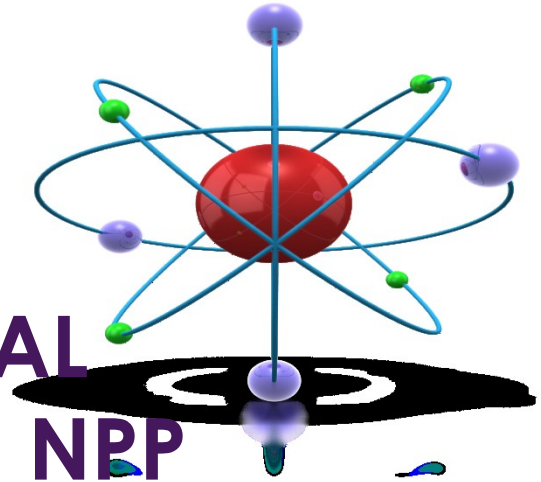

INTEGRATED RADIOLOGICAL PROTECTION SYSTEM FOR AN NPP

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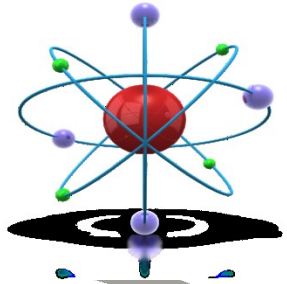
MTF-RMS CONCEPT

MTF-RMS: the system of the systems



- Any NPP is fully equipped with many monitoring equipments
  - The systems dedicated to monitor radiations have continuously grown in number and complexity
- The main goal of radiological protection is to reduce the personal exposure levels
  - For a proper optimization the information quality and quantity is critical
- To take full advantage of all data provided by these monitors (over 100 channels for each unit), it is a must to view and consolidate all inputs into one central system.
  - Storage of data
  - Possibility of trend studies of the data
  - Set/modify aquisition parameters
  - Possible correlation between parameters
- Make all systems belonging to various generations, technologies and/or manufacturers to work together

The answer: MTF-RMS (*MaTe-Fin Radiological Monitoring System*)

MTF-RMS

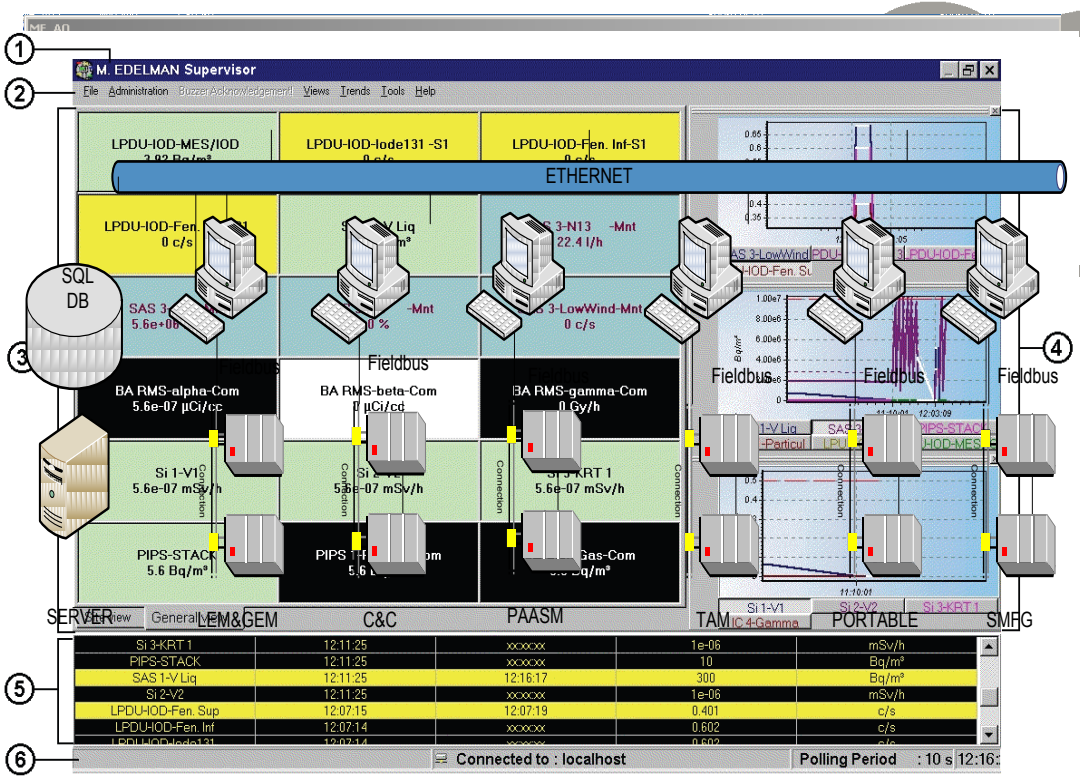
Short History

- Generation I
- For the first time in 2005, all data from various radiation monitoring systems are put together.
- MTF-RMS generation I was built around the Ramvision software developed by MGP Instruments.
- MATE-FIN has also developed custom software for TAM, C&C monitors and portable monitors.
- There were separate servers for data collection and storage.
- Data were visualized via software clients, inside the local network.

- Generation II
- The generation II is using the newest IT technologies, like industrial Ethernet, fiber-optic, virtual machine, etc.
- There is one central data-base with modern data management: detailed reports, data visualization, trends, etc.
- The system is redundant and flexible
- There is an unlimited number of clients through the web interface (JSON / WCF Webservice) accessible all over Intranet

MTF-RMS First Generation

Cernavoda NPP Unit 2



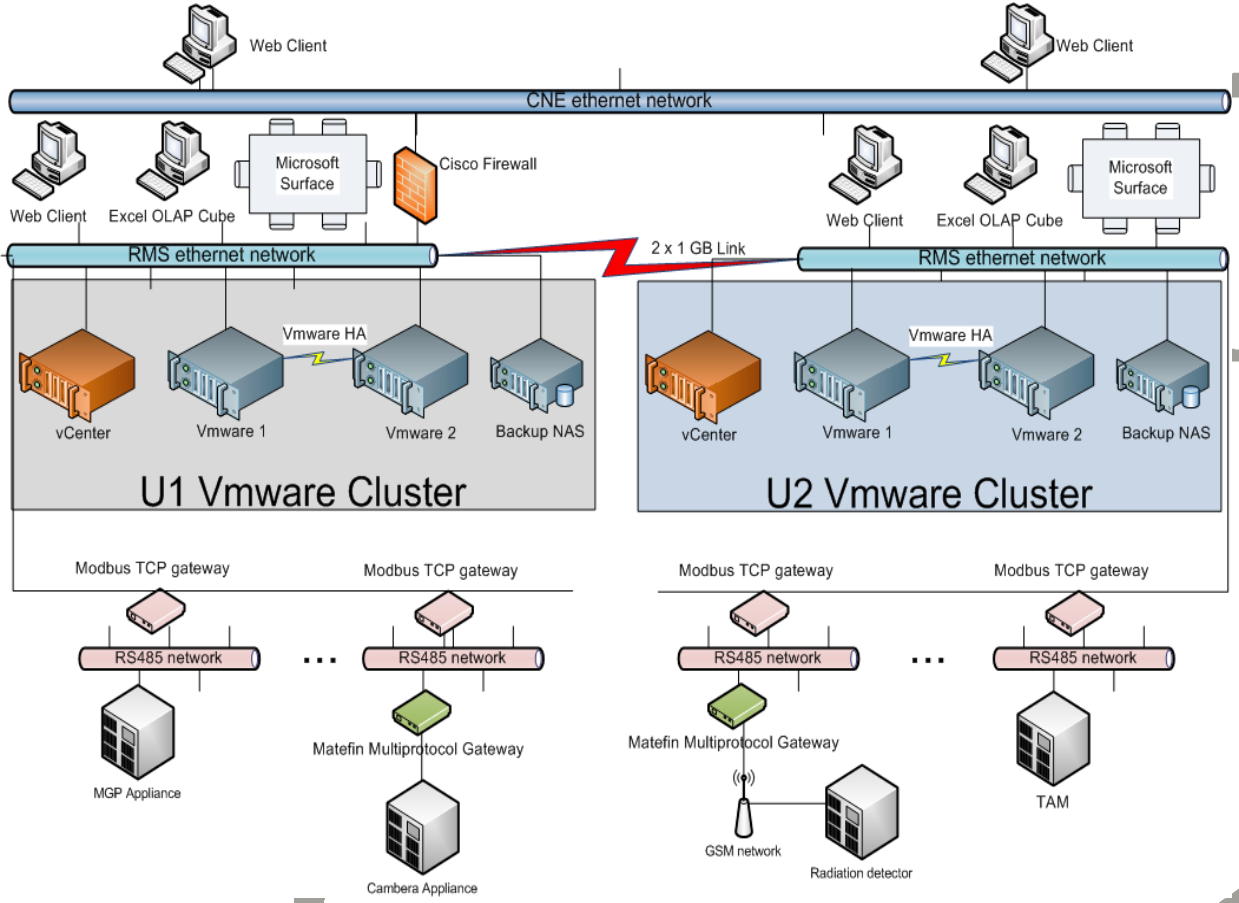
MF-AO manages information from Overhoff Tritium Monitors. The first attempt to monitor on-line the H3 and integrate into a RMS system .

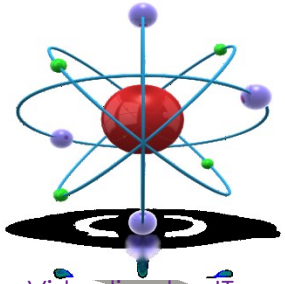
MF-AR manages information from all Contamination Monitors

PAMVISION The system is on service from 2006, based on MGP software RAMVISION and in-house software MF_AO and MF_AR manages information from all MGP specific systems

The main components of the MTF-RMS for NPP Cernavoda Unit 2 are 7 computers linked into a LAN. They are responsible for making the link with fildbuses with different systems scattered all over the site. There is a central SQL DB server who stores the data.

MTF-RMS - Second Generation





The second generation ne
VMware vSphere HA. Virtualized IT environment is a 100% client -server application.

The architecture is divided into 3 main components:

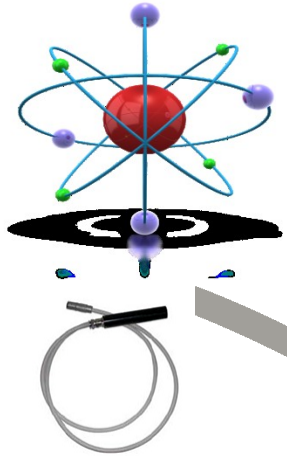
- The acquisitions tasks are distributed to specific hardware TCP/Fieldbus gateways and all protocols are converted to TCP/MODBUS protocol.
- The data processing servers like SQL, OPC, Backup or WEB, and the application software itself, are located on different VM.
- The clients can be any computer with IE and Excel to view data and generate reports. Optional, different interfaces are available.

AAGM

Gamma Area Monitors

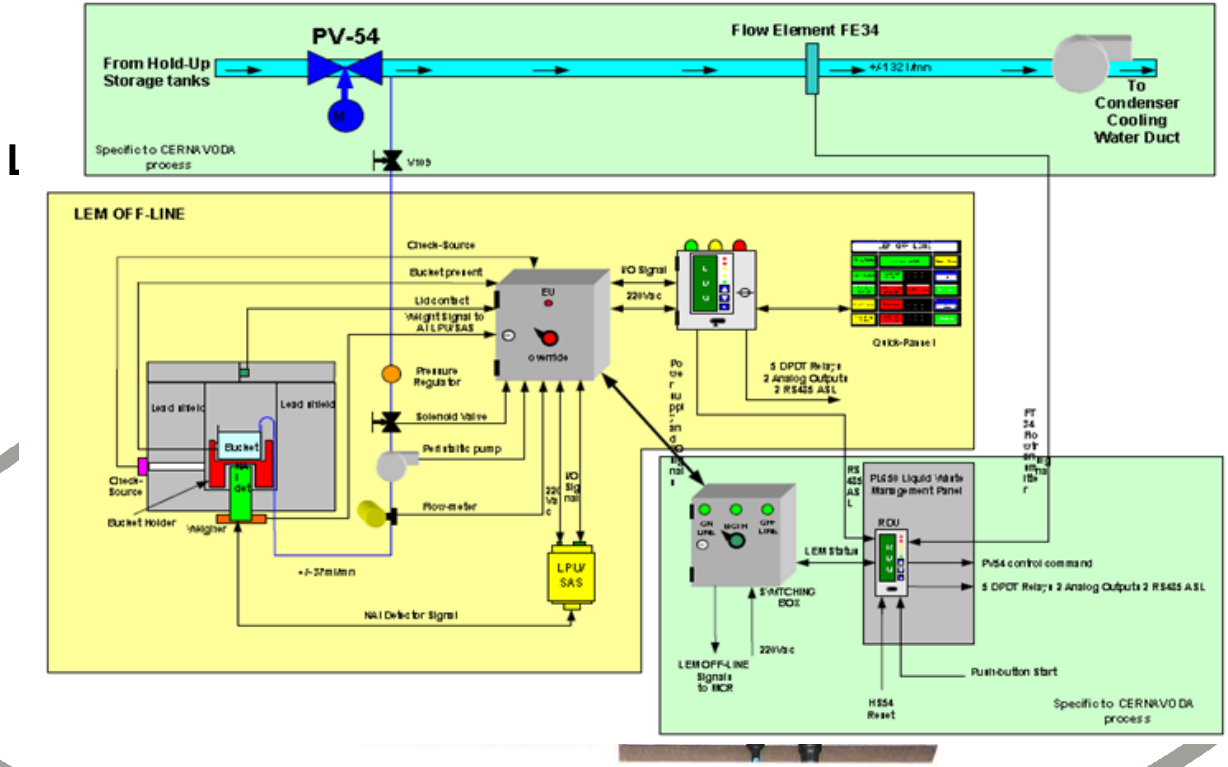
- AAGM, with its 35 channels, provides real-time measurements of Gamma levels (reactor building and the service building)
- Channels installed inside the reactor building have ionization chambers and Si detectors with special mineral cables, allowing to operate in high gamma and neutron fields for at least 30 years
- MGP Instruments (part of MIRION Group, France) equipment
- Unit 1: all original equipment was replaced after 15 years of operation (MATE-FIN)
- Unit 2 reactor building: channels upgraded (MATE-FIN)
- AAGM both in unit 1 and 2 are under full maintenance by MATE-FIN.

Channel	Acquisition interface	Unit
AL DR	MTF-Gateway RS-485	mSV/h
Dose Rate	MTF-Gateway RS-485	mSV/h
Door	MTF-Gateway RS-485	N/A
LowCps	MTF-Gateway RS-485	c/s
HighCps	MTF-Gateway RS-485	c/s
Temp	MTF-Gateway RS-485	Deg.C
TID	MTF-Gateway RS-485	mSv
Dose	MTF-Gateway RS-485	mSv
DoseR1	MTF-Gateway RS-485	mSv/h



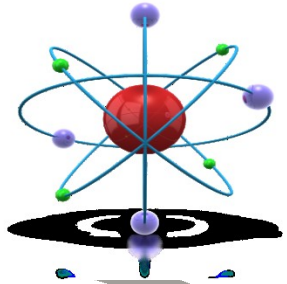
LEM Liquid Effluent Monitor

Critical system, redundant configuration



There are two independent systems made by MGP Instruments, which drive the valve PV54 responsible for liquid discharge. Thanks to that configuration, we get a zero time for maintenance.

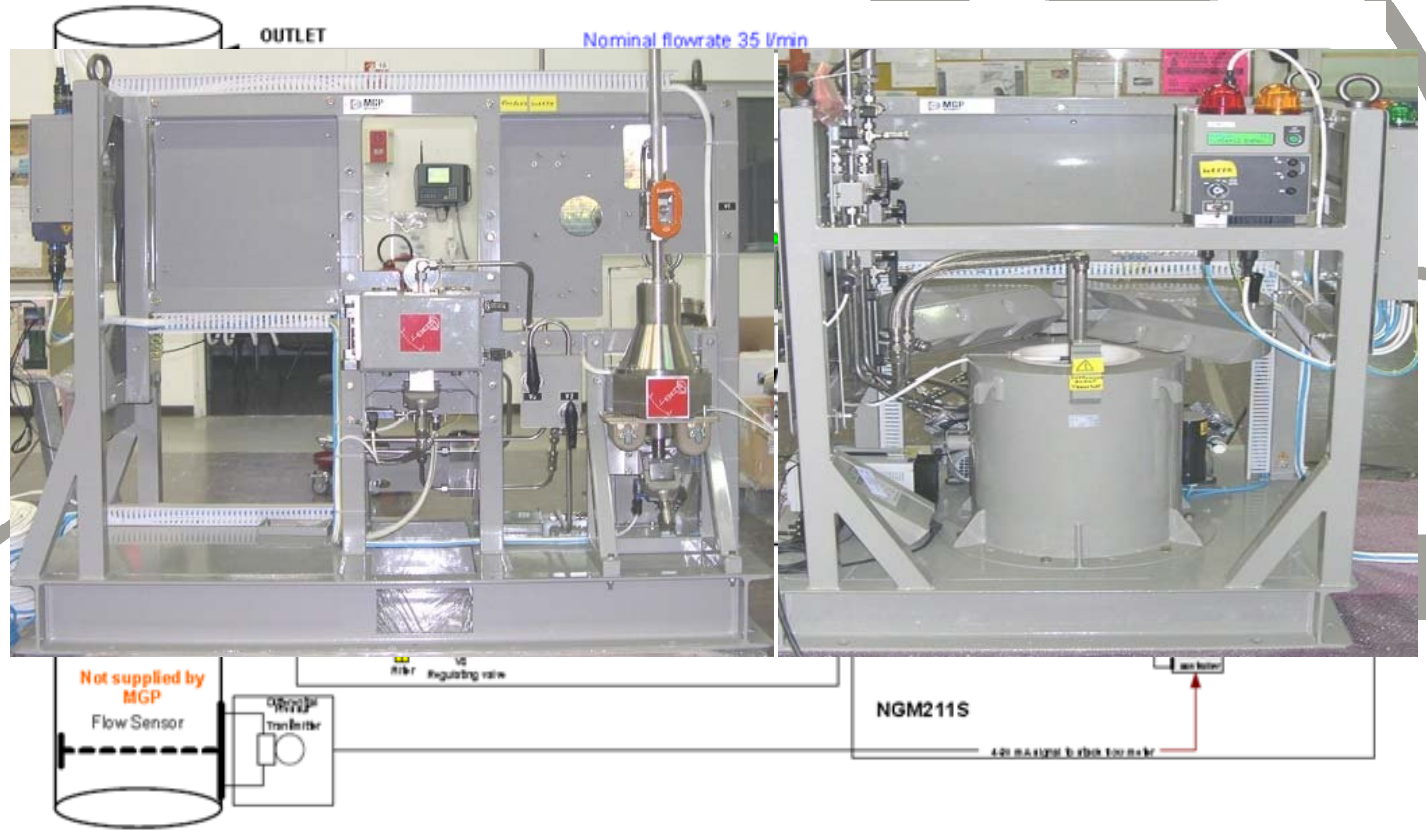
LEM Liquid Effluent Monitor



Channel	Aquisition interface	Unit
LEM ONLINE		
LiqAct	MTF Gateway RS-485	Bq/ml
Discharg	MTF Gateway RS-485	l/h
CS137CPS	MTF Gateway RS-485	c/s
GrosWin1	MTF Gateway RS-485	c/s
GrosWin2	MTF Gateway RS-485	c/s
Temp	MTF Gateway RS-485	°C
DO1	MTF Gateway RS-485	N/A
LEM OFFLINE		
BkgAct	MTF Gateway RS-485	Bq/ml
Discharg	MTF Gateway RS-485	l/min
VolAct	MTF Gateway RS-485	Bq/ml
Cs137Cps	MTF Gateway RS-485	c/s
Win1Cps	MTF Gateway RS-485	c/s
Win2Cps	MTF Gateway RS-485	c/s
Temp	MTF Gateway RS-485	°C

GEM

Gaseous Effluent Monitor - Critical system

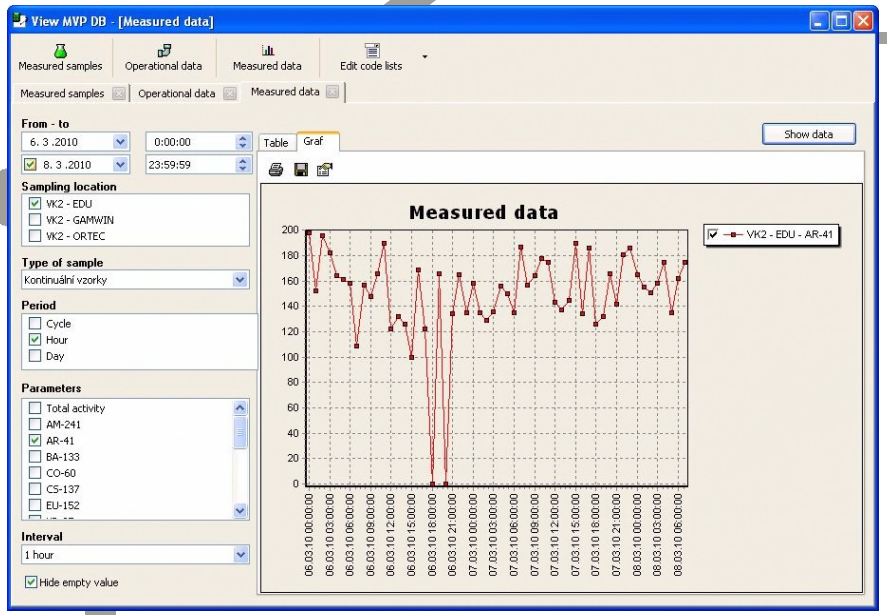


Monitors the stack gases, using isokinetic sampling, by:

- ABPM - Particulate Monitor
  - 16 acquisition channel
- IM - Iodine Monitor
  - 13 acquisition channel
- NGM - Noble Gas Monitor
  - 17 acquisition channel
- Passive samplers for H3 and C14

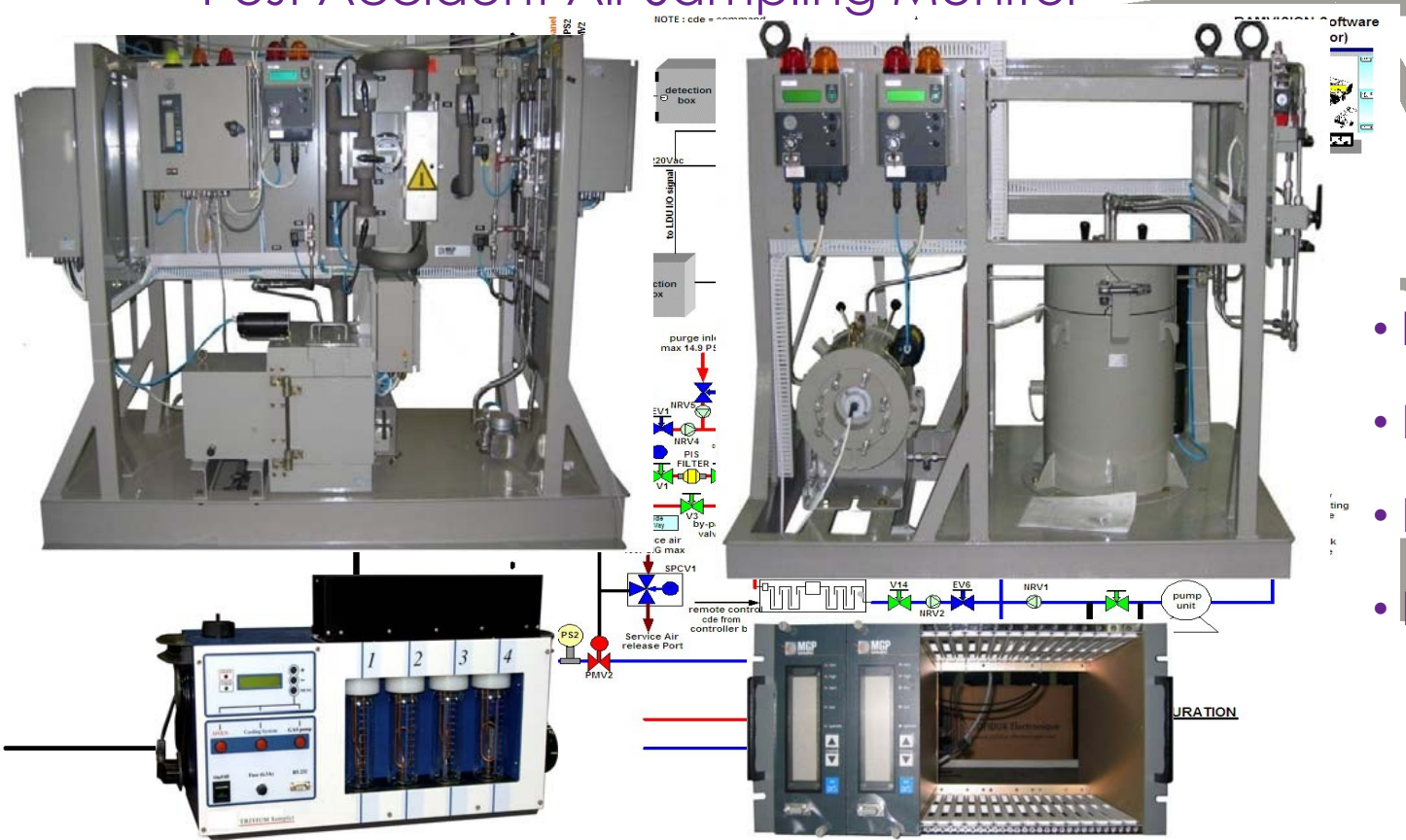
GEM Spec

Additionally, the noble gases release is monitored on-line for ten different isotopes, by Gamma spectrometry. All history and spectra are stored into an Oracle SQL DB. Many analysis and reports are available
10 acquisition channel



PAASM

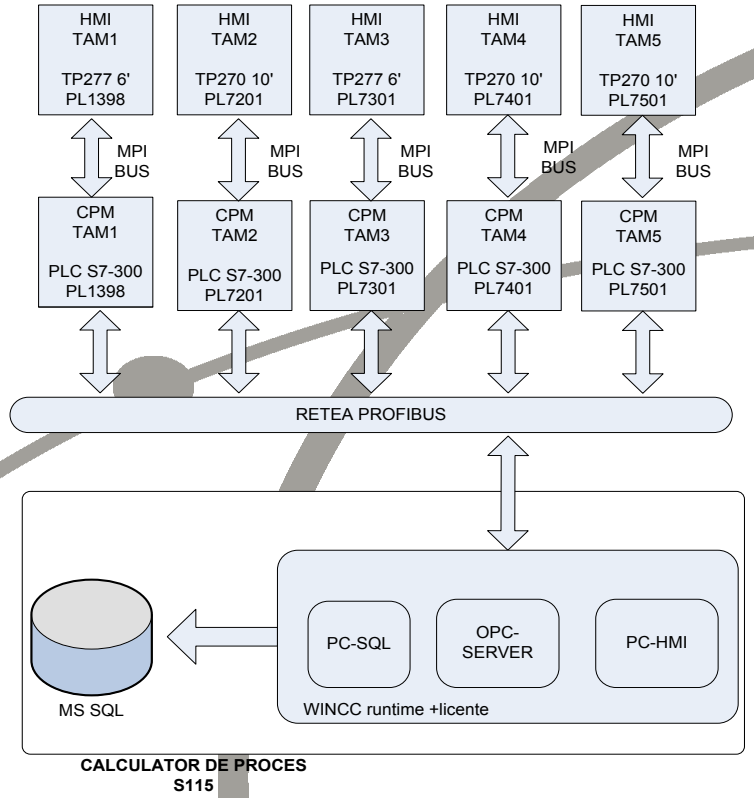
Post Accident Air Sampling Monitor



- IM-Iodine Monitor
  - 7 acquisition channel
- NGM-HR
  - 9 acquisition channel
- NGM-LR
  - 7 acquisition channel
- H3 Sampler

TAM - Tritium in air monitor

Architecture overview

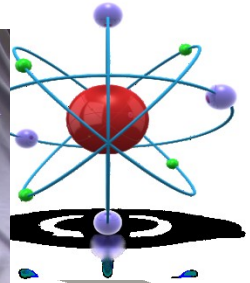


The latest generation of TAM is working at Cernavoda NPP Unit1 since 2010.

- New concept, using the power of PLC to optimize the sampling process.
- All information are available using a HMI interface, locally and remote.
- six hour memory buffer for each monitor to save the measurements in case of SQL server malfunction.

TAM

Tritium in Air Monitors



TAM is a MATE-FIN design

- Overhoff 357 H3 monitors
- custom sampling system based on PLC technology.
- Over forty locations (reactor building and service building)
  - U1 – 5 monitors, 42 sampling location
  - U2 – 8 monitors, 32 sampling location
- Complex scanning algorithms
  - the system is able to locate very quickly any leak of heavy water.

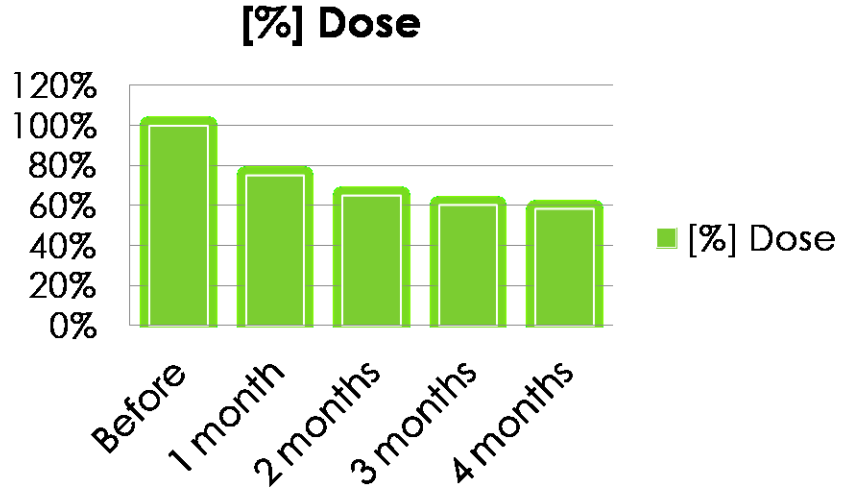
Screenshot from the sampling system

SCHEMA TEHNOLOGICA TAM 4

TAM benefits

Tritium doses have decreased significantly

- After the TAM has become operational, the personnel Tritium doses have decreased significantly.
  - There is no need anymore to deploy personnel for manual measurement of Tritium levels.
- Data provided by TAM are used to optimize the functioning of dryers in the ventilation system.



C&C
Contamination and clearance monitors

- hand and foot monitors installed inside the power-plant, at the cross-border of zone 1 and zone 2,
- total body contamination monitors installed at the exit of zone 2.

(RADOS Technologies Finland, part of MIRION group)

Channel	Interfata Achizitie	Unit
Normal operation/failure	MTF-Gateway DI	N/A
Contamination	MTF-Gateway DI	N/A
Measurement under contamination level	MTF-Gateway DI	N/A

Portable

Portable and mobile monitors

- MTF-RMS has also the possibility to connect with mobile monitors (gamma, neutron, tritium, particulate, etc.)
- Portable monitors are connected to MTF-RMS via sockets installed inside the power-plant, and the data are collected, displayed and stored by the central system
- Automatic identification of instrument type and location

CEAS
Continuous Environmental Air Samplers

- 12 sampling stations installed around the power-plant for continuous sampling of environmental air for off-line measurement of Tritium, Iodine and radioactive particles
  - 19 acquisition channel

(F&J Specialty Products USA, integrated by MATE-FIN)

MTF-MOBCAR

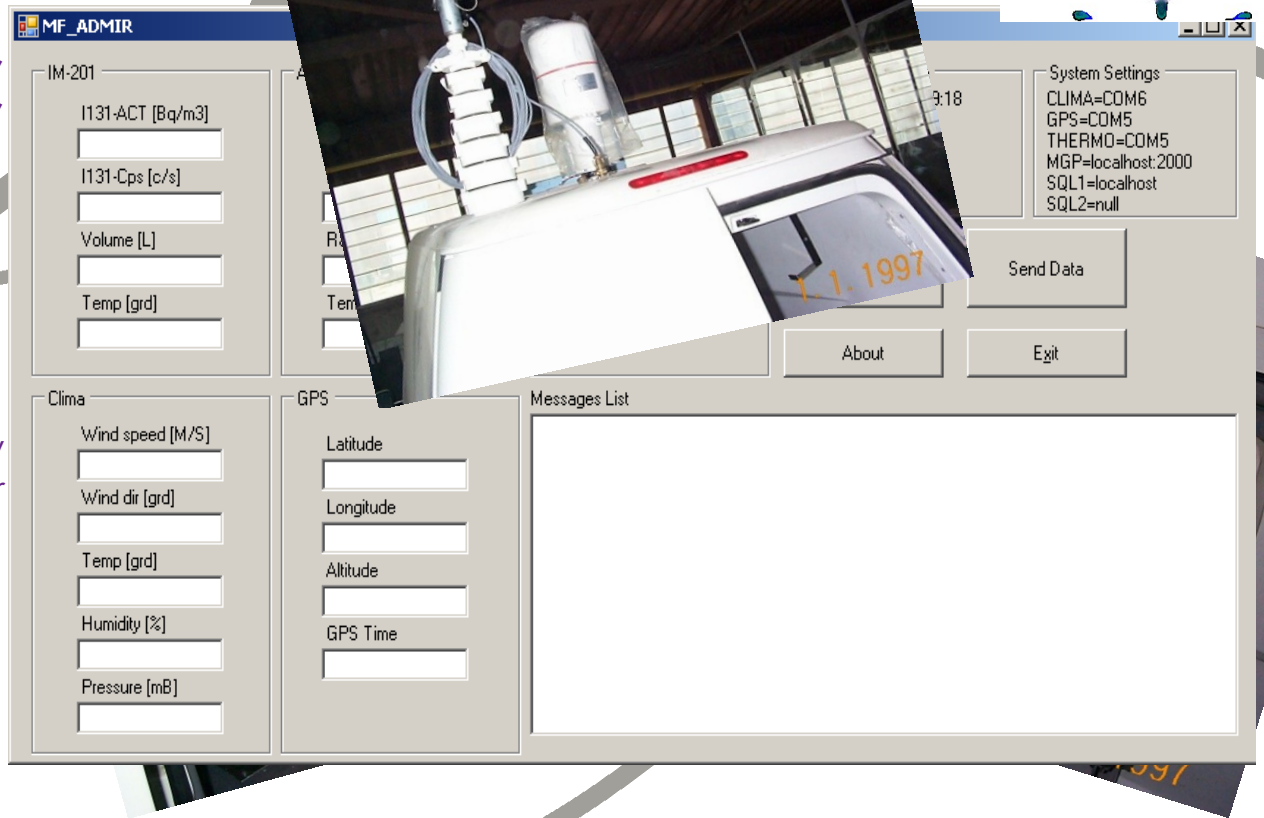
Radiological Emergency Lab

Mobile radiological laboratory, integrated into the MTF-RMS, equipped with:

- ABPM - Particle Monitor
- IM - Iodine Monitor
- Gamma monitor
- Weather Station
- GPS System

All information are remotely stored in a database server for later reporting and analyze.

MF-ADMIR - local software that collects and sends all information to the SQL server



Open Door

MTF-RMS: the system of the systems

And finally, probably the most important of the systems: “The Open Door”

Based on open standards like Profibus, Profinet, Modbus, OPC and SQL server, MTF-RMS keeps the door open for future systems and, even more, for the future systems of Units 3 and 4.

Personal dosimetry

Personal Dosimetry and Teledosimetry

- This system measures and records the Gamma dose for each worker entering the radiological area. The system consists, for each unit, of 200 Personal Alarming Dosimeters (PAD), together with 6 readers. All data, from all units, are collected by one central database server
- Dosimetry and teledosimetry systems in Cernavoda NPP were provided by MATE-FIN, using equipment manufactured by MGP Instruments France, part of MIRION group.
- Dosimetry systems are maintained by MATE-FIN under maintenance contract signed with Cernavoda NPP

Equipments

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Equipments

Code	Name	Equipment type	Location	Not available	Return necessary	Expiry ...
r						
Respiratory Particulate Filter - F301	F301	Respiratory Particulate Filter	Hot Laun...	☐	☐	24/12/2009
Respiratory Particulate Filter - F303	F303	Respiratory Particulate Filter	Hot Laun...	☐	☐	24/12/2009
Respiratory Particulate Filter - F305	F305	Respiratory Particulate Filter	Hot Laun...	☐	☐	03/10/2009
Respiratory Particulate Filter - F309	F309	Respiratory Particulate Filter	Hot Laun...	☐	☐	03/10/2009
Respiratory Particulate Filter - F312	F312	Respiratory Particulate Filter	Hot Laun...	☐	☐	01/10/2009
Respiratory Particulate Filter - F321	F321	Respiratory Particulate Filter	Hot Laun...	☐	☐	02/01/2010
Respiratory Particulate Filter - F322	F322	Respiratory Particulate Filter	Hot Laun...	☐	☐	01/10/2009
Respiratory Particulate Filter - F323	F323	Respiratory Particulate Filter	Hot Laun...	☐	☐	19/11/2009
Respiratory Particulate Filter - F324	F324	Respiratory Particulate Filter	Hot Laun...	☐	☐	07/10/2009
Respiratory Particulate Filter - F326	F326	Respiratory Particulate Filter	Hot Laun...	☐	☐	24/12/2009
Respiratory Particulate Filter - F327	F327	Respiratory Particulate Filter	Hot Laun...	☐	☐	
Respiratory Particulate Filter - F328	F328	Respiratory Particulate Filter	Hot Laun...	☐	☐	03/10/2009
Respiratory Particulate Filter - F329	F329	Respiratory Particulate Filter	Hot Laun...	☐	☐	24/12/2009
Respiratory Particulate Filter - F331	F331	Respiratory Particulate Filter	Hot Laun...	☐	☐	19/11/2009
Respiratory Particulate Filter - F333	F333	Respiratory Particulate Filter	Hot Laun...	☐	☐	03/10/2009
Respiratory Particulate Filter - F340	F340	Respiratory Particulate Filter	Hot Laun...	☐	☐	21/10/2009

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THANK YOU FOR YOUR ATTENTION

COMMENTS

QUESTIONS