



International Atomic Energy Agency

CUC Activity Stage 2 “Standardization”

Elaboration of Desired Feature 7.2

Sama BILBAO Y LEON

**Technical Cooperation Workshop on
Common User Considerations
Vienna, September 22-25, 2008**



INPRO
International Project on
Innovative Nuclear Reactors
and Fuel Cycles

Objectives of the Consideration

- **Optimize/Minimize the amount of engineering work required to adapt a standard design to a given site**
 - **Spread/Share design cost**
 - **Simplification of licensing process**
 - **Simplification of construction**
 - **Common safety analysis methodologies**
 - **Common training methods**

Objectives of the Consideration

- **Advantages of a “User’s Group”**
 - **Share lessons learned on operation and maintenance**
 - **Share supply of spare parts**
 - **Assurance of supplier support**

Standardization Desired Features

7.2.1	The NPP should be designed based on standardized plant design and components that should be established to include the maximum numbers of site conditions without significantly increasing costs.
7.2.2	The Supplier should minimize number of different types of components to the extent possible, without compromising the safety of the plant.
7.2.3	The design of equipment and components should allow for the supply of their replacement during the life of the NPP by manufacturers other than the original manufacturers.
7.2.4	The Standard International (SI) unit system should be used in the design and related documentation.



Other Desired Features related to Standardization

2.4.2	The NPP should be capable of operating under local grid frequency conditions and load fluctuations.
3.4.1	The NPP should be designed to withstand the impact of external site' specific events.
3.4.2	The Supplier should consider a range of external events parameters that allow development of standard plant design at multiple sites.
4.1.1	The radioactive and chemical releases from the NPP to the environment should comply with the user's national regulations as well as related international conventions and treaties and relevant regulations in the region.
4.1.2	The nuclear energy system should be designed to operate with minimum water consumption.
4.3.1	Production of solid, liquid and gaseous wastes and effluents during plant lifetime should be kept as low as reasonably achievable (ALARA).
6.1.1	The NPP design should incorporate technical features and provisions to protect against theft, sabotage and acts of terrorism through integration of plant arrangements and system configuration with plant security design, in accordance with international guidance, practices and User's national regulations.
7.14.1	The NPP should be designed for easy adaptation to different sites.



Part 1

Design Standardization: Determination of Site Characteristics with an impact on Plant Design



Steps in the Determination of Site Characteristics with an impact on Plant Design

1 - Identification of parameters to be considered

- **1. General Site Parameters**
 - Thermal Capacity
 - Local Grid Size and stability
 - Available Acreage
 - Maximum Height & Depth
 - Soil Characteristics
 - Access Routes
- **2. Meteorological and Atmospheric Parameters**
 - Atmospheric Pressure
 - Ambient Temperature
 - Ambient Humidity
 - Atmospheric Dispersion Patterns
- **3. Cooling Requirements**
 - Source
 - Cooling Intake Temperature
 - Cooling Flow Rate
 - Discharge Temperature
 - Chemistry
 - Drought Conditions
 - Auxiliary water requirements



Steps in the Determination of Site Characteristics with an impact on Plant Design

1 – Identification of parameters to be considered (cont)

➤ 4. External Events

- Rain
- Snow and Ice
- Lighting & Electrical Storm
- Wind
- Large Storms: Hurricane, Cyclone, Typhoon, Tornado
- Seismic Events
- Volcanic Events
- Flood
- Aircraft Crash
- Other Human-Induced: Explosion, Fire, Toxic Gas/Liquid, etc
- Natural Events: Insects, Sand Storms, Fish, etc
- Other Events: Landslide, Avalanche, Dam Collapse, etc



Steps in the Determination of Site Characteristics with an impact on Plant Design

2 – Influence of these parameters on

- Design of NPP systems (e.g. cooling tower)
- Design of buildings
- Design of components
- Layout of the site
- Materials selection
- Construction techniques



Steps in the Determination of Site Characteristics with an impact on Plant Design

3 – Cost Sensitivity of each parameter on cost

- Order of magnitude / qualitative assessment / rule of thumb
- Based on previous experience

4 – Assessment of number of sites enveloped by the generic **CUC List of Site Parameters** (CUC LSP)

5 – Approach for definition of “typical” generic CUC LSP

- Global
- Regional
- Climatic (e.g. tropical generic site, polar ...)



Steps in the Determination of Site Characteristics with an impact on Plant Design

Elements to be provided by

- **Technology Holder (TH)**

- Provide feedback on draft CUC LSP
- Typical values used in NPP design
- Gross estimate of cost sensitivity of parameters

- **Technology User (TU)**

- Provide feedback on draft CUC LSP
- Characteristics of potential site(s)



Goals of this Elaboration

- **Refinement of CUC LSP**
- **Compilation of characteristics of CUC proposed sites**
- **Compilation of a Cost Sensitivity Matrix**
- **Definition of a methodology for combining parameters**
- **Elaboration of generic site characteristics & discussion**
 - **Tropical**
 - **Polar**
 - **Other?**



Part 2

Standardization of Components

Drivers and Challenges for Definition of “Generic components” Steps

1 – What are/would be generic components

- **Possibility to be manufactured by multiple suppliers**
- **Usable on more than one system**
 - **Within the same design**
 - **On different designs**

2 – Necessary conditions to allow multiple suppliers ?



Drivers and Challenges for Definition of “Generic components”

Steps

3 – Identification of “eligible” components

- Mechanical
 - Valves
 - Pumps
- Electric
- ...

4 – Identification of parameters influencing the design of “eligible” components

- Typical number of each type of component
- Geometry
- Operating conditions
 - Fluid & chemistry
 - Temperature
 - Pressure
 - Radiation level
 - ...



Drivers and Challenges for Definition of “Generic components” Steps

4 - Potential impact on cost

- Order of magnitude / qualitative assessment / rule of thumb
- Based if available of previous experience



Drivers and Challenges for Definition of “Generic components” Steps

4 - Potential impact on cost

- Order of magnitude / qualitative assessment / thumb rule
- Based if available of previous experience

5 - Potential impact on safety

- Availability
 - Reliability
 - Diversification
- Potential for existing or future water cooled reactors ?
 - Potential for other technologies ?



Drivers and Challenges for Definition of “Generic components”

- **Elements to be provided by Technology Holder**
 - **List and number of components with close geometry and close operating conditions on existing designs**
 - **Impact of parameter variation on cost**
 - **Reasonable variation of parameter acceptable**



Proposed Detail of Activity

- **Elaboration of a list of components potentially eligible to become generic components and discussion**
 - **Water cooled reactors**
 - **Other technologies**



Participants & Responsibilities

Time scale

- **To be defined during breakout sessions**

