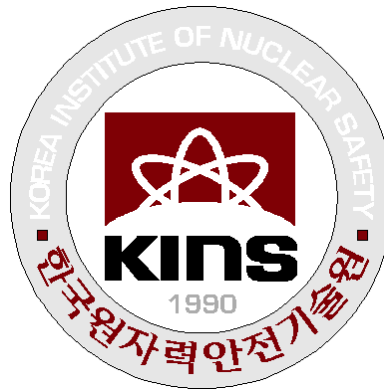


Overview of Quality Assurance



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CONTENTS

- I. Outline of Nuclear Quality Assurance**
- II. Regulatory Requirements on QA**
- III. QA Regulation**
- IV. Concluding Remarks**

I. Outline of Nuclear Quality Assurance (QA)

□ Quality

- Overall feature and characteristics of the products and services related to the capability to ***comply with the specified requirements***
 - Appropriateness of application (***consumer's viewpoint***)
 - Conformity to the requirements or specifications (***manufacturer's viewpoint***)

□ Nuclear QA

- Nuclear QA is to establish and implement ***the control system to satisfy the requirements*** necessary for design, manufacturing, construction, operation and maintenance of NPP

I. Outline of Nuclear Quality Assurance (QA)

- Definition of QA in the Non–Nuclear Field
 - Systematic Activities performed by the producer to assure that the quality required by the consumer is sufficiently satisfied.
- Definition of Nuclear QA
 - All those planned and systematic actions necessary to **provide adequate confidence** that a structure, system, or component (SSC) **will perform satisfactorily in service**. (USNRC 10 CFR 50 Appendix B, KEPIC QAP)
 - ***To achieve the safety and reliability of NPP***

I. Outline of Nuclear Quality Assurance (QA)

Comparison of the Quality Characteristics (Table 1)

Classification	Non-nuclear Industry	Nuclear Industry
Characteristics of Items	Light, Thin, Short, Small	Heavy, Thick, Long, Bulky
Method of Fabrication	Various Items Mass-production	Sole Items Small Quantity
Duration of Production	By Hour Basis	By Month/Year Basis
Quality Verification	Verified by manufacturer	Verified by Third Party personnel
Methods of Quality Verification	Product Quality	Product Quality with Quality Records
Purpose of quality Activity	Customer Satisfaction	Safety & Reliability
Qualification Requirements	None	Personnel, Equipment, Procedures, Processes

I. Outline of Nuclear Quality Assurance (QA)

□ Characteristics of Nuclear QA

- **Management Aspects**

- **Quality system and program** shall be established in advance.
- **Qualification required** (personnel, process, procedures & equipment, etc.)

- **Technical Aspects**

- **Regulatory, technical & contractual requirements** are applied (design, purchase, process, inspection and test, etc.)
- Involvement of **regulatory body** and third party inspection agency

II. Regulatory Requirements on QA

□ Nuclear Regulation

- Purpose

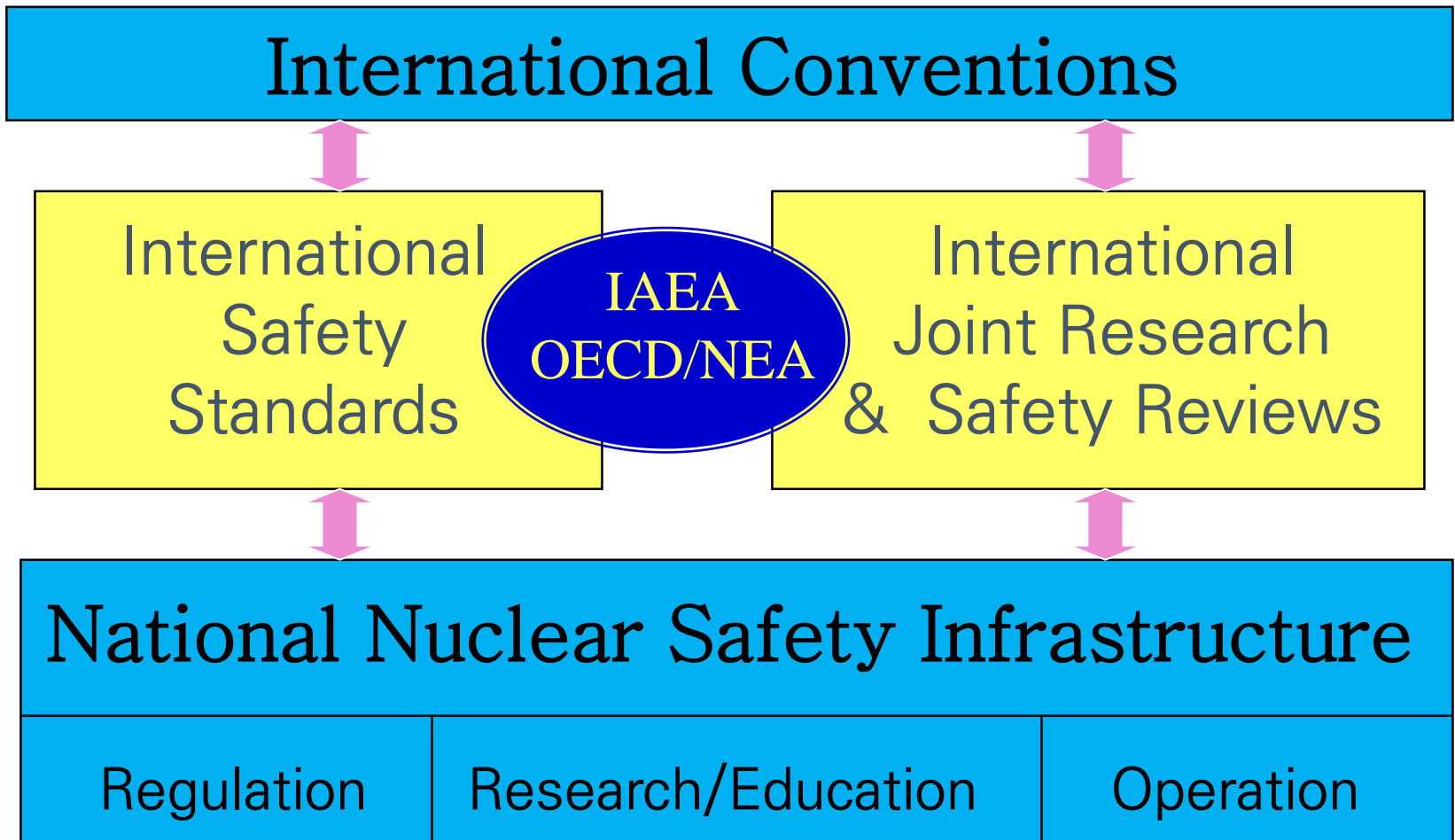
To prevent radiation disasters for the sake of public safety by setting forth matters concerning *safety management* for research, development, production, and use, etc. of nuclear energy.

- How safe is safe enough?

- Nuclear safety is not a matter of one country but an international one.
- *Internationally acceptable level of requirements* within the global nuclear safety regime. (*Common rules based on state of the art*)

II. Regulatory Requirements on QA

□ Fig.1 Global Nuclear Safety Regime



II. Regulatory Requirements on QA

□ Convention on Nuclear Safety (CNS)

- Objectives :

To establish and maintain effective defenses in nuclear installations against potential radiological hazards in order to protect individuals, society and the environment.

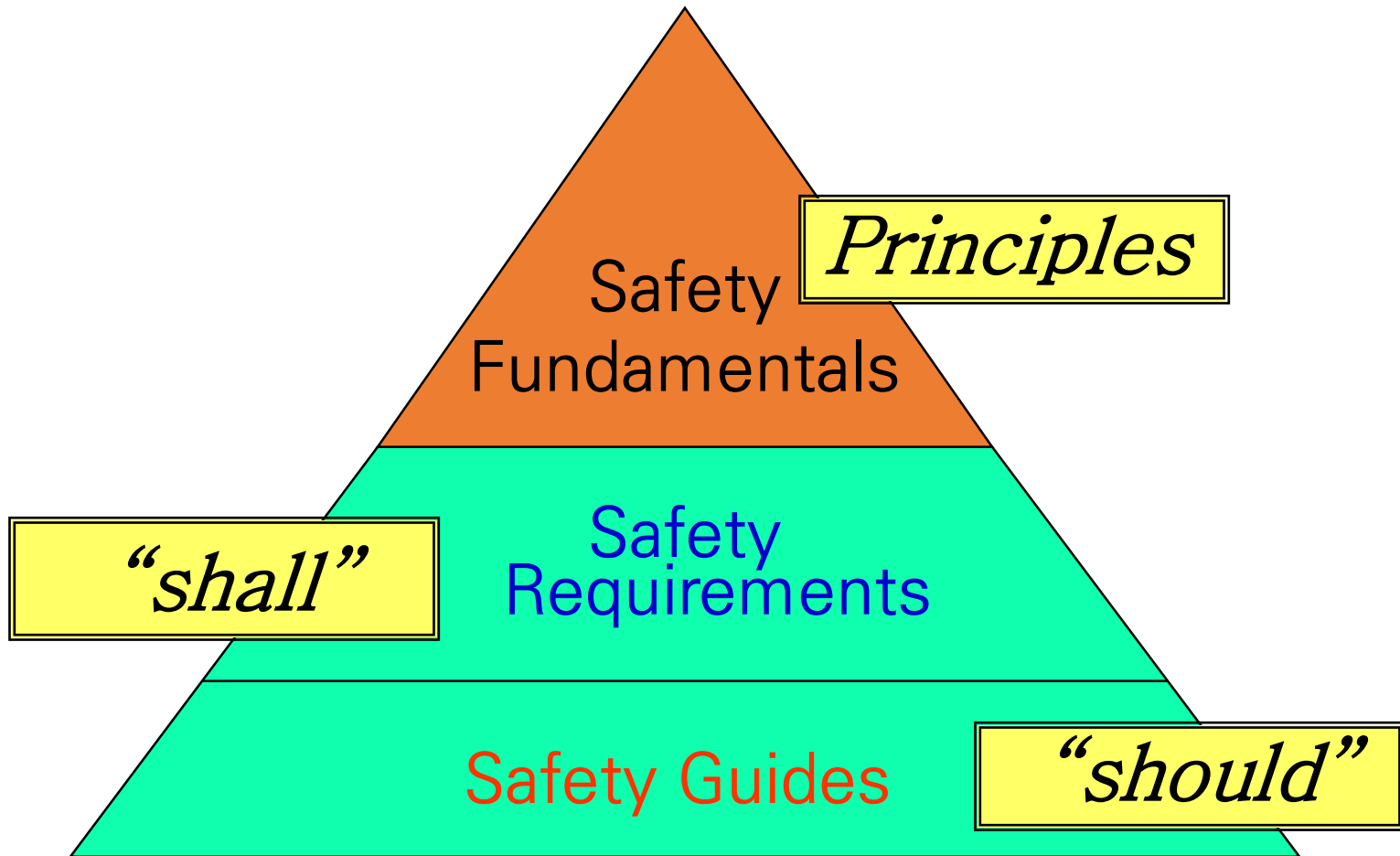
- General Safety Consideration :

Priority to safety, human factors, **QA**, assessment & verification of safety, radiation protection, emergency preparedness.

➤ *Essential means of prevention of abnormal operation and failure of NPPs are conservative design and **high quality of construction and operation**.*

II. Regulatory Requirements on QA

- Fig.2 Hierarchy of Safety Standards



II. Regulatory Requirements on QA

□ Korean Regal System and IAEA Safety Standards

IAEA	Korea	U.S.A.
Safety Fundamentals	Nuclear Safety Act (NSA)	AEA, Policy Statements
Safety Requirements	Enforcement Decree and Enforcement Regulation of the NSA	10 CFR 50
Safety Guides, TECDOC	KINS Regulatory Guides	Regulatory Guides of the USNRC

II. Regulatory Requirements on QA

□ Regulatory Requirements

- **Procedural Requirements**

- Authorization Process with *Standards for Permit including QA Program*
- *QA Inspection* and Enforcement *Policy*

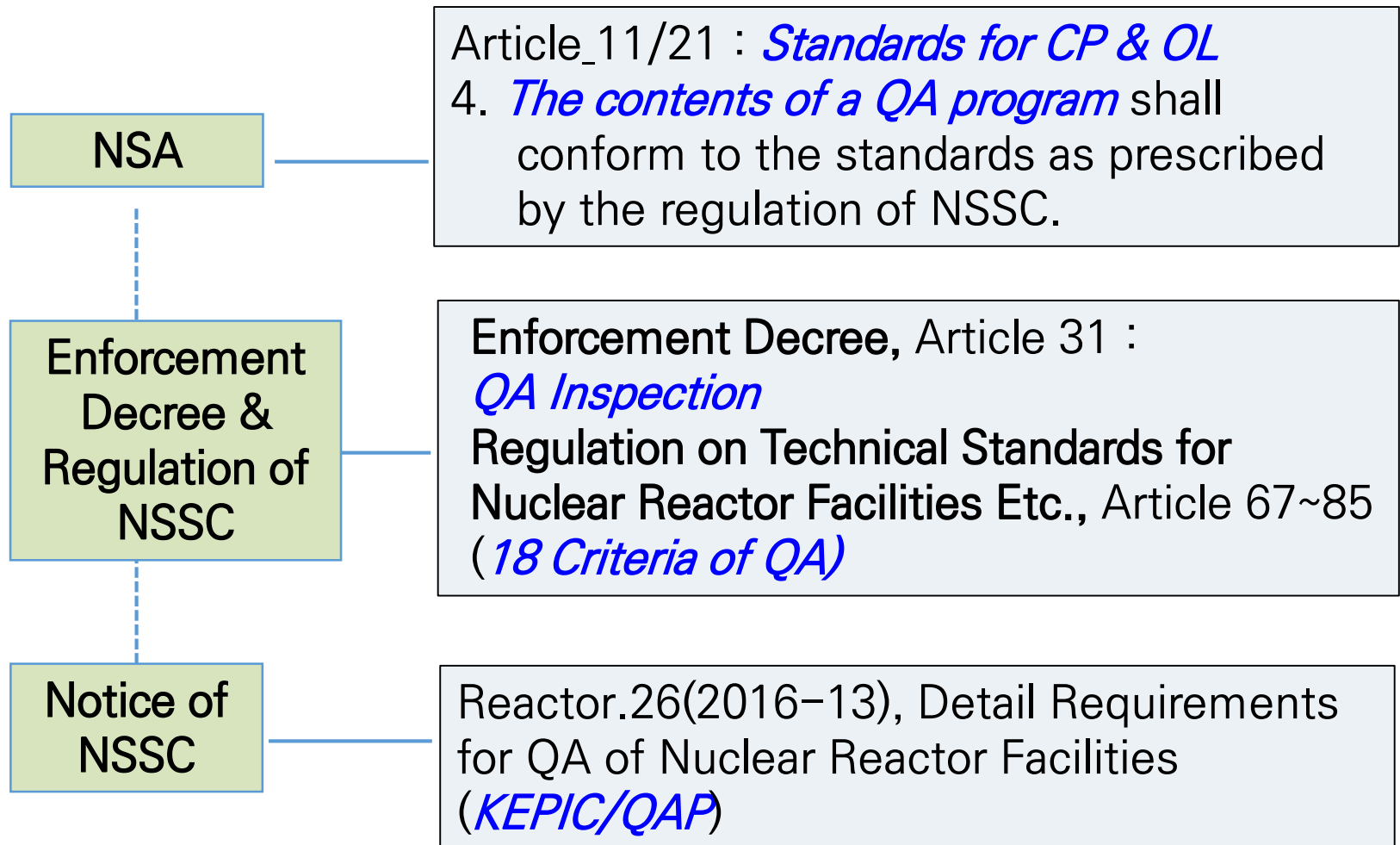
- **Technical Requirements***

- *18 QA Criteria* regarding Construction and Operation of NPP
- Design Criteria regarding Location, SSC, Installation, and Performance of NPP

* *Regulation on Technical Standards for Nuclear Reactor Facilities Etc.*

II. Regulatory Requirements on QA

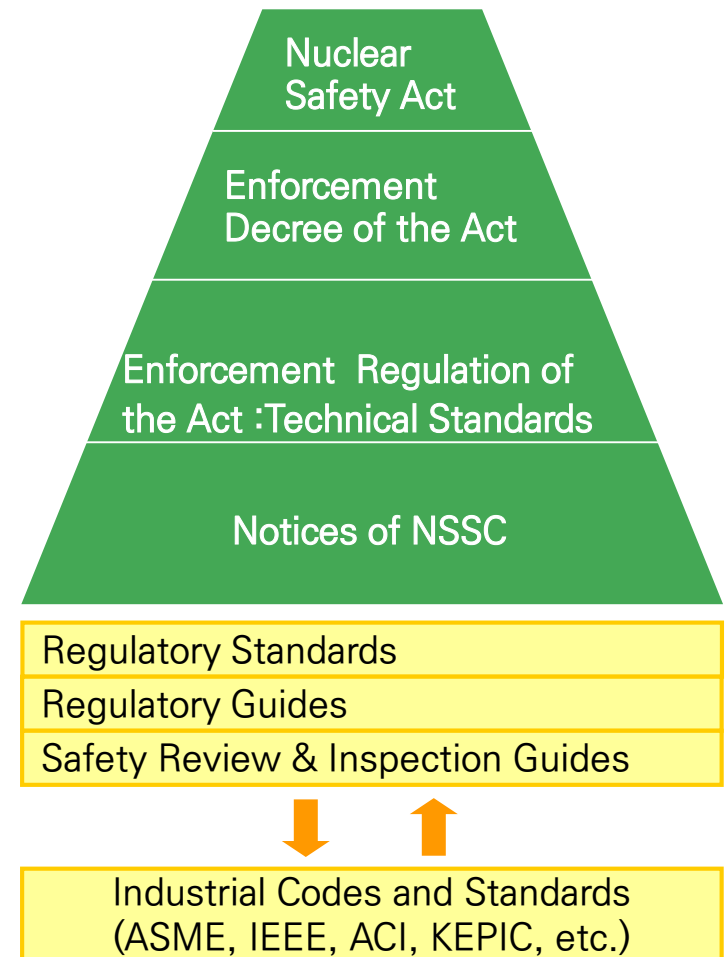
□ Legal Basis on QA



II. Regulatory Requirements on QA

- Legal Basis on QA (continued)
- Notice of NSSC, Reactor.26
 - ▶ *For construction**: KEPIC/QAP ('00 to '11 Ed.) or ASME/NQA-1 (1994 to 2009 Ed.) were endorsed as detailed requirements.
 - ▶ *For operation*: KEPIC/QAP (ASME/NQA-1) + ANSI/ANS 3.2 (1994 to 2009 Ed.)
- Application of other Code & Standards
 - ▶ *The addition and limitation* of other codes and standards are given in KINS Regulatory Standards and Guides.

** Construction includes design, manufacturing and assembling of the components*



II. Regulatory Requirements on QA

□ 18 Criteria of QA

1. Organization	10. Inspection
2. QA program	11. Test control
3. Design Control	12. Control of measuring and test equipment
4. Procurement Document Control	13. Handling, storage and shipping
5. Instructions, procedures and drawings	14. Inspection, test and operation status
6. Document control	15. Control of non-conforming items
7. Control of purchased items and services	16. Corrective action
8. Identification of control of items	17. QA records
9. Control of special processes	18. Audit

III. QA Regulation

□ Safety Assessment on QA Program

- Purposes

- To confirm *the contents of QA Program* satisfies the requirements in the standards for permit or license and KEPIC/QAP
- To review *the change of QA Program* especially organization

- Objects

- NPP : 26 in operation, 3 under construction and 1 preparation for decommissioning
- Research Reactor : 1 in operation 1 under construction
- Fuel cycle facilities : 1 KNF and 1 Rad-waste storage facility

III. QA Regulation

□ QA Inspection

• Purposes

- To verify that **QA program** of objects are complying with applicable industry codes, standards, and reg. requirements.
- To verify effective **implementation of QA program**.
- To verify **identification of root cause of problems** such as non-conformances, and adequacy of corrective actions.
- To verify **feed-back of problems** arose in previous audits and/or inspections, reflection of design modifications and results of those modifications.

III. QA Regulation

□ QA Inspection (continued)

• Objects

- **Reactor Licensee** : Perform construction & operation of NPP, procurement and/or control activities of vendors (KHNP HQ, Site, Changwon, NY, and Paris Office)
- **Designer** : Supplies design service (KEPCO E&C)
- **Manufacturers** : Manufactures and supplies major components to reactor licensee (Doosan, KNF)
- **Vendors** : Supplies components, or service to reactor licensee or manufacturer (Samshin, Weir, Target Rock, Andritz, etc.)

III. QA Regulation

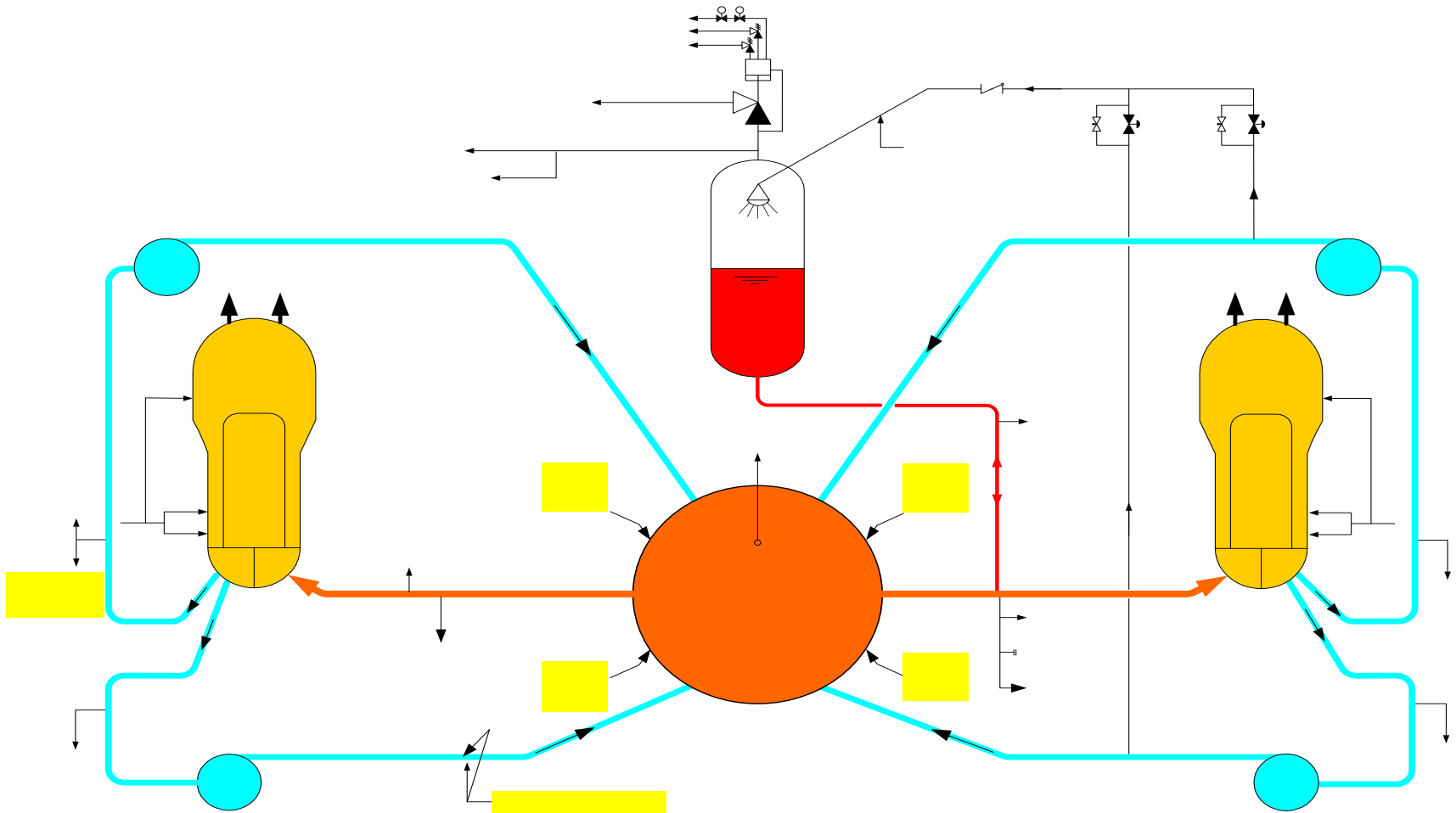
□ QA Inspection (continued)

- **Disposition of Inspection Results**

- Issuance of *findings and recommendations* to NSSC as well as the related licensee, manufacturer, and vendors
- Reports of scheduled inspections and reactive inspections to NSSC as well as the related licensee, manufacturer, and vendors and *verify their corrective actions*.
- Annual report to NSSC, related licensee, manufacturer, and vendors.

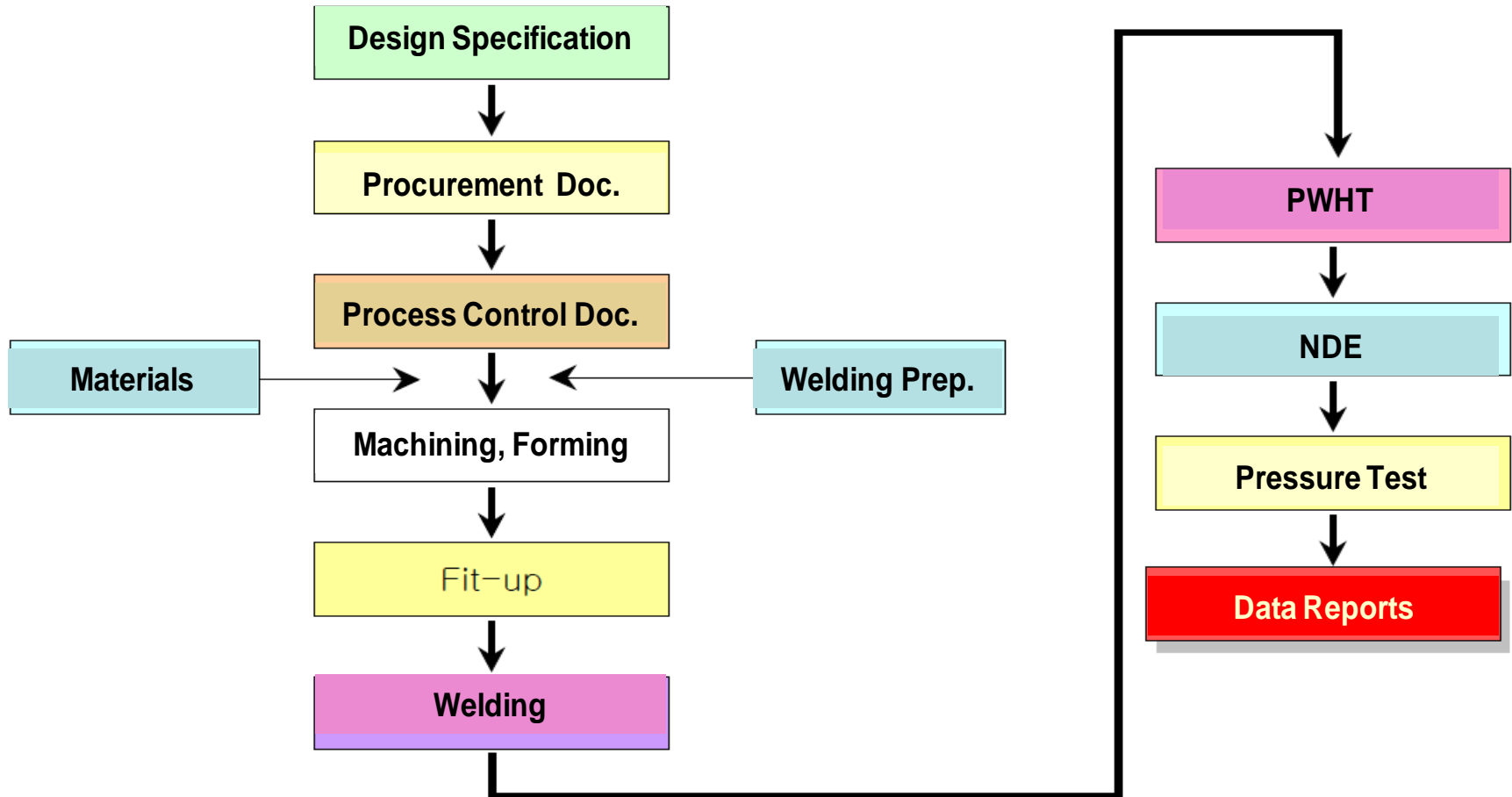
III. QA Regulation

❖ Major Components of Reactor Coolant System



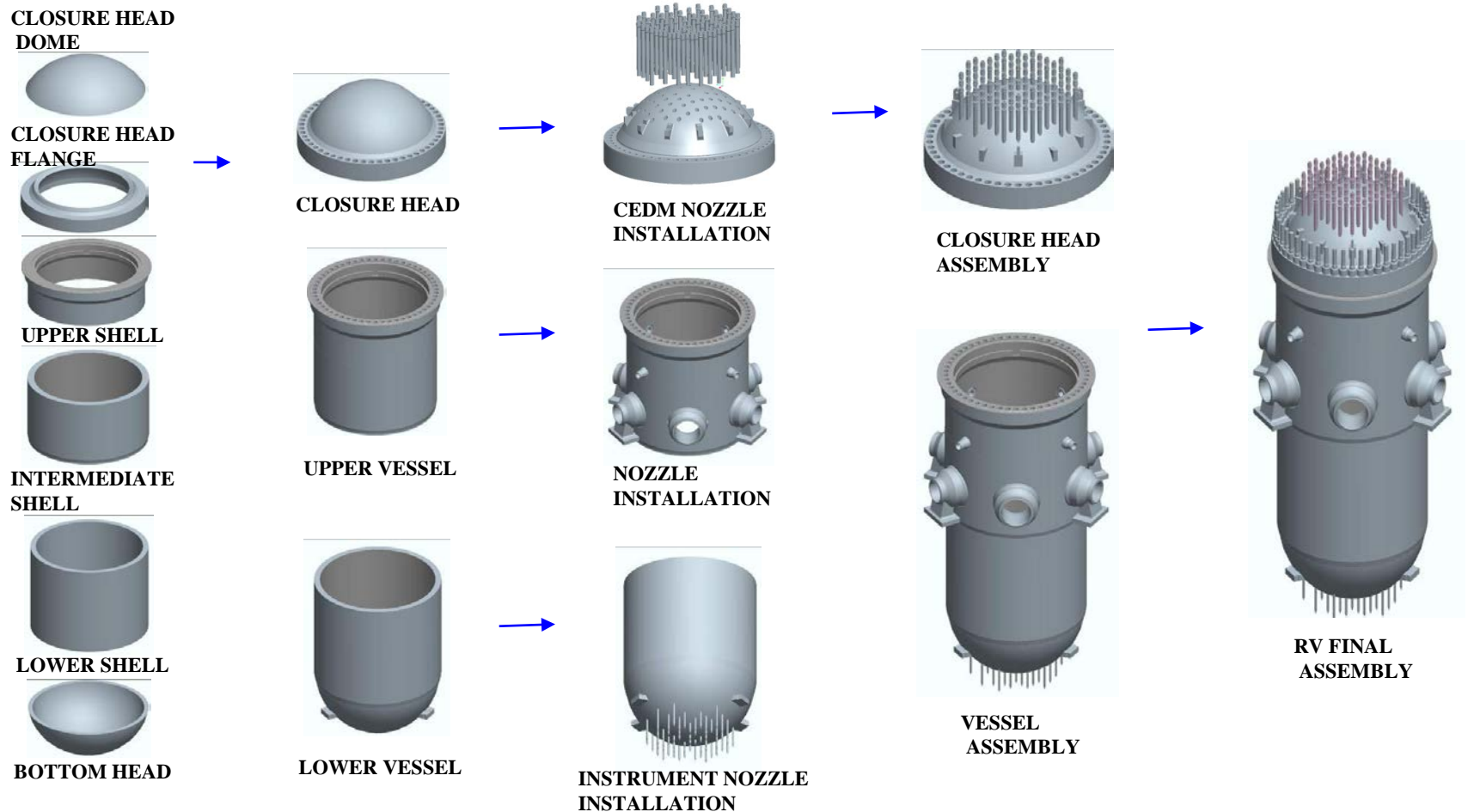
III. QA Regulation

❖ Manufacturing & Construction Process



III. QA Regulation

❖ Manufacturing Process of Reactor Vessel (RV)



III. QA Regulation

❖ Transportation of RV



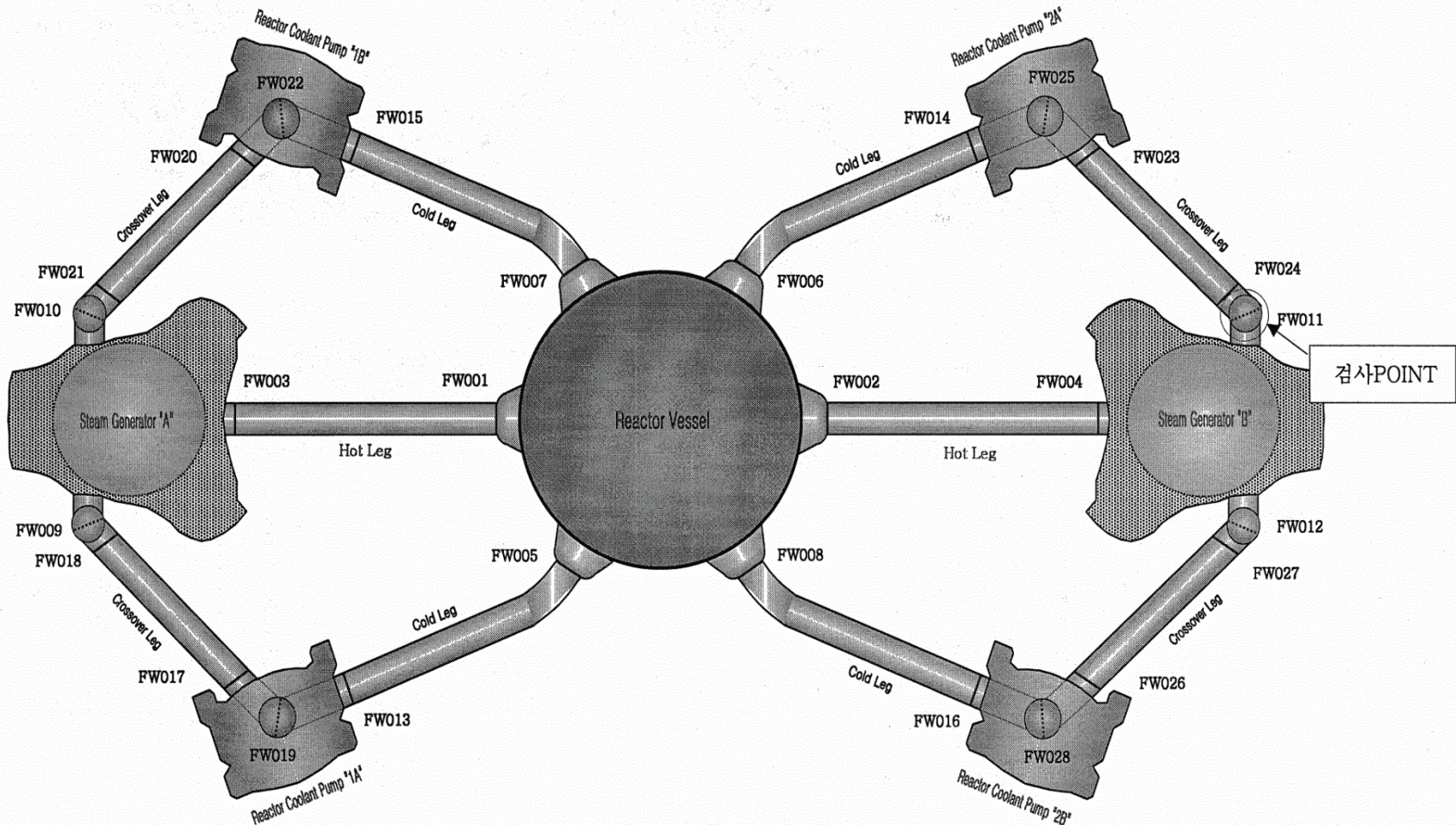
III. QA Regulation

❖ Installation of RV



III. QA Regulation

❖ Assembly of Reactor Coolant System (RCS)



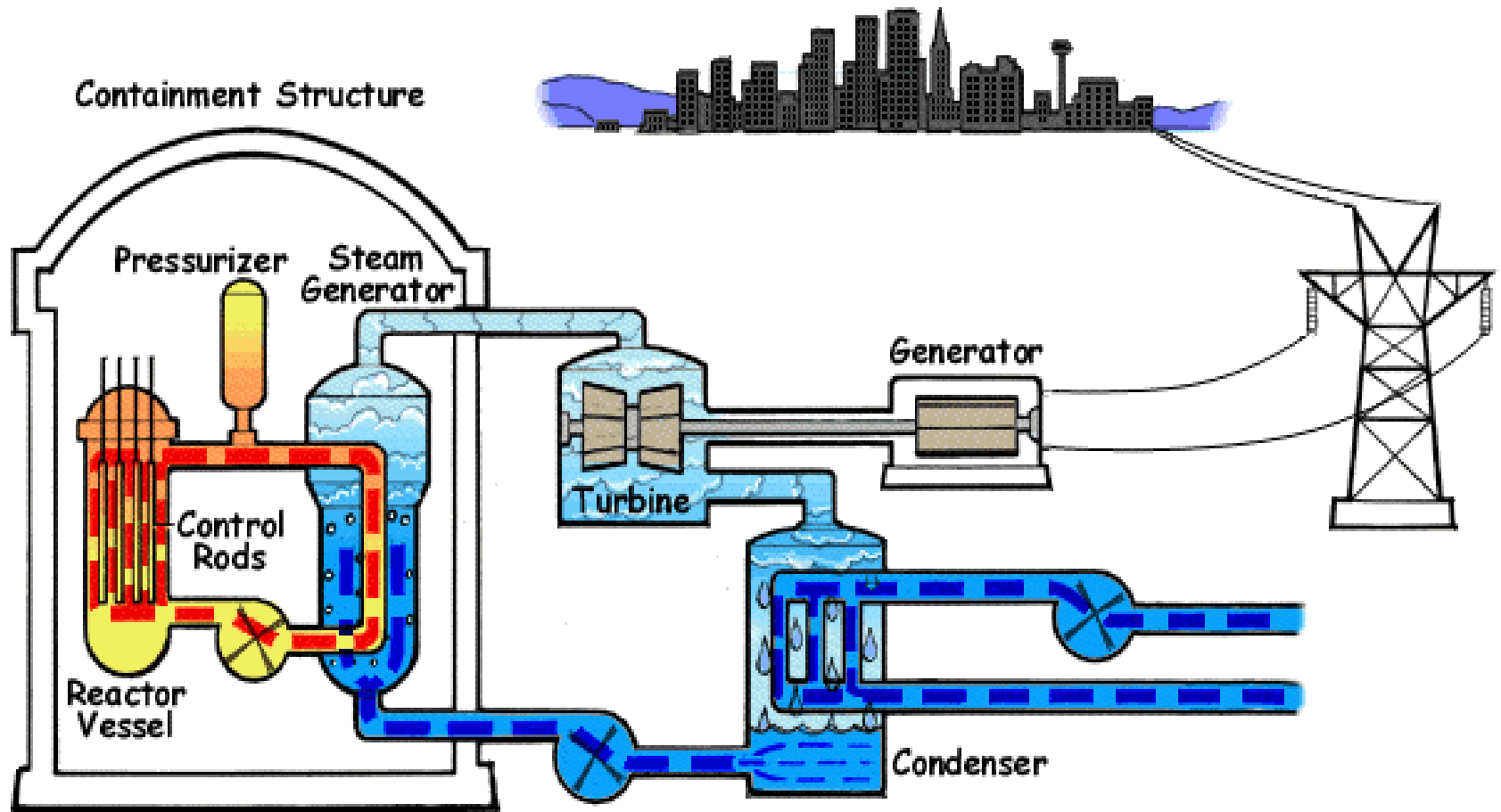
III. QA Regulation

❖ Welding of RCS Piping



III. QA Regulation

❖ Nuclear Power Plant



Always we keep watching
our Atomic Power



Thank You



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