of the visit the device was not used because due to the additional resistance the air flow had dropped to 250 m^3 per hour and changes in the setup were discussed.

The team also noted a 2 m^2 precipitation collector which has been developed by IFJ as a prototype.

Ambient gamma dose rate measurements are transferred automatically every 10 minutes to NAEA. All other measurement data are transferred routinely twice daily to NAEA.

The verification activities with respect to the measurement and sampling stations 'at the fence' do not give rise to particular remarks.

7.2 Sanitary Inspection (WSSE) – local laboratory in Krakow (unit nr. 23)

Sample handling

The verification team visited the WSSE laboratory in Krakow and verified the presence and operability of the laboratory instruments, as well as the adequacy of the analytical systems in place, including sample registration and preparation and various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The team noted that all the instructions and procedures were present and readily available at all workstations. Four persons are employed by the laboratory (among a total staff of 284 persons).

Sampling is performed at district level by local staff. Upon arrival, sample information is entered in a log book using a unique sample code. Each sample is accompanied by a sample protocol with all sampling data, the name of the sampling person, his/her signature and the registration number of the station. The sample preparation is done in the laboratory. Samples are not archived after measurement. The laboratory proceeds between 70 and 80 samples per year routinely for determination of Cs-137 (milk, fish, potatoes, fruit, vegetables, tap water, surface water and feeding stuff).

Verification activities with respect to sample reception, encoding and preparation do not give rise to particular remarks.

Laboratory equipment

The verification team noted: The laboratory has a liquid scintillation counter (PerkinElmer Guardian Wallac 1414) for alpha and beta measurements, two NaI(Tl) detectors for gamma spectrometry (connected to an Inter-Polon Tristan 1024 MCA with manual peak setting; Polon electronic devices) and one Inter-Polon Sapos-90 device (generally used with 3 channels for NaI(Tl) gamma measurements and for dose rate). A service contract is in place for all this equipment. Reference sources with the corresponding certificates were available. The laboratory has no electricity back up.

The verification team emphasises that NaI(Tl) based gamma spectrometry is a low resolution application. It is reasonably suited for the measurement of single nuclides showing few peaks. If measurements are performed on a sample with a complex spectrum the so called 'Cs' channels may represent rather an indicator for 'gross gamma'. The team strongly recommends taking this into account in the reporting of such data.

Quality assurance, archiving and reporting

The laboratory is fully accredited, including for radiological measurements (certificate: 2005/017-488.03.03). For Polish routine monitoring the NAEA system of acceptance applies (QA/QC by NAEA president, via participation in national inter-comparisons). All measurement techniques as well as the resulting data are approved by the president of NAEA. Data are archived only on paper since 2003. Quarterly reports are sent to NAEA

The verification activities with respect to quality control, archiving and reporting do not give rise to particular remarks.

7.3 Sanitary Inspection (WSSE) – local laboratory in Sanok (unit nr 39)

The verification team visited the WSSE laboratory in Sanok and verified the presence and operability of the laboratory instruments, as well as the adequacy of the analytical systems in place, including sample registration and preparation and various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The team noted that all the instructions and procedures are present and readily available at all workstations. Six persons are employed by the laboratory (two of them are in charge of detection of irradiation of food which is becoming a new task for the laboratory).

Sample handling

Sampling is performed at district level by local staff. Upon arrival, each sample receives a unique sample code which is entered y in a log book. Each sample is accompanied by a sample protocol with all sampling data, the name of the sampling person, his/her signature and the registration number of the station. All sample data are registered in the log book. Together with the measurement data, they are manually transferred into Excel® spreadsheets. The sample preparation is done in the laboratory. The laboratory proceeds routinely samples for determination of Cs-134, Cs-137, and K-40 in waters, milk (monthly), fish, potatoes, fruit, vegetables, tap water, surface water and feeding stuff. All samples other than milk are sampled on average quarterly.

Verification activities with respect to sample reception, encoding and preparation do not give rise to particular remarks.

Laboratory equipment

The laboratory has two NaI (Tl) detectors for gamma measurements. An Inter-Polon Sapos-90 high voltage supply / amplifier / SCA / counter is generally used with 3 channels for the NaI(Tl) measurements and one channel for dose rate measurements.

The laboratory is equipped with a 20% low energy HPGe from Canberra (shield 10 cm Pb, 1 mm Cu) connected to a PC using Canberra Genie 2000 3.1 software for spectrum accumulation and analysis. Measurement results are printed out, then manually transferred to a PC for reporting. Currently a central data base network for the whole laboratory is under preparation.

To avoid cross-contamination, all samples are wrapped in plastic foil before measurement.

Available sample geometries are Marinelli beakers and plastic boxes; air filters are pressed into a 5 cm geometry. Calibration is performed once or twice per year using MRNS from Polatom (Swierk). Energy checks are done before every measurement using a calibration source or a point source (e.g. Cs-137, Na-22). Background measurements are performed at least once per month with a 4 days measuring time.

Reference sources with the corresponding certificates were available. The laboratory has an electricity back up for about one hour, permitting to put a diesel generator to work.

(If many samples have to be measured, the laboratory additionally uses an own production shield SCC-1 and germanium (Ge/Li) detector of about 8% relative efficiency, together with Polish software for calculations).

The verification team endorses the set up of a central data network for this laboratory, in particular with a view to avoid errors when inputting data.

Quality assurance, archiving and reporting; traceability of sample data

The laboratory is accredited for high resolution gamma spectrometry (Polish ISO 17025 accreditation since 2001, valid until August 2009; certificate: AB 358 24.08.01). For Polish routine monitoring the NAEA system of acceptance applies (QA/QC by NAEA president, via participation in national inter-comparisons). All measurement techniques as well as the resulting data are approved by the president of the NAEA.

Filters from the local ASS-500 station (since 2000) and ashes of food samples (since 2002) are archived after measurement. Data are archived. Quarterly reports are sent to NAEA (through WSSE headquarters)

A sample of pork meat (76/SRL/05 from 9 February 2005, collected by WSSE, was traced by the team. The gamma spectrum was archived on a PC and all calculations until the final measurement result could be traced.

The verification activities with respect to quality control and reporting do not give rise to particular remarks.

Verification of the PMS and ASS stations, outside the laboratory building

The PMS station has an on-line connection to NAEA and measures continuously gamma dose rate. Measurement data are transferred every 10 minutes to NAEA.

The ASS-500 station belongs to CLOR. It has also a built in NaI(Tl) detector measuring continuously gamma spectra. All measurement data are transferred routinely twice daily to NAEA.

The verification activities with respect to the 'outside' measurement stations do not give rise to particular remarks.

7.4 Institute of Meteorology and Water Management (IMGW), local laboratory in Lesko

The verification team visited the IMGW laboratory and verified the presence and operability of the laboratory instruments, as well as the adequacy of the analytical systems in place, including sample registration and preparation and various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The laboratory has no ISO 17025 accreditation but follows the NAEA procedures of quality management. The team noted that all the instructions and procedures are present and readily available at all workstations.

Ambient gamma dose rate

The team noted: The location of the ambient dose rate detector for 'normal' measurements, an ESM FHZ 621 G-L proportional counter (measuring range 5 nSv/hr to 5 mSv/hr; energy range 30 keV to 1.3 MeV; gauging mark 23.22/91.03) has been well selected, on a flat hill outside town, within a wide area, far away from buildings etc.. The detector is mounted ca. 1 m above ground. Data transmission to a PC inside the building is every 10 minutes. As a backup, a GM detector is available; it is placed

close to the building and uses an Inter-Polon Sapos-90M Environmental Radiation Monitor for signal processing (which displays values in µR/hr).

The verification team suggests placing a sticker on the data display of the backup gamma dose rate monitor showing the conversion from µR/hr to SI units.

Beta and gamma measurements

The team noted two beta scintillation detectors, the standard one being interfaced to a PC (for signal processing and using 'GammaBeta' software for data analysis). The other one is connected to an Inter-Polon Sapos-90 device and is used as backup. Calibration is performed every 7 days with a K-40 source (kept in an exsiccator for keeping it dry and thus retaining its geometry).

The team noted a NaI(Tl) detector for low resolution gamma spectrometry, connected to a PC. Canberra Genie 2000 software is used for analysis. Procedures were available. The calibration of the system is performed once per year. These systems are used for verification in emergency situations by measuring aerosol samples taken with the RAS-1 pump – see below (analysis for I-131 and Cs-137).

The verification team emphasises that NaI(Tl) based gamma spectrometry is a low resolution application. It is reasonably suited for the measurement of single nuclides showing few peaks. If measurements are performed on a sample with a complex spectrum the so called 'Iodine' and 'Cs' channels may represent rather an indicator for 'gross gamma'. The team strongly recommends taking this into account in the reporting of such data.

Automatic aerosol monitor

The verification team was shown the automatic aerosol monitor FHT 59Si. It was informed that every day generally between 0600 and 0700 UTC all data are sent to IMWG headquarters in Warsaw (which at around 0800 to 0900 UTC sends daily reports to CEZAR-NAEA).

Dry and wet deposition

The verification team noted the presence of precipitation samplers located in the meteorological garden and well situated with regards to any obstacles. One device is for daily samples, 3 are for monthly samples (measured independently, calculation of mean). The team was informed that in case the containers are dry at sampling time, the devices are rinsed with distilled water. During winter alcohol is added to avoid freezing.

Precipitation samples are prepared by partly evaporating using lamps. Then the samples are combusted in a furnace (450°C) on planchettes. These planchettes undergo beta measurement.

Other samples

Some samples such as daily precipitation from the local fallout sampler and milk are measured at the laboratory however not within the national programme.

The verification team noted the presence of an air pump RAS-1 with gas counter for flow measurement and aerosol filter and charcoal cartridge which is available for sampling in any accidental situations.

Data management and reporting

Fallout measurement values are manually input into the PC data base at 0600 UTC. The daily reports containing all data including those from the automatic stations are sent to IMGW headquarters in Warsaw, which forwards a daily overall report to NAEA.

With the exception of the above suggestions with regard to the spare gamma dose rate monitor and using NaI(Tl) based measurements for gamma analysis the verification does not give rise to any specific remarks.

7.5 Institute of Meteorology and Water Management (IMGW), local laboratory in Zakopane

The team noted that the setup of this local IMGW laboratory is similar to the one at Lesko.

The verification team visited the laboratory and verified the presence and operability of the laboratory instruments, as well as the adequacy of the analytical systems in place, including sample registration and preparation and various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The laboratory has no ISO 17025 accreditation but follows the NAEA procedures of quality management. The team noted that all the instructions and procedures are present and readily available at all workstations.

The setup of this local laboratory is similar to the one in Lesko

Ambient gamma dose rate

The team noted: The location of the ambient dose rate detector for 'normal' measurements, an ESM FHZ 621 G-L proportional counter (measuring range 5 nSv/hr to 5 mSv/hr; energy range 30 keV to 1.3 MeV) has been well selected. The detector is mounted ca. 1 m above ground. Data transmission to a PC inside the building is every 10 minutes. As a backup, an old SSU-70-2 detector is available; it is placed close to the building and uses an Inter-Polon Sapos-90M Environmental Radiation Monitor for signal processing (which displays values in µR/hr).

> *The verification team suggests placing a sticker on the data display of the backup gamma dose rate monitor showing the conversion from µR/hr to SI units.*

Beta and gamma measurements

The team noted two beta scintillation detectors, the standard one being interfaced to a PC (for signal processing and using 'GammaBeta' software for data analysis). The other one is connected to an Inter-Polon Sapos-90 device and is used as backup. Measuring times are 30 minutes. Calibration is performed once per week with a K-40 source.

The team noted a NaI(Tl) detector for low resolution gamma spectrometry, connected to a PC. Canberra Genie 2000 software is used for analysis. Procedures were available. The calibration of the system (500 ml Marinelli and iodine cartridge geometry) is performed once per year using mixed radionuclide sources. One NaI(Tl) detector is available as reserve. These systems are used for verification in emergency situations by measuring aerosol samples taken with a specific pump (analysis for I-131 and Cs-137).

> *The verification team emphasises that NaI(Tl) based gamma spectrometry is a low resolution application. It is reasonably suited for the measurement of single nuclides showing few peaks. If measurements are performed on a sample with a complex spectrum the so called 'Iodine' or 'Cs' channels may represent rather an indicator for 'gross gamma'. The team strongly recommends taking this into account in the reporting of such data.*

Automatic aerosol monitor

The verification team was shown the automatic aerosol monitor FHT 59Si. Calibration is performed every 3 months with Sr and Am sources (after filter band change).

Dry and wet deposition

The verification team noted the presence of precipitation samplers located in the meteorological garden and well situated with regards to any obstacles. One device is for daily samples, 3 are for monthly samples.

Precipitation samples are prepared by partly evaporating using lamps. Then the samples are combusted in a furnace (450°C) on planchettes. These planchettes undergo beta measurement.

Other samples

Some samples such as daily precipitation from the local fallout sampler and milk are measured at the laboratory however not within the national programme.

Data management and Reporting

Fallout measurement values are manually input into the PC data base. Between 0600 and 0700 UTC the daily reports containing all data including those from the automatic stations are sent to IMGW headquarters in Warsaw, which forwards a daily overall report to NAEA.

With the exception of the above suggestions with regard to the spare gamma dose rate monitor and using NaI(Tl) based measurements for gamma analysis the verification does not give rise to any specific remarks.

7.6 NORM related verification

As outlined in 6.2 currently there is no legal activity concentration limit for NORM discharges and thus also for coal mine discharges in place in Poland.

The verification team recommends setting up a monitoring system for NORM discharges and adapting the national monitoring system to cover NORM related contamination of the environment.

7.6.1 Visit of the Piast coal mine and its purification station

The team received detailed presentations with regard to the Piast coal mine in general, the problematic of radium in brine waters, the radium purification station and the environmental monitoring of radioactivity in the vicinity of the site.

The team visited the radium purification station at 650 meters underground. All workers at the purification station wore badges with TLDs, which are read out periodically by the Mining Institute in Katowice.

The team noticed that written procedures for the handling of the purification process were available at the site of the purification station. Before treatment, the average concentration of Ra-228 + Ra-226 is 16 kBq/m^3. The purification of discharge waters is performed by using $BaCl_2$ for co-precipitation of Ra (about 500 kg per day to purify daily about 8600 m^3 of mining waters). After treatment with $BaCl_2$ (containers of 220 kg are used) and extensive mixture of this reagent with the brine waters of the mine in flooded galleries of about 12 km, the content in the discharge waters is on average 0.2 to 0.3 kBq/m^3 Ra-226 and 0.3 to 0.5 kBq/m^3 Ra-228. The activity remaining in the precipitation sediments stays within the mine. Samples of discharge waters are taken 4 times per year in the purification station down in the mine.

Verification activities with respect to the visit of the purification station in the Piast coal mine, including quality management aspects such as availability of written procedures, do not give rise to particular remarks.

7.6.2 Visit of the settling pond in the vicinity of the mine

The team visited the Bojszowy reservoir, a 16 ha large settling pond for discharge waters of the Piast coal mine. The pond is out of use since purification of discharge waters started. For the moment a re-utilisation of this contaminated area is discussed at political level. GIG performs radio-ecological studies on the site, including the measurement of radioactivity in plants growing on the site and in old

sediments. Up to 5 kBq/kg radium have been measured in sediment at certain places. Currently in the surroundings of the site dose rates of about 0.27 µSv/h are measured. In the center of the now dry settling pond gamma dose rates are 2.2 to 2.5 µSv/h.

Verification activities with respect to the visit of the former settling pond for the Piast coal mine discharge waters do not give rise to particular remarks.

7.7 Verification of the radiological laboratory of the Central Mining Institute (GIG) in Katowice

The verification team visited the GIG laboratory and verified the presence and operability of the laboratory instruments, as well as the adequacy of the analytical systems in place, including sample registration and preparation and various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The team noted that all the instructions and procedures are present and readily available at all workstations. Twelve persons are employed by the laboratory, among 530 persons working in the Central Mining Institute, mainly dealing with mining safety and environmental engineering.

Water and sediment samples are provided by the coal mines where sampling is performed by mine staff. Upon arrival, samples are given a unique sample code. Each sample is accompanied by a sample protocol with all sampling data, the name of the sampling person, and his/her signature. All sample data are registered in a log book and in a computer (backups are stored on CD-Rom). The GIG radiological laboratory handles 600 to 700 samples per year. Sample preparation is done in the laboratory.

Laboratory equipment

Gamma spectrometry

Three persons are allocated to gamma spectrometry (one of them for sample preparation; one physicist has expertise in the physics background of such measurements).

With regard to density correction the verification team noted that 3 standard sources in Marinelli geometry are available having various densities. Not all detectors are calibrated with the complete set.

The generally used geometries are 0.6 l Marinelli, 'Nivea' cup, and some others e.g. air filter (special calibration standard from CLOR, Warsaw).

Marinelli beakers used for radon determination are covered but not sealed airtight; measurement is conducted after sample preparation and may be repeated after several days.

Efficiency calibrations are kept for long times; calibration is done systematically using certified materials from IAEA and EPA. Efficiency checks are performed after each filling with LN_2.

For energy checks the K-40 peak of the sample is used. Re-calibration has to be done a few times per year, depending on detector performance.

Background is measured a few times per year during holidays.

Measuring time for samples is usually 24 hr, for sediments from coal mines 5 hr, in accordance with the procedures no BR-3/2-004, 30.09.2003, approved by the Polish Centre of Accreditation. For sediment samples LLDs for Ra-226 as low as 1 Bq/kg are achieved; LLDs for Ra-228 and Ra-224, K-40 and other natural and artificial isotopes are on similar levels.

Refilling the dewars with $LN_2$is performed 1/2w or 1/10d, manually.

All procedures are available at the workplace.

Liquid scintillation counting

LSC measurement of Ra-228 and Ra-226 is done after chemical separation (co-precipitation of Ra using BaSulphate as carrier); 1 hr single measurements are performed.

The laboratory has air condition and a UPS for a one hour autonomy.

> *The verification activities with respect to laboratory equipment do not give rise to particular remarks.*

Devices outside laboratory

The radiological laboratory of GIG operates a 'normal' ASS-500 station, just outside the laboratory building. The device is part of the national monitoring system. The verification team noted that the device is set-up between two high buildings close to one wall.

> *The verification team draws attention to the fact that the device is not optimally placed with regard to undisturbed air sampling.*

Quality assurance, archiving and reporting; traceability of data

GIG as a whole has ISO 9001 certification since 1998.

The radiological laboratory is accredited since 1993 by the National Polish Authority for gamma dose rate, gamma spectrometry, alpha spectrometry, calibrations etc. (Polish ISO 17025 accreditation AB 005, PM-EN ISO 17025, current validity from 31.12.2002 to 30.12.2006). The laboratory was at that time accredited as the first radiometric testing laboratory in Poland.

The laboratory participates in intercomparison exercises.

Measured samples are archived for one year until the statutory report is published. A data base – currently in dBASE – was created in 1989. Data are archived on CD ROMs twice yearly.

The measurement data are transferred to the customer (coal mine). It is not within the remit of GIG to report such individual data directly to NAEA.

A yearly report is sent by the coal mine to NAEA (statutory obligation for the coal mine), which makes an evaluation of these data. Annual reports on radiation hazards to miners focussed on the assessment of occupational exposure are also sent directly by GIG to NAEA.

The verification team performed the tracing of a sample (discharge water to Gostynka river from April 2003) analysed by gamma sepctrometry. Data were archived on PC and CD-ROM and all calculations until the final measurement result could be traced.

> *The verification activities with respect to quality control and reporting do not give rise to particular remarks.*

7.8 Verification of the Central Laboratory for Radiological Protection (CLOR) in Warsaw

The verification team visited different departments of the CLOR laboratory, ie.: the dosimetry department, the department of radiation hygiene and the department of radioactive contaminations.

7.8.1 Dosimetry department

The team acknowledged that this laboratory is responsible for analyses of air and soil samples by gamma spectrometry. It verified the presence and operability of the laboratory instruments and the

adequacy of the analytical systems in place, including sample registration and preparation as well as various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The team noted that all the instructions and procedures are present and readily available at all workstations.

The verification team noted that 4 persons are involved in these laboratory measurements handling approximatively 400 samples per year.

Soil samples are taken according to procedures provided by IAEA and EPA, i.e. 6 sub-samples in a hexagon of 2 m diameter and 1 in the center using a 10 cm diameter borer. The sub-samples are pooled and processed together.

Air filter samples arrive at the laboratory by mail already pressed in disks and accompanied by a sampling sheet.

Reception and registration of samples

The team noted that environmental radioactivity monitoring programme samples are registered and tagged with unique identifiers upon receipt at CLOR. The registration information includes such data as: sample type, sampling period, date and time of sample arrival, sampling location, sample volume (or mass) etc. and is recorded in a log. Samples are directed to the sample preparation unit. They are treated physically and/or chemically. The parameters and a description of the results of the treatment are added to the sample registration document. Then the samples are transferred to the radioactivity measurement area.

Laboratory equipment

With regard to gamma spectrometry equipment the team noted that detector end caps are plastic covered to avoid contamination; the shields are colour coded for easier identification. The QM features of the Genie 2000 gamma spectrum analysis software are not used. The team verified the availability of the associated written procedures. The original documentation of some equipment was not available at the working places. Sample centering devices are not used. The verification team was informed that for the 'geometry critical' samples (i.e. the air filters) the detector crystal had a reasonably large diameter to avoid any severe centering problems.

One anti-compton shield that was formerly used with a NaI(Tl) detector is not in use anymore.

Efficiency calibration is performed once per year using certified mixed radionuclide calibration sources from the Czech Metrological Institute and DKD – Germany for soil samples (450 ml Marinelli beaker, density 1.3 g/cm^3) and PTB – Germany (for air filter geometries). The sources generally are kept in a safe in a locked storeroom and may be borrowed to other laboratories of CLR for calibration purposes. The traceability of the calibration sources is documented in a registration book.

Before each measurement campaign efficiency checks are performed. For energy checks the K-40 peak in each sample is used. Background spectra are collected every two weeks. Activity calculations are performed using the Genie 2000 software; since 1990, results are manually typed into a logbook.

Archiving and Traceability

Since 2000, the spectra of measured air filters and the corresponding measurement results are stored on electronic support. Soil samples are kept for 10 years. Air filters are stored as well (the oldest originating from 1988) and are made available for other contaminant determinations (e.g. plutonium by PTB).

The team performed the tracing of a historical sample and its archiving. For this, a soil sample from 06 October 2004 with the registration details: Krakow N° 83, OBIDOWA 06.10.2004, registration number 367, was chosen. The measurement data for K-40, Ra-226 and Ac-228 and the spectrum were

traced by the team. The archiving of the sample itself could be verified as well. All results were available in electronic format as well as on an Excel spreadsheet.

Verification activities with respect to sample preparation, measurements and record keeping at the Dosimetry Department (with regards to gamma spectrometry) do not give rise to particular remarks.

7.8.2 Department of Radiation Hygiene

The verification team visited the Department of Radiation Hygiene (DRH) of CLOR and verified the presence and operability of the laboratory instruments. Seven persons are employed by DRH. The team verified the adequacy of the analytical systems in place, including sample registration and preparation as well as various aspects of quality assurance and control (working instructions, methodologies, calibration, maintenance, bookkeeping of results, reporting etc.). The team noted that all the instructions and procedures are present and readily available at all workstations. Twelve persons are employed by the laboratory, five in gamma spectrometry, three dealing with alpha spectrometry and four others dealing with beta analysis.

Since 2003 DRH performed measurements of Tritium, Cs-137 and Sr-90 in water of different origin. Tritium measurements have been stopped. DRH measures Cs-137 and Pu-239,240 in bottom sediments. The laboratory collects the samples from 12 different locations in rivers and 6 sampling points in lakes.

Reception and registration of samples

The team noted that environmental radioactivity monitoring programme samples are registered and tagged with unique identifiers upon receipt at DRH. The registration information includes data such as: sample type, sampling period, date and time of sample arrival, sampling location, sample volume (or mass) etc. and is recorded on paper log. Samples are directed to the sample preparation unit. They are treated physically and/or chemically. The parameters and a description of the results of the treatment are added to the sample registration document. Then the samples are transferred to the radioactivity measurement area.

Analytical measurement room

Gamma spectrometry

Calibrations for the various measurement geometries are performed once per year using a mixed nuclide source.

Alpha spectrometry

The verification team was informed that the ORTEC 576 A alpha spectrometer is presently not used; all work is done with the new device. Alpha spectrum analysis is done manually.

Low activity beta measurements

Daily background measurements for the Risø anticoincidence system are performed during the night followed by an 8 hours sample measurement during the day. The team was informed that this device is not only used for determinations of Sr-90 but also for low level Cs-137 measurements (after chemical separation and only when the presence of Cs-134 can be ruled out) taking advantage of the high sensitivity of this method.

The written procedures for beta counting were available at the work place, but the instruction manuals of the devices were not. Counting results are printed out locally. Final values are calculated manually.

The calibration of the device is done yearly according to the calibration manual.

Intercomparisons and quality assurance

The laboratory has participated in international inter-comparison exercises arranged by IAEA, such as within the ALMERA[3] network in 2002 for measurements in water, Cs-134, Cs-137 in soil, and in those arranged yearly by NAEA and PROCORD (France), as well as in those organised by Risø for HELCOM. For measurements within the Polish national monitoring system, methods and procedures have been accepted and approved by the president of NAEA.

Archiving and tracing

Sampling data and measurement results are transferred in parallel in paper format to a log book and electronically into a computer.

After measurement, samples for plutonium analyses are archived and measurement data are back-uped on CD-ROMs.

The team traced the plutonium analysis of a 30 g sediment sample from the River Narew (tributary to Vistula) at Pultusk, taken on 1 December 2003. The team noted that the alpha spectrum and measurement data were available and could be followed through the data management routines easily.

Verification activities at the Department of Radiation Hygiene with respect to sample preparation, measurements and record keeping do not give rise to particular remarks.

7.8.3 Department of Radioactive Contaminations

The verification team visited this department and was informed that it currently prepares all reference materials for the intercomparison exercises organised by NAEA on a yearly basis. Due to time constraints the team did not verify the measureing devices of this department.

At the moment of the visit of the verification team, the laboratory produced an inter-comparison sample of liquid milk with a very low level of radioactivity (Cs-137: 0.56 Bq/l, Sr-90: 0.27 Bq/l). It produced the samples individually radionuclides from Polatom and stable carrier material. The low levels of radioactivity are checked with a gamma spectrometer and with the above mentioned Risø device respectively. Each sample to be distributed is checked individually by the laboratory.

(For 2007 NAEA plans to place a call for tenders for water or cereals as reference material.)

The laboratory follows the Polish regulations concerning the standard registered sources. The verification team saw the certificates for caesium and strontium standard sources. The caesium provider is Polatom.

Verification activities at the Department of Radioactive Contaminations with respect to the preparation of inter-comparison samples do not give rise to particular remarks.

7.8.4 PMS and ASS stations at the CLOR premises

The verification team visited the PMS and ASS stations outside of the laboratory.

The modified ASS-500 device which is operating in a testing mode currently encounters considerable decreases in air flow. Flow rate is measured after allowing for flow laminarisation. In deviation from the standard ASS-500 devices, data from the NaI(Tl) detector are transferred in 10 minute intervals.

[3] ALMERA: Analytical Laboratories Monitoring Environmental Radioactivity, it is a network of analytical laboratories with special skills and experience to provide assessments of radionuclide contamination in the environment in case of a radiological emergency

The verification activities with respect to the 'outside' measurement stations do not give rise to particular remarks.

7.8.5 Reporting at CLOR

For NAEA, CLOR provides periodically reports (i.e. from ASS-500 filters the results are sent on a monthly basis and for soil, air, feedstuff and foodstuff reports are submitted on a quarterly basis). CLOR sends a report with the results concerning surface waters, sediments, and biota periodically to the Inspectorate of the Environment. The results concerning the emergency issues are sent directly to CEZAR-NAEA.

Based on the different data stemming from the environmental monitoring programme and received from all measuring institutions of Poland, NAEA prepares an annual official report, which is also publically available.

The verification activities with respect to reporting by CLOR do not give rise to particular remarks.

7.9 Verification of the CEZAR-NAEA data centre in Warsaw

With regard to the PMS system the verification team was informed that 11 stations have been modernised and use new hard- and software, including for data transmission. The other two stations still use analogue modems but will be upgraded until end of March 2007. The team had a view at the data transmission routine which includes system status information.

With regard to the ASS-500 system (13 stations) online data from the NaI(Tl) detector (hourly spectra) are transmitted from 11 stations. The last 2 stations will be modernized (extra equipped with NaI(Tl(detectors) in 2007. The team had a thorough view on the data presentation software (similar to the one for PMS – 'AirPMS'). A visualisation of spectra and time trends is possible. The team noted that for some graphs internal knowledge is necessary for interpretation of the information content.

A geographical presentation of data is not built directly into the software. However, within the PMS software package (based on the Danish Argos system), fixed presentations for verified data are foreseen. These presentations are also published on the internet.

The verification team was informed that the description of the systems is contained 'in the procedure', which however was not available at the work place.

A report generator is available that includes all data (including those from the IMGW gamma dose rate monitoring system).

The team was informed that a close collaboration exists between CEZAR and the measuring laboratory to improve information on any artificial radionuclides 'detected' by the low resolution gamma spectrometry devices contained in the PMS and ASS-500 systems.

With regard to the transfer of laboratory based data to the REM data base in Ispra, at the moment Easy Proteo is used, based on MS Excel, which in its turn is filled in manually based on written reports. Data are checked before inputting. Currently an electronic approach for the internal data transfer is discussed.

The verification team noted that with regard to procedures for all measurement types needed in national monitoring and for all laboratories involved, the original documents are available at the centre.

With regard to improving the transparency and user friendliness of the data presentation system – in particular the one for the ASS-500 stations – the verification team suggests

introducing clear links between presentation parameters and display at the occasion of a software update. Any improvement in achieving automatic data management replacing manual data input is encouraged.

8. 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 before the start and during the verification, was useful. The information provided and the outcome of the verification activities led to the following observations:

(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 in Poland were in place. The Commission could verify the operation and efficiency of these facilities.

(2) The team noted that current monitoring campaigns in the vicinity of coal mines (and other NORM industries) are not part of a well established routine programme, and it recommends to consider setting up such a programme.

(3) A number of topical recommendations are formulated. These recommendations aim at improving some aspects of environmental surveillance in Poland. The recommendations do not discredit the fact that environmental monitoring in Poland is in conformity with the provisions laid down under Article 35 of the Euratom Treaty.

(4) The verification findings and ensuing recommendations are compiled in the 'Main Findings' document that is addressed to the competent authority in Poland through the Permanent Representative of Poland to the European Union.

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

(6) The Commission Services ask the Polish competent authority to inform them of any implementation achievements with regard to the situation at the time of the verification and especially, concerning the set up and implementation of a routine environmental radioactivity monitoring programme for NORM industries.

(7) 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 13/11

a.m.

1. Opening meeting, introductions and presentations at IFJ (Niewodruiczaski Institute) premises in Krakow[4]

2. Team starts verification activities at the environmental radioactivity laboratory of IFJ and verifies provisions for monitoring and sampling of the radioactive discharges, and the analytical systems in place. The team verifies the site related provisions of the environmental monitoring.

p.m.

3. Team starts verification of the national monitoring system in the Krakow area (sampling; automatic systems) in the local Sanitary Inspection laboratory in Krakow.

Tuesday 14/11

a.m. and p.m.

4. The team starts verification of the national monitoring system in south-eastern Poland (sampling, automatic systems) and checks the provisions for monitoring and sampling of the radioactive discharges of the local laboratory of Sanitary Inspection in Sanok, and the local laboratories of the Institute of Meteorology and Water Management in Lesko and Zakopane.

Wednesday 15/11

a.m.

5. The team starts verification of the Piast coal mine (Bierun-Katowice) on the discharge matters of the coal mines.and the environmental monitoring provisions in place.

p.m.

6. The team visits the Central Mining Institute's local laboratory in Katowice on the analytical systems in place with regards to coal mines discharges and environmental monitoring

Thursday 16/11

a.m.

7. EC party travels from Krakow to Warsaw

p.m.

8. The team verifies the presence and operability of the laboratory instruments and the adequacy of the analytical systems in place, for th environmental monitoring at the Central Laboratory for Radiological Protection, (CLOR) in Warsaw.
9. The team verifies the telemetric network management and data centre at the Radiation Emergency Centre of the NAEA, in Warsaw

Friday 17/11

a.m.

10. Closing meeting at the NAEA premises in Warsaw and the presentation by the ECverification team of the preliminary conclusions.

[4] By those ministries and/or institutions that have statutory obligations with respect to national radiation monitoring and to site surveillance.

APPENDIX 2

DOCUMENTATION

National (Polish) Atomic Agency (NAEA)
(http://www.paa.gov.pl/?frame=0.1)

Legislation

Radiation protection

- Act of Parliament of 29 November 2000 – Atomic Law, published in the Official Journal of 2004 No.161, Item 1689 and No. 173 Item 1808.
- Regulation of the Council of Ministers of 17 December 2002 on stations for the early detection of radioactive contamination and units which measure radioactive contamination, published in the Journal of Laws, No. 239, item 2030.

NORM industry

- Regulation of the Council of Ministers of 03 December 2002 on the requirements imposed on the content of natural radioisotopes in raw materials and components applied in buildings for the accommodation of people and livestock, and in industrial waste applied in construction, and the control of radioisotope content, published in the Journal of Laws, No. 220, item 1850.

Mining environment

- *Regulation* of the Ministry of Economy of 06 June 2006 amending the regulation on work safety and hygiene, operations and specialist safeguards in underground mining facilities, published by the Official Journal 2006, No 124.
- Annex 9, 'Radiation hazard from natural radioactive substances' of the Regulation of the Ministry of Economy of 06 June 2006 amending the regulation on work safety and hygiene, operations and specialist safeguards in underground mining facilities, published by the Official Journal 2006, No 124.

Radiological emergency

- Regulation of the Council of Ministers of 17 January 2005 on the emergency planning for radiological emergency, on the basis of Article 87, paragraphs 1 and 2 of the Act of Parliament of 29 November 2000 – Atomic Law (Polish O.J. of 2004 No. 161, Item 1689 and No. 173 Item 1808).

State Mining Authority
(www.wug.gov.pl)

- Presentation in English (slides and CD-ROM) titled 'State Mining Authority'.

Institute of Nuclear Physics
(www.ifj.edu.pl**)**

- Overview of the Department of Nuclear Chemistry and its publications:
  - Investigation of Os and Re in Sulfuric Acid solutions
  - Fast isolation of Short-Lived Osmium Isotopes from Hydrochloric Acid Solutions on Nickel
  - Potassium Hexacyanoferrate
  - A search for the Element 110 in nature
  - Plutonium isotopes in bottom sediments of Mazurian Lakes
  - Transfer of Cs-137, Sr-90, Pu-238, 239, 240 and Am-241 to some species of insects
- Gamma emitters, Sr-90, Am-241, and plutonium in bones of small mammals eaten by owls- - A new long energy gamma ray spectrometer in ERL

  Modernisation of the ASS-500 high volume aerosol sampler

APPENDIX 2

DOCUMENTATION (continuation)

Institute of Meteorology and Water Management (IMGW)

(http://www.imgw.pl/wl/internet/zz/english/index.html)

- Technique of gamma dose rate measurement in air for basic stations (document in Polish)
- Technique of artificial alpha and beta activity of airborne aerosols measurement (document in Polish)
- Technique for gamma spectrometry measurement of radionuclides' content in samples of total fallout (document in Polish)
- Technique of total alpha and beta activity measurements in daily and monthly samples ofentire precipitation (document in Polish)
- Programme of gamma dose rate measurement in air for basic stations of IMGW in normal situations (document in Polish)
- Programme of alpha and beta activity of airborne aerosols measurement for basic stations of IMGW in normal situation. (document in Polish)
- Programme of measurements for specialized stations of IMGW in normal situation (document in Polish)

Central Laboratory for Radiological Protection (CLOR)

(http://www.clor.waw.pl)

- Measurement techniques for radiological contamination of the atmospheric air using the ASS-500 stations, issued by the Department of Dosimetry, 2003. (document in Polish)
- Radiation Atlas of Poland, 2005
- Radiation monitoring network in Poland – Structure and activities, Radioactive Contamination Department
- Methodology for radiochemical Cs-137 assay in foodstuff samples and in water, Department of Radioactive Contamination
- Methodology for radiochemical SR-90 assay in foodstuff samples and in water, Department of Radioactive Contamination
- Annual report, 2005
- Paper and electronic report of CLOR on the Research and the Operational Activities, 2002-2003

Other documents:

- Questionnaire on the implementation of Art. 35 of the EURATOM Treaty in the Republic of Poland, 2006
- Verification activities under the terms of Art. 35 of the Euratom Treaty, preliminary information questionnaire addressed to the national competent authority in view of preparing the Art. 35 verification in Poland 13-17 November 2006.
- CD-Rom containing the NORM IV Conference held on 16-21 May, 2004 in Szczyrk, Poland
- CD-ROM containing the conference: Advances in Liquid Scintillation Spectrometry, 17-21 October 2005, Katowice, Poland