



Centre for Energy Research,  
Hungarian Academy of Sciences

---

# Environmental and Radiation Protection at the KFKI campus



**Anikó Földi, Károly Bodor**



Centre for Energy Research,  
Hungarian Academy of Sciences

---

# NUCLEAR INSTALLATIONS IN HUNGARY

**Educational Reactor : 100 kWth**

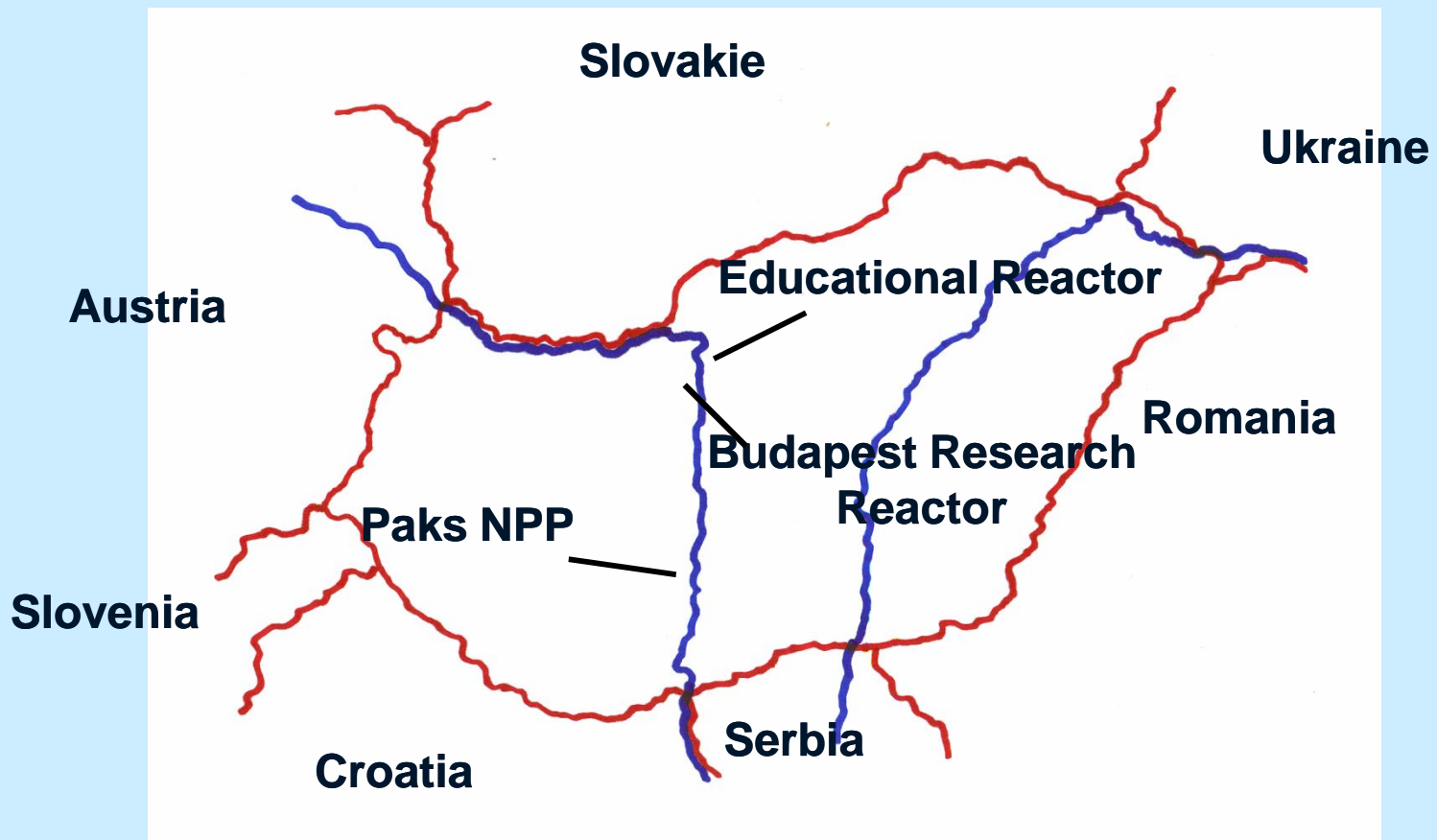
**Budapest Research Reactor : 10 MWth**

**Nuclear Power Plant (Paks) : 2000 MWth**



Centre for Energy Research,  
Hungarian Academy of Sciences

# Location of Nuclear Installations in Hungary





# Centre for Energy Research, Hungarian Academy of Sciences

## Budapest Research Reactor & Institute of Isotopes Co. at the KFKI campus

**TYPE :**

**VVR-M10 Water cooled and  
water moderated tank type**

**UTILIZATION :**

- **Research**
- **Training**
- **Isotope production**



**IZOTOP** COMPANY BUSINESS UNITS PRODUCTS CONTACT ONLINE PAYMENT

Address: 1121 Budapest, Konkoly Thege Miklós út 29-33. \* Tel.: (36-1) 395-9081 \* E-mail: [izotop@izotop.hu](mailto:izotop@izotop.hu) Search:

**IZOTOP** INSTITUTE OF ISOTOPES CO. LTD. **Institute of Isotopes Co., Ltd.**

The Institute of Isotopes Co., Ltd. (Izotop) is dealing with the research, development and production of a wide variety of radioactive isotopes and other products for a broad range of application areas, especially healthcare, research and industry.

Navigation: HU ES JP RU



# Environmental monitoring

## ON LINE MONITORING

- Dosimetrical data
- Meteorological data
- Release data

## OFF LINE MONITORING

- Aerosol sampling
- Fall out sampling





## **ON LINE MONITORING**

**17 stations : equipped by GM tubes  
(Philips GM + locally developed  
electronics)**

- **For normal operation : 0.1-1 mGy/h**
- **For accidental situation : 1-1000 mGy/h**

**Data collecting :**

**Refreshing period : 1 sec**

**Saving period : 10 minute**





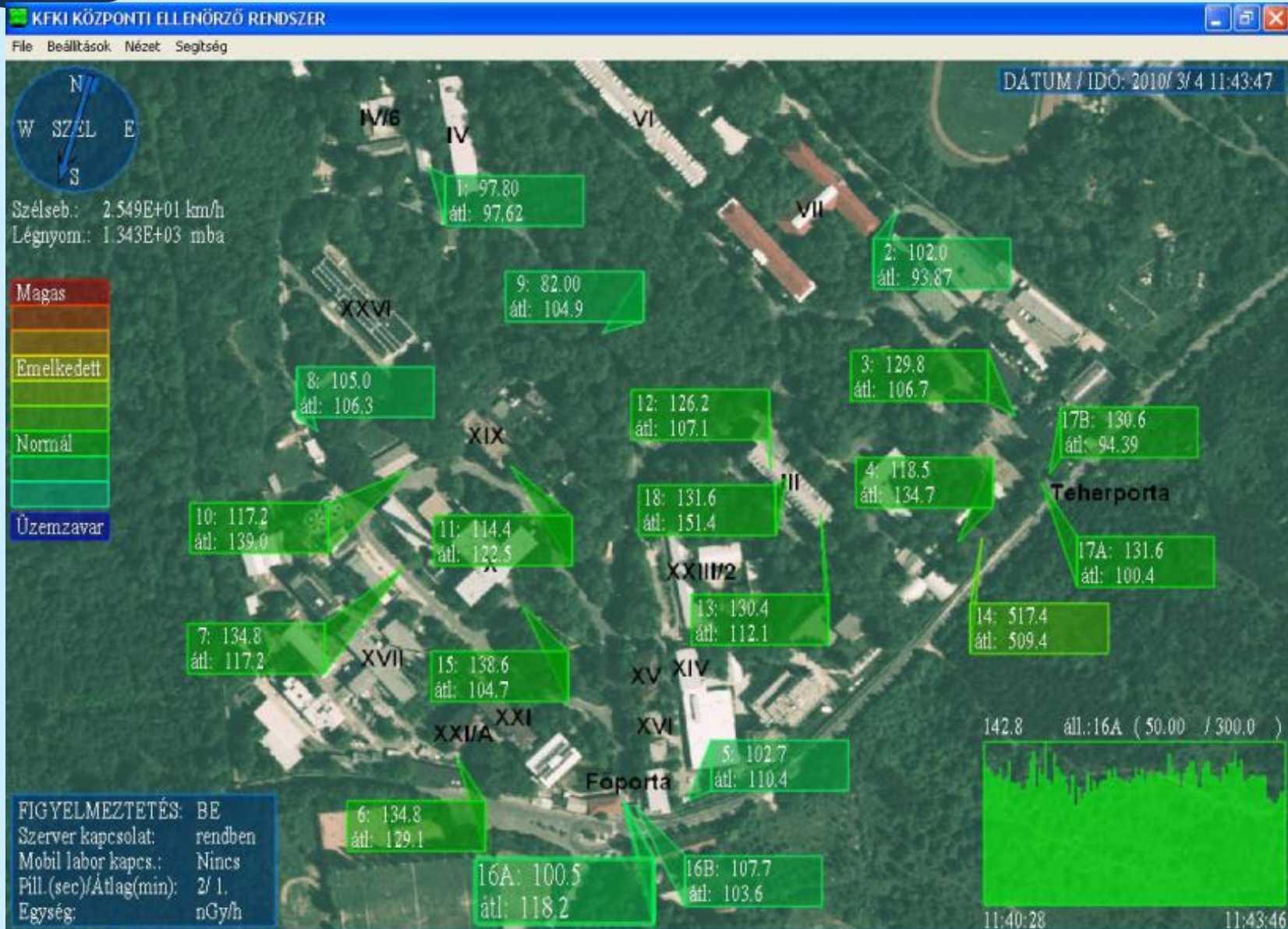
Centre for Energy Research,  
Hungarian Academy of Sciences

# DOSIMETRICAL STATIONS





# Centre for Energy Research, Hungarian Academy of Sciences







Centre for Energy Research,  
Hungarian Academy of Sciences

---

## RELEASE AT NORMAL OPERATION

### RESEARCH REACTOR : noble gases

- – Ar-41 ( $5,27 \cdot 10^{13}$  Bq )
- – Kr-85m, Kr-87, Kr-87
- – Xe-133, Xe-135

### ISOTOPE INSTITUTE : Iodines

- I-125,
- I-131





## OFF LINE MONITORING

### Aerosol sampling:

- 100 m<sup>3</sup>/day : 4 stations
- 10 000 m<sup>3</sup>/week : 1 station

### Fall out sampling :

- 4 stations
- 0.2 m<sup>2</sup> surface





Centre for Energy Research,  
Hungarian Academy of Sciences

# REFERENCE STATION





## AEROSOL MEASUREMENTS

### Gross beta measurements:

- By 10 proportional counter
- Detection limit :  $100 \mu\text{Bq}/\text{m}^3$



### Gamma spectrometry:

- By high purity Ge detectors
- Detection limit :  $40 \mu\text{Bq}/\text{m}^3$







Centre for Energy Research,  
Hungarian Academy of Sciences

# WASTE WATER SAMPLING AND MONITORING

## WASTE WATER SAMPLING

- CONTINUOUS SAMPLING : ~5 l/day
- MOMENTAN SAMPLING : 2x 1L

## WASTE WATER MONITORING

- GROSS BETA MEASEUREMENTS
- GROSS GAMMA MEASUREMENTS





## Personal dosimetry and other activities

Gamma and neutron

Whole body counting

Calibration: gamma, beta, neutron, radon

Storage

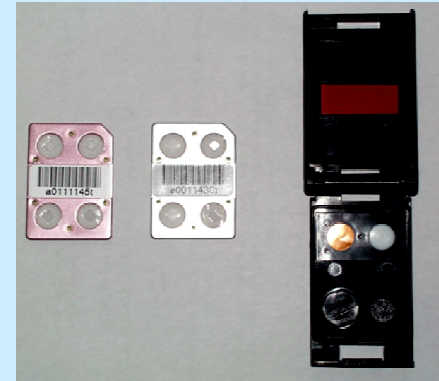




# RADIATION PROTECTION

## PERSONAL DOSIMETRY :

- **EXTERNAL :**
  - ❑ BY FILM BADGETS
  - ❑ BY TLD DOSIMETERS
- **INTERNAL :**
  - ❑ BY WHOLE BODY COUNTING
  - ❑ BY TYROID MONITOR





## **EMERGENCY PREPAREDNESS**

### **FIX + MOBILE LABORATORY:**

- **AIR SAMPLING**
- **DOSE RATE MEASUREMENT → Dose rate maps**
- **IN SITU GAMMA SPECTROMETRY**
- **RADON MEASUREMENTS**
- **SOIL, PLANT SAMPLING AND MEASUREMENT**
- **Participating in national & international comparison exercises**





Centre for Energy Research,  
Hungarian Academy of Sciences

# MOBILE LABRATORY





# Consequence calculations

## Routine releases : PC CREAM

## Accidental releases:

- Hypothetical :
  - ❑ PC COSYMA
- Real situation :
  - ❑ RASCAL
  - ❑ RODOS
  - ❑ SINAC

**AEKI**  
Magyar Tudományos Akadémia  
KFKI Atomenergia Kutatóintézet  
Környezetvédelmi Szolgálat

### Léggöri terjedés- és dózisszámító szoftverek összehasonlítása

Földi Anikó, Deme Sándor, Mészáros Mihály, Sági László,  
Dombóvári Péter\*, Szántó Artúr\*\*, Tóth Krisztina\*\*  
Magyar Tudományos Akadémia KFKI Atomenergia Kutatóintézet  
\*Paksi Atomerőmű Zrt., \*\*Országos Katasztrófvédelmi Főigazgatóság

**ALKALMAZOTT PROGRAMOK**

- RASCAL** (Radiological Assessment System for Consequence Anal. Anal.)  
Developed for the U.S. Nuclear Regulatory Commission by Lawrence Livermore National Laboratory.
- PC COSYMA** (Code-System for Marts)  
An Italian Code-System developed by the Institute of Nuclear Physics (INFN) at Padua University.
- RASCAL** (Radiological Assessment System for Consequence Anal. Anal.)  
Developed for the U.S. Nuclear Regulatory Commission by Lawrence Livermore National Laboratory.
- SINAC** (Simulation of Nuclear Accident Consequences)  
A French Code-System developed by the Institut de Radioprotection et de Sûreté Nucléaire (IRSN).
- RODOS** (Rapid Release Dose and Source)  
A British Code-System developed by the Health Protection Agency (HPA).
- PC CREAM** (Code-System for Routine Releases)  
A Hungarian Code-System developed by the KFKI Institute for Energy Research.

**PROGRAMOK TELJESÍTMÉNYSZÁMÍTÁSA**

Program	RASCAL	PC COSYMA	RASCAL	RODOS	SINAC	TRAC
1. Programok	10000	10000	10000	10000	10000	10000
2. Programok	10000	10000	10000	10000	10000	10000
3. Programok	10000	10000	10000	10000	10000	10000
4. Programok	10000	10000	10000	10000	10000	10000
5. Programok	10000	10000	10000	10000	10000	10000
6. Programok	10000	10000	10000	10000	10000	10000
7. Programok	10000	10000	10000	10000	10000	10000
8. Programok	10000	10000	10000	10000	10000	10000
9. Programok	10000	10000	10000	10000	10000	10000
10. Programok	10000	10000	10000	10000	10000	10000

**EREDMÉNYEK**

Program	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)
1. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
2. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
3. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
4. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
5. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
6. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
7. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
8. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
9. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

**50 m-es EFFEKTIV DÓZIS EREDMÉNYEZŐ BECSÜLT KIBCSATOLT AKTIVITÁSOK**

Program	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)
1. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
2. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
3. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
4. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
5. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
6. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
7. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
8. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
9. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

**EREDMÉNYEKHEZ ÉRKEZŐ INVEZTKÖZLÉS EREDMÉNYEK**

Program	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)	Erősség (Bq/m³)
1. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
2. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
3. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
4. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
5. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
6. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
7. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
8. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
9. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10. Programok	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00

Others: HYSPLIT, RESRAD, MICROSIELD





Centre for Energy Research,  
Hungarian Academy of Sciences

**Thank you  
for your attention!**

