

**Fire protection
at nuclear installations**

Topic of interest:

Management of Fire Loads

Presented by: Diego Lisbona (ONR, UK) and Samu Rinta-
Filppula (STUK, FI)

Aspects to be discussed



1. Approaches to determination and management of fire loads

Fire load exclusion and minimisation, inspection, quantification and accountancy tools, roles & responsibilities



2. Link to provision & design of fire protection measures

Fire load density criteria, including consideration of protected fire loads, and treatment of fixed/transient inventories



3. Lessons learnt in the management of fire loads

Significant deficiencies, improvements and actions

Expected outcome of discussion

- Overview of practices in the management of fire loads
- Better insights from national approaches to share experience and identify potential good practices or challenges

1. Approaches to determination and management of fire loads

- Fire load exclusion and minimisation, inspection, quantification and accountancy tools, roles & responsibilities

Approaches reported in NARs

Tihange 3 (Belgium): the creation of a unique **storage database** gives the organisation a clear overview on the **allowed fire load in the unit** (feedback from WANO PR & NEIL)

Conservative approach applied to fire loading assessments, whereby the **assumption is that all the fire load is available for combustion** in each compartment. Data sources are held in **Assessment Management System** (AMS) database; this includes inventories of all combustibles per compartment (EDF NGL, UK)

Use of **scheduled and unscheduled fire rounds daily, weekly, monthly** depending on the fire load class of the areas (Cofrentes NPP, Spain)

Predetermined, occasional and worksite **temporary storage areas are subject to written justification** of their duration and need, they are subject to risk analysis and are **limited in duration to three months** maximum per user and per zone (Tricastin NPP, France)

Questions - Approaches to determination and management of fire loads

- 1. How are fire load inventories (fixed and transient) identified?**
- 2. What fire load limits/ controls are in place to manage fire risk? How is storage (permanent or transient) permitted? Please share the key features of the permit system**
- 3. How frequently are the combustible inventories inspected and verified and by whom?**
- 4. What tools are in use to record and manage them?**
- 5. How do fire load inventories inform operations?**



2. Link to provision & design of fire protection measures

Fire density criteria, including consideration of protected fire loads, treatment of fixed/transient inventories

Fire load criteria reported in NARs:

Oskarshamn 3 NPP (Sweden): Fire compartments with a fire load up to 200 MJ/m² are within the original design basis for fire resistance of 60 minutes (Fire Resistance Class A60) in accordance with SBF 72

Spain: RD 2267/2004:

Q _s (MJ/m ²)	Intrinsic Risk Levels							
	Low		Medium			High		
	1	2	3	4	5	6	7	8
Q _s (MJ/m ²)	Q _s ≤ 425	425 < Q _s ≤ 850	850 < Q _s ≤ 1,275	1,275 < Q _s ≤ 1,700	1,700 < Q _s ≤ 3,400	3,400 < Q _s ≤ 6,800	6,800 < Q _s ≤ 13,600	13,600 < Q _s

Leibstadt Nuclear Power Plant (Switzerland): maximum fire loads defined and documented at 1000 MJ/m²

KCB NPP (Netherlands): three categories of fire load: small (< 100 MJ/m²), middle (100 – 1000 MJ/m²) and high (> 1000 MJ/m²). The fire suppression systems are designed based on these fire loads. Dutch Building Decree: fire compartment constituted when fire load density is higher than 400 MJ/m². A fire barrier must ensure its integrity for at least 90 minutes

2. Link to provision & design of fire protection measures

Fire load density criteria, including consideration of protected fire loads, treatment of fixed and transient inventories

Fire load criteria reported in NARs:

Lithuania: In any case in order to exceed fire rating of the walls REI60, fire load should exceed 900 MJ/m^2

Romans Sur Isère / Framatome Romans – BNI 63-U: The fire load per unit area is kept below 400 MJ/m^2 , without exceeding 600 MJ/m^2 in any particular place

DEPOSITO OPEC 2 storage facility (Italy): Specific design fire load does not exceed 900 MJ/m^2 . Waste storage must guarantee a fire resistance class of 60 minutes ($850 < 900 \text{ MJ/m}^2$)

Several countries including UK report a 900 MJ/m^2 limit for 60 min fire protection

2. Link to provision & design of fire protection measures

Fire load density criteria, consideration of protected fire loads, treatment of fixed and transient inventories

Approaches reported in NARs

Finland: **quantitative approaches** are used to determine **permanent** fire loads which are input into the Fire PSA. Quantitative approaches are used for **transient** fire loads which are permitted by the fire brigade, marked on plant and subject to management up with upper limits to 600 MJ/m² with temporary work orders/ notices

NB sectorisation analysis notes do not provide a room-by-room picture of the authorised fire loads (Tricastin NPP, France)

The dynamic containment of the rooms of BNI No. 63-U (France) and management of this containment in the event of fire improved through PSR - **new walls preventing fire propagation** have been installed in the facility and fire loads have been moved

Questions - Link to provision & design of fire protection measures

- 1. How do actual fire load inventories inform design and fire resistance ratings? Are there exclusions e.g. protected fire loads?**
- 2. What fire load limits and criteria are in use and how are they verified through-life?**
- 3. How are transient combustible inventories / temporary storage accounted for in the design of passive and active measures?**



3. Lessons learnt in the management of fire loads

Significant deficiencies, improvements and actions

Potential areas for improvement reported in NAR or identified by TPR experts

NPP Leibstadt (Switzerland) - Fire load management is kept in a separate database. This means that work has to be done in two different systems

Decommissioning Hot Cell facility - Risø site (Denmark); the statement that combustible materials are stored unnecessarily in the facility

Research reactors MARIA, ŚWIERK (Poland) - the management of temporary fire loads

Spent fuel storage Dry SFDS Krško NPP site (Slovenia) - the acknowledgement that the DSB inlet duct walls and side walls are constructed with panels of sandwiched shielding plastic (High Density Polyethylene, HDPE) between steel sheets

The seemingly high value for “low” fire loads at $< 1100 \text{ MJ/m}^2$ (Sellafield, UK)

Questions - Lessons learnt in the management of fire loads

- 1. What shortfalls in the management of fire loads have been typically identified at facilities in your respective countries?**
- 2. What actions have been taken to address shortfalls and learning from incidents?**
- 3. What improvement programmes (completed, ongoing or planned) from your facilities/countries would you highlight as key to the management of fire loads?**

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Thank you for your participation and contributions !