



Annual Users' Conference

**ADVANCING RADIATION SAFETY.
EMPOWERING PROGRESS.**

M Resort, Henderson, NV | June 15 – June 18



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*Advancing Radiation Safety.
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Qualification & Commercial Grade Dedication Capabilities

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Mirion Connect | Annual Users' Conference 2026

Henderson, NV

Agenda

- *Qualification vs. Dedication*
- *Equipment Qualification (EQ)*
 - *Qualification Approach*
 - *Mirion Capabilities*
 - *Mirion EQ examples*
- *Commercial Grade Dedication (CGD)*
 - *Mirion Capabilities*
 - *Mirion EQ examples*

Qualification vs. Commercial Grade Dedication

Qualification

- Equipment designed and manufactured under an NQA-1 QA program
- Demonstrates equipment performance
- Design verification, testing and analysis
- Primarily system or equipment level

Commercial Grade Dedication (CGD)

- Commercial item designed and manufactured outside an NQA-1 Program
- Demonstrates suitability for intended safety function
- Verification of critical characteristics
- Primarily component level

Mirion provides end-to-end qualification and Commercial Grade Dedication capabilities

✓ Qualified Products & Solutions

- In-house qualified equipment portfolio
- Application specific design and qualification under an NQA-1 program

✓ Qualification Services

- Equipment qualification services for customer products
- In-house environmental, seismic, EMC, and aging test capabilities

✓ Commercial Grade Dedication Services

- Critical characteristic identification, verification and dedication
- CGD of 3rd party components

Equipment Qualification



Equipment Qualification (EQ)

Definition

Equipment Qualification (EQ) demonstrates that equipment can perform its intended safety function throughout its qualified life under normal operation, anticipated operational occurrences, and accident conditions.

Why Mirion?

- **12,000+ qualification projects** delivered for utilities and nuclear facilities worldwide
- Active participation with **EPRI and NRC** in development of EQ industry guidance and criteria
- **Expertise** in environmental, seismic, EMC, aging, radiation, LOCA, and accident qualification
- Proven methodologies that **reduce qualification risk**, schedule impacts, and retesting
- Comprehensive qualification reports and long-term support

➤ **Mirion is a single-source partner for end-to-end Equipment Qualification**

Worldwide Regulatory Frameworks

- Various regulatory frameworks apply for different countries.
- Mirion is experienced with any of these either in the US or in Europe.

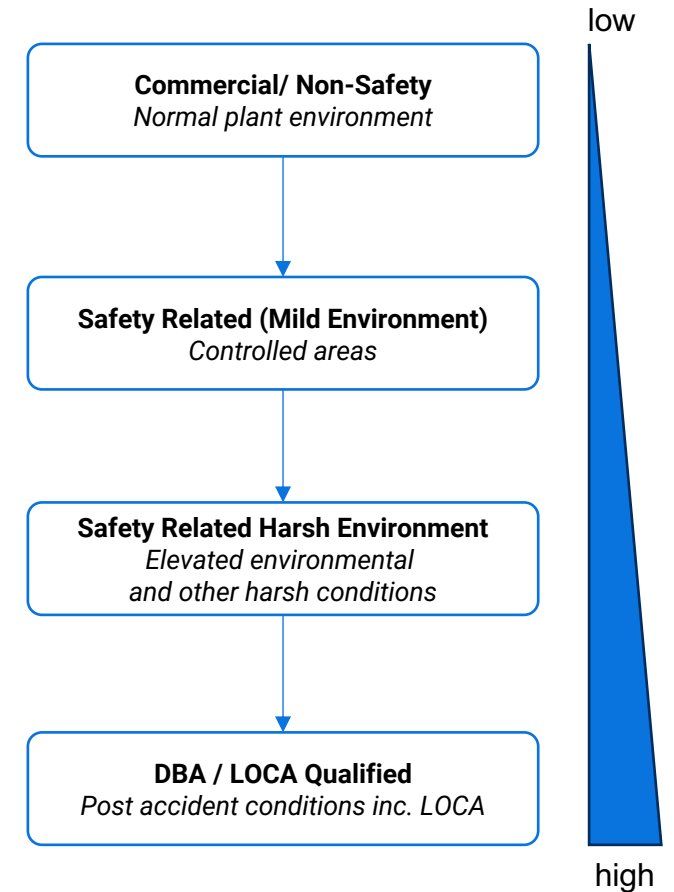
	General	Electrical	Nuclear
International			
US			
European			
Germany			

US Specific Regulatory Frameworks

- *10 CFR 50 Appendix B – Quality Assurance Criteria*
- *10 CFR 21 – Reporting of Defects and Noncompliance*
- *10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety*
- *Regulatory Guide 1.180 – Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems*
- *Regulatory Guide 1.89 – Seismic Qualification of Electric Equipment*
- *Regulatory Guide 1.100 / IEEE 323 Endorsement – EQ methods and documentation*
- *CSA N289.1-08 – General Requirements for Seismic Design and Qualification of CANDU Nuclear Power Plants*
- *CSA N289.4-12 – Testing Procedures for Seismic Qualification of CANDU Nuclear Power Plant Structures, Systems, and Components*
- *CSA N20.13-05 – Environmental Qualification of Equipment for CANDU Nuclear Power Plants*
- *IEEE 60780-323 – 2016 - IEEE Standard for Nuclear Power Generating Stations – Equipment Qualification for Class 1E Equipment*
- *IEEE 323 1974, 193, 2003 – IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations*
- *IEEE 344 1975, 1987, 2004, 2013 – IEEE Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations*
- *IEEE 382 1980, 1986 – IEEE Standard for Qualification of Safety-Related Actuators for Nuclear Power Generating Stations*
- *EPRI TR-102323, Rev. 0 through 5 – Guideline on the Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications*

Qualification Requirements

- Qualification requirements depend on the equipment's safety function and operating environment—from mild environment applications to harsh environment, DBA/LOCA, and severe accident conditions
- Mirion supports qualification programs ranging from mild environment applications through harsh environment, DBA/LOCA, and severe accident conditions.



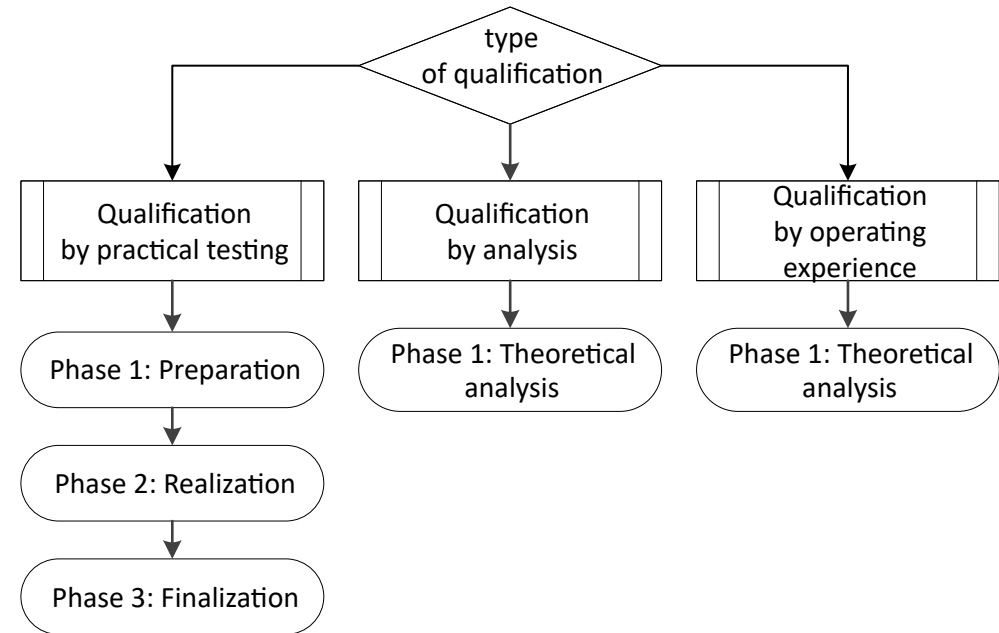
Qualification methods

Mirion follows international up-to-date standards of EQ requirements and test realization

IEC/IEEE 60780-323:2016

- *Type Testing*
- *Operating experience*
- *Analysis*
- *Combined methods*

Example: Mirion MUC Process description



Qualification phases

Phase 1 - Qualification preparation

Design input provides a definition of safety functions and expected service life of the equipment, identification of plant specific normal and PIE service conditions for which qualification is required.

Mirion output: “Qualification Strategy”

Example



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proTK™

General Qualification Strategy

for Neutron Measurement Systems

ECN: N

AL: N

Project: ---	EMI: --	Confidentiality: Mirion restricted
Author  Lautenbacher, A.	Reviewer  Rottler, K.	Formal Release  F. Sigg
Department: EQU	Edition: 2	Date: 2025-04-16
Page 1 of 46	Mirion Technologies (MGPI H&B) GmbH Landsberger Str. 328a 80687 München, Germany	Doc.-No. SA-2430017 A30E

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Form SA-1930021 F 101 ed.3

Qualification phases

Phase 2 – Qualification Realization

Based on the design input, EQ requirements and acceptance criteria are defined, and qualification methods are selected.

Mirion Output depending on selected the method

“Type testing” : Test Plan, Test Reports

“Analysis” : Analysis Report

Example

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PLAN de QUALIFICATION GENERAL
GENERAL QUALIFICATION PLAN

Page : 1

DIFFUSION INTERNE / Internal dispatching							
C. CALI	EDR	M.FABRE	AFR	E. BOYER	MKR	M. EDELMAN	ATL
CP ETUDES team	EDR	O. RICHARD	EDR	J.MESTRE	MKR	A.LAUTENBACHER	MUC
VVQ team	EDR	AFR team	AFR	C.DUFAURE	AQ		
APS team	EDR	J. FALAIX	EDR				
Electronic design team	EDR						
MPN team	EDR						
Mech. & Elect. design team	EDR						
Software design team	EDR						

EQUIPMENT / SYSTEM: RAMSYS PRODUCT LINE

DOCUMENT CATEGORY: GENERAL QUALIFICATION PLAN

Number of pages: 46

Project n°: not applicable

N	May 19	DEVS 27471	A.POMMIER	G.LAPEYRE	C.CALI		
M	June 13	DEVS 21569	S.BRUYERE	A.POMMIER	C.CALI		
L	Aug 10	DEVN 18684	EHRWEIN	CALI	DUFAURE		
K	Oct 09	DEVS 17618	EHRWEIN	POMMIER	GASIGLIA		
J-M	May 07	Clarifications	POMMIER	GOURONC	MASCLET		
J	July 06	Update 7 : add new EDF CST	POMMIER	GOURONC	MASCLET		
H	Jan 06	Update 6 : add new customer's specification	POMMIER	GOURONC	MASCLET		
G	July 04	Update 5 : new and updated applicable standard	POMMIER	GOURONC	PONCELET		
F	June 02	Update 5 : for customer's spec and 1E requirements	POMMIER	GOURONC	/		
E	April 97	Update 4 : for new organization and customer's specification	POMMIER	GOURONC	/		
D	Jan 96	Update 3 : for type test report 111145 compliance	POMMIER	CHLOSTA	/		
C	Aug 94	Update 2	POMMIER	CHLOSTA	/		
B	June 94	Update 1	POMMIER	CHLOSTA	/		
A	Dec 93	Edition originale First edition	POMMIER	CHLOSTA	CHAPELOT		
Inf. Rev	DATE	EVOLUTION Evolution	MF	Num Name	Visa	Num Name	Visa
				Redige par Written by		Verifie par Checked by	
						Approuve par Approved by	

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Qualification phases

Phase 2 - Qualification Realization – Test sequence

Equipment qualification shall demonstrate functionality of the EUT under all specified conditions over its entire operating life.

A series of tests is performed in specified order.

IEC/IEEE 60780-323:2016	Test Description	Mirion tests
§ 7.4.1.8 a)	Identify test sample	Initial tests
§ 7.4.1.8 b)	Specified functional test under normal conditions	Functional / Reference tests
§ 7.4.1.8 c)	Test to the extremes of all normal conditions	Climatic tests EMC tests
§ 7.4.1.8 d)	Age conditioning (if required)	Thermal Aging Mechanical Aging Radiation Aging
§ 7.4.1.8 e)	Seismic qualification (if required)	Seismic test
§ 7.4.1.8 f)	Simulated accident conditions (if required)	LOCA, MSLB, HELB, SA (if required)
§ 7.4.1.8 g)	Post-test inspection	Post-test inspection

Qualification phases

Phase 3 - Qualification preservation

- Test reports and the associated results are maintained within a Digital Management System (DMS).
- Whenever a product is modified, for example due to obsolescence, the change is reviewed in detail, with any possible effects on qualification being assessed and recorded in full.
- Should the qualification be impacted, a re-qualification is required.

Example



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Description and evaluation of modifications

Description and evaluation of modifications (formal) SA-1630019 F31DE ed.4

Short description of modification <i>Kurze Beschreibung der Änderung</i>	Type of MIL connectors (concerning surface coating) at warning unit NW 103.xx, peripheral devices (flash lamp, sounder) and cables NK 608 H, NK 618 HE, power cable for NW 103.xx is changed.		
Reason for Modification <i>Ursache der Änderung</i>	Achieve ROHS conformity. MIL connector with Cadmium coating (non-ROHS conform) is replaced by MIL connector with Nickel coating (ROHS conform)		
EMI*-no. <i>EMI*-Nr.</i>	E-2410072, E-2410114		

*EMI: Notification of development / Entwicklungsmitteilung

ECCN: N

AL: N

	Name <i>Name</i>	Date <i>Datum</i>	Signature <i>Unterschrift</i>
Responsible developer <i>Zuständiger Entwickler</i>	Andrea Münster	03.09.2024	
Plant expert <i>Werkstatteinverständiger</i>	Andreas Lautenbacher	09.09.2024	
Quality Management <i>Qualitätsmanagement</i>	Dr. Götz Berner	10.09.2024	

Edition: 1 / 2024-08-13
EMI: E-2410072, E-2410114

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QA aspects

EQ is done..

- under a specified QA program depending on country / customer (10CFR50, ISO 19443, KTA 1401,...)
- on routine tested series equipment – released production file for the EUT is required; traceability to version and type of EUT is documented
- using only calibrated laboratory test equipment for any test – calibration of all devices is documented and checked on a regular basis (e.g. annually)
- only in accredited external test facilities traceable to ISO/IEC 17025, with a proven NQA-1 program (depending on customer / country), or by Mirion CGD of service.
- by Mirion with traceability in all aspects

Example



EQ Risk Mitigation

There is a place for risk mitigation in all areas of qualification. The goal of safety nets is to allow us to be able to drive forward motion in our programs until suitability of the test specimen can be fully concluded.

*****Risk mitigation is a large differentiator versus competitors*****

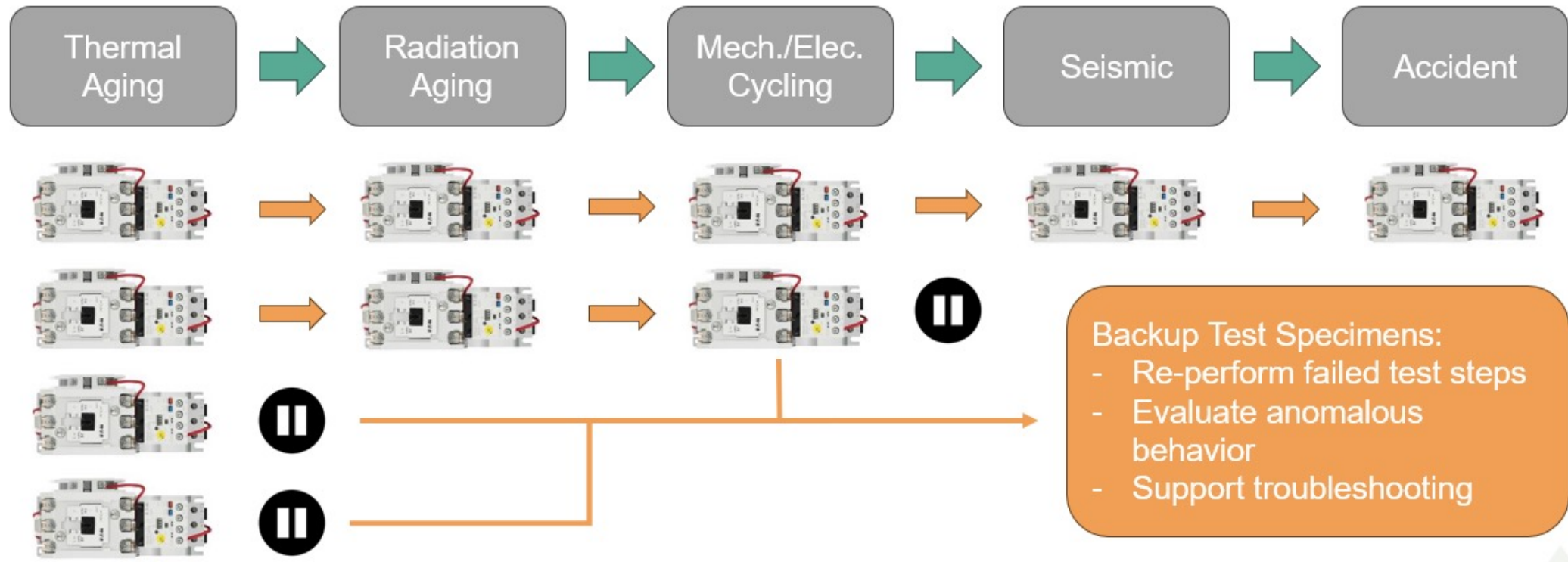
This serves to:

- *Avoid common downfalls in qualification*
- *Give ourselves room to be able to troubleshoot*
- *Give ourselves the ability to justify anomalous behavior*
- *Avoid having to restart our test programs to reach our formal conclusion on suitability*



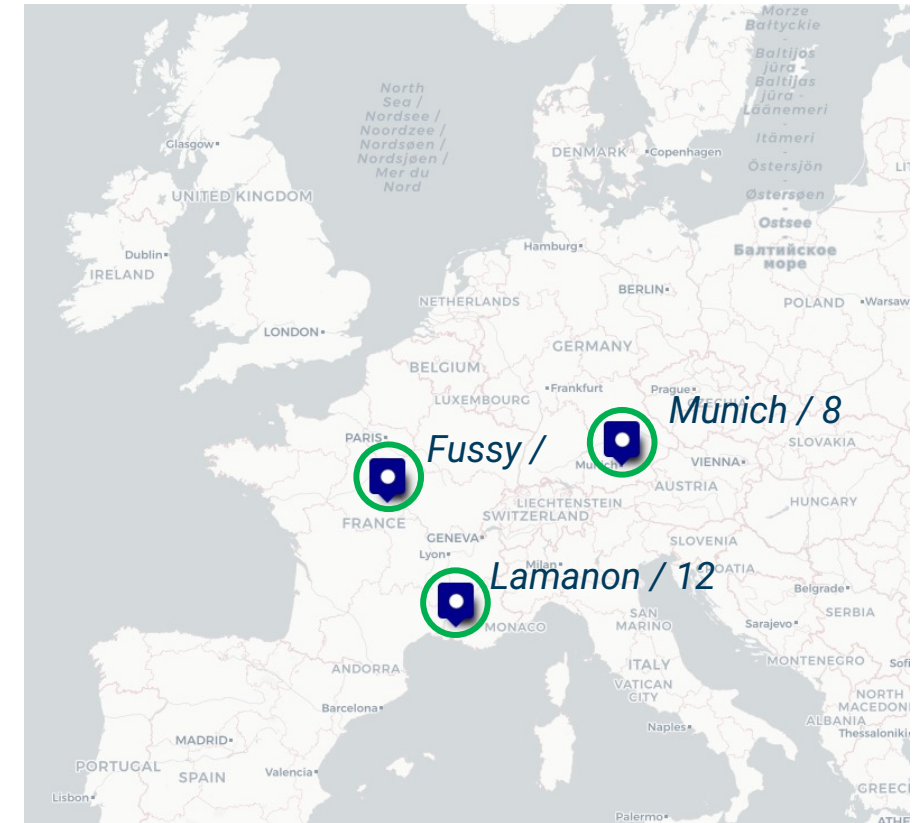
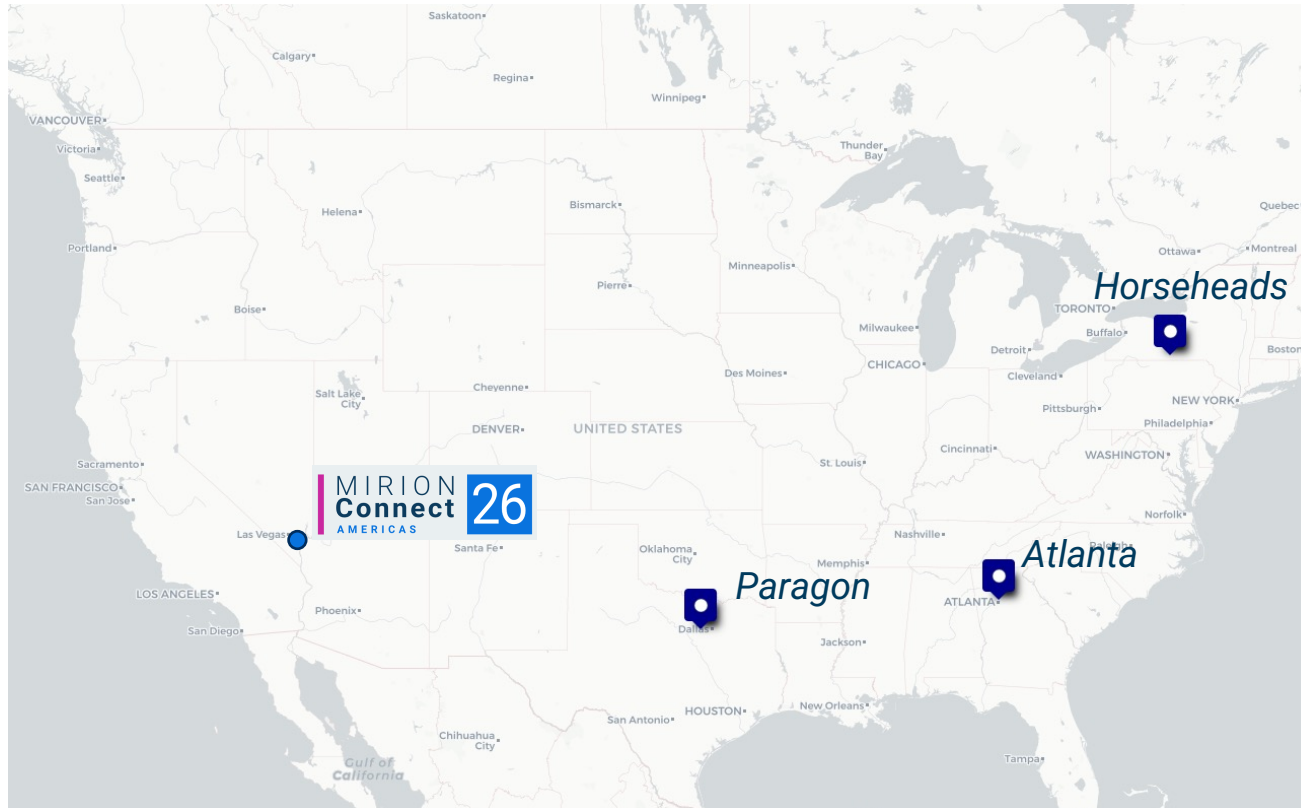
EQ Risk Mitigation: Number of Test Specimens

Starting off a qualification program with the right number of test specimens in the first step to building your safety net and is the first step in initiating a successful program.



Mirion Technologies sites including EQ

- Worldwide 6+ sites where qualification is performed
- In US EQ is built into each of the sites engineering teams per discipline
- European sites do have dedicated EQ Teams

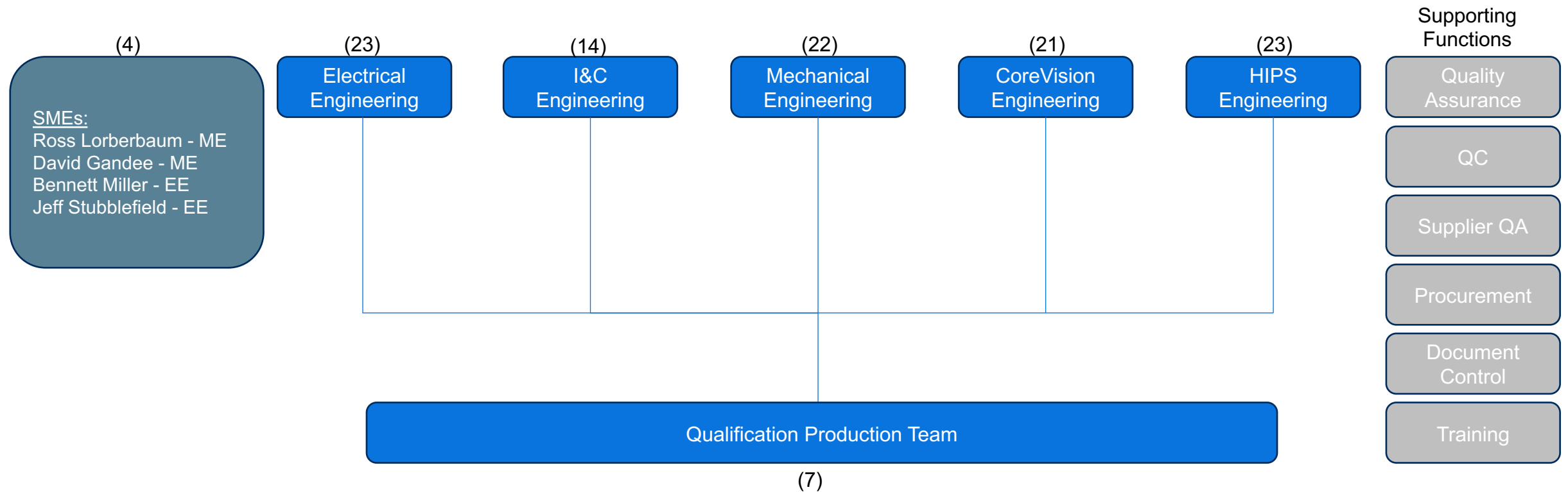


Independent EQ Teams (EUR)

- EQ teams are independent from the design Teams and dedicated to qualification of products and systems
- **EQ team mission:** *To ensure the compliance and performance of the products and systems according to*
 - *customer requirements,*
 - *Technical specifications,*
 - *Reference and applicable standards*
- EQ teams are involved throughout the entire project lifecycle, from early project phases to final system
- **EQU teams consists of:**
 - *Team leader*
 - *Software qualification (V&V)*
 - *Hardware qualification*

Integrated EQ (US): Example Paragon

- Qualification knowledge is built into each of our engineering teams per discipline.
- Knowledge transfer program is critical as our engineering teams continue to grow.

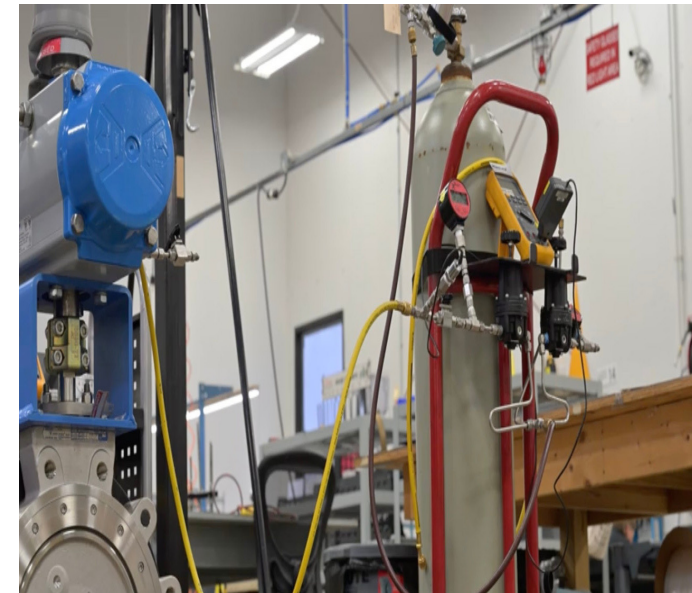
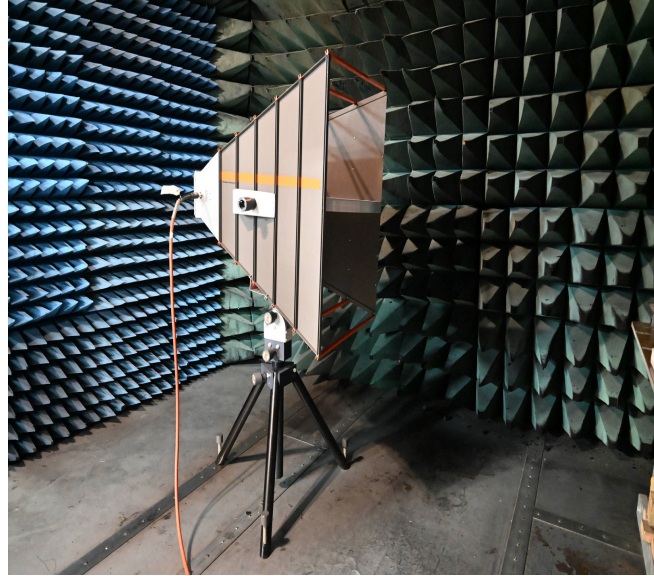


EUTs & Specific Knowledge

- *Neutron Flux Monitoring Systems (NFMS)*
- *Reactor Protection Systems (RPS)*
- *Radiation Monitoring Systems (RMS)*
- *Electrical Penetration Systems (EPS)*
- *I&C Analog and Digital Electronics*
- *Motor Control Center Buckets (MCCs)*
- *Control Panels*
- *Low & Medium Voltage Switchgear*
- *Commercial Mechanical Equipment (Valves, Actuators, Positioners, etc.)*
- *Commercial Electrical Equipment (Starters, Relays, Breakers, Switches, etc.)*
- *HVAC (Room coolers, Chillers, air handlers, etc.)*

EQ In-House Capabilities

- *Seismic Analysis & Testing*
- *Thermal Aging*
- *Cyclic Aging / Testing*
- *EMI/RFI Testing*
- *Radiation Testing (Outsourced)*
- *Loss of Coolant Accident (LOCA)*
- *High Energy Line Break (HELB)*
- *Chemical / Water Spray*
- *Submersion*
- *Flame Testing (Outsourced)*
- *Any Required Equipment Modification*



In-house Climatic and Thermal and Aging Capabilities

Multiple Thermal Chambers are available on each site

@Paragon



@Europe, Atlanta, Horseheads



Irradiation Capabilities

- *Irradiation is mostly performed at external test labs or research facilities*
- *Labs are accredited or approved by Commercial Grade Survey (CGS) or Source Inspection (SI).*



In-house: EMC/EMI Capabilities

Scope

- Radiated Emissions
- Conducted Emissions
- Radiated Susceptibility
- Conducted Susceptibility
- Fast Transient Susceptibility
- Surge Susceptibility
- Electrostatic Discharge Susceptibility

In-house EMC lab:

- NRC Reg. Guide 1.180 compliant
- EPRI TR-102323 compliant
- MIL-STD-461
- IEC compliant

@Paragon



In-house: Seismic Capabilities

Types of Seismic Testing Activities:

- Resonance Search
- Vibration Aging
- Multi-Frequency Testing (OBE & SSE [DBE])
- RIM (Required Input Motion)

At Paragon four (4) seismic tables are available:

- **Seismic Table 1** - Is a small electrodynamic bi-axial table used to test individual components, such as relays and switches.
- **Seismic Table 2** - Is a computerized hydraulic bi-axial table (6' x 6') with a capacity of 15,000 lbs. Maximum levels of 6g ZPA and over 40g peak accelerations can be obtained. The table stroke of 18" allows us to meet low frequency spectra.
- **Seismic Table 3** - Is a large computerized tri-axial hydraulic table (10' x 10'). This table is used to test large components and assemblies up to 14,000 lbs.
- **Seismic Table 4** - Is a medium computerized tri-axial hydraulic table (4' Hexagon). This table is used to test mid-sized components and assemblies up to 2000 lbs.

@Paragon



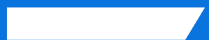
In-house Accident Testing

Accident chambers available in:

- *Munich for radiation detectors with associated cables*
- *Paragon historically performed this testing in-house.*
 - *Plans to update our accident setup with automated controls to enhance capability/safety.*
 - *Chambers fabricated in-house.*
 - *LOCA/HELB with Boric Acid spray*

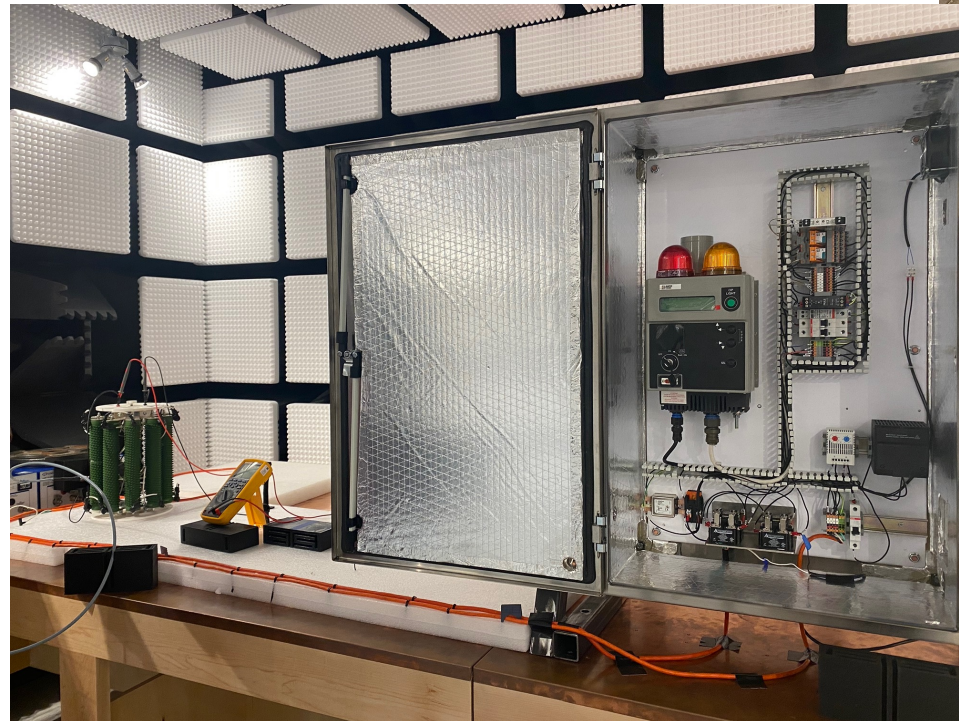
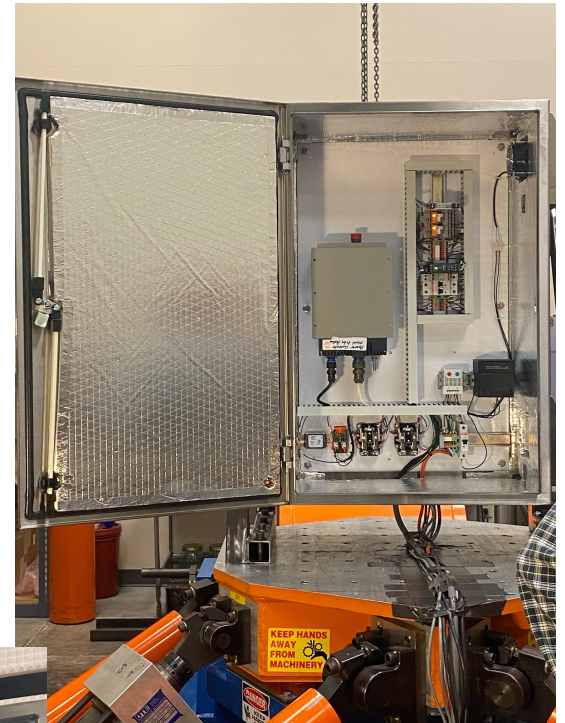


EQ examples



US Application specific Qualification

- *RAMSYS Equipment in outdoor application*
 - *CGD of additional SR 3rd party components (Relays)*
 - *LMN MPE of RAMSYS monitor*
 - *Component irradiation testing*
 - *System Seismic*
 - *System EMC testing*

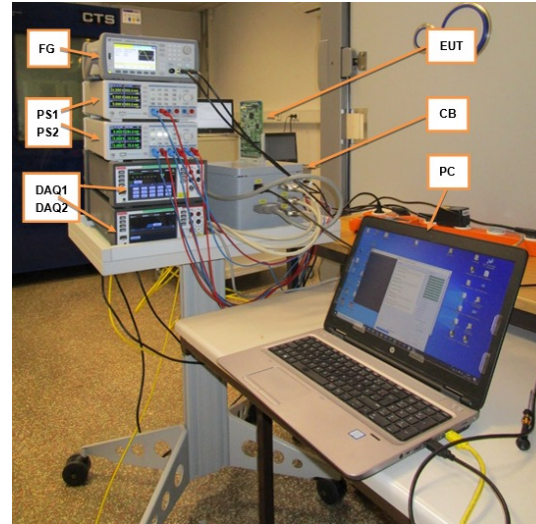


NMS proTK – Digital electronic module qualification

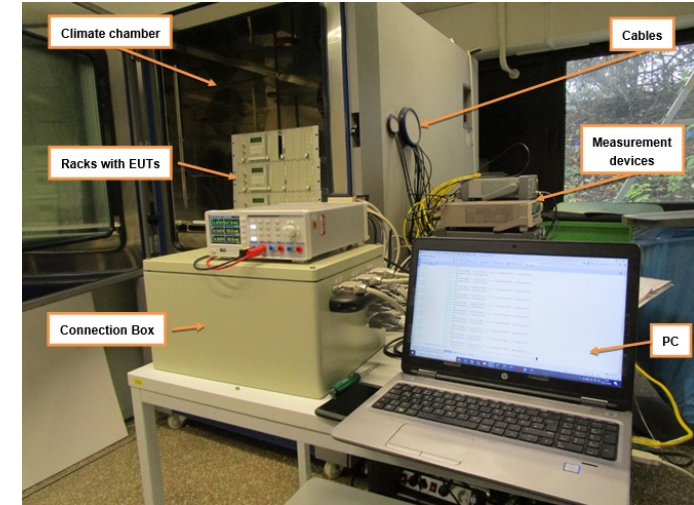
Test setup proTK™/260 series



Initial / functional tests



Inhouse climatic tests



Radiation Aging

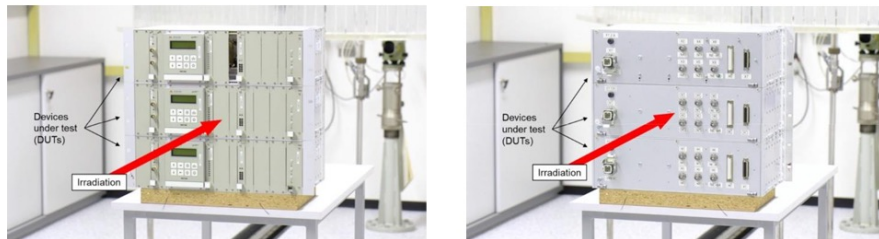
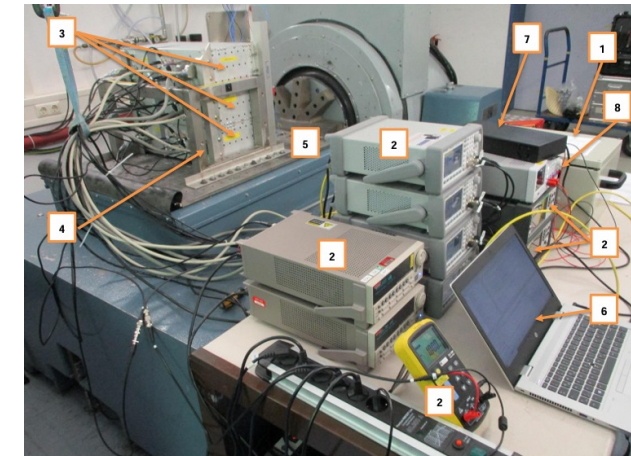


Figure 8: Realization Radiation Aging - half the total dose was applied with the devices' front sides facing the Co-60 beam (left), the second half with their rear sides facing the beam (right).

Vibration / Shock tests

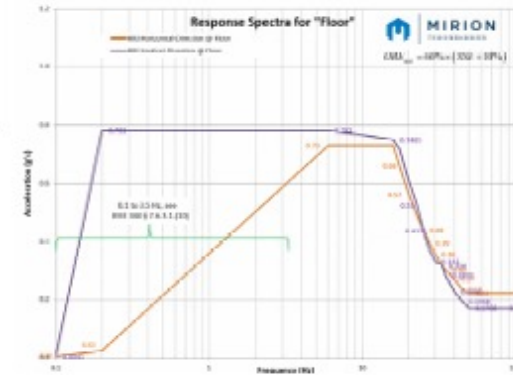
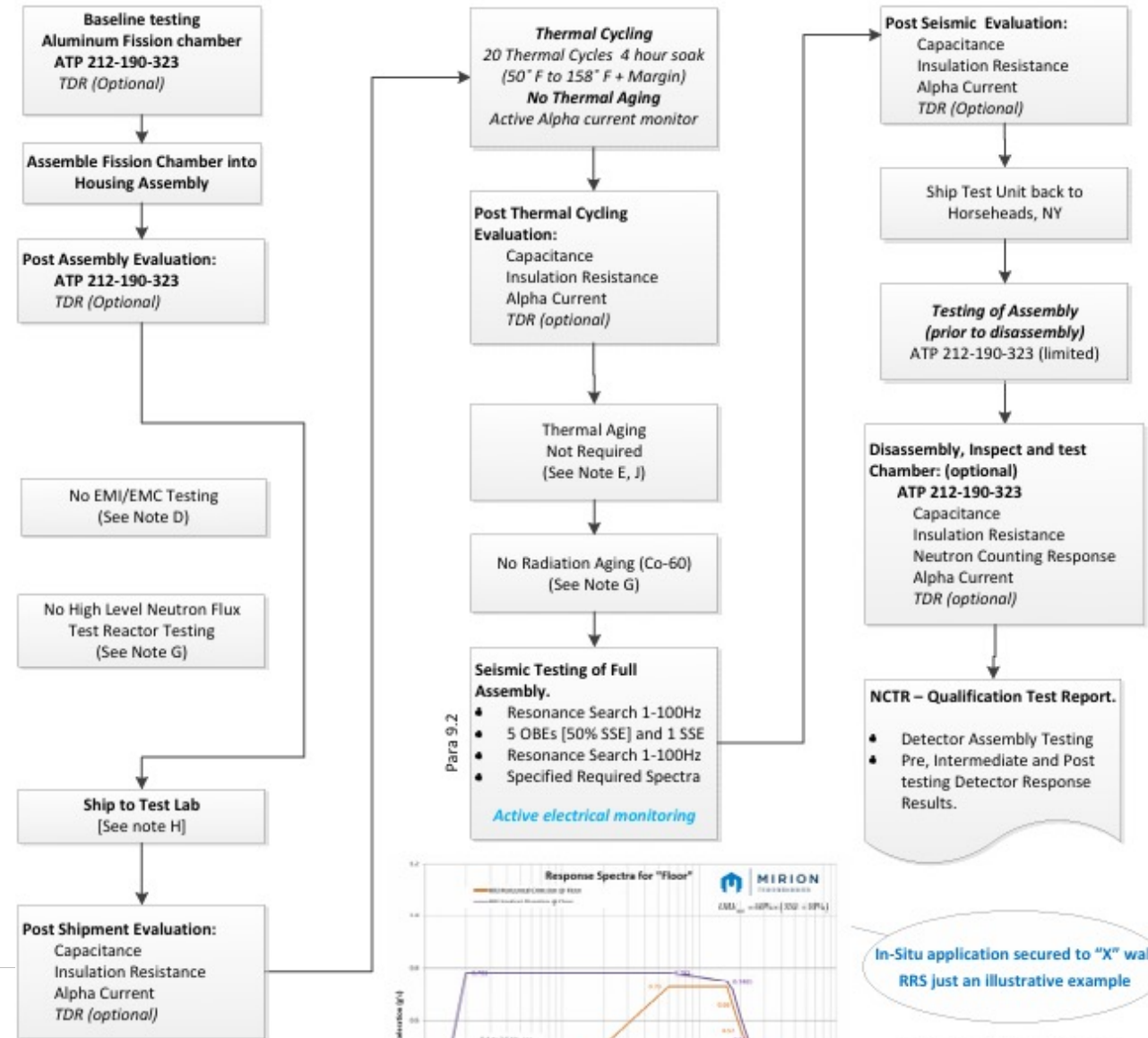
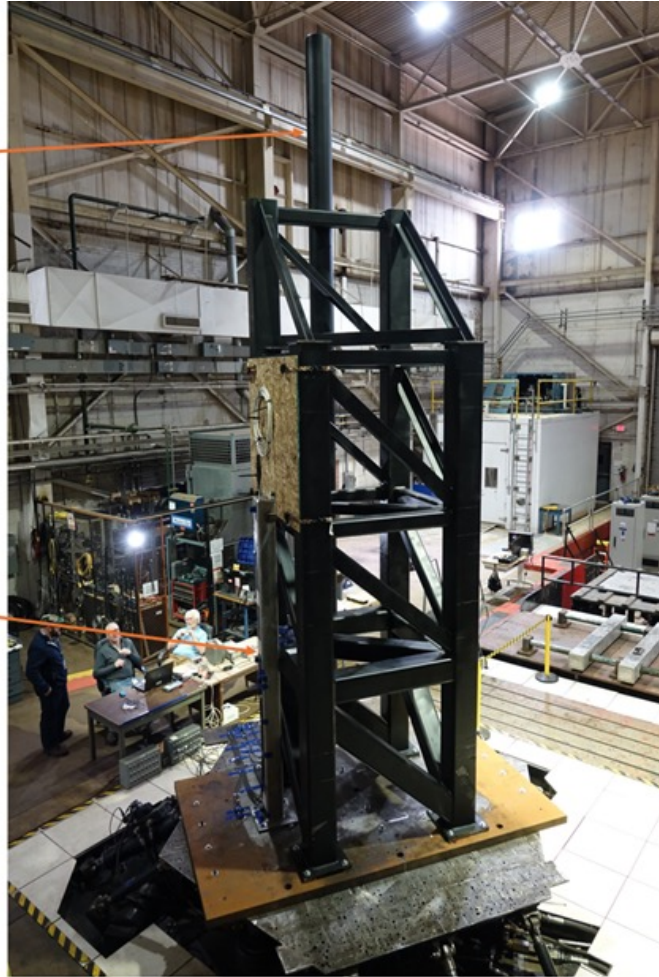


Example FC EQ Sequence

AP1000
Instrument Tube
Mounted on Front
(in prep for WEC Testing
non-Mirion IR Assembly)

Assembly will be loaded
Into tube using WEC
EDIT (*excore detector
insllation tool*).

TerraPower
Instrument Tube
Mount on Side (cut off
from structure on
4/10/2026)



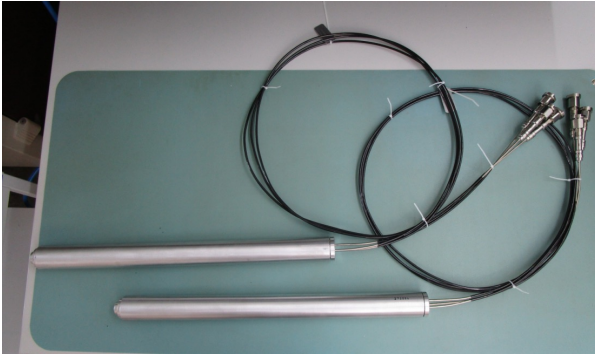
In-Situ application secured to "X" wall
RRS just an illustrative example

Clark Testing Lab Seismic Table

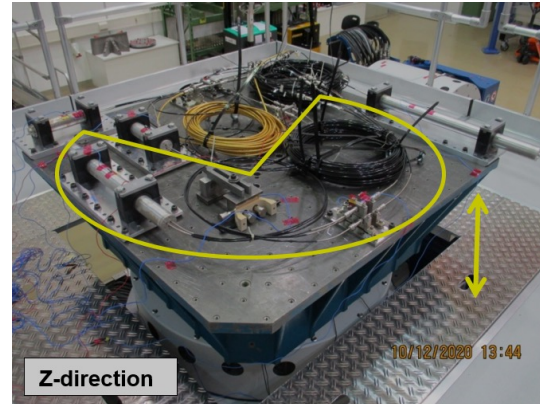
Table 1	Tri-Axial (Anco)
Size	15'L x15'W x45'H
Payload	25,000lbs
Acceleration	8G ZPA, 18G SRS
Frequency Range	1-100Hz

Detector qualification (example: CIC)

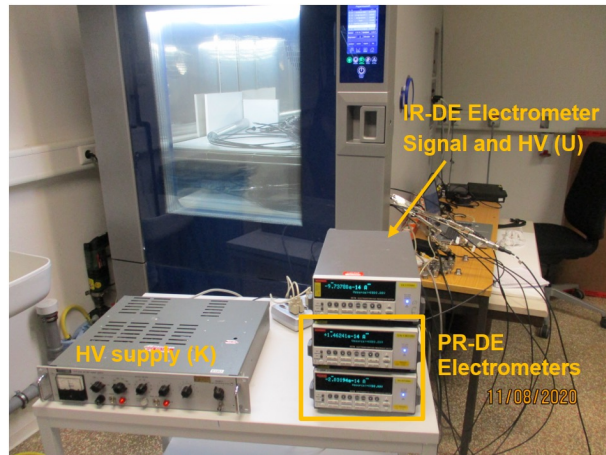
Initial / functional tests



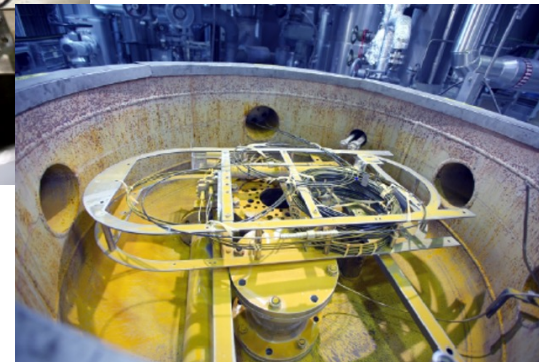
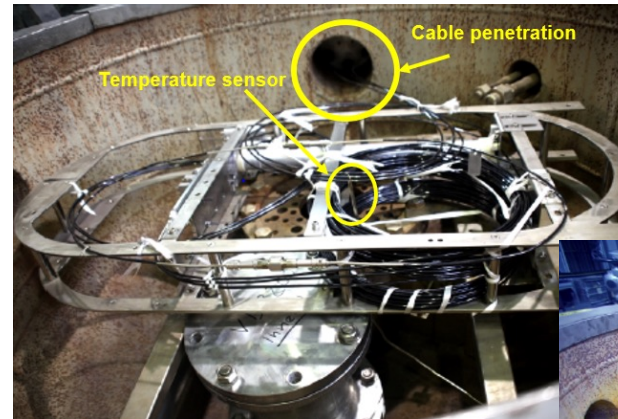
Vibration/Shock tests



inhouse Climatic tests



LOCA / Submergence

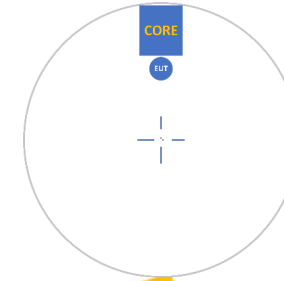
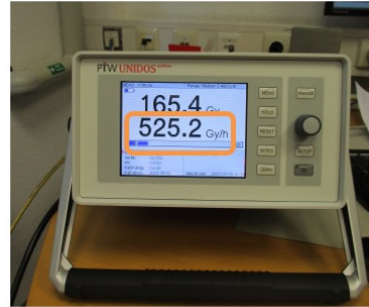
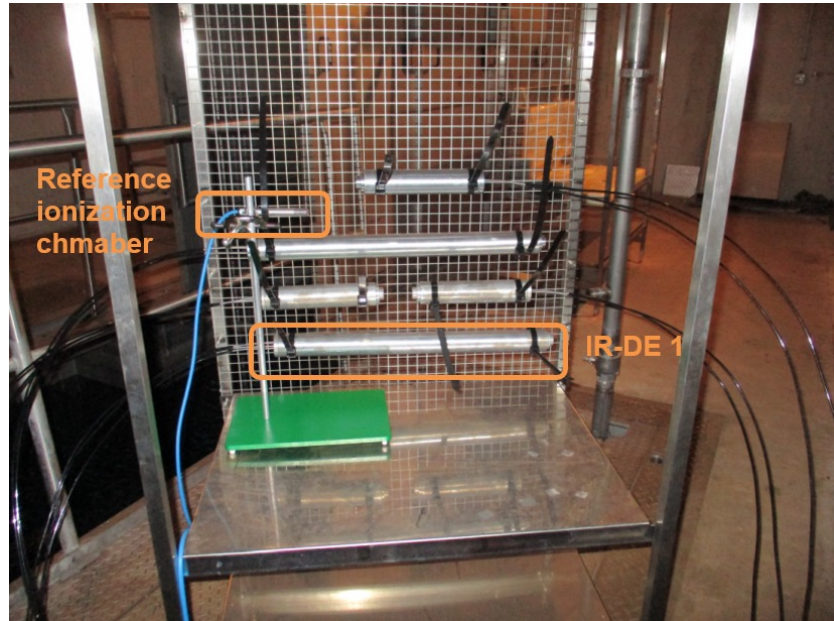


Seismic test

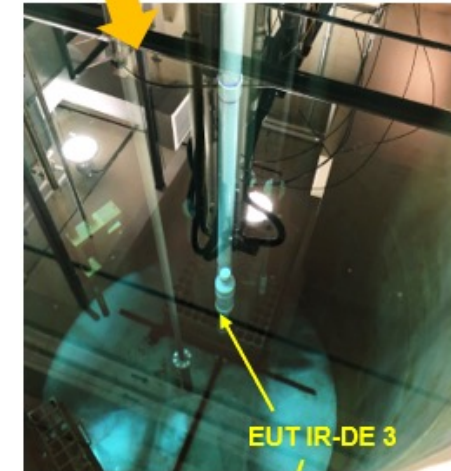


Detector qualification (CIC)

Operation under gamma radiation



Operation under
neutron flux
(reactor test)

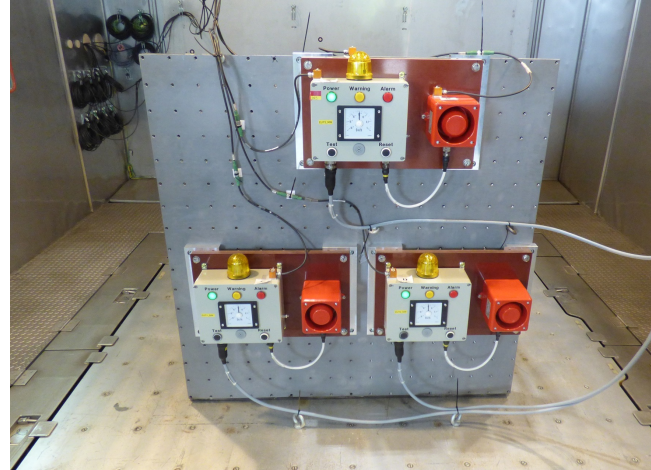


NMS/RMS/EPA Component tests - examples

Climatic tests
(pressure devices)



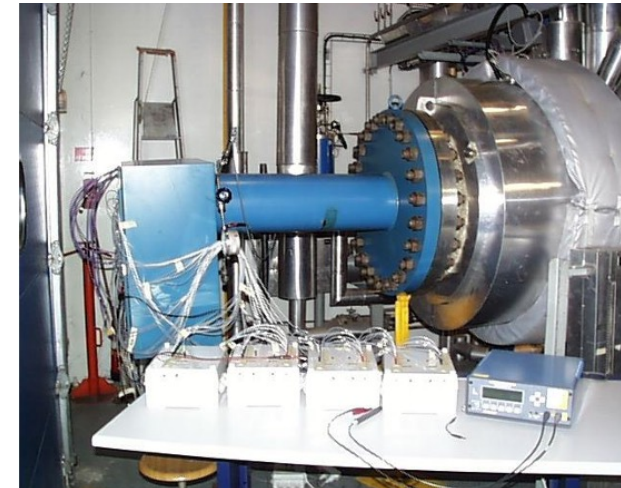
Seismic test
(Warning unit)



DBE tests
(Gamma ionization chambers)

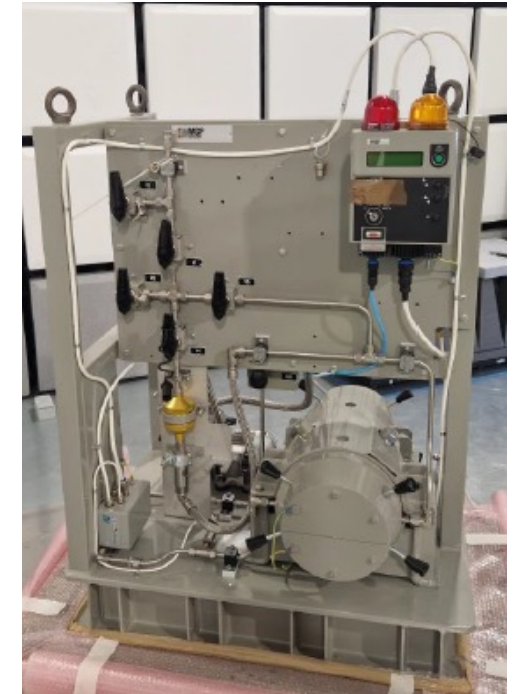
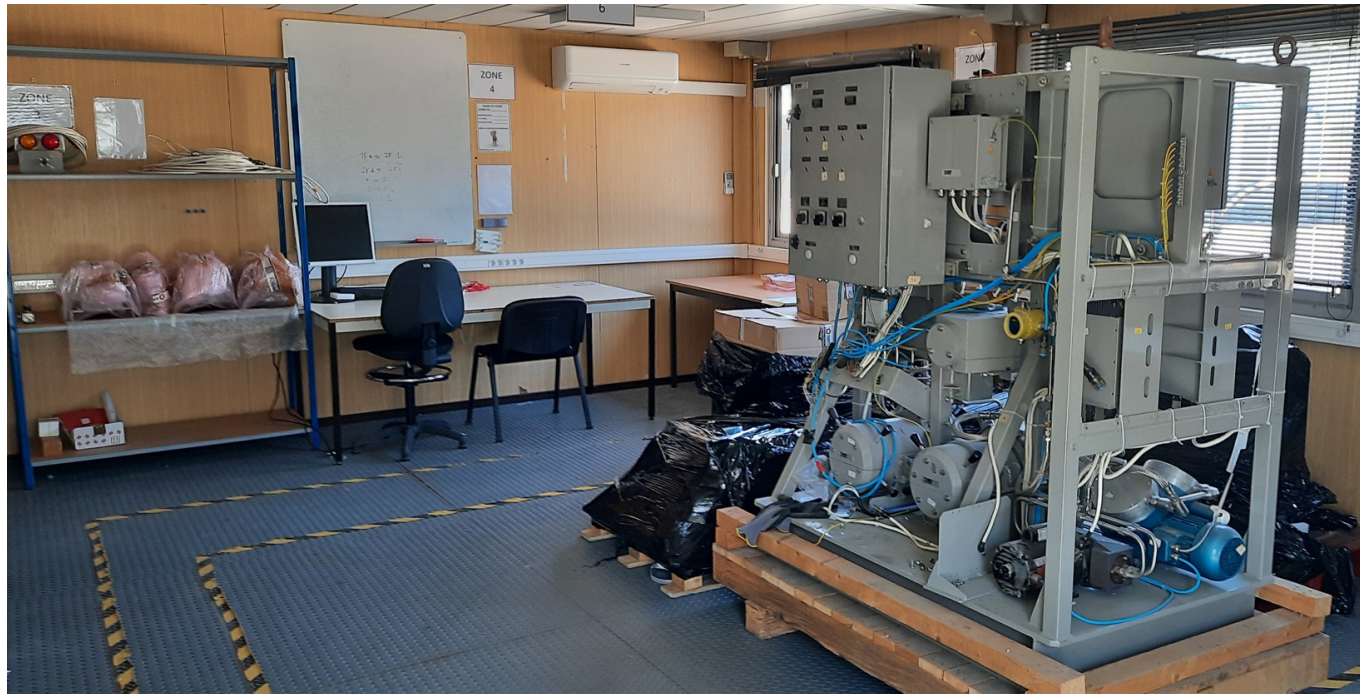


(Electrical Penetration Assemblies)



RAMSYS: Current EQ projects / workload

- qualification campaign 2024 – 2026
- consisting of 7 monitors + 1 boronmeter + 1RDU3 cabinet

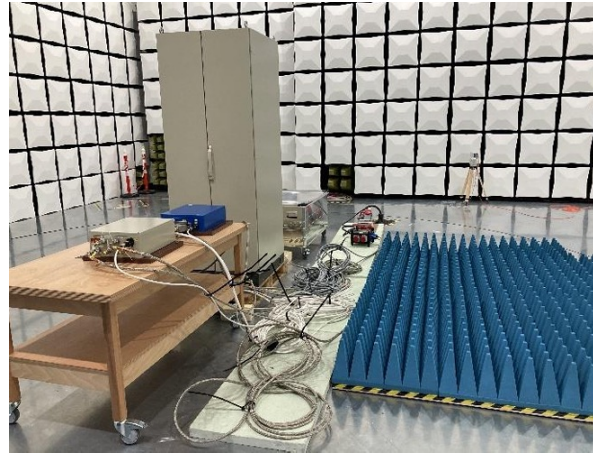


NMS/RMS/MCC: System Test

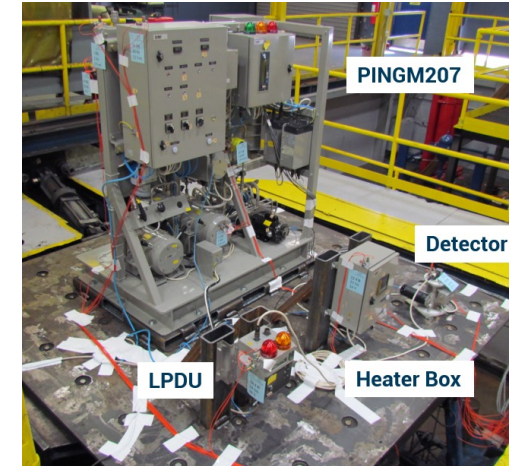
Climatic tests
(NFMS)



EMC tests
(NFMS)



Seismic test
(RAMSYS)



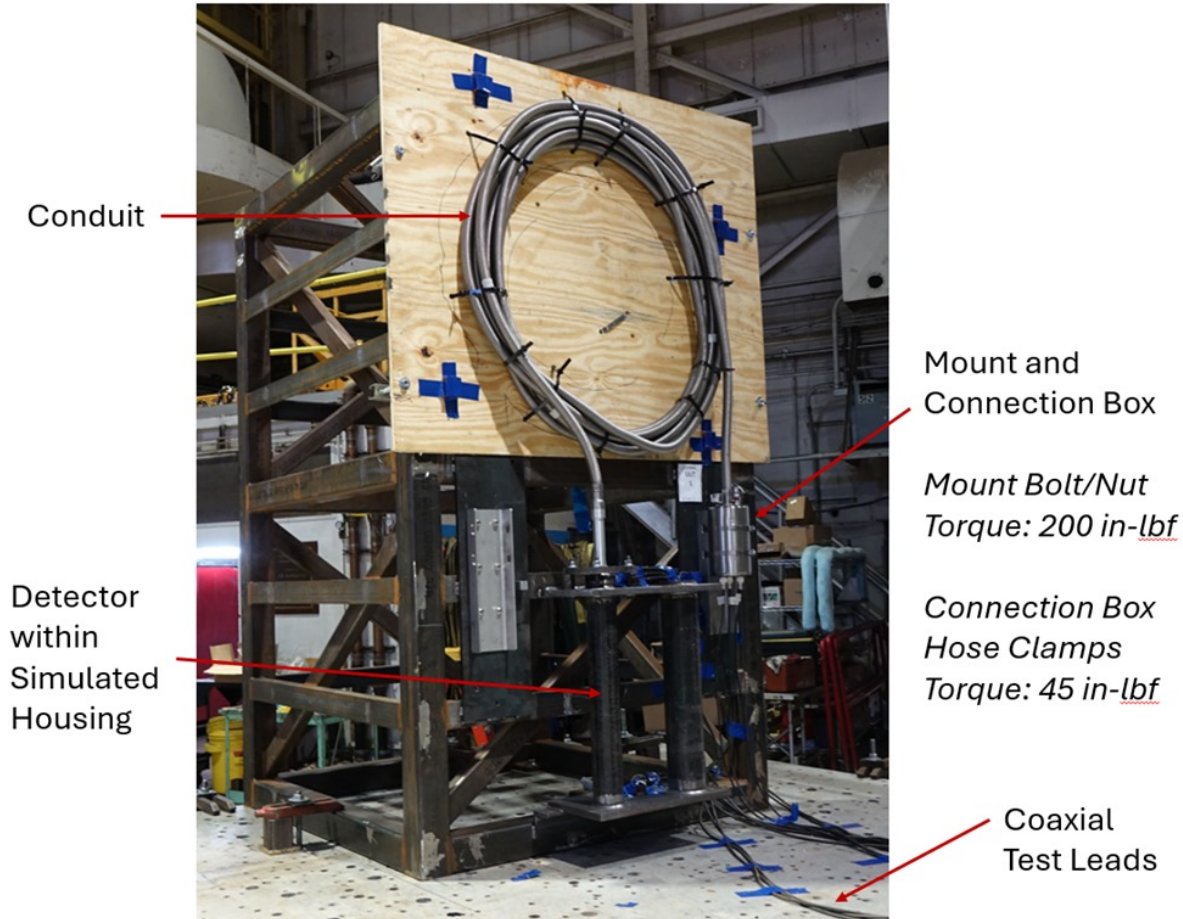
(Motor Control Center)



Advancing Radiation Safety.
Empowering Progress.

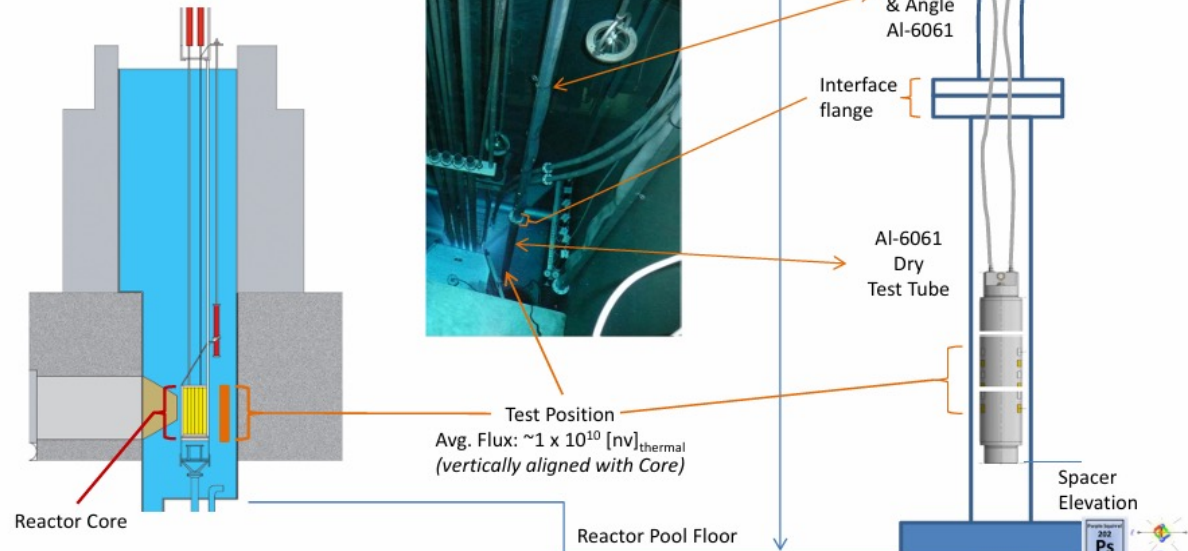
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NMS Fission Chamber Assembly Qualification



"Swimming Pool" Test Reactor

- Steady-State Power: 1 Megawatt_{thermal}
- Fuel:
 - Length of Active Fuel 24 inches [61 cm]
 - Enrichment 4.0 wt% U-235
- Moderator:
 - Material H₂O (light water)
 - Temperature 70°F - 105°F [21 °C - 41°C]

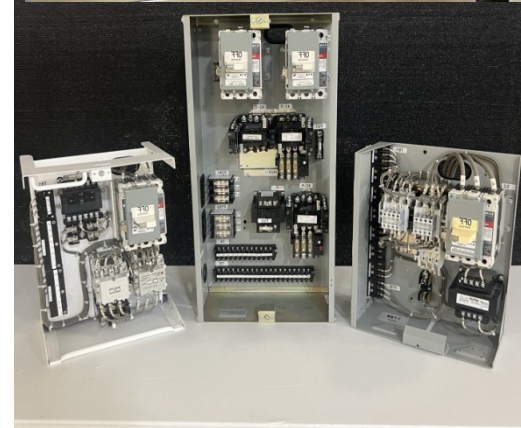


Slide 6 JEL

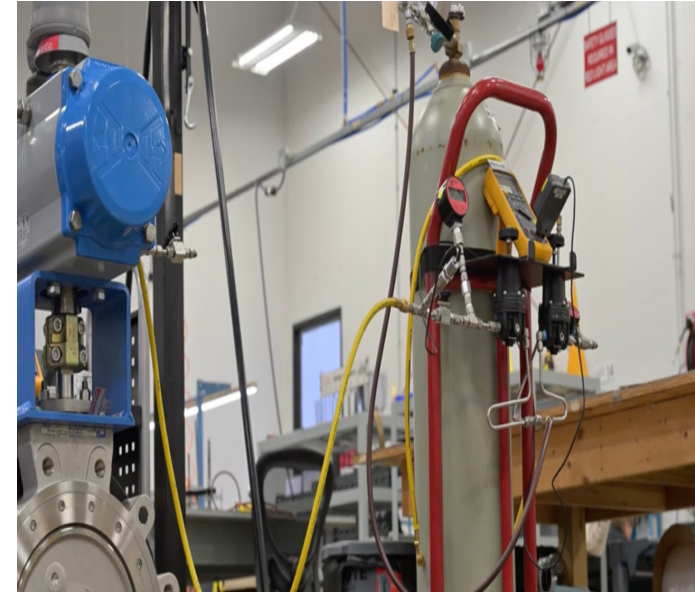
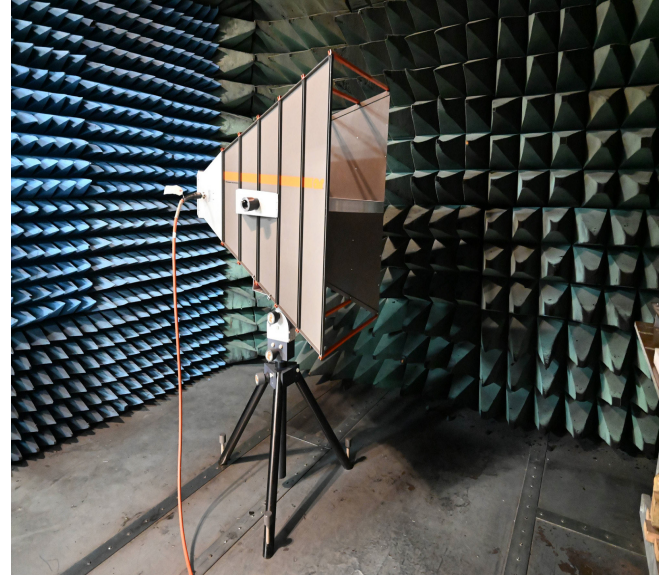
Paragon Examples

Paragon has qualified over 12,000 different components/assemblies:

- Motor Control Center Buckets (MCCs)
- Control Panels
- Low & Medium Voltage Switchgear
- Commercial Mechanical Equipment (Valves, Actuators, Positioners, etc.)
- Commercial Electrical Equipment (Starters, Relays, Breakers, Switches, etc.)
- HVAC (Room coolers, Chillers, air handlers, etc.)
- I&C Analog Electronics (Commercial, Reverse Engineered, Paragon Designed)
- Neutron Flux Monitoring Systems
- Reactor Protection Systems



Paragon Examples



Other EQ Topics

Commercial Operating Fleet Versus New Nuclear

- New Nuclear EQ requirements are somewhat undefined
- Uncertainty around what standards to use
- New aging mechanisms and higher environmental parameters

Mirion has worked to help develop qualification specifications for these customers.



Commercial Grade Dedication (CGD)



Commercial Grade Dedication

The Challenge

Many components used in nuclear applications are only available as commercial products and are not manufactured under an NQA-1 QA Program.

The Solution

CGD provides reasonable assurance that a commercial item will perform its intended safety function and can be accepted for safety-related service.

Mirion Commercial Grade Dedication Service

✓ CGD Packages

- *Top-down system-to-component approach*
- *In-house dedication of Mirion Equipment*

✓ Verification Services

- *Critical characteristic identification & verification*
- *In-house CGD and testing support*

✓ Third-Party Component Services

- *CGD of 3rd party components*
- *Over 20,000 CGD plans created and in the Paragon library*

Regulatory Frameworks

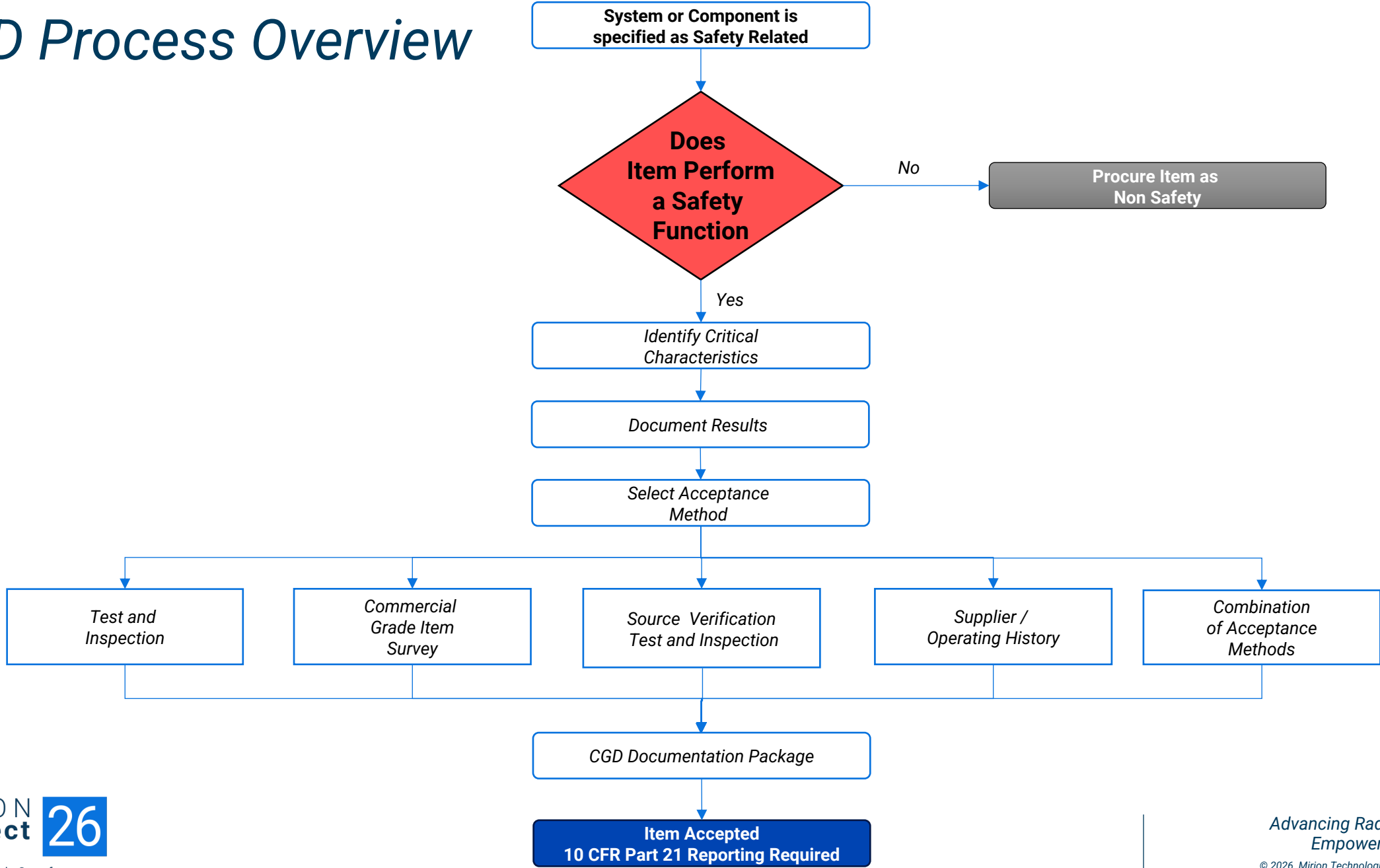
- **10 CFR 50 Appendix B** – *Quality Assurance Criteria*
- **10 CFR 21** – *Reporting of Defects and Noncompliance*
- **NRC Regulatory Guide 1.33 February 1978** – *Quality Assurance Program Requirements.*
- **NRC Generic Letter 89-02 – 1989** *Actions to Improve the Detection of Counterfeit and Fraudulently Marked Components.*
- **NRC Generic Letter 91-05 – 1991** - *Licensee Commercial-Grade Procurement and Dedication Programs*
- **NRC SECY 89-010 -1989** - *Advanced Notice of Proposed Rulemaking Acceptance of Products Purchased for Use in Nuclear Power Plant Structures, Systems, and Components*
- **NRC SECY 90-076 – 1990** - *Inspection and Enforcement Initiatives for Commercial-Grade Procurement and Dedication Programs*
- **EPRI NP-6629** – *Guidelines for the Procurement and Receipt of Items for Nuclear Power Plants*
- **EPRI NP-6406** - *Guidelines for the Technical Evaluation of Replacement Items in Nuclear Power Plants (NCIG-11)*
- **EPRI NP-5652** - *Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications*
- **EPRI TR-102260** - *Supplemental Guidance for the Application of EPRI Report NP-5652*
- **EPRI TR-017218-R1** - *Guideline for Sampling in the Commercial-Grade Item Acceptance Process [*
- **EPRI 3002002982** - *Guideline for the Acceptance of CGI*
- **EPRI 3002002289** - *Guideline for the Acceptance of Commercial-Grade Design and Analysis Computer Programs Used in Nuclear Safety-Related Applications*
- **EPRI 3002029261**-*Commercial_Grade Item Dedication CGD Experience and Efficacy*
- **EPRI TR-102323, Rev. 0 through 5** – *Guideline on the Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications*

Verification Method Overview

Method	How Compliance is Verified
<i>Special Tests & Inspections</i>	<i>Direct testing and inspection of critical characteristics</i>
<i>Commercial Grade Survey</i>	<i>Assessment of supplier quality controls and processes</i>
<i>Source Verification</i>	<i>Witnessing manufacturing, inspections, and testing</i>
<i>Supplier / Operating History</i>	<i>Evaluation of proven performance and operating experience</i>

Most dedication packages employ multiple verification methods to provide reasonable assurance of intended safety function at reasonable costs

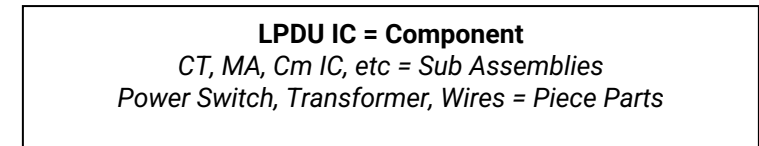
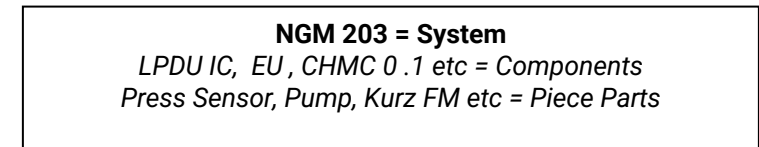
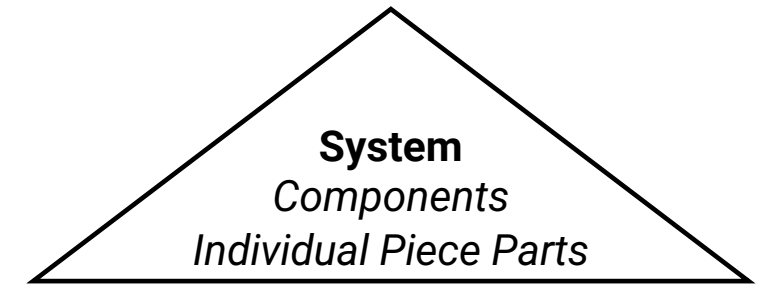
CGD Process Overview



Mirion CGD Package Approach

Safety starts at system level

- *Top-Down Dedication Approach*
 - *System Material Procurement Evaluation (MPE)*
-
- *System MPE – Define System Safety Functions, Failure Modes, Critical Characteristics (cc), and safety classification of all components and piece parts of the system.*
 - *Component Evaluation – Define Component Safety Functions (as it relates to the system) Failure Modes, critical characteristics (cc), and Safety classification of all sub assemblies and piece parts of the component.*
 - *Piece Part Evaluation – Define Piece Part Safety Functions (as it relates to the parent component), Failure Modes, critical characteristics*



By starting at the system level and flowing requirements down to components and piece parts, Mirion ensures dedication efforts focus on characteristics that truly impact safety

Paragon's Proven Process

- **Technical Evaluation** - are performed to determine the Quality and Technical requirements for the Purchased item. This is the 1st phase in the Commercial Grade Dedication Package.
- **Item Description** – The Evaluation will identify the Name and Manufacture of the Item being Dedication. In addition, the *unique code used to identify the item in the plant's inventory management system.*
- **Parent / Host Component information** - Provide information on the actual function(s) of the component within the system in which it is installed.
- **Bounded Scope of Use** - Bounding the scope requires clearly defining the postulated safety functions on which the commercial-grade item dedication technical evaluation and acceptance plan are based.
- **Failure Modes/Mechanisms and Effects Analysis** - The credible failure mode(s)/mechanism(s) associated with safety functions of the item in its operating environment are considered in the selection of critical characteristics.
- **Operating Experience/Historical Performance Information** - Document the operating experience reviewed to identify information about the quality of the item.
- **Critical Characteristics** – are those important design, material, and performance characteristics of a commercial grade item that, once verified, will provide reasonable assurance that the item will perform its intended safety function
- **Acceptance Method** - This involves identification of acceptance methods that will be used to verify the critical characteristics identified in the technical evaluation.

Paragon's Procedures

- **10 CFR 50 Appendix B** – *Quality Assurance Criteria*
- **10 CFR 21** – *Reporting of Defects and Noncompliance*
- **QAP-03** - *Design Control*
- **QAP-08** - *Identification and Control of Items*
- **QAP-10** - *Inspection*
- **QAP-11** - *Test Control*
- **QAP-12** - *M&TE*
- **ENG-01** – *Commercial Grade Dedication*
- **ENG-07** - *Control of Software and Software Dedication*
- **ENG-12** - *Failure Modes and Effects Analysis and Item Safety Classification*
- **ENG-21** - *Failure Analysis*
- **ENG-25** - *Custom Design*
- **SOP-026** - *Production Travelers*

Acceptance Methods Details

Method 1: Special Tests and Inspections

Special tests and inspections, often referred to as Method 1, are performed by the dedicating entity after the item is received to verify selected critical characteristics. The testing and inspections performed should ensure that the selected critical characteristics of the item are verified. Acceptance criteria, including tolerances (when applicable), must be documented to facilitate conduct of acceptance activities when a special test or inspection is specified.

Method 2: Commercial-Grade Survey

Conducting a commercial-grade survey of a supplier is often referred to as Method 2. Supplier audits to verify compliance with a nuclear QA program (such as auditing to the requirements of 10CFR50, Appendix B [7]) do not meet the intent of a commercial-grade survey. A commercial-grade survey is a performance-based assessment of a supplier conducted to determine the adequacy of supplier quality controls that are directly related to ensuring that the critical characteristics of the product being dedicated are acceptable.

Method 3: Source Verification

Source verification, often referred to as Method 3, entails verification of critical characteristics during manufacture and testing of the item being procured. Source verifications are typically performed in conjunction with key milestones in the production process or final testing so that important activities can be witnessed by the dedicating entity. Section 9 of this report explores source verification in more detail.

Method 4: Item/Supplier Performance Record

The performance history (good or bad) of the item and supplier is a consideration when determining the use of the other acceptance methods and the rigor with which they are used on a case-by-case basis. Specific regulatory expectations for the use of a supplier's or item's performance record are included in NRC GL 89-02

Custom Design Dedication

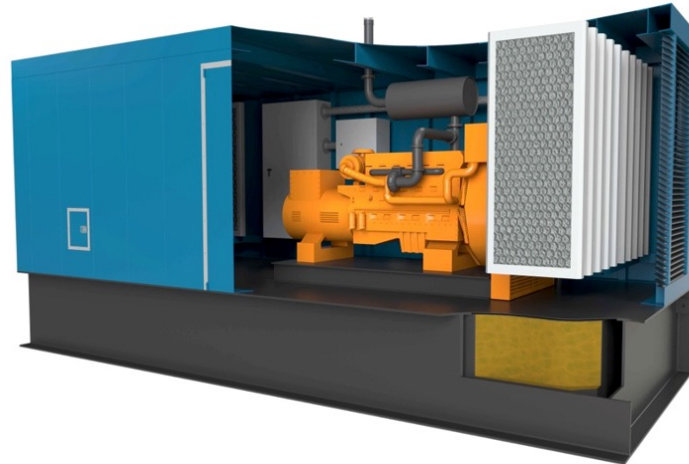
✓ Design and Dedication

- *Design utilizing COTS equipment*
- *Critical characteristic identification & verification per Paragon procedures and processes*
- *Qualification plan development and testing*
- *In-house CGD plan development and testing*
- *Complete safety related documentation package provided, including:*
 - *Drawings*
 - *Qualification Plan & Report*
 - *Dedication Plan & Report*
 - *Instruction & Operation Manual*



Dedication Services

- **Third-Party Dedication Services**
- **Paragon is the largest Third-Party provider of Safety Related equipment to the nuclear industry**
- **Over 20,000 dedicated items supplied over 3 decades**
- **Any conceivable items required as safety related, including:**
 - **Water, Grout & Sand**
 - **Electrical components**
 - **Mechanical components**
 - **5-Mw generators**
 - **Diesel generators**
 - **HVAC equipment**
 - **And so much more...**



Typical CGD Plan

Step	Purpose
Item Description	Define item, manufacturer, model, and intended application
Failure Modes Analysis	Identify credible failure mechanisms affecting safety function
Operating Experience & Inspection Attributes	Utilize historical performance and define inspection criteria
Critical Characteristics	Define attributes that provide assurance of safety function
Safety Function Basis	Establish the technical basis linking characteristics to safety function
Review & Approval	Independent review and approval of dedication package

Each dedication package provides traceable technical justification that the commercial item will perform its intended safety function.

Open Discussion





Back-up



CGD Plan Detailed



Item Description

- Identify the Items Name, Manufacturer / Model Number and Stock Code, if applicable.
- This information will be traceable back to the Technical Evaluation completed for the Item.
- Ramp Generator / Singal Converter Woodward Model 9903-015

Commercial Grade Item Dedication Technical Evaluation and Test Plan			
Document Number	CGD-9903-015	Revision	

SECTION A: ITEM DESCRIPTION

Inventory Control No. / Cat. ID / Stock Code:	
Noun Identifier:	Ramp Generator and Signal Converter
MANUFACTURER NAME	MANUFACTURER MODEL / PART / CATEGORY NUMBER(S)
Woodward	9903-015

Revisions:

Revision	Description of Revision	Revision Impact (Note 1)	NCR # (If Applicable) (Note 1)
0	Initial Release	N/A	N/A
		☐ Yes ☐ No	

Note 1: Changes to the methodology or the acceptance criteria that are more conservative in nature shall be evaluated to determine if this revision adversely affects previously dedicated / supplied equipment. If so, an NCR shall be generated per QAP-15 to evaluate that appropriately.

End Use Information

- *This information is applicable to the Safety Classification and Functional Mode of the Parent Component.*
- *Safety Related component with both Passive and Active Mode*

Commercial Grade Item Dedication Technical Evaluation and Test Plan			
Document Number	CGD-9903-015		

SECTION B: END USE / PARENT / HOST EQUIPMENT INFORMATION

Note: If the specific end-use(s) / plant applications are not known, complete Section C of this form in lieu of Section B prior to proceeding.
☐ Not Applicable (Section C Completed Below)

EQUIPMENT ID (TAG) NUMBERS OR DESCRIPTION OF ITEM USAGE		
ID Numbers: N/A		
PARENT COMPONENT / HOST DESCRIPTION		
EG-M Module for Woodward EG-Type Governor Control System		
FUNCTIONAL SAFETY CLASS OF COMPONENT / HOST		BASIS / SOURCE
☒ Safety-Related ☐ Non-Safety Related (item is not a candidate for dedication)		Must be present in customer purchase order.
IDENTIFICATION OF PARENT COMPONENT / HOST EQUIPMENT FUNCTION(S)		
FUNCTIONAL MODE	BASIC SAFETY FUNCTION(S)	DESCRIBE (AS REQUIRED)
☐ Active ☒ Passive	Maintain Structural and Electrical Integrity	The RGSC must maintain structural and electrical integrity during and after design basis event.
☒ Active ☐ Passive	Maintain steam turbine speed	Maintain a steam turbine at a constant speed.
☒ Active ☐ Passive	Produce error signal	An error signal is produced by comparing the actual speed with the desired speed.
☒ Active ☐ Passive	Drive a valve actuator	Error signal drives a valve actuator which opens to increase speed or closes to decrease speed.
PARENT COMPONENT / HOST EQUIPMENT IS (CHECK ALL THAT APPLY)		
☐ HARSH EQ ☐ ASME SECTION III ☒ CLASS 1E ☐ CONTAINMENT PRESSURE BOUNDARY ☒ SEISMIC CLASS 1 ☐ SERVICE LEVEL 1 COATING ☐ OTHER (SEE BELOW) ☐ N/A		

Item Information

- This information is applicable to the Safety Classification and Functional Mode of the Item being Dedicated.
- Safety Related Item with both Passive and Active Mode

Commercial Grade Item Dedication Technical Evaluation and Test Plan		
Document Number	CGD-9903-015	

SECTION D: ITEM INFORMATION

ITEM DESCRIPTION		
Ramp Generator and Signal Converter		
FUNCTIONAL SAFETY CLASS OF ITEM		BASIS / SOURCE
☒ Safety-Related ☐ Non-Safety Related (item is not a candidate for dedication)		The item is safety related as indicated by the client Purchase Order.
IDENTIFICATION OF ITEM FUNCTION(S)		
FUNCTIONAL MODE	BASIC SAFETY FUNCTION(S)	DESCRIBE (AS REQUIRED)
☒ Active ☐ Passive	Signal Conversion	Convert the speed command signal to levels compatible for the EGM
☐ Active ☒ Passive	Maintain Structural and Electrical Integrity	The signal converter must maintain structural and electrical integrity during and after design basis event.
☒ Active ☐ Passive	Voltage Ramp	Provides voltage ramp at initial start-up
ITEM IS (CHECK ALL THAT APPLY)		
☐ HARSH EQ☐ ASME SECTION III ☒ CLASS 1E☐ CONTAINMENT PRESSURE BOUNDARY ☐ SEISMIC CLASS 1☐ SERVICE LEVEL 1 COATING ☐ EMBEDDED DIGITAL DEVICE☐ N/A ☐ OTHER:		

FMEA Analysis

- *This identifies the Creditable Failure Modes as determined by FMEA*
- *Electronic Component Failure, Loss of Structural Integrity and Isolation Failure.*

Commercial Grade Item Dedication Technical Evaluation and Test Plan			
Document Number	CGD-9903-015	Revision	0

SECTION F: FAILURE MODES / MECHANISMS AND EFFECTS ANALYSIS		
CREDIBLE FAILURE MODE / MECHANISM	EFFECTS ON SYSTEM / COMPONENT FUNCTION	CRITICAL CHARACTERISTICS
Electronic Component Failure	The effects of electronic component failures will be clearly evident during infant mortality testing and functional testing. Premature failure of these components would lead to improper or complete lack of functionality of the signal converter.	1, 2
Loss of Structural Integrity and Isolation Failure	Isolation failure could result in shorts to ground that could prompt loss of power to the devices in the circuit. Also, potential damage to equipment connected to the unit. A loss of structural integrity could create inability to install the subject unit into the host system.	3
BASIS FOR SELECTION OF CREDIBLE FAILURE MODE(S) / MECHANISM(S)		
The item's function was considered in evaluating failure modes, failure modes relating to its operation and configuration, factory/ assembly defects, and the safety functions it will be performing were all taken into account while analyzing failure modes.		
1. The ramp generator and signal converter is manufactured with a number of electronic sub-components. The sub-components are also susceptible to infant mortality. A sub-component failure could cause a failure of the overall power supply unit's ability to operate. 2. Failure modes affecting the item's configuration and dimensions were considered and evaluated. An Isolation failure could adversely impact the operation of the RGSC or connected systems, preventing the unit from performing its safety function.		

OE & Identification and Inspection Attributes

- Operating experience and Historical information also has a place to be included when available.
- Inspection Criteria, Sample Plan and Acceptance Criteria identified to provide Reasonable Assurance the Item will perform its Safety Function.

Commercial Grade Item Dedication Technical Evaluation and Test Plan				
Document Number	CGD-9903-015		Revision	

SECTION G: OPERATING EXPERIENCE / HISTORICAL PERFORMANCE INFORMATION

SOURCES REVIEWED AND RESULTS	RESPONSE
A review of Paragon's component experience database and the NRC website were performed, and no adverse operating experience specific to this Ramp Generator and Signal Converter was found.	N/A

SECTION H: IDENTIFICATION & INSPECTION ATTRIBUTES

IDENTIFICATION & INSPECTION ATTRIBUTE	DESCRIPTION OF INSPECTION	SAMPLING PLAN	ACCEPTANCE CRITERIA
Manufacturer	Visually inspect part or packaging	100%	Manufacturer: Woodward
Part number and label	Visually inspect part or packaging	100%	Part Number: 9903-015
Workmanship	Perform workmanship inspection on the unit and record on SOP-PRD-024-1 form. Note: IPC-A-610 Class 2 shall be used as inspection guidance and any process indicators or deficiencies shall be recorded for Engineering Evaluation in accordance with SOP-PRD-024.	100%	The workmanship of the unit meets the requirements of SOP-PRD-024.

Critical Characteristics

- *Design and Performance Characteristic that will be verified by Inspection and Testing.*
- *Infant Mortality, Physical and Mechanical Interface, Electrical Functionality.*

Commercial Grade Item Dedication Technical Evaluation and Test Plan						
Document Number	CGD-9903-015		Revision	0		
SECTION I: CRITICAL CHARACTERISTICS						
CC #	CRITICAL CHARACTERISTIC	ACCEPTANCE METHOD	DESCRIPTION OF ACCEPTANCE ACTIVITY	SAMPLING PLAN	ACCEPTANCE CRITERIA (INCLUDING TOLERANCES)	
1	Infant Mortality	Method 1	Perform Acceptance Testing in accordance with Section 11 of Reference 4, 9903-015-AP-1, Rev. 0	100%	9903-015-AP-1, Rev. 0 contains all acceptance criteria for verification of CC#1 Burn-In Duration IAW customer requirements as directed by the JOF or traveler.	
2	Physical Parameter / Mechanical Interface	Method 1	Perform Acceptance Testing in accordance with Section 6 of Reference 4, 9903-015-AP-1, Rev. 0	100%	9903-015-AP-1, Rev. 0 contains all acceptance criteria for verification of CC#2.	
3	Electrical Functionality	Method 1	Perform Acceptance Testing in accordance with Section 7-10 of Reference 4, 9903-015-AP-1, Rev. 0 after completion of CC#1.	100%	9903-015-AP-1, Rev. 0 contains all acceptance criteria for verification of CC#3	

Safety Functions Basis

- Outlining the Basis for the Safety Function and Critical Characteristic.

Commercial Grade Item Dedication Technical Evaluation and Test Plan			
Document Number	CGD-9903-015	Revision	
		0	
SAFETY FUNCTION(S) SUPPORTED / BASIS FOR SELECTION OF IDENTIFICATION ATTRIBUTES AND CRITICAL CHARACTERISTICS / ACCEPTANCE CRITERIA INCLUDING MAINTAINING SEISMIC AND ENVIRONMENTAL QUALIFICATION			
Section H	Faceplate Identifiers – Verification of the manufacturer name and part number supports reasonable assurance that the item received is the item ordered. Workmanship Inspection – Verification of workmanship ensures that the unit was properly built and is not damaged. This ensures that the unit will operate correctly at initial startup, or after, and would carry the rated design specifications to the circuit. Successful execution of SOP-PRD-024 will provide evidence of satisfactory workmanship.		
CC #1	Infant Mortality –Performing an extended burn-in at nominal output voltage will mitigate the risk of infant mortality of electrical components. Execution of Reference 4, 9903-015-AP-1, Rev. 0, Section 11, provides evidence of completion of burn-in. The duration of the burn in will be in accordance with customer requirements present on the JOF or job traveler. CC #1 must be performed prior to CC#3.		
CC #2	Physical Parameter / Mechanical Interface –Reference 4, 9903-015-AP-1, Rev. 0, was developed by Paragon using applicable OEM documents to fully test the subject unit. Justification of test methodology, acceptance criteria, and tolerances are defined in Section 4 of Reference 4. Section 6 shall be performed after burn-in activities. Successful completion of the Acceptance Procedure provides reasonable assurance of operational fidelity		
CC #3	Electrical Functionality – Reference 4, 9903-015-AP-1, Rev. 0, was developed by Paragon using applicable OEM documents to fully test the subject unit. Justification of test methodology, acceptance criteria, and tolerances are defined in Section 4 of Reference 4. Section 7 to 10 shall be performed after burn-in activities. Successful completion of the Acceptance Procedure provides reasonable assurance of operational fidelity.		

References & Approvals

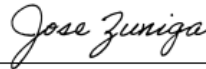
- *The Identification of the reference Documents used to complete the Commercial Grade Dedication Plan.*
- *Showing a 3 Step Review and Approval process based on the criticality of the process.*

Commercial Grade Item Dedication Technical Evaluation and Test Plan			
Document Number	CGD-9903-015	Revision	

SECTION J: REFERENCES

Ref. #	DOCUMENT / SOURCE	REVISION / DATE	COMMENTS
1	Paragon Engineering Procedure, ENG-01, <i>Commercial Grade Item Dedication</i>	Revision 7 December 2023	Paragon Document
2	EPRI Report, TR-017218-R1, <i>Guideline for Sampling in the Commercial-Grade Item Acceptance Process</i>	Revision 1 January 1999	EPRI Technical Report
3	EPRI 3002002982, "Plant Engineering: Guideline for the Acceptance of Commercial-Grade Items in Nuclear Safety-Related Applications: Revision 1 to EPRI NP-5652 and TR-102260"	September 2014	EPRI Technical Report
4	Acceptance Procedure 9903-015-AP-1, Rev. 0	Revision 0	Paragon Document
5	Paragon Standard Operating Procedure Electronic Refurbishment and Repair SOP-ENG-015	Revision 4	Paragon Document

SECTION K: REVIEW AND APPROVAL

STAKEHOLDER	SIGNATURE	PRINT NAME	DATE
Prepared by:		Jose Antonio Zuniga	04/22/2026
Reviewed by:		Christopher Brown	04/22/2026
Approved by:		Jose Alvarez	04/22/2026

HH references

TerraPower and KJRR Detection assemblies

Scope: Seismic Testing

Where: Clark Testing

KJRR WRFC with DWK-260

Scope: high flux neutron response testing (counting, MSV and DC)

Where: NC State.

Holtec SMR

Scope: TBD

Where: TBD

Others

- we performed EQ testing on JRTR for Munich (full qualification)
- APWR for MELCO,
- Assisted WEC on the AP1000 Detector EQ (thermal aging, and assistance with other tests).