

Release Notes

Fire Risk Investigation 3D

Version 1.2.0

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Released: *TBD*

Highlights

Validated against NUREG-1934. FRI3D's FDS and CFAST deck generation has been checked model-by-model against the NRC reference decks for Appendix A (CFAST) and Appendix B (FDS). Several defects that silently changed simulation results were found and corrected — see *Changes that affect existing models* below. The validation models ship with this release.

Equipment beside a fire now fails when it should. In a CFAST run, the temperature probe that stands in for a cable tray or a piece of equipment was written into the deck offset from the item itself — by half the item's own size — so an item close to a fire could be measured metres away, in the cool lower layer, and never register as failed. Probes now sit on the item they represent. Failure times move on existing models, in both directions.

Large models are workable again. Switching between zones and scenarios, and deleting zones, used to take minutes on large models and could crash. It is now a matter of seconds, and the crashes on repeated open-and-switch are gone.

Long FDS runs finish.

Work with whole categories at once. Select a category in the model tree and apply operations to everything under it — select, hide, show, wireframe, and solid — with

multi-select supported.

Fire sources can now fail equipment directly. Assign fire sources to the equipment they damage. A failed raceway now fails every cable it carries, and if a simulation fails, cables are still evaluated through FLASH-CAT and THIEF rather than being written off wholesale.

Signed installer and a real About dialog. FRI3D now ships as a signed installer, and About reports the exact version of FRI3D together with the bundled CFAST, FDS, OpenCASCADE, OpenVDB, and IFC components.

What's new

- **Category operations in the model tree** — select, hide, show, wireframe, and solid across every item under a category, plus multi-select.
- **Fire source to equipment failure coupling** — assign sources to the equipment they fail, including cables carried by a failed raceway.
- **Sodium pool fire presets** — sodium pool fire heat release rates are available in the liquid fuel library as fire source presets.
- **Liquid pool fires run in FDS** — a fire source using any liquid fuel (crude oil, diesel, transformer oil, sodium, and the rest of the liquid library) previously aborted FDS deck generation with an internal error; only CFAST could run it. FDS now builds the pool's heat release rate from the fuel properties and the pool's own geometry, the same way CFAST always has.
- **New cable properties for FLASH-CAT** — Plastic Mass Fraction and Heat of Combustion.
- **Per-tray Cable Fill** — cable trays carry their own FLASH-CAT fuel loading, and the fire elevation follows the trays that are actually burning.

- **PLANTX import** — import plant models directly from a PLANTX Access database.
- **FDS import** — bring in sources, vents (mechanical, static, and holes), and the zone boundary from an existing FDS input file.
- **RiskSpectrum output without a simulation run** — produce RiskSpectrum output from a scenario that has no CFAST or FDS results. A PRA model path may also be given relative to the project, and an unresolvable one is now reported in the PRA calculation dialog and on Run instead of failing part-way through.
- **Smokeview ships with FRI3D** — the NIST FDS result viewer (`smokeview.exe`) is installed alongside the solvers, in the version paired with the bundled FDS, so FDS output can be viewed without a separate FDS install.
- **About dialog** — shows the FRI3D version, the licensee, and the versions of every bundled solver and library.

Improvements and fixes

Simulation accuracy

- The FDS computational mesh now encloses the full wall envelope. Previously walls, floors, and ceilings could fall outside the mesh and be pushed inward — burying equipment, narrowing rooms, and disabling compartment leakage.
- Compartment leakage now works as intended. The ambient leak opening was being placed where FDS accepts it without complaint but it has no effect, which allowed sealed compartments to over-pressurize.
- Mechanical ventilation flow direction now follows the vent's orientation consistently in both FDS and CFAST. Supply vents were in some cases written as exhausts.
- Duct enclosures around mechanical vents now default to sheet steel rather than a perfectly insulating material, matching the reference decks.
- Compartment leak ratios you enter are now used exactly as entered, including zero for a deliberately sealed compartment.

- Walls and slabs are guaranteed at least one mesh cell thick, fixing FDS aborts on scenarios that use zone boundaries.
- Vent directions, material conductivity, and emissivity in generated FDS input have been corrected.
- CFAST temperature probes are placed on the item they represent. They were offset by half the item's size, so equipment and raceways near a fire could be measured from the wrong place and never fail.
- With more than one fire in a scenario, a target is now measured against the nearest fire and faces it. Previously the search compared against the wrong point, so targets could follow whichever fire happened to be written last, and an item could inherit the previous item's measurement point.
- A fire source that FRI3D has to nudge to keep it inside its compartment is now reported by name, with the offset, in the run's model checks — the 3D view still draws it where you placed it, but the simulation uses the nudged position.
- An item's stored extents are refreshed before the model is saved. Both solvers read those extents as the item's real size and place in the room, and an item moved or resized since they were last calculated kept the old ones — which could put an obstruction outside the FDS mesh, silently dropping any fire standing on it, and move a CFAST probe off the item.
- The burning area of a pool fire now adds up across every object the pool sits on. A pool spanning two floor slabs, or lapping onto a kerb, previously counted only the last of them, concentrating the same heat release into a smaller area and driving flame height and nearby temperatures too high.

PRA and RiskSpectrum

- RiskSpectrum output no longer requires a CFAST or FDS run first.
- Opening PRA preferences no longer stores the PRA model path over the base initiating event. Projects saved with the old behavior are repaired on first open — the corrupted value is cleared, so RiskSpectrum reports that no initiating event is set

and you pick one again, instead of every run failing with a confusing message about missing simulation results.

- Changing the PRA model now clears the stored base case and initiating event, which named entities in the previous model.
- PRA model paths may be relative to the folder FRI3D was started from, the project's folder, or the project's working folder. If the path cannot be resolved, the PRA calculation dialog says so and names the folders searched.

Performance and stability

- Zone and scenario switching, and zone deletion, are dramatically faster on large models.
- Fixed crashes when opening several models in succession and when switching zones.
- Items with no assigned location are no longer dropped from every scenario.
- Fixed a double selection when a category and then an item were selected.
- FRI3D now runs on machines with Intel integrated graphics.
- Dragging the timeline as soon as a CFAST or FDS run finishes no longer crashes FRI3D.
- Duplicating a mechanical or natural vent, or a zone boundary, no longer closes FRI3D without warning and without saving.
- Duplicating a fire source, or a detection or suppression item, now produces the copy. It previously did nothing at all — no item, no error.
- Duplicating a piece of equipment now places the copy beside the original at the same position and size. The copy was being attached to the item it was made from, which pushed it out of view and drew it oversized; pasting position onto it read back correctly while still rendering wrong.
- A duplicated Physical Only item keeps its Building Item Type instead of falling back to Elements, and changing that type now moves the item to the matching sub-

category immediately. Two sub-categories that no item could ever match — a mis-named Element and a missing Spaces — are corrected.

- The 3D column icon in the Zone Inspector updates after a paste, rather than still showing wireframe on an item that now has geometry.

Simulation runs

- FDS runs are no longer terminated after fifteen minutes. The idle-solver check sampled processor activity on the batch file that starts FDS instead of on FDS itself; that file does nothing but wait, so it looked idle from seconds after launch and every run reaching the threshold was stopped and reported as hung.
- FDS progress is reported once per step rather than repeated dozens of times, and the radiation-loss figure now reaches the log instead of appearing as .
- When an FDS run fails, the progress dialog now closes properly and Cancel works. Failures that previously surfaced as an unhelpful internal error now report the real cause.
- A CFAST run no longer aborts without explanation on older projects that are missing solver settings; FRI3D falls back to its standard defaults and warns.
- Simulation logs are far less noisy.

Changes that affect existing models

The corrections in this release change simulation results. **Re-run affected scenarios rather than comparing against 1.1.0 output.**

1. **FDS meshes are larger.** The mesh now encloses the wall envelope, so cell counts and run times increase somewhat on any model with walls. Decks generated before 1.2.0 are not directly comparable.

2. **Duct enclosures conduct heat.** Mechanical vent ducts default to sheet steel instead of a perfectly insulating material, so heat loss through ducts is higher. This is the physically correct behavior and matches the NRC reference decks.
3. **Vent flow direction may change.** Where a vent's orientation disagreed with its From/To compartments, orientation now wins. Check mechanical ventilation direction on models built before 1.2.0.
4. **Cable tray "Fuel Loading" is now "Cable Fill",** and tray cost fields are hidden.
5. **CFAST failure times change.** Target probes now sit on the item they represent rather than half an item-size away, so equipment and raceway failure times move — later as well as earlier, and items that never failed may now fail. On the Appendix B validation model one additional cabinet fails and six existing failure times shift a few seconds later. Compartment results (temperatures, layer heights, pressures) are unchanged. Archived failure results from earlier releases should not be compared against 1.2.0.
6. **Compartment leak ratios are honored exactly.** A leak ratio of zero now means a genuinely sealed compartment. Zones that were never configured — both wall and floor left at zero — are automatically updated on first open to the standard values for typical construction, so existing results are preserved. A zone where you set one ratio and deliberately left the other at zero keeps your values. New zones you create from this release on start at the standard values rather than at zero, so you no longer have to set them to avoid an accidentally sealed compartment.
7. **Stored item extents are recalculated on save.** An item moved or resized since FRI3D last calculated its extents kept the stale ones, and both solvers treat those extents as the item's real size and place in the room. On an affected model the FDS obstruction could sit outside the mesh — dropping a fire standing on it and returning a run with no fire in it — and the CFAST probe could sit off the item. **Open and re-save any model built before 1.2.0**, then re-run: the correction happens on save, not on open. This compounds with change 5 — both move CFAST probes, so an affected model sees probe movement from two independent causes.

8. **A fire spanning more than one object now burns over its full area in FDS.** Only the last object's surface was counted before, so the same heat release was squeezed into a smaller burner and the flux, flame height, and near-field temperatures ran high. FDS results change on any scenario where a fire source overlaps two or more objects. Where it overlaps exactly one — the common case — the generated input is unchanged.

Known limitations

- **CFAST scenarios that use zone boundaries** subdivide a room into several compartments but do not yet connect them, so the room is simulated as separate sealed volumes. CFAST reports a normal exit, so results look plausible but are not correct. Avoid zone boundaries with CFAST in this release; FDS is unaffected.
- **Mechanical vent duct material cannot be set per vent** in the interface. All ducts use the built-in sheet steel default.
- **Smokeview is not launched from inside FRI3D.** It ships in the installation folder and is opened separately, against the `.smv` file in the run's output folder.
- **FDS cell size is approximate.** The resolution you request is treated as a target — actual cell size can differ by up to about 3% because the solver requires particular cell counts, and room walls may not fall exactly on cell boundaries. Walls are kept solid regardless.
- **Where two objects meet underneath a fire, the seam between them still counts as burning surface** in FDS. It is counted once rather than twice, but it is not recognised as an interior face and excluded.

Installing

FRI3D 1.2.0 is distributed as a signed offline installer. Verify the download against the published checksum before installing.

Installer SHA-256: *TBD*