IGORR22/IAEA TM ON INTEGRATED MANAGEMENT SYSTEMS FOR THE SUSTAINABLE SAFE OPERATION AND EFFECTIVE UTILIZATION OF RESEARCH REACTORS, JUNE 16-19, 2025, MITO, JAPAN

IMPLEMENTING AN INTEGRATED MANAGEMENT SYSTEM AT THE JM-1 RESEARCH REACTOR

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ICENS INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND NUCLEAR SCIENCES

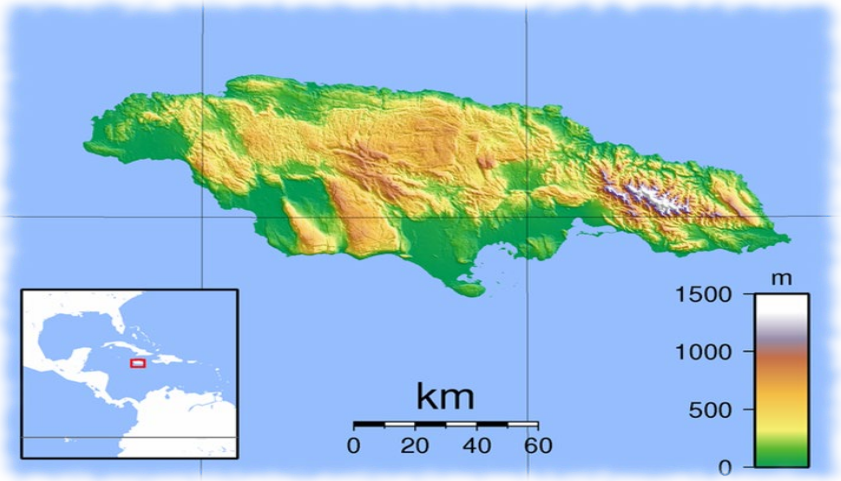
ACKNOWLEDGING JOHN PRESTON

PRESENTATION OUTLINE

- The JM-1 Research Reactor
- IMS Objectives
- IMS Implementation
- Computer-based tool (NURIMS)
- Impressions
- Lessons learnt

THE JM-1 RESEARCH REACTOR

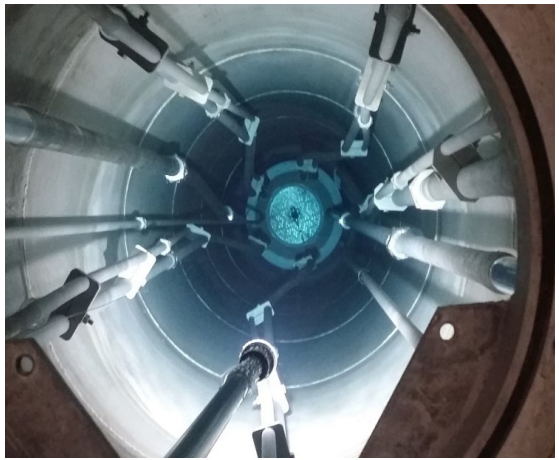
- The JM-1 research reactor is the only nuclear reactor in the English-speaking Caribbean.
- Commissioned with HEU fuel (93% ^{235}U) in 1984.
- Of the seven SLOWPOKE reactors, JM-1 is the only one commissioned outside of Canada and the last one commissioned with HEU fuel.

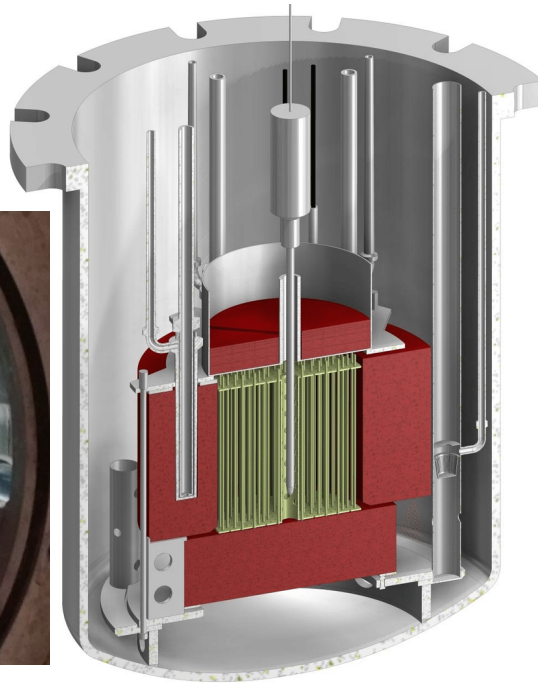


- Successfully converted to LEU fuel in 2015 via collaboration between the US DOE, through the Argonne National Laboratory and ICENS within the framework of the NNSA's M^3 program with the assistance of the IAEA.

THE JM-1 RESEARCH REACTOR

Commissioned :	March 1984
Power :	~20 kW
Maximum Excess Reactivity :	+ 4.0 mK
Flux :	1 x 10^{12} n.cm^{-2} s^{-1}
Core:	UO_2 pellets 19.9% ^{235}U Zircaloy cladding
Reflector:	Primary: Beryllium metal Secondary: Light water
Moderator :	Light Water
Cooling :	Natural convection
Irradiation Sites :	5 inner and 1 outer





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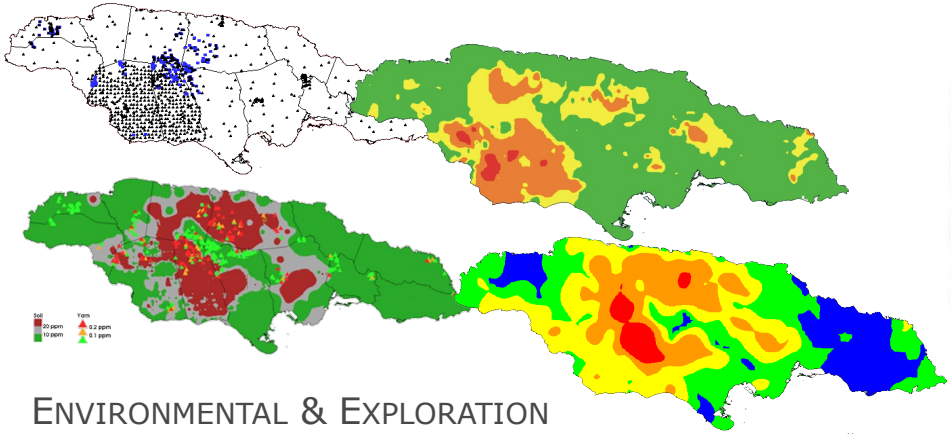
THE JM-1 RESEARCH REACTOR



ENVIRONMENTAL & EXPLORATION GEOCHEMISTRY

AGRICULTURE, SOILS & FOOD SECURITY

HEALTH

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IMS OBJECTIVES

In 2015 a decision was made to integrate the management of the reactor operations to ensure that strategic decisions were not made in isolation. Specific objectives of the IMS are to:

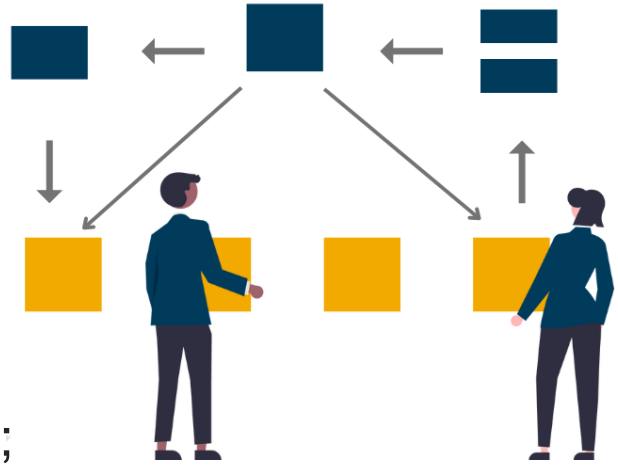
- Develop a **process-based** approach to ensuring the safe and sustained operation of the JM-1 Research Reactor facility in all stages of its life;
- Ensure a **safe environment** for the facility staff, the public and the environment by fostering a systematic approach to managing its operations;
- Ensure **systems and infrastructure are maintained** (modified, refurbished, upgraded) over the lifetime of the facility;
- Assist the facility in complying with its **regulatory requirements**;
- Assist the facility in **maximizing the safe utilization** of the research reactor;
- Assist in **knowledge management** over the life of the reactor;
- Foster a **data-driven approach** to managing all aspects of the operation of the reactor and facility.

IMS IMPLEMENTATION STRATEGIES

- Engage **management and staff** at all stages of the implementation
- Utilize a **graded approach** to ensure a fit-for-purpose system
- Determine **process/activities/tasks** constructs for all activities related to reactor operation on a step-by-step basis
- Implement **real-time monitoring** of operating parameters to provide the basis for a data driven approach to the management and operation of the reactor
- Establish clearly defined **acceptance criteria** for all surveillance activities
- Utilize a **computer-based** information management system.
- **‘Not let the perfect be the enemy of the good'**

IMS IMPLEMENTATION

Step 1 – Process Mapping



- Identify all processes including scope & purpose;
- Identify process owners;
- Identify and verify all process inputs and outputs;
- Identify the various process activities and tasks (what work is done, who carries it out and how it is performed);
- Identify the resource needs (roles, responsibilities, training needs and equipment);

IMS IMPLEMENTATION

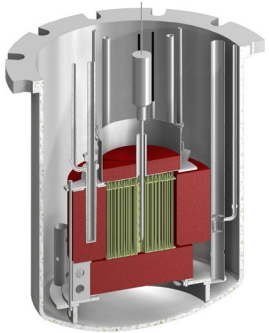
Process Map

MANAGEMENT

- ❑ DOCUMENTATION
- ❑ REGULATORY COMPLIANCE
- ❑ OPERATIONS REVIEW
- ❑ SELF ASSESSMENTS
- ❑ PROCESS AUDITS

CORE

- ❑ REACTOR OPERATION
- ❑ SAMPLE IRRADIATION



SUPPORT

- ❑ RADIATION PROTECTION
- ❑ EMERGENCY RESPONSE
- ❑ CONTROLLED MATERIALS
- ❑ HUMAN RESOURCES
- ❑ MAINTENANCE
- ❑ SAFETY/SECURITY

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IMS IMPLEMENTATION

Step 2 – Identify Activities and Tasks

Identify process activities and tasks. These were taken from the following existing documents:

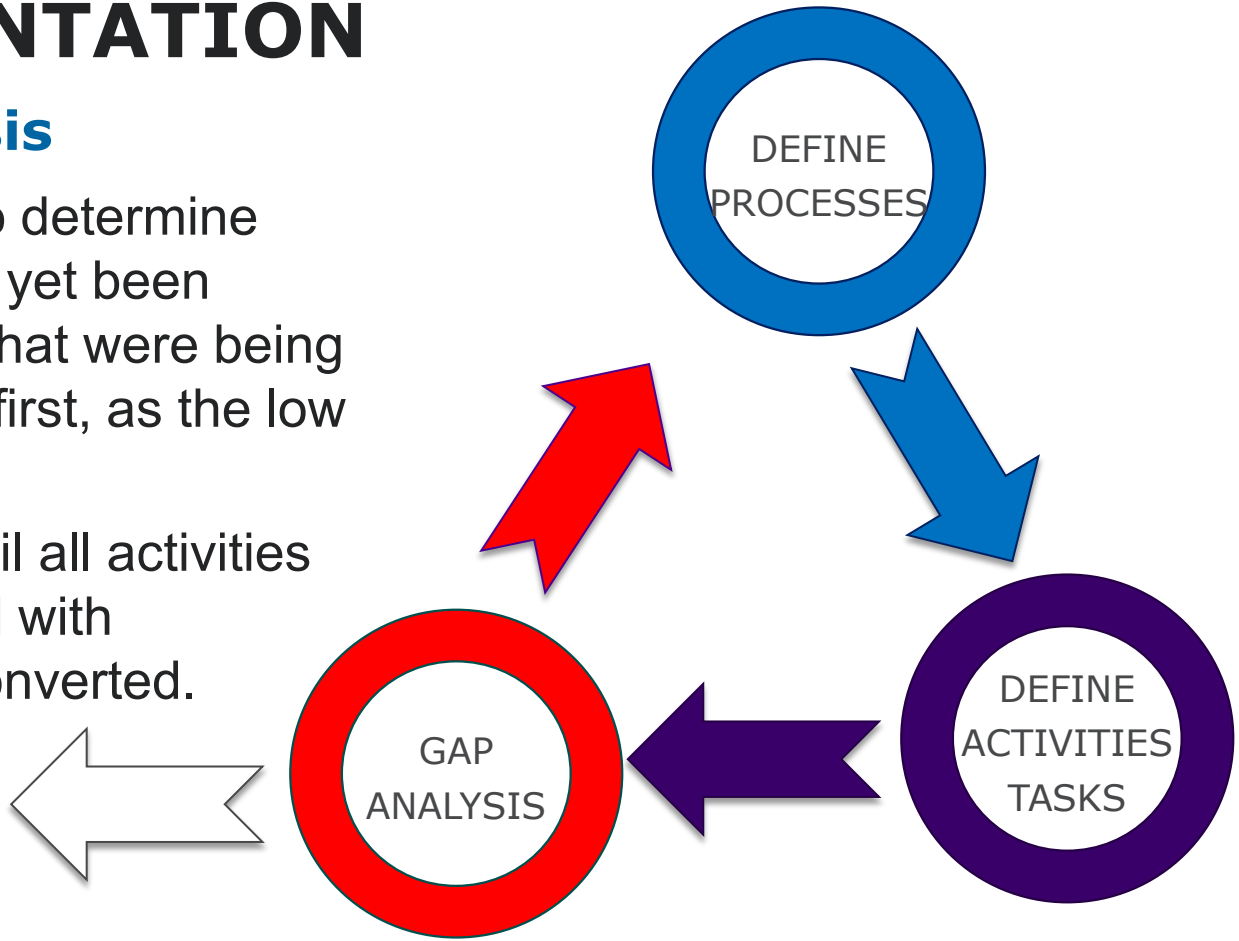
- SAR
- OLCs
- Reactor Operation and Maintenance Manual
- Quality Manual
- Physical & Computer Security Policies
- Emergency Preparedness & Response Policy
- Radiation Protection Policy
- Radioactive Waste Management Policy
- Standard Operating Procedures for Sample Analyses
- Training Manual

IMS IMPLEMENTATION

Step 3 – Gap Analysis

Perform a gap analysis to determine what processes have not yet been defined. Consider those that were being managed by procedures first, as the low hanging fruit.

Go to step 1 and loop until all activities that were being managed with procedures have been converted.



PROCESS OBJECTIVES (EXAMPLES)

RADIATION PROTECTION

- To establish a system for **monitoring** occupational **exposure** of **personnel** and the **environment** in supervised and controlled areas;
- To establish a system for **monitoring** the radiation exposures in **public areas** in and around the facility;
- To establish a system of **assessment and review** of occupational exposures;
- To **report** the findings of exposures to all interested parties.

CONTROLLED MATERIALS

- To implement a system of **control** over **radioactive sources** and devices in which the sources are incorporated;
- To implement a **categorization** of **sources** based on the potential injury to people and the environment that could result if those sources are not safely managed or securely protected;
- To implement a system for the safe and secure storage of **radioactive waste**;
- To implement a system of **assessment** and **auditing** of the process activities and results to improve the process.

COMPUTER-BASED TOOL

NURIMS

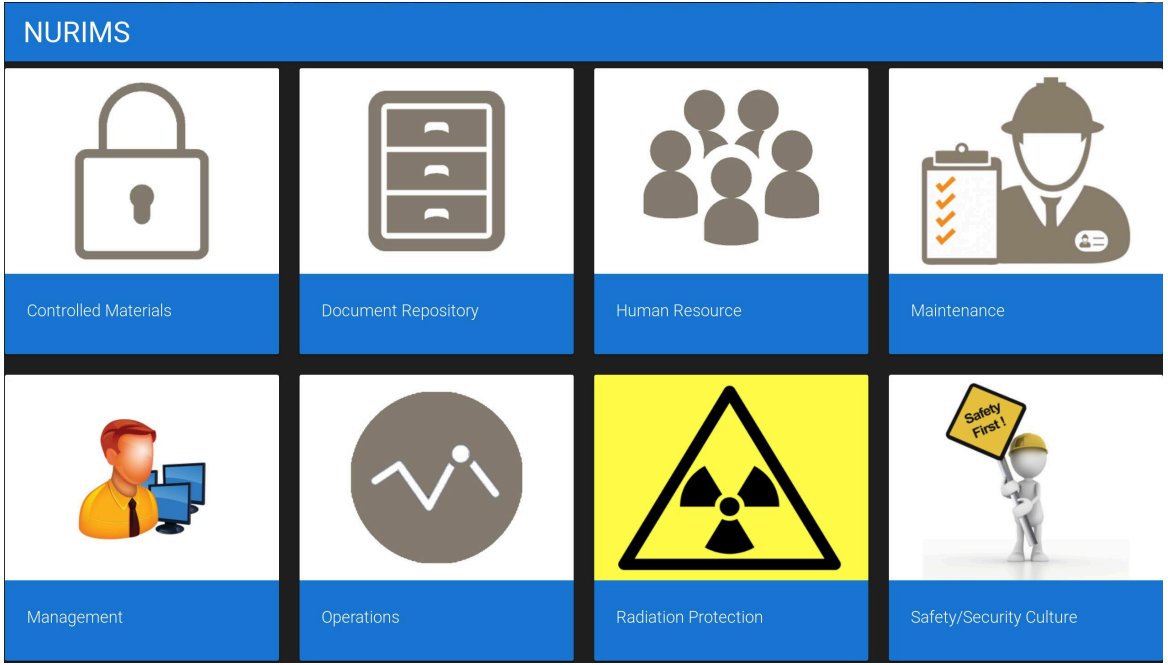
NUCLEAR AND

RADIOLOGICAL

INTEGRATED

MANAGEMENT

SYSTEM

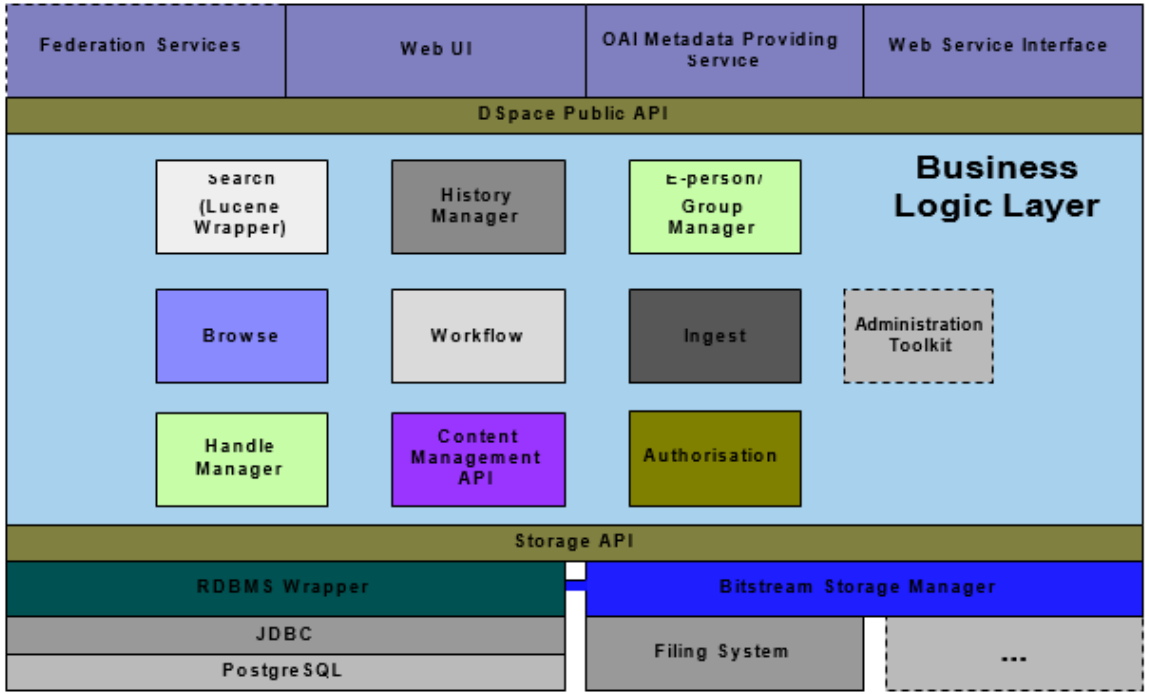


COMPUTER-BASED TOOL

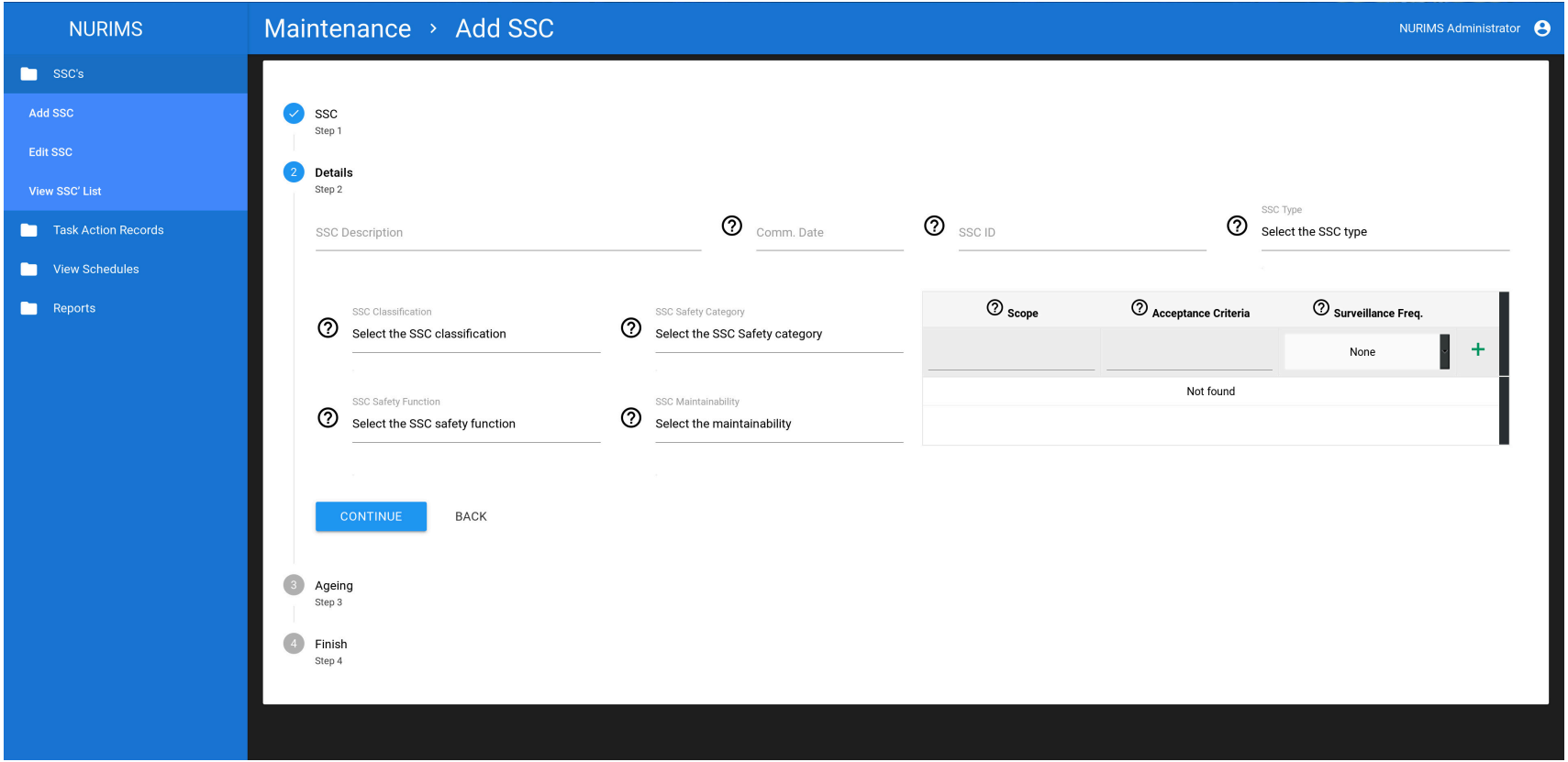
NURIMS

The base system is a digital library DSPACE, which:

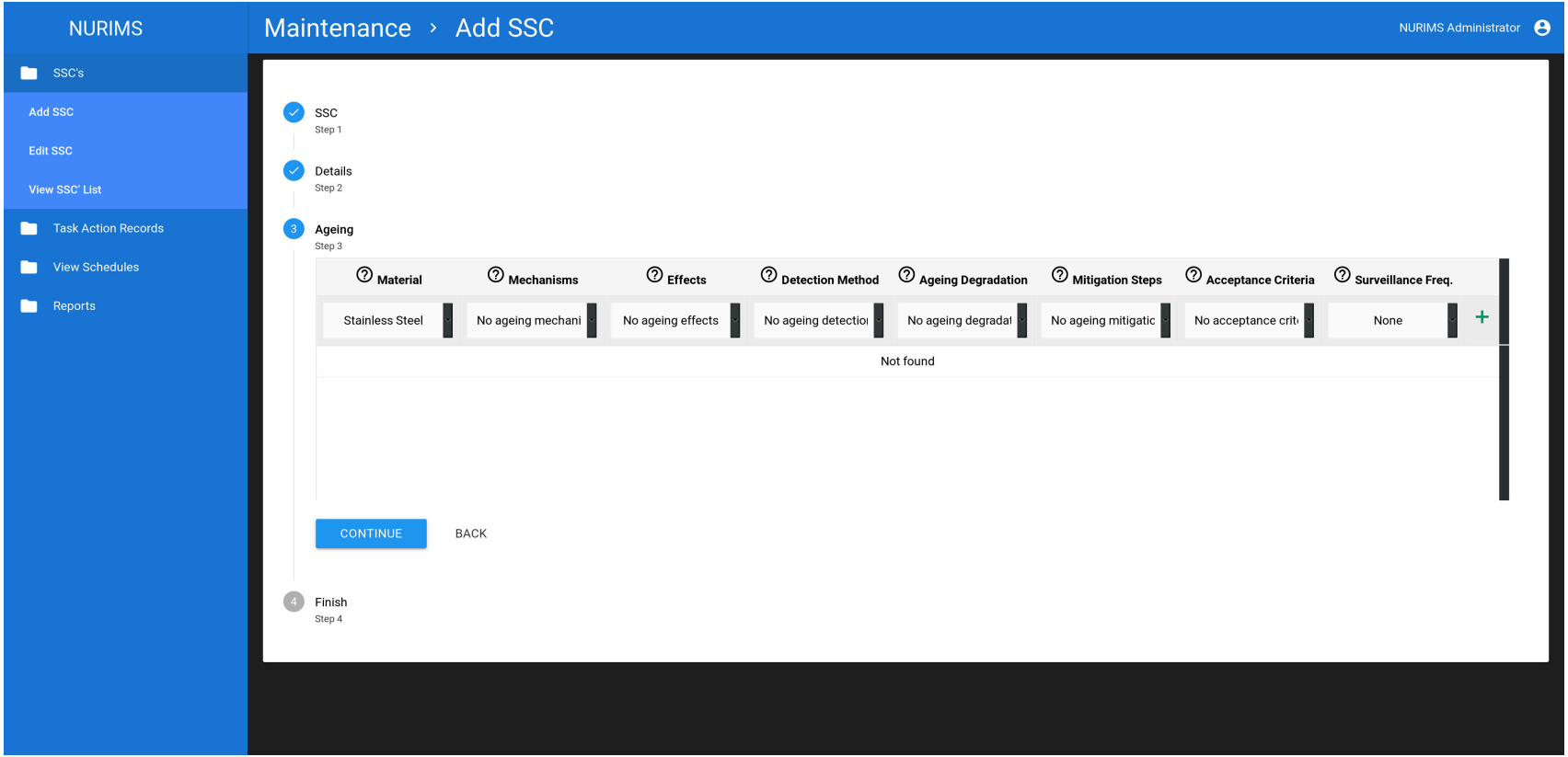
- captures items in any format,
- indexes digital items so they can be easily retrieved,
- preserve the digital content over the long term.



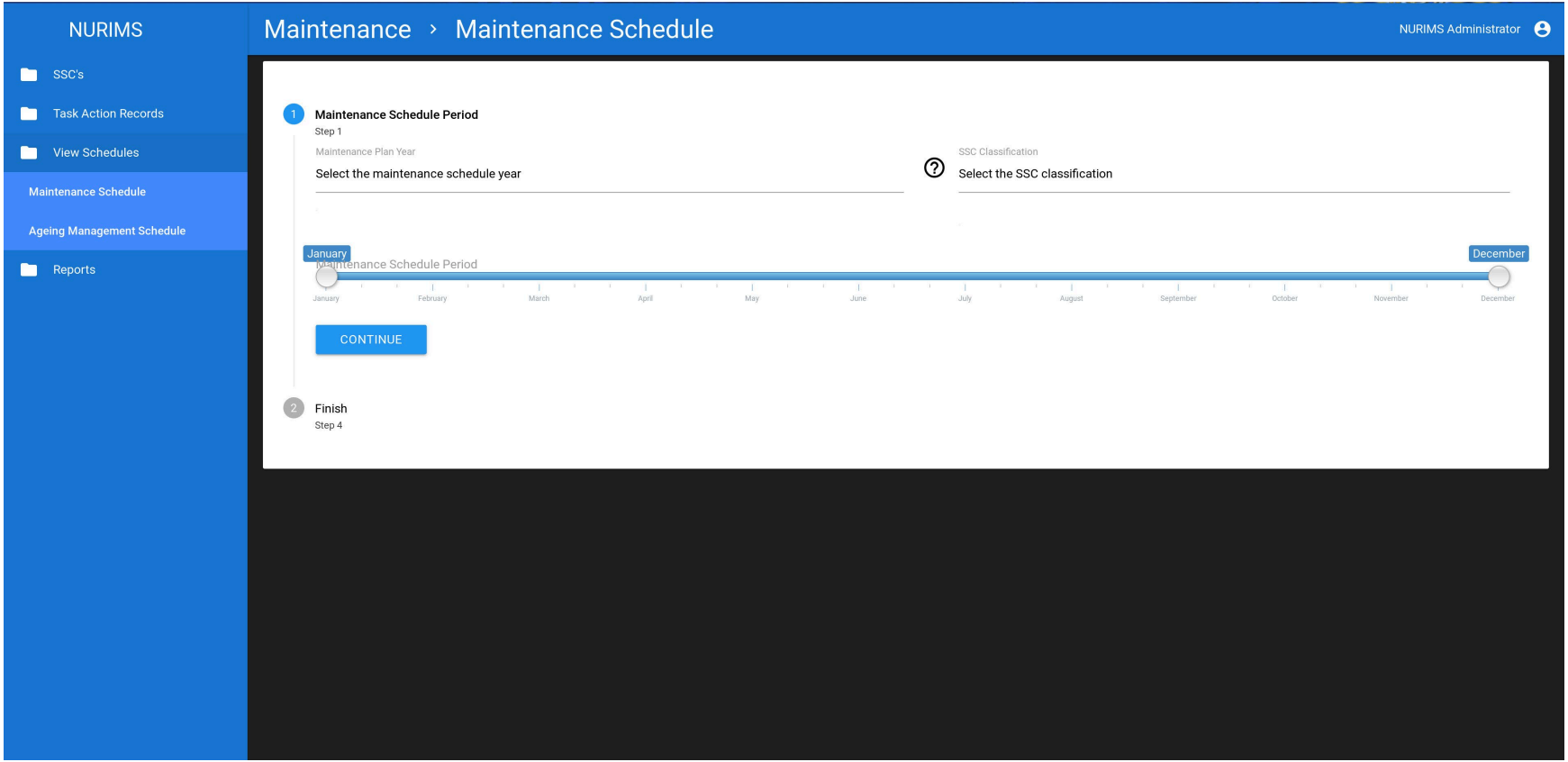
MAINTENANCE/ISI PROCESS – ADD SSC



MAINTENANCE/ISI PROCESS – ADD SSC



MAINTENANCE/ISI PROCESS – GENERATE PLAN



MAINTENANCE/ISI PROCESS – GENERATE PLAN

JM-1 SLOWPOKE Maintenance Plan
JANUARY - DECEMBER 2025

NURIMS
2025

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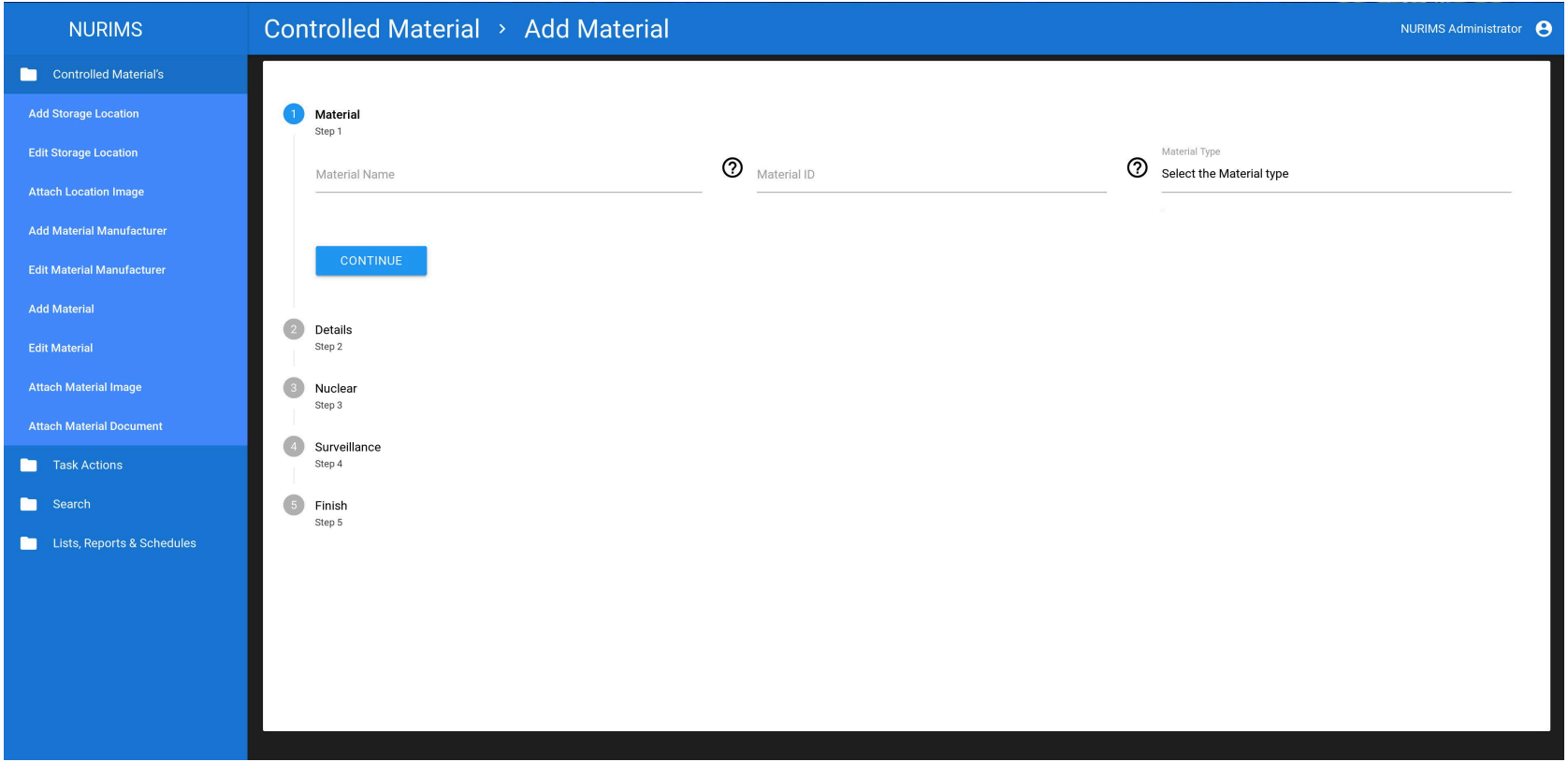
Maintenance Schedule

Weekly schedule

Week Dec 31 - Jan 4

SSC	Maintenance Scope	Acceptance Criteria	Completed	Accepted	Initials
POOLCHILLER	water temperature control	10C to 15C chilled water	❑ MONDAY ❑ TUESDAY ❑ WEDNESDAY ❑ THURSDAY ❑ FRIDAY	❑ Yes ❑ No	
	chilled water flow rate	6-7 GPM	❑ MONDAY ❑ TUESDAY ❑ WEDNESDAY ❑ THURSDAY ❑ FRIDAY	❑ Yes ❑ No	

CONTROLLED MAT. PROCESS– ADD MAT.



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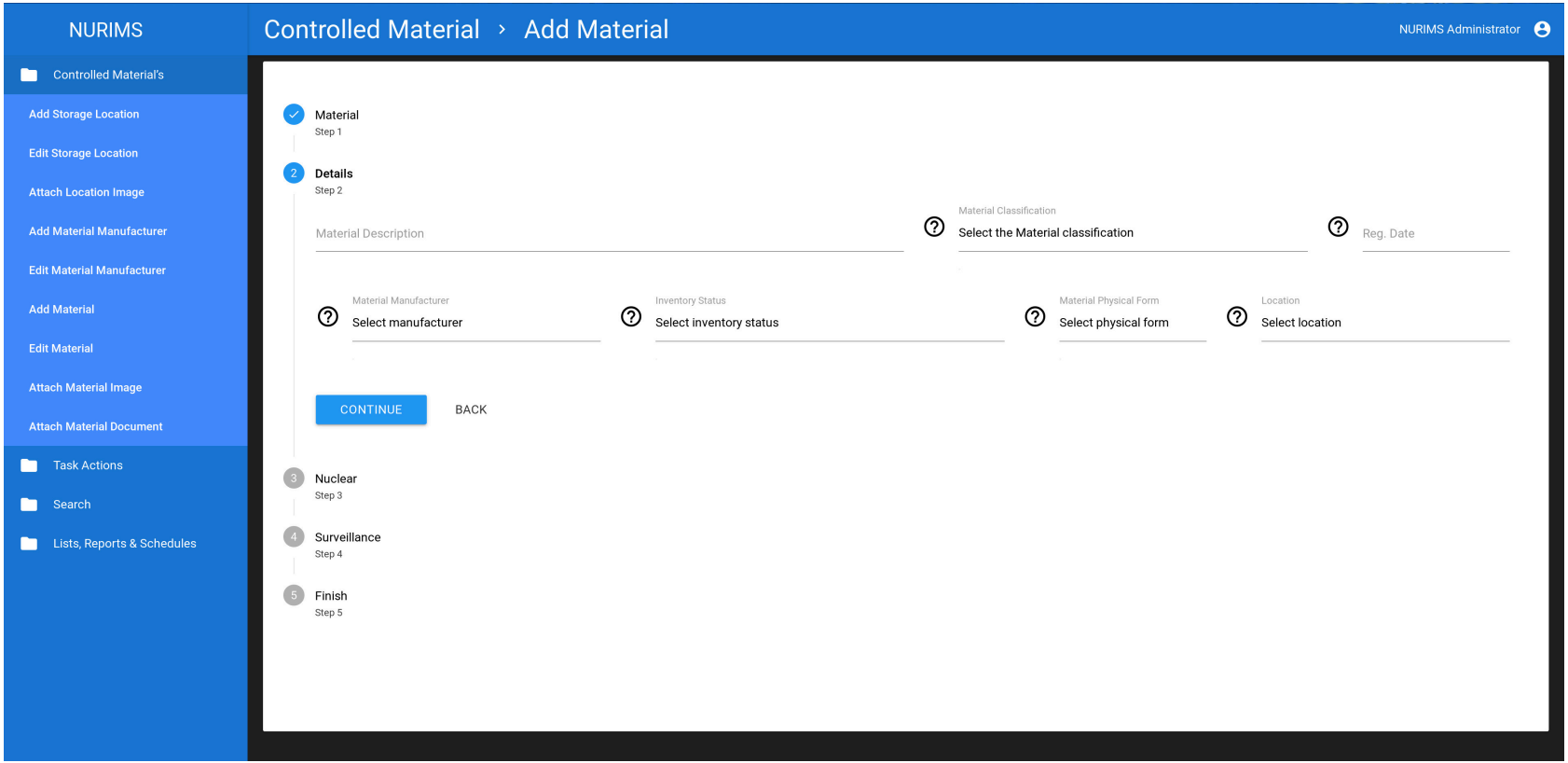

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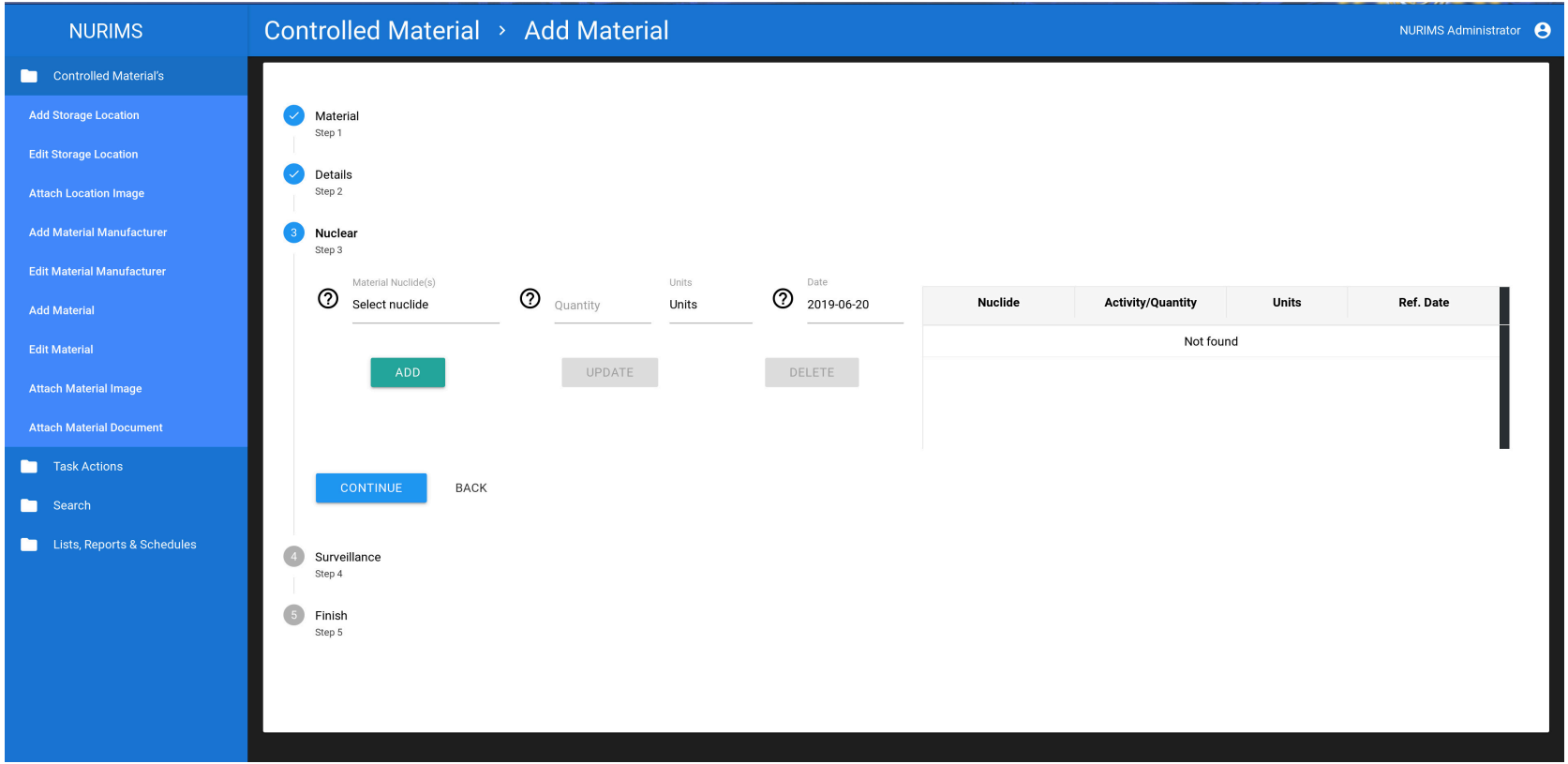

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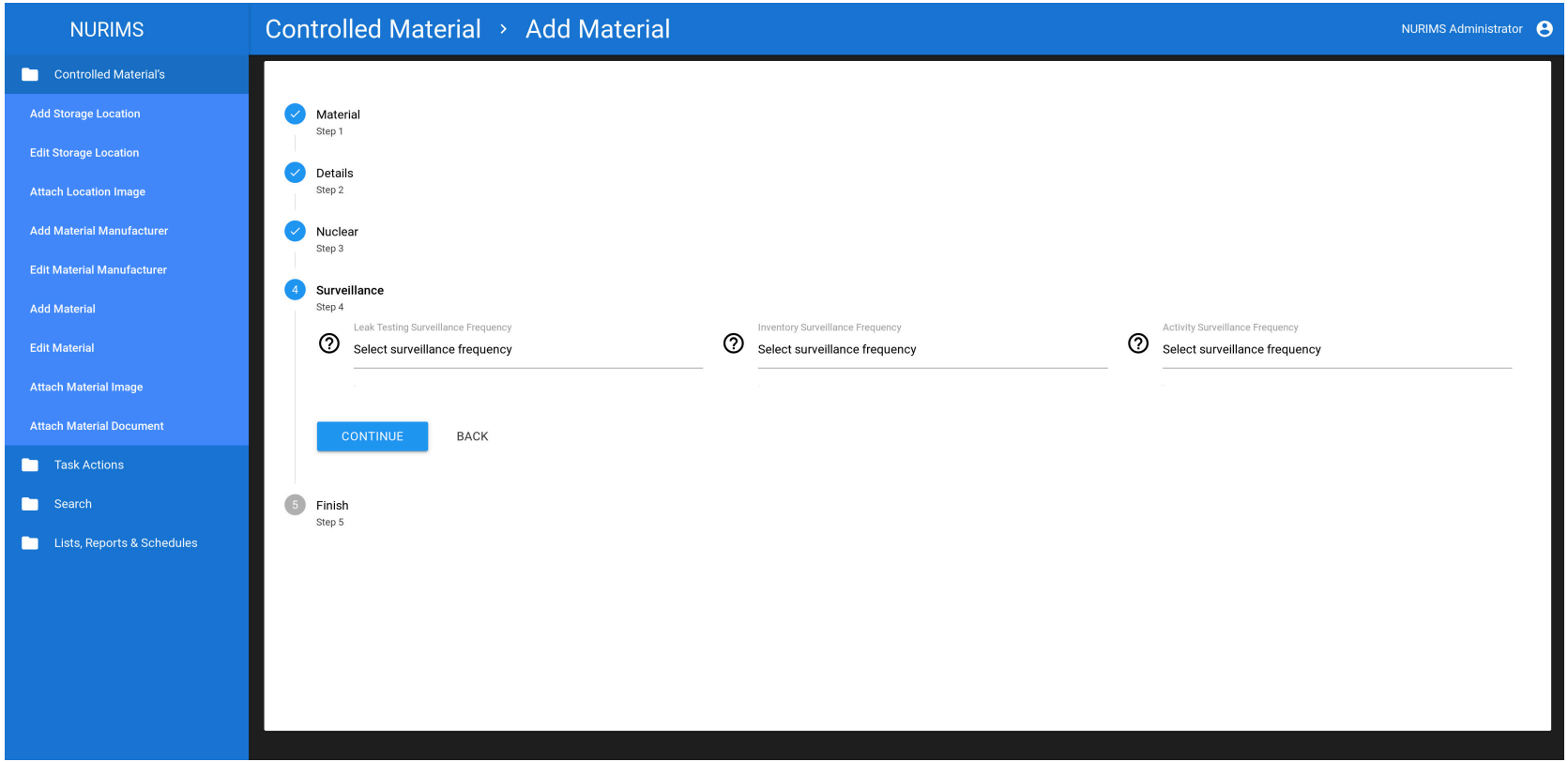


CONTROLLED MAT. PROCESS– GENERATE LIST

Report Date: 2025-01-29

International Centre for Environmental and Nuclear Sciences
2 Anguilla Crescent
Kingston 7, Jamaica

Page: 1

Controlled Materials List

Abstract

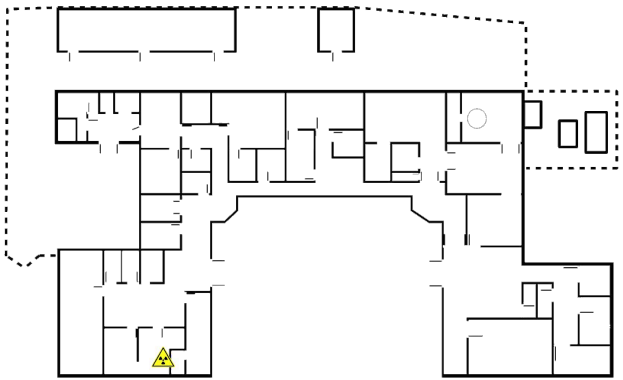
This report lists the radioactive and nuclear materials and associated nuclear items under control at the ICENS.

23650-HC-8507 : Cs-137 Industrial Source

Record :	nurims/1572		
Name :	Cs-137 Industrial Source		
ID :	23650-HC-8507		
Description :	Cs-137 Industrial Source		
Manufacturer :	Unknown		
Registration Date :	2022-02-04		
Form :	Solid		
Classification :	Category 5, Most unlikely to be dangerous to the person		
Inventory Status :	DisUsed		
Storage Location :	-		
Surveillance :	Inventory: Annual Leak Testing: Annual Activity Testing: None		
Nuclides :	Nuclide	Activity/Quantity	Ref. Date
	Cs-137	-	2022-02-04

TLD Reader 0

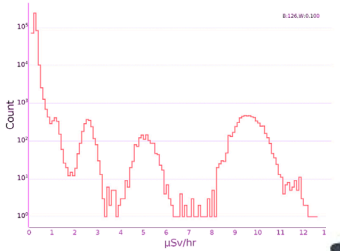
Harshaw 6600 TLD reader



RADIATION PROTECTION – DOSE OPTIMIZATION

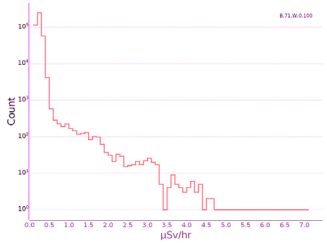
Reactor Ceiling

ID : 971098
From : 2019-03-01T07:51:26
To : 2019-03-24T10:03:14
Count : 423523
Minimum : 0.10 µSv/hr
Maximum : 12.70 µSv/hr
Mean : 0.37 µSv/hr
Median : 0.2 µSv/hr
Std. Deviation : 1.15 µSv/hr



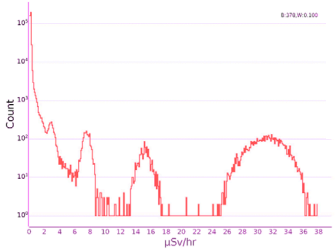
IC1

ID : 973014
From : 2019-03-01T07:51:24
To : 2019-03-24T10:03:14
Count : 426132
Minimum : 0.10 µSv/hr
Maximum : 7.20 µSv/hr
Mean : 0.19 µSv/hr
Median : 0.2 µSv/hr
Std. Deviation : 0.12 µSv/hr

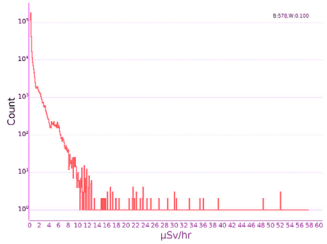


Reactor

ID : 971073
From : 2019-03-01T07:51:24
To : 2019-03-24T10:03:13
Count : 419822
Minimum : 0.10 µSv/hr
Maximum : 37.90 µSv/hr
Mean : 0.72 µSv/hr
Median : 0.2 µSv/hr
Std. Deviation : 3.78 µSv/hr

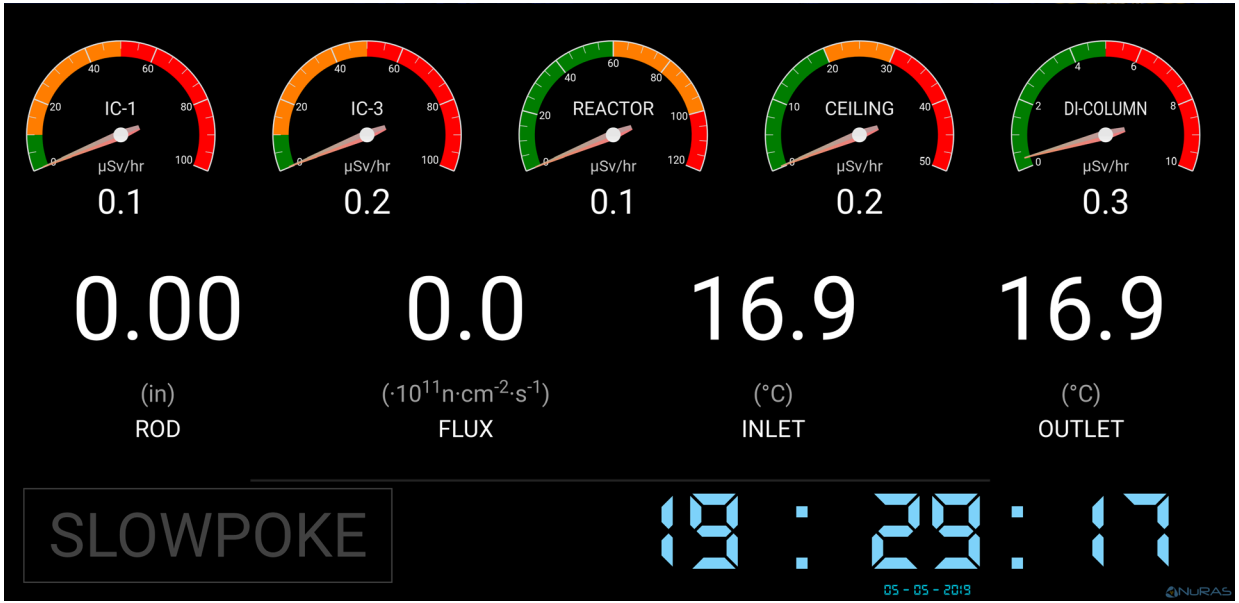


ID : 971070
From : 2019-03-01T07:51:22
To : 2019-03-24T10:03:12
Count : 422344
Minimum : 0.10 µSv/hr
Maximum : 57.90 µSv/hr
Mean : 0.45 µSv/hr
Median : 0.2 µSv/hr
Std. Deviation : 0.99 µSv/hr



REACTOR OPERATION DASHBOARD

PROVIDES REAL TIME STATUS OF RADIATION AREA MONITORS AND REACTOR OPERATING STATUS TO ALL AREAS OF THE FACILITY.



IMPRESSIONS

- Implementation of the IMS has been instrumental in re-evaluating and re-establishing the bases for all aspects of the reactor and facility operations.
- The adoption of an integrated process-based approach to managing the operations of the research is aimed at enhancing reliability and availability of the reactor.
- The use of computer-based tools is key to realizing efficiencies especially in situations of small staff numbers and high staff turnover.
- The use of the IMS in relation to reactor utilization has provided new insights into the multiple factors that must be managed to enhance reactor utilization.

LESSONS LEARNT

- Engage all stakeholders early in the process.
- Solicit feedback periodically during development and implementation.
- Moving from a procedural management system towards a process-based one should be considered in the same realm as a change in culture and thus will require a high level of effective and consistent communication.

THANK YOU FOR YOUR ATTENTION