B-RISK Software Version Release Notes

Version 2018.05
3 August 2018

1. Development environment upgraded to VS 2017. New installation wrapper used.
2. NMATH premium libraries are referenced in the source.
3. Monte Carlo excel export – sprinkler response time and smoke detector response time is added to available export options.

Version 2018.04 (current release)
1 June 2018

1. Monte Carlo excel – multi-room data not saved to excel file for general outputs. Fixed.
2. Problem with running some models, where a CLT sub-model option has been incorrectly set causing a program crash. Fixed by ensuring CLT model option is off for all models created in 2018.01 or earlier.
3. Version updated to 2018.04.

Version 2018.03

31 May 2018

4. Monte Carlo excel – data not saved to excel file for FED gas, FED thermal. Fixed.
5. Monte Carlo graphs – check box inputs were showing through the chart displays. Fixed.
6. CLT model – older models created before 2017.05 may have the CLT model inadvertently turned on. This will be checked and turned off.
7. VM2 mode – the time at which the upper layer exceeds the nominated upper layer temperature endpoint value (def 200 C) is added to the results. This is only reported for the room of fire origin.
8. Debonding submodel for CLT added to the CLT integral model.
9. Version updated to 2018.032.

11 May 2018

10. Only use McCaffrey plume entrainment with the wood crib postflashover model to avoid discontinuities when switching between the Heskestad and McCaffrey models. Affected cases are where fire was FSA-controlled when flashover criteria was reached.
11. No longer automatically loads previous iteration on opening a model, as it means that any changes made to model since it was last run may be lost.
12. Debonding submodel for CLT added to the CLT dynamic charring model.
13. Version updated to 2018.031.

Version 2018.02
23 April 2018

1. Enabled plots for char depth in upper wall and ceiling – useful in conjunction with CLT model.
2. Version updated to 2018.02.

Version 2018.01 (current release)
23 January 2018

1. Option to automatically save the results excel file added.
2. Ceiling jet temps, velocity and device/link temps for all sprinklers are added to the view results output.
3. **Debugging.** When switching a model using T3 fire to VM2 mode, the power law fire will be reset to T2. This no longer happens.
4. **Debugging.** In a compartment with no ventilation, when the layer reaches the floor level, the plume flow was not reaching zero because a minimum layer height of 5 mm is enforced for numerical reasons. This caused a nonzero plume flow and HRR when eventually zero values would be expected. This has been corrected to ensure that no plume flow occurs when the layer height drops to 5 mm. A minimum lower layer volume is also enforced in the differential equation solver consistent with a 5 mm layer.
5. **Debugging.** When a pre-existing run is automatically loaded when opening an existing model in B-RISK. The temp endpoint value in the tenability settings was not converted from Kelvin to Celsius. This is fixed.
6. Version updated to 2018.01.

2017.05 (development - not released)
23 January 2018

1. **Debugging.** When a pre-existing run is automatically loaded when opening an existing model in B-RISK. The temp endpoint value in the tenability settings was not converted from Kelvin to Celsius. This is fixed.
2. **Debugging.** In a compartment with no ventilation, when the layer reaches the floor level, the plume flow was not reaching zero because a minimum layer height of 5 mm is enforced for numerical reasons. This caused a nonzero plume flow and HRR when eventually zero values would be expected. This has been corrected to ensure that no plume flow occurs when the layer height drops to 5 mm. A minimum lower layer volume is also enforced in the differential equation solver consistent with a 5 mm layer.
3. **Debugging.** When switching a model using T3 fire to VM2 mode, the power law fire will be reset to T2. This no longer happens.
4. Default setting for useCLTmodel in basemodel_default.xml file changed from true to false.
5. Version updated to 2017.05.

2017.04
18 September 2017

1. **Debugging.** New rooms added were defaulting to one-zone. This is changed to two-zone.
2. **Debugging.** In relation to saving user input on FED path form.
3. **Debugging.** User input on fire item form caused issues when switching between VM2 and risk simulator mode.
4. **Debugging.** Under some conditions when adding a new room, the default material thermal properties were not set.
5. **Debugging.** Removed flame spread inputs from the View Inputs screen when the flame spread model was turned off.

6. **VM2 Mode.** The default values for probability of vent initially open (0) and for the reliability of a hold open device (1) may not be changed when in VM2 mode.

Development (pre-release - non-public)

7. **Functionality.** CLT submodel inputs are saved to the basemodel file.

2017.02
12 June 2017

1. **Bug.** DFG would not load multiple items in version 2017.01. Fixed.

2017.01
1 June 2017

1. **Graphics.** Sensitivity analysis plots are available making use of the Monte Carlo option, placing a uniform distribution on the input parameter of interest. For example, a plot of the vent width versus time for layer height to drop below 2 m can be generated. Currently only selected input variables and output criteria are available.
2. **Functionality**. When opening a basemodel project, previous run data (if existing) is also loaded.
3. **Functionality**. New versions of smokeview were not compatible with B-RISK. A compatible version of smokeview is now distributed with B-RISK.
4. **Functionality**. The math library was upgraded so that the computer GPU can be used for calculation as well as the CPU.
5. **Input.** Screen for input of materials for room surfaces has been redesigned, and is now included in the same place as room dimensions, rather than on a separate form.
6. **Output.** Wall vent flow data is saved in a text file in project folder.
7. **Output.** QStar parameter in printed output is now calculated using the average room height instead of the maximum room height.
8. **Output.** A pdf file containing summary input/output is automatically generated at the completion of each simulation and saved in the project folder. This file is useful for QA purposes e.g. for reviewers of fire designs to ensure the input and output relate to the same simulation.

Development (pre-release - non-public)

9. Mass loss rate model with fuel response effects for pool fires and user supplied mass loss rates.

2016.02
15 July 2016

1. **Graphics.** Graph showing internal temperatures in surface linings had incorrectly labelled node depths when a substrate lining was present. Fixed.
2. **Graphics.** Units for time axis on graph can be switched from seconds to minutes.
3. **Results output.** Additional open/close information for vents added to results output.

4. **Ceiling Jet.** The Alpert equations for an unconfined ceiling jet have been updated to match the formulations given in the 5th Edition of SFPE Handbook. There was a slight difference previously.

5. **FED thermal.** A threshold temperature below which the convective component of the FED thermal does not accumulate has been added. The temperature used is 25C.

6. **Fuel Mass.** The total mass of fuel present based on the area under the HRR curve is automatically calculated. It is shown in the new items screen but is not editable by the user.

7. **Sprinklers.** Bug reading the binary dump file associated with the sprinkler data when reloading data from a previously run iteration. Fixed.

8. **Ceiling vent discharge coefficient.** This can be entered by the user.

9. **Post flashover wood crib submodel.** Change made to ventilation controlled mass loss rate.

$$\dot{m}_f = \frac{13100\,\dot{m}_p Y_{O2,L}}{\Delta H_c} \qquad (0.1)$$

$13100\,\dot{m}_p Y_{O2,L}$ is the maximum rate of heat release supported by the oxygen in the plume flow and ΔH_c is the heat of combustion of the fuel. If ventilation controlled burning governs, the mass loss rate is multiplied by Ω where Ω is a user-defined factor representing an excess fuel fraction where $\Omega = 1$ corresponds to all the fuel generated burning within the room and $\Omega = 1.3$ is a default value for wood cribs. Previously the excess fuel fraction was applied before determining the governing burning mode. Now it is applied after and only affects the ventilation-controlled burning rate.

Development (pre-release - non-public)

10. **Flame spread**
    a. Flame spread model– the calculation of the wall area burning constrained by vertical and horizontal distance limits was amended to account for the case where the upward pyrolysis front at ignition is higher than the vertical limit.
    b. The burner width setting in the flame spread form was overridden by the object #1 dimensions. The separate burner width user input box is removed.
    c. Flame spread model was not accessible unless user mode was changed to risk simulator immediately after start up. Fixed.

2016.01 (no public release)

2015.07
12 November 2015

1. Barrier failure for ceiling represented as a ceiling vent opening. Time to integrity failure based on emissive power of furnace gases was calculated incorrectly when wall barriers also present.

2. Bug fix – error occurred when number of ceiling vents exceeded the number of wall vents in a room.

2015.06
18 September 2015

1. T2 alpha coefficient maximum permitted value changed from 1 to 10 when validating input.
2. Bug fix. Vent opening options for multiple ceiling vents gave an error.

2015.050 – 53 (no public release)
6 August 2015

1. Development work only.

2015.04 (no public release)
4 August 2015

1. When entering a base file name with a space included, two similarly named folders were incorrectly created under the riskdata folder instead of a single folder. This is fixed.
2. Default material for walls and ceiling is changed from 100 mm concrete to 13 mm plasterboard.
3. Fire barrier model – if there is more than one vent using the heat load, emissive power method; only the energy dose for the first vent was correctly calculated. Fixed.

2015.03 (no public release)
2 July 2015

1. A Development Mode option is created requiring the user to enter development key code to access new features under development.
2. Flame spread development module pre-release.
3. When using the 'File, New, ISO 9705 simulation' menu command, an error occurred due to a missing cvents.xml file. Fixed.
4. Errors sometimes occurred in new installations with missing database files. The fire and thermal databases are now added to a dbases folder under the application folder and copied to set up new projects.
5. User created materials/thermal database file can be loaded using the file, utilities, Change Material Database file menu command.

2015.02
19 March 2015

1. When saving an existing project with a base file name, ceiling vent data was not copied to the new location. Fixed.
2. Exporting Monte Carlo dump file results – data was not being correctly exported to the excel worksheet. Fixed.
3. Saving results of single run to excel file – previously this only worked if done immediately after running the simulation. This now also can be done after loading data for a previous run using the <File, Load input*.xml File> command.
4. Bug. In multi-room models using VM2 mode, where the room of fire origin is not room 1, in some cases (depending on the relative dimensions of room 1 compared to the room of fire

origin) the plume entrainment algorithm for a WALL was selected instead of a CENTRE location. Fixed.

2015.01
20 February 2015

1. When saving a project initially located outside the default riskdata folder, and then moving it to the riskdata folder when asked, if that folder already exists it will now first be deleted and then project files will be copied to the folder. Previously not all the files were correctly copied if that folder pre-existed.
2. When saving an existing project with a new name/location, ceiling vent data was not copied to the new location. Fixed.
3. Wood crib postflashover submodel. Error in crib porosity controlled burning rate fixed. Crib height added as user input variable.
4. Data type edited for vent discharge coefficient (single to double precision) and input*.xml file edited to remove ventcd duplicate entry. Other data type edits were made for parameters for the statistical distributions when using Monte Carlo.
5. An option has been added to designate a vent as part of a wall or a ceiling assembly, and assign a fire resistance rating to the vent. The vent will be opened upon reaching designated criteria which represents the onset of barrier failure (criteria include upper layer gas temperature, cumulative radiant emissive power of the fire gases or normalised heat load). The percentage of vent area to be opened and the time period over which to open the vent can also be specified. This allows barrier failure in fully developed fires to be modelled. This feature is currently undocumented and included for research purposes.

2014.17 (not public release)
24 September 2014

1. When using the wood crib post-flashover model, a change was made to the calculation of the oxygen limited HRR when fuel surface area burning takes place (ie during decay).
2. Run time debugging added when reading the riskdatafolder from the configuration file on first opening the program.

2014.16
29 August 2014

1. A change to the plume flow calculation when using the postflashover wood crib submodel to account for the elevation of the fire above floor level.
2. A change to the oxygen constrained submodel where previously if excess oxygen was in the upper layer then it was consumed and included in the heat release. However, this occasionally created instabilities and it is removed. Only oxygen available in the plume flow is used for combustion.
3. An error in the calculation of the emissivity of CO_2 gases in the lower layer is corrected and a change made to the radiant heat flux striking a surface due to emitting gas layer.

2014.15
23 July 2014

1. Bug fix – Only affects vented rooms modelled as single zone. When a vent flow from outside entered a room modelled as single zone, the species were not deposited into the 'single zone' and therefore concentrations would remain unchanged regardless of the magnitude of the flow i.e. no dilution. This is fixed.
2. Option to change line colours on the single run graphs has been added.
3. Additional outputs added to single run graphs for surface heat fluxes, convective heat transfer coefficients, internal node temperature in boundary surfaces and adiabatic surface temperatures.
4. Some miscellaneous debugging of user interface when reading/writing base files.

2014.14

13 July 2014

1. A change has been made to the folder-file structure. Project folders should be located beneath the riskdata folder ie. "…\riskdata\myproject\". The user can change the default riskdata parent folder location from the File menu. The currently selected default location of the riskdata folder and the current project folder are displayed beneath the output log screen. Projects can be run from other locations but a prompt will ask the user if they wish to copy the project to the riskdata folder.
2. For non-fire rooms modelled as a single-zone, instead of forcing the layer to the floor (creating a single zone), a steady layer height of 0.1 m above the floor is assumed. This makes little practical difference to the result but is helpful for speeding up the simulation.
3. Net heat fluxes to room surfaces have been added to the excel export file and to single graphs.
4. Bug fix – if the (manual) opening and closing time specified for a vent was the same and nonzero, then vent did not close. Fixed.
5. Bug fix – if the room dimensions were changed, room surface material selections were reset to default. Fixed.
6. Auto opening vents triggered by flashover, ventilation limit or fire size must be connected to the fire room to open.
7. Bug fix – a correction was made to the subroutine calculating radiation exchange between the room surfaces due to the fire and upper/lower gas layers, including the assumed location of the point source for calculating the radiation component from the fire source, and the fraction of the radiant component of the fire intercepting each of the surfaces. The main impact of this change is to increase post-flashover fire temperatures, however it may also increase some preflashover gas temperatures and reduce some FED thermal times and sprinkler activation times.
8. Bug fix – a correction to the specific heat of water vapour at temperatures below ~350K was made.
9. New outputs added in results for total heat loss to room surfaces and a calculation of 'normalised heat load (NHL)'. Equivalent time of exposure based on NHL added to results.
10. Location of documentation files has moved to program files folder rather than the users personal folder.

2014.13   26 June 2014

1. Bug fix – In the results output screen, Q* was only shown when the room of fire origin was room 1. Fixed.
2. Edits made to the summary of inputs, with simulation time and status of enhanced burning option added.
3. Room description labels added to the .smv file, for display in smokeview.
4. Bug fix – Spill plume routines required fire room to be in the lowered number room to work correctly. Fixed.
5. Bug fix – An error in the standard entrainment routine in multiple room scenarios under some conditions was corrected.

2014.12   7 June 2014

1. Bug fix – The ventilation limit was not being correctly detected in some models and auto opening vents on reaching ventilation limit did not always occur with multiple rooms/vents. Fixed.
2. The fire object width, length, height not shown in view input screen when using VM2 mode.

2014.11   1 April 2014

1. Bug fix - The choice of finite difference solver (LU Decomposition vs Gauss-Jordan) for the heat conducted through the surface lining materials, was not read/writing correctly to the base file xml file. Fixed.

2014.1   28 March 2014

1. Ceiling vents user interface changed. Vent data now contained in cvents.xml file. The ceiling vent area can be assigned a distribution.
2. Bug fix – when choosing print preview from the view inputs/results form, the dialog box would be hidden behind the current form and not able to be seen. Fixed.
3. Bug fix – Changed HRRPUA not saved in models with VM2 user mode set. Fixed.
4. Bug fix – option for T2 or T3 fire growth is not maintained when opening a previously saved file.
5. Bug fix – Calculation of thermal FED was not possible if gas temp was below zero. Fixed.
6. Bug fix – In the results screen, when showing the CO yield at each timestep, sometimes the incorrect value of CO yield used was displayed in the output. However, the correct value was used in the calculations of CO concentration and FED.
7. Bug fix – automatically opening a vent following a trigger (eg sprinkler, smoke detector) was causing a numerical problem with the solver at the time of opening the vent that did not occur when manually setting the vent opening time. A change has been made to the code controlling the opening of the vent to avoid the problem.
8. The input of fire room for FED egress path must now be selected from the drop down box, the input box is not editable.
9. The egress path (rooms, time intervals) are now shown on the FED plots.
10. The shape factor (Af/H^2) is now calculated using average floor to ceiling height instead of max floor to ceiling height.

2013.21   9 December 2013

1. Changes to installation wrapper, allowing previous versions to remain in the "my programs" folder.

2013.20   3 December 2013

1. More changes to splash screen behaviour to try and prevent program closing when focus was lost early when used in a virtualised environment.

2013.19   27 November 2013

1. More changes to splash screen behaviour to try and prevent program closing when focus was lost early when used in a virtualised environment.

2013.18   20 November 2013

1. User interface bug introduced in ver 2013.17 causing forms to disappear on screen after a short period. Fixed.

2013.17   19 November 2013

1. Exporting Monte Carlo results for individual parameters in a multi-room model to Excel did not work. Fixed.
2. Changes to splash screen behaviour to prevent program closing when focus was lost early.
3. Added unconstrained heat release rate to printed output screen and graphical output.
4. Debugging for exporting MC results to excel.

2013.16   6 November 2013

1. The software did not work on a computer where the user locale was set to a region (e.g. Sweden, Germany etc) that did not use a period as the decimal separator. This has been fixed.
2. Room surface materials reverted to default after the room properties were edited. Fixed.

2013.15   18 September 2013

1. Error occurred when using the Utilities, Open BRANZFIRE Mod file to import .mod file. Fixed.
2. Error occurred when opening an existing multi-room model at the point of reloading data from previous runs. This should not affect the user working with or running the opened model. Fixed.
3. The upper layer gas emissivity only appeared in the dump file spreadsheet output when the FED egress path segment was set. Fixed.
4. When there was more than one vent connecting two spaces (or outside) that were both set to open at the ventilation limit, only one vent would be automatically opened not both. Fixed.
5. Some editing of data types and minor tweaks in the ODE solver.
6. Some user interface editing of TAB order on some forms.

2013.14   22 July 2013

1. Error occurred when trying to open project created in version older than 2013.11. Fixed.

2. Error occurred when using the Utilities, Open BRANZFIRE Mod file to import .mod file. Fixed.
3. Some editing of how forms are displayed/hidden/closed on screen.

2013.13   15 July 2013

1. A change was needed to ensure when the floor elevation was read from the rooms.xml file it was stored as the correct data type, only relevant to rooms with a non-zero floor elevation. Incorrect data type caused an excess of digits producing an error message while checking valid vent dimensions.
2. Interface tidy up to remove old room dimensions screen no longer required.

2013.12   4 July 2013

1. Three changes are made to the smoke detector response algorithm. The changes are made to help ensure consistency between detector response time in the room of origin where an allowance for smoke transit time was made compared to those outside of the room of origin where smoke transit time was not previously considered.
    a. Firstly, the specified smoke detector radial distance from the plume is compared to the length of the room diagonal, and if the former exceeds the latter, then the length of the room diagonal is used in the calculations instead of the specified radial distance.
    b. In the room of origin, the transit time is checked to see if the ceiling jet has reached the detector (a requirement) before the detector is allowed to respond.
    c. For detectors not in the room of origin, the detector is not allowed to respond until at least the ceiling jet in the fire room has traversed the length of the fire room diagonal. This transit time is also added to the time at which the optical density criterion is met to give the response time of the detector. In some cases, this may lead to longer response time predictions outside the room of origin than previously determined.
2. When a vent is opened upon reaching the ventilation limit, there was a change needed to get the correct updated value of the new ventilation limit due to the additional oxygen introduced by the vent.
3. When attempting to write to a vents.xml file where no vents exists, the file was not closed which sometimes generated an error next file the file was read. Fixed.
4. The room data is now included in a rooms.xml file and the input screen has changed.
5. Distributions can be assigned to room length and room width parameters.
6. File New, defaulted to flame spread model ON when using Risk Simulator Mode. It has been changed to flame spread model OFF.
7. When a room is removed from the model, only vents connecting to that room are deleted instead of all vents. Existing vents are then changed to match new room numbering.
8. Shape factor (SF) and Q* (optional selected from print variables) are calculated and added to room details in View Input/Results screen.

    $SF = \frac{A_f}{H_e^2}$ $\dot{Q}^* = \frac{\dot{Q}}{1110 H_e^{5/2}}$ where $\dot{Q}$ is the heat release rate, A_f is the floor area and H_e is the enclosure height.

9. Some changes made to data types within the software code.

2013.11   21 June 2013

1. When displaying CO yields in the view results screen, yield may not have been correctly shown if more the one run had been made in the session since starting the program. A variable needed to be reset at the start of the simulation. Did not affect actual results, only caused a postflashover yield to display when it may have actually been the preflashover value. Fixed.
2. When using VM2 mode and manual inputs for CO and soot yield, the switch to postflashover values only occurred upon reaching an upper layer temperature of 500C. A change has been made so that the switch also occurs upon reaching a ventilation limit.
3. Exporting results to excel function crashed if there were no smoke detectors. Fixed.
4. When switching between risk simulator and VM2 user modes, the flame spread model options were not being correctly enabled/disabled. Fixed.
5. Output shown in the console screen log is now included in the summary of results events log.
6. Some problems with the vents.xml file becoming corrupt have been addressed.
7. Change of functionality when using the File New command. Default xml files are now stored in the /data/ folder. When the File New command is given, the default files are copied into the /riskdata/basemodel_default/ folder, effectively restoring the original files. A user can therefore change the default parameters by editing or replacing the xml files in the /data/ folder if they wish.
8. Change of functionality when using the File, Basemodel Save As command. Previously if a project model was to be saved in another location, the user had to first create the folder to save the project in. Now the project folder will be automatically created beneath the selected folder.

2013.10   18 June 2013

1. When using a power law design fire, the summary of inputs and results did not include power law fire parameters. Fixed.
2. A change was made to check that the lower layer temperature does not exceed the upper layer temperature. This should help with the numerical solution of models including shafts/stairs.
3. A notification time can be added to the time for activating a hold open device. The same delay time for automatically opening a vent on smoke detector activation will be used.

2013.09   3 May 2013

1. The default setting for the room populate method was to auto-populate the room with the fire items, and this was not changed when VM2 user mode was selected. With the auto-populate room method, the position of the item could mean the location for entrainment purposes (centre, wall, corner) could randomly change each time the simulation is run, giving a different result. Fixed to ensure VM2 mode uses manual positioning, and default setting changed to manual positioning.
2. The order the wall vents are listed is changed from the order they were added to being grouped by room number instead.
3. The position of the fire was sometimes incorrectly shown in Smokeview. Fixed.

4. When in VM2 mode, when a project was opened, the elevation of the fire, peak HRR, alpha coefficient, storage height and the FLED were reset to default values, rather than keeping the previously saved values. Fixed.
5. If the heat release rate data (time, kW) pairs contained spaces, the simulation would not correctly read the data and a no HRR would appear. Fixed.
6. Where multiple items are present, an error in the entrainment calculation, for non-burning items where the upper layer temperature was < 400 K, caused an entrainment quantity to be calculated where it should have been zero for that item. Fixed.
7. Flame spread sub-model – HRR cone calorimeter data for wall and ceiling lining did not plot under graphs menu item. Fixed.
8. Room populate screen. The copy layout to clipboard option (right click, copy) gave different item numbering than was shown on screen. Fixed.
9. Specific heat for compartment surfaces added to summary of input data.
10. A technical change has been made to the 'wood crib' post-flashover model. The equation for calculating the ventilation-controlled burning rate has been changed from equation 91 in the user guide to the following, which assumes the wood cribs burn 30% fuel rich.

$$\dot{m}_f = 1.3 \frac{\dot{Q}_{f,\text{constrained}}}{\Delta H_c}$$

This allows the wood crib post-flashover model to be used for multi-compartment models where previously it could only be used for a single compartment with all vents to the outside.
11. A technical change has been made to the submodel for calculating the near vent mixing flow where a mass flow from the upper layer is entrained into the vent in-flow and deposited into the lower layer. The new correlation is based on research by Utiskul. Details are given in Annex A which is intended to replace section 7.11.2 in the B-RISK user guide.

2013.08   18 Apr 2013

1. The room surface lining materials and thicknesses of rooms were sometimes inadvertently changed by being assigned to the wrong room after changing the room selection in the room dimensions form. Fixed.
2. In the automatic vent opening options, the values for the delay after trigger threshold and the duration of opening, were sometimes wrongly changed to values entered for another vent. Fixed.
3. Excel file of output – 'results' is stored was stored under the riskdata folder even if the project folder was stored elsewhere. Changed to store in project folder.
4. User mode setting is added to input summary printout.
5. FED results format is changed in results printout.

2013.07   12 Apr 2013

1. When mechanical ventilation fans were used in more than one room, there was an error in the fan contribution to the mass balance calculation. Fixed.
2. Visibility outputs were incorrectly reported as being 20m+ after accessing and closing the settings form. Correct readings were given if model was run immediately after opening the base file. Fixed.

3. In the view results screen, there is an option to display CO yield. The value shown was switching between pre and postflashover values based on global equivalence ratio rather than the flashover criteria. This did not affect the actual calculations done. Fixed.

2013.06   8 Apr 2013

1. The form for vent auto open/close options was being hidden behind other forms. Fixed.
2. The auto/manual setting option for the CO and soot yields were <u>still</u> not being saved. Fixed.
3. After a run is completed, the estimated gas transit time for each smoke detector is saved in the smokedets.xml file.
4. Output for optical density at the smoke detector location has been disabled. Requires further work.
5. Export Monte Carlo Results, Export Output to Excel, Export All (from dump.dat file) – did not correctly save. Fixed. Other edits associated with saving multi-room output to excel.
6. The FED's are calculated for the specified egress path and not separately for each room. In excel output they will appear under the room of fire origin with FEDs in other rooms showing as zero.

2013.05   2 Apr 2013

1. The auto/manual setting option for the CO and soot yields were not being saved. Fixed.
2. The room description was not always saved. Fixed.
3. When creating a new ISO 9705 model, smokedets.xml and fans.xml were not created in the new folder. Fixed.
4. When using the File New command, all existing sprinklers, smoke detectors and fans are now removed from the model.
5. Mechanical system reliability – distributions.xml file included in the install is updated to include system reliability value.
6. FLED value could only be edited from the distributions form. Fixed.
7. Vents input screen, changed to prevent form being hidden behind other forms.
8. Project base file name now also shows at the bottom left of the main screen, as well as the console screen.
9. User guide / technical reference manual can now be viewed from the help menu.

2013.04   Mar 2013

1. First public release.

Annex A

Related References

Y. Utiskul, "Theoretical and Experimental Study on Fully-Developed Compartment Fires" *NIST GCR 07-907,* National Institute of Standards and Technology, Gaithersburg, MD (2007).

7.11.2 Near Vent Mixing

When cool air flows into the room through a wall vent, it is assumed to entrain some of the upper layer gases from the upper layer into the lower layer. The near vent mixing correlation developed by Utiskul has been applied where the incoming cold air behaves like a jet entering the vent with a characteristic velocity and diffusing downward because of buoyancy. While the cooler air descends, the surrounding hot gas is entrained with a velocity that is proportional to the incoming flow characteristic velocity. An equation for the ratio of mass entrained to the total incoming mass flow was developed and single-vent compartment fire experiments were conducted to establish the correlation for the mixing at the quasi-steady state. The correlation exhibited a linear relationship up to an apparent asymptote for the mixing ratio of about 1.3.

Utiskul's correlation for the mass flow entrained ($\dot{m}_d$) in the incoming vent flow ($\dot{m}_i$) is:

$$\begin{cases} \dot{m}_d = 1.14\ \varphi\ \dot{m}_i & \text{for } \varphi < 1.1 \\ \dot{m}_d = 1.28\ \dot{m}_i & \text{for } \varphi \geq 1.1 \end{cases} \tag{70}$$

where,

$$\varphi = \left(\frac{T_o}{T}\right)\left(1 + \frac{N-S}{W_o}\right)\left(\frac{N-z}{N-S}\right)$$

and T_o is the gas temperature of the inflowing gases, T is the gas temperature of the upper layer gases, N is the elevation of the neutral plane above the floor, S is the elevation of the sill above the floor, W_o is the width of the opening and z is the layer height above the floor.

This vent mixing mass flow, taken from upper layer and added to the lower layer, applies both to vents to the exterior and vents to adjacent rooms.

The effect of the change can be illustrated in the Steckler room fire tests with a single vent as shown below. The accuracy of the lower layer temperature prediction is improved.

Steckler KD, Baum HR and Quintiere JG. 1983. 'Fire Induced Flows Through Room Openings – Flow Coefficients'. NBSIR 83-2801. National Bureau of Standards, USA.