MDEP
HTGR WG
Programme Plan
2024-2025

Related to: HTGR Working Group Activities

HTGR WG Programme Plan for 2024 and 2025

Multi-National Design Evaluation Programme

HTGR Working Group (HTGRWG)

1. HTGRWG Goals

- Leverage national regulatory resources by sharing information and experience on the regulatory safety design reviews of the HTGR with the purposes of enhancing the safety of the design and enabling regulators to make timely licensing decisions to ensure safe designs:
    1. Exchange experience on licensing process and design reviews, lessons learnt, and design-related construction, commissioning, and operating experience,
    2. Work to understand the differences in regulatory safety review approaches in each country to support potential use of other regulators' safety design evaluations, where appropriate.
- Promote safety designs through cooperation (consideration should be given to promoting harmonisation of regulatory practices where there may be a safety benefit):
    3. Identify and understand key design differences including those originating from regulatory requirements and then document the reasons for differences in regulatory requirements,
    4. Document common positions on aspects of the review to enhance the safety of designs,
    5. Coordinate communications on MDEP views and communicate common positions to vendor and operators regarding the basis of safety evaluations,
    6. Use experience gained in learning about similarities and differences in licensing frameworks to identify potential paths forward to harmonise licensing approaches and practices when there is a safety benefit.

2. Intermediate Objectives

7. Share information including evaluations among HTGRWG members to leverage resources and focus design reviews on safety issues including Fukushima-related issues and commissioning activities in regulatory areas that are significant for licensing decisions,
8. Encourage improvement of designs through design safety review cooperation when there is a clear safety benefit,
9. Enhance multilateral cooperation in licensing frameworks to harmonise licensing approaches and practices when there is a safety benefit,

10. Document the activities of the technical expert subgroups through technical reports and common positions.

3. 2024 -2025 MDEP HTGRWG Work Plan

- Communicate review results and timelines for sharing regulatory evaluations of the HTGR among all HTGR WG member countries,
- The following technical topics will be discussed in 2024 - 2025:
    1. Fuel safety:
        i. Key safety properties of the TRISO Fuel, including mechanical, geometrical, and chemical properties, should be properly managed and regulated for both irradiated and un-irradiated fuel (draft regulations).
        ii. It is essential that the design, fabrication, and qualification of the fuel is adequately and properly regulated by the regulatory body to ensure that the fuel meets the required high level of safety performance.
        iii. Define an adequate and proper procedure for the regulation of design, fabrication, and verification of the fuel by the regulatory body.
    2. Materials selection:
        i. Develop a guideline at international level for the introduction and verification of new materials for HTGRs.
        ii. Clear guidance on safety grade classification for the structure systems and components for HTGR reactors is required for designers and regulators.
        iii. Due to the high temperature design properties of HTGRs and the special requirements for the material, it is highly recommended to initiate benchmark on the material selection to have more knowledge about different options of materials for HTGRs.
- Potential topic for future consideration include:
    1. Defence in Depth (DiD):
        i. Establish regulatory expectations for safety classification of plant equipment at different Defence in Depth levels.
        ii. The products of other international platforms such as the IAEA SMR regulators forum or the Generation IV international forum is a good starting point to be considered by MDEP, especially the work related to DiD.
        iii. Regarding HTGRs, a challenging point is to analyze how the different roles of the barriers can affect DiD.

2. Probabilistic Safety Assessment:
    i. Issue practical regulatory principles and to have a clear regulation for defining the safety objectives and the boundary conditions by the regulatory body could be the meaningful measures to facilitate the design and commissioning of the HTGRs.
    ii. For the regulator to establish clear safety objectives, the HTGR-specific requirements for PSA (such as the format and content of the probabilistic safety assessment report), and adequate consequence metric for quantifying the risk to facilitate the design and commissioning of HTGR.
    iii. PSA can also be used in the demonstration of safety objectives, categorization of event sequences in different plant states considered in the design, selection of important beyond design basis accident sequences and design extension conditions, demonstration of design alternatives, safety classification of structures, systems, and components, and evaluation of defense-in-depth (DID) adequacy.
3. Regulatory Framework:
    i. Need to amend regulatory framework for the Nuclear Power and Process Station (NPPS) with HTGR design development.
    ii. Since some regulators do not accept the principle of dynamic containment, this must be part to find common ground during the licensing and pre-licensing process.
    iii. A difference of views also remains regarding the containment systems and practical elimination, which will require more discussions to find common ground, especially between GIF and MDEP.
    iv. Further discussion on containment vs confinement can help to develop the methodology and best practice to determine the radionuclide inventory of the primary circuit, and further the potential radioactive dose to the public. The discussion should consider IAEA TECDOC.

- Following additional discussions on the topics above, HTGR technical expert subgroups (TESG) can be established.
- These TESGs should perform the following:
    1. The technical expert subgroups should provide a work plan including description and scope of issues to be addressed to the HTGRWG and report on the status at every HTGRWG meeting,

2. Meet regularly to exchange information on relevant aspects of the design review status,
3. Share relevant evaluations when they become available,
4. Produce technical expert subgroup technical reports on subjects that the subgroup deems important to safety to identify and document similarities and differences among designs, regulatory safety review approaches and resulting evaluations,
5. Produce MDEP common positions, especially on important safety evaluation findings,
6. Post evaluations, positions, reports, etc. in the MDEP library.

- Follow the construction and commissioning progress of HTGR:
    7. Share significant design changes, if any, in construction and commissioning,
    8. Provide feedback on construction and commissioning experience.
- When necessary, plan and conduct technical site visits.
- Provide recommendations, when appropriate, to the MB for considering possible items as topics to address generically.

4. Planning outputs of the HTGR WG during 2024-2025

- Commence the development of the following technical reports (TR) and Common Positions (CP)
    1. Common position on Vienna Declaration
    2. Fuel safety:
        1) Safety strategy for accident management
        2) Investigation on special accidents for TRISO fuel
        3) Benchmark on the differences in safety properties between prismatic fuel and pebble fuel
    3. Materials selection:
        1) Review of the ASME III-D5 code for material selection, and share of operational experience, in order to investigate the possibility of use of new types of materials. (Note: that will require the involvement of ASME and other Standards Development Organisations if necessary)
        2) The way the high temperature environment and radiation fluence affect the lifespan of the materials and components.

3) A design concepts of mobilized GCMR, the design input of RPV, RPV material selection principle, the work for material selection analysis, and the verification of material performance of the selected 316H.

- Workshop in 2025 on one of the topics.
- Contribute to the MDEP 2025 Annual Report,
- Share lessons learnt from design reviews and design issues faced during HTGR safety review and construction,
- Recommendations and inputs to other MDEP working groups regarding potential generic issues and harmonisation opportunities (coordination with CNRA/WGNT, GIF/RSWG, CSNI/EG SMR, LW-SMMRWG, as appropriate).

5. Key Stakeholders with whom the HTGR WG members will interact

- Other MDEP regulators as needed (care shall be taken NOT to share proprietary or sensitive info inappropriately)
- Non-MDEP regulators, as appropriate
- GIF/RSWG
- CNRA/WGNT
- CSNI/EG SMR
- HTGR Utilities/Licensees/Operators
- Other Groups, as appropriate, to further MDEP goals (IAEA, TSO, etc)