Safety and Security a Single Entity at the JM-1 SLOWPOKE-2 Reactor Facility

RONMCCREA CUSHNIE

JOHN PRESTON

The International Centre for Environmental and nuclear sciences

International Conference on Physical Protection, November 13-17 2017, Vienna

Overview

- Facility Overview
- Project Rationale
- Work Done
- Findings/Conclusions

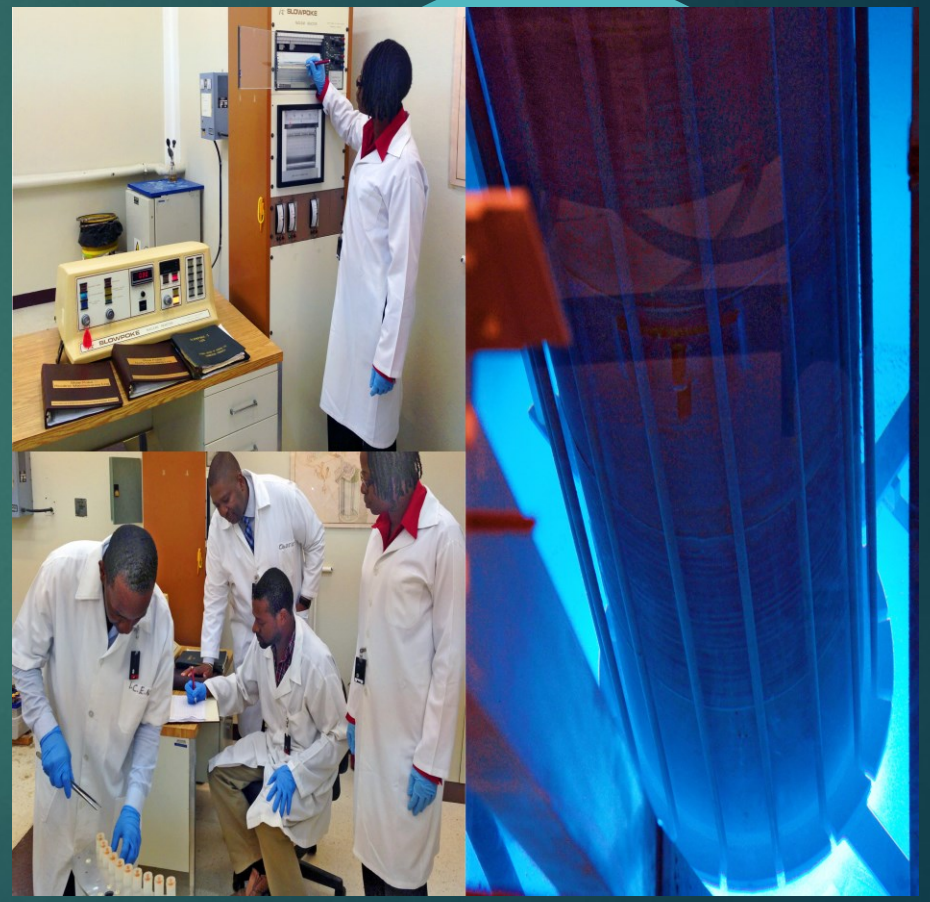
Facility Overview

- Located on the University of the West Indies Mona Campus in Kingston Jamaica
- Operating the JM-1 SLOWPOKE-2 RR since 1984

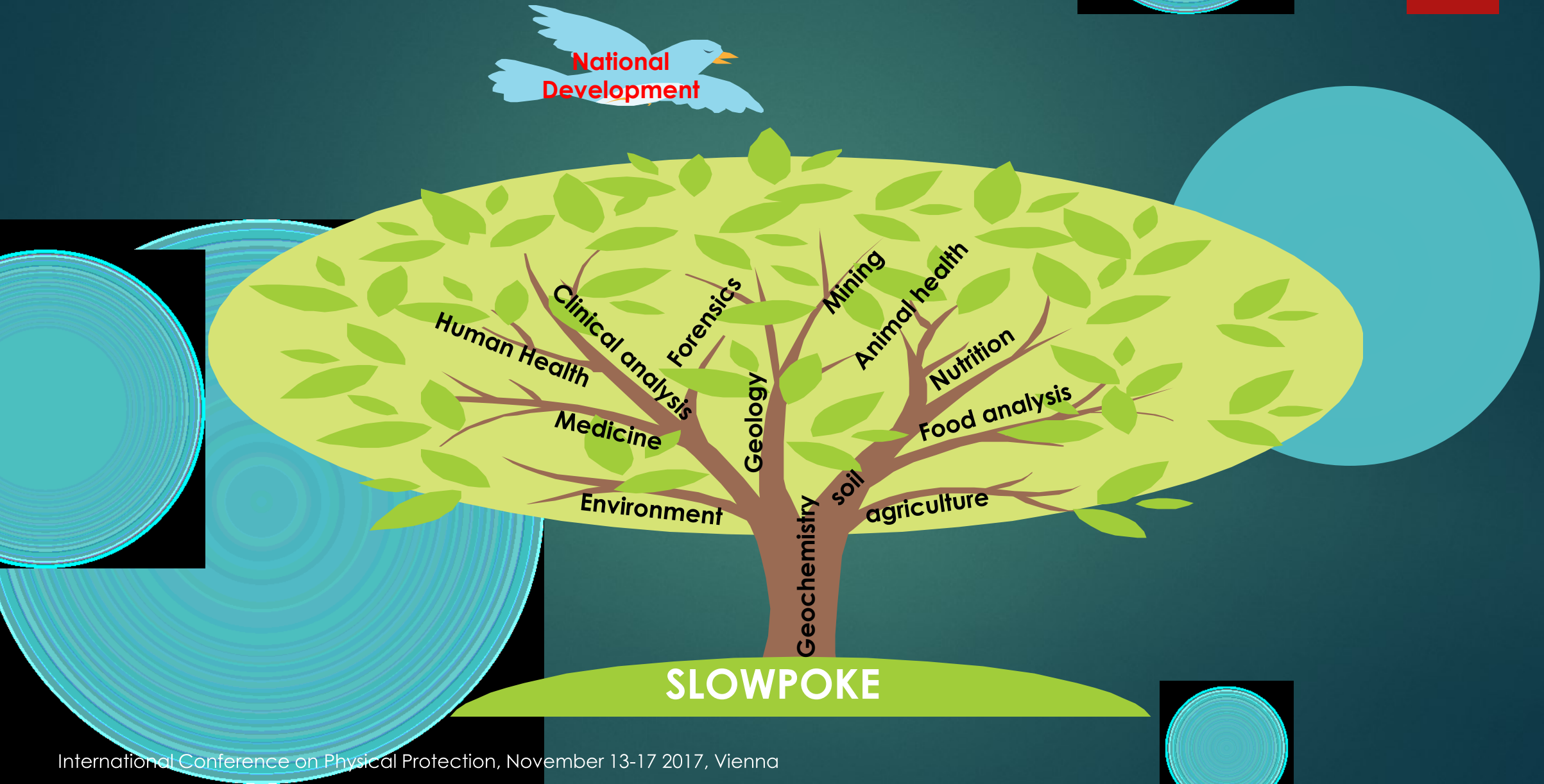
Staffing and Operations

- 27 Staff members
  - 15 scientific operating across 3 Laboratories
    - 7 Nuclear Laboratory

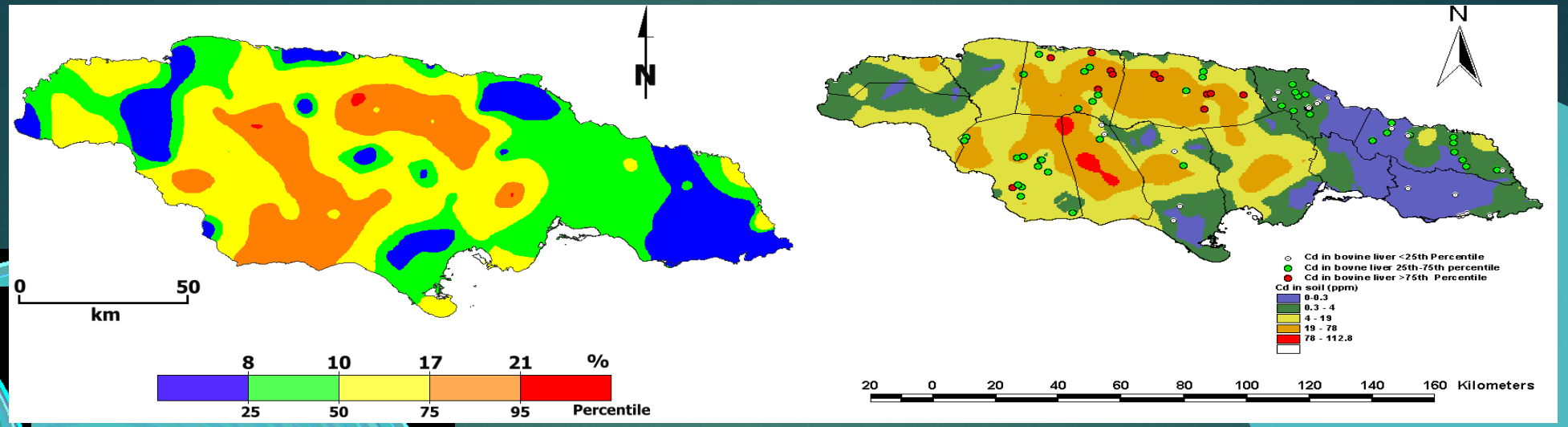
- Nuclear Analytical Laboratory
  - NAA
  - X-ray fluorescence
- Solutions Laboratory
  - Wet chemistry
- Radiation Protection & Nuclear Security Laboratory
  - Rad protection
  - Nuclear Security
  - Dosimetry

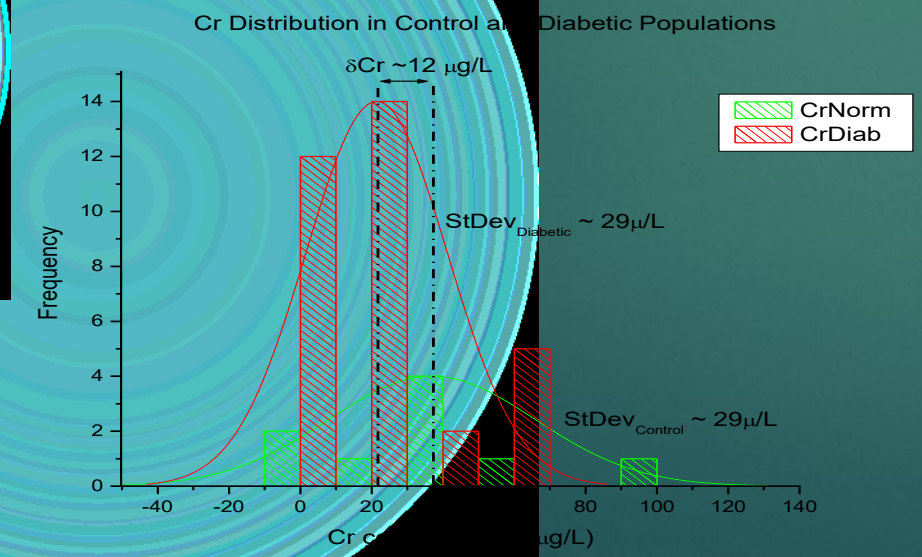


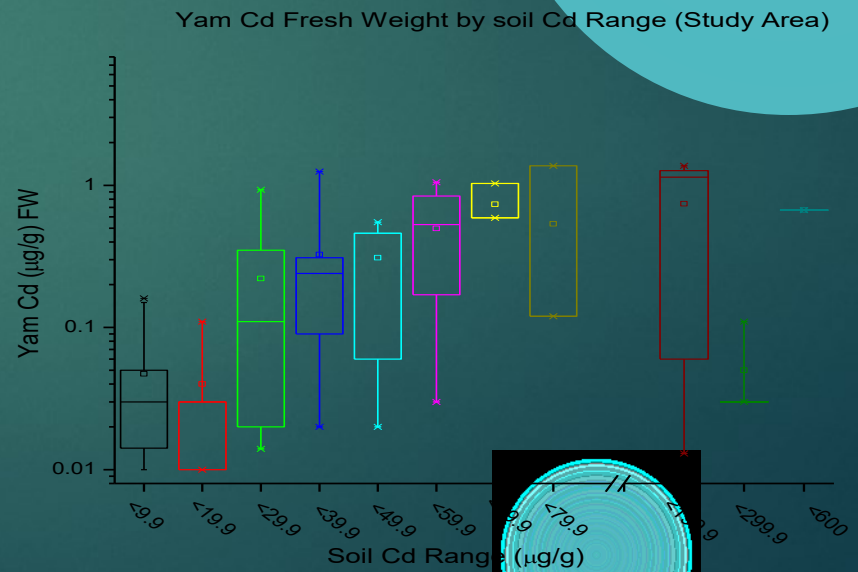
Peaceful Uses of Atoms



Studies


N
0
50
km
8
10
17
21
%
25
50
75
95
Percentile
N
Cd in bovine liver <25th Percentile
Cd in bovine liver 25th-75th percentile
Cd in bovine liver >75th Percentile
Cd in soil (ppm)
0-0.3
0.3 - 4
4 - 19
19 - 78
78 - 112.8
20 0 20 40 60 80 100 120 140 160 Kilometers


Cr Distribution in Control a Diabetic Populations
δCr ~12 μg/L
CrNorm
CrDiab
Frequency
StDev Diabetic ~ 29μ/L
StDev Control ~ 29μ/L
Cr c ug/L)


Yam Cd Fresh Weight by soil Cd Range (Study Area)
Yam Cd (μg/g) FW
Soil Cd Rang (μg/g)

Core Conversion

Performance Characteristics HEU vs LEU		
	HEU	LEU
Maximum operating power	**20 kW**	**20 kW**
Maximum operating time at 3mk	**6 hrs**	**12 hrs**
Maximum operating time at 4 mk	**16 hrs**	**24 hrs**
Operating range between shim additions	**2.5 – 4.0 mk**	**1.5 – 4.0 mk**
Core Life-Time	**20 Years**	**40 Years**

With a better core……..

Expansion of research ✓

Expansion of services ✓

Everyone is Happy ✓

What did this expansion mean for operations?

With no additional human or financial resource allocation and in the face of the new regulatory environment, the facility management has decided to place greater emphasis on the following programs:

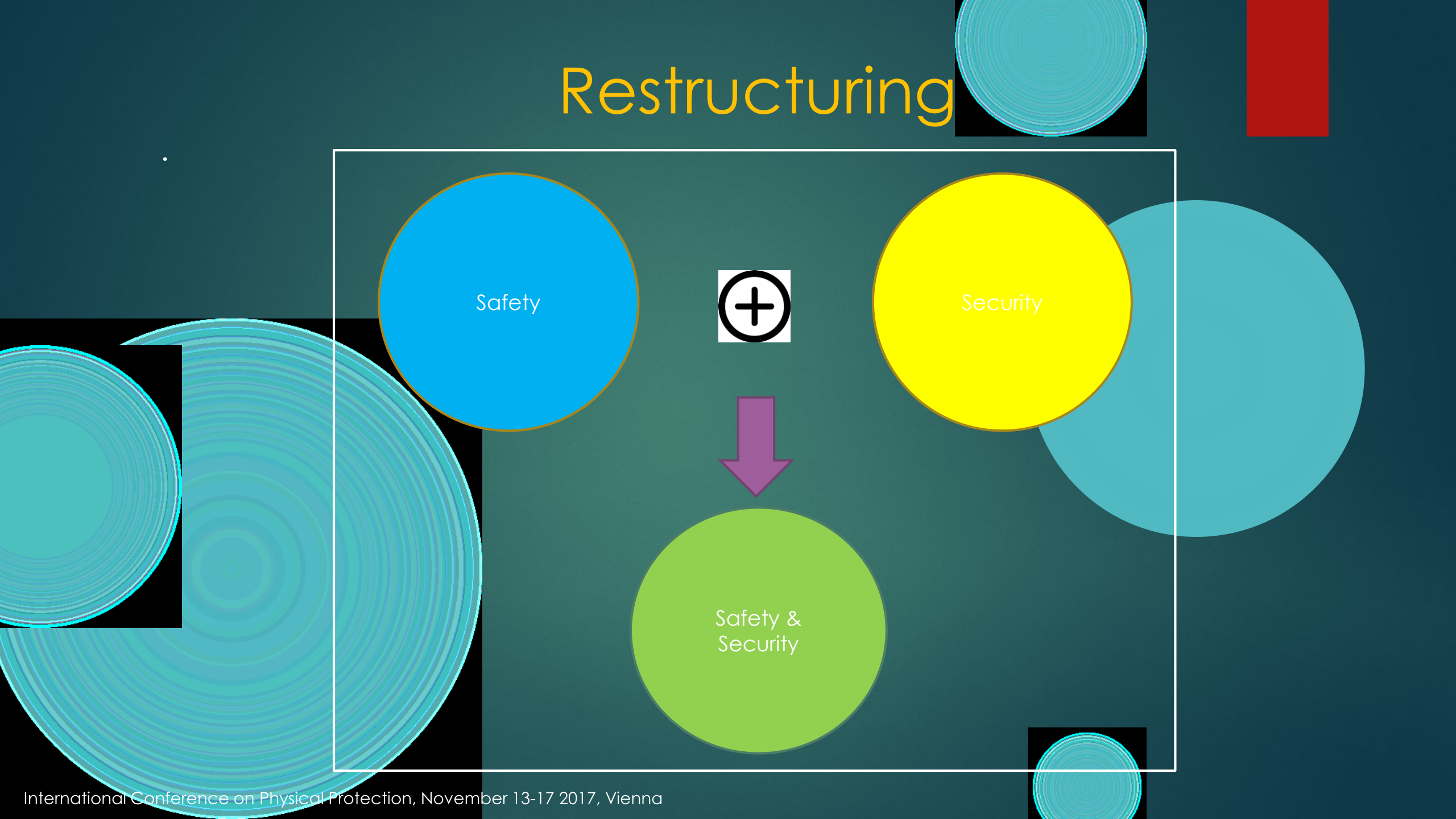
- Ageing management
- Predictive and preventative maintenance
- Multitasking and shared roles and responsibilities
- Automation of routine tasks
- Remote facility monitoring and management
- Safety and security to mitigate the increased risk

How was this achieved?

Step 1

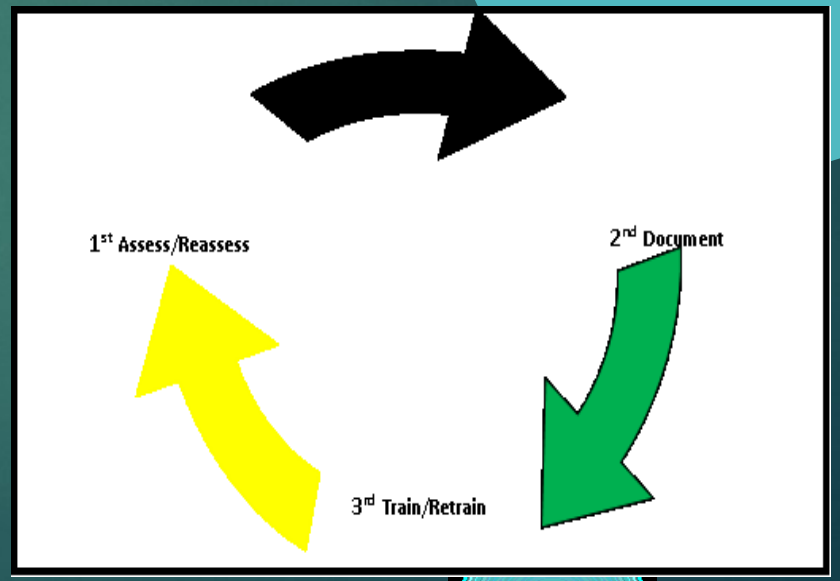

Organizational Restructuring:
Reasons, Strategies & Benefits

Restructuring



Steps 2,3&4

- PPS upgrade to include procedures, plans and policies
- Review of the radiation protection and emergency response plans
- Updating the SAR



Steps 5&6

- Classification and Identification of the reactor related systems and their components:
  - Auxiliary
  - Reactor safety
  - Facility safety
  - Facility security
- Classification and Identification of all other digital infrastructure and their components:
  - Computer networks
  - Other electrical equipment

For each safety/security system component, specific key performance indicators were identified and tagged to be monitored:

- Reactor rod position
- Inlet and outlet Thermocouple
- Reactor flux
- Pneumatic pressure
- Water flow rate
- Motor currents
- Dose rate
- Security system status
- Fire system health status
- Computer network traffic and hosts

Reactor Safety Systems

Auxiliary Systems

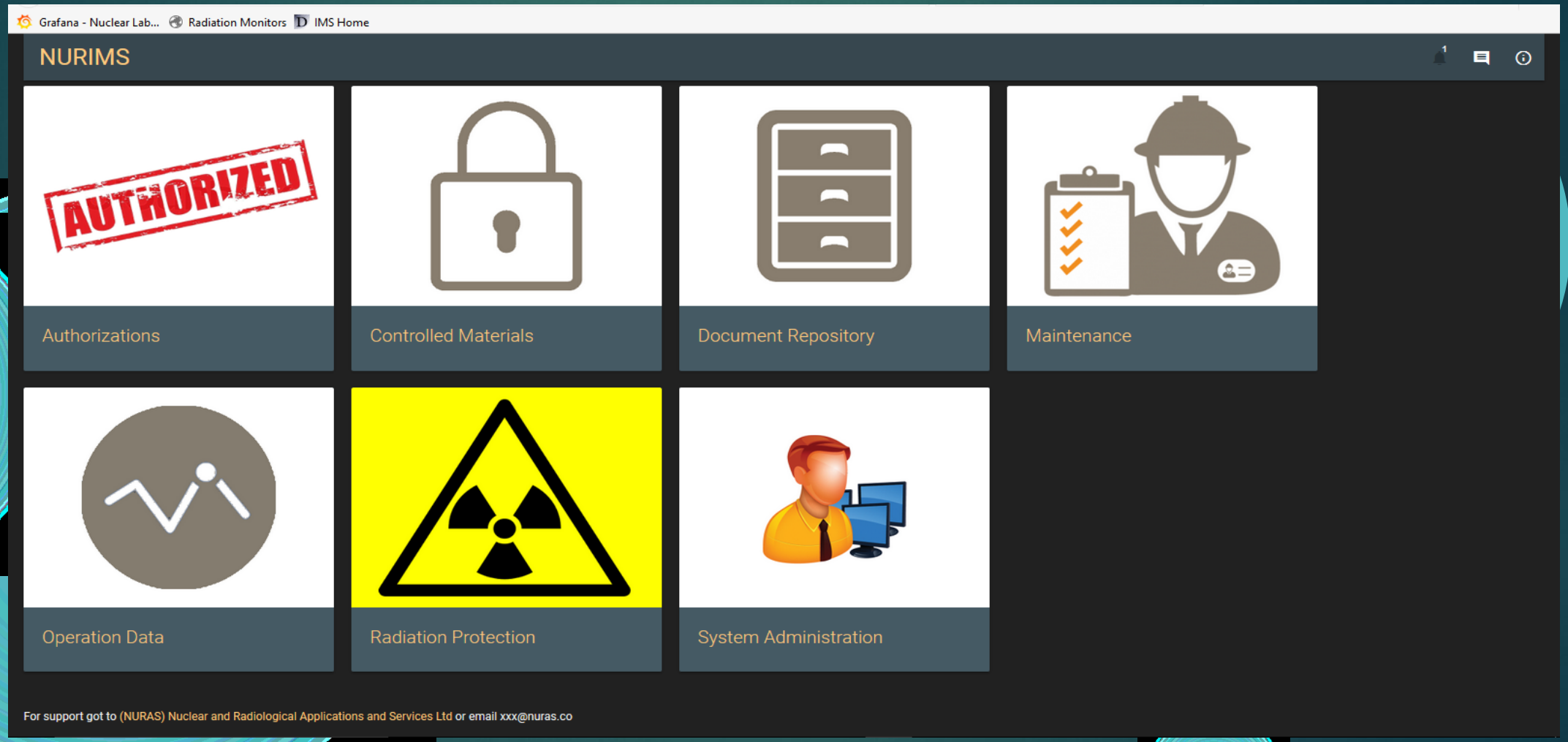
Primary Security Systems

Infrastructure Management System

The key performance indicators for each safety and security system component is monitored by the IMS. The IMS and have the following capabilities using the data streams gathered:

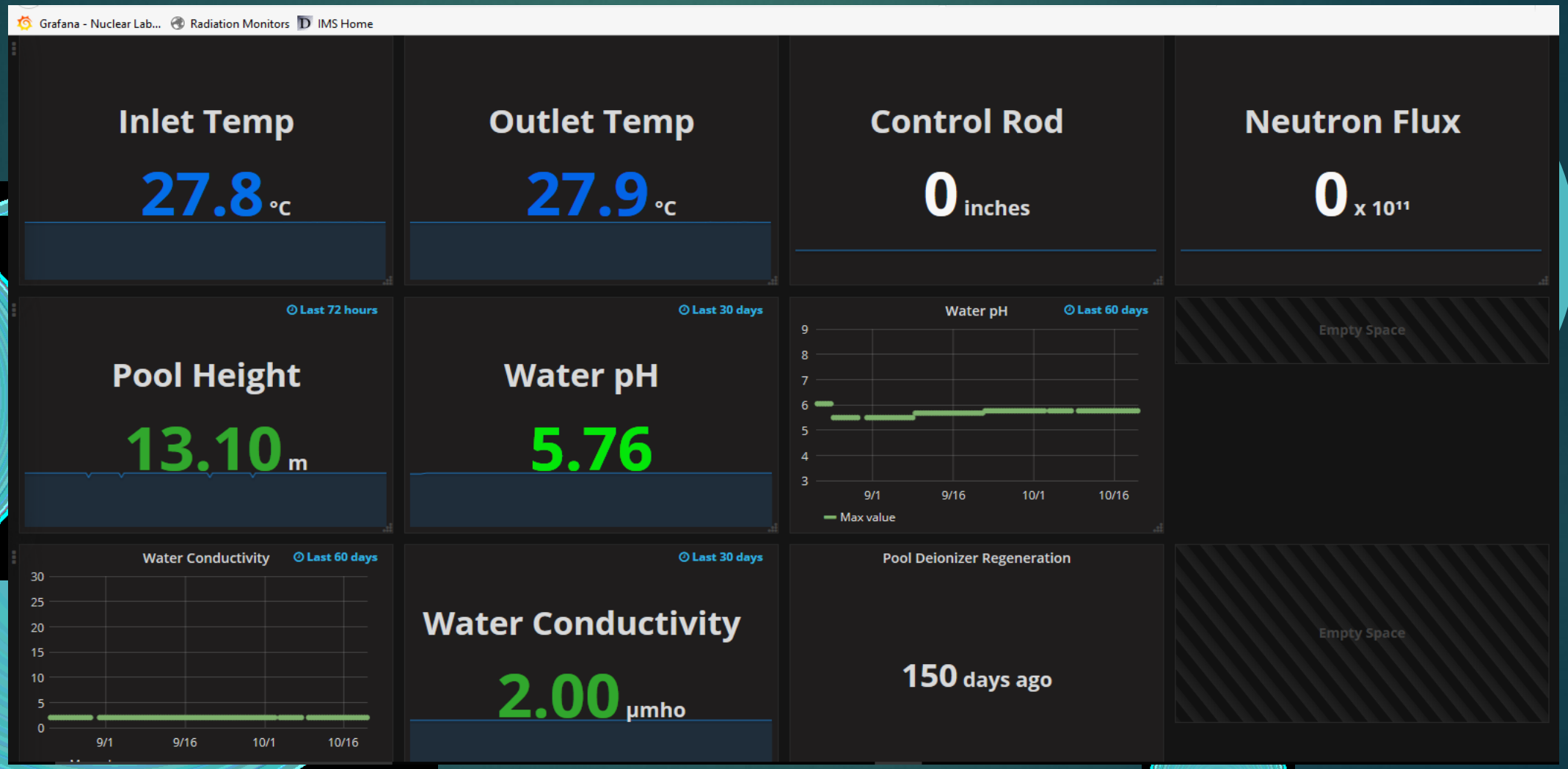
- Real-time data visualization
- Graphing charting and data correlation
- Alarm monitoring and communication

Real-time Monitoring

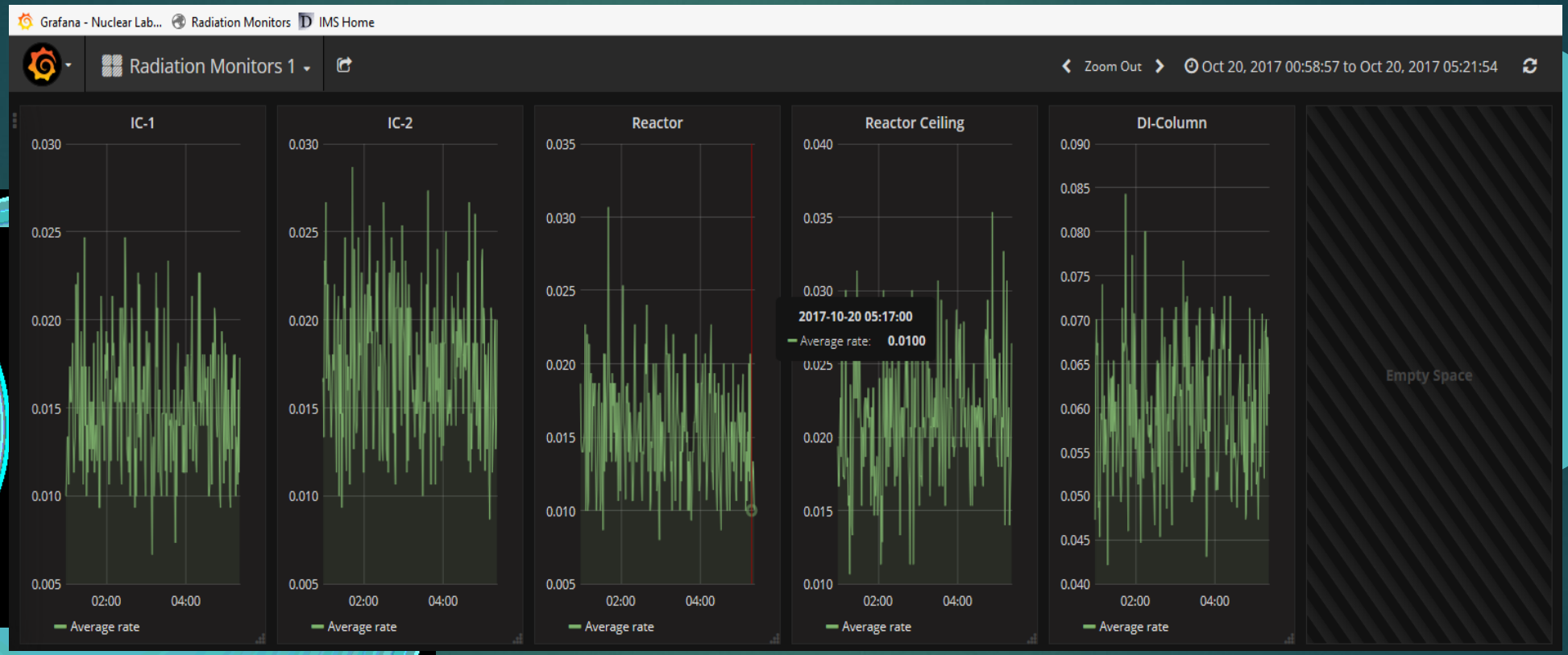


Radiation Monitors

Reactor Operation Data



Data Trending and Correlating



Cyber Security

Reconfigured of computer networks to simplify management and monitoring by the IMS. The following measures are also being applied as cyber security controls:

- Cryptography for all hosts and network traffic
- Network traffic and hosts are monitored
- Isolated and segregation of networks
- Autonomous agents used to monitor network hosts and traffic

Conclusions

- Merging safety and security simplifies the designing and implementation of any change in security or safety at the facility.
- The IMS gives insight into the level of system operability
- The IMS helps with preventative and predictive maintenance program which reduces downtime
- The IMS helps to increases general facility safety
- The IMS assists with the management and modernization of the facility because of its modularity and scalability.
- The IMS will assist with the management of safety and security at the JM-1 facility.


THANK YOU