EPRI

PEARTS

AGENDA

EPRI Procurement Engineering and Related Topics Symposium

November 11th – 12th, 2025 • Zürich, Switzerland

TUESDAY, NOVEMBER 11, 2025		
TIME	**TOPIC**	**PRESENTER**
7:30 a.m.	**60 Min – Coffee / Networking**	
8:30 a.m.	Welcome and safety moment	***Marc TANNENBAUM**, EPRI*
8:45 a.m.	Welcome to Zürich	***Gabriela R. ARAUJO,** SwissNuclear*
9:00 a.m.	The Imperative for a Global, Resilient, Nuclear Supply Chain	***Dr. John KICKHOFEL**, Apollo Plus*
9:25 a.m.	EPRI Technical Procurement Update	***Marc TANNENBAUM**, EPRI, **Jon THOMAS**, EPRI*
9:55 a.m.	**15 Min – Break / Networking**	
10:10 a.m.	**Panel Discussion** – Building the Nuclear New-Build Supply Chain	***Dr. John KICKHOFEL**, Apollo Plus, **Peter ČAMBÁL**, Slovenské electrárne, **Howard LECOMPTE**, Paragon Energy Solutions, **Marc TANNENBAUM**, EPRI*
10:35 a.m.	ISO-19443 Update	***Natalia AMOSOVA**, Apollo Plus*
11:00 a.m.	Improvement of Spare Parts Management in Yangjiang Nuclear Power Plant	***Nie JIEBING**, Yangjiang Nuclear Power Co., Ltd.*
11:25 a.m.	Equivalency Evaluation Basics	***Jon THOMAS**, EPRI*
12:00 p.m.	**60 Min – Lunch / Networking – *Sächsilüüte Room***	
1:00 p.m.	Critical Spares Basics	***Marc TANNENBAUM**, EPRI*
1:30 p.m.	Obsolescence Management at Paks	***Dr. Zoltán VAJNA**, Paks*
1:55 p.m.	**Panel Discussion** – Obsolescence Management	***Dr. Zoltán VAJNA**, Paks, **Arne CLAES,** Engie, **Jon THOMAS**, EPRI*
2:20 p.m.	**15 Min – Break / Networking**	
2:35 p.m.	Requalifying Surplus Valves	***Greg MASON**, Element Nuclear*
3:00 p.m.	**Breakout Sessions** – Topics selected by poll: Commercial-grade dedication Obsolescence Management	
3:55 p.m.	Breakout Session Report-outs	***Breakout Leaders***
4:15 p.m.	Supplier Lightning Round – Brief introduction to attending supplier's capabilities	***Supplier Participants***
4:45 p.m.	Wrap Up and Adjourn	***Marc TANNENBAUM,** EPRI*
5:00 – 7:00 p.m.	**Welcome Reception and Networking / Supplier Tabletop Displays**	

WEDNESDAY, NOVEMBER 12, 2025

TIME	TOPIC	PRESENTER
7:30 a.m.	**60 Min – Coffee / Networking**	
8:30 a.m.	Safety Moment	***Jon THOMAS**, EPRI*
8:35 a.m.	International Atomic Energy Agency (IAEA) Harmonization and Standardization Initiatives	***KIM, Shin Whan**, IAEA*
9:00 a.m.	World Association of Nuclear Operators (WANO) Procurement Quality Working Team Activities	***Martin SEIDL**, CEZ and WANO CGD Team Leader*
9:25 a.m.	The KELPO Method	***Hannu EKLÖF,** TVO* ***Kari Pihala**, TVO*
10:00 a.m.	**15 Min – Break / Networking**	
10:15 a.m.	Implementing Commercial-Grade Dedication at CEZ	***Martin SEIDL**, CEZ*
10:35 a.m.	**Panel Discussion** – The Future of CGD and similar Nuclear Procurement Alternatives	***Martin SEIDL**, CEZ, **Dr. John KICKHOFEL**, Apollo Plus, **Hannu EKLÖF,** TVO, **Kari PIHALA**, TVO, **Marc TANNENBAUM**, EPRI*
11:10 a.m.	Procurement Strategies for First of a Kind (FOAK) Projects	***John PORTILLO**, Paragon Energy Solutions*
11:35 a.m.	Project Risk Evaluation	***Alejandra ZERTUCHE**, AXPO*
12:00 p.m.	**60 Min – Lunch / Networking – *Sächsilüüte Room***	
1:00 p.m.	ASME NQA-1 activities to address industry challenges	***Pascal ANCION**, Westinghouse*
1:20 p.m.	**Panel Discussion** – Applications for Artificial Intelligence in Nuclear Procurement	***Jon THOMAS**, EPRI, **Javier BARROSO MARTIN**, Westinghouse, **Howard LECOMPTE**, Paragon Energy Solutions*
1:55 p.m.	**Open Discussion** - Top 10 Procurement and Supply Chain Challenges	***All***
2:20 p.m.	Wrap-up and adjourn	***Marc TANNENBAUM,** EPRI* ***Jon THOMAS,** EPRI*
2:45 p.m.	**Adjourn**	

3rd International PEARTS

PROCUREMENT ENGINEERING AND RELATED TOPICS SYMPOSIUM

EPRI

Zürich Switzerland

Marc H. Tannenbaum
Principle Technical Executive, Electric Power Research Institute

EPRI Joint Utility Task Group Procurement Forum
November 11 & 12, 2025

PEARTS parent organization is EPRI Plant Reliability and Resiliency

- EPRI's Plant Reliability and Resiliency performs research to inform decisions related to the continued safe, reliable, and efficient operation of nuclear power plants. Research activities address key equipment issues and the effectiveness of plant engineering programs
- The program also supports technology transfer through technical assistance programs, user groups, interest groups, and training.

PEARTS Mission:

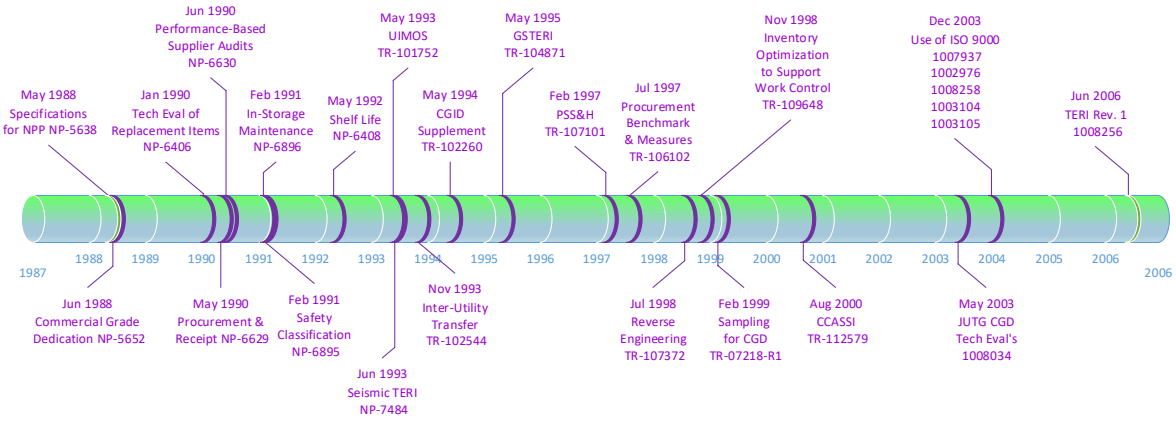
Provide EPRI members and their suppliers with a resource for addressing procurement engineering and technical supply chain issues through collaboration, development of training, sponsoring EPRI projects, and benchmarking

- Functional Safety Classification
- Commercial Grade Item Dedication
- Equivalency Evaluation
- Technical and Quality Requirements
- Procurement quality issues
- Obsolescence
- Storage and shelf-life
- Reverse Engineering
- Critical Spares

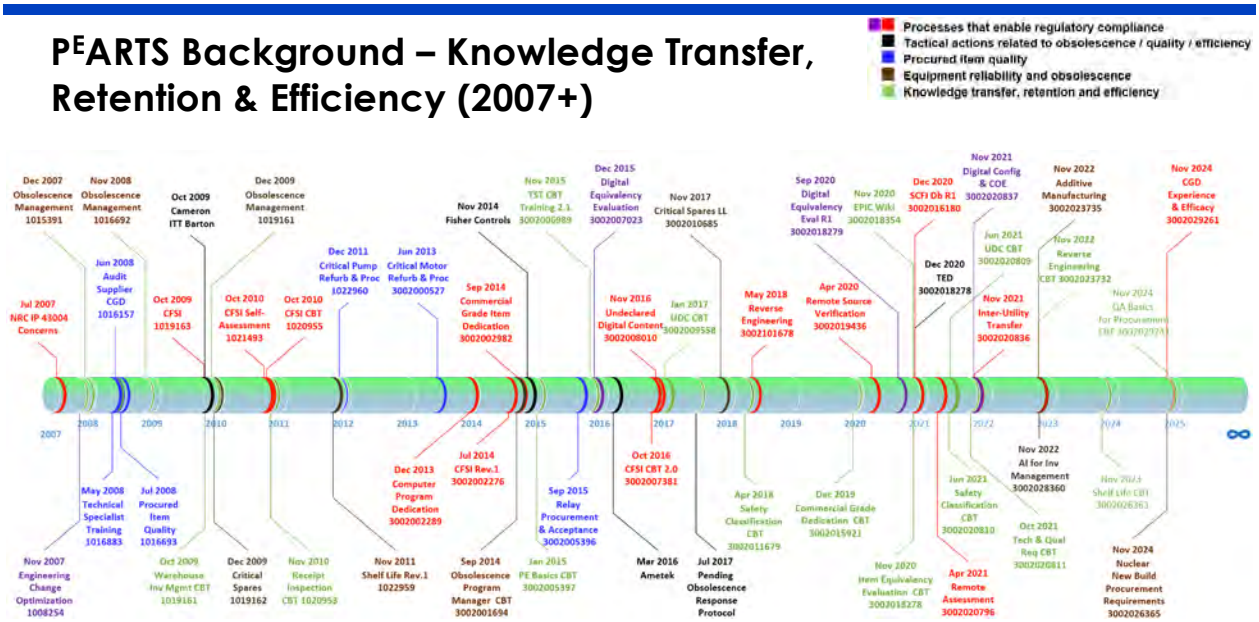
EPRI PEARTS Attendees

- Formed in 1990 as the EPRI Joint Utility Task Group (JUTG), PEARTS is a diverse mix of nuclear professionals
  - Suppliers & Licensees
    - Procurement Engineers and Technical Staff
    - Supply Chain Professionals
    - Supplier Quality Auditors and Inspectors
  - Oversight / Regulatory Organizations
- EPRI PEARTS is a recognized procurement engineering “community of practice” worldwide

PEARTS Background – Transition from construction to operations



PEARTS Background – Knowledge Transfer, Retention & Efficiency (2007+)



A few of the many PEARTS guidance documents

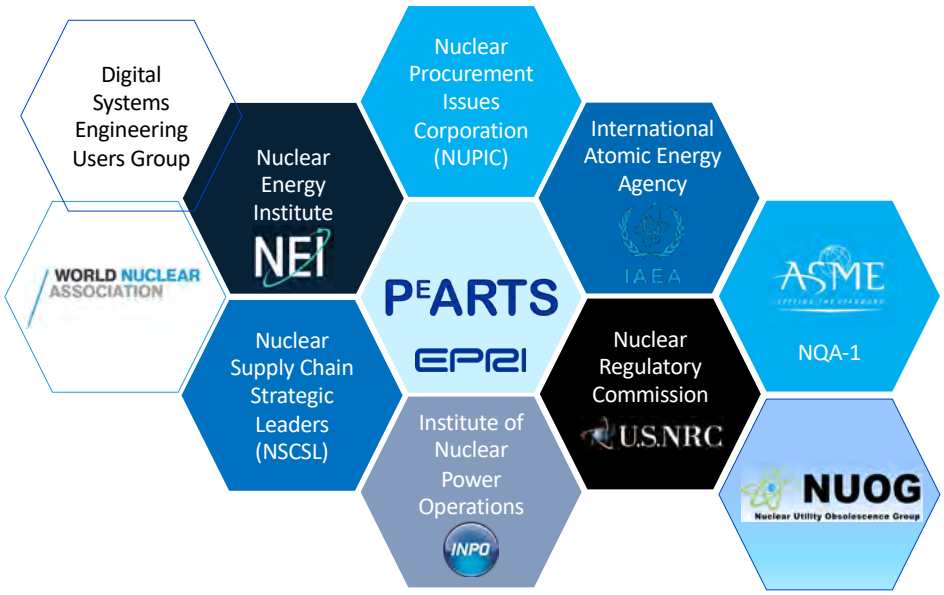
Members can find documents and more information at the EPRI Procurement Information Center (epic.epri.com)

EPRI Product	Title
3002029261	Commercial-Grade Item Dedication (CGD) Experience and Efficacy
3002026363	Nuclear New Build Procurement Requirements: Considerations for Promoting Readiness to Support Operations and Maintenance
3002011678	Guidance for the Use of Reverse-Engineering Techniques: Revision 1 to EPRI TR-107372
3002010685	Critical Spares: Program Implementation and Lessons Learned
3002008010	Guideline on Prevention and Detection of Undeclared Digital Content
3002005396	Plant Engineering: Relay Procurement and Acceptance, Checklist and Considerations
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 endorsed in NRC RG 1.164
3002002276	Plant Support Engineering: Counterfeit and Fraudulent Items—Mitigating the Increasing Risk, Revision 1 of 1019163 mentioned in NRC SECY 15-0003
3002000527	Plant Engineering: Critical Motor Refurbishment and Procurement Checklist - Key Project Phases and Considerations
1021493	Plant Support Engineering: Counterfeit and Fraudulent Items, A Self-Assessment Guideline
1019161	Plant Support Engineering: Proactive Obsolescence Management, Program Implementation and Lessons Learned
1008254	Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants, Revision 2

PEARTS Objectives

- PROMOTE AWARENESS OF INDUSTRY ISSUES
- SHARE AND DISCOVER BEST PRACTICES
- **"BRING IT BACK"** TO YOUR ORGANIZATION
- IDENTIFY TOP TECHNICAL PROCUREMENT AND SUPPLY CHAIN ISSUE(S)
- DEVELOP PROJECT IDEAS FOR EPRI
- PARTICIPATE IN PROJECTS THAT HELP US ALL SUCCEED
- NETWORKING

PEARTS Interfaces



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Welcome to PeARTS 2025 in Zurich, Switzerland

International Procurement Engineering and Related Topics Symposium

Gabriela Araujo, 11.11.2025

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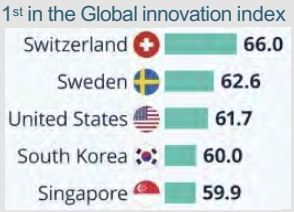
Zurich: The world's leading hub for innovation

- *Strong **cooperation** between research & private sectors.*
- *Innovation-friendly authorities regulate without hindering innovation.*
- *Authorities act **pragmatically** and **constantly exchange** with the industries concerned.*

*Source

1st in the Global innovation index



Pragmatism
exchange of ideas
collaboration with regulators & across sectors
QUALITY innovation
reliability

A great place to gather, exchange ideas & strengthen collaboration.

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The Swiss nuclear landscape

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Three Operating NPPs - a third of Switzerland's electricity production.

All in long-term operation (LTO>40y) – Procurement engineering is essential for safe, compliant & viable LTO

swissnuclear – The Association of Swiss NPP Operators

- Facilitates dialogue with regulators, suppliers, and international partners like WANO, WNA, EPRI, ENISS & WENRA.
- Supports NPPs on topics such as LTO, regulation, supply chain, and research & industry training.

axpo BKW Kernkraftwerk Gösgen KKL Kernkraftwerk Leibstadt

Recent EPRI Nuclear Utilities Procurement Course in Switzerland (03.2025)

Our challenges in procurement engineering

From the recent workshop:

"The procurement of parts and components in Switzerland is increasingly facing challenges: fewer suppliers, higher prices, and suppliers' limited familiarity with Swiss processes increase the effort required for collaboration as well as delivery times."

Obsolescence Management
proactive procurement
lack of clear specifications
collaboration with regulators
local implementation of CGD
qualification of parts

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EPRI International PEARTS, Zürich Switzerland - Day 1

Explore Zurich

Walks: Limmat river (1), old town (2), lake promenade (3), old botanic garden (4).

Views: From Lindenhof (5), ETH Polyterrasse (6), Quaibrücke (7).

Museums: Kunsthaus (8), ETH Focus Terra (9), Swiss National Museum (10).

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The Imperative for a Global, Resilient, Nuclear Supply Chain

Thoughts and Perspectives

Dr. John Kickhofel
Managing Partner, Apollo+
jkickhofel@apolloplus.com

EPRI iPeARTS

Zürich, Schweiz
November 2025

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Tomorrow's Supply Chain is nothing like Today's Supply Chain

Today's Supply Chain is... unusual...

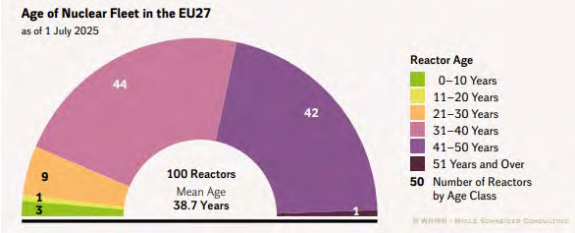
especially in the West

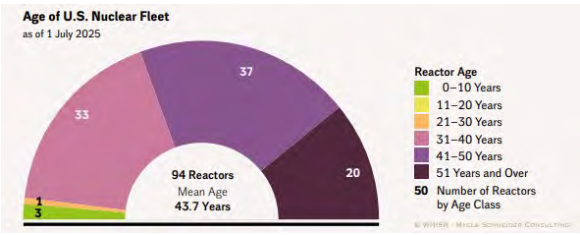
Today's supply chain is leveraging capacity & capability used primarily for **other industries**, it is dedicated to supplying legacy spare parts and engineering services for **old reactor fleets**, it has survived on orders related to **digitalization, safety upgrades and power uprates**…
…and a small handful of **new-build projects** with meaningful European/North American Supply Chain participation in last **25 years**:

foreign

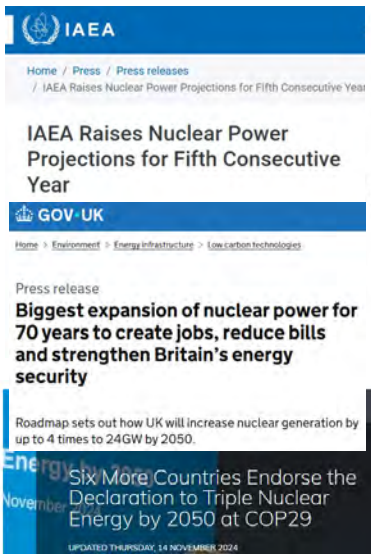
-Vogtle 3&4
~~-Summer 2&3~~
-OL3
~~-Hanhikivi 1~~
-Flammanville 3
*-*EMO 3&4*
*-*HPC, 2 units*
-Taishan 1&2
-Sanmen 1&2
-Haiyang 1&2
-ROK OPR-1000s
*-*ROK APR-1400s*
*ongoing

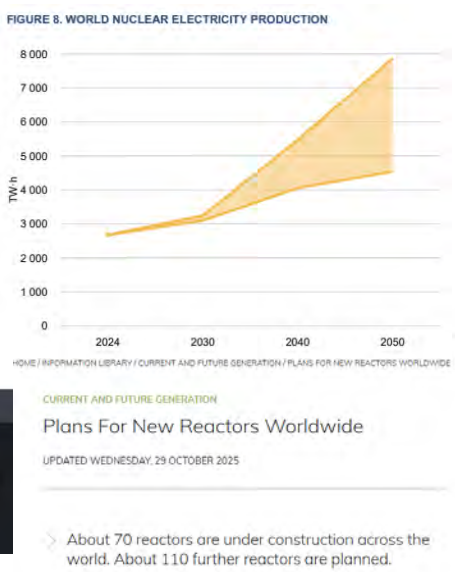
Few near-term projects:
-DNNP, 1 (+3?) units SMR*
*-*SZC, 2 units*
-Paks II (5 & 6)
*-*Penly, 2 units*
*-*Dukovany 5*
*-*Lubiatowo-Kopalino, 3 units*
*-*Kozloduy 7&8 (pre-construction)*
-USA re-starts / potential re-starts
*no construction license





Tomorrow's Supply Chain is... up & to the right ↗





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But until then…

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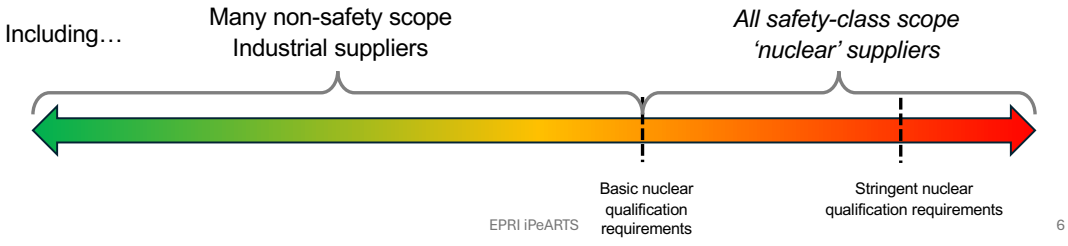
Today's Supply Chain

Globally, we estimate there are approximately **5,000-6,000 suppliers** with meaningful participation in the nuclear industry...
(most of which count on nuclear for only a small fraction of their business revenue)

- *Compare with: aerospace, 30,000+*
- *Compare with: oil & gas, 5,000+ only within mechanical API-standards space*

- Project Development & Finance
- Regulatory, Licensing & Legal
- Design, Engineering & Consulting
- Reactor Technology & NPP Developers*
- Major Systems & Structures*
- Component Manufacturing & Supply*
- Construction & Civil Works
- Nuclear Fuel Cycle*
- Site Services & Plant Operations (including SaaS)
- Waste Management & Decommissioning*
- Professional & Corporate Services
- Research & Development



What is Resillience

in a nuclear supply chain

Equipment and services are available, delivered on-time, at reasonable cost, with the right quality - independent of local, regional or global disruptions

What do resilient supply chains look like?

- Local companies involved in an ongoing pipeline of projects
- Companies delivering to a fleet of reactors following the same design, quality, and qualification expectations
- Companies which deliver serially manufactured components common to other industries

How can owner/operators improve resilience?

- Have many ways to procure (e.g. CGD), mutual recognition of international quality management approaches, have expectations (QA/QC) similar to other industries
- Understand what spare parts you need and when you will need them
- React quickly and in a programmatic manner to obsolescence issues
- Be skilled at change & configuration management, including design change
- Carefully manage key supplier relationships, and spend time face-to-face
- Attempt to cooperate and converge requirements with other owner/operators and fleets
- Learn about new supplier all the time

Industrialization

- In the future, new reactor developers and EPC's will attempt to leverage industrial supply chains to a much greater extent, bringing business to traditionally non-nuclear players

- Advanced reactor developers are aiming to greatly **reduce the amount of safety-class equipment in the plant**
  - ✓ **example**: HTGR aiming to use ASME Section VIII, U-stamp manufacturers
  - ✓ **example**: use of general industrial or process industry I&C functional safety architecture (e.g. IEC 61508 or IEC 61511) instead of nuclear (IEC 61513)

- The supply chain could become more competitive with lower margins
- Some specialized nuclear areas will always remain...

Obsolescence

- Being 'proactive' is **extremely difficult**
- Obsolescence can often be **'reversed'**, learn to do it
- Improve ability to react to obs., have a clear, written, step-by-step playbook
- Develop logical **prioritization scheme**
- Efficient supplier management, procurement, and engineering design processes **strongly mitigate obsolescence issues**

It is one thing for spare parts to be 'available' from the supplier...
...it is another to have them installed and ready to use on schedule

Spare Parts Management

What have we learned from 50+ years of NPP operations?

Better understanding of the importance of OEM recommended spare parts, recommended replacement parts, understanding maintenance cycles, etc.

Clear procurement forecasts **are not always available**, while costs and lead times for spare parts can be **difficult to predict**

Suppliers can **disappear**, along with organized knowledge of recommended spares, replacements parts and maintenance cycles

The importance of inventory management
The value of good data

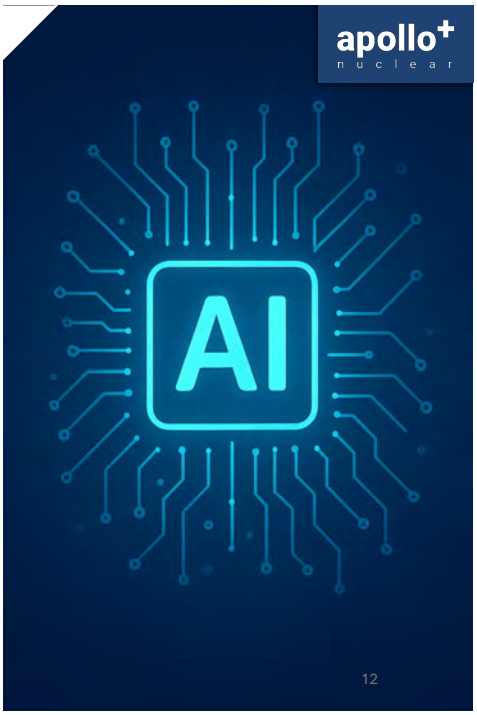
The importance of non-safety-class SSCs which are **critical for generation**

AI should improve the ability of the supply chain to:

-More efficiently review specs, RFQs, review T&Cs
-Streamline the budgetary estimate and pricing process
-Speed up the pace of issuing quotations, accepting POs, issuing quality plans, etc.
-Help to track ongoing projects, hold points, etc.
-Increase the pace of business

AI should improve the ability of owner/operators to:

-More efficiently review quotations, T&Cs and issue POs
-Track ongoing orders and issues
-Track inventory data
-Manage procurement and supplier data
-Increase the pace of business



Final Thoughts

We must find ways to **"#makenuclearsimpler**", we must be more organized, and work smarter, with much greater efficiency – utilize AI and digital tools, focus on what is important, on 'easy wins'

Suppliers are often performing poorly, and the trend does not look good,

buyers need to invest more in supplier performance improvement and relationship management, build 'intelligent customer' capability

suppliers need to monitor their own performance and make corrections

The world is a crazy place: build resilience now, and **localize** what you can

Mass nuclear new-build will bring both benefits and challenges to spare parts procurement for LTO of existing fleets

If this all sounds like too much...

...there are 10 boats parked down at the lake, filled with wine... 🍷

70th Expovina Weinausstellung

- ✓ *200+ Exhibitors*
- ✓ *4700 Wines*
- ✓ *>20 Countries*

Tues/Wed until 9pm
Last day Thurs until 8pm
https://expovina.ch

Thank you for your attention!

info@apolloplus.com
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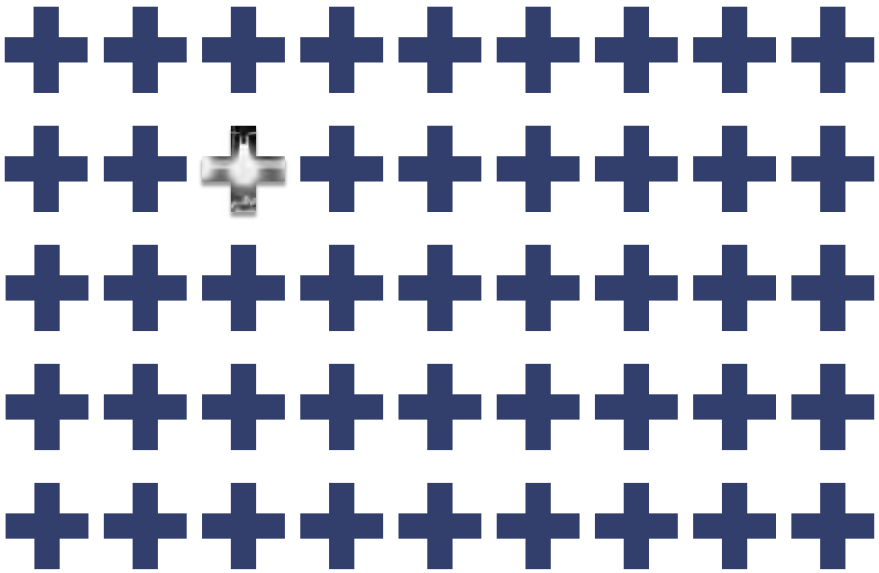

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nuclear

EPRI Procurement Engineering and Supply Chain Update

Marc H. Tannenbaum
Principal Technical Executive

Jon Thomas, P.E.
Principle Technical Leader

Procurement Engineering and Related Topics Symposium (PEARTS) – Zürich, Switzerland
November 11, 2025

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PEARTS
PROCUREMENT ENGINEERING AND RELATED TOPICS SYMPOSIUM

MISSION:

Provide EPRI members with a resource for addressing procurement engineering and technical supply chain issues through collaboration, development of training, sponsoring EPRI projects, and benchmarking.

Formed in 1990 to address NRC concerns with licensee procurement and facilitate the transition from construction procurement to operations and maintenance procurement.

Today PEARTS is the procurement engineering "community of practice." Supplier, regulator, and international participation is an essential ingredient in PEARTS' success.

Scope of activities typically addressed:

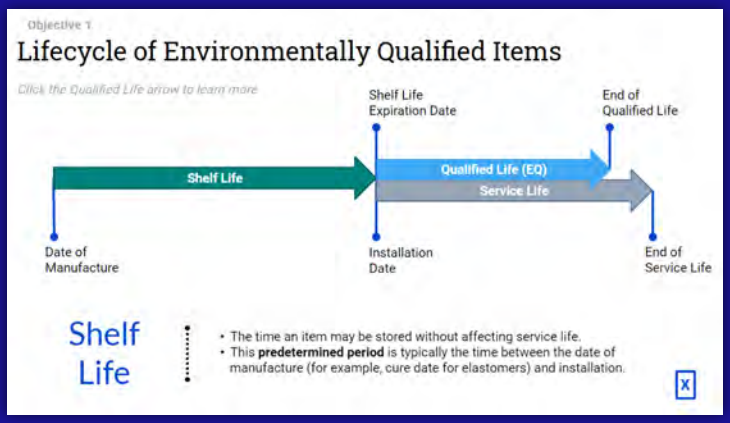
- **Functional Safety Classification**
- **Equivalency Evaluation**
- **Training Products**
- **Supplier Quality Issues**
- **Commercial Grade Item Dedication**
- **Obsolescence**
- **Storage and Shelf-Life**
- **Reverse Engineering**
- **Technical and Quality Assurance Procurement Requirements**
- **Critical Spares**

EPRI Procurement Update

Quality Assurance Basics CBT (3002029241)

- On-demand, self-paced
- Communicates basic quality assurance concepts and quality activities
- Discusses quality assurance requirements and hierarchy
- Discusses quality assurance activities that contribute to quality of procured items
- Discusses the two options for procuring a safety-related item
- Discusses reporting of defects and noncompliance

Shelf-Life Computer-Based Training (3002026363)



- On-demand, self-paced
- Communicates basic shelf-life concepts and methodology
- 5 methods for determining shelf-life
- Project selected due to issues/observations identified during NRC CGD inspections
- Collaboratively developed during breakout sessions at the 2023 winter and summer PeARTS meetings
- Based on EPRI 1022959

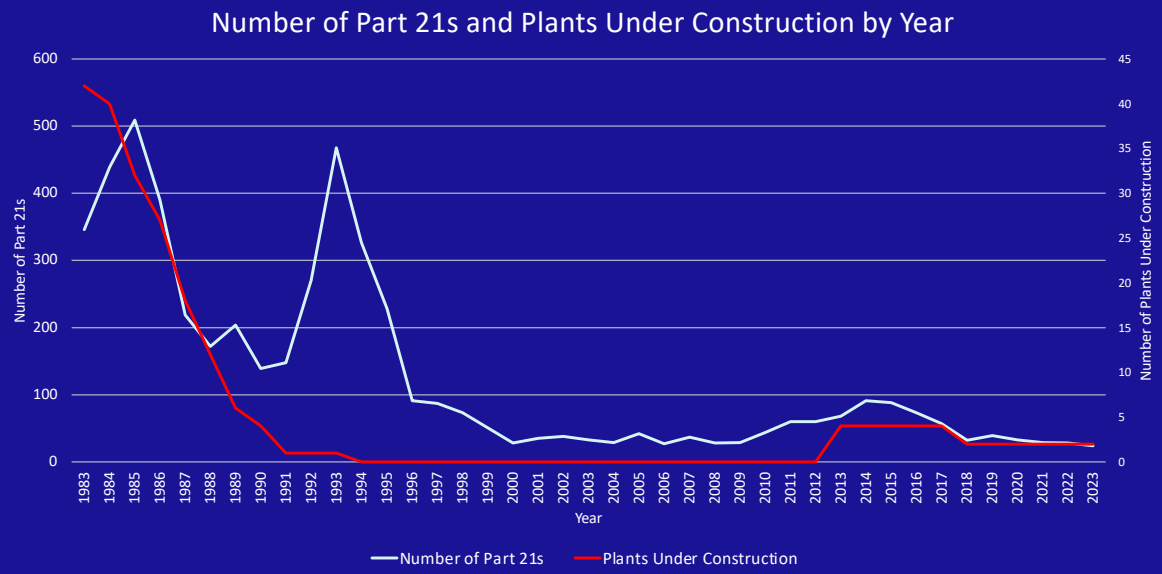
EPRI 3002029261

- The Commercial-Grade Dedication (CGD) acceptance method developed by EPRI members in 1988 has been successfully used in the US for over 3.5 decades during which time overall plant performance has improved
- CGD is an effective tool in supporting long-term operation of a nuclear facility
- Participants recognize items accepted using CGD as equal in quality to items accepted via traditional quality program methods
- Supports international interest in use of CGD
  - Regulatory Agencies
  - Licensees
- Provides information for use in broader discussions about use of industrial–grade items in safety-related applications for advanced and small modular reactors

Application of Commercial-Grade Dedication Methodology

- Study included Internationally-focused surveys and meetings involving 12 nuclear licensees (93 reactor units) and 7 suppliers
- ~40% of nuclear power reactors worldwide dedicate and use commercial-grade items on a regular basis
- CGD comprises a significant percentage of safety-related procurements in many jurisdictions surveyed
- Close coordination with World Nuclear Association and Nuclear Energy Agency Committee on Nuclear Regulatory Activities
- Analysis of NRC 10CFR21 reports (defects and noncompliance) indicate increased use of CGD is not resulting increased failures or significant safety issues

Reported failures have decreased while CGD has significantly increased



Case studies for 11 jurisdictions are included

The Korean fleet implemented CGD in early 2000s now does >600 CGD procurements/year, is expanding supplier partners, and is a leader in CGD of digital devices

In the Czech Republic, two NPPs have used CGD to accept 14 different item batches since implementing CGD in 2021

In 2016, the Spanish fleet collaborated to revive CGD efforts started in the 1990s and are reporting successful increased application of CGD

A domestic nuclear power project in China implemented CGD for 18 categories and 154 models of commodity-level items, developing test methods for 58 specific critical characteristics

Some of Japan's top tier nuclear suppliers have developed comprehensive CGD guidelines and executed pilot projects related to CGD

A review of > 3 decades of experience using CGD in the US concluded that there are no systemic issues with the use of CGD items

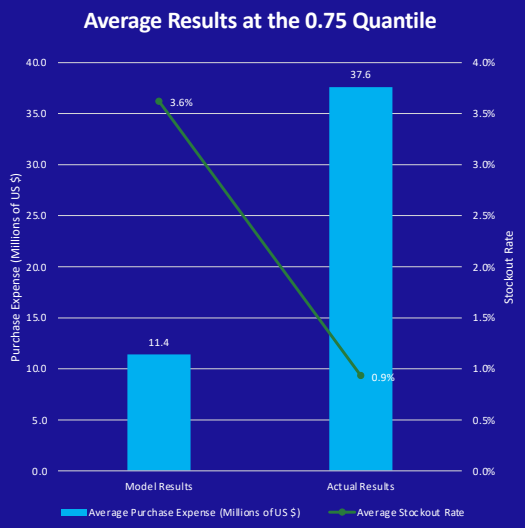
Use of Artificial Intelligence to Inform Reorder Decisions

Artificial Intelligence to Optimize Inventory - Exploratory Data Analysis

Many requests never have parts issued	If parts are issued, it's usually the requested amount	Most transactions are for a very small quantity	A small number of SKUs account for a majority of transactions	Most SKUs are used very infrequently
57%	93%	46%	20%	38%
Percentage of requests that have parts issued	Percentage that issue the **EXACT** amount requested	Percentage of transactions that issue a quantity of **ONE**	Percentage of SKUs that account for a majority (70%) of transactions	Percentage of SKUs that have only been used **ONCE** in the past **10** yrs

Results of 1-Year Model Simulation

- At best (0.75 quantile), model achieved:
  - A 70% reduction in purchasing expenses
  - At stockout rate of 3.6%
    - Stockout is higher than actual
    - Service level is still high at 96.4%
- Insights:
  - Demand description served as the most important field for determining if a transaction will issue parts
  - Model attempted to predict unknown demand (materials not yet reserved) based on last outage timeframe
  - Use of model predictions could reduce expenses and inventory levels without significant compromise to service level, and free up capital to spend elsewhere (plant upgrades, projects)



Key Findings

ARTIFICIAL INTELLIGENCE

- Back testing of this model results indicates its use could result in a 70% reduction in purchase expenses while having a 96.4% service level (or availability of requested parts) – All SKUs (Critical and Non-Critical)
  - The updated models were not able to outperform the actual utility purchasing decisions in both purchase expense and stockout rate. However, at a slightly increased average stockout rate of about 3.6% (vs. the actual stockout rate of 0.82%), the updated models showed an average purchase expense reduction of about 70% over the actual purchase expenses. An important caveat is the AI models used a just-in-time approach, while the actual utility approach may not have been as lean.

Key Findings (cont.)

ARTIFICIAL INTELLIGENCE

- Only 12.7% of all transactions were critical transactions.
  - Use a risk-based approach to apply model and focus on non-critical transactions/SKUs.
- Predicting unknown demand based on past usage history (online and outage).
- Reduction in item procurements and inventory levels, freeing up dollars at the corporate level to be used somewhere else. Frees up money that can be allocated and used in areas where priority/need is higher.

Next Steps Timeline

November 2025

- **EPRI Technical Update 3002029361**
  - **Publish with complete results and evaluation of the current algorithm and model performance**
  - **Document lessons learned and areas for improvement**

- **End User Application Development**
  - **Design intuitive interface for end users**
  - **Include features for scenario analysis, reorder alerts, and parameter tuning**
- **Deployment & Operational Use**
  - **Roll out application to inform reorder decisions and stocking parameters (min/max levels)**
  - **Monitor performance and gather user feedback for future iterations**

2025 | 2026 | 2027

- **Algorithm Refinement & Optimization**
- **Continuous Model Training & Data Utilization**
  - **Leverage current data since last model run (post-2023) to improve forecasting and decision support**

Distance Learning Computer-Based Trainings

These **and many more** CBTs can be found on EPRI's Learning Management System (LMS) at: http://www.epri.com/training

Procurement Engineering

3002015958	Procurement Engineering Fundamentals
3002020810	Procurement Engineering Safety Classification
3002015921	Commercial Grade Dedication Basics
3002018278	Item Equivalency Evaluation
3002020811	Technical and Quality Requirements
3002023732	Reverse Engineering Techniques
3002026363	Establishing, Maintaining and Extending Shelf Life

2023

Related Topics

3002013813	Obsolescence Program Manager
3002013790	Nuclear Supply Chain - Warehouse Inventory Management
3002013801	Quality Control Receipt Inspection
3002015959	Technical Specialist Training for Audits and Surveys
3002015960	Counterfeit, Fraudulent, and Suspect Items
3002020809	Undeclared Digital Content
3002029241	Quality Assurance Basics

2024

Future PEARTS Meetings

- **February 16-20, 2026**
  - Joint with NUPIC/NOC
  - NSCSL?
  - Sheraton Sand Key
    Clearwater, Florida
- **August 11-13, 2026**
  - Sheraton Sand Key
    Clearwater, Florida
- **November 2026**
  - Warsaw?
- **February 9-11, 2027**
  - EPRI, Charlotte, NC
- **August 10-12, 2027**
  - Sheraton Sand Key
    Clearwater, Florida

PEARTS

PROCUREMENT ENGINEERING AND RELATED TOPICS SYMPOSIUM

Resources

PEARTS Tools Available

EPRI ELECTRIC POWER RESEARCH INSTITUTE

EPRI PROCUREMENT INFORMATION CENTER

Find EPRI resources at epic.epri.com

P[E]ARTS

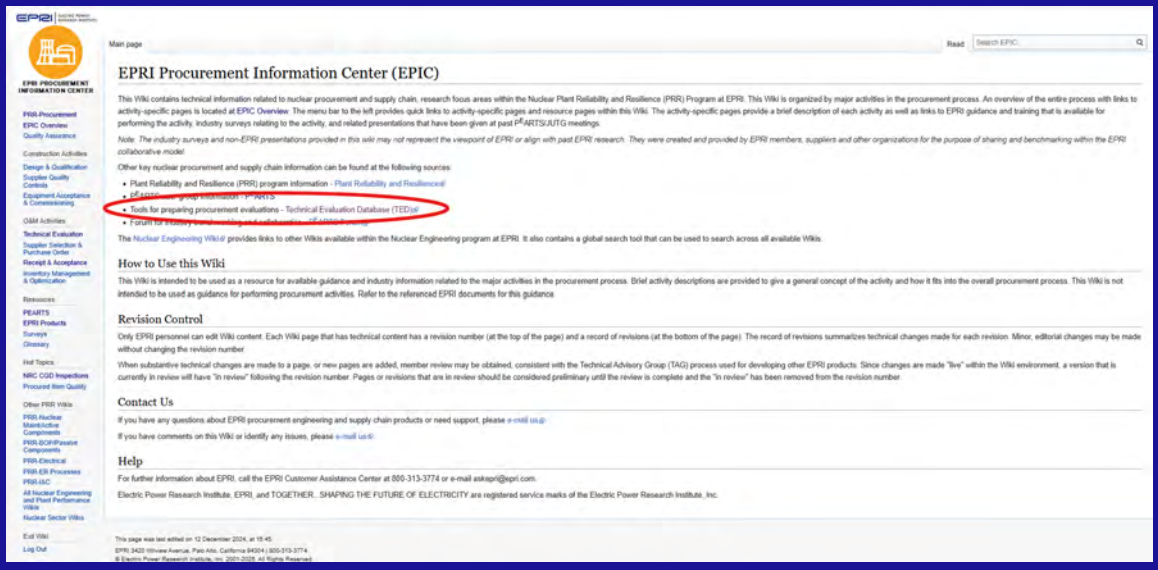
Procurement Engineering and Related Topics Symposium (PeARTS)
LinkedIn Group

Join the P[E]ARTS LinkedIn Group

Subscribe to the P[E]ARTS Forums!
nuclearprrforum.epri.com
Procurement Engineering
Nuclear Supply Chain

EPRI credentials are required to access the EPIC Wiki and Forums

EPIC Wiki

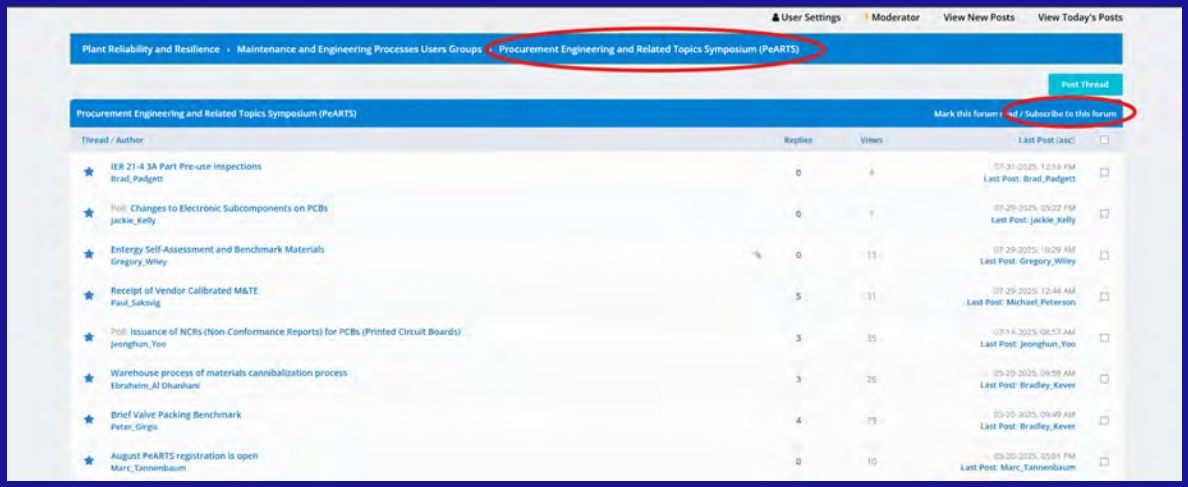


Technical Evaluation Database (TED)

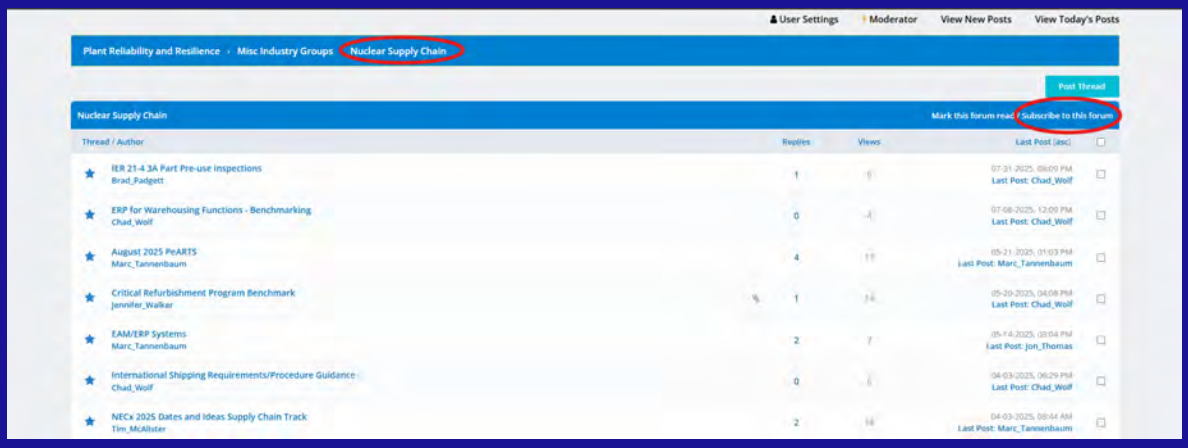
- SPEED
  - Smart Procurement Engineering Evaluation Data (SPEED) provides the ability to capture engineering information that can be used to prepare commercial grade item dedication, equivalency, and RISC-3 procurement treatment evaluations
- CFSI
  - Suspect Counterfeit and Fraudulent Items (SCFI) provides a venue for reporting incidents of suspected counterfeit or fraudulent items
- UsOne
  - Utility-Supplier Obsolescence Notification Exchange (UsOne) helps allows utilities to upload a list of items they need and suppliers to upload a list of items they have available to solve obsolescence challenges
- POP
  - Pending Obsolescence Protocol (POP) began when EPRI's Joint Utility Task Group on Procurement Engineering (JUTG) started contacting suppliers that announced discontinuation of nuclear products or quality assurance programs

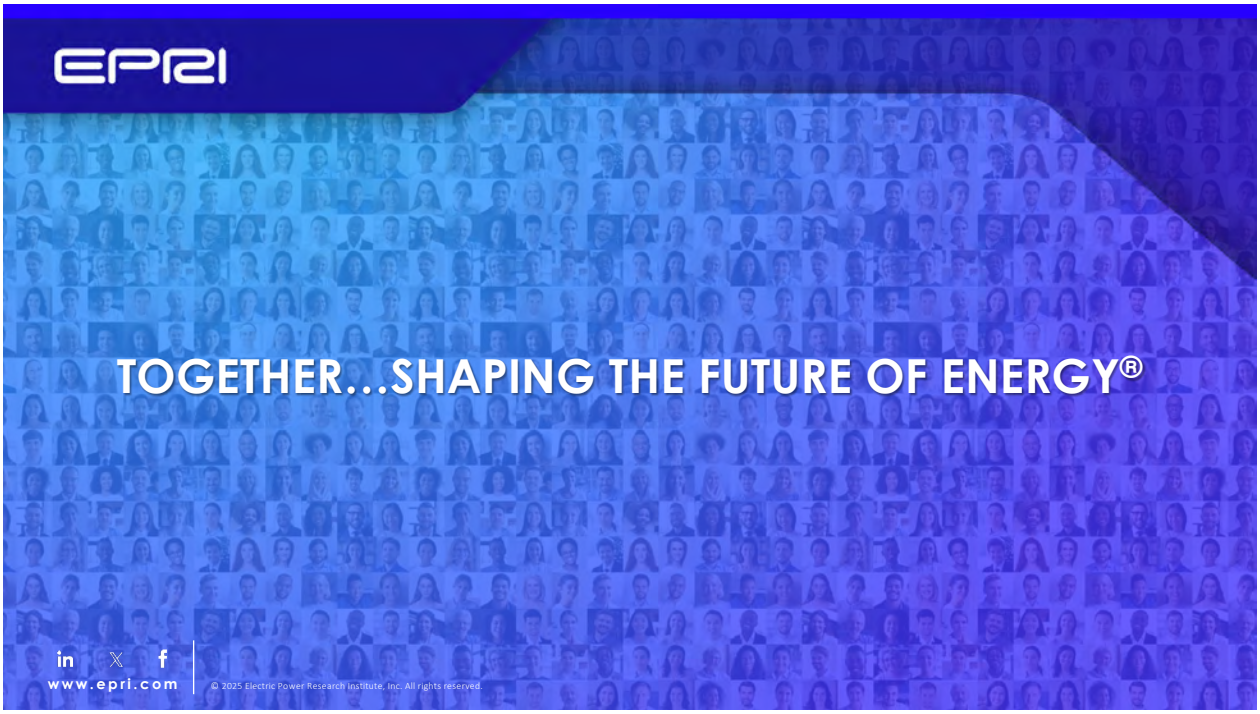
Technical Evaluation Database (TED)

Subscribe to the PEARTS Forum



Subscribe to the Supply Chain Forum

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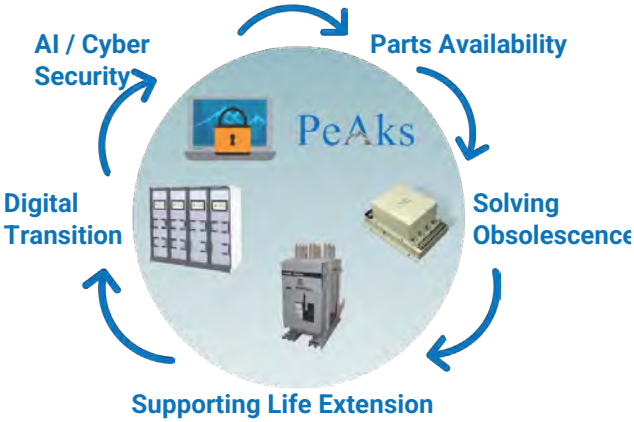
Paragon

Building the New Nuclear Supply Chain



Paragon

Critical Attributes

- The difficulty is to Build a Supply Chain without knowing Timing and Volume
- Finding Teaming Partners from outside the Industry to help bolster your Supply Chain.
- Finding Suppliers that have foresight to invest in Time and Capital without knowing the Value propositions.
- Procurement strategies for First of a Kind (FOAK) vs Nth of a Kind (NOAK) Projects
- Having Manufacturer's Critical Inventory Data (Part Number, Description, Quantity, and Contact Information) loaded into Paragon's Brokerage Database. (PeAks)

Paragon

Our Partners

Paragon's technical expertise and unique partnership agreements allow for end-to-end component manufacturing and sourcing

Example Custom Design & Manufacturing

Replacement of **Motor Control Center** sub-components into OEM design requirements

Switchgear modification to withstand seismic thresholds

Chiller controls upgrade from analog to digital

Exclusive & Preferred Supplier Agreements

Reuter-Stokes (a baker hughes business) — *Teaming on neutron monitoring detectors*

Schneider Electric — *Exclusive LV, MV breakers supplier*

IMI — *Exclusive valve and actuator supplier*

ABB — *Teaming on I&C and safety systems*

STRYTEN ENERGY — *Exclusive Class 1E station batteries supplier*

Johnson Controls — *Preferred temperature control/ chiller supplier*


Paragon
SMR
Questions?
53


Paragon
SMR
Bridging Nuclear's Present and Future

apollo+ nuclear

ISO 19443, ISO/TR 4450

Quality management systems, standards development

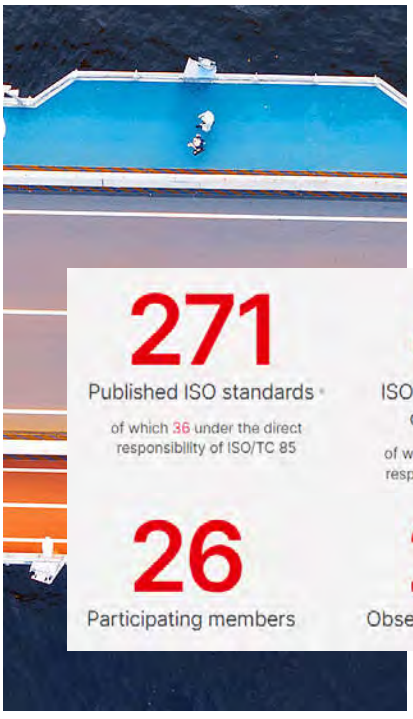
Updates and next steps

Dr. John Kickhofel
Managing Partner, Apollo+
jkickhofel@apolloplus.com

Technical Meeting on Current Topics in Nuclear
Supply Chain and Procurement Management

Vienna, Austria
October, 2025

info@apolloplus.com
apolloplus.com



TECHNICAL COMMITTEES

ISO/TC 85

Nuclear energy, nuclear technologies, and radiological protection

Reference	Title
ISO/TC 85/SC 2	Radiological protection
ISO/TC 85/SC 5	Nuclear installations, processes and technologies
ISO/TC 85/SC 6	Reactor technology
ISO/TC 85/CAG	Chair's Advisory Group
ISO/TC 85/WG 1	Terminology
ISO/TC 85/WG 4	Integrated management systems in nuclear and radiological domains

Organizations in liaison (Category A and B)

Acronym	Title
CEOC	International Confederation of Inspection and Certification Organisations
EC - European Commission	European Commission
IAEA	International Atomic Energy Agency
WANO	World Association of Nuclear Operators
WNA	World Nuclear Association

apollo+ nuclear

Welcome to standardization on nuclear energy, nuclear technologies and radiological protection

Nuclear energy is a form of energy released from the nucleus, the core of atoms, made up of protons and neutrons. The main application concerns the civil electricity production in power plants.
The other applications are less well-known. Radiosotopes, nuclear power process heat and non-stationary power reactors have essential uses across multiple sectors, including consumer products, food agriculture, medicine and scientific research, transport and water ressources and the environment

The purpose of ISO/TC 85 is to improve safety security and radiological protection for all nuclear activities, nuclear technologies and application of ionising radiation and to sustain the present globilisation of the markets with new international standards

More on ISO/TC 85

ISO/TC 85 page on iso.org
Business Plan - 2024 Edition
Permanent resolutions
Our meetings
WG 4 - 9 July
2026 in USA (date and venue to be determined)

My ISO job

Who develops ISO standards?
What delegates and experts need to know ?
Toolkit for ISO Working Group Convenor

3

← ISO/TC 85

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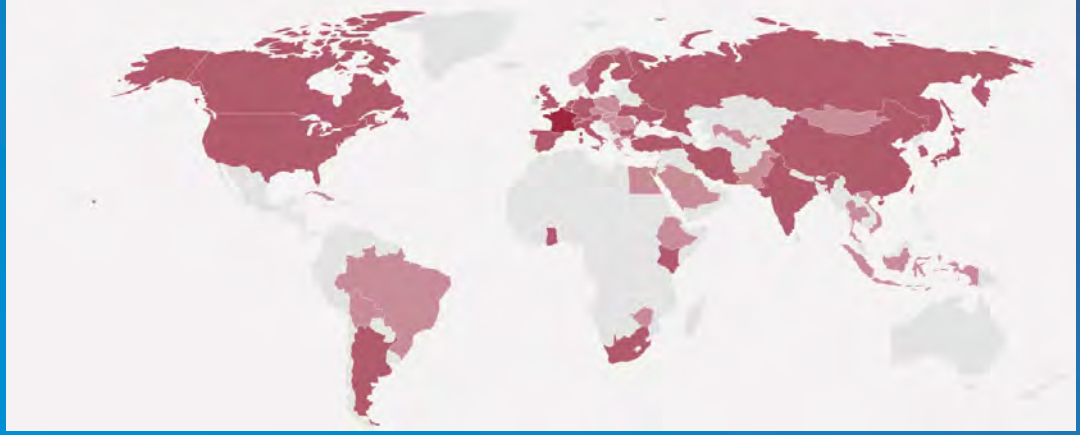
Participation

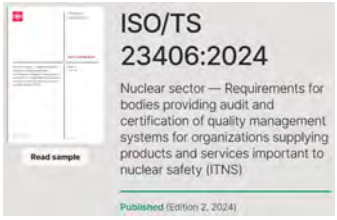


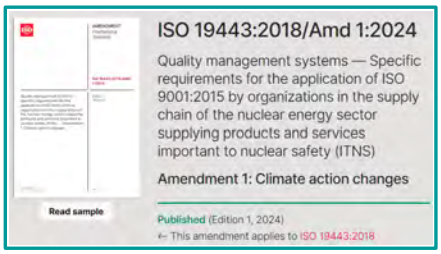
Participating Members [26]
Observing Members [22]

4

ISO Nuclear QMS Ecosystem

Nuclear quality management, ISO/TC 85/WG 4





Standards under development

Nuclear quality management, ISO/TC 85/WG 4

Bruno MARQUIS
Chef de mission
Secrétaire Général adjoint de l'AFCEN
Administrateur AFCEN au BNEN
Représentant EDF dans NQSA
EDF – DISC – Direction de la Supply Chain
Direction Qualité Industrielle
Département Réglementation ESP(N), Sûreté, Soudage (DRESS)

Work Programm

Maritie CHAMBILLE
Audit & Certification Manager
Framatome – Direction Qualité

ISO/CD 19443
Quality management systems — Specific requirements for the application of ISO 9001:2015 by organizations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety (ITNS)

Work Programm

Dr. John Kickhofel
Managing Partner
apollo plus GmbH

ISO/AWI TR 4450
Quality management systems — Guidance for the application of ISO 19443:2018

Standards under development

Nuclear quality management, ISO/TC 85/WG 4

Work Programm

ISO/CD 19443

Quality management systems — Specific requirements for the application of ISO 9001:2015 by organizations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety (ITNS)

The need for revision

Updates to ISO 19443 and lessons learned

Improving clarity! Enhancing areas of importance.

Update relies on ISO 9001 update progress...

Main Changes in ISO 9001:2026 DIS

ISO/TC 176/SC 2

Clause	Change Area	Key Updates
4.1 & 4.2	Context & Stakeholders	Climate change amendments from 2024 now integrated; Organizations must analyze which interested party requirements need to be addressed through QMS
5.1.1	Leadership & Commitment	New requirement: Top management must actively promote and demonstrate quality culture and ethical behavior with expanded guidance
6.1	Risk & Opportunity	Major restructure: New subclauses (6.1.1-6.1.3) separate risk and opportunity management; Stronger requirement to analyze and evaluate (not just identify) risks and opportunities
6.3	Change Management	Expanded from 4 to 7 factors, now includes monitoring effectiveness, communicating changes, and reviewing results
7.1.6	Organizational Knowledge	Focus shifts to achieving QMS intended results; Knowledge must be retained, applied, and shared (not just "made available")
7.3	Awareness	New requirement: Personnel must be aware of quality culture and ethical behavior standards
8.2.1	Customer Communication	Organizations must communicate contingency actions for service/product disruptions; Modern channels (social media, websites) acknowledged
10.1	Continual Improvement	Strengthened to explicitly address suitability, adequacy, and effectiveness of the QMS
Annex A	Guidance	Significantly expanded with detailed guidance aligned with clauses 4-10

Support for ISO 19443 Implementation

Guidance-level (not requirement) for organizations applying ISO 19443

Introduction

As general consideration, this guideline document:

— has been developed to assist users to apply the quality management system requirements of ISO 19443:2018 by organizations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety (ITNS)[1],

— does not add to, subtract from, or in any way modify those requirements,

— does not prescribe mandatory approaches to implementation, or provide any preferred method of interpretation of ISO 19443:2018 requirements supplementing those of ISO 9001:2015[2], but only provide examples of possible solutions an organization can implement to meet the requirements,

— proposes also good practices for some clauses of ISO 9001 when applied to ISO 19443.

ISO/AWI 4450

An ISO TC 85 / WG 4 **ballot** is currently open until November 20th, calling for experts to participate in the revision. We are forming sub-groups to focus on drafting specific sections of the revised document.

We are seeking interested members to take part in the following sub-groups:

1. **CFSI (Counterfeit, Fraudulent, and Suspect Items)**
2. **Type and extent of control / Commercial grade items**
3. **Graded approach**
4. **Determination of ITNS (Important To Nuclear Safety) items and activities**
5. **Design and development of products and services**
6. **Control of externally provided processes, products and services**

Reference: ISO/TR 4450:2020 revision - WG consultation

Working Group:	ISO/TC 85/WG 4	**Type:**	WG (Working Group Consultation (ad hoc))
Status:	Open		
Start date:	2025-07-24	**End date:**	2025-11-20
Opened on:	2025-07-24 00:03		

Note: You are kindly invited to

- submit your proposals regarding the listed items, using the pre-filled comments table;
- specify the sub-group(s) you wish to participate in.

Next Meeting

ISO/TC 85/WG 4
December 1st and 2nd, 2025
VIRTUAL

Two-day meeting will allow us to make progress on establishing sub-groups for **ISO/TR 4450** update and also share updates on status of ISO 9001 and ISO 19443.

Due to the high volume of expected comments from the ISO 9001 DIS enquiry (closing in November), a **consolidated ISO 19443 draft will not be available in December.**

A **dedicated meeting to review and harmonize ISO 19443 with the revised ISO 9001**—while preserving its specific requirements—is planned for **August 2026**, once the situation is clarified.

How to Participate

CONTACT YOUR NATIONAL STANDARDS BODY
See backup slides for some national contact points

Help build consensus standards which shape the future of the nuclear industry!

Some National Standards Bodies

Instituto Argentino de Normalización y Certificación - IRAM
Perú 552/556
C1068AAB Buenos Aires
Argentina
Tel: +54 11 43 46 06 48
Fax: +54 11 43 46 06 51
E-mail: ltrama@iram.org.ar

Associação Brasileira de Normas Técnicas
Av. 13 de Maio, nº 13, 28º andar
20031-901 - Rio de Janeiro-RJ
Brazil
Tel: +55 11 30 17 36 00
Fax: +55 11 30 17 36 33
E-mail: abnt@abnt.org.br

Standards Council of Canada
600-55 Metcalfe Street
Ottawa K1P 6L5 Ontario
Canada
Tel: +1 613 238 32 22
Fax: +1 613 569 78 08
E-mail: info@scc.ca

Standardization Administration of China
No. 9 Madian Donglu, Haidian District
Beijing 100088
China
Tel: +8610 8226 2644
Fax: +8610 8226 0660
E-mail: sac@sac.gov.cn

Czech Office for Standards, Metrology and Testing
Biskupský dvůr 1148/5
110 00 Praha 1
Czech Republic
Tel: +420 2 21 80 21 11 / +420 224 907 175
Fax: +420 221802300
E-mail: unmz@unmz.cz

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11 rue Francis de Pressensé
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France
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Fax: +33 1 49 17 90 00
E-mail: Standardization@afnor.org

Ghana Standards Authority
Near Tetteh Quarshie Interchange
Accra
Ghana
Tel: +233 302 50065
Fax: +233 302 500092
E-mail: gsadir@gsa.gov.gh

Bureau of Indian Standards
Manak Bhavan
9 Bahadur Shah Zafar Marg
New Delhi 110002
India
Tel: +91 11 23230131 / +91 11 23233375 / +91 11 23239402
Fax: +91 11 23234062 / +91 11 23239382 / +91 11 23239399
E-mail: info@bis.gov.in

Iran National Standards Organization
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South West Vanak Square,
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Tehran
Iran, Islamic Republic of
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Fax: +98 26 32818787
E-mail: standard@inso.gov.ir

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Via Sannio, 2
I-20137 Milano
Italy
Tel: +39 02 70 02 41
Fax: +39 02 70 02 4499 / +39 02 70024375
E-mail: normazione@uni.com

Please get in touch with your national standards body

Some National Standards Bodies

Japanese Industrial Standards Committee
Technical Regulations, Standards & Conformity Assessment Policy Unit
Ministry of Economy, Trade and Industry
1-3-1, Kasumigaseki, Chiyoda-ku
Tokyo 100 - 8901
Japan
Tel: +81 3 35 01 94 71
Fax: +81 3 35 80 86 37
E-mail: bzl-jisc-iso@meti.go.jp

Jordan Standards and Metrology Organization (JSMO)
Dabouq area
#50 Khair Al-Din Al-Ma'ani St.
P.O. box 941287
Amman 11194
Jordan
Tel: +962 6 530 1225
Fax: +962 6 530 1249
E-mail: jsmo@jsmo.gov.jo

Korean Agency for Technology and Standards
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Eumseong-gun 27737
Chungcheongbuk-do
Korea, Republic of
Tel: +82 43 870 5400
Fax: + 82 43 870 5668
E-mail: standard@kats.go.kr

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Fax: +212 537 7117 73
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Pakistan Standards and Quality Control Authority
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Scheme No. 36
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Karachi, Sindh 75950
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Fax: +92 21 99333902
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Fax: +63 2 751 47 35
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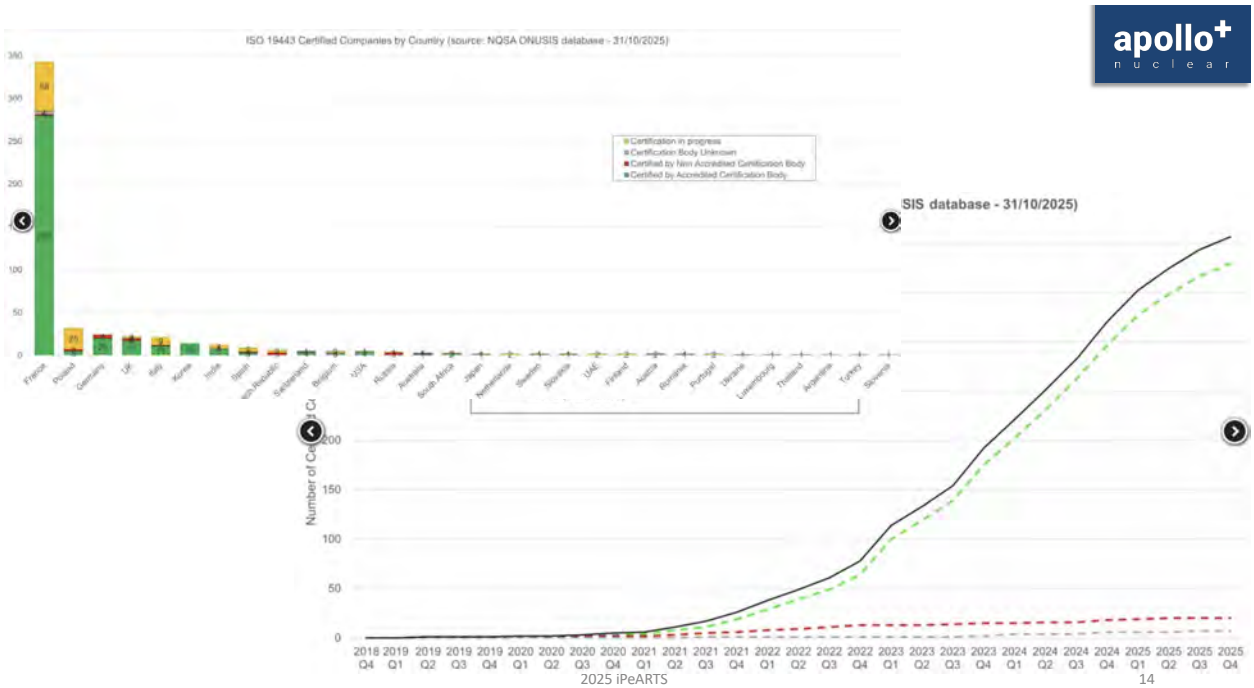
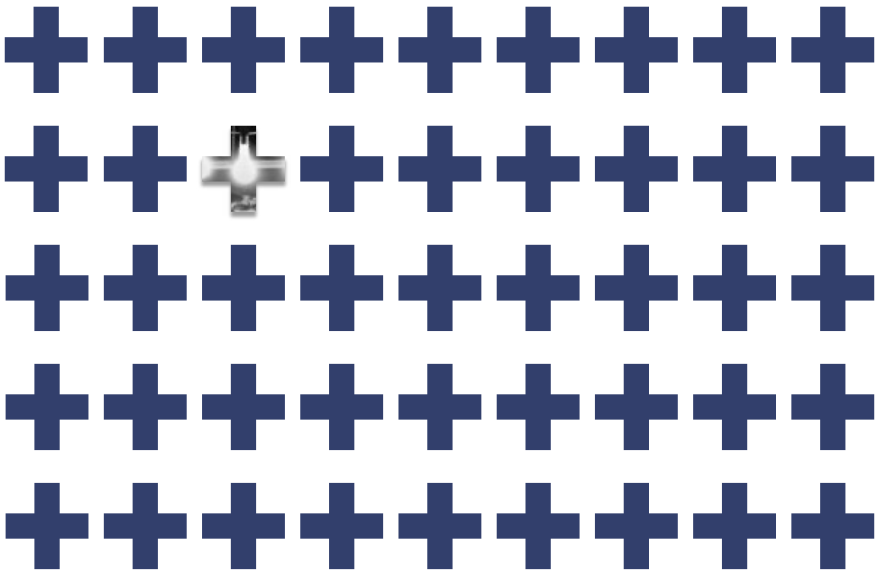
Washington 20036 DC
United States
Tel: +1 212 642 49 00 / +1.202.293.8020
Fax: +1 212 398 00 23 / +1.202.293.9287
E-mail: info@ansi.org

Please get in touch with your national standards body





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a+ nuclear

中广核 CGN

阳江核电有限公司
Yangjiang Nuclear Power Co., Ltd.

严 · 慎 · 细 · 实

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

November 2025

Content

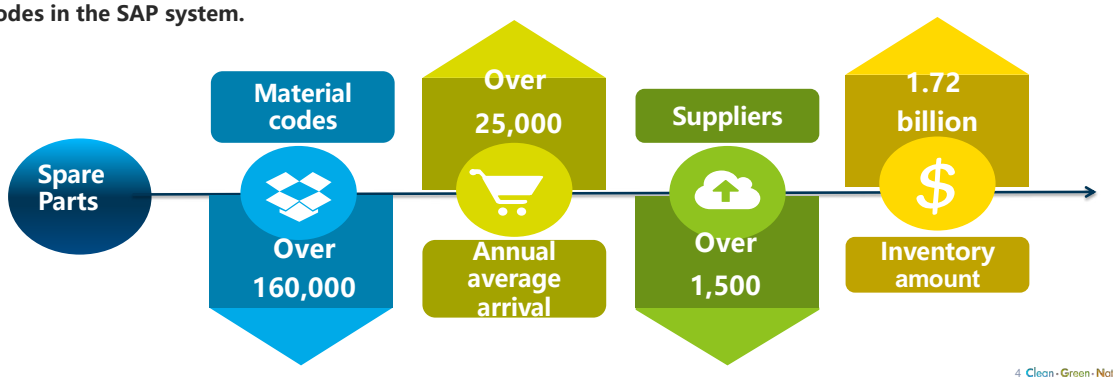
01

中广核 CGN
阳江核电有限公司
Yangjiang Nuclear Power Co., Ltd.

Current Spare Parts Management Situation in Yangjiang Nuclear Power Plant

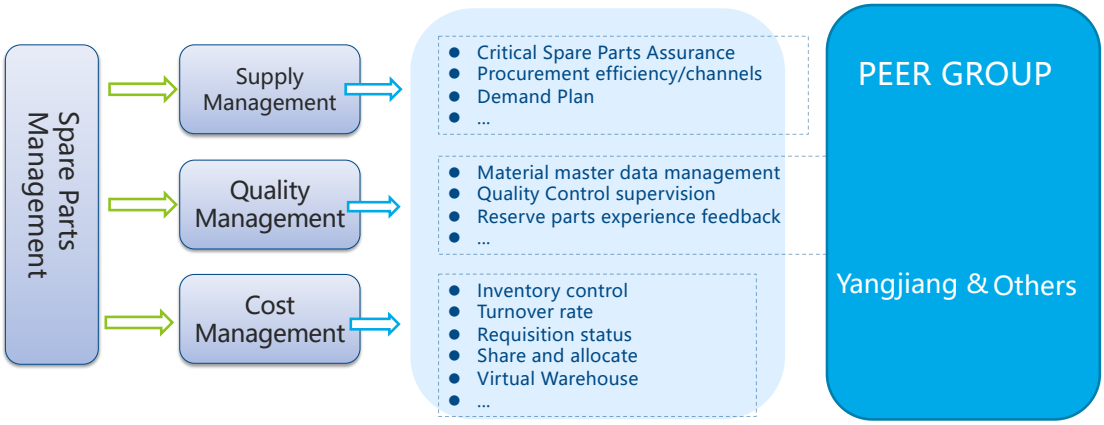
Introduction

In the power plant procedures, "spare parts" are defined as a certain quantity of equipment, components, consumables, etc. That are procured, manufactured, and stocked in advance to meet the needs of power plant operation and maintenance activities. Specifically, they refer to inventory material items with material codes in the SAP system.



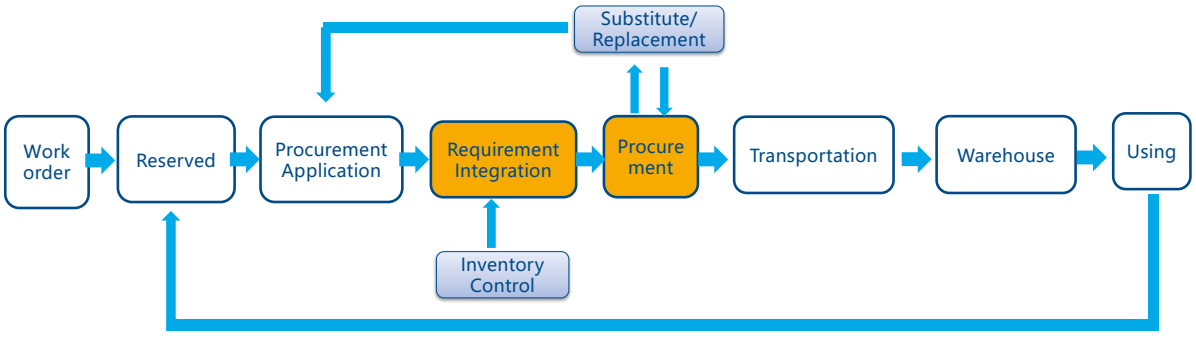
Current Spare Parts Management Situation in Yangjiang Nuclear Power Plant

Management System



Current Spare Parts Management Situation in Yangjiang Nuclear Power Plant

Supply Chain



Current Spare Parts Management Situation in Yangjiang Nuclear Power Plant

Problems

中广核 CGN
阳江核电有限公司 Yangjiang Nuclear Power Co., Ltd.

02

中广核 CGN

阳江核电有限公司 Yangjiang Nuclear Power Co., Ltd.

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

Equipment management improvements

Lean Equipment Management

Predictive Maintenance

Identify and classify key equipment
Measure: Identification of full-chain SPV points for shutdown, reactor shutdown, and load shedding

Performance Monitoring
Measure: Optimize and develop intelligent monitoring model

Corrective Action
Measure: Major equipment failure prediction and plan preparation

Continuous improvement of equipment reliability
Measure: Full application of predictive maintenance

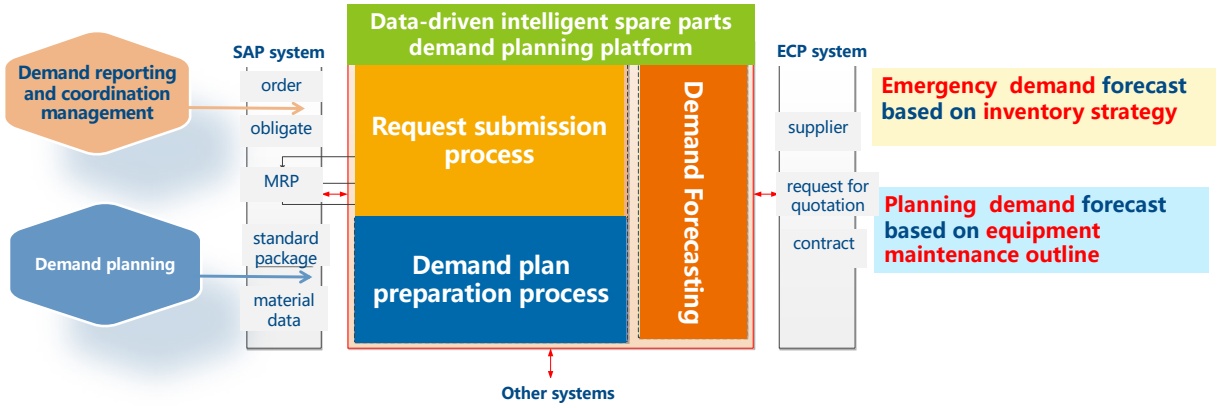
Lifecycle Management
Measure: Long-term asset management

中广核 CGN

阳江核电有限公司 Yangjiang Nuclear Power Co., Ltd.

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

Demand management improvement

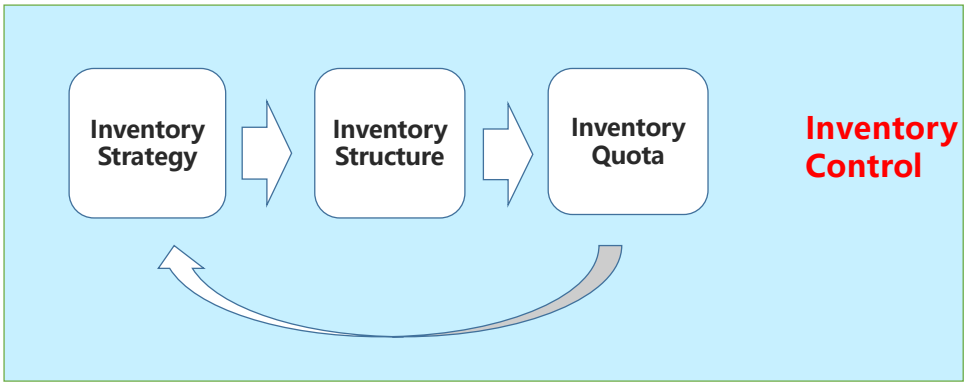


中广核 CGN

阳江核电有限公司
Yangjiang Nuclear Power Co., Ltd.

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

Inventory Management Improvement



中广核 CGN

阳江核电有限公司
Yangjiang Nuclear Power Co., Ltd.

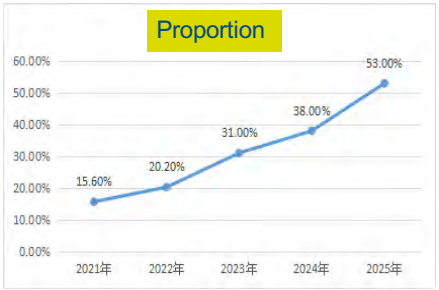
Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

Procurement management improvement

Procurement efficiency

- Expand the range of quick orders
- Application of information platforms
- Unified negotiation & separate signing
- Promote the improvement of contract performance capacity

Quick order



Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

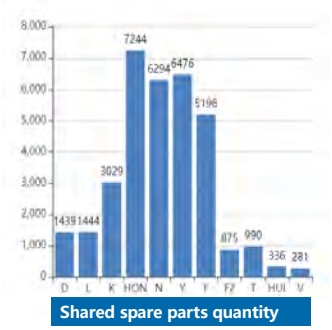
Supplier management improvement

By continuously strengthening the safe, reliable, economic and efficient nuclear energy supply chain system, deepening cooperation, building a win-win ecosystem, realizing the high level of self-reliance and self-strengthening of the nuclear energy industry, and creating a "win-win chain" through the supply chain, CGN will continue to move toward the high end of the nuclear energy value chain.

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

Sharing management improvements

Group-owned power plant spare parts sharing



Shared spare parts quantity

Reuse of spare parts in engineering construction

Cross-group support agreement

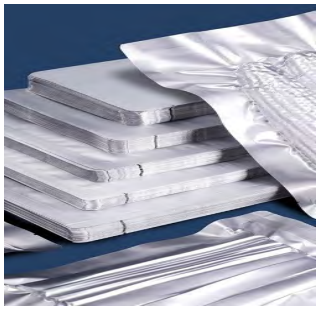
Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

Warehouse management improvement

Unified planning and construction

Intelligent transformation

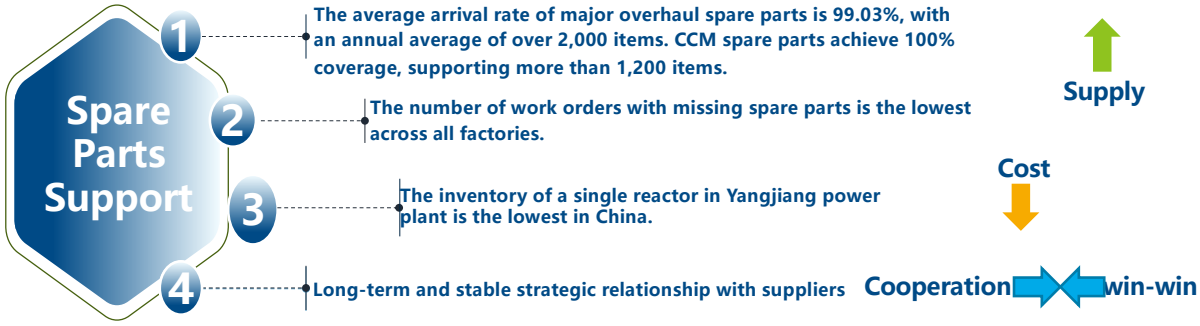
Maintenance method improved



中广核 CGN
阳江核电有限公司 Yangjiang Nuclear Power Co., Ltd.

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

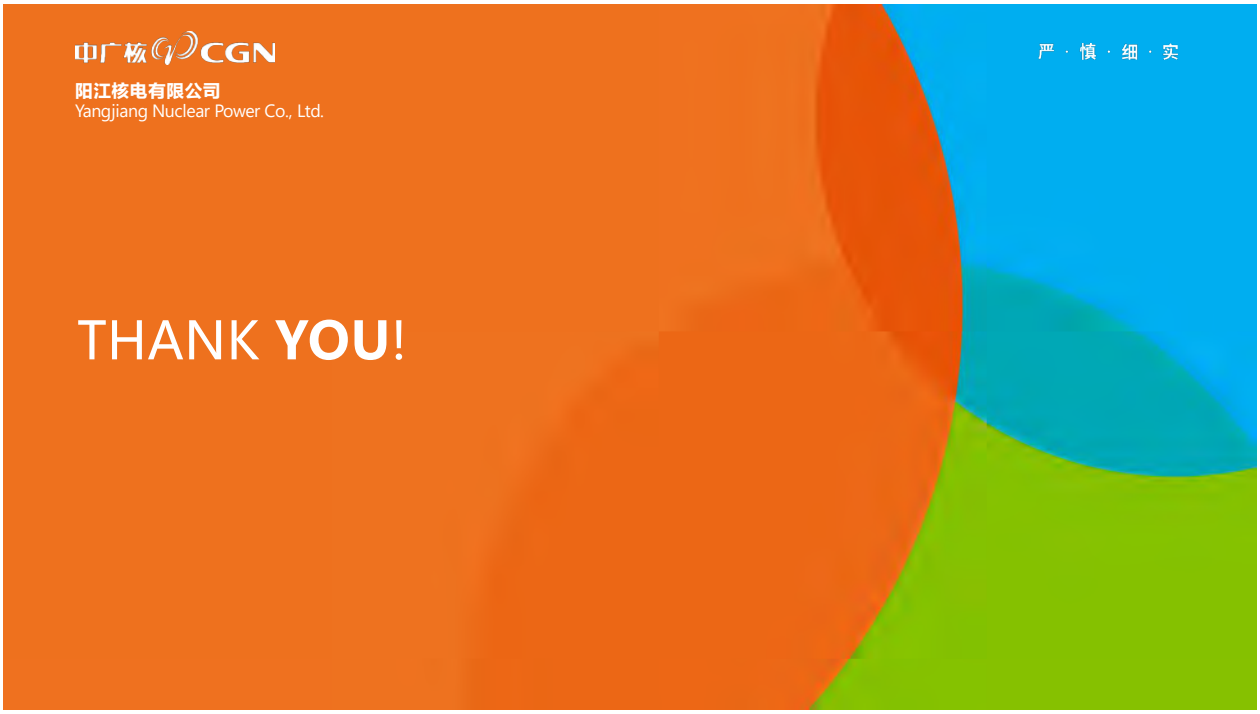
Enhance effect



03

Communication & Disccusion

1. Good Practices in Full-Chain Control for Spare Parts Management Improvement
2. Application of Intelligent Technology for Spare Parts Management
3. Foreign material prevention management of spare parts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Yangjiang Nuclear Power Co., Ltd.
严 · 慎 · 细 · 实
THANK YOU!

Equivalency Evaluation Basics

Back-to-Basics

Jon Thomas, P.E.
Principal Technical Leader

Procurement Engineering and Related Topics Symposium
(P[E]ARTS) – Zürich, Switzerland
November 11, 2025

The procurement process established in EPRI 1008256

1. Determine need for technical Evaluation
2. Determine end use applications (in the nuclear facility)
3. Safety Classification

Safety Classification
(Graded Approach to Quality)

4. Determine if the item has changed since the last time it was specified (like-for-like or alternate item)
5. If alternate item – Document Equivalency Evaluation

Equivalency Evaluation
(Design Control)

6. If safety-related, determine procurement scenario (supplier with nuclear quality program or CG dedication)
7. If non-safety-related, determine procurement scenario (non-safety or non-safety, augmented quality)
8. Specify technical, quality, and documentation requirements

Procurement Specification
(Translate Design Requirements into procurement Documents)

Fundamentals of the technical evaluation

Over time the manufacturer/supplier may change the design of the item, but the licensee remains responsible for ensuring the current design is “suitable for the application”

Quality assurance requirements for the procurement of items requires “planned coordination with the supplier”

The KEY questions are……

Has the item’s design changed since the last time it was specified?

Can it be specified the same as before, or must different requirements (e.g., technical, quality or documentation) be communicated to the supplier?

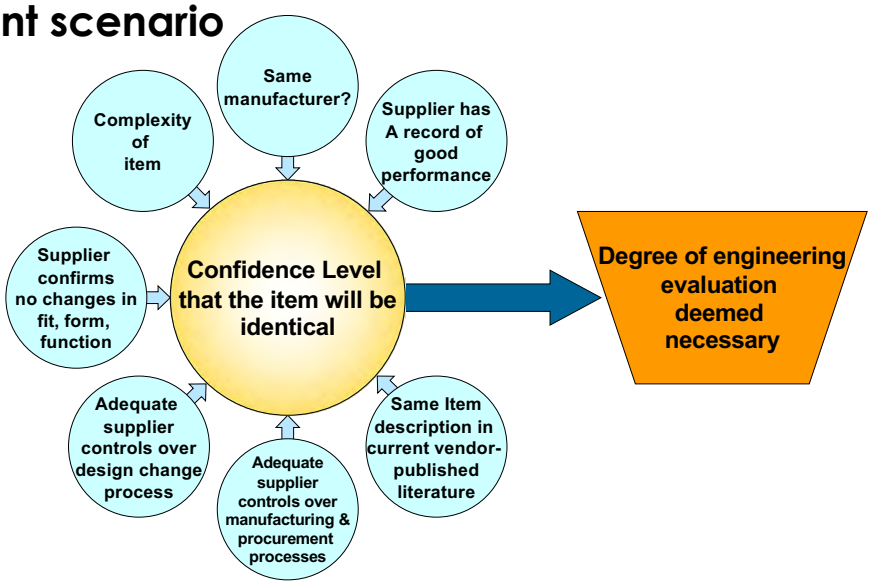
If the item can’t be specified the same way as before:

This situation causes the licensee to revisit design control requirements which requires all designs to be verified

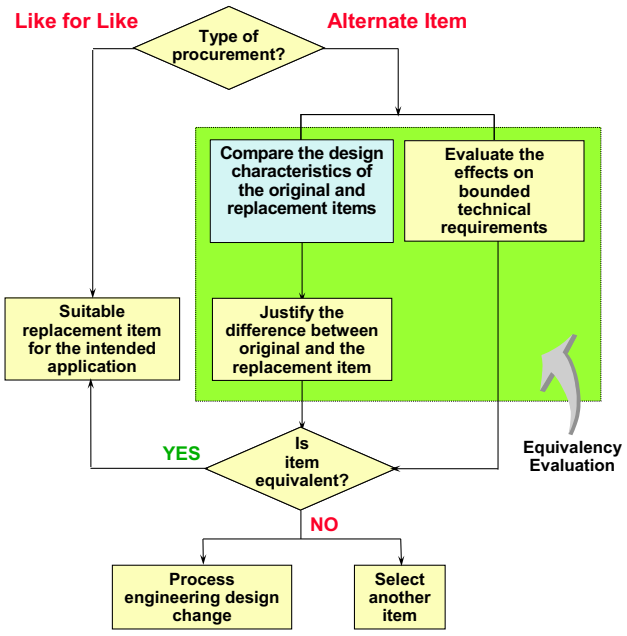
It behooves the purchaser to determine if changes to the item’s design have occurred and whether the item will be specified differently, as early in the procurement process as possible

Typically, specifications that are generated automatically from pre-engineered procurement requirements are reviewed for equivalency only after a supplier has taken exception to the requirements specified

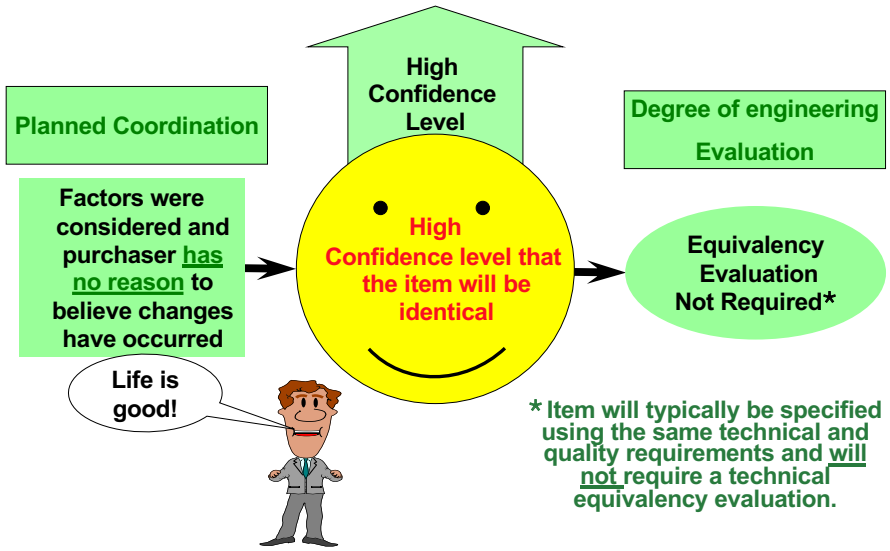
Factors considered to determine the type of procurement scenario



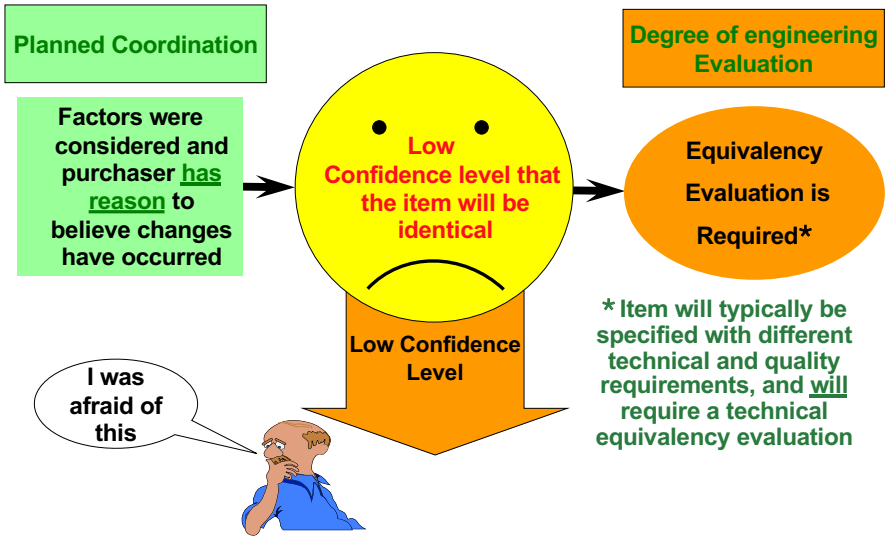
Process Overview



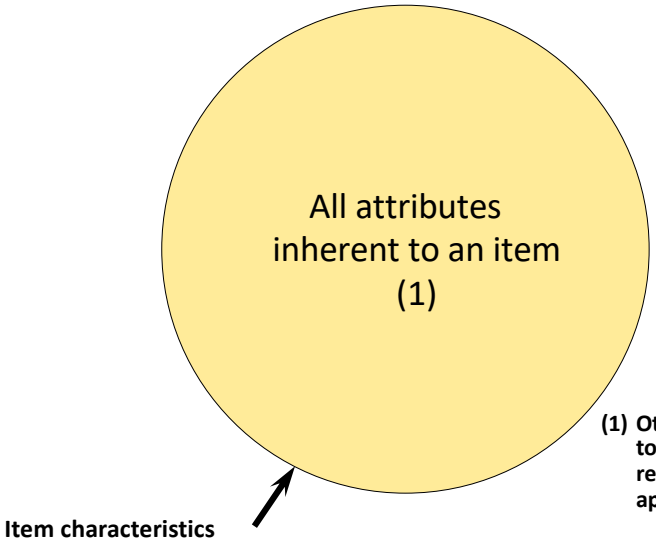
Like-for-Like procurement scenario



Alternate item procurement scenario



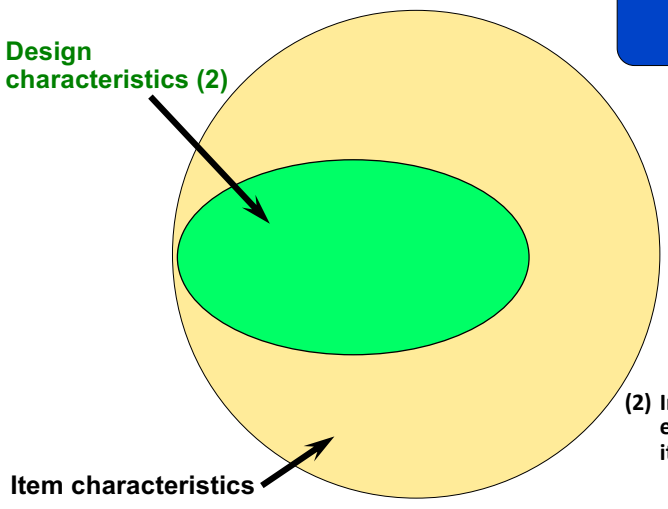
Item characteristics



(1) Other characteristics are inherent to the item's design but are not required/used in the purchaser's application

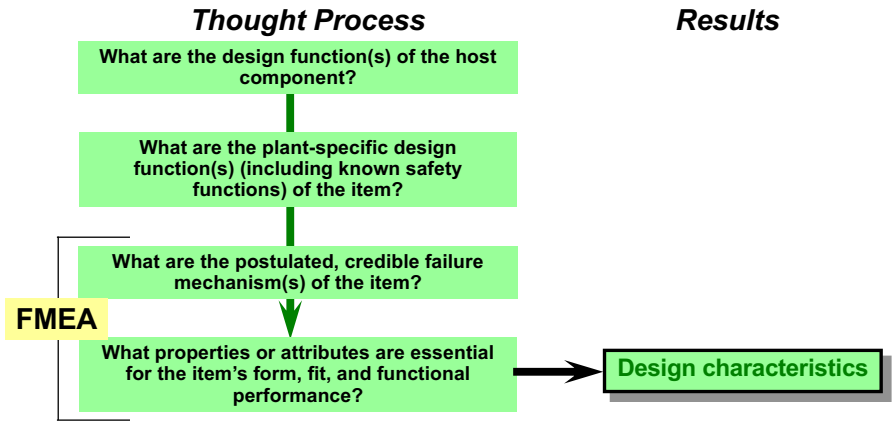
Determining design characteristics

Until 2014, EPRI referred to the green subset as *critical characteristics for design*



(2) Includes those attributes that ensure the performance of the item's design function

FMEA and design characteristics



Failure Modes and Effects Analysis is an effective tool for deriving design characteristics. It "links" the item's design function(s) to the attributes/characteristics necessary for it to perform those functions!

Side by Side Comparison

- One approach is to determine if the alternate (proposed replacement) item is equal to, or better than the original
- To determine equivalency, you compare

Design characteristics of the alternate item	versus ? =	Design characteristics of the original item

Premise

If the alternate item meets or exceeds the design of the original, and we know the original design was suitable, then the alternate is likewise suitable.

Equivalent alternate items

Knowledge of the component design basis is often needed when determining if a design characteristic meets or exceeds the requirements of the original

If the item's design has changed, but it is equal-to-or-better-than the original design, then the host design basis does not need to change to accommodate the alternate item

Thus, the replacement item is *equivalent* to the original

Additional Guidance

- "Like-for-like" is a term used in association with the technical evaluation referring to how the replacement item will be specified
- A "like-for-like" procurement is based on the original item being:
  - Designed correctly
  - Suitable for its end use application
  - Specified correctly the last time it was procured
- The purchaser then reaffirms on subsequent purchases changes have not occurred to the replacement item's design
- The term "like-for-like" describes a procurement scenario not the item itself (i.e., not describing an "identical" replacement item)

Fundamentals of the technical equivalency evaluation

When inadequate knowledge of design information prohibits a comparison of the alternate item to the original, another approach is to determine if the alternate item adversely affects "bounded technical requirements"

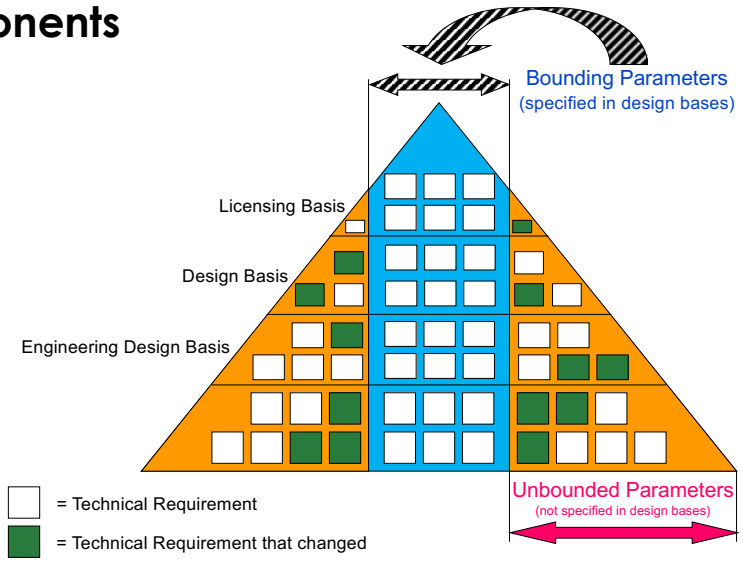
To find this out, you determine if....

Design characteristics of the alternate item

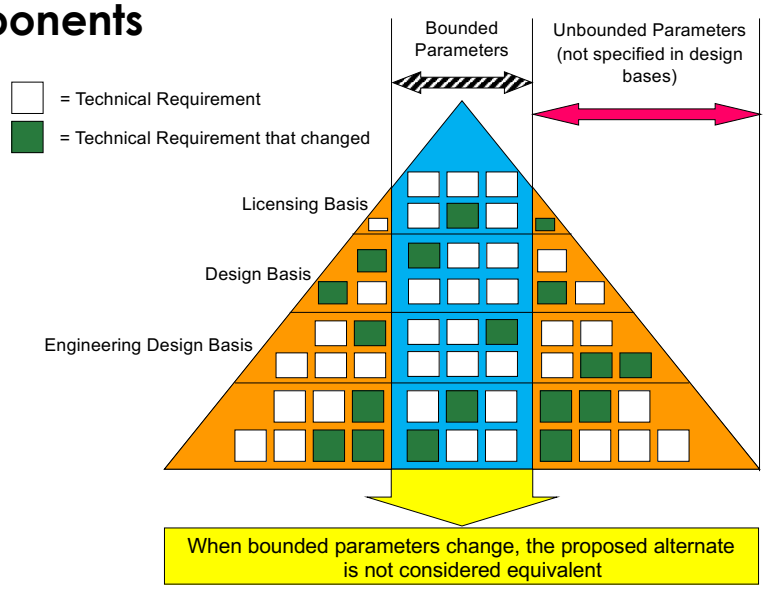
Meet the design basis of the host system, structure, or component

Whether these types of evaluations are controlled by design change procedures and are performed by design engineers varies among licensees

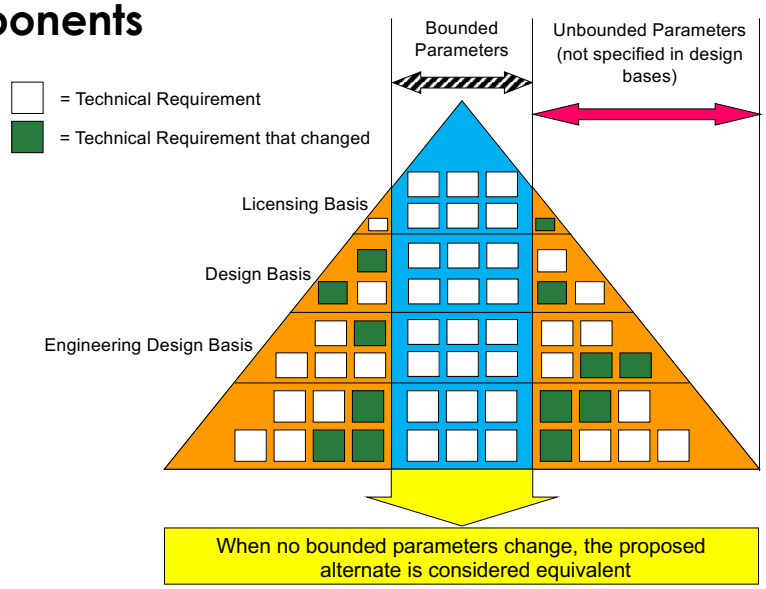
Analyzing Changes of Structures, Systems and Components

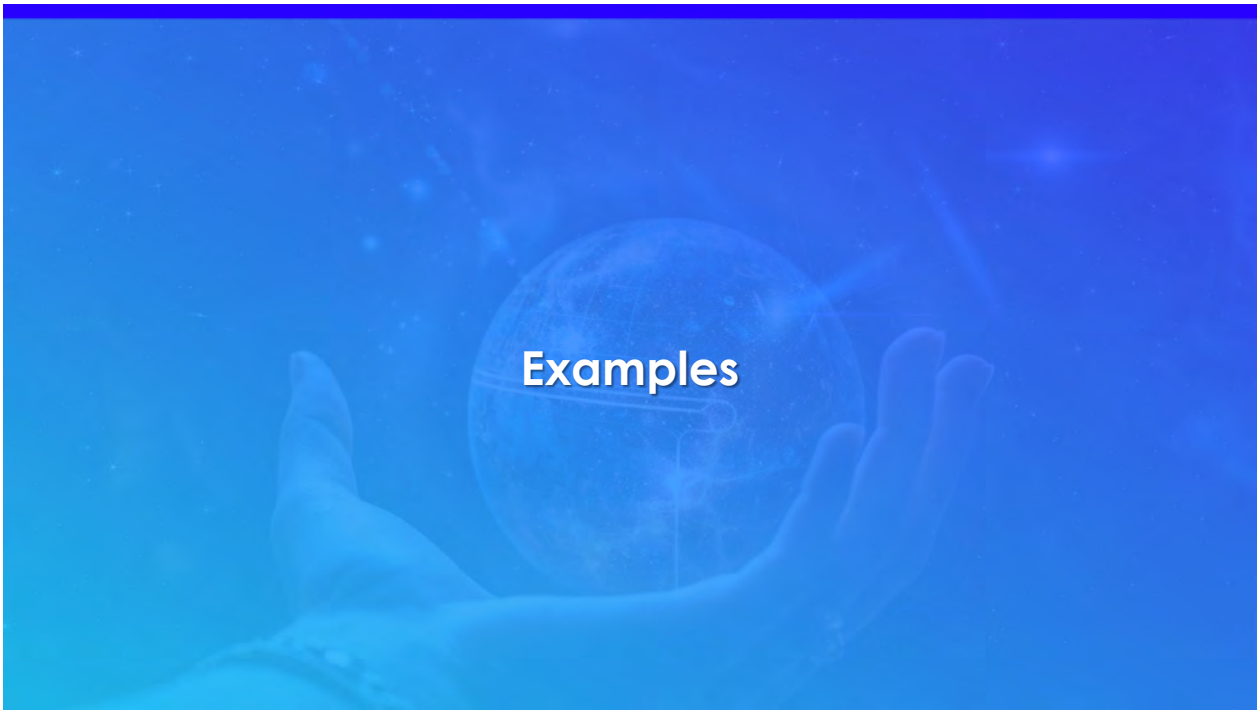


Analyzing Changes of Structures, Systems and Components



Analyzing Changes of Structures, Systems and Components





Design Characteristics Original versus Alternate - Capacitor

Design Characteristic	Original	Replacement	Comparison
Type	Radial	Radial	Same
Material	Aluminum Electrolytic	Aluminum Electrolytic	Same
Dimensions	5 mm (dia) x 20 mm (L)	8 mm (dia) x 16 mm (L)	See Evaluation
Capacitance	5000 micro-Farad	6000 micro-Farad	See Evaluation
Temperature Range	-30 to +100 Deg C	-40 to + 105 Deg C	See Evaluation
Rated Voltage	450	450	Same
Tolerance (Capacitance)	+/- 20%	+/- 10%	See Evaluation

Design Characteristics Original versus Alternate – 1" Valve

Design Characteristic	Original	Replacement	Comparison
End-to-End Length	5"	6"	See Evaluation
Valve Centerline to top of bonnet	3"	3-5/8"	See Evaluation
Valve Process Diameter	1"	1"	Same
End Connection Type	Socket Weld	Socket Weld	Same
Configuration	Manual, gate	Manual, gate	Same
Bonnet Closure	Bolted	Bolted	Same
ANSI Pressure Class	1500#	1500#	Same
Body Material	ASME SA105 Carbon Steel	ASME SA105 Carbon Steel	Same
Disc Material	ASTM A276 Type 410	AMS 5387	See Evaluation
Hard facing	Stellite 6	Stellite 6	Same
Valve Weight	9.0 lbs.	18.7 lbs.	See Evaluation
Design Pressure/Temperature	1575 psig/267 Deg F	3705 psig/100 Deg F	See Evaluation
Flow Coefficient (Cv)	7.0	6.0	See Evaluation

Equivalency Terminology

Technical Evaluation		Equivalency Evaluation Results
Situation	Procurement Scenario	
Reason to believe the item is different	Alternate Item – equivalency evaluation required	Alternate item is equivalent or Alternate item is not equivalent – design change required
No reason to believe the item is different – expect item to be identical	Like-for-Like – Equivalency evaluation NOT required	Equivalency Evaluation not applicable for like-for-like scenario

Term	Definition
Identical	Identical Item: An item that exhibits the same technical and physical characteristics. (See EPRI 1008256)
Like-for-Like	Like for Like Replacement: The replacement of an item with an identical item (e.g., replacement in kind). (See EPRI 3002002982, EPRI 1008256)
Alternate Item	Alternate item: A replacement item not physically identical to the original. These replacement items require an equivalency evaluation to ensure that the design function will be maintained. (See EPRI 1008256)

Key Take-Aways

If a like-for-like procurement is being made, design characteristics need not be identified and/or documented and evaluated

Only those design characteristics that have changed from the original item need to be documented when evaluating the equivalency of an alternate replacement item

EPRI guidance allows for item evaluation through either comparison of design characteristics, or by evaluating the effects the alternate item has on bounded technical requirements

References

- EPRI 1008254 - Plant Support Engineering: Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants, Revision 2
- EPRI 1008256 - Guidelines for the Technical Evaluation of Replacement Items in Nuclear Power Plants (Revision 1)
- 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
- EPRI 3002018278 – Item Equivalency Evaluation Computer-based training course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Critical Spares

Focus on the most important equipment

Marc H. Tanenbaum
Principal Technical Executive

International Procurement Engineering and Related Topics Symposium
Zürich, Switzerland, 11-12 November 2025

www.epri.com

Large capital assets have to be managed

- Assets like power plants, manufacturing facilities, ships, aircraft and even automobiles must be managed over their operating lifetime
  - Preventive and corrective maintenance is required
  - Sometimes, design changes are required
  - Replacement items are required to enable maintenance and design change
- Organizations and processes are typically in place to manage the asset
  - Maintenance
  - Engineering
  - Purchasing
  - Inventory management
- All of these organizations play a role in managing the asset

Effective management of equipment

- A typical nuclear power plant has tens of thousands pieces of equipment with equipment identification numbers
- Valves, pumps, breakers motor control centers, instruments, component supports, heat exchangers, transformers, generators, cables . . . even fuses have their own identification number

- Should all of these items be given the same priority with respect to maintenance and operations?

Prioritizing Nuclear Power Plant (NPP) equipment

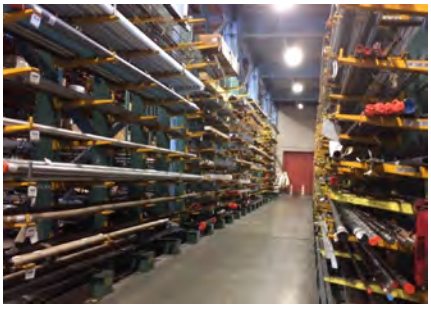
Processes that can benefit from focus/prioritization

- Resources are focused on the highest-priority equipment
  - Reduces unplanned unavailability of equipment critical to safety and generation
  - Helps ensure availability and readiness of items needed to support critical equipment
- The most important work gets done first
- Work backlogs can be prioritized so important work is not inadvertently delayed
- Can be very helpful in an environment where “planning for every contingency” is normal

- Maintenance
- Inventory Management
- Procurement
- Operations
- Design Engineering
- Procurement Engineering

Experience indicates

- Planning “for every contingency” adversely impacts supply chain
- Inventory management considerations should include:
  - Importance to safety
  - Importance to generation
  - Obsolescence status
- Supplier and item availability can change quickly
- Plants typically stock tens of thousands of items
  - Some are needed
  - Some are needed, but may never be used
  - Some are not needed
  - Some are left over from construction or for equipment that has been removed from the plant



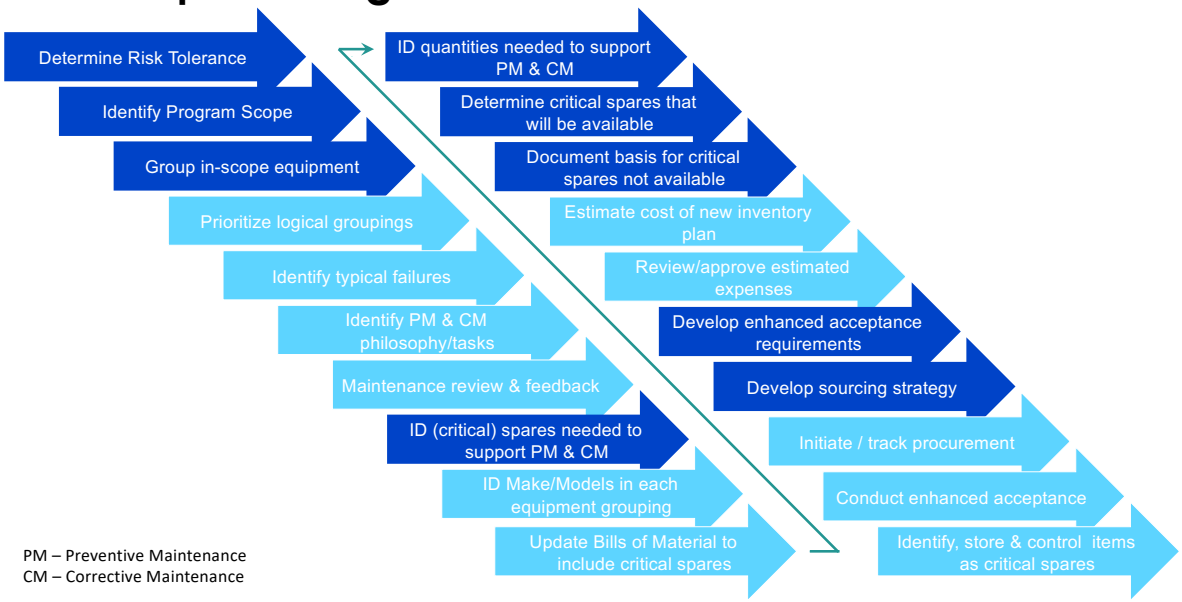
Ability to focus on the most important items is critical

Critical Spares Implementation and Lessons Learned

- Value-based approach
  - Balances risk and cost to optimize availability of critical spares
- Ensure that the spare and replacement items needed to support operation of critical equipment are evaluated
  - If appropriate, they are available to minimize equipment unavailability and optimize generation

EPRI 3002010685

Critical Spares Program Lessons Learned



PM – Preventive Maintenance
CM – Corrective Maintenance

Critical Spares Implementation and Lessons Learned

A well-defined scope is the crux of a critical spares program	Wider scope dilutes focus on equipment and associated spare and replacement items
Scope should reflect senior management's tolerance for risk, mitigation strategy, regulatory requirements, and condition of equipment	Considerations include risk mitigation strategy, regulatory requirements, and condition of equipment
Critical spares may be thought of as insurance against the impact of unexpected equipment failures	Establishing the scope of a critical spares program is like choosing the type of insurance policy and level of coverage to purchase

Critical Component - NEI Efficiency Bulletin 16-25

A component is critical if if a single active component failure will directly result in:

- Reactor scram or trip
- Significant power transient of greater than 20% plant transient (Operational Loss Event)
- Mitigating System Performance Index (MSPI) monitored component failure (failure of a safety system to perform its function)
  - Emergency alternating current (ac) power
    - Onsite standby diesel generators
    - Ancillary AC diesel generators
  - *MSPI function—high-pressure injection*
    - *Automatic depressurization system*
    - *Accumulators*
    - *In-containment refueling water storage tank*
  - MSPI function—heat removal
  - MSPI function—residual heat removal
    - Passive residual heat removal heat exchanger
    - Core markup tans
    - Normal residual heat removal system
  - MSPI function—cooling water
- Any single failure that causes a complete loss of any of the following critical safety functions:
  - Core, reactor coolant system, or spent fuel pool heat removal
  - Containment isolation, temperature, or pressure
  - Reactivity control
  - Vital ac electric power
- A single equipment failure that results in the loss of a Maintenance Rule high-safety significant or risk-significant function

International Equipment Reliability Working Group

	Suggested Scope ofptions and Definitions			
Classification	1 – Nuclear Safety Usually regulated as mandatory (reference International Atomic Energy Agency [IAEA] SSG-30)	2 – Production Sustained production, minimization of scrams, maximum MWhr	3 – Economics Long-Term Operation Life Extension Asset Life Optimization (reference INSAG 14)	4 – Combined Balanced comprehensive
C1 Critical 1 1st Gold Top, Highest, Grand, Big, No 1	Systems, structures, and components (SSC) preventing off-site release of nuclear material from Reactivity Control Cooling, Containment (3Cs, SPVs	SSC that cause production to be stopped quickly or for a long time (such as SPVs causing scrams, turbine trip, loss of lubrication) SPVs	Life-limiting SSC that are impossible to repair or replace, such as reactor pressure vessel, usually large, passive structures	*C1s from Nuclear Safety and Production and Economics or Nuclear Safety and Production, or Production and Economics*
C2 Critical 2 2nd Silver Second, Middle	SSC preventing on-site release of nuclear material from Reactivity Control Cooling Containment (3Cs)	SSC that cause production output to be reduced— long period of revealed deterioration	such as large one-offs or large quantities of smaller items (for example, heat exchanger replacement or station electrical cables)	C2s from Nuclear Safety and Production and Economics Or Nuclear Safety and Production, Or Production and Economics
C3 Critical 3 3rd Bronze Third	SSC preventing worker dose or contamination	Minor impact to station output, such as fueling delays due to fuel path equipment failures	SSC that impact station efficiency or SSC where their replacement cost far outweighs the cost of maintenance	C3s from Nuclear Safety and Production and Economics or Nuclear Safety and Production, Or Production and Economics
C4 to C 'n' Critical 4, Noncritical Bottom, Lowest Out of Scope, Not Covered	No nuclear or radiological impact	No production impact	Fix/replace on failure or delegate to the supply chain to maintain	Minimum, legal, good industry practice

Critical Spares Implementation and Lessons Learned

Careful consideration is warranted when identifying critical spares

Additional inventory can directly impact financial results and external obligations, such as ad valorem taxes

Input from maintenance personnel familiar with the equipment can be helpful

Enhanced acceptance activities can be implemented where appropriate to ensure that in-stock critical spares function reliably when they are installed, such as:

- Detailed procurement specifications
- Supplier oversight
- Pre-receipt inspection and testing
- Pre-installation inspection and testing

Determine critical spares that will be available

Part or Component-level Spares (one component can address many parts if replacement at the component level is practical)

Consider a different response to emergent failure (replace) than to regular maintenance activities (repair)

- Availability of a component-level critical spare may be more efficient than availability of all part-level items

Options other than inventory may exist

- Arrangements for a supplier to provide the item quickly in lieu of storing in warehouse
- Shared (pooled) inventory
- Sources identified in advance
- Implement planned modifications / equivalent replacement

Document basis for critical spares that will not be made available

Documented basis can be used to inform future decision making

Basis can be consulted if future operating experience indicates stocking plan needs to be adjusted

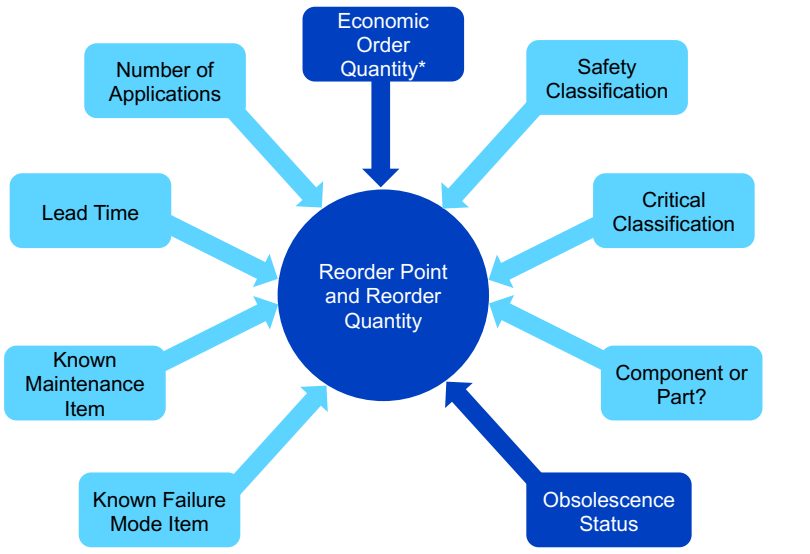
Basis can be helpful in determining extent of condition if an issue results

Adjust other items not stocked for the same reason

Identify and Store Items as Critical Spares

- Physically identify items in inventory
  - Prevent issue for work on non-critical equipment
- Consider programmatic control / approval to prevent issue that would reduce quantity-on-hand to a level below that needed to service critical spares
- Identify items in information systems
- Enables “manual” prioritization of reorders

Reorder parameters for critical spares

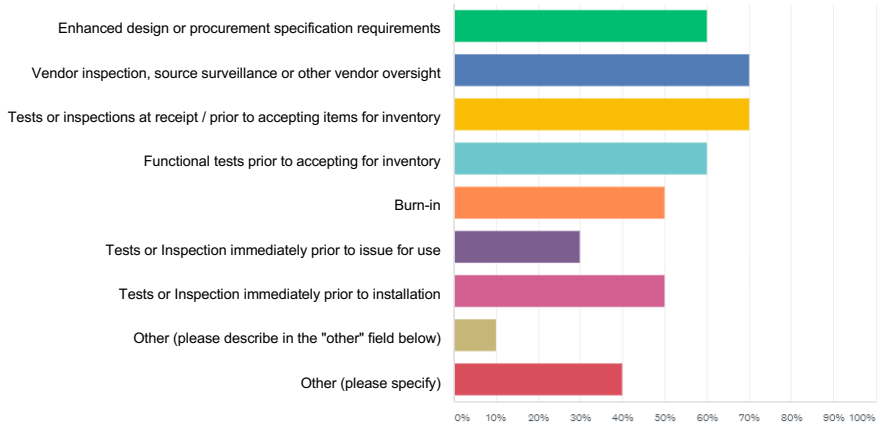


* Typically calculated based on annual demand, per-unit cost, purchase order cost, holding cost

Control of critical spares

What special controls are used to ensure function/reliability of critical spare parts? Please select all responses that apply:

Answered: 10 Skipped: 2



Other:

- Preventive maintenance on items, including critical spares, as required by our procedures. (e.g. motors, breakers, etc.)
- First two items as deemed necessary, on a case by case/item by item basis
- Will probably use a 3rd party to obtain the spares and have them do the PQI testing. this way the costs go into the AUP and not an O&M expense.
- ISPM

Refining Focus – Total Number of Critical Spares / Unit

	2014 Survey	2018 Survey
Basis for identifying Critical Equipment and spares	Early and flexible definition for critical equipment developed by the Equipment Reliability Working Group	Delivering the Nuclear Promise (DNP) Efficiency Bulletin with clear criteria defined for identification of critical equipment*
Number of critical spares for 1 operating unit	Range: **31 to 17,921**	Range: **172 to 7,000ᵃ**
Survey average number of critical spares for 1 unit	**3,234**	**2,767 (15% decrease from 2014)**

*DNP Efficiency Bulletin Efficiency Bulletin: 16–25, *Critical Component Reduction*
ᵃ Not all survey respondents had completed reclassification

How big is the population of critical spares

If your organization has completed component/equipment re-categorization (reduction based on updated definitions of single point vulnerability and critical) as a result of DNP, what is the new total number of critical components per plant/site?

Answered: 10 Skipped: 2

7000 average per 2-unit station					
847					
	Plant 1		Plant 2		Plant 3
Tier 1	34 } 172		53 } 378		35 } 555
Tier 2	138 }		325 }		520 }
Unknown					
Approximately 1500 per unit					
1679					
Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6
5350	1946	2141	6459	4139	3809
Not Sure					
Do not know					
Unknown					

Proactive Obsolescence Program at NPP Paks

Dr. Zoltán Vajna
MVM Paks Nuclear Power Plant Ltd.

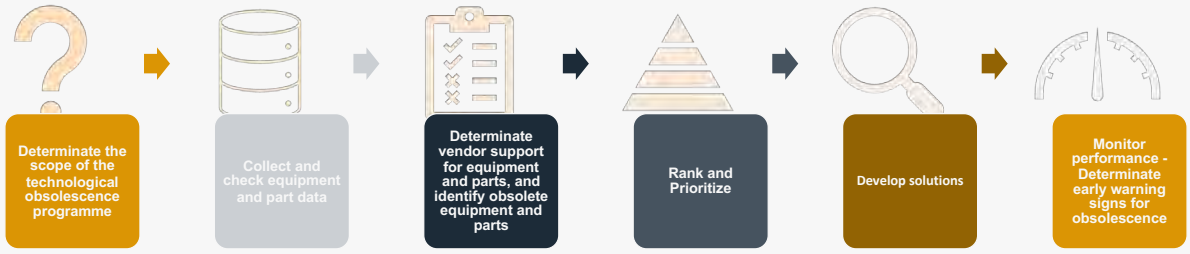
MVM Paks NPP

Motivation, purpose

- **Operating time extension authority**
  - „TÜH": Operating time extension project
- **Identify proactively obsolete equipments**
- **Plant ageing**
  - As the plant ages the impact of obsolescence problems become more and more
  - The date of the start of the 1. block:1982

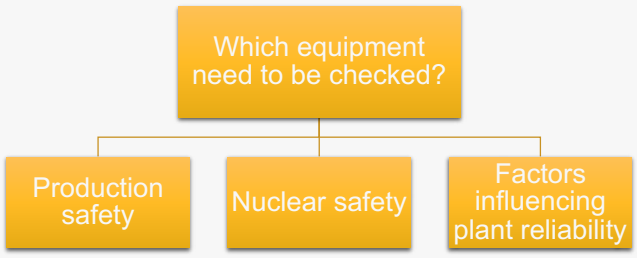
MVM Paks NPP

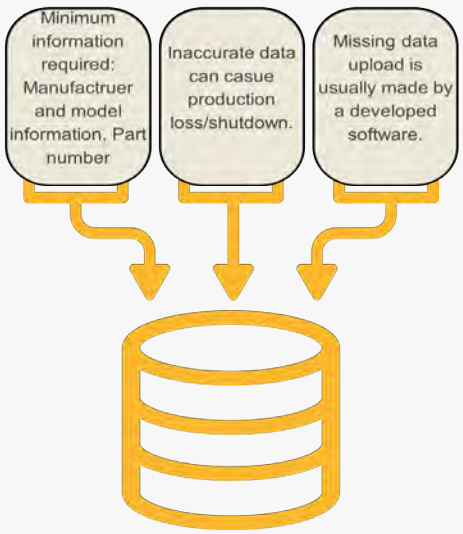
The main process according to EPRI



MVM Paks NPP

Identifying the obsolescence

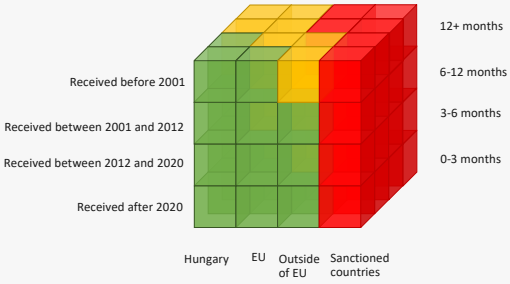




Identify Obsolescence

- The Request Information should be as easy as possible for the vendor to respond
- The market research is made by the Procurement Organization
- Cooperation from other organizations is required in order to address obsolescence

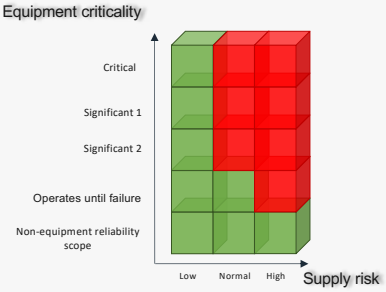
MVM Paks NPP



Which equipment needs to be inspected?

- Nuclear safety
- Production reliability

Risk matrix



Supply risk

1. Low

- Received after 2020
- From Hungary
- Supply lead time: 0–3 months

2. Normal

- Received before 2001
- From outside of EU
- Supply lead time: 0–3 months

3. High

- Received before 2001
- Sanctioned countries
- Supply lead time: 0–3 months

5

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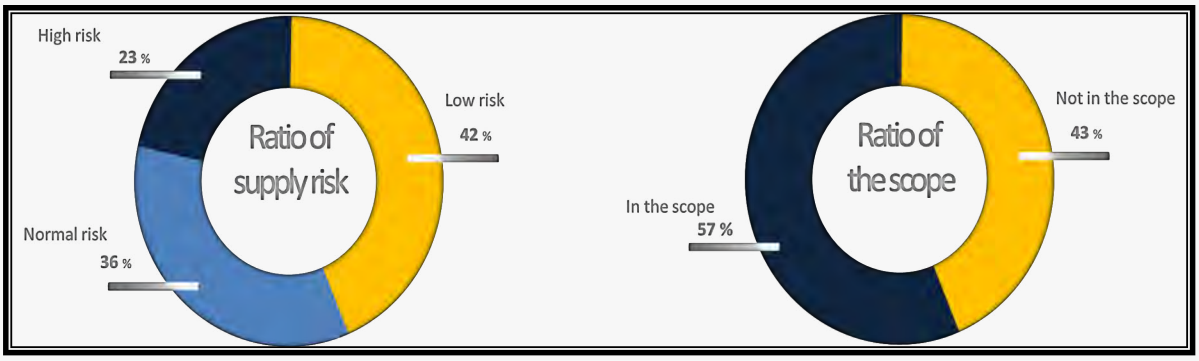
Risk matrix first trial results



6

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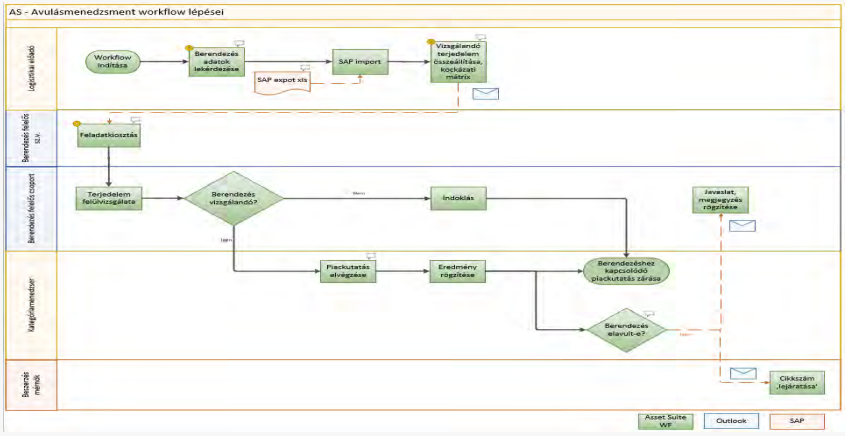
IT solution in obsolescence Management

In 2024, a shared SharePoint platform was established with the current scope, containing all related information.

At the beginning of 2025, the first phase of the IT development was completed, introducing a pre-screening workflow that enables:

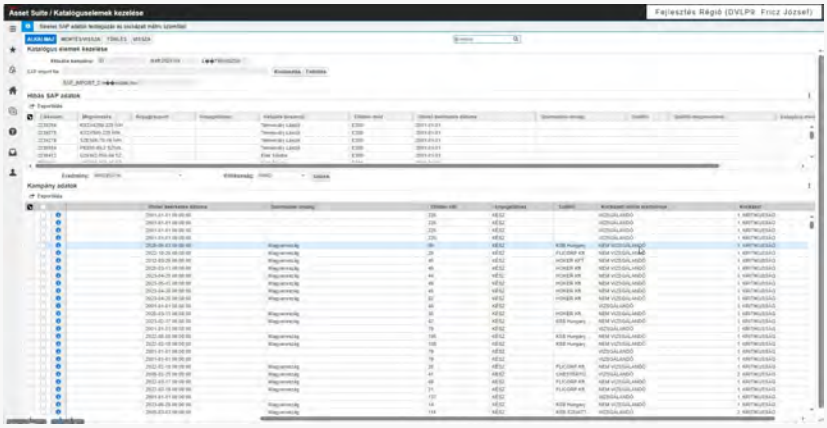
- data uploading,
- risk matrix calculation supplemented with AS9 data,
- review processes,
- task coordination,
- managerial delegation,
- inspections,
- category manager activities,
- and status tracking.

Creation and implementation of the Obsolescence Management Pre-Screening Workflow in AS9



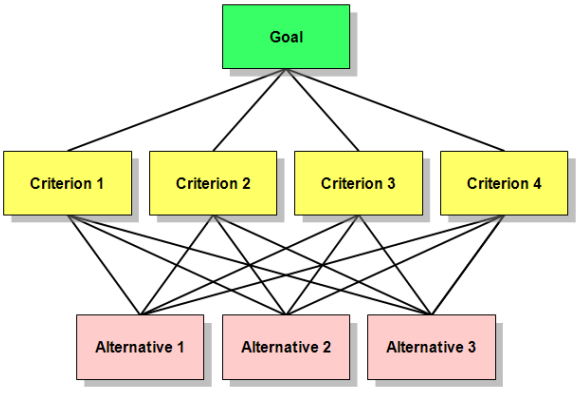
Integration of a Dual Risk Matrix

We have integrated a custom-built dual risk matrix into AS9, making the filtering of the full scope of equipment and components according to the criteria, that is, the generation of the scope to be examined, fully automated.



Applied to problems where multiple aspects need to be considered, and the decision contains complex, subjective elements.

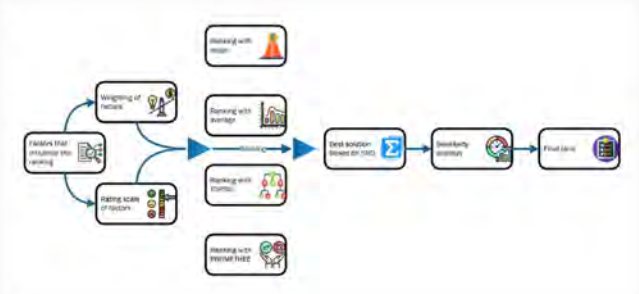
- AHP steps:
  - Goal definition – What do we want to optimize / select
  - Hierarchy construction – Goal(s) → Criteria → Alternatives
  - Pairwise comparison – Evaluating the importance of the elements (on a scale of 1–9)
  - Weight calculation – Determining relative importance (using the eigenvector method)
  - Consistency check – Checking whether the evaluations are logical (CR < 0.1)
  - Summary of results – Ranking the alternatives based on the weights.



Factors and weighting

No.	Factor name	Explanation	Weight
1	Equipment designated for emergency inventory	Equipment designated in the enterprise management system for use in cooling or maintaining the cooling of the reactor units in case of an event.	16%
2	Safety class classification	The ABOS classification of the equipment.	10%
3	Part of the fire protection system	Equipment that plays a role in the facility's fire protection.	6%
4	Classification into equipment criticality category	Classification of the equipment based on ER criticality criteria (Critical, Report 1–2, etc.).	14%
5	Equipment reliability (based on failure statistics and condition reports)	Equipment managed based on reliability monitoring processes, including failure statistics and condition reports generated within the system.	8%
6	Equipment designated as SPV	Single Point of Vulnerability. Equipment identified as SPV in the enterprise management system.	22%
7	Availability of current warehouse stock	The quantity of stock available at the storage location at a given time.	6%
8	Installed quantity	The number of units of the given equipment currently operating in the plant.	5%
9	Equipment listed in the ÜFK	Equipment subject to operational restrictions and conditions.	13%

During the ranking process, we defined various evaluation factors, taking into account the extent of obsolete equipment. These factors help to establish a ranking among the alternatives, which forms the basis for decision-making.



Development of a Ranking Methodology

Defining Prioritization

After accurately determining the scope, a ranking must be established to define the order in which experts should begin seeking solutions to address the obsolescence of the given equipment.

Application of Mathematical Methods

The methods of operations research and applied mathematics, such as multi-criteria decision support, can assist in selecting the most appropriate solutions and establishing the ranking.

SRD (Sum of Ranking Differences)

The SUM OF RANKING DIFFERENCE (SRD) method is a quantitative comparative evaluation technique often used to compare the performance of different models, methods, or decision alternatives. Its essence lies in ranking the examined elements, comparing them to a “reference” ranking, and calculating how much they deviate from it.

Kit_AN_ID	Criticality	Safety Classification	Fire Protection System	Single Point Vulnerability	Operating Conditions and Limitations	Emergency	Reliability	Current Stock	Installed Quantity	AVERAGE	MEDIAN	TOPSIS	PROMETHEE
2029728 10LHX10001 BETÁP MEGSZAKÍTÓJA	-0,0797	-0,14	-0,01	-0,1	-0,18	0,2033	0,0971	-0,0195	0,0231	-0,0449	0,0048	0,49699754	0,07545165
2029728 10LHX10002 BETÁP MEGSZAKÍTÓJA	-0,0797	-0,14	-0,01	-0,1	-0,18	-0,1018	0,0971	-0,0195	0,0231	-0,1836	-0,0533	0,45144177	-0,6958205
2029728 20UG33D001 BETÁP MEGSZAKÍTÓJA	-0,0797	-0,05	-0,01	-0,1	-0,18	0,2033	0,0971	-0,0195	0,0231	-0,0075	0,0048	0,49897932	0,16203758

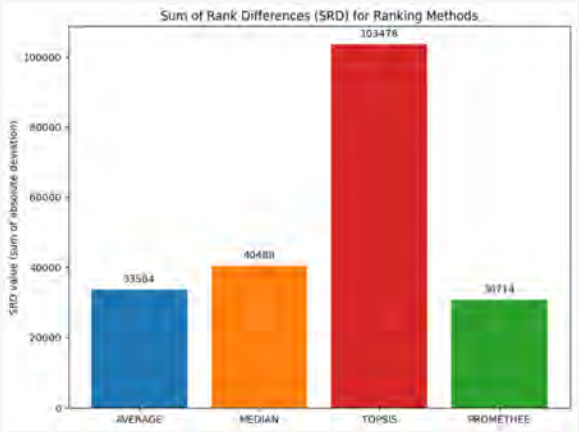
AVERAGE RANKING	MEDIAN RANKING	TOPSIS RANKING	PROMETHEE RANKING
264,5	264,5	271,5	251,5
647,5	521	564,5	653,5
83	234,5	157	38

MEDIAN OF RANKINGS
257,5
618
111

	ABSOLUTE DIFFERENCE AVERAGE	ABSOLUTE DIFFERENCE MEDIAN	ABSOLUTE DIFFERENCE TOPSIS	ABSOLUTE DIFFERENCE PROMETHEE
	6	7	14	6
	31,5	31	31,5	17,5
	26	325,5	26	73
SRD value	63,5	227,5	73,5	116,5

Paks NPP

Integration of Ranking



After validating the prioritization methodology, the calculations required to establish the ranking will be integrated into the AS9 system, enabling more efficient automation and monitoring of the process.

According to our current calculations, this will be the PROMETHEE multi-criteria ranking method, as it appears to be the most stable in our environment.

Paks NPP

PAST	PRESENT	FUTURE
2024	2025	2026
Scope definition Establishment of a custom risk assessment matrix Mathematical calculations Implementation of the obsolescence management process We have initiated market research for the relevant equipment	Partial development of a digitized process (AS9 workflow) suitable for obsolescence identification Development of a ranking methodology for obsolete items	Integration of ranking into the AS9 Obsolescence Management Pre-screening Workflow Problem-solving / Solution development Definition of KPIs Development of a process monitoring system and early warning indicator system

MVM Paks NPP

Thank you for your attention!

Dr. Zoltán Vajna – vajnaz@npp.hu

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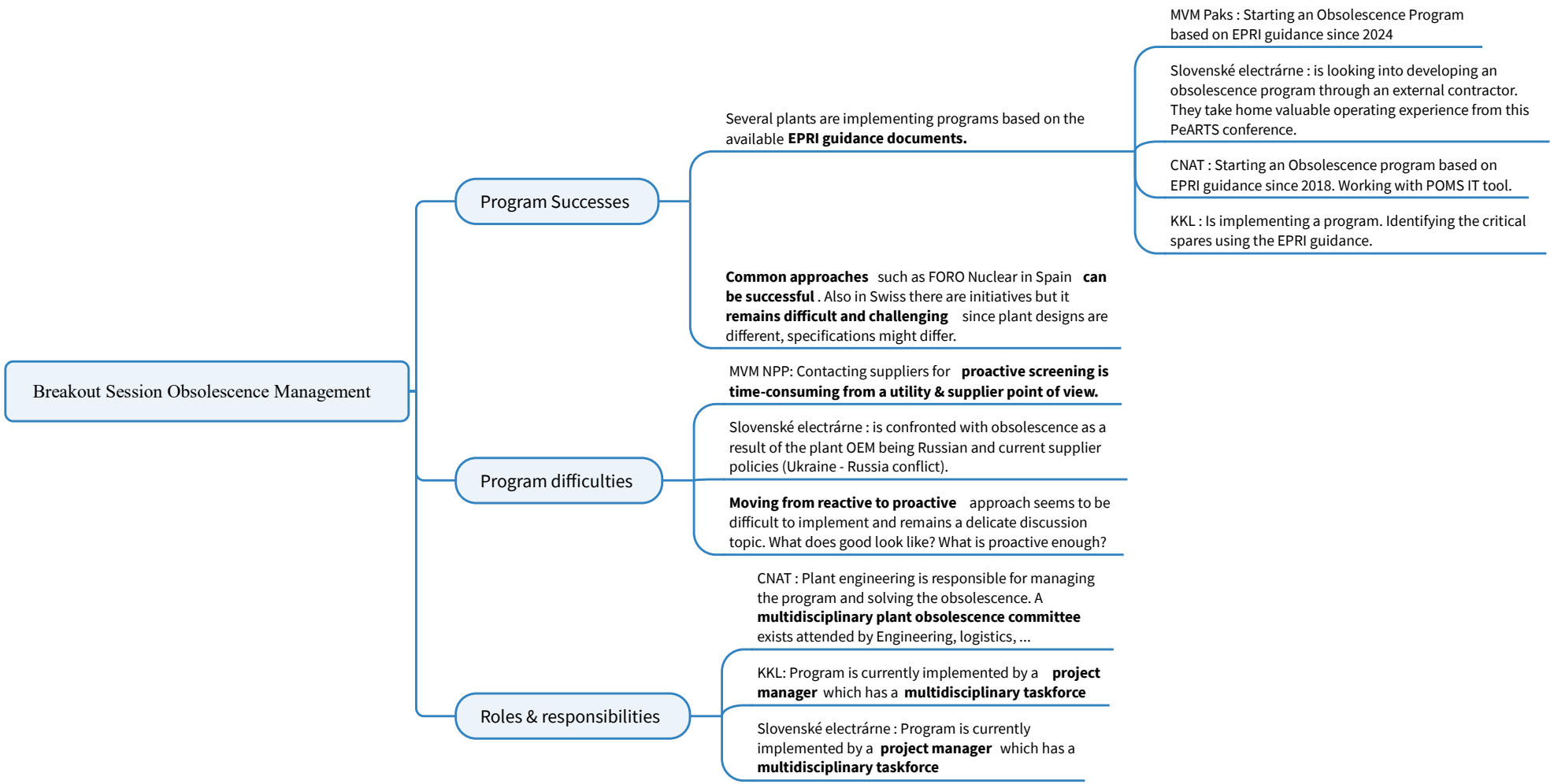

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element Nuclear

- Equipment Qualification
- Third Party Qualification (TPQ)
- Exclusive Yokogawa Supplier
- Valve and Snubber Testing/Repair
- Materials Testing

HSV
Center of Excellence

element

Element Materials Technology, Huntsville Nuclear Presentation on Surplus Safety Relief Valves to Plant Inventory

EPRI International PeARTS Conference
Zürich, Switzerland
November 2025

element

THE JOURNEY SO FAR

55,000+ CUSTOMERS

- CONNECTED TECHNOLOGIES
- MOBILITY
- LIFE SCIENCES
- BUILT ENVIRONMENT
- AEROSPACE

OUR PURPOSE
MAKING TOMORROW SAFER THAN TODAY

60%+

#1 ESG RANKING IN INDUSTRY VIA SUSTAINALYTICS

10X REVENUE GROWTH TO OVER $1.5B

47 ACQUISITIONS

Introduction of Element Nuclear

element

Element Nuclear, formerly known as NTS Labs and Wyle Laboratories, is proud to be part of the Element family. While our name has changed, we continue to offer the industry's most comprehensive and cost-effective programs for the full array of nuclear equipment qualification, commercial grade dedication, obsolescence solutions, aging analysis, component supply including sole supplier of Yokogawa products, SRV and Snubber testing/repair services and material testing.

Element Huntsville

element

80
Colleagues

1
Location
122 Acres
238,000 sqft

300
Customers

2
Distinct
Business
Streams

Element Huntsville Nuclear

element

New SMR Facility

2x HELB

1x LOCA Horizontal

1x LOCA Vertical

element

Background of Marble Hill

- Construction began in 1977; Ended in 1984
- 50% complete having spent $2.5 billion
- 1 of more than 100 plant cancellations following the Three Mile Island accident
- 1985 first auction ~$8 million work of already purchased nuclear hardware

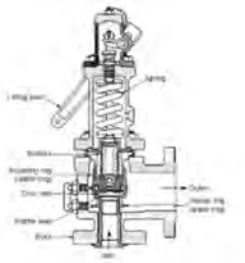
element

Supply of Surplus Crosby Pressurizer SRVs

- End User contacts Park Nuclear in June 2023
- Two Crosby HB-BP-86 style Pressurizer Safety Relief Valves are procured as surplus spares
- Communication between Park Nuclear, NTS Labs, Emerson Crosby Valve and End User as to reestablishing safety-related quality level 1 for the valves
- A plan to provide verification to original Crosby Valve documentation for each valve along with refurbishment and recertification by NTS Labs with Crosby Valve

element

Verification and Certification by NTS Labs



- Receipt Inspection and Valve Disassembly
- Performed Physical Inspection and photographed each part for signs of damage or previous rework
- Verification of Inspections Data
- XRF of all metallic parts with exception of springs due to Cadmium coatings. It was noted that the coating integrity had been maintained
- Inlet and Bonnet studs are impact driven so could not be removed. XRF was used along with visual inspection of each stud to provide adequate traceability to the original valve and document package
- Ultimately, Crosby and NTS Labs determined that all components were original to the valve and document package was established

element

Verification and Certification by NTS Labs

- Crosby Valve performed normal refurbishment activities prior to steam test
- NTS Labs performed steam set pressure and seat leakage testing
- Crosby performed jack and lap of each valve
- NTS Labs performed nitrogen seat leakage and backpressure testing
- Complete data package assembled:
  - Original Crosby Valve & Gage Company documentation at original purchase by Public Service of Indiana Marble Hill Nuclear Plant
  - NTS Labs Inspection Certificate of Conformance
  - NTS Labs Certification Test Reports
  - Crosby Valve Refurbishment Report
  - NTS Labs Testing Certificate of Conformance

element

Conclusion

- Purchase of valves until project completion within 3 weeks
- End User was able to save hundreds of thousands of dollars
- Four different companies: Park Nuclear, Emerson Crosby Valve, End User and NTS Labs all working together in support of the Nuclear Promise

THANK YOU

element

Greg Mason, Nuclear Technical Director

Element Materials Technology
Huntsville Nuclear

256-603-0903 mobile
greg.mason@element.com
www.element.com

Paragon

What's New at Paragon!

- Paragon is in a transformative stage with heavy investments in people and facility changes to support Digital I&C and NFMS projects for both New Nuclear and Digital Upgrades
- Facility upgrades to support large influx of I&C Repair and RE to support plant restarts and operating fleet obsolescence
- Updating assembly area to support large MCC cubicle and switchgear upgrades for the existing fleet




Westinghouse Parts Business

GLOBAL DELIVERY

PARTS ENGINEERING | **PARTS SUPPLY** | **VENDOR MANAGED INVENTORY**

CAPABILITY OVERVIEW

- OEM for half of the world's nuclear power plants
- Over $50 million components in inventory
- Key capabilities
  - ✓ Complete commercial dedication function
  - ✓ Circuit breaker manufacturing & refurbishment facility
  - ✓ Complete machine shop (ASME certified)
  - ✓ Electrical, mechanical and I&C part assembly and testing
  - ✓ I&C system cabinet assembly, testing, and repair shops
  - ✓ Warehousing and storage (category B)
  - ✓ Non-OEM product inspection and testing
  - ✓ Strategic bulk supply

Take a virtual tour of the Westinghouse Parts Business

[click here]

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Parts Solutions

I&C
Detectors, transmitters, power supplies, circuit boards, cables, cabinets

Mechanical
Seals, pump, motor parts, auxiliary motors and pumps, reactor vessel, valves

Electrical
LV and MV breakers, electrical cabinets, electro-mechanical control components

Manufacturing & Repair
Parts repair, refurbishment and replacement

Commercial Grade Dedication & Environmental Qualifications
Advanced test equipment

Obsolescence Solutions
Including Reverse engineering, qualification

What is POMS ?

Reduced costs: A centralized service
That enables pooling of industry costs, acting as a single point of contact

- **Identify obsolete items**
- **Find solution information.**
- **Prioritize obsolescence problems**
- **Forecast demand impact0**
- **Compare to industry data**

A one-stop-shop for obsolescence identification and management

- **Move towards early obsolescence detection**: reduce your costs and improve your decision-making capability

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HAYWARD TYLER

energy steel | Exclusively Nuclear

Hayward Tyler

Company Introduction for:

EPRI
ELECTRIC POWER RESEARCH INSTITUTE

Mario Carratú
Business Development Manager Europe – Hayward Tyler
Canned Motor Pumps
mario.carratu@haywardtyler.com
+34 639 457 382

November 2025

Our Businesses

HAYWARD TYLER energy steel Exclusively Nuclear

- **Our businesses includes:**
  - **Design and manufacturing of pump and motor units (new and existing designs)**
  - **Design and manufacturing of spare parts and product upgrades**
  - **Design and manufacturing of nuclear fabrications**
  - **In-house service and overhaul of our installed base and competitor equipment (re-winds, etc.)**
  - **Field service of our installed base**
  - **Engineering services (engineering studies, problem diagnostics, structural analysis, seismic, CFD, etc.)**
  - **Teaming agreements / nuclear manufacturing partnerships**
- **All products and services are delivered with SAFETY and QUALITY as top objectives**
- **Maintain an approved supplier list (ASL) to support our Nuclear and Safety related business**

Commitment to the Nuclear Market

- Active in the nuclear market since the mid 1950s
- ASME stamps and readiness to work with international standards
- Experience in USA, Europe, South Korea, others
- Continually maintained our quality assurance programs meeting the NRC requirements of NQA-1, 10CFR50 Appendix B and 10CFR21
- 600+ pumps and other equipment in active service in nuclear applications across the world
- Over 70% of operating nuclear stations in North America operate with Hayward Tyler and Energy Steel products
- Hayward Tyler currently sits on the following ASME committees:
  - BPV III – Working Group on Pumps
  - BPV III – Special Working Group on High Temperature Reactor Stakeholders
  - BPV III – Task Group Appendix V – Data Report Forms
  - BPV III – Subgroup on Fusion Energy Devices

Hayward Tyler Luton Heritage

- Circulating Pumps
  - BCP Style (Calder Hall)
  - Reactor Internal Pumps (Forsmark NPP)
- Process Pumps
  - Boric Acid Pumps – EDF Sizewell
- Re-processing Pumps – Sellafield
- Reactor Coolant Feed Water Pumps (RCFW) – RR MOD
- Reactor Water Clean Up Pumps (RWCUP)
- Control Rod Prime Motors – RR MOD
- Control Leakage Pumps

**Historic qualifications such as ASME U Stamp*

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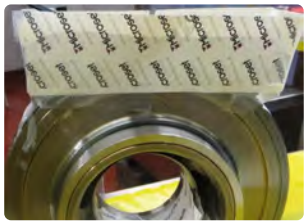
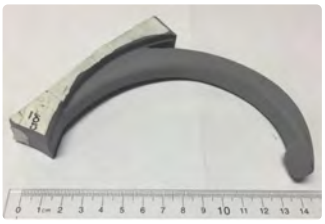
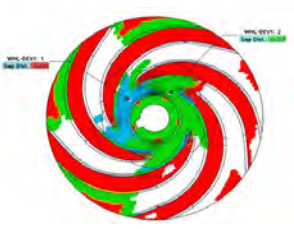
In a nutshell

- **Over 1000 nuclear pump projects since 1982**
- **40 years of experience in Nuclear Reverse Engineering**
- **ASME III / N-STAMP / 10 CFR 50 App.B**
- **NQA-1**

Reverse Engineering of an Obsolete Safety Related Pump



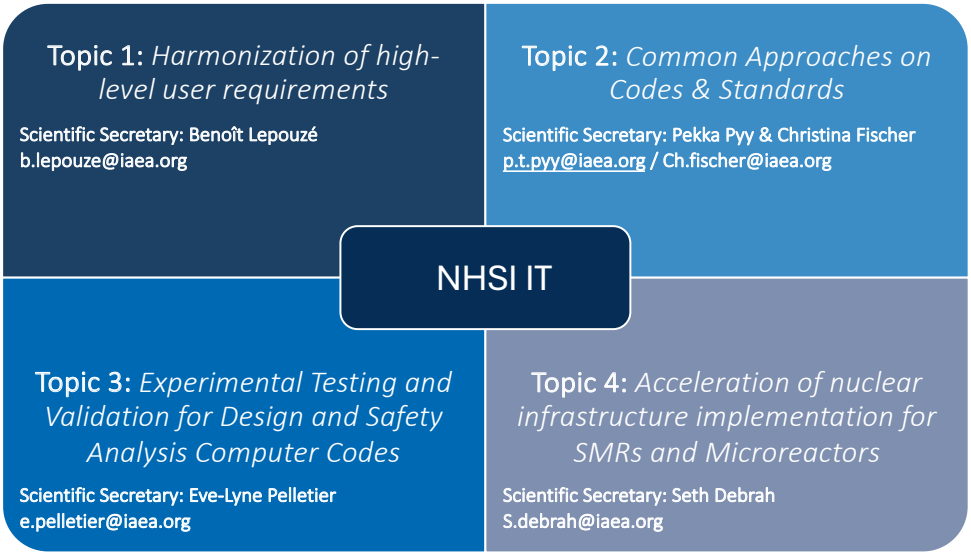
IAEA NUCLEAR HARMONIZATION & STANDARDIZATION INITIATIVE

IAEA

IAEA NHSI Industry Track Topical Group 2 – Common Practices on Codes and Standards: Achievements and Updates

Shin Whan Kim, IAEA NE

The NHSI Industry Track is divided into 4 topical groups to foster initiatives in the industry that aim to facilitate global deployment of SMRs through standardization and harmonization.



Topic 2 Objectives

Topic 2 - Common Approaches on Codes and Standards

Mission & Vision with approaches on C&S:

- **Identify** similarities and differences
- **Understand** why they exist
- **Share information** on the findings
- **Develop common approaches**
- **Harmonize** where possible

#MakeNuclearSimpler

Now 44 participating organizations from 18 Member States with **WNA as a key partner**

"The more, the merrier ...."

NHSI Industry Track Topic 2

TG2 platform for information sharing

NHSI Topic Group 2

I. Codes & Standards

- A. QUALITY AND MANAGEMENT SYSTEM STANDARDS USED WIDELY IN THE MEMBER STATES (APPLICALBE TO SMRS)
- B. ENGINEERING STANDARDS FOR THE DESIGN AND CONSTRUCTION OF SMRS (WNA TO LEAD)
- C. EQUIPMENT QUALIFICATION STANDARDS FOR NUCLEAR (SMRS) FACILITIES
- D. C&S USED IN VARIOUS SMRS (AND THEIR PROJECTS)
- E. C&S FOR ADVANCE MANUFACTURING (AM) TO BE USED FOR SMRS (AND THEIR PROJECTS)

II. Oversight & Acceptance

- A. A USE OF STANDARD, PROVEN SERIALLY MANUFACTURED INDUSTRIAL/COMMERCIAL-GRADE iITEMS)
- B. NON-NUCLEAR CODES, STANDARDS, LAW AND REGULATIONS RELEVANT TO SMR DEPLOYMENT
- C. OVERSIGHT ACTIVITIES REQUIRED BY CODES, STANDARDS, LAW AND REGULATIONS
- D. LONG LEAD ITEMS

Nine topics covered during NHSI Phase II 2025-2026

Topic 2: Common Approaches on Codes and Standards - Plans for Phase II

I. CODES AND STANDARDS FOR USE IN SMRs

I. A Quality and management system standards used widely in the member states (applicable to SMRs)

- Database updates (changes in standards, new versions, etc.) regularly
- We have added the ENGIE quality passport and **are open to adding more organizational approaches** (some of them already e.g. in SC management toolkit 6.1)
- Consider writing a position paper about the role of I.A standards

I.B Engineering standards for the design and construction of SMRs (WNA partner)

- Update the databases on mechanical and ISI codes
- **We do not have all the codes from all the members – how to fix?**
- **ISI Working paper (ADVANCED DRAFT)**
- **New area the civil C&S database -** Working paper about civil codes and their differences **(early draft exists)**

Topic 2: Common Approaches on Codes and Standards - Plans for Phase II

I. CODES AND STANDARDS FOR USE IN SMRs

I.C Equipment qualification standards for nuclear facilities

- Update the I.C standards database - no changes
- Paper considered e.g. on difference between design qualification and manufacturing quality assurance - would require volunteers to lead

I.D C&S used in various SMRs (and their projects)

- Continued presentations by members (info restricted to TG2 members only)
- "These are the C&S series in our project" or "These are C&Ss that we require/prefer?"

I.E C&S for advanced manufacturing (AM) to be used for SMRs

- Update the I.E standards database, collection of **roadmaps,** examples & experience
- A working paper on AM considered (subject to available experience?)
- **IAEA ISOP network works on the topics of AM**

Topic 2: Common Approaches on Codes and Standards - Plans for Phase II

II. OVERSIGHT AND ACCEPTANCE ISSUES RELATED TO C&S

II. A Use of standard, proven serially manufactured industrial/commercial grade items

- Database for II.A practices in the MSs updated - developments taking place in many MSs

-TECDOC 2034 and a two-pager issued

-Consider starting a publication on "graded approach including examples/strategies to manage supply chain risks" (name TBC, including use of industrial grade items)

II. B Non-nuclear codes, standards, law and regulations relevant to SMR deployment

- Mapping another area leading to design modifications **after the ongoing fire exit data collection finalized**

- The fire exit data collection is not finalized – are there any more interested organizations to contribute?? New areas like material routes & lifting requirements …

-New topical papers considered based on the member experiences

Topic 2: Common Approaches on Codes and Standards - Plans for Phase II

II. OVERSIGHT AND ACCEPTANCE ISSUES RELATED TO C&S

II. C Oversight activities required by codes, standards, law and regulations

- Updating the database on oversight practices for safety related components in the MSs (link to II.A)

- We have II.D going on so members to advise on if updating this could be parallel or not

II. D Oversight of long lead items for NPP projects

HIGH-INTEGRITY LONG LEAD ITEMS

II. OVERSIGHT AND ACCEPTANCE ISSUES RELATED TO C&S

- **Probe Questionnaire with selected Regulators in 2023**
- **TG2 Working Paper Issued in 2024: "Potential for Harmonization and Standardization in the Approval Processes for High Integrity Long-Lead Items"**
- **Mapping Exercise for MS Practices (Questionnaire sent in Summer 2025, Analysis ongoing)**
- **Final Analysis and Working Report expected in Q1 2026**
- **Collaboration with NHSI RT and SMR RF on LLIs throughout 2026**

Long-Lead Items – Joint RT & IT activity

High-integrity long-lead items (LLIs) such as pressure vessels, piping and valves, transformers, heat exchangers etc. will present a challenge for the expedited deployment of SMRs – especially in areas of oversight and inspection

- For RPV: Regulatory/AIO oversight may start well before manufacturing begins; the end user/licensee might not yet be known
- Procurement/manufacturing time will affect the overall critical path of the construction project, probably more so than large-scale NPPs

Joint NS-NE TECDOC on regulatory approaches for SMRs and microreactor long-lead items will seek to address these issues

- Collaboration between Regulatory Track and Industrial Track to harmonize deployment models and develop approaches that leverage regulatory oversight activities
- First consultancy meeting planned for Q1 2026
- Anticipated publication end of 2026/early 2027

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Topic 2: Common Approaches on Codes and Standards – Achievements

IAEA TECDOC – "Suitability Evaluation of Commercial Grade Products for Use in Nuclear Power Plant Safety Systems"

Working Paper – "Why Serially Manufactured Industrial Products Are Crucial for Reliable Deployment of Small Modular Reactors"

Working Paper – "Why Non-nuclear Codes and Standards Are Important for Harmonizing SMRs"

Working Paper – "Potential for Harmonization and Standardization in the Approval Processes for High Integrity Long-Lead Items"

Working Paper – *"Why a consistent approach to nuclear codes and standards is crucial for the serial deployment of standardized SMRs"*

Working paper on ISI C&S issued in Oct 2025

Harmonization of in-service inspection codes and standards to boost SMR exports

#makenuclearsimpler

IAEA NE Supply Chain Webinar Series

Typically 100+ participants – and posted online afterward for wider audience

Slide decks in MSCQ Supply Chain Management Toolkit Section 6.10

Nuclear Supply Chain Introductory Webinars

- Covid-19 and Its Impact on the Nuclear Power Supply Chain (9 July)
- Nuclear Supply Chain Management – The Global View (3 December)
- Requirements to the Supplier – Why are they important and where do they come from? (16 December)
- How to Find Good Suppliers – and how to know if they are good for you (14 January)
- Supply Chain Management Strategy – How to simplify the complex? (28 January)
- Supervising the Supply Process – What do you need to do? (11 February)
- Non-Conformances – What are they and how to manage them? (25 February)
- Delivery Process Final Stages – What do you have to Remember? (18 March)

Nuclear Supply Chain Advanced Webinars

- Counterfeit, Fraudulent, and Suspect Items – What do you need to know? (6 May 2021)
- Use of Commercial Grade Items - When and how? (9 June in cooperation with NNF21)
- COVID-19 and the Nuclear Supply Chain – What have learned? (9 September 2021 in cooperation with FORATOM MSE2021)
- Remote and Hybrid Verifications, Audits and Inspections – What have we learned? (20 January 2022)
- Graded Approach – What are its secrets? (13 April 2022)
- Codes and standards in nuclear – potential for more common approaches? (7 December 2022)
- Achievements and Work of NHSI Industrial Track TG2 - Common Approaches on Codes and Standards (26 March 2025)
- Experience and Developments in Using Commercial Grade Items – What is New? (11 June 2025)
- High-Integrity Long-Lead Items: Challenges and Solutions for SMRs (9 October 2025)

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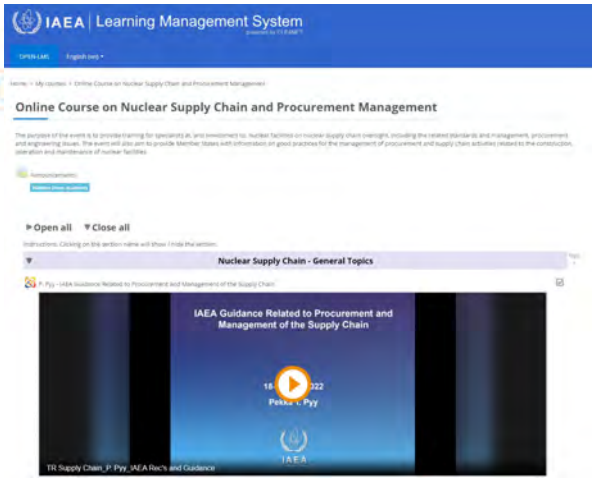
TRAINING EVENTS & MISSIONS

In-person training courses for – last edition in Vienna 16-19 June 2025 (see coming meetings for 2026)

Limited possibility also for tailored Missions on Management Systems, Procurement and Industrial Involvement

Virtual training SC course available on the IAEA learning management system



2026 Schedule

Next activities

1. **11 – 12 December 2025 (Virtual), Updates from NHSI Plenary meeting and planning 2026 scope**
2. **5 – 7 May (Hybrid)**
3. **1 – 2 October (Hybrid)**
4. **Separate activity calls for specific topics (as needed)**
5. **Technical Meeting on the current SC topics, 14 – 18 December 2026 (TBC)**
6. **Training Course on Supply Chain and Procurement Management 27 – 31 July 2026 (TBC)**
7. **Cooperation meetings with strategic partners**

EPRI International PEARTS, Zürich Switzerland - Day 2

MSCQ (earlier: MSN)

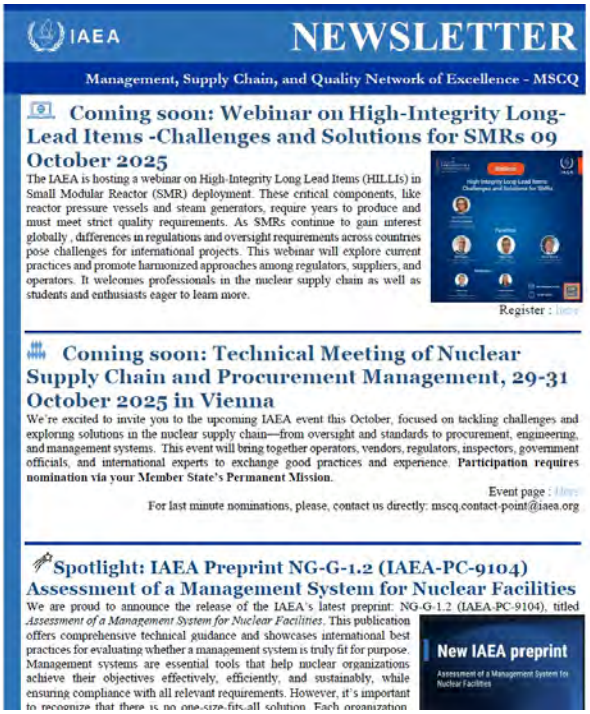
IAEA NUCLEUS CONNECT Network

Link to join MSCQ

MSN.Contact-Point@iaea.org

Newsletter to MSCQ members

Latest edition 10/2025



IAEA NEWSLETTER

Management, Supply Chain, and Quality Network of Excellence - MSCQ

Coming soon: Webinar on High-Integrity Long-Lead Items -Challenges and Solutions for SMRs 09 October 2025

The IAEA is hosting a webinar on High-Integrity Long Lead Items (HILLIs) in Small Modular Reactor (SMR) deployment. These critical components, like reactor pressure vessels and steam generators, require years to produce and must meet strict quality requirements. As SMRs continue to gain interest globally , differences in regulations and oversight requirements across countries pose challenges for international projects. This webinar will explore current practices and promote harmonized approaches among regulators, suppliers, and operators. It welcomes professionals in the nuclear supply chain as well as students and enthusiasts eager to learn more.

Register : Here

Coming soon: Technical Meeting of Nuclear Supply Chain and Procurement Management, 29-31 October 2025 in Vienna

We're excited to invite you to the upcoming IAEA event this October, focused on tackling challenges and exploring solutions in the nuclear supply chain—from oversight and standards to procurement, engineering, and management systems. This event will bring together operators, vendors, regulators, inspectors, government officials, and international experts to exchange good practices and experience. **Participation requires nomination via your Member State's Permanent Mission.**

Event page : Here

For last minute nominations, please, contact us directly: mscq.contact-point@iaea.org

Spotlight: IAEA Preprint NG-G-1.2 (IAEA-PC-9104) Assessment of a Management System for Nuclear Facilities

We are proud to announce the release of the IAEA's latest preprint: NG-G-1.2 (IAEA-PC-9104), titled *Assessment of a Management System for Nuclear Facilities*. This publication offers comprehensive technical guidance and showcases international best practices for evaluating whether a management system is truly fit for purpose. Management systems are essential tools that help nuclear organizations achieve their objectives effectively, efficiently, and sustainably, while ensuring compliance with all relevant requirements. However, it's important to recognize that there is no one-size-fits-all solution. Each organization

New IAEA preprint

Assessment of a Management System for Nuclear Facilities

IAEA Nuclear Supply Chain Management

NHSI SHARE in IAEA NUCLEUS CONNECT MSN/MSCQ

JOIN MSCQ BY USE OF THIS LINK!

THANK YOU FOR YOUR ATTENTION

-

MSCQ.Contact-Point@iaea.org

Harmonization and Standardization

Similar but different

Harmonization refers to the process of aligning or coordinating different rules, regulations, procedures, or standards to make them compatible across different systems, organizations, or countries.

It doesn't necessarily mean making them identical but ensures that they work together without conflict.

Standardization is the process of developing, implementing, and adhering to a set of specific norms, guidelines, or specifications intended to ensure uniformity, quality, and consistency across processes, designs, or organizations.

Code is related to complying with legal requirements and often gives **what** needs to be done (whereas standard presents **how exactly**)

Mutual recognition is an agreement between two or more parties (typically countries or regulatory bodies) to accept each other's codes & standards, regulations, or conformity assessments as equivalent, even if they differ in detail. This means that a product, service, or professional qualification legally accepted in one country is accepted in another without the need for further testing or certification.

EPRI International PEARTS, Zürich Switzerland - Day 2

What can different organizations do?

- **Policy makers:** Clear signals of a stable nuclear energy investing environment (with financing, where applicable); Foster developments in local and regional supply chains within the nuclear power sector & Coordinate between different regulators for a harmonized set of requirements
- **Nuclear Regulators:** Collaborate to 1. develop common / consistent nuclear regulations across jurisdictions (including mutual recognition, where applicable) and 2. Work to harmonize interpretations in use of codes between different regulations (nuclear, health, safety, building, fire, security, etc.) & Develop early engagement approaches in licensing processes including developing supplier readiness.
- **Owner/operators:** Sustaining and strengthening supply chain by lowering commercial, project and quality management risks by partnering etc. and providing suppliers with incentives to enter or stay in the nuclear market & Lead efforts to standardize codes & standards on quality/management, design, materials, testing, qualification etc., by engaging designers, suppliers and vendors and other industries.
- **Technology Developers / Vendors:** Demonstrate that technology is proven with necessary safety case and engage early with the supply chain for near-term deployment with an existing supply chain in intended jurisdiction.
- **Suppliers of Products and Services:** Demonstrate readiness and develop capabilities, e.g., via participating/establishing industrial associations and similar early engagement mechanisms together with owners and technology vendors for once-though design.
- **SDOs & R&D:** think of End Users & Suppliers so that we could speed up the developments

International organizations: to continue work together in identifying bottlenecks, inform and share experiences with national players and identify avenues for solutions with organizations in non-nuclear fields.

1. Comply with all the legislative, regulatory and owner's requirements in the jurisdiction you are targetting ("complete fit-for-purpose tailoring" – "**project approach**")
2. Enveloping approach - develop a set of project requirements conforming with the set of most demanding requirements ("**platinum grade approach**")
3. Justification approach - develop a set of project requirements conforming with a set of requirements seen to comply with the levels required with reasonable assurance (**"standardized design with exemptions"** sought by justifying C&S with "code case" equivalences)
4. Regional approach - develop a set of project requirements conforming with a set of requirements seen to comply with the regional C&S ecosystem ("standardized design" additional few national jurisdiction tailored solutions) – may be a specific case of 3 "**product approach**"
5. **Standard design approach** – no changes agreed in C&S ("one fits all" as conformance with safety and other objectives is sufficiently assured on the plant design level)

...and extensive use of proven serially manufactured commercial grade items, SI units, etc.

CLEAN ENERGY OF TOMORROW

EPRI iPeARTS

WANO Procurement Quality Working Team Activities

Martin Seidl
Zürich
11.11 – 12.11.2025

www.cez.cz

WANO QC I-WG
Subgroup CGD:

Martin Seidl, *ČEZ, Czechia*
Richard Bíro, *SE, Slovakia*
Jonathan Thomas, *EPRI, USA*
Andy Reed, Brett Shaw, *EDF Energy (HPC), UK*
Arne Claes, *Engie Nuclear, Belgium*
Maryna Topchii, Olena Dyakova, *Energoatom, Ukraine*
Kari Pihala, *TVO, Finland*
Chen Chen, *CGN, China*
Peter Lovrenčič, *NEK (Krško), Slovenia*
Tammi Smith, *Sellafield Ltd, UK*
István Szilágyi, *Pakš, Hungary*
Marc Tannenbaum, *EPRI, USA*
Oleksii Popop, WANO, France
Mahtab, *Ontario Power, Canada*
Juan Ferrero Manuel, *Na-Sa, Argentina*

CGD members

Our members have various levels of experiences with CGD. Some of them are at the beginning of operation, some of them are in the decommisioning phase, but all of us are using or going to use **CGD**.



Under construction → In operation → Decommisioning

WANO QC I-WG CGD

Sub-group	Commercial Grade Dedication (CGD)
Objective	Develop a WANO document considering the following: • Unification of CGD procedure • Determination of quality criteria for CGD items (identifying the critical characteristics, verifying their acceptability) • Recommendation for procurement. • Unified procedures for supplier approval.
Problem Statement	Inconsistent CGD procedures / lack of awareness by manufactures
Lead	Martin Seidl, CEZ, a.s.

Problem statement by CGD members

- Difficult to understand CGD for new user.
- Too much publication related to the CGD.
- Problems with preparing CGD plans.
- Design knowledge to define critical characteristic.
- Quality of dedication by vendors is poor.
- Many CGD suppliers and manufactures have no idea about CGD.
- Purpose of CGD is challenging to understand for people outside of nuclear supply chain.
  - (in some cases also for regulators).

WANO QC I-WG, subgroup CGD – Document content

1) **Introduction.**
2) **Purpose of the document.**
3) **CGD – generally** (we have to consider our comments: difficult to understand CGD for new users).
4) **Reference to the available guidelines.**
   - **Comparisson of EPRI and FORATOM guideline.**
   - **CGD requirements in different jurisdictions – selection of best practices, recommendation for users.**

WANO QC I-WG, subgroup CGD – Document content

WANO QC I-WG, subgroup CGD – Document content

5) A section for overall CGD documentation process, it could be a simple flow chart + brief explanations of each step and references to documents (EPRI, FORATOM).

- Here we have to use our best practice.
- Problems with preparing CGD plans.
- Knowledge/identification to define critical characteristic.

6) Implementation of CGD.

7) Poster (simple, creative W-F poster of CGD).

8) A section to identify the quality record in the CGD process.

9) Lessons-learned

- Model/Practical Examples of dedication of most dedicated items (valves, pumps, bearings, relay, ….).
- Survey via WANO.

WANO QC I-WG, subgroup CGD – Document content

10) Unification of the procedure – as there are differences within the dedication, two groups will dedicate differently same item, are we able to unify at least some mandatory steps, e.g. mandatory critical characteristics?

11) Recommendation for procurement – what have to be consider.

12) Unified procedures for supplier approval – (For example - Acceptance Method 2, some recommendation, requirements, cooperation, joint approval?).

13) Recommended templates for CGD, Technical equivalency evaluation of different types of equipment.

14) KELPO

CGD SURVEY RESULTS:

USE OF THE CGD PROCESS

Widespread CGD Adoption

Most nuclear organizations actively use or are implementing the CGD process to enhance operational efficiency and supply chain resilience.

Addressing Component Obsolescence

CGD helps overcome challenges like component obsolescence by allowing use of commercial items in nuclear applications.

Supply Chain Flexibility and Cost Reduction

The process reduces lead times, lowers costs, and ensures availability of critical spare parts in limited supplier markets.

EPRI International PEARTS, Zürich Switzerland - Day 2

RECOMMENDATIONS AND BENEFITS

Broad Adoption and Consensus

Organizations widely recommend CGD due to its proven value in nuclear facility operations and maintenance.

Obsolescence Resolution

CGD effectively addresses obsolescence issues by improving spare parts availability and supplier access.

Cost Reduction and Savings

CGD reduces costs through strategic procurement and enables savings on repetitive or simple item purchases.

Enhanced Operational Continuity

CGD mitigates risks from single-source suppliers and supports equipment reliability with commercial-grade item integration.

CGD METHODS USED

Test and Inspection

Method 1 involves direct testing and inspection, preferred when hands-on evaluation is possible and effective.

Source Verification

Method 3 relies on manufacturer-provided information or documentation to verify product compliance.

Survey and Historical Data

Methods 2 and 4 use surveys and historical performance as supplementary approaches to assess compliance.

Flexible Method Application

Organizations adapt and combine CGD methods based on item specifics and regulatory needs.

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COMPARISON WITH STANDARD PROCUREMENT

Resource and Knowledge Demand

CGD requires more resources, technical expertise, and time compared to standard procurement methods.

Quality and Availability Control

CGD offers enhanced control over item quality and availability ensuring better component suitability.

Efficiency in Simple Items

For simple or repetitive components, CGD can be more cost-effective and efficient than standard procurement.

Complex Item Procurement

Standard procurement is preferable for complex components due to superior supplier expertise and quality assurance.

LEGISLATION AND REGULATION

CGD Methodology Standards

Organizations follow EPRI 3002002982 methodology or its adaptations for CGD to align with industry best practices.

Regulatory Authority Role

Regulatory bodies approve CGD processes, conduct audits, and review dedication plans to ensure compliance.

Exclusions and Jurisdiction Variations

Certain components are excluded from CGD depending on jurisdiction, with significant differences in legislative requirements.

Adapting to Local Regulations

Organizations adapt CGD processes to comply with both international guidelines and local legislative requirements.

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CHALLENGES AND PROBLEM AREAS

Identification Challenges

Difficulty in identifying safety functions and critical characteristics affects CGD implementation accuracy.

Testing and Acceptance Issues

Defining acceptance criteria and testing methods presents a significant challenge for consistent CGD outcomes.

Knowledge and Communication Gaps

Gaps in team expertise and communication with unfamiliar manufacturers hinder CGD progress.

Maintaining Assurance and Compliance

Ensuring reasonable assurance and regulatory compliance requires robust documentation and expertise.

QUALITY ASSURANCE AND EXPERIENCE

CGD Quality Assurance

CGD provides assurance equal to or greater than standard procurement from qualified suppliers when applied properly.

Role of Third-Party Services

Organizations use in-house teams and third-party labs for validation and to maintain high standards in CGD activities.

Qualification and Auditing

Auditing and qualifying third-party providers are critical to ensuring compliance and maintaining quality standards.

Continuous Improvement and Experience Sharing

Experience sharing and continuous improvement help refine CGD processes adapting to changing regulations.

EPRI International PEARTS, Zürich Switzerland - Day 2

TYPES AND FREQUENCY OF DEDICATED ITEMS

Common Dedicated Items

Small electrical components, mechanical parts, and instrumentation devices are frequently dedicated through CGD programs.

Frequency Variability

Dedication frequency varies greatly due to plant size, operational scope, and CGD program maturity.

Optimization Benefits

Tracking dedicated items helps optimize CGD strategies and resource allocation to reduce costs.

OTHER INSIGHTS

Early CGD Implementation

Organizations beginning CGD emphasize knowledge transfer and capacity building for successful adoption.

Cross-functional Collaboration

Effective teamwork among engineering, quality assurance, and procurement drives CGD success.

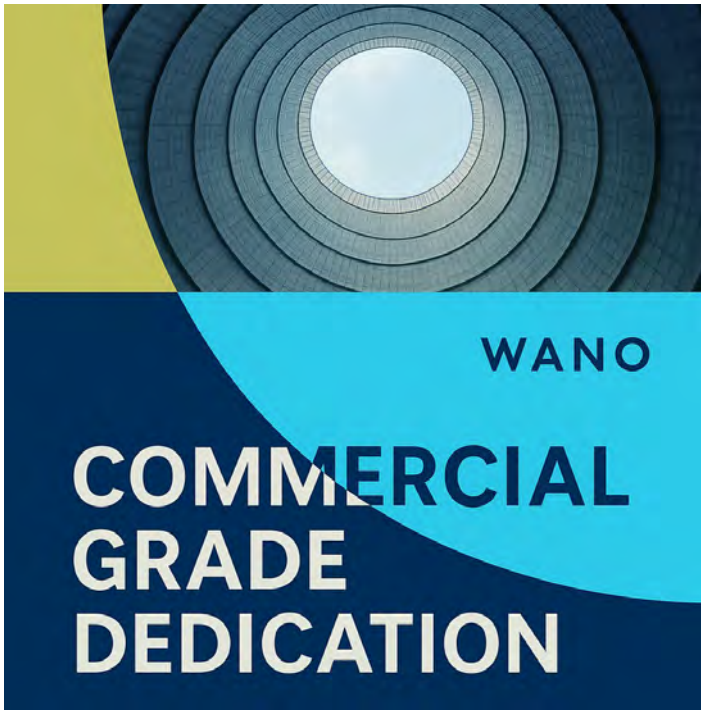
Experience Sharing and Best Practices

Sharing experiences and dedication plans fosters industry best practices and continuous improvement.

Ongoing Stakeholder Dialogue

Continuous cooperation among stakeholders addresses challenges and maximizes CGD benefits.

CLEAN ENERGY OF TOMORROW



Thank you.

Martin Seidl

KELPO™ Method

EPRI PROCUREMENT ENGINEERING AND RELATED TOPICS SYMPOSIUM
12th Nov 2025

Hannu Eklöf, Olkiluoto NPP, TVO
Kari Pihala, Olkiluoto NPP, TVO

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Existing challenges in nuclear supply chain

- Many of the existing suppliers are not anymore interested in nuclear segment due to the specific requirements and low purchase volumes
  - Challenging to find new suppliers willing to fulfil nuclear-specific requirements
- Long delivery times
  - Spare parts delivery time is typically far too long and, in some cases, challenging the nuclear safety
  - Difficult to balance adequate delivery times with outages
- Equipment maintenance during outage vs. installation of a whole new equipment
  - Normally shorter work duration to install new equipment → scheduling benefits and lower dosage rate
  - Safety improvement achieved by replacing worn-out obsolete equipment with new high quality standard equipment
- Pricing of products in nuclear segment has increased significantly

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Developments in conventional industry

- Equipment manufacturing industry has experienced radical changes during last 20-40 years
  - Globalization → bigger markets, more competition
  - Customer expectations of product quality have increased
  - Harder competition → increased quality, shorter delivery times
  - Standard harmonization (e.g. EN-standards)
- How has manufacturing industry answered to the changes?
  - Quality systems are widely implemented (ISO 9001, PED, harmonized EN-standards etc.)
    - Systematic procedures, continuous improvement of products and operation
  - Production control systems have developed significantly
    - Increased automation and condition monitoring systems of manufacturing machines ensures high quality level
    - Improved efficiency, shorter delivery times

→ Product quality and reliability has improved significantly

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Finnish regulatory (STUK) requirements for serially manufactured mechanical equipment

- Definition of serially manufactured component from STUK guidelines for mechanical equipment
  - "Serially manufactured component shall refer to a component which has not been designed particularly based on the customer's specification, but it is procured from an existing product line of the manufacturer. Typically, one is manufactured in large quantities, and can be used for other applications, too. Functionality, structure, dimensions, materials, manufacturing process and quality of the component do not essentially differ within and between production lots."
- E.g. STUK explanatory memorandum for Valves of a nuclear facility (YVL E.8)
  - "It is possible to have a serially manufactured valve approved for nuclear facility use following a procedure deviating from that of a built-to-order valve in Safety Classes 2 and 3. In such a case it is assumed that a serially manufactured valve can be just as good in terms of quality and suitability or, in some cases, even better due to its manufacture in large series of uniform quality than a built-to-order valve."
- Flexibility in the requirements according to the Graded Approach principle
  - "Graded Approach" (requirements are set in proportion based on the significance of the component in fulfilling the design bases and implementing the safety function required of the component)."

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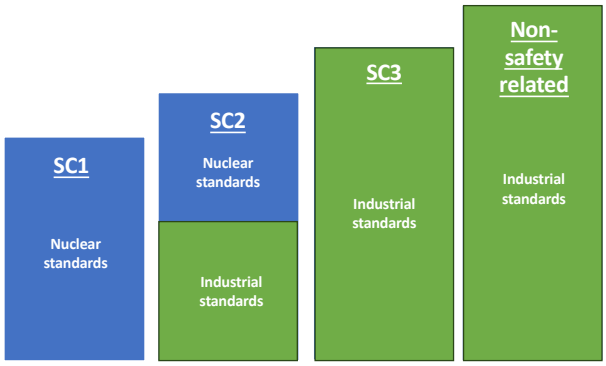
KELPO™ scope



- KELPO™-method is utilized for mechanical equipment utilizing graded approach
- Equipment safety classification scope of KELPO™ includes
  - SC3
  - SC2 - low energy systems
    - T ≤ 120˚C
    - p ≤ 20 bar
- Pilot phase for safety class 2 high-energy equipment is ongoing
- Most critical equipment related to nuclear safety are excluded from KELPO™

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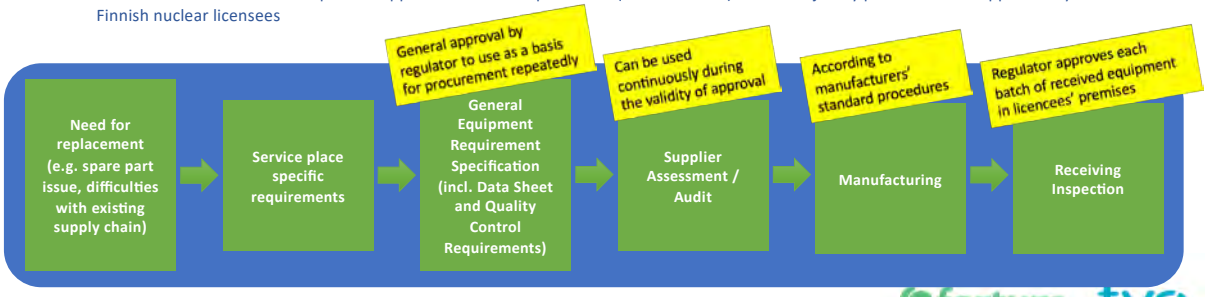
KELPO™ process

- General Equipment Requirement Specification (GERS) relies on ISO 9001 and PED requirements and are common for both Finnish nuclear licensees
- GERS are prepared at equipment group level (e.g. manual valves, safety valves, plate heat exchangers…) with Quality Control Requirements (QCR) and Data Sheet template as an attachment to each GERS
- GERS and QCR are generally approved and utilized in procurement
- Data Sheet is a service place specific template and shall be filled in each procurement case individually
- KELPO™-method includes a separate Supplier Assessments procedure (KELPO™-audit) which are jointly performed and approved by both Finnish nuclear licensees



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Benefits

- Securing the supply network
  - New suppliers are encouraged to enter nuclear segment
  - Currently 15+ new suppliers
- Improved spare part availability
  - +500 pcs of equipment approved as of September 2025
  - Firsts installations in 2020
  - No non-conformities and good operational experience
- Significantly shorter delivery times, approx. 6-12 weeks, “Months to Weeks”
- Resources are optimized
  - Developed procedures for KELPO™-scope equipment allow resources to be focused on more safety-critical equipment (Graded Approach)
  - GERS are done and approved only once per regulatory jurisdiction
  - Supplier is approved for all licensees with the same approval process
- Possible cost-efficiency compared to existing nuclear segment products

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KELPO™ suppliers

- Countries with KELPO™-suppliers
  - Germany
  - Spain
  - Italy
  - England
  - Netherlands
  - Luxembourg
  - Czech Republic
  - Serbia
  - Finland

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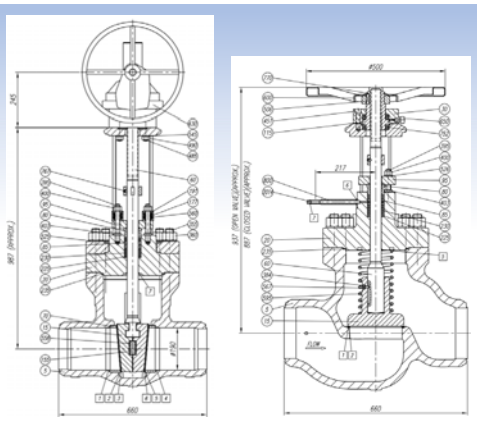
KELPO™ pilot



- Scope of the pilot
  - Shut-down cooling system (valves 16 pcs)
  - SC3
  - Gate, globe and ball valves
  - DN200 and DN250
  - 100 bar, 300°C
  - Active media
- For TVO KELPO™-pilot project suppliers with nuclear references were considered
  - All selected suppliers were known nuclear suppliers having also conventional product range
  - 4 potential suppliers were selected and all of them were audited → 2 were selected for pilot project procurement
- Delivery time was 3 months
  - Without KELPO™ installation of the valves would have been postponed two years

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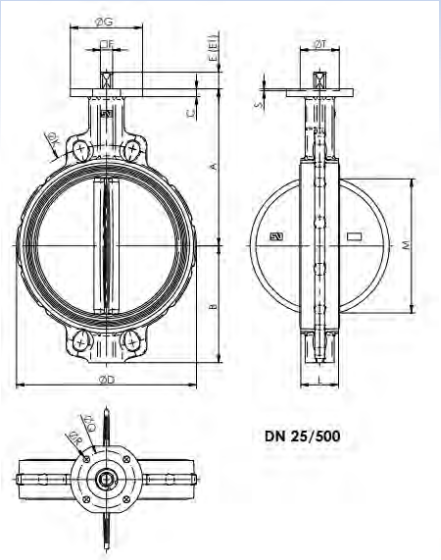
KELPO™ case #1

- Shut-down service water system (SC2, low-energy) and Diesel-backed normal operation service water system (SC3)
- Butterfly valve, rubberlined
- DN50 – DN250
- Several deliveries (first 2022), normal delivery time is 1-2 months
- Good operating experiences



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KELPO™ case #2

- Start-up air system (EDG)
  - SC2
  - Safety valve, set pressure 33 bar, design temperature 75 °C
- Safety valves (built-to-order) had problems, for example, with set pressure and tightness after closing
  - Supplier of valves was chosen based on their capability to fulfill SC2 nuclear quality and documentation requirements
- During the EDG test runs, PED-safety valves were installed, and their operation was flawless both on the test bench and at the equipment location
  - Serially manufactured safety valves were ordered with KELPO™-method to replace the faulty ones
- Fulfillment of nuclear documentation does not guarantee quality and especially functionality
- Ordered serially manufactured safety valves had decades of history behind the design, manufacturing and operation → proven quality giving secure functionality

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CLEAN ENERGY OF TOMORROW

EPRI iPeARTS

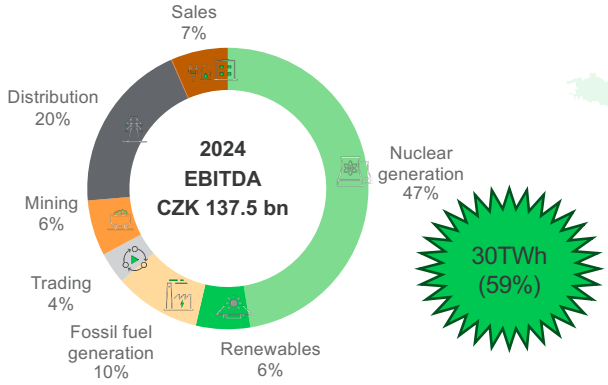
Implementing CGD at CEZ

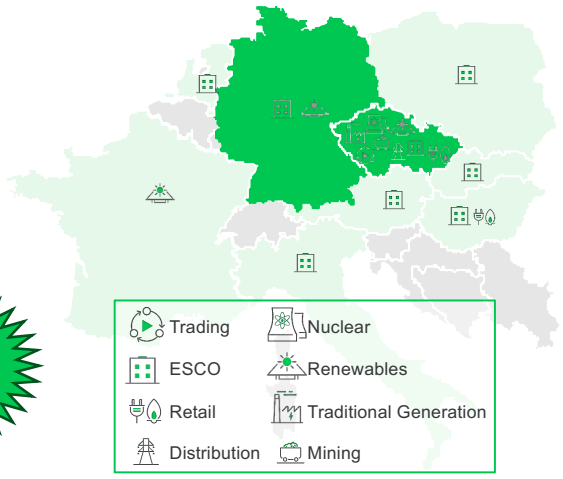
Martin Seidl
Zürich
11.11 – 12.11.2025

www.cez.cz

CEZ Group is an international utility, among the largest in Europe by market cap

CEZ Group
14th largest in number of customers
12th largest in installed capacity
6th largest by market capitalization*





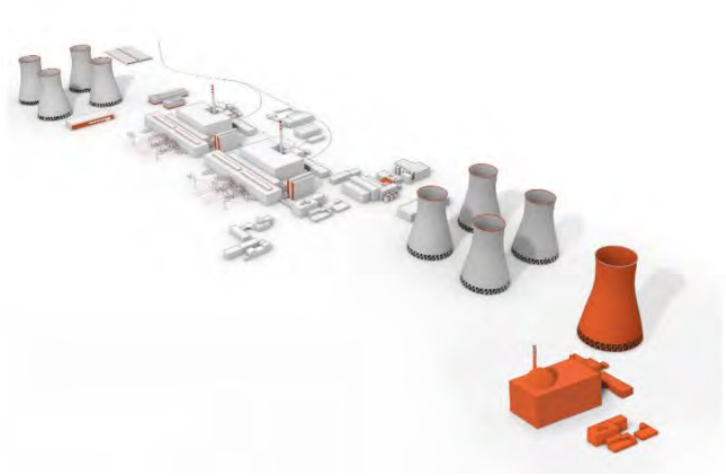
* as of August 25, 2025

Introduction CEZ a. s.

NPP Dukovany – PWR.
Built year: 1985-1987.
4x 510MWh (originally 4X440MWh).

NPP Temelín – PWR.
Built year: 2002.
2x 1125 MWh (originally 2 x 981MWh).

Future – EDU II (Dukovany II)



Implementing CGD at ČEZ

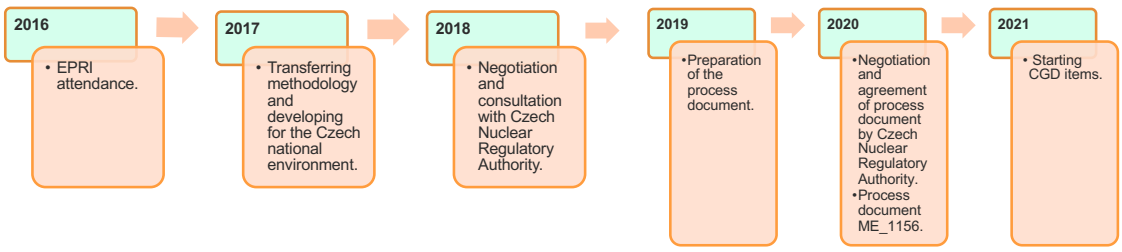
In recent years, we have been dealing with problems connected with the delivery of the spare parts to NPPs. Due to such situation, we are trying to use CGD items within ČEZ NPPs.

- Loosing of Manufactures
- Poor quality of spare parts
- International situation
- Manufacturer/ supplier does not meet requirements of Czech Legislation
  - Economic evaluation x Conformity assessment process

- The main idea of CGD is to use equipment that is manufactured according to the same or even more demanding standards.

Implementing CGD at ČEZ

- ČEZ started in year 2016
- The basis for CGD process is EPRI Guideline.
- 2020 – first issue of Process document ME_1156
- 2024 – so far 20x cases of used CGD items.



Implementing CGD at ČEZ

According to the ČEZ_ME_1156 **It is not intended** for the priority purchase of items in commercial quality if items with documented quality required **by applicable legislation** for the nuclear energy sector are available on the market.
The valid ČEZ methodology ČEZ_ME_1156 allows the use of the CGD process only **for parts** of safety-related components (a specific feature of Czech legislation).

	Example
Equipment	Switchgear cabinet (INC), measuring circuit, valve, pump, vessel, heater, cooler, steam generator, building structure (containment, turbine hall).
Component	Switchgear panel section, branch connection, pump electric motor, pump casing, valve body, actuator, tube sheet of steam generator.
Part	Circuit breaker, fuse, relay, sensor, thermometer, bolt, nut, stem, gasket, packing, yoke, cover, bearing, valve electric motor.

ČEZ_ME_1156 CGD Methods

Method 1
Verification of the item quality and properties documentation

- Goal: Demonstrate the product quality and properties documentation, according to which the item was manufactured, and which item meets.

Method 2
Evaluation of the item operational experience

- Goal: To identify the item reliability based on its verified operational history and usage experiences.

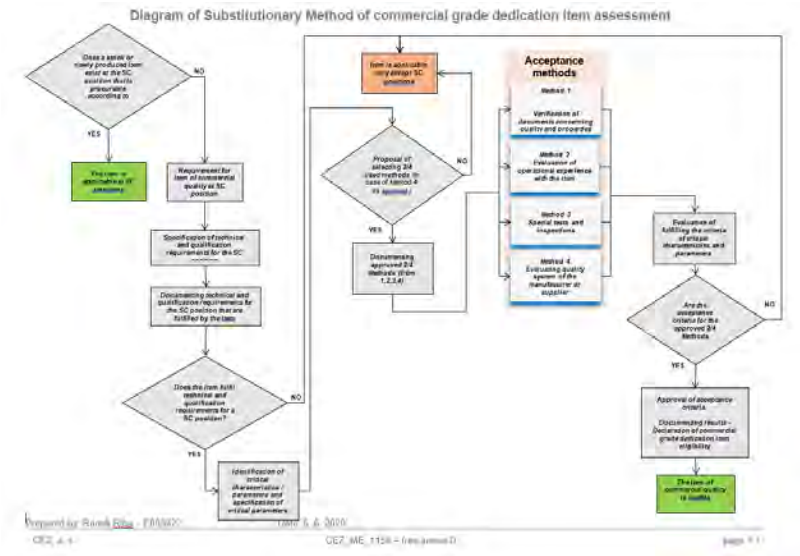
Method 3
Special tests and inspections

- Goal: Verification of the critical parameters that could not be proved by the other methods.

Method 4
Proof of the producer quality management system in time of production

- Goal: Demonstrate the existence of producer/supplier quality management system.

Commercial grade dedication process

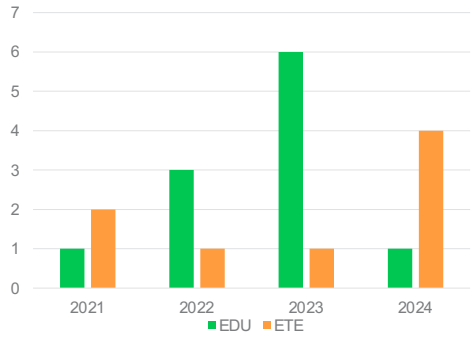


ČEZ_ME_1156 CGD Plan

- **Section A** Description of evaluated item
- **Section B** Information on use of the item at specific design position (as safety classified equipment (SC) or SC Part in the host system or component)
- **Section C** Information on requirements for host systems for anticipated applicability fields of the item
- **Section D** Information on the evaluated item (of associated technical documentation (ATD) of the product/item)
- **Section E** Degradation mechanisms
- **Section F** Information on operational history and experiences
- **Section G** Critical characteristics / parameters
- **Section H** Verification of item identification
- **Section I** Selection of acceptance methods
- **Section J** Summary of item evaluation (final tests, assessment)
- **Section K** References, documents
- **Section L** Inspection and approval

CGD at NPP Temelin and Dukovany

- In total 20 cases of CGD items used in NPP Temelin and Dukovany.
  - 11 mechanical
  - 6 electrical
  - 3 I&C
  - SC2 – 6x
  - SC3 – 14x
- In total 55 items (spare parts) used as CGD items.
- Acceptance methods acc. to ME_1156.
  - Methods 1 …. 13x
  - Methods 2 …. 19x
  - Methods 3 …. 8x
  - Methods 4 …. 12x
- Based on Method 3:
  - additional test are performer, e.g. Non-destructiove test, Electrical test…
- Required time for complete CGD approval process is about 2-5 month.



Implementing CGD at ČEZ

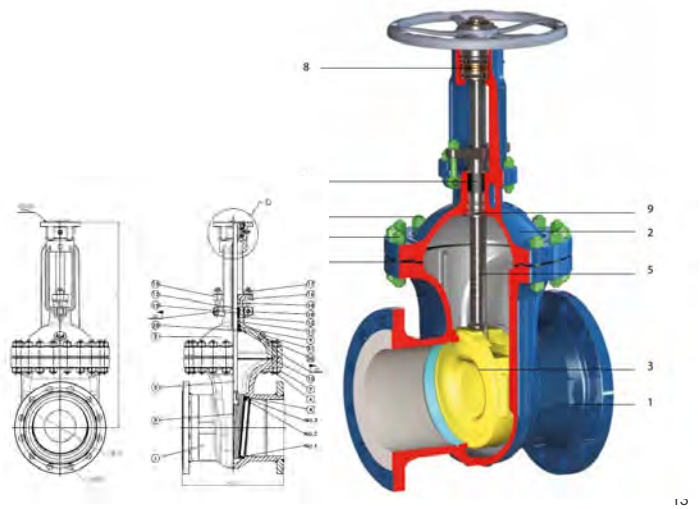
Entry into a joint project between TVO and Fortum:

- Kelpo methodology for serially manufactured components.

TVO fortum

ČEZ evaluation of KELPO methodology

- Commonly used valves AS33 acc. to ČEZ Technical specification.
- Commercial grade (serialy manufactured) S33, identical to AS33 acc. to KELPO.
- **Quality test at TaRC** (Training and Realization Center – own Material Laboratory)
  - Body, cover, wedge, spindl, bolts.
  - Impact test, tesile test, chemical compossition, Hardness test.



CLEAN ENERGY OF TOMORROW

Thank you

Paragon

FOAK Procurement Strategies

EPRI Internation PEaRTS
Zurich, Switzerland
11/12/2025

John Portillo
VP, Global New Nuclear
Paragon

Paragon

Nuclear Safety Culture in Action

A Questioning Attitude:

Every day at Paragon, we question how to serve the needs of our customers to the highest degree.

This ensures that we can rigorously and systematically support nuclear safety while achieving the best service, highest quality, and easiest procurement process.

Paragon

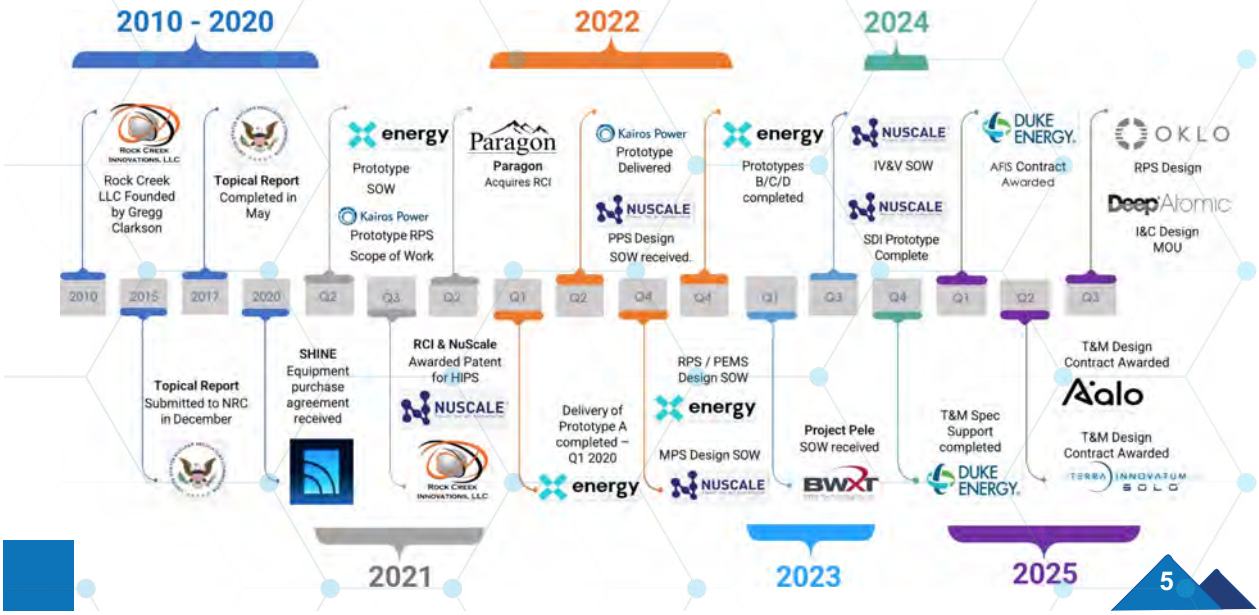
Initial Design to Implementation

- What is the end goal?
- Why is this a FOAK?
- Clearly define technical & quality requirements.
- Work with vendor(s) early and often not just AE's.

- It always takes longer than you think
- Either collaborate on the design or make sure it is 100% complete before issuing.
- Do not over specify
- Over communicate

Paragon

Historical Paragon Designs Process



Paragon

Where to Begin?

- Iterative design with suppliers, in-house design or AE design?
- Do the heavy lifting up front.
- Engage early and often with supply chain
- Do you need to involve licensing group for new design?
- Engage all stakeholders at the site for input

Paragon

Establish QA Requirements

- Clearly define and communicate the quality requirements for the scope.
- Is the scope truly safety related?
- Could ISO 9001 or potentially ISO 19443 be applied
- Can 10CFR50 Appendix B be applied by US suppliers or is it country specific?

Paragon

Supporting FOAK Supply – You built the first one, now what?

Does your Supplier have solutions for the following:

- Life cycle management of the product
- Manufacturing & supply of spare components capabilities
- Process to address obsolescence issues
- Field support (troubleshooting & installation)
- Licensing support, if applicable

Paragon

Areas of Focus

Manufacturing & Supply Readiness

People & Facilities

Paragon is securing the best talent in the industry as we ramp up to support immense growth on the horizon. We are in process of facility and equipment upgrades in preparation for manufacturing readiness.

Programmatic & System Updates

With a long history operating within the nuclear environment, Paragon is working to align systems, QA procedures, and processes to support manufacturing efforts for both HIPS and CoreVision.

Supply Chain

In light of the demand landscape for both HIPS and CoreVision, our supply path is of high priority. Working with supplier quality to audit and survey vendors now will align us with successful deployment of our products.

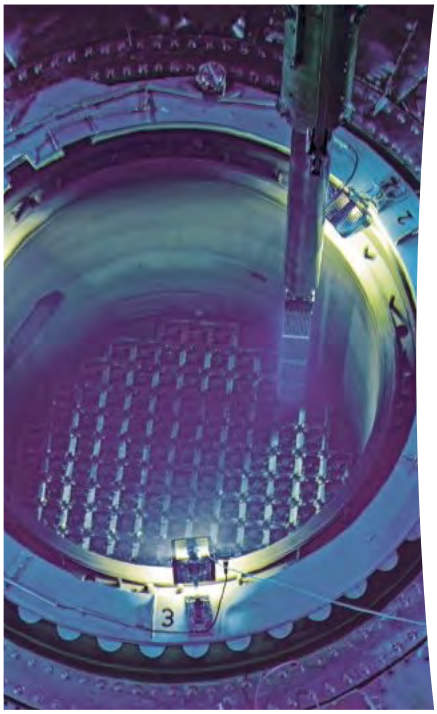
9

Project Risk Evaluation (PRE)

Alejandra Zertuche
12 Nov. 2025

PRE- Preliminary Risk Evaluation

1. The challenge
2. Industry Best Practice
3. What is PRE?
4. How to do a PRE?
5. When to do a PRE?
6. Who is involved in PRE?
7. Why do a PRE?



The Challenge: Mitigating Risks in Complex Projects

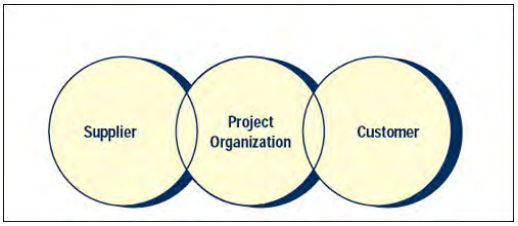
- Nuclear projects often experience deviations in cost, quality, and schedule.
- Mitigating Risks in Complex Projects
- Systematic risk evaluation is crucial for successful project delivery.

Building on Industry Best Practices

- Aligning with the graded approach, IAEA document 1740.
- Framework developed by Natalia Amosova (Apollo Plus).
- The concept was reviewed internally by:
  - Procurement
  - Project Management
  - Quality
  - Technical departments

→ Which points are relevant from each perspective?

What is PRE?
Proactive Risk Management in Procurement Projects



Early involvement

- A proactive process for identifying and mitigating risks early in the project lifecycle.
- Integrates into the offer/request phase *before* project approval.
- Supports informed decision-making and improves project outcomes through risk mitigation.

PRE Steps

- PRE- Assessment planning: Define scope and checklist.
- PRE- Execution: Use graded approach and checklist.
- PRE- Evaluation & Results: Identify critical concerns and integrate findings into supplier evaluation.

How to do a PRE? What are the topics?

Offer-Request Phase

We are exchanging key information relevant for the procurement project with the potential suppliers

Topics:

- Critical aspects: e.g. long lead items and regulatory requirements.
- Supplier experience and capabilities.
- Supplier financial stability and risk management.
- Understanding the supply chain structure.
- Lessons Learned from similar projects.

The supplier has also the opportunity to discuss any project open questions

Project Management Information

- Prepare relevant PRE-related questions (checklist) in advance for the risk evaluations.
- Ability to determine critical paths (including identifying potential risks) for the project
- Discuss supply chain topics

→ Together with the supplier detect any possible project risks

When to do a PRE?

Perform PRE:
- For high-risk projects with significant safety, cost, or schedule impacts.
- When critical supply chain elements.
- New technology or new design.
- Projects with complex regulations or multiple interfaces.
- For new suppliers or those with limited experience.

Skip PRE:
- Repetitive projects with well-known, mature supply chain processes.
- When previous projects with the same supplier did not have issues (repetition can reduce need).
- For projects with minimal safety impact or low complexity.

- The decision is based on a project risk matrix, assessing factors like size, complexity, supplier experience, and safety relevance. Graded approach.

Who is involved in PRE?

From the customer:
- Project Purchaser. Initiates PRE based on defined criteria.
- PRE Leader. Responsible for organizing, planning, and reporting the assessment.
- PRE Team Members. Specialists with identified requirement profiles:
  - Technical expert
  - Project manager
  - Quality manager

From the supplier:
- Responsible Project Manager
- Sales Representative
- Quality Manager
- Technical Expert(s), as needed

→ Outcomes from pilots helped standardize the assessment process

How Long?
1.5 days:
- 1 day to cover the topics
- 0.5 for summary & wrap up

Where?
- At the supplier’s facilities

Why do a PRE? What Are the Benefits of PRE?

- Improve risk management through early identification and mitigation of potential issues.
- Reduce deviations in cost, quality, and schedule.
- Support better project outcomes and decision-making.
- Promote transparency and better communication with suppliers.
- Process understanding from both parties
- Enhances overall quality assurance.
- Strengthens the relationship with our business party

Thank you!

EPRI International PEARTS, Zürich Switzerland - Day 2

ASME NQA-1 activities to address industry challenges

EPRI PEARTS
Zürich, Switzerland
November 11 & 12 2025

Pascal Ancion

Pascal Ancion

Holds an Engineering Degree from Université Catholique de Louvain in Belgium

35 years of nuclear experience at Westinghouse in Engineering (I&C, Safety Analysis, Design) and Quality.

His main tasks :

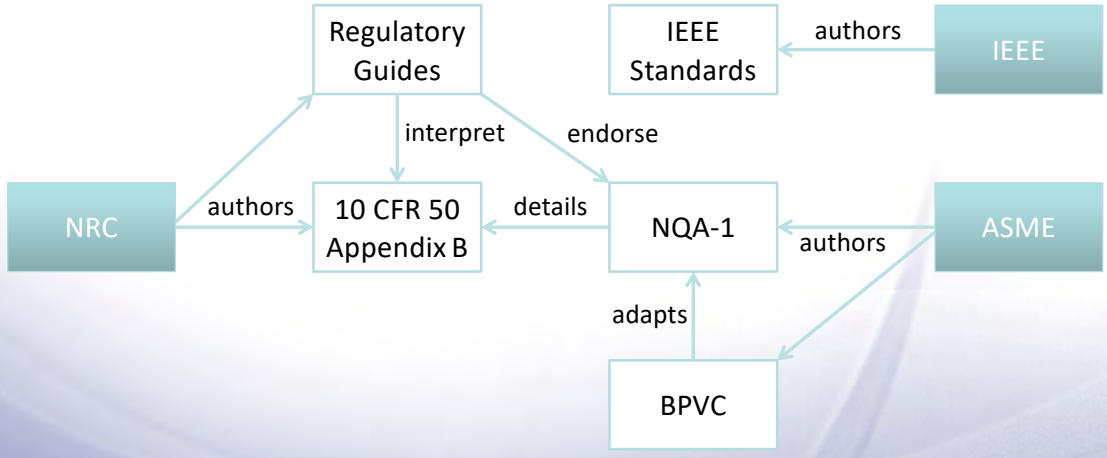
- Supplier Assessment & Qualification according to Regulations and Codes & Standards applicable in the Nuclear Industry (US NRC, ASME, RCC-M, ISO).
- Representing Westinghouse on Quality Codes & Standards matters in the various Nuclear Industry related activities.

He also serves as

- Chairman of ASME NQA EMEA International Working Group.
- Member of ASME NQA Sub-Committee on International Activities.
- Member of the ASME NQA-1 Standard Committee.
- Member of the ASME III & XI EU International Working Group.

ASME NQA-1 activities to address industry challenges
ASME NQA-1 organization

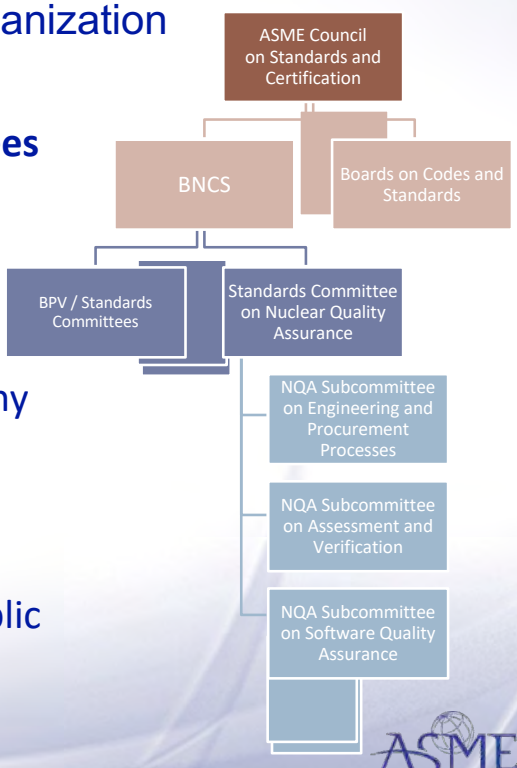
Overview of the U.S. Regulatory Regime



ASME NQA-1 activities to address industry challenges
ASME NQA-1 organization

ASME Codes & Standards Committees

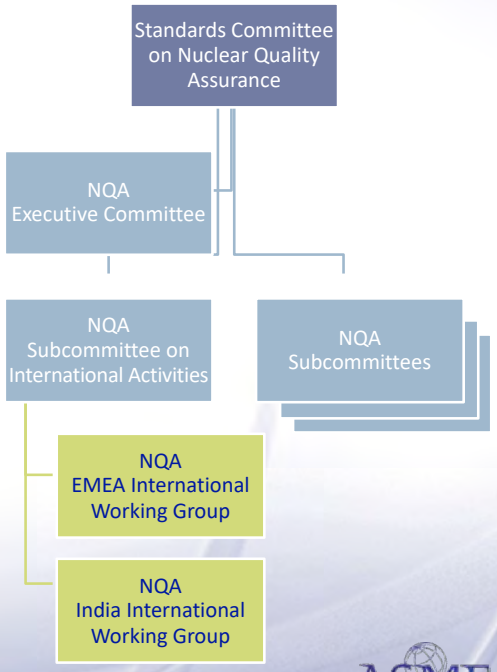
- 5,000 volunteers (of which 1,200 international) in 700 committees
- Consensus standards:
  - Balance of interest and company representation
  - Sophisticated voting/balloting
- Open to "public", for example no registration needed to attend public NQA-1 Sub-Committee sessions
- Industry standards



ASME NQA-1 activities to address industry challenges
ASME NQA-1 organization

ASME International Working Groups

- Provide a national or regional platform for exchange of information and experience
- Propose changes with a focus on comparison and harmonization of international standards
- Support responses to local inquiries
- Provide a forum for best practice sharing, training and discussion



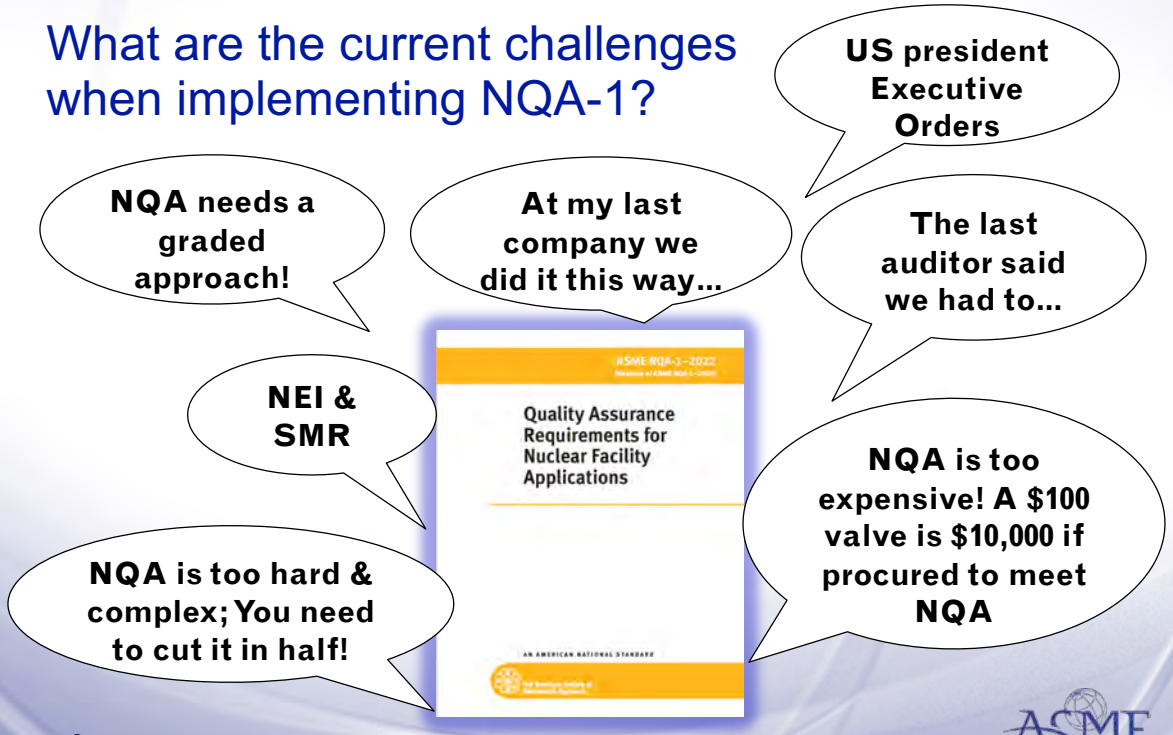
ASME NQA-1 activities to address industry challenges

Future Vision
Prepared with
Taunia Sandquist,
NQA Standard Committee Chairwoman

- Understanding of current challenges when implementing NQA-1
- What is the NQA Standard Committee doing to address these challenges?

ASME NQA-1 activities to address industry challenges

What are the current challenges when implementing NQA-1?



ASME NQA-1 activities to address industry challenges

"Three-Cs Initiative"

A Three-Parts Plan for Excellence:

1) **Clarify** the standard with clear language for better user understanding,
2) **Clean up** and enhance training with an ASME/NQA-controlled knowledge exam
3) **Create** a new product and/or guideline that integrates industry lessons learned and applies a graded approach.

Clear, Clean, Create — Driving Quality Forward

ASME NQA-1 activities to address industry challenges

NQA-1: ***"Three-Cs Initiative"***

1) Clarify: Clear Language

Objective:

To ensure that:

Requirements IN = Requirements OUT.

The reader can clearly find and understand the requirements.

It is clear as to "who is supposed to do what"

2028 Edition: Clear Language Entire Standard

ASME NQA-1 activities to address industry challenges

1) Clear Language – for ex. NQA Requirement 16:

- Original

100 GENERAL

Conditions adverse to quality shall be identified promptly and corrected as soon as practicable. In the case of a significant condition adverse to quality, the cause of the condition shall be determined and corrective action taken to preclude recurrence. The identification, cause, and corrective action for significant conditions adverse to quality shall be documented and reported to appropriate levels of management. Completion of corrective actions shall be verified.

- Proposed New Text

100 GENERAL

The organization shall promptly identify conditions adverse to quality and correct those conditions as soon as practicable.

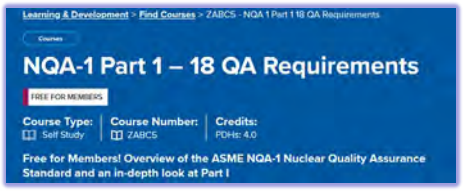
For significant conditions adverse to quality, the organization shall:

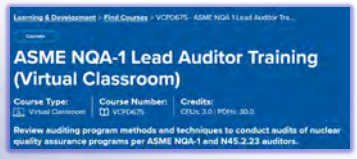
a) determine the cause of the condition.
b) implement corrective action(s) to preclude recurrence of the condition.
c) document the identification and cause of the condition and the corrective actions taken.
d) report the identification, cause, and corrective actions to appropriate levels of management.
e) verify completion of corrective action(s).

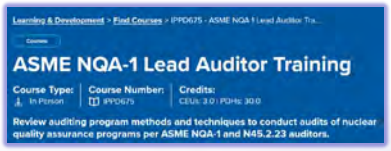
ASME NQA-1 activities to address industry challenges

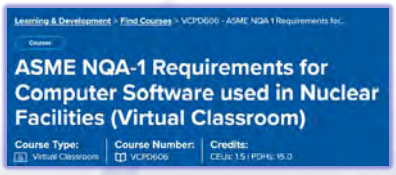
2) Clean Up: Current Training Evaluation

Selected NQA members are currently reviewing and providing feedback on ASME NQA Training.









ASME NQA-1 activities to address industry challenges

2) Clean Up: NEW NQA-1 Base Knowledge & Lead Auditor Exam

ASME NQA Base Knowledge Exam: Based on feedback from the industry, concern that NQA is not fully understood nor implemented as intended, as for example Lead Auditor

- Over-interpreting NQA-1 requirements
- Considering guidances as requirements
- Lack of reasonable judgement

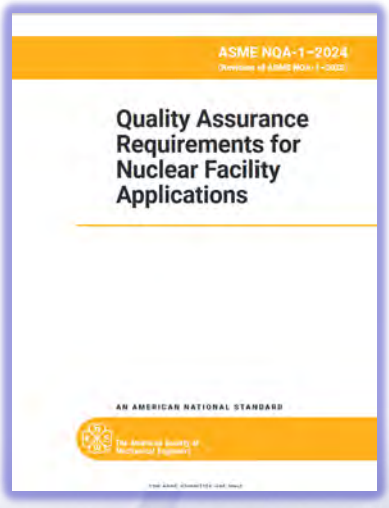
Under Development:

- ASME/NQA-Controlled NQA Knowledge Exam
- ASME/NQA-Controlled Lead Auditor Exam

ASME NQA-1 activities to address industry challenges

3) Create: NEW Guidances & Derivative Products, as

- **White Paper** being prepared on **NQA QA Graded Approach Philosophy**, including examples
- **Potentially add a subpart to Part III of NQA-1:** Guidance on Applying NQA Graded Approach and/or Guidance on Risk-Informed Approach (Subpart 3.1-2.5)



ASME
SETTING THE STANDARD

Paragon

PeAks+ AI

Paragon

What is PeAks+ AI?

PeAks+ AI is a virtual assistant that blends AI, your data, and industry data to provide you with essential tools to tackle the challenges of parts availability, lead times, and obsolescence.

What does PeAks+ AI do?

Streamlines daily productivity

- Works through supply chain backlogs
  - Highlights obsolescence risks
  - Identifies lead time issues
  - Facilitates vendor communication and follow-up
- Simplifies internal collaboration
- Revolutionizes access to plant and industry data

Why use PeAks+ AI?

Top benefits

- Reduces surprise work impacts
- Increases daily productivity and efficiency
  - Automates repetitive tasks
  - Brings the data to *you*
- Facilitates informed decisions
  - Analyzes large data sets
  - Speeds up innovation
- Reinforces the culture of safety, quality, and reliability


Paragon
AI drew this picture of me
Paragon
SMR
Questions?

Bring it Back

Highlights from November 2025 International PEARTS to share with your organization

Marc H. Tannenbaum
Principal Technical Executive

Jon Thomas, P.E.
Principle Technical Leader

Procurement Engineering and Related Topics Symposium (P^{E}ARTS) –
Zürich, Switzerland
November 11-12, 2025

Day 1 – Tuesday

3rd International PEARTS

PROCUREMENT ENGINEERING AND RELATED TOPICS SYMPOSIUM

EPRI

Zürich Switzerland

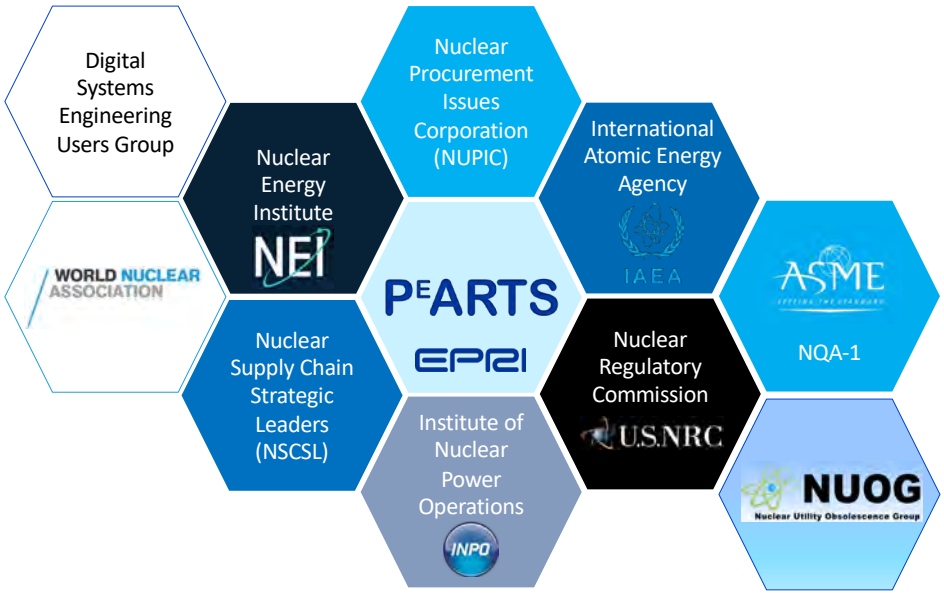
Marc H. Tannenbaum
Principle Technical Executive, Electric Power Research Institute

EPRI Joint Utility Task Group Procurement Forum
November 11 & 12, 2025

PEARTS Objectives

- PROMOTE AWARENESS OF INDUSTRY ISSUES
- SHARE AND DISCOVER BEST PRACTICES
- **"BRING IT BACK"** TO YOUR ORGANIZATION
- IDENTIFY TOP TECHNICAL PROCUREMENT AND SUPPLY CHAIN ISSUE(S)
- DEVELOP PROJECT IDEAS FOR EPRI
- PARTICIPATE IN PROJECTS THAT HELP US ALL SUCCEED
- NETWORKING

PEARTS Interfaces



Welcome to PeARTS 2025 in Zurich, Switzerland

International Procurement Engineering and Related Topics Symposium

Gabriela Araujo, 11.11.2025

SWISSNUCLEAR

EPRI

The Swiss nuclear landscape

Three Operating NPPs - a third of Switzerland's electricity production.

All in long-term operation (LTO>40y) – Procurement engineering is essential for safe, compliant & viable LTO

swissnuclear – The Association of Swiss NPP Operators

- Facilitates dialogue with regulators, suppliers, and international partners like WANO, WNA, EPRI, ENISS & WENRA.
- Supports NPPs on topics such as LTO, regulation, supply chain, and research & industry training.

Recent EPRI Nuclear Utilities Procurement Course in Switzerland (03.2025)

Our challenges in procurement engineering

From the recent workshop:

"The procurement of parts and components in Switzerland is increasingly facing challenges: fewer suppliers, higher prices, and suppliers' limited familiarity with Swiss processes increase the effort required for collaboration as well as delivery times."

Obsolescence Management
proactive procurement
lack of clear specifications
collaboration with regulators
local implementation of CGD
qualification of parts

The Imperative for a Global, Resilient, Nuclear Supply Chain

Thoughts and Perspectives

Dr. John Kickhofel
Managing Partner, Apollo+
jkickhofel@apolloplus.com

EPRI iPeARTS

Zürich, Schweiz
November 2025

info@apolloplus.com
apolloplus.com

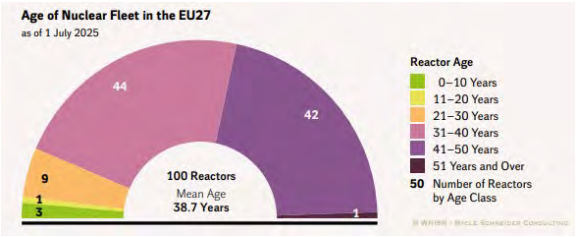
Today's Supply Chain is... unusual...

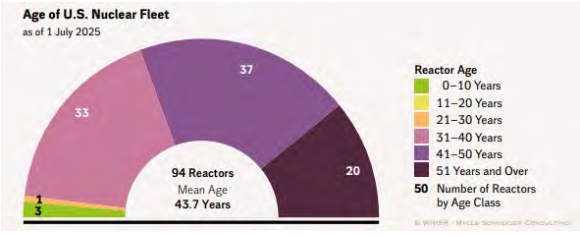
especially in the West

Today's supply chain is leveraging capacity & capability used primarily for **other industries**, it is dedicated to supplying legacy spare parts and engineering services for **old reactor fleets**, it has survived on orders related to **digitalization, safety upgrades and power uprates**…
…and a small handful of **new-build projects** with meaningful European/North American Supply Chain participation in last **25 years**:

foreign
-Vogtle 3&4
~~-Summer 2&3~~
-OL3
~~-Hanhikivi 1~~
-Flammanville 3
*-*EMO 3&4*
*-*HPC, 2 units*
-Taishan 1&2
-Sanmen 1&2
-Haiyang 1&2
-ROK OPR-1000s
*-*ROK APR-1400s*
*ongoing

Few near-term projects:
-DNNP, 1 (+3?) units SMR*
*-*SZC, 2 units*
-Paks II (5 & 6)
*-*Penly, 2 units*
*-*Dukovany 5*
*-*Lubiatowo-Kopalino, 3 units*
*-*Kozloduy 7&8 (pre-construction)*
-USA re-starts / potential re-starts
*no construction license



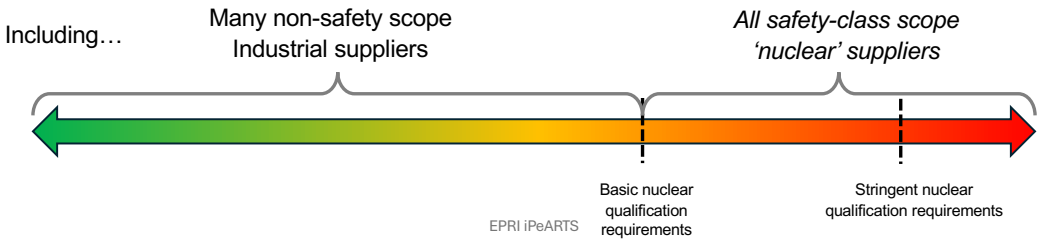


Today's Supply Chain

Globally, we estimate there are approximately **5,000-6,000 suppliers** with meaningful participation in the nuclear industry...
(most of which count on nuclear for only a small fraction of their business revenue)

- *Compare with: aerospace, 30,000+*
- *Compare with: oil & gas, 5,000+ only within mechanical API-standards space*

- Project Development & Finance
- Regulatory, Licensing & Legal
- Design, Engineering & Consulting
- Reactor Technology & NPP Developers*
- Major Systems & Structures*
- Component Manufacturing & Supply*
- Construction & Civil Works
- Nuclear Fuel Cycle*
- Site Services & Plant Operations (including SaaS)
- Waste Management & Decommissioning*
- Professional & Corporate Services
- Research & Development



Final Thoughts

We must find ways to **"#makenuclearsimpler"**, we must be more organized, and work smarter, with much greater efficiency – utilize AI and digital tools, focus on what is important, on 'easy wins'

Suppliers are often performing poorly, and the trend does not look good,
buyers need to invest more in supplier performance improvement and relationship management, build 'intelligent customer' capability
suppliers need to monitor their own performance and make corrections

The world is a crazy place: build resilience now, and **localize** what you can

Mass nuclear new-build will bring both benefits and challenges to spare parts procurement for LTO of existing fleets

EPRI Procurement Engineering and Supply Chain Update

Marc H. Tannenbaum
Principal Technical Executive

Jon Thomas, P.E.
Principle Technical Leader

Procurement Engineering and Related Topics Symposium (P^{E}ARTS) – Zürich, Switzerland
November 11, 2025

www.epri.com

EPRI Update

- Procurement
  - Quality Assurance Basics CBT (3002029241)
  - Shelf-Life CBT (3002026363)
  - CGD Experience and Efficacy (3002029261)
  - Use of Artificial Intelligence to Inform Reorder Decisions (3002029361)

Distance Learning Computer-Based Trainings

These **and many more** CBTs can be found on EPRI's Learning Management System (LMS) at: http://www.epri.com/training

Procurement Engineering		Related Topics	
3002015958	Procurement Engineering Fundamentals	3002013813	Obsolescence Program Manager
3002020810	Procurement Engineering Safety Classification	3002013790	Nuclear Supply Chain - Warehouse Inventory Management
3002015921	Commercial Grade Dedication Basics	3002013801	Quality Control Receipt Inspection
3002018278	Item Equivalency Evaluation	3002015959	Technical Specialist Training for Audits and Surveys
3002020811	Technical and Quality Requirements	3002015960	Counterfeit, Fraudulent, and Suspect Items
3002023732	Reverse Engineering Techniques	3002020809	Undeclared Digital Content
3002026363	Establishing, Maintaining and Extending Shelf Life	3002029241	Quality Assurance Basics

2023 2024

PEARTS Tools Available

EPRI ELECTRIC POWER RESEARCH INSTITUTE
EPRI PROCUREMENT INFORMATION CENTER

Find EPRI resources at epic.epri.com

PEARTS
Procurement Engineering and Related Topics Symposium (PeARTS)
LinkedIn Group

Join the PEARTS LinkedIn Group

Subscribe to the PEARTS Forums!
nuclearprrforum.epri.com
Procurement Engineering
Nuclear Supply Chain

Note: You will have to log in using your EPRI credentials to access these tools

Technical Evaluation Database (TED)

- SPEED
  - Smart Procurement Engineering Evaluation Data (SPEED) provides the ability to capture engineering information that can be used to prepare commercial grade item dedication, equivalency, and RISC-3 procurement treatment evaluations
- CFSI
  - Suspect Counterfeit and Fraudulent Items (SCFI) provides a venue for reporting incidents of suspected counterfeit or fraudulent items
- UsOne
  - Utility-Supplier Obsolescence Notification Exchange (UsOne) helps allows utilities to upload a list of items they need and suppliers to upload a list of items they have available to solve obsolescence challenges
- POP
  - Pending Obsolescence Protocol (POP) began when EPRI's Joint Utility Task Group on Procurement Engineering (JUTG) started contacting suppliers that announced discontinuation of nuclear products or quality assurance programs

Building the New Nuclear Supply Chain Panel

Dr. John KICKHOFEL
apollo+ nuclear
SWITZERLAND

Peter ČAMBÁL
SLOVENSKÉ ELEKTRÁRNE
SLOVAKIA

Howard LECOMPTE
Paragon
UNITED STATES

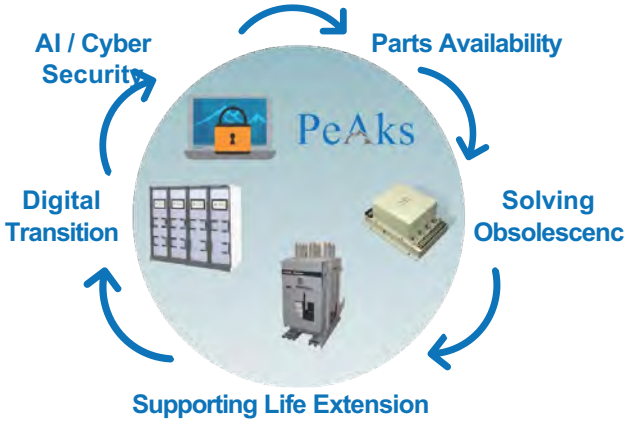
Marc TANNENBAUM
EPRI
UNITED STATES

Building the New Nuclear Supply Chain Panel

- How do you find suppliers and compile a list of suppliers?
  - Last week's experience at the WNE in Paris was highly productive, particularly in engaging with suppliers and identifying new potential partners. We are now in the process of compiling a comprehensive list of suppliers for future collaboration and utilization.
- How can you recruit new suppliers for activities?
  - Transparency in project information is essential, with decisions driven by technical expertise rather than political influence. All relevant data should be published openly, with detailed contributions from both suppliers and operators. To support project execution, it's critical to form clusters of capable companies and establish standardized technical specifications. These efforts should culminate in a clear, replicable model for how new build projects will be executed, ensuring consistency, collaboration, and efficiency across all stakeholders.
- What is it that tells a supplier it is time to invest, based on a true demand signal?
  - The true indicator of demand is the purchase order (PO), which reflects actual needs rather than projections. To plan effectively for future requirements, it's essential to analyze the data behind these orders. Suppliers must also take an active role in educating operators—clearly communicating insights derived from data and deliverables to ensure alignment and informed decision-making.

Paragon

Building the New Nuclear Supply Chain



ISO 19443, ISO/TR 4450

Quality management systems, standards development

Updates and next steps

Dipl.-Ing. Ms. Natalia Amosova
Principal Consultant, Apollo+
namosova@apolloplus.com

EPRI iPeARTS

Zürich, Schweiz
November, 2025

info@apolloplus.com
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Key Take-Aways

- Nuclear Quality Management, ISO/TC 85/WG 4
  - Standards currently under development
    - ISO/CD 19443 – Quality Management System – Specific requirements for the application of ISO 9001:2015 by organizations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety (ITNS)
      - Updates to ISO 19443, which is tied to the ISO 9001 update (quality culture), and lessons learned
    - ISO/AWI TR 4450 - Quality Management System – Guidance for the application of ISO 19443:2018 (How to apply ISO 19443)
      - Lessons learned from ISO 19443:2018 implementation, auditing, and certification
      - 6 focused subjects/sub-groups

中广核 CGN

阳江核电有限公司
Yangjiang Nuclear Power Co., Ltd.

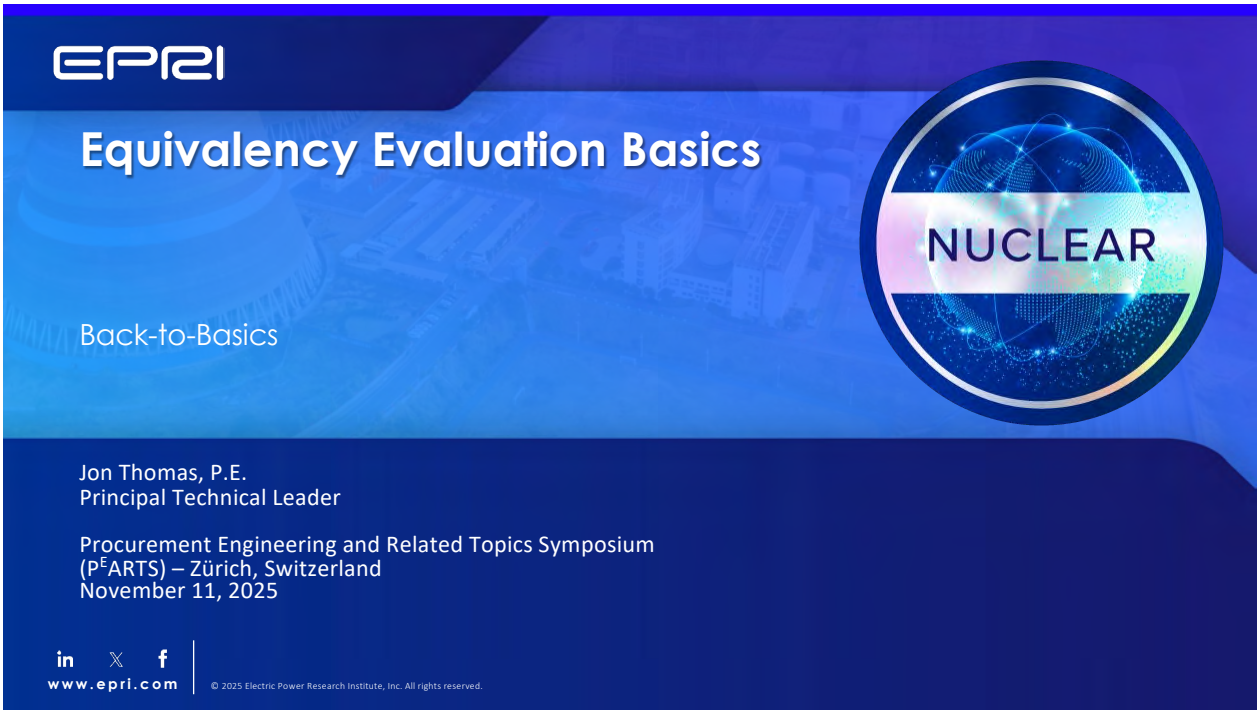
严 · 慎 · 细 · 实

Improvements of Spare Parts Management in Yangjiang Nuclear Power Plant

November 2025

Key Take-Aways

- Spare Parts Management
  - Over 160,000 material codes with over 25,000 parts received annually
  - Supply Management
  - Quality Management
  - Cost Management
  - Supply Chain
  - Challenges with waiting for spare parts
- Improvement Focus Areas
  - Equipment Management (key equipment identification, predictive maintenance)
  - Demand Management (planning, coordination, reporting)
  - Inventory Management (inventory control)
  - Procurement Management (procurement efficiency)
  - Supplier Management (supply chain system and streams)
  - Sharing Management (parts sharing, reuse of spare parts, agreements)
  - Warehouse Management (planning, construction, intelligence, maintenance)



Key Take-Aways

If a like-for-like procurement is being made, design characteristics need not be identified and/or documented and evaluated

Only those design characteristics that have changed from the original item need to be documented when evaluating the equivalency of an alternate replacement item

EPRI guidance allows for item evaluation through either comparison of design characteristics, or by evaluating the effects the alternate item has on bounded technical requirements

Critical Spares

Focus on the most important equipment

Marc H. Tanenbaum
Principal Technical Executive

International Procurement Engineering and Related Topics Symposium
Zürich, Switzerland, 11-12 November 2025

Key Take-Aways

- Large capital assets must be managed
- Effective management of equipment
  - Focus
  - Prioritization
- Critical spares program implementation
  - Identification
  - Stocking levels
  - Order/reorder parameters
  - Controls
  - Storage

Proactive Obsolescence Program at NPP Paks

Dr. Zoltán Vajna
MVM Paks Nuclear Power Plant Ltd.

MVM Paks NPP

PAST	PRESENT	FUTURE
Scope definition Establishment of a custom risk assessment matrix Mathematical calculations Implementation of the obsolescence management process We have initiated market research for the relevant equipment	Partial development of a digitized process (AS9 workflow) suitable for obsolescence identification Development of a ranking methodology for obsolete items	Integration of ranking into the AS9 Obsolescence Management Pre-screening Workflow Problem-solving / Solution development Definition of KPIs Development of a process monitoring system and early warning indicator system
2024	2025	2026

MVM Paks NPP

Obsolescence Management Panel

Dr. Zoltán VAJNA

MVM Paks NPP

HUNGARY

Arne CLAES

ENGIE

BELGIUM

Jon THOMAS

EPRI

UNITED STATES

Obsolescence Management Panel

- What is the biggest challenge in managing obsolescence?
  - A significant challenge in managing obsolescence is staying ahead of it—anticipating and mitigating risks before they disrupt operations. This requires a proactive, coordinated approach across multiple departments and systems, which is often easier said than done.
- What information is missing that would be helpful?
  - Missing item/part information (M/N, P/N, Shop Order number from prior/original orders, drawings, specifications)
- What has been most effective step taken to manage obsolescence?
  - Promote education and awareness across all functional groups involved in the program or process to ensure a shared understanding of roles, dependencies, and objectives. This alignment enables teams to effectively leverage relationships with vendors and suppliers—especially Original Equipment Suppliers (OES) and Original Equipment Manufacturers (OEM)—by knowing when and how to "pull the string" to access critical support, resources, or alternatives.
- When do you typically find out when an item is obsolete?
  - Procurement Attempts: When the Supply Chain team initiates a purchase and the vendor or supplier responds that the item is no longer available or has been discontinued.
  - Field-Level Communication: Maintenance or craft personnel may learn of obsolescence directly from on-site vendors or through informal vendor communications during routine operations.

Element Materials Technology, Huntsville Nuclear Presentation on Surplus Safety Relief Valves to Plant Inventory

EPRI International PeARTS Conference
Zürich, Switzerland
November 2025

Recertifying Non-Safety ASME Valves – Greg Mason - Element

- Supply of two surplus Crosby Pressurizer SRVs
  - Required reestablishment of valves as Safety Related
    - Verification to original documentation
    - Refurbishment
    - Recertification
  - Project duration was 3 weeks (purchase of valves to delivery)
  - Industry and utility collaboration was key to support successful deliverables of the valves

Breakout Session – Commercial-Grade Dedication

- What are some successes and failures of using CGD or the KELPO method?
  - Successes of CGD
    - Supplier's providing replacement items to utilities utilizing CGD
    - Supplier leveraging the process to use a third-party vendor with good past performance history for parts
    - Helps identify changes in items at time of receipt during the acceptance process
    - Helps identify CFSI items
  - Failures of CGD
    - Missed change in design of a timing relay, which included a digital, programmed chip
  - Successes of KELPO
    - Has successfully been used since 2020 to accept/approved over 500 items with no identified issues (no non-conformances and good operating experience)
    - Huge reduction in lead-times
  - Failures of KELPO
    - Some suppliers cannot fulfill all requirements
    - Suppliers have received non-conformances and have not been successful in resolving and closing the NCR's

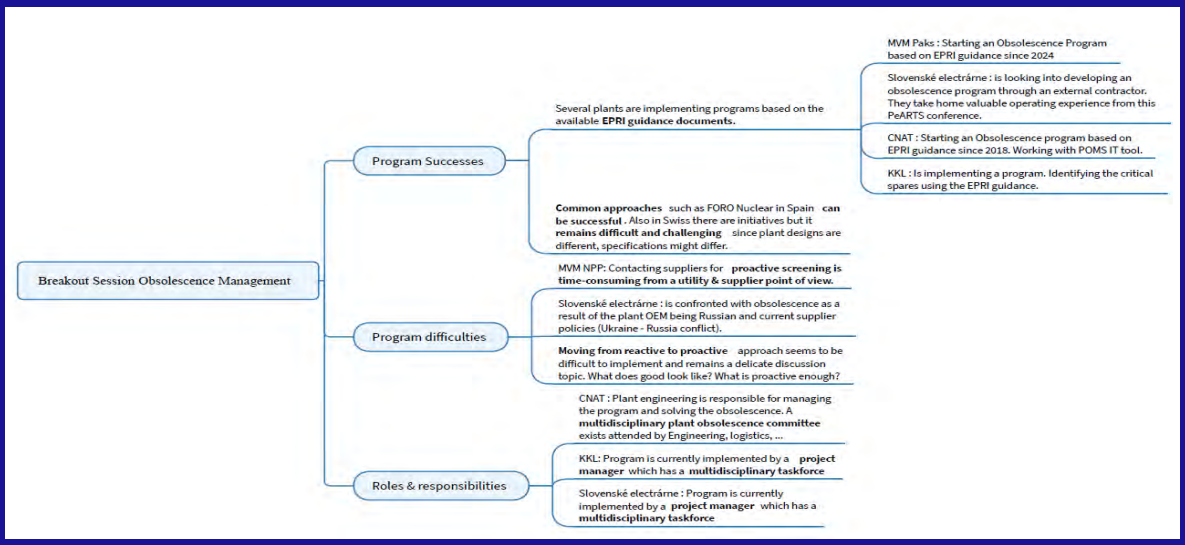
Breakout Session – Commercial-Grade Dedication

- What is needed to help expand acceptance and use of CGD or the KELPO method?
  - Unified standard in CGD
  - Training
  - Involvement and training of regulators
  - Deployment of CGD in ISO 19443
- What are good applications for CGD to support nuclear new build efforts?
  - Specialized equipment will be used for new build development and CGD would be required to support
- Is there interest in working with EPRI's SPEED application to collaborate on CGD technical evaluations for certain items? If so, what kind of items?
  - Yes, no items provided during breakout
  - Would help drive standardization
- Would it be valuable to have a technical presentation on CGD at the next P^{E}ARTS meeting?
  - Yes, please possibly an additional presentation on KELPO method

Breakout Session – Obsolescence Management

- Who in this group has implemented obsolescence programs and what are some of the successes and failures?
- Do you have a list of obsolete items (utilities) or existing obsolescence solutions (suppliers), and would you be willing to share this data to identify existing solutions and opportunities to collaboratively develop new solutions for items that are (or will be) needed by more than one utility?
- What would prevent sharing of this type of data?
- Do you see obsolescence management as a separate issue or is it something that should be considered for many processes at a nuclear facility. For example: determining system health, determining inventory levels, deciding when design changes are necessary and should be funded before replacements are needed)?

Breakout Session – Obsolescence Management



Day 2 – Wednesday

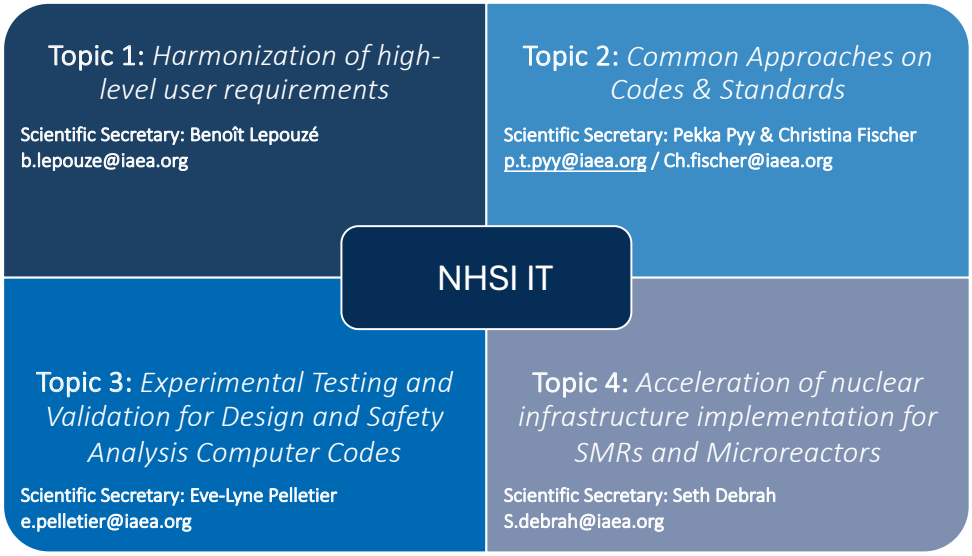
IAEA NUCLEAR HARMONIZATION & STANDARDIZATION INITIATIVE

IAEA

IAEA NHSI Industry Track Topical Group 2 – Common Practices on Codes and Standards: Achievements and Updates

Shin Whan Kim, IAEA NE

The NHSI Industry Track is divided into 4 topical groups to foster initiatives in the industry that aim to facilitate global deployment of SMRs through standardization and harmonization.



NHSI Industry Track Topic 2

TG2 platform for information sharing

NHSI Topic Group 2

I. Codes & Standards

A. QUALITY AND MANAGEMENT SYSTEM STANDARDS USED WIDELY IN THE MEMBER STATES (APPLICALBE TO SMRS)
B. ENGINEERING STANDARDS FOR THE DESIGN AND CONSTRUCTION OF SMRS (WNA TO LEAD)
C. EQUIPMENT QUALIFICATION STANDARDS FOR NUCLEAR (SMRS) FACILITIES
D. C&S USED IN VARIOUS SMRS (AND THEIR PROJECTS)
E. C&S FOR ADVANCE MANUFACTURING (AM) TO BE USED FOR SMRS (AND THEIR PROJECTS)

II. Oversight & Acceptance

A. A USE OF STANDARD, PROVEN SERIALLY MANUFACTURED INDUSTRIAL/COMMERCIAL-GRADE iITEMS)
B. NON-NUCLEAR CODES, STANDARDS, LAW AND REGULATIONS RELEVANT TO SMR DEPLOYMENT
C. OVERSIGHT ACTIVITIES REQUIRED BY CODES, STANDARDS, LAW AND REGULATIONS
D. LONG LEAD ITEMS

Nine topics covered during NHSI Phase II 2025-2026

Topic 2: Common Approaches on Codes and Standards – Achievements

IAEA TECDOC – "Suitability Evaluation of Commercial Grade Products for Use in Nuclear Power Plant Safety Systems"

Working Paper – "Why Serially Manufactured Industrial Products Are Crucial for Reliable Deployment of Small Modular Reactors"

Working Paper – "Why Non-nuclear Codes and Standards Are Important for Harmonizing SMRs"

Working Paper – "Potential for Harmonization and Standardization in the Approval Processes for High Integrity Long-Lead Items"

Working Paper – *"Why a consistent approach to nuclear codes and standards is crucial for the serial deployment of standardized SMRs"*

Working paper on ISI C&S issued in Oct 2025

Harmonization of in-service inspection codes and standards to boost SMR exports

#makenuclearsimpler

CLEAN ENERGY OF TOMORROW

EPRI iPeARTS

WANO Procurement Quality Working Team Activities

Martin Seidl
Zürich
11.11 – 12.11.2025

WANO QC I-WG
Subgroup CGD:

Martin Seidl, *ČEZ, Czechia*
Richard Bíro, *SE, Slovakia*
Jonathan Thomas, *EPRI, USA*
Andy Reed, Brett Shaw, *EDF Energy (HPC), UK*
Arne Claes, *Engie Nuclear, Belgium*
Maryna Topchii, Olena Dyakova, *Energoatom, Ukraine*
Kari Pihala, *TVO, Finland*
Chen Chen, *CGN, China*
Peter Lovrenčič, *NEK (Krško), Slovenia*
Tammi Smith, *Sellafield Ltd, UK*
István Szilágyi, *Pakš, Hungary*
Marc Tannenbaum, *EPRI, USA*
Oleksii Popop, WANO, France
Mahtab, *Ontario Power, Canada*
Juan Ferrero Manuel, *Na-Sa, Argentina*

WANO QC I-WG CGD

Sub-group	Commercial Grade Dedication (CGD)
Objective	Develop a WANO document considering the following: • Unification of CGD procedure • Determination of quality criteria for CGD items (identifying the critical characteristics, verifying their acceptability) • Recommendation for procurement. • Unified procedures for supplier approval.
Problem Statement	Inconsistent CGD procedures / lack of awareness by manufactures
Lead	Martin Seidl, CEZ, a.s.

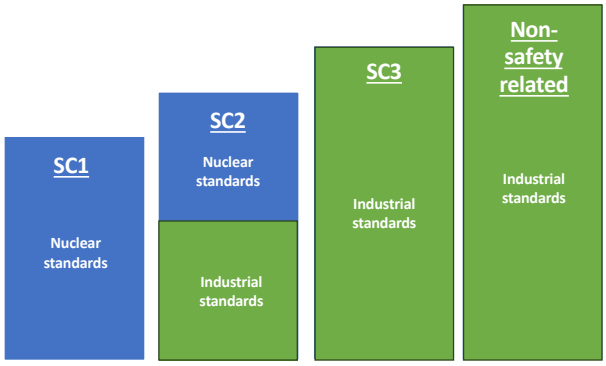
KELPO™ Method

EPRI PROCUREMENT ENGINEERING AND RELATED TOPICS SYMPOSIUM
12th Nov 2025

Hannu Eklöf, Olkiluoto NPP, TVO
Kari Pihala, Olkiluoto NPP, TVO

fortum tvo

KELPO™ scope

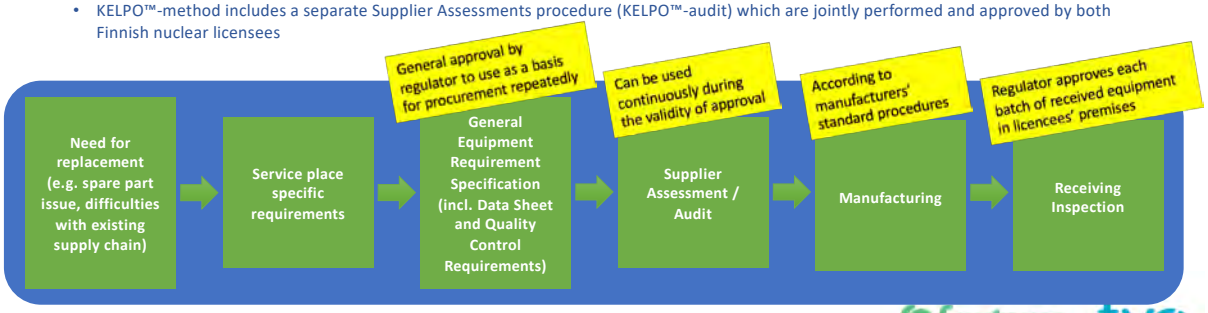


- KELPO™-method is utilized for mechanical equipment utilizing graded approach
- Equipment safety classification scope of KELPO™ includes
  - SC3
  - SC2 - low energy systems
    - T ≤ 120˚C
    - p ≤ 20 bar
- Pilot phase for safety class 2 high-energy equipment is ongoing
- Most critical equipment related to nuclear safety are excluded from KELPO™

fortum tvo

KELPO™ process

- General Equipment Requirement Specification (GERS) relies on ISO 9001 and PED requirements and are common for both Finnish nuclear licensees
- GERS are prepared at equipment group level (e.g. manual valves, safety valves, plate heat exchangers…) with Quality Control Requirements (QCR) and Data Sheet template as an attachment to each GERS
- GERS and QCR are generally approved and utilized in procurement
- Data Sheet is a service place specific template and shall be filled in each procurement case individually
- KELPO™-method includes a separate Supplier Assessments procedure (KELPO™-audit) which are jointly performed and approved by both Finnish nuclear licensees



CLEAN ENERGY OF TOMORROW

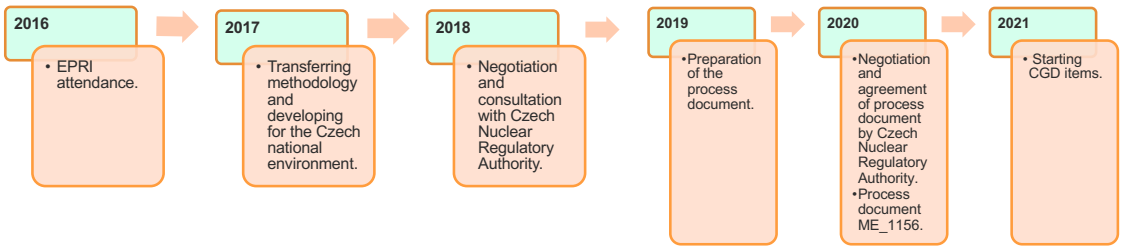
EPRI iPeARTS

Implementing CGD at CEZ

Martin Seidl
Zürich
11.11 – 12.11.2025

Implementing CGD at ČEZ

- ČEZ started in year 2016
- The basis for CGD process is EPRI Guideline.
- 2020 – first issue of Process document ME_1156
- 2024 – so far 20x cases of used CGD items.



ČEZ_ME_1156 CGD Methods

Method 1
Verification of the item quality and properties documentation

- Goal: Demonstrate the product quality and properties documentation, according to which the item was manufactured, and which item meets.

Method 2
Evaluation of the item operational experience

- Goal: To identify the item reliability based on its verified operational history and usage experiences.

Method 3
Special tests and inspections

- Goal: Verification of the critical parameters that could not be proved by the other methods.

Method 4
Proof of the producer quality management system in time of production

- Goal: Demonstrate the existence of producer/supplier quality management system.

The future of CGD and Similar Methods Panel

Dr. John KICKHOFEL

apollo+ nuclear

SWITZERLAND

Martin SEIDL

GROUP CEZ

CZECH REPUBLIC

Hannu EKLÖF

tvo

FINLAND

Kari PIHALA

tvo

FINLAND

Marc TANNENBAUM

EPRI

UNITED STATES

The future of CGD and Similar Methods Panel

- What are the biggest challenges implementing CGD or the KELPO method?
  - Change and change is challenging, resources (particularly in-house within the organization)
- Does your regulator allow, or are they considering allowing the use of commercial-grade dedication or the KELPO method?
  - Getting better with the regulator, as they see the potential with use of CGD. Regulator does recognize that change in the future is needed, thus the potential use of KELPO method.
- What are the future advantages of using the KELPO method?
  - Most important is the short delivery times, but also diversity and the expanded supply chain streams for items.
  - This will also help with mitigating obsolescence, leveraging suppliers that are mast producing items which would support long term supply stream.
- Does the world need CGD?
  - If a country has a supply chain that is robust and competitive, then no as the supply streams will support quality procurement of items.
  - It will be needed as an option, especially for existing plants/fleet as they run to end of life.

FOAK Procurement Strategies

EPRI Internation PEaRTS
Zurich, Switzerland
11/12/2025

John Portillo
VP, Global New Nuclear
Paragon

Key Take-Aways

- Initial Design to Implementation
- Establish QA Requirements
- Supporting FOAK Supply
  - Life cycle management
  - Manufacturing and supply of spare components/parts (readiness)
  - Process to support obsolescence
  - Field support (troubleshooting and installation)
  - Licensing support (if applicable)

Project Risk Evaluation (PRE)

Alejandra Zertuche
12 Nov. 2025

PRE- Preliminary Risk Evaluation (Procurement Point of View)

- The challenge – Mitigating risks in complex projects
- Industry Best Practice – Graded approach, IAEA 1740
- What is PRE?
  - Proactive Risk Management in Procurement Projects
- How to do a PRE?
  - Offer-Request Phase, Project Management Information
- When to do a PRE?
  - High-risk project, new technology/design, FOAK, new supplier in jurisdiction
- Who is involved in PRE?
  - Customer (Project buyer, PRE team leader, PRE team members)
  - Supplier (PM, Quality Manager, Sales)
- Why do a PRE?
  - Improve risk management, deduce deviations, strengthens customer/supplier relations, enhances overall quality assurance

ASME NQA-1 activities to address industry challenges

EPRI PEARTS
Zürich, Switzerland
November 11 & 12 2025

Pascal Ancion

Key Take-Aways

- ASME NQA-1 Overview/Activities to address industry challenges
  - U.S. Regulatory Regime
  - ASME Codes & Standards Committees
  - ASME International Working Groups
- Future Vision
  - Understanding of current challenges when implementing NQA-1
  - What is the NQA Standard Committee doing to address these challenges?
- Three-Cs Initiative – Three-Part Plan for Excellence
  - **Clarify** the standard with clear language for better user understanding
  - **Clean up** and enhance training with an ASME/NQA-controlled knowledge exam
  - **Create** a new product and/or guideline that integrates industry lessons learned and applies a graded approach

Applications for Artificial Intelligence in Nuclear Procurement Panel

Javier BARROSO MARTIN

Westinghouse

SPAIN

Howard LECOMPTE

Paragon

UNITED STATES

Jon THOMAS

EPRI

UNITED STATES

Application of AI in Nuclear Procurement Panel

- What AI tools are available for use?
  - Paragon – Peaks+ plus AI
  - Westinghouse – POMS+
  - EPRI – Demand Predictions, Technical Report 3002029361
- What new tools/applications are being developed?
  - EPRI – NILLM (Nuclear Industry Large Language Model), collaborative effort between EPRI, INPO, NEI for an AI Assistant tool/application (Knowledge Assistant, OE Assistant, Troubleshooting Assistant)
- How is AI information output, how is verification approached?
  - Approach as “Trust by Verify”
  - Review and validate, particularly check the referenced sources and applicable information
  - Establish bounds (i.e., what information is shared, how it is shared, user groups/access groups, logins)
  - Ensure there is a feedback loop when gaps, errors, hallucinations are identified so the models can be further developed/improved; using an OE/Lessons Learned approach

Paragon

What is PeAks+ AI?

PeAks+ AI is a virtual assistant that blends AI, your data, and industry data to provide you with essential tools to tackle the challenges of parts availability, lead times, and obsolescence.

2025 iPARTS Recent Successes

Procurement and QA Alignment	Dedicate several items that were difficult to procure	We see the light at the end of the tunnel	Impeding new tools for finance	No work delayed due to procurement	Wait until the old lazy guys are gone
Qualification of external personnel from the supplier	Hiring advanced reactors SME	New Staffing	Cross-functional review of high-value procurement	Departmental realignment	Successful shutdown
Implementing new procurement processes	Found an alternate item manufacturer for a utility	New team focus only on procurement topics	We were able to purchase and transport some critical items from Russia and Ukrain and nobody got sick or crazy	Optimized organization	Building a new team
	Right sizing QA Requirements	Leveraging AI	Improved internal processes	Rebuilding Staffing	

EPRI

Top 10 Procurement and Supply Chain Challenges

- TBA