

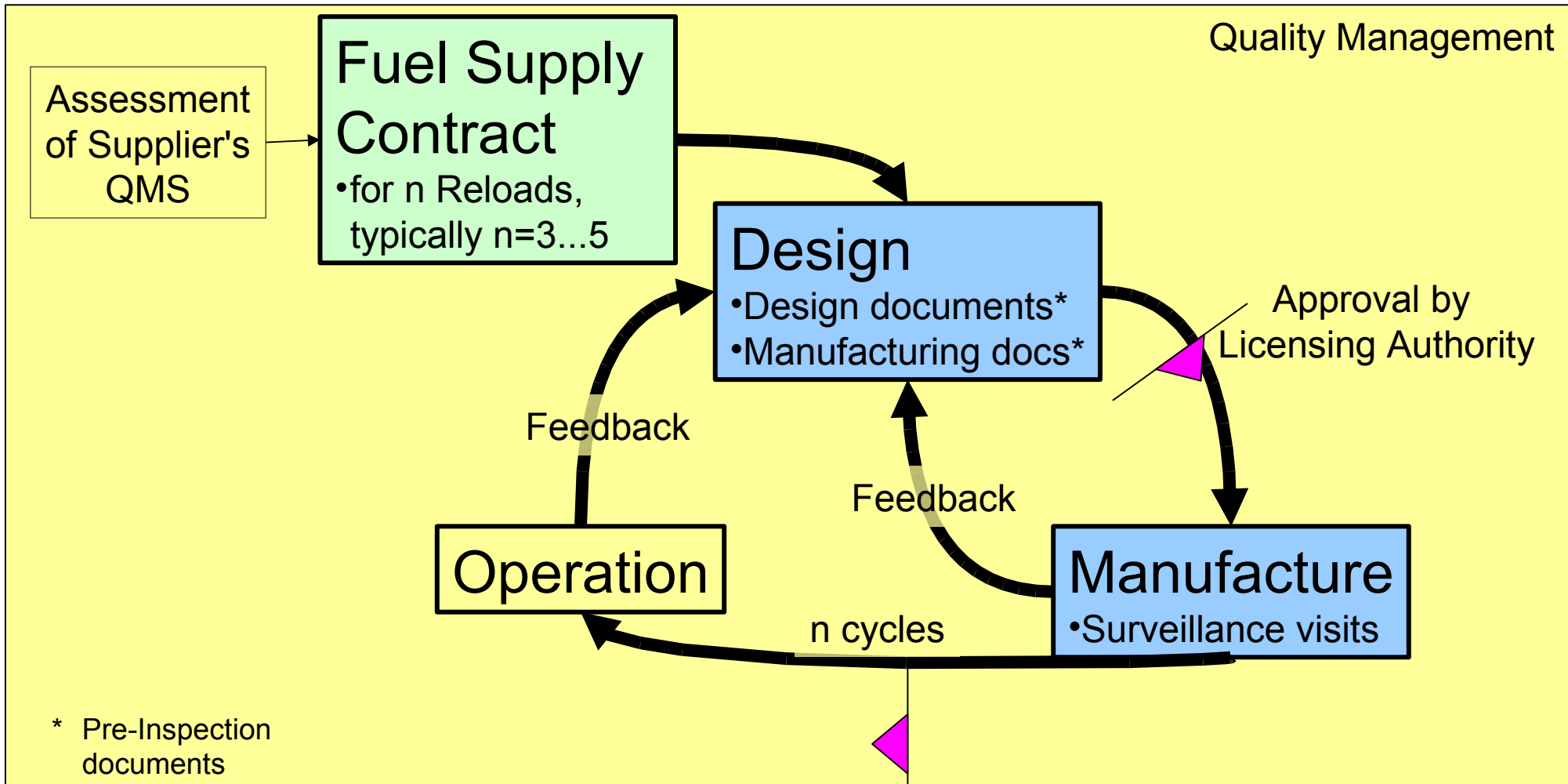
Finnish Approach in Fuel Manufacturing Surveillance

Risto Teräsvirta

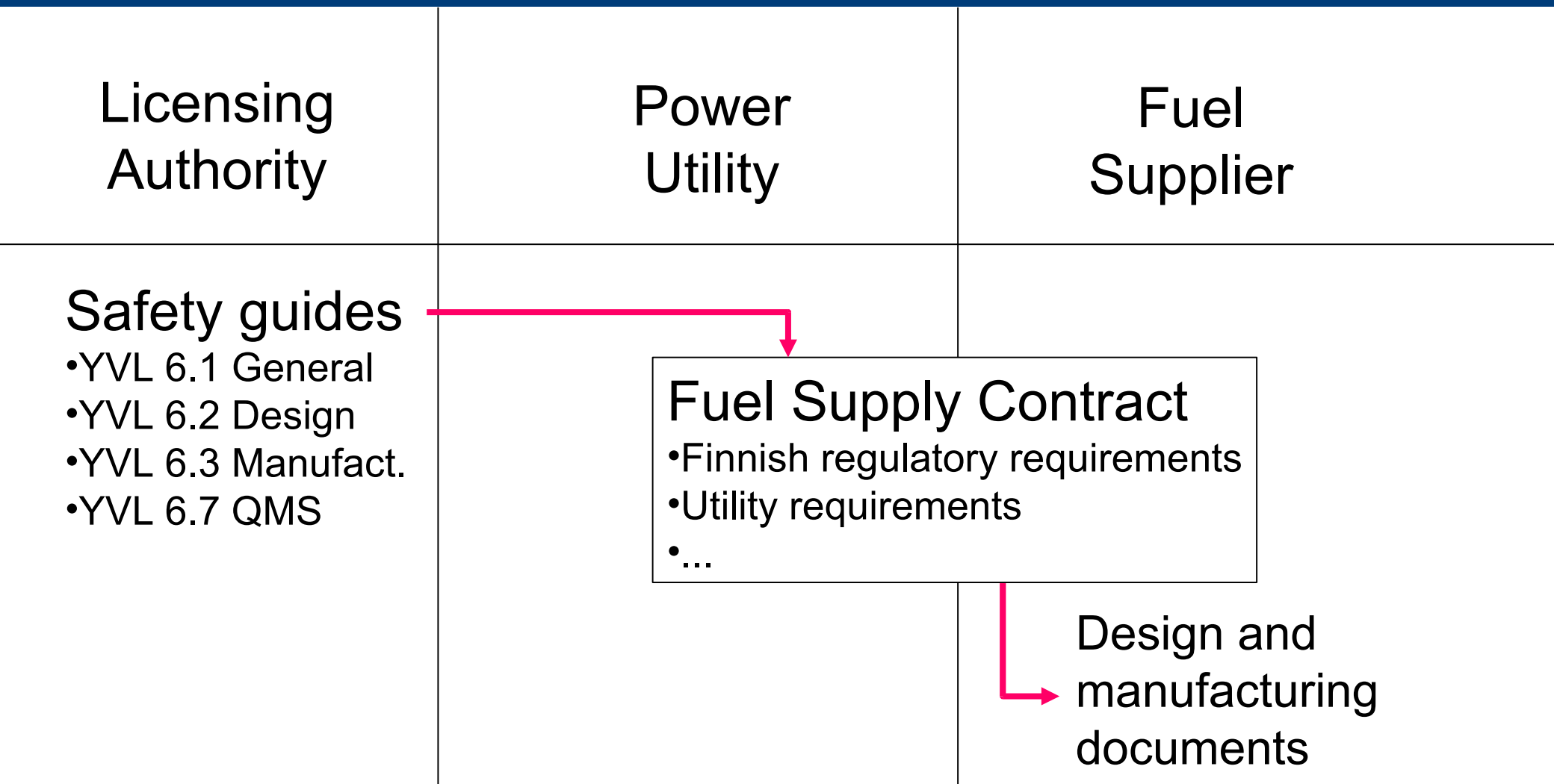
Fortum Nuclear Services

YG Seminar in Hanasaari Espoo, 3 November 2003

Fuel Supply Cycle



Main Documents governing the Fuel Supply



Pre-Inspection Documents (1/4)

YVL 6.3

Supervision of nuclear fuel and control rods

- Supplier's, Designer's and Manufacturer's Quality Manuals (for information)
- Analyses, Experimental studies and Operational experience demonstrating that Design Bases Requirements are met
- Product Specification with reference to associated manufacturing documents (specifications, drawings)
- Technical Specifications for materials, components, and products
- Drawings
- Manufacturing and Inspection plans
- Lead use fuel assembly inspection programme
- Manufacturing control plan (for information)

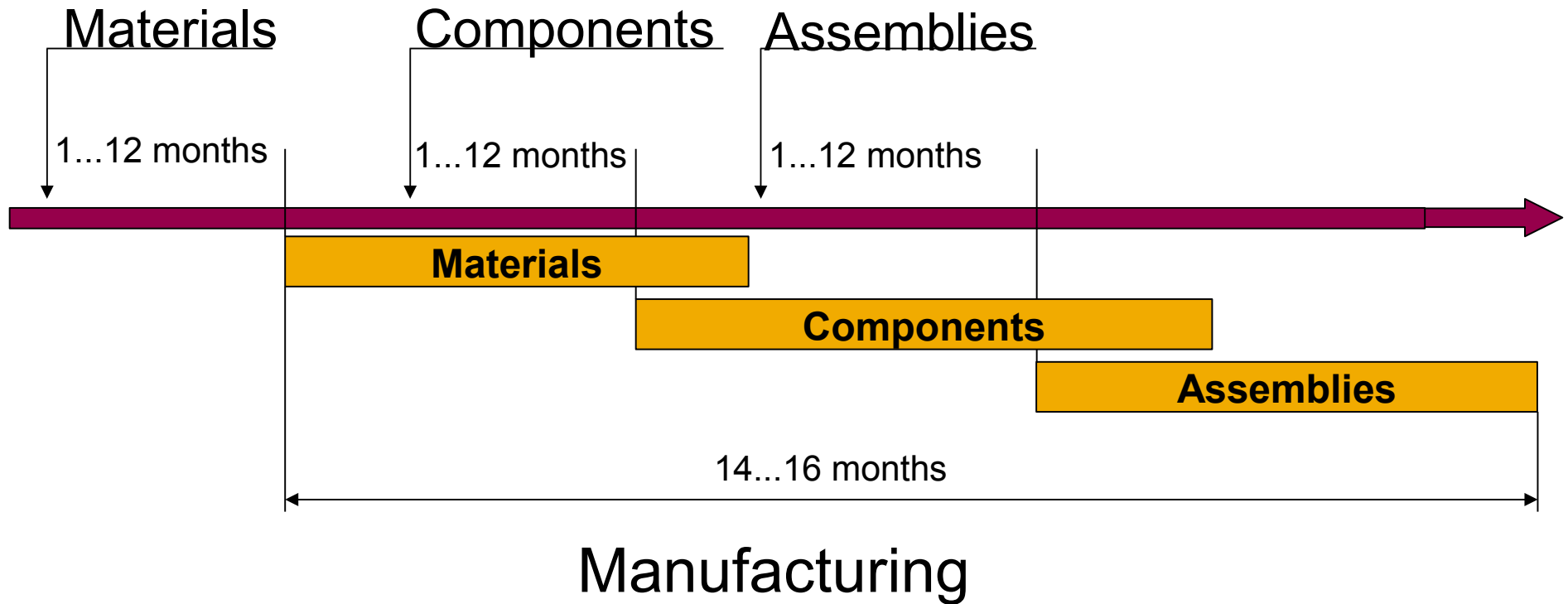
Pre-Inspection Documents (2/4)

PID on Manufacturing:

- PID may be, and often is, splitted into several parts, for instance for materials, components and assemblies because of different timing of their manufacture.
- PID shall be inspected and approved by the Utility and approved by Licensing Authority before manufacturing of materials, components and fuel assemblies may start
- PID shall be worked out and approved by STUK for each individual fuel reload batch, even if there are no changes compared with previous reload.
- Only the Parts List and changed (from previous reloads) PID have to be submitted to STUK

Pre-Inspection Documents (3/4)

Submittal of PID



Pre-Inspection Documents (4/4)

Product Specification and associated documents

Product Specification, Reload NN, rev Y			
Item	Tech Spec.	Drawing	Mat. Spec
Assembly	DocId, revNo	DocId, revNo	
SubAssembly1	DocId, revNo	DocId, revNo	
Component 1	DocId, revNo	DocId, revNo	DocId, revNo
Component 2	DocId, revNo	DocId, revNo	DocId, revNo
SubAssembly2	DocId, revNo	DocId, revNo	
Component 1	DocId, revNo	DocId, revNo	DocId, revNo
Component 2	DocId, revNo	DocId, revNo	DocId, revNo

Surveillance of manufacturing

Objective

- Making sure that the items are manufactured in accordance with pre-inspection documents

Measures

- Auditing and assessment of Supplier's, Designer's, Manufacturer's and most important Sub-suppliers' Quality Management Systems
- Surveillance visits to manufacturing plants

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Surveillance of manufacturing Auditing Quality Management Systems (1/2)

Objects

- Fuel Supplier
- Supplier's Design organisations
- Supplier's Manufacturing organisations
- The most important sub-suppliers

Audit Team

- 1 Quality Engineer (Lead Auditor)
- 1 Fuel Engineer

Guides



INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 2001

SÄTEILYTURVAKESKUS JULKAISUT

YVL-ohjeet

< TAKAISIN



Surveillance of manufacturing Auditing Quality Management Systems (2/2)

QMS auditing plan for 2006 - 2008

Object \ Year	Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006				2007				2008				2009	2010	
													I	II	III	IV	I	II	III	IV	I	II	III	IV		
Fuel Supplier	1	☒				☒	☒			☒									◎							◎
FA Manufacturer	1					☒			☒			◎													◎	
Main Designer	2					☒			○		☒												◎			
Pellet manufacturer	2					☒				○	☒												◎			
Cladding manufacturer	2							☒		○							◎									
Spacer grid manufacturer	2					☒	☒			☒											◎					
Other comp. manufacturer1	3							○											●							
Other comp. manufacturer2	3							○			○								●							
Other comp. manufacturer3	3										○														●	
Other comp. manufacturer4	3									○																●

☒ - Performed audit

◎ - Planned audit

○ - Performed Supplier's audit

● - Planned Supplier's audit

Categories

1 Fuel Supplier, FA manufacturer

Once in 3 years

2 Main Designer, Manufacturer of main components

Once in 4 years

3 Others

On a need to do basis

Surveillance of manufacturing

Objective

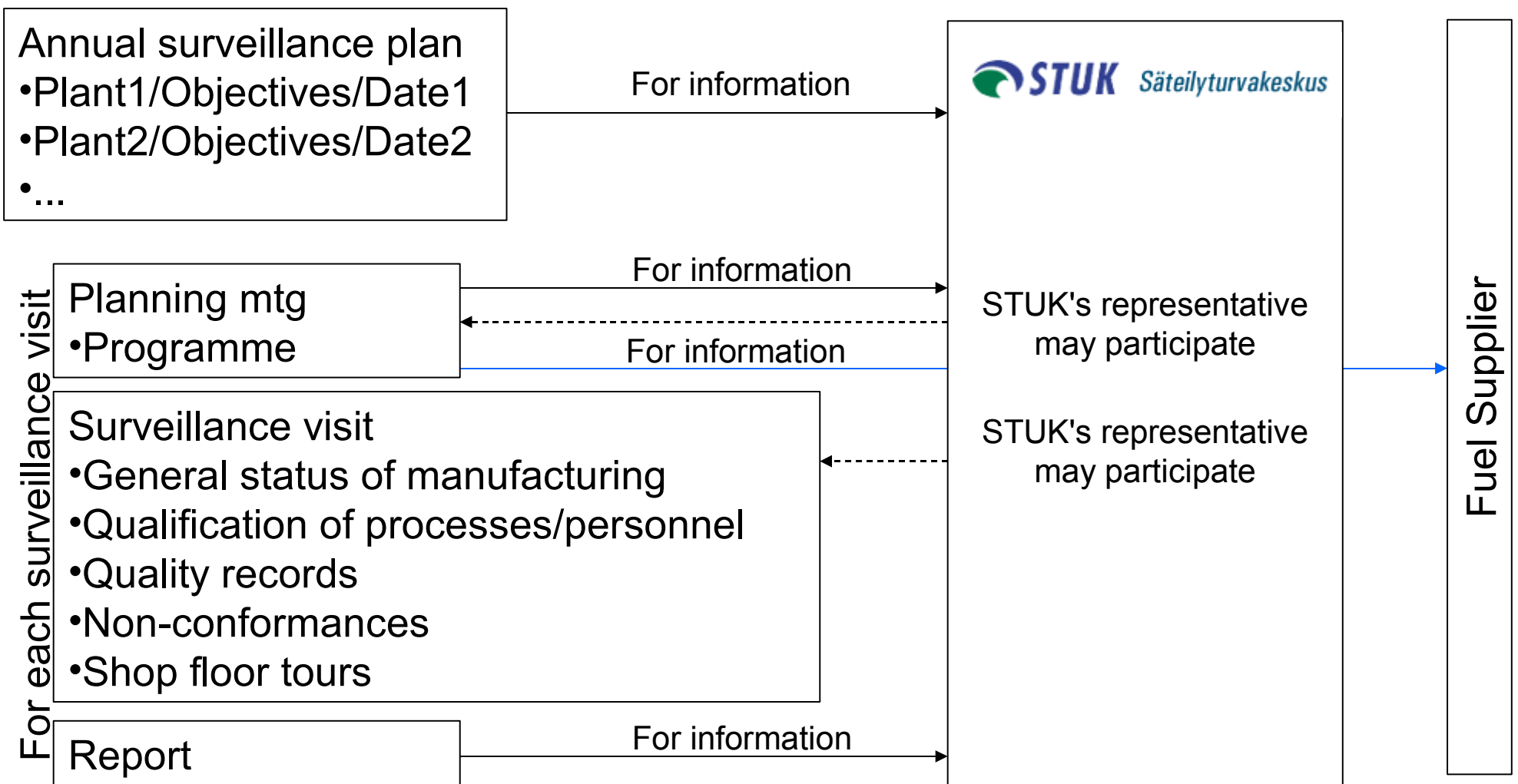
- Making sure that the items are manufactured in accordance with pre-inspection documents

Measures

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- **Surveillance visits to manufacturing plants**

Surveillance of manufacturing

Surveillance visits to manufacturing plants (1/5)



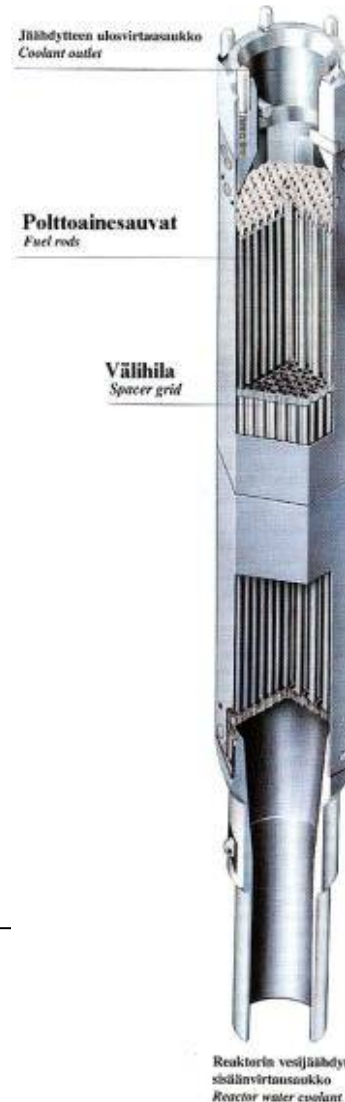
Surveillance visits to manufacturing plants (2/5)

Visits per Reload

- Fuel Assembly manufacturer (Typically: Pellets, Fuel Rods, Spacer grids, Skeletons, Nozzles and Fuel Assemblies)
 - 2 times per Reload
- Important components (Typically: Fuel cladding tubes, Spacer grids, Nozzles), Zr material
 - Every other Reload
- Other components
 - On separate occasions
- The inspection team consists typically of 1 Fuel Engineer (group leader) and 1 QC Engineer

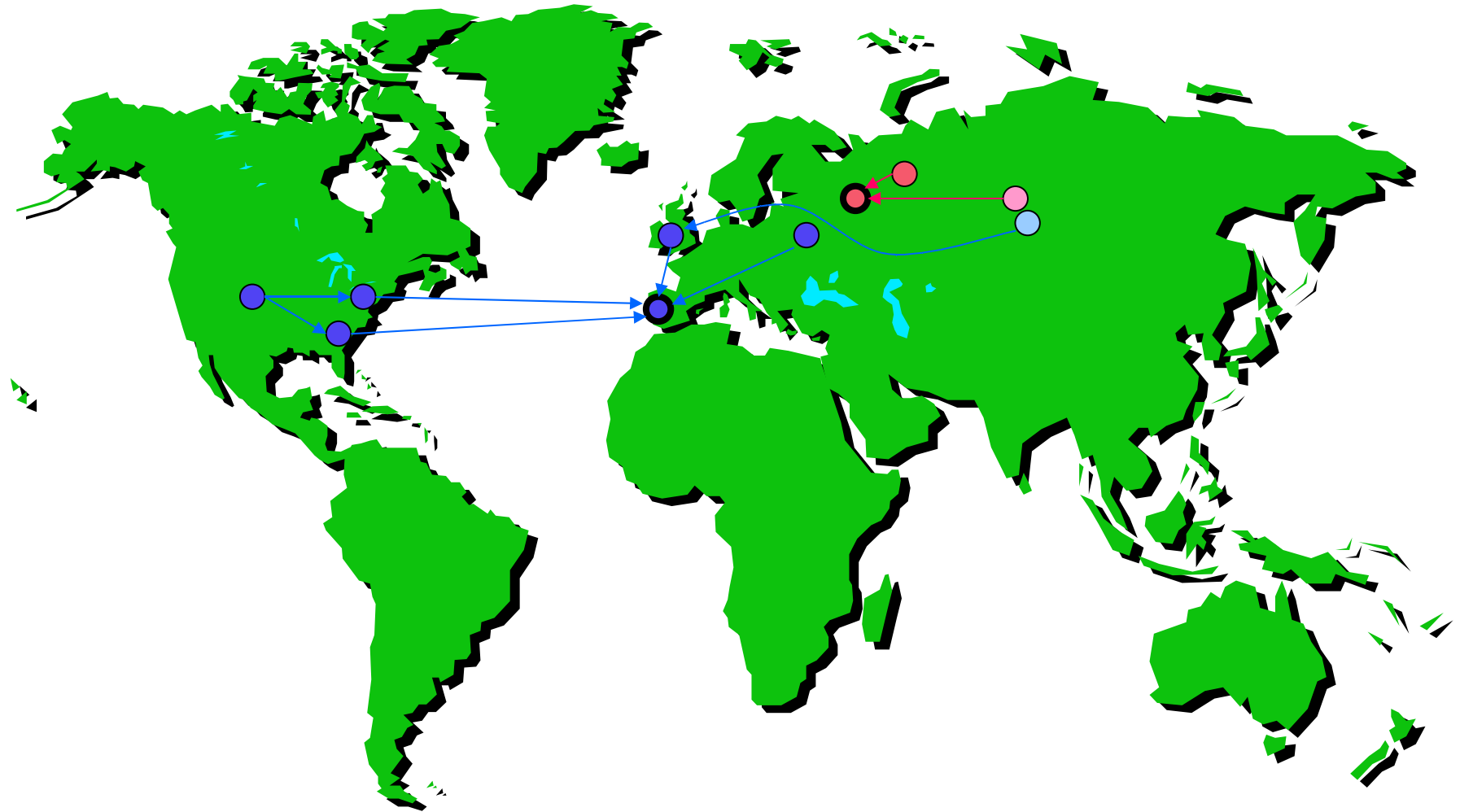
Avattu polttoainenippu

Cross section of a fuel assembly
- kokonaispituus 3195 mm
total length



Surveillance visits to manufacturing plants (3/5)

Fuel Manufacturing Plants / Loviisa NPP



Experience

- Manufacturing of Nuclear fuel for Loviisa has been surveyed by Fortum at the manufacturing plants since 1989.
 - Before that special measures were taken to compensate for not being able to visit the manufacturing plants
- Overall the co-operation with the Suppliers/Manufacturers has been quite positive and improving by the time.
- Most Challenging areas:
 - Document control / Traceability
 - Manufacturing/Inspection plans and Process Qualification versus confidentiality & "know-how"
- Participation of STUK's inspector in surveillance visits has facilitated rapid solving of arisen issues.
- Operational Experience of Loviisa Fuel has been excellent. No fuel failures in fuel assemblies manufactured after 1993.

Conclusion

Although the quality of the fuel is made in design and manufacturing by the fuel Supplier, the manufacturing surveillance by the Power Utility serves its purpose in contributing the final quality of the fuel assemblies.

Thank you for your attention!