Intended use of RAMP codes at X-energy

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RAMP User Group Meeting,
Non-LWR HP Technical Meeting
Including RADTRAD Code Discussion
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Plant features / attributes include:
• Use of well proven UCO TRISO based fuel
• Proven intrinsic safety
• Operated without the need for a water source
• Load-following to 40% power within 15 minutes
• Continuous online fueling with passive on-site spent fuel storage
• Requires less time to construct (2.5 to 4 years)
• Factory assembled road transportable components/systems
• Deployable for electricity generation, process heat or co-generation
Primary safety goal is to ensure that fission products are retained within the TRISO coated fuel particles to the maximum extent possible.

This is achieved through production of high quality TRISO fuel and ensuring that temperatures in the core never exceed the temperatures for which the fuel has been tested (AGR Experiments).
### Source Term Calculation

#### Source Term Path

<table>
<thead>
<tr>
<th>Source Term Path</th>
<th>Element / Isotope</th>
<th>Form / State</th>
<th>Mechanism</th>
<th>Physical Phenomena</th>
<th>Methods / Software Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Releases from TRISO fuel particles</td>
<td>Iodine, Silver, Strontium, Cesium</td>
<td>Gaseous FPs</td>
<td>- Release from TRISO particles into matrix graphite</td>
<td>Temperature, irradiation time, fast fluence, burnup, particle defects, contamination</td>
<td>VSOP-A, VSOP-99, MGT SCALE, PARCS, OREGIN FLOWNEX, STAR-CCM+ XS-Term</td>
</tr>
<tr>
<td>Releasess from fuel elements (pebbles)</td>
<td>Iodine, Silver, Strontium, Cesium</td>
<td>Gaseous FPs</td>
<td>- Diffusion from pebble into the helium stream</td>
<td>Temperature, irradiation time, fast fluence, burnup, contamination</td>
<td>VSOP-A, VSOP-99, MGT SCALE, PARCS, OREGIN FLOWNEX, STAR-CCM+ XS-Term</td>
</tr>
<tr>
<td>Releases from Pressure boundary</td>
<td>Iodine, Silver, Strontium, Cesium</td>
<td>Gaseous FPs</td>
<td>- Leakage from HPB into building and structures</td>
<td>Instrumentation line failure, small &amp; large pipe breaks, plate-out, liftoff</td>
<td>ORIGEN XS-Term</td>
</tr>
<tr>
<td>Releases from building</td>
<td>Iodine, Silver, Strontium, Cesium</td>
<td>Gaseous FPs</td>
<td>- Transport throughout building to the environment</td>
<td>Plate-out, liftoff</td>
<td>XS-Term MELCOR SNAP/RADTRAD?</td>
</tr>
<tr>
<td>Max dose at site boundary</td>
<td>Iodine, Silver, Strontium, Cesium</td>
<td>Gaseous FPs</td>
<td>- Atmospheric dispersion</td>
<td>Postulates</td>
<td>XS-Term STAR-CCM+ SNAP/RADTRAD?</td>
</tr>
</tbody>
</table>

#### Color Legend:

- **Legacy codes**
- **US/DOE Codes**
- **X-energy in house code**
- **Commercial NQA-1 Code**
Possible use of RAMP Codes

Source term calculation V&V

- XS-Term validation:
  - Code-to-code comparison
  - SNAP/RADTRAD?

Fuel Handling System

- Approximately spheres 1000 circulated per day

- Spheres are transported pneumatically in the fuel handling system with no human interaction needed

- Could RADTRAN calculate exposure during fuel cask transport from reactor building to spent fuel storage area?