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GENERAL TECHNICAL SERVICES

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GENERAL TECHNICAL SERVICES

ANNUAL REPORT

1986

DIVISION HEAD : R. VANHAELEWYN

S.C.K./C.E.N.
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CONTENT

STAFF (July 1986)

	A0	A1	A2	A3	Total
Technical Services	9	8	106	29	152
Electronics and Instrumentation	8	7	14	3	32
Waste Treatment and Disposal	9	8	40	33	90
Total	26	23	160	65	274

A0 : University degree and assimilated

A1 : Industrial engineer and assimilated

A2 : Specialized technician

A3 : Technician

1. TECHNICAL SERVICES

(J. Van der Auwera)

The Technical Services are in charge of :

- design, realization and maintenance of the infrastructure such as buildings (laboratories and offices), roads, bridges, including electric installations and heating, cooling and ventilation systems;
- design, manufacturing and assembly of special equipment, prototype installations and technical support to various research programmes;
- purchase of machines and tools on request of the departments;
- printing of reports and leaflets;
- energy audits and measurements in industrial installations.

The total efforts (personnel costs, manufacturing and services by outside firms, procurement of materials and equipment) were divided as follows :

- 40 % for research programmes and constructions and maintenance of scientific installations;
- 10 % on request of research departments for general applications;
- 5 % on request of administration and public relations;
- 13 % for infrastructure works;
- 25 % for maintenance of buildings and technical installations;
- 5 % for maintenance of the residential quarter;
- 2 % for maintenance of vehicles.

1.1. MECHANICS

(E. Collignon, P. De Meyer, L. Vansteelandt, P. Verjans, V. Verdonck)

This service consists of four groups : the design and drawing office including the preparation for manufacturing by outside firms and the purchase of machine tools; the main workshop which is specialized in fine mechanics and special welding techniques; the assembly maintenance group and the carpentry workshop; the specialized workshops such as the glass workshop and the workshops located in the Metallurgy and Physics departments.

During 1986, the Mechanical service treated 1,164 work orders.
The main jobs of the design and drawing office were :

- for Electrochemistry : the design of a precision roller with a cylinder width of 400 mm and regulation accuracy of 2 µm for laminating thin foils of porous material to obtain specific qualities;
- for Biology : the purchase and installation of racks for Bio-Animals 2 with easy possibilities of modification and cleaning and the study of a water softening installation on the water supply;
- for Metallurgy : a testing apparatus for Foucault currents, special parts for fatigue measuring instruments and a new core for a metal testing furnace;
- for Radiation Protection : the design of an irradiation installation for horizontal and vertical beams for the new radiation calibration building;
- for Geo-Technology : the study for mounting of pH measurement apparatus for tests on clay in the underground laboratory;
- for Chemistry : an ejection venturi with a capacity of 1000 m^3/h;
- for the Electronics service : the design of a wire feeding mechanism for a wrap installation for supraconduct bobbins.

A study is also made for the connection of the drinking water circuits to the utility water supply PIDPA.

The main parts manufactured by outside firms were :

- for Waste : three stainless steel vessels for liquid waste treatment, a series of stainless steel covers for concrete containers, and a new piping assembly for the Evence Coppee incinerator;
- for LHMA : piping elements for the hot cell for the FAFUMA project;
- for Chemistry : several parts for the fabrication of electrolysis membranes, and parts for press dies for research on ceramics;
- for BR2 : a series of funnels for the reactor channels, several storage container-tubes, and the repair of a butterfly valve of the BR2 secondary cooling circuit;
- for the Super Dissolver Project : several electrical passages through the concrete shielding of chemical cells C1 and C2 and construction of different parts such as ceiling shielding and supports for the cell windows;

- for Reactor Physics : a support and shielding for a Ge(Li) photon detector;
- for Radiation Control : shielding parts for the new radiation calibration bunker, and two apparatus for alpha measurements.

Following new equipment has been purchased :

- five numerical position reading systems for lathes in the workshop and in BR2;
- a TIG (Tungsten Inert Gas) welding equipment for the main workshop.

The main jobs in the main workshops were :

- for Technology : construction of parts for two electrolyser modules. Special technics were used for the turning of structure rings in polysulfone and the welding of studs on the bipolar plates in nickel;
- for Geo-Technology : "in situ" adaptations of measurement holes in the cast-iron lining of the underground laboratory;
- for Chemistry : manufacturing of several parts for a chopper for the HERMES programme and parts for a gasification installation;
- for Metallurgy : fabrication of parts for corrosion measurement experiments for the geological waste disposal experiments and test specimen in different materials for fatigue tests;
- for Waste : parts for the exhaust extraction of the FLK and Evence Coppee incinerators, a shielding for the Canberra detector and a tipping device for waste storage containers;
- for BR1 : manufacturing and assembling of a submersible photon detector;
- for BR2 : fabrication of a working floor under the water tower with new piping;
- for BR3 : modification of the Safety Injection System of the reactor (first phase) and modification of a permutation machine for Tihange.

The main jobs of the Assembly and Maintenance groupe were :

- for BR3 : installation of a new heating device and steam generator;
- for Electrochemistry : installation of a new suspension mixing machine, modification of two laminating machines and the arrangement of new laboratories;

- for LHMA : different piping for compressed air, and a measuring system for the control of the air contamination;
- for Administration : fabrication of different information panels for exhibitions and public relations;
- for Radiobiology : installations of ventilation and arrangement of new laboratories in the new building extentions;
- for Medicine : the equipment of a new ambulance;
- for LMB : the arrangement of new laboratories;
- for the Radiation Calibration building : the mounting of several lead shieldings and special equipment.

The main jobs of the specialized Workshops were :

In the METALLURGY workshop :

- specimens for tensile tests and notch shock tests for various research programmes;
- several parts for the ferritic steel programme.

In the PHYSICS workshop :
various construction works for :

- photovoltaic conversion of solar energy;
- studies on supermagnets;
- low activity measurements;
- radiation dosimetry.

In the GLASS workshop :

- various glass works for the different departments and for C.B.N.M. - C.E.C. (melting of uranium capsules).

The Mechanical service has also co-operated in the following projects :

- the MIBEMOL spectrometer installed in Saclay : preliminary study and purchase of a crane for manipulation of the target devices;

- the HAWAI project : special collaboration has been given in the design of the flow-sheets for the waste handling and the incinerator circuits.
  The detailed study of the piping plans has been started.
  Studies are made for the storage possibilities of the different waste products which will be treated and the sorting and feeding installation of the incinerator.

1.2. ELECTRICITY

(H. Beckx, J. Coune, F. Leysen)

The Electricity service is in charge of the high-voltage and low-voltage power distribution, the telephone network and the alarm circuits for control of the technical installations.
In 1986 the service received 238 work orders and carried out the routine interventions and repairs. The most important jobs were :

- the fabrication and installation of an electronic control panel for central control with day and night regime of the heating and ventilation of the different buildings and laboratories;
- the wiring and installation of control panels for the Post Accident Heat Renoval (PAHR) safety experiments on request of the Technology department;
- the design and construction of the electric control panels of the new 90 kW ventilator of the Evence Coppee incinerator;
- the mounting of special connectors on 128 thermocouples and 64 heating wires for corrosion experiments in the underground laboratory (HADES project).

The following new constructions and maintenance works have been carried out in the high-voltage power distribution :

- the replacement of two HT 500 kVA transformers into 630 kVA for the Biology department;
- the replacement of two HT 315 kVA transformers into 500 kVA for the Chemistry department;
- the power supply for tests with an electrolyser for the Technology department.

The new SCK/CEN offices at Brussels were equipped with a new telephone exchange, the lighting and power circuits were adapted to the new office grouping and the computer was reinstalled.

1.3. CIVIL ENGINEERING AND MAINTENANCE

(J. Schoofs)

This service is in charge of the new construction works and maintenance of all buildings, roads and bridges.
In 1986 the service treated 1,206 work orders for extension or new constructions and routine interventions for maintenance and small repair.

The most important jobs were :

- the study for implantation and site preparation for the high-temperature slagging incinerator (HAWAI project);
- the repair of the BR1 ventilation building after a hydrogen explosion;
- the installation of sheds for electrolysis tests and radioactive waste storage;
- the arrangement of the new SCK/CEN offices at Brussels;
- the arrangement of several laboratories.

The following important maintenance works have been carried out :

- the renewal of the windows of dormitory 4 of residential quarter 2;
- the outside painting of the Mathematics building, dormitories 3 and 4 and the appartment buildings 3 of residential quarter 2;
- the renewal of the roof of several buildings of the Waste department, the garage and the storehouse;
- the painting of the metal supports of the plutonium ventilation ducts in the Chemistry building;
- several painting works in laboratories and offices;
- the renewal of several floors and floor coverings.

1.4. VENTILATION AND CENTRAL HEATING

(E. Neeskens, J. De Decker, W. Swinnen)

This service is in charge of all the heating and cooling installations and has a special experience in the ventilation systems for nuclear applications. In 1986, the service received 71 work orders and carried out the routine repairs.

The main jobs were related to :

- the study of new heating and ventilation circuits and the modification of several hoods in the radioactive laboratories to reach the minimum values prescribed for air renewal, underpressure and air velocity according to the new exploitation concession;
- the mounting of a separate ventilator on the radioactive waste vessel SILB 7;
- the study for a heat recovery in the new workhall of the Technology building, a cooling installation for laboratory 25 of the Metallurgy department and the air conditioning of several laboratories for Biology.

The following important maintenance work has been carried out :

- the replacement of the valves of the extraction ventilators of modules 3 and 4 of the Chemistry building.

1.5. ENERGY ANALYSIS IN INDUSTRY

(H. Van den Bergh, P. De Boeck, J. Van Roy)

The two main tasks were the execution of bus audits according to the energy bus audit system and sectorial measurement campaigns.

The energy bus programme was directed to two activities :

- the sectorial audits of the CEC-contract, where SCK/CEN is the group leader in the dairy sector;
- the development of a calculation programme for an energy balance and resulting advices in swimming pools.

The measurement group has, during recent years, elaborated an important set of instruments for energy measurements and the necessary experience to use these instruments in the field :

- temperature measurements : thermocouples, thermosensors, I.R.-instruments;
- heat flux measurements with probes for processes and buildings;
- flow measurements with counters, turbines or anemometers for water, air and gases with different pressures and temperatures; saturated steam flows with VORTEX-meters in semi-mobile sets enabling measurements in a wide range of flow and pressure;
- humidity measurements of air and exhaust gases;
- pressure measurements subordinated to energy flows;
- illumination measurements;
- measurements for the determination of boiler efficiencies : flue gas losses and possibly standing losses;
- electricity measurements : power, power factor for direct read-out, counting or registration in single phase or three phase lines, generally without any interruption of running installations, quarter peak measurements on installed counters; simulation bench for instrument control and calibration.

A sectorial measurement and analysis campaign, first part, in co-operation with the Belgian Central Diary Commission was finished in 1985. A second measurement campaign was started but stopped prematurely as a remet of national budget restrictions.

For the RVA (National Employment Service) a course was organized on energy management. Ten participants followed a 2-month course session and a 3-month practical training.

A study tour was organized for UNIDO. After a programme congress and the necessary preparations 9 participants from medium developed countries followed a training week in Mol.

Some direct orders were : the energy study of a social complex, a melting furnace energy balance, assistance to environment effect reports.

2. ELECTRONICS AND INSTRUMENTATION

(L. Binard, E. Musyck)

2.1. STUDIES

(L. Binard, G. Cocquyt, J. Lauwers, E. Musyck, R. De Clerck, J. Rogé, L. Eersels, B. Coupé, F. Geyzen, H. Vandenhoudt)

Work relating to the contract 367 SOMIW for the Esprit project of the European community was directed to the study of the cryptographic security of an algorithm which can be implemented on a one-chip microprocessor and can generate a non-linear sequence at a rate of 64 kbyte/s.

A prototype apparatus to verify the authenticity of bank-cards and the identity of their bearer was made. The bearer of the bank-card enters his Personal Identification Number (PIN) on the keyboard of the apparatus and next introduces his card in the reader slot. The apparatus encrypts these informations with the aid of a public key and the result of the operation is displayed on a LCD screen. The identification-number of the card is shown correctly if the PIN is right. Only the banking agency which prossesses the secret key corresponding to the public key used can produce these bank-cards.

The philosophy of a one-chip microprocessor electronic seal, which has led to a first prototype, was reconsidered. While maintaining the principle of cryptography with pseudo-public key, the DES (Data Encryption Standard) algorithm, which is subject to certain doubts, will be replaced by an exponential function of a block of 96 bits.

In a study of nuclear power-plant control, the research basis was the introduction of rules of thumb. Therefore a lot of efforts was put into advanced model reduction. One of the results is that, roughly speaking, the internal damping ratio of the PWR 1000 MW power-plant is proportional to the square root of the product of the temperature coefficient and the nuclear power. In the same way non-linear control studies have been performed in order to get rules that may improve nuclear power-plant safety.

For the technical division, a microprocessor controlled, averaging temperature recorder EL16B12 has been built.

Taking into account the remarks of the Health Physics Department several features have been added to the software of the Digital Ratemeter built previously for the IAEA. This way the new prototype EL6E1 will for instance have a logarithmic scale with a self adapting time constant.

On the system for Computer Aided Design of printed circuit boards some 90 lay-outs for the SCK/CEN have been made during 1986 and meanwhile also 7 jobs have been done for industry.

For the radon measurement a new detector EL7C2 has been designed.

At the request of "Electro-Nite" an instrument was built that can be placed between their combined temperature/oxygen probe and the measuring electronics. By injecting automatically current at the start of the test, the accuracy of the oxygen concentration measurement can be improved.

A HV Relay type EL2E5 for Eurocard modules was developed.

A HV Divider type EL2E4 was made. It incorporates a power supply for +5V and -2.5V for very sensitive preamplifier.

A new version of the Amplifier type EL4E2 was developed with a 10^{-12} C sensivity.

A timer type EL9E1 was developed. It is a double timer intended to measure the fall-times of fuel rods in the reactor BR2.

The Gammascan equipment for fuel rod burnup measurements has been delivered and is in its experimental phase.

2.2. QUALITY CONTROL

(S. Vandevyvere, D. Van Beckhoven, R. D'Joos)

Many instruments and prototypes were tested and improved.

1	EL2B8	Constant current reference supply
1	EL2B9	Constant current reference supply
18	EL6T1	Ratemeter
6	EL6P2	Ratemeter

Commissioning :

5	PK60	Power Supply VERO
3	Mains filters - comparative test	

Repairs :

1	FLUKE 2165 A	Digital thermometer
1	FLUKE 845 A	Null Detector
1	KEITHLEY 195	Digital Multimeter
1	EL6T3	Reference clock
1	EL6T1	Ratemeter
1	Papertape driven motor control	

Hardware and Software Support was given to several projects.

- The Metallurgy Department for the corrosion tests in the Geotechnology gallery.
- The Metallurgy Department for the silicon sensors project.
- The Waste Department.

The database on distributors and products on the Belgian market was regularly updated.
The Electronic stores catalog was updated.

2.3. GENERAL INSTRUMENTATION

(H. Van Trappen, G. De Wilde, C. Vandermeeren)

About 76 tasks were carried out. The most important developments are the following:

- 5 apparatus type EL2N2 with fixed currents (new version of EL2B8) were constructed.
- Cooperation in the development of a weather-station with remote indication of the outer-temperatures. Daily the maximum and minimum temperatures are printed out, also the calculated mean temperature and the centrigrade-days.

- Development of a new temperature controller for a drying oven. The used temperature sensor is a Pt 100.
- In continuation of the experiment in the decontamination by etching surfaces at the waste department, a commercial constant current source (40A/30V) with an own-made electronic timer (99 min. max.) was delivered.
- Different power supply transformers, high tension transformers (IAEA), filter coils etc... for electronic devices were constructed.

Superconducting coils

- Winding of a "Homogeneous field double Helmholtz coil" of about 1 Tesla.
- Winding of a IMI coil for the open gradient magnetic separation system.

Repairs :

- 84 repair orders are closed. Many apparatus are reported on the same order.
- 20 permanent maintenance orders for different kinds of installations or apparatus are running.

2.4. CONSTRUCTION

(R. De Clerck, A. Lambert)

- The series of apparatus for the maintenance of control instrumentation of the Iraqi reactor IRT was terminated and delivered. It consists of 60 racks, Eurocard modules and printed circuits made at SCK/CEN.
- 18 Universal Logarithmic Ratemeters type EL6T1 were constructed for several departments.
- 1 Hand & Foot Monitor type EL12R4 and EL12R5 was contructed and delivered. 23 are under construction.
- 6 Portable Ratemeters type EL6P2 were constructed and tested. 24 more are being constructed.
- 12 Program Units type EL19B6 have been made and are being tested.
- 4 Quad Digital Ratemeters type EL6E1 have been constructed and are ready for testing.
- 15 Printers type EL10E1 have been assembled.
- 4 Working Control type EL19R12 were constructed and tested.
- 70 High Voltage transformers were made for IAEA.

2.5. INTERNATIONAL RELATIONS

At the request of IAEA, several technical missions were performed.

- J. Lauwers conducted a 3 week training course on "the construction, testing and maintenance of modular nuclear instrumentation" in the framework of ARCAL at the Instituto de Asustos Nucleares (IAN) (Bogota/Columbia).
- S. Vandevyvere conducted a 4 week course on the use of advanced desktop microcomputers in nuclear experiments at the "Ghana Atomic Energy Centre" (GAEC) (Accra/Ghana). He was assisted by J. Bonnyns from the Informatics department.

- At the request of the AGCD/ABOS, technical support was given by G. De Wilde to the laboratories of CREN (ZAIRE) during a 3 weeks mission.

3. WASTE TREATMENT AND DISPOSAL

(N. Van de Voorde, H. Spriet, A. Taeymans, W. Blommaert, G. Dumont, D. Hennart, R. Vanbrabant, W. Balleux, L. Krieckemans, M. Fevery, C. François, G. Geenen, J. Gijbels, K. Peeters, T. Tabuchi (*), T. Sakamoto (**))

The main tasks of the SCK/CEN Waste Treatment and Disposal Plant are reception, conditioning and interim storage of radioactive waste on behalf of NIRAS/ONDRAF. Final disposal is delayed until a political decision in this field is taken and implemented. At the end of the year, a transfer operation was initiated from the SCK/CEN interim storage sheds for conditioned waste to a prefab concrete hall owned by NIRAS/ONDRAF.

The service has also to carry out routine and emergency decontamination works in nuclear installations and laboratories inside and outside SCK/CEN. Such operations concern equipment and work clothing.

Last the service runs the SCK/CEN drinking water and demineralized water production plant.

3.1. EXPLOITATION SECTIONS

3.1.1. Pretreatments (G. Dumont)

3.1.1.1. Waste reception

The quantities of waste receptioned at SCK/CEN during the year 1986 are shown in Table 1, which also gives its α, β, ^{3}H and ^{226}Ra radioactivity contents.

3.1.1.2. Storage

Three storage fields are available on the plant premises.

The first one is used for interim storage of waste before treatment. Its contents at 25 December 1986 are described in Table 2.

(*) JGC Corporation, Oarai Nuclear Research Centre, Japan

(**) Power Reactor and Nuclear Fuel Development Corporation, Tokai, Japan

The second one is used for decay storage of medium-level solid waste put retrievably in concrete pits or containers. At 26 December 1986, this field contained, outside of the twelve pits, 1791 concrete containers with 202 m^3 of waste, 14.6 PBq β, 5.44 TBq α and 3.4 TBq of ^{226}Ra.

The third one is used for interim storage of conditioned waste insolubilized in concrete, bitumen, polystyrene or other matrixes. At 26 December 1986, this field contained 6,518,725 kg of conditioned waste (the mass of the containers and shieldings included).

Various liquids are also stored before treatment in tanks or other suitable containers or vessels. The corresponding quantities are given in Table 3.

3.1.1.3. Interventions (C. François)

The intervention teams have spent 4,720 working hours for decontamination and dismantling operations.

3.1.2. Liquids processing (H. Spriet)

3.1.2.1. Radioactive liquid waste treatment (L. Krieckemans)

Aqueous liquid waste treatment is carried out by means of successive chemical precipitations aiming at the insolubilization of various radionuclides. The efforts are focused on ^{137}Cs and ^{90}Sr elimination. After treatment, the decontaminated liquids are released into a local river, the Molse Nete. The sludge containing the trapped nuclides is insolubilized in bitumen after filtration. The quantities treated during the year 1986 are as follows :

- in the "cold" installation (treatment of suspect liquid waste : 157,537 m^3 with average concentration of 0.90 $kBq.m^{-3}$ of α-emitters, 37.4 $kBq.m^{-3}$ of β-emitters, 1.97 $kBq.m^{-3}$ of ^{90}Sr and 1.60 $MBq.m^{-3}$ of ^{3}H.
- in the "mild" installations (first and second treatment cycles for class 1 low-level liquid waste, second and third treatment cycles for class 2 low-level liquid waste) : 26,029 m^3 with average concentrations of 1.95 $MBq.m^{-3}$ for α-emitters, 72.5 $MBq.m^{-3}$ for β-emitters, 3.53 $MBq.m^{-3}$ for ^{90}Sr, 212 $MBq.m^{-3}$ for ^{131}I and 355 $MBq.m^{-3}$ for ^{3}H.

- in the "hot" installations (first treatment cycle for class 2 low-level liquid waste) : 1,388 m^3.
- in the sludge insolubilization installation : 55.2 m^3 which gave rise to the production of 76 100-gal. drums with an average content of 422 kBq α and 15.7 GBq β per drum. The global volume reduction factor for low-level liquid waste treatment is therefore 902.

3.1.2.2. Drinking water production

During the year 1986, the water purification plant produced 898 356 m^3 of raw filtered water, 381,875 m^3 of drinking water and 488,831 m^3 of demineralized water.

3.1.3. Solids processing (A. Taeymans)

3.1.3.1. Low-temperature incineration furnace (Evence-Coppée)

The Evence-Coppée furnace treats combustible solid waste contaminated with β-emitters or low-enriched uranium. During the year 1986, this incinerator treated 3,041 m^3 of various solids (general trash : 247 tons from German power stations, 35 tons from Belgian power stations, 1,072 m^3 from industry, research and medicine; wooden frame HEPA filters : 71 m^3, animal carcasses : 18 m^3) and produced about 631 55-gal drums, which corresponds to a volume reduction factor of 24.1.

An extensive refurbishment operation was carried out from August 15 to September 15. The refractory lining was totally renewed and the vaulted ceiling was renewed by a suspended one.

3.1.3.2. Treatment of non-combustible β solid waste

During the year 1986, the installations for compaction and encapsulation of non-combustible β solid waste treated 256 m^3 of waste in 7-gal. boxes, 18 m^3 of waste in 55-gal drums, 47.88 m^3 of prefilters and HEPA filters and 20 m^3 of various trash. 1,180 55-gal. drums from the stock of ashes from low-temperature incineration were also conditioned by compaction and bitumen encapsulation. A total of 1,088 100-gal-drums was produced. The global volume reduction factor for this installation is 1.33.

3.1.3.3. Treatment of non-combustible α solid waste

During the year 1986, the α-hall treated 39.8 m^3 of compressible waste in 7-gal. boxes; 12.2 m^3 of non-compressible waste in drums or in bulk and 9 m^3 of glove-boxes to be dismantled, producing 160 55-gal. drums containing bitumen-encapsulated compacts or pieces. The global volume reduction factors obtained in this installation are : 1.88 for the boxes, 2.10 for the non-compressible waste and 1.80 for the glove-boxes.

3.1.3.4. Decontamination

The decontamination team treats small items from various origins.
They steadily improve their equipment in view of ultrasonic cleaning and electropolishing. Another team runs the active laundry which washed 25,538 kg of work clothing, controlled 20,064 kg and ironed 10,642 kg during the year 1986.

3.2. UTILITY SECTIONS

3.2.1. Laboratories (W. Blommaert)

3.2.1.1. Process laboratory (M. Fevery)

The main task of this laboratory is the development and refining of chemical precipitation treatments for the decontamination of class 2 low-level liquid waste and evaporator bottoms; they also check the correct operating sequence during treatment. Procedures are defined for each batch.

3.2.1.2. Scientific research laboratory

During the year 1986, this laboratory worked essentially on concrete encapsulation of ashes from the Evence-Coppée furnace.

3.2.2. Waste treatment technology (R. Vanbrabant)

This section consists of following teams :

- technical secretariate (follow-up of commands and stocks);
- warehouse (various packaging material for the clients, protective clothing, small tools, and so on);
- mechanical workshop (G. Geenen);
- electrical workshop (W. Balleux);
- instrumentation and computer technology (J. Gijbels);
- drawing office;
- project team, the present aim of which is the design and construction of a high-temperature slagging incinerator for non-radioactive toxic waste treatment. The installation with 400 kg/h capacity should start operation in 1989;
- technological research and development team, which runs a high-temperature slagging incineration pilot plant for treatment of combustible and light compressible α-waste and organic liquids at 1,400 - 1,500°C. During the year 1986 this installation, called FLK-60 or HTSI, treated 22,000 kg of combustible power station waste, 6,500 kg of mixed SCK/CEN waste, 1,400 kg metallic waste, 2,000 kg glass waste and 1,300 kg recycled granules, and also 26 m^3 of organic liquids from biological and medical research, 13 m^3 waste oil from power stations and 1,7 m^3 of suspect kerosene from a reprocessing plant. It produced 78 25-gal. drums of granules (about 10,600 kg), 845 kg of fly-ash, 748 m^3 of scrub liquid (class 1 low-level liquid waste) and 5.64 m^3 of prefilters and HEPA filters (to be treated in the installation itself). At the end of the year a test run was carried out with 90 liters of a 30 % TBP solution while 57 kg of chalk was added to the solid feed in order to neutralize the resulting phosphoric acid.

3.3. MONITORING SECTION

3.3.1. Control laboratory (K. Peeters)

This laboratory checks the effluents to be released into the Molse Nete river after treatment. They should satisfy the following condition, which has been edicted by Royal Decree :

$$[\beta] + 5\,[\alpha] + 7.5\,[^{90}Sr] + 300\,[^{226}Ra] + 3\,[^{131}I] + 0.001\,[^{3}H] \quad 2 \text{ TBq/year}$$

During the year 1986, SCK/CEN released 260,908 m^3 of water containing 134 GBq of β-emitters, 521 MBq of α-emitters, 4.04 GBq of ^{90}Sr, 5.15 MBq of ^{226}Ra, 1.61 GBq of ^{131}I and 9.93 TBq of ^{3}H, which, after weighting according to the formule, corresponds to a total of 183 GBq or 9.16 % of the annual release limit.

Table 1 : Waste receptioned during the year 1986

Code	Description	Volume (m^3)	Activity (Bq)			
			α	β	^{3}H	^{226}Ra
A 11	β and LEU combustible solids	3,417.580	174 E 06	5.33 E 12	1.27 E 12	37.0 E 03
A 12	β compressible solids (boxes, drums)	309.440	180 E 03	314 E 09	213 E 09	0
A 13	β prefilters and HEPA filters	121.440	37.0 E 06	35.0 E 09	60 E 06	0
A 14	β non-compressible solids (b., drums)	142.595	37.0 E 06	100 E 09	610 E 09	0
A 15	β charcoal filters	25.35	0	3.70 E 09	0	0
A 16	Sources (incl. lightning protectors)	2.293	28.0 E 09	170 E 09	57.2 E 09	9.20 E 09
A 21	α and TRU combustible solids	298.280	27.0 E 09	50.0 E 09	37.0 E 03	37.0 E 03
A 22	α compressible solids (boxes, drums)	50.090	1.20 E 12	720 E 09	74.0 E 03	440 E 03
A 23	α prefilters and HEPA filters	48.180	4.70 E 09	79.0 E 09	0	0
A 24	α non-compressible solids	16.106	56.0 E 09	2.40 E 09	0	0
	Items to be dismantled	102.526	850 E 09	1.07 E 09	0	0
A 3	Medium-level solid waste (2 mSv/h)	4.901	38.0 E 09	612 E 12	0	0
B 1	Non-radioactive condensates	13,945	0	0	0	0
B 2	Suspect liquid waste (0.37 $MBq.m^{-3}$)	158,908	896 E 00	37.4 E 03	1.60 E 06	0 E 00
B 3	Combustible liquids	38.996	410 E 03	851 E 12	852 E 12	4.40 E 09
B 4	Aqueous liquids (bottles, no TRU)	45.360	450 E 03	9.60 E 12	5.60 E 12	37.0 E 03
B 5	LLLW. class 1 (0.37 to 370 $MBq.m^{-3}$)	26,309.665	1.95 E 06	72.5 E 06	355 E 06	0 E 00
B 6	LLLW. class 2 (0.37 to 37 $GBq.m^{-3}$)	1,544.875	E	E	E	E
B 7	Evaporator bottoms (CNT, TNK)	342.921	0	9.10 E 12	190 E 09	0
B 8	Aqueous liquids (bottles, with TRU)	0.619	110 E 09	6.90 E 09	0	0

Table 2 : Non-conditioned low-level solid waste stocks at 25.12.86

Code	Description	Quantity (m^3 ou t)
A 11	β and low-enriched uranium solids	246 m^3
A 11	Idem, shredded and compacted (from power stations)	469 t
A 12	β compressible solids in boxes or drums	497 m^3
A 13	β non-combustible prefilters and HEPA filters	74 m^3
A 14	β non-compressible solids in boxes or drums	523 m^3
A 15	β non-compressible charcoal filters	135 m^3
	Radioactive sources (incl. lightning protectors)	3 m^3
	β solid waste to be dismantled	293 m^3
	β resins	10 m^3
A 21	Combustible solids with transuranics	314 m^3
A 22	α compressible solids in boxes or drums	25 m^3
A 23	α non-combustible prefilters and HEPA filters	66 m^3
A 24	α non-compressible solids in boxes or drums	35 m^3
A 25	α solids to be dismantled (glove-boxes)	203 m^3
	Radium combustible solids	301 m^3
	Radium non-combustible solids	25 m^3
	Radium filters	50 m^3
	Non-conditioned ash from the Evence-Coppée furnace	160 m^3
	Non-conditioned granules from the FLK-60 furnace	24 m^3

Table 3 : Non-conditioned liquid waste stocks at 25.12.86

Code	Description	Quantity (m^3)
B 1	Non-radioactive condensates	0
B 2	Suspect liquid waste (0.37 $MBq.m^{-3}$)	0
B 3	Organic liquids (bottles, drums, tanks)	89
B 4	Aqueous liquids in bottles, without transuranics	3.830
B 5	Low-level liquid waste, class 1 (0.37-370 $MBq.m^{-3}$)	2,519
B 6	Low-level liquid waste, class 2 (0.37-37 $GBq.m^{-3}$)	357
B 7	Evaporator bottoms (CNT, German power stations)	300
B 8	Aqueous liquids in bottles, with transuranics	2.18
	Medium-level liquid waste (IRE)	3.525
	Non-conditioned chemical precipitation sludges	722
	Biological sludges (RDB farm)	30