Shepherd 3.2 Release Notes



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by

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Executive summary

A summary of key changes to the Shepherd software tool brought into effect by the release of Shepherd 3.2 are outlined in this document. These changes include updates to Explosion exceedance, ellipse methodology, the facility to perform IRPA calculations and a number of smaller enhancements and bug fixes. A full guide to the functionality in Shepherd can be found in the User and Technical Guides [1-2].

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1. Introduction

A summary of key changes to the Shepherd software tool brought into effect by the release of Shepherd 3.2 are outlined in this document. A full guide to the new functionality can be found in the User and Technical Guides [1-2].

2. Significant Enhancements

2.1. Updates to Explosion methodology

2.1.1. CAM Explosion Scenario

A significant update to the underlying science used to model unconfined vapour cloud explosions used for facility siting has been released in this version of Shepherd. This incorporates all the changes implemented to the CAM model in FRED 7.0 [3]. The changes generally result in a reduction of the predicted overpressures (~10%) subject to the model geometry and fuel that has been selected.

2.1.2. New Exceedance Building Types

Five new construction types are now available for Exceedance buildings:

- B1_New – Wood, Temporary Buildings, Trailers stud not notched – updated 2006
- B1_New(Notched) – Wood, Temporary Buildings, Trailers stud notched – updated 2006
- B11 – Pole Tent
- B12 – Light Frame Tent
- B13 – Blast Resistant Frame Tent

The first two are based upon new modelling of the Texas City Refinery incident. B11 and B12 are based upon guidance in API 756 (published September 2014). B13 is based upon the Baker Risk Mahaffey MAX756 tent.

2.1.3. Options for Overpressure in Open

The methodology for calculating overpressure in the open has been extended to allow users to model 4 rulesets, depending on their requirements.

- TNO Head Impact
- Shell QRA Ruleset Congested
- Shell QRA Ruleset Open
- Singapore Ruleset

The Shell QRA rulesets are based upon UK HSE guidance for congested and open plant areas, while the Singapore ruleset is based upon the 2016 Singapore regulations. The TNO head impact probit is documented in the TNO "Green book" and was the default option in Shepherd 3.1.

2.1.4. Generate default Exceedance leaks

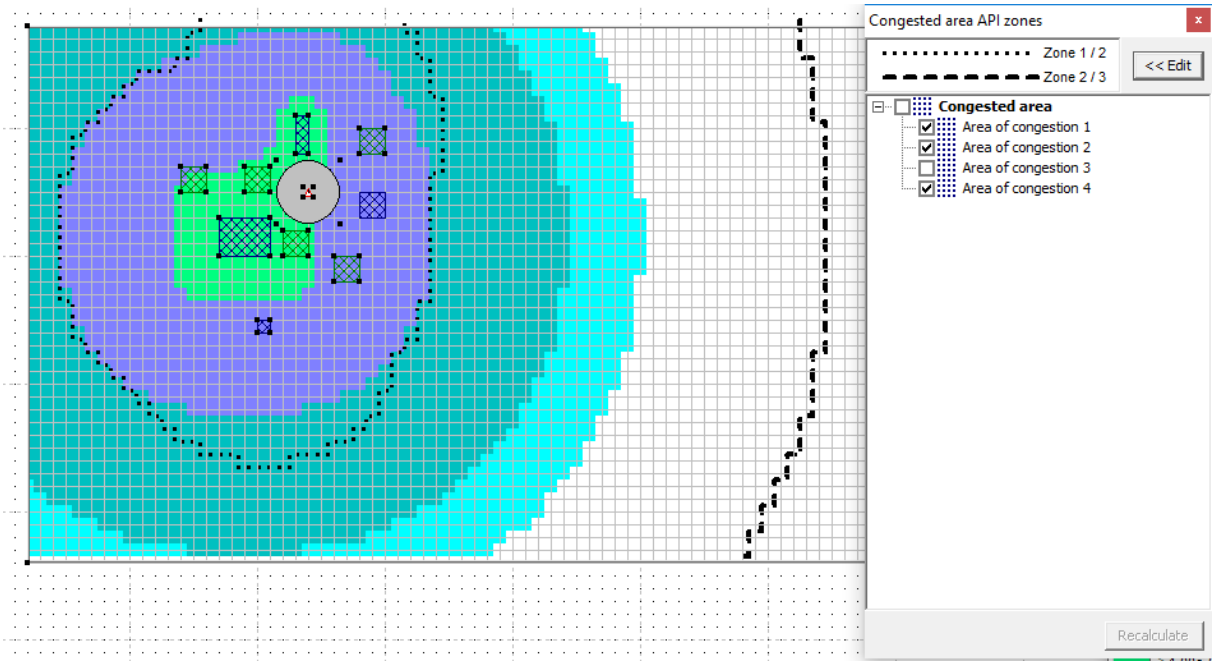
A new button has been added to the Leak Summary page. This button will generate default leaks to be used for Shell's facility siting methodology. The leaks have the "correct" frequency/hole size, but other parameters, e.g. LFL distance still need to be defined. The button has been added to the four scenarios used in Shell facility siting studies; process block, point source, pipeline and reactor hazard scenario

2.1.5. API 753

Shepherd can now draw contours for standback distances as defined in API753, with dotted and dashed lines used to display the boundaries between three zones:

- Zone 1 – Either not allowed or detailed assessment required
- Zone 2 – Detailed assessment required
- Zone 3 – No restrictions

When running a simulation, these contours are generated around all congested areas (or all selected areas if evaluating for selected objects only). The contours can be drawn on their own or on top of other contours. See Section 3.3.10.1 of the Shepherd User Guide for further details.



2.1.6. Total Facility Siting Risk

When planning the location of a new building it is useful to predict the risk to personel within that building at different locations. To help with this, a new contour has been added to the "Explosion max invidual risk" options called "Total Facility Siting Risk". This calculates a combined risk from the following event frequencies:

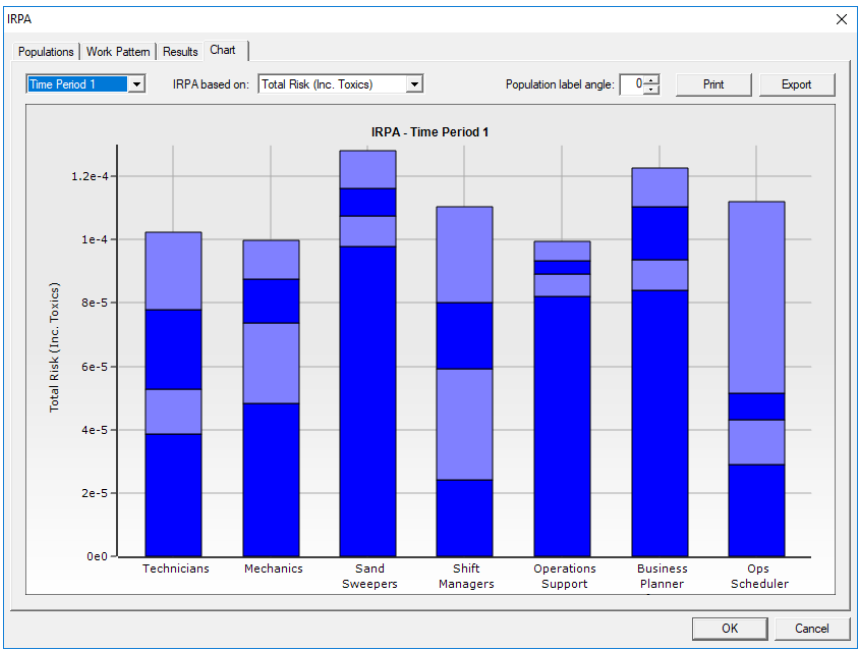
- Explosion risk to buildings
- Cloud fire
- Incident radiation flux
- Fireball thermal

This must be enabled as a secondary effect in the "Simulation Details". See Section 2.1.5.5 of the Shepherd User Guide for more details.

2.2. IRPA Calculations

Support has been added for doing IRPA calculations via a new feature available on the simulation toolbar. This allows worker groups or population types to be defined and for these worker groups to be given an occupancy in all Area Receiver objects that have been defined on the Work Area.

The assigned hours can be changed for the different time periods defined for the simulation. Once the simulation has been run, the total IRPA calculated for each population is available for various risk contours, along with a breakdown by Area Receiver. This can also be viewed as a chart:



See Section 2.1.5.12 of the Shepherd User Guide for further details.

2.3. Updates to Ellipse Methodology

A number of enhancements have been made to the ellipse methodology to extend the approach beyond toxic calculations

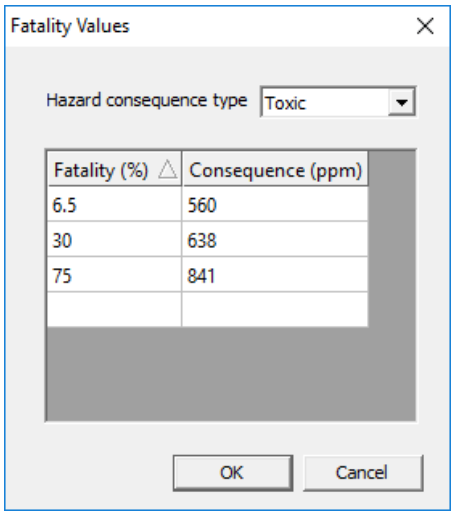
2.3.1. Momentum Ellipse leaks

Momentum Ellipse leaks can now be defined. This leak type uses the standard ellipse parameters of length, half width, distance to half width and offset, but it is independent of wind. The ellipse is therefore universally distributed around the release location. It is intended for modelling jet fires and cloud fires

2.3.2. Fatality-Concentration data

The Fatality-Concentration data for an ellipse is now defined per consequence. This allows different values to be set for different hazard consequence types, which is necessary to allow batch calculations for jet and cloud fires.

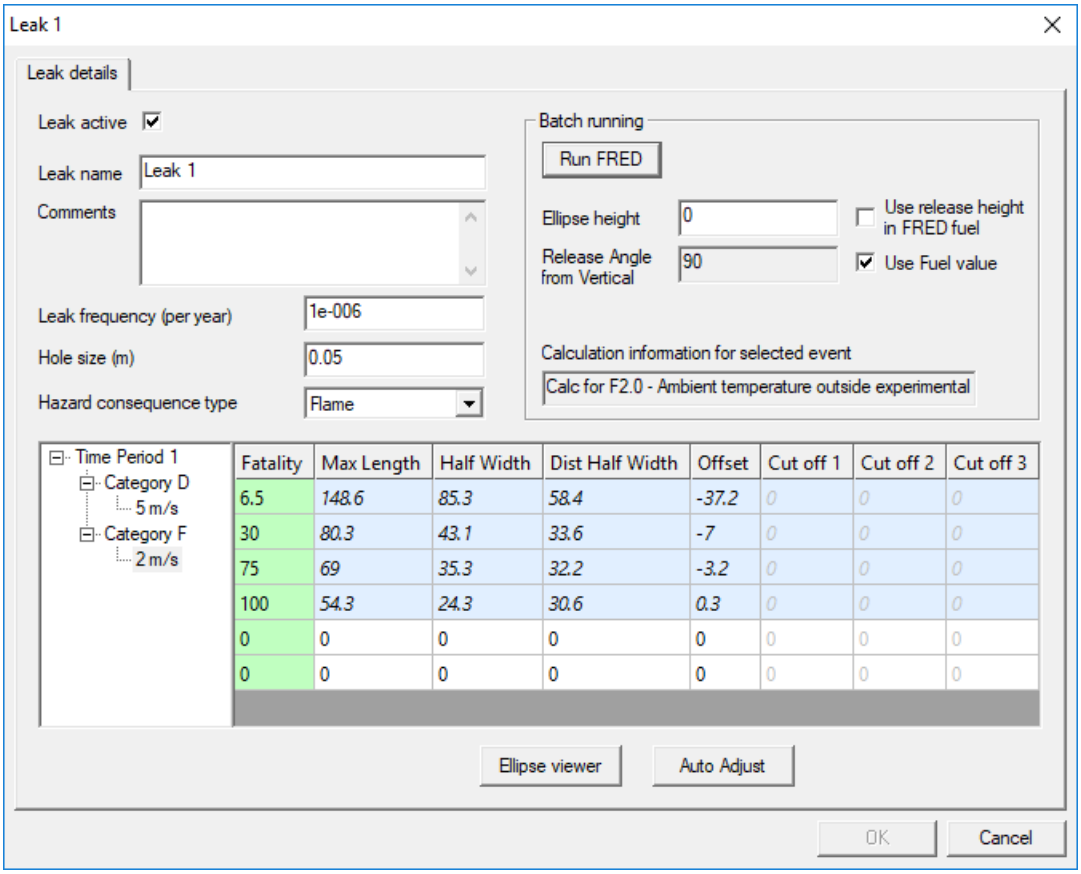
The usability of this control has also been improved, so that the table now auto-sorts the fatality values and uses validation to make sure that concentration values are in ascending order.



2.3.3. Extending Batch Calculations

FRED Batch calculations can now be performed for Flame (jet fire) and Cloud fire consequences. Similar to the toxic calculations, selecting the Run FRED button will use the data on the leak page with the associated Pressurised Release inputs associated with the FRED Fuel to calculate the associated ellipse parameters.

The associated consequence for each fatality level are defined by the Fatality – Consequence Pairs. For cloud fires, the LFL value for the associated FRED fuel is determined automatically.



The inputs also allows the release angle from vertical to be modified, to allow vertical jet fires to be modelled.

2.3.4. Explosion Calculations

Ellipse calculations now contribute to exceedance overpressure calculations. This is enabled if the ignition model is set to Background (Original Shepherd) in the Global Settings and an equivalent overpressure fuel is selected on the fuel page of the ellipse release objects. Then if a cloud fire consequence hits a congested area, the explosion frequency is calculated to be equivalent to the cloud fire frequency and will trigger the subsequent Exceedance overpressure calculations.

2.3.5. Miscellanous improvements

- An "auto adjust" feature has been added to the ellipse leaks page. This button can be used to try to adjust the ellipses if they are "overlapping", rather than manually adjusting the distance to half width, etc.
- The ellipse and ellipse pipeline scenarios can now be defined as multiple objects.
- Ellipse and ellipse pipeline scenarios can now display Top Releases. To support this, the Fuel page also has a setting for the phase of the fuel: vapour, mixed, or liquid.
- After performing a FRED batch calculation in an ellipse leak, the cells containing the calculated data are modified to have a light blue background and the value is in shown in italics. This returns to a white background and normal font if the value is manually edited.
- Improved the Ellipse Viewer so that: (1) The x-y ratio is 1:1 (2) Circular ellipses are shown as a full circle. (3) Wind speed is now only shown when applicable.
- A warning is given to the user before performing batch calculations if the user change the hole size for a FRED fuel that was defined using Known Mass Flow Rate.

2.4. Object Templates

Groups of objects, e.g. a cat cracker or LNG train, often contain standard releases that can be reused in multiple Shepherd files. A new facility has been added to Shepherd to save a group of objects into a "template" file. This file can then stored and reused as and when required by loading it up into an existing Shepherd project. When loading a template, the user has the option to apply a prefix or suffix to the object labels (to avoid name clashes), and can adjust the location where the group is placed, see Section 2.1.1.3 of the Shepherd User Guide.

The facility allows users to create a library of standard objects and hence better tracebility than functionality such as using copy and paste.

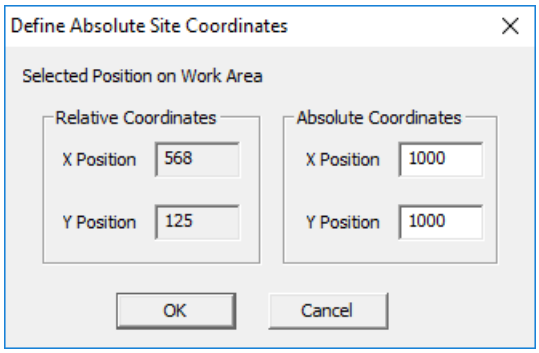
2.5. Load External Risk

An externally defined risk contour can now be imported into a Shepherd file via the "Load External Risk" option in the File menu. For example, this can be used to add the total risk from a facility siting file to a standard QRA file. The risk must be in the form of a .csv file, with each line specifying coordinates in the format "x, y, risk" and therefore it is easiest to import contours created in another Shepherd project that have been exported using the CSV option of Save All Screens – see Section 2.1.1.4 of the Shepherd User Guide.

When an external risk has been imported, the combined risk is shown when the user selects the Total Risk contour. When this is displayed, the key is updated to indicate that external risks are also included.

2.6. Site Coordinates

There is now the option to define absolute site coordinates from the View menu. By selecting a point on the map, an alternate set of coordinates can be specified, using this point as the reference.

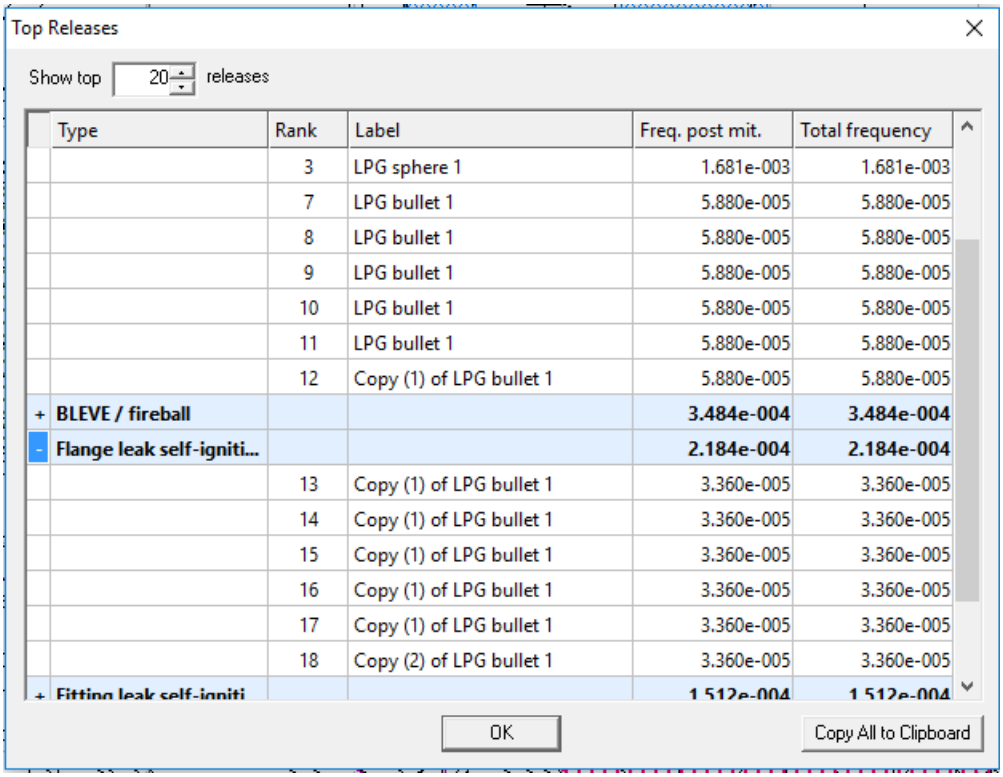


This defines a new coordinate system which is then used when generating the following outputs:

- Contour data as .csv
- Site Report
- Excel Object Report
- Ellipse leak Excel export

2.7. Top Release List

The "Top Releases" list has been significantly updated to allow a better interrogation of the releases that have been defined across the Shepherd project. The dialog, shown below, now displays the individual top releases for each release type, as well as the overall frequency for that release, in order of frequency.



The dialog also includes the label for the object to allow the main contributors to be more easily identified. The number of releases can also be modified to focus on the main contributors to the risk.

2.8. Change Log

Functionality has been added to view a log of all actions within Shepherd, as can be seen in the screen shot below. It shows the time/date when a range of actions have been performed. If the user requires to document specific details, there is a space for specific comments to be added by the user. The log can be disabled if the log size is becoming too large. See Section 2.1.1.15 in the Shepherd User Guide for further details.

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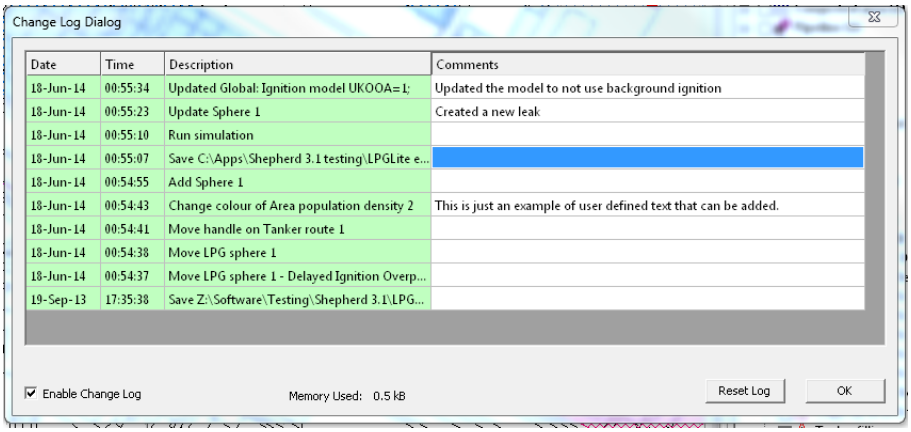

3. Minor Enhancements

3.1. Performance

- The file loading and saving speeds have been improved, especially for files containing large sites.
- Enabled Shepherd to access more than 2 GB of memory, with the limit now being 4 GB on 32-bit versions Windows 7 or Vista.
- Optimised memory usage when multiple time periods are not being used.
- Simplified gas hit list processing, no longer storing the names of multiple gas sources in overpressure hits, which can significantly reduce file size.
- Improved screen refresh speed, especially for small grid sizes. This also avoids the issue where Shepherd continually refreshes the screen when drawing large contours over a large area.

3.2. User Interface

- The menu bar has been rearranged to logically collect functionality together that has been added over recent releases. These changes include a new "Calculation" menu which has options for configuring and running simulations, Excel imports/exports, and viewing site-wide results (e.g. IRPA).
- Made several improments to the functionality when copying objects into a new instance of Shepherd:
    - Object labels are no longer prepended with "Copy (X) of".
    - Any FRED files (defined in the Hazard Manager) that are linked within a scenario are now copied with the scenario. If a duplicated name is detected, the user can replace or rename the copied FRED file.
    - Objects are pasted into the same position on the new instance, rather than to the bottom-right of the original position.
    - Shepherd will offer to expand the work area if the coordinates of the new object would be place it outside the original work area.
- An opacity control has been added to the Set Contour Settings dialog. This allows better control of the contours when displayed over a sitemap that was loaded from a bitmap/jpeg image. A 50% opacity level is automatically applied when loading an older Shepherd 3.1 file. This option is disabled when using site maps based upon DXF files, because there are no colours.
- Improved handling of Line Contour thickness, so that line can be seen when the view is zoomed out.
- Calculations are no longer reset when a new background site map is loaded.
- The library used to convert and load PDF files as background site maps has been updated and can now handle more complex PDF files.
- The user is now informed that the smallest grid size will be used when saving all output screens in CSV format when more than one simulation area with a different grid size has been defined.
- The default value for early ignition fraction in Energy Institute ignition model has been changed to 0.5 (from 0.33)
- It is now possible to select and delete several leaks at the same time within the Leak Scenarios page of a release object.

- When editing a multiple Area of Population object, the time period can now only be selected if they are enabled and have a non-zero fraction defined in Global Settings. If an unavailable time period is already selected, the time period is now appended with "(Inactive)" and a warning is shown when exiting the dialog.
- A confirmation dialog is now shown if a time period is disabled or set to zero while in use by an area of population density.
- The equipment pages in the Process Blocks and Reactor Sections objects have been simplified. The equipment list tables are hidden by default and only shown when "use lists" is selected on the specific equipment page.
- Added validation to check if layout leaks are defined when switching a multiple process block from Layout mode to Standard mode. If layout leaks are defined, a message box informs the user to go to the Leak scenarios page to check and update the leaks.
- Added functionality to restrict the position of points when creating polygon and polyline objects to always be vertically or horizontal aligned with the previous point. This makes it easier to draw objects, such as Process Blocks or Pipelines, with straight lines. This is achieved by pressing shift when adding the object to the Work Area.
- The Hazard File Manager now displays the phase of the loaded FRED fuel.
- Update the Hazard File Manager to support FRED 7 files (.fr7).
- The chart and its associated export functionality has been updated.
- The text within a Text object can now be left, centre or right aligned when it is drawn on the Work Area.

3.3. Updates to Global Settings

- Renamed the "Reset" and "Update" buttons in the Global Settings dialog to make the functionality clearer – Reset is now "Restore Default" and Update is "Set as Default".
- Added new option to disable the Disconnecting jet cloud fire model. By default this option will be disabled in new Shepherd files, but it will enabled when loading Shepherd 3.1 and older files.
- Renamed the options for Cloud fire ignition model. "Background" has been appended with "(Original Shepherd)" and "Delayed" has been renamed "Energy Institute", to match the wording in the Shell protocols. As before "Combined" uses both methodologies – see user guide.
- The maximum number of ellipse releases per wind sector can now be increased to 30 to improve the visual resolution of the contours
- Updated the layout of the Calculation page
- The contour levels, on the Visualisation tab, are now automatically rearranged if the user modifies one of the values, to keep the values in order.
- API 752 option on the overpressure page has been appended with "(1st Ed.)" to make it clear that the building vulnerabilities associated with this specific option refers to the first edition of the API guidance.
- Added an option to select the overpressure in open probit – see Section 2.1.3.

3.4. Interface to Excel

- The maximum number of rows that can be output to Excel has been extended from 65,536 to 1,048,576.

- The data exported to Excel when using the "Export Ellipse Information to Excel" and "Export Ellipse Data" functions has been reduced to speed up the process. Rows which have a fatality of zero are no longer output to the Excel worksheet. Note that if all fatalities are zero for a given leak, then one line is still exported to allow for correct format for importing.
- Import standard Leak and Ellipse data can now import from .xlsx format
- The x and y coordinates of the release location are now included in the Excel export of ellipse information.
- The fatality and consequence values associated with an ellipse object can now be updated using Import Ellipse Leak functionality.

3.5. PIPA

- Removed carriage returns being applied to the Notes field on the Scenario Description page.
- Improved the formatting of the scenario description on a A3 report, so that more text can be included.
- Improved the Fire Fighting section of A3 reports to only show short text for equipment.
- Added a Notes field to the Water Balance page and added it to the reports.

4. Bug fixes

4.1. Calculations

- Pool frequency was incorrectly calculated if the number of sectors in the Wind Rose was not 12. The pool frequency was adjusted by a factor dependent on the ratio of number of defined sectors / 12 and therefore was 1.333 bigger when 16 sectors were defined and 0.666 smaller when 8 sectors were defined.
- A calculation can now be started if the user has selected "Evaluate for Selected Objects" and the selection only includes compound site objects.
- In ellipse leaks, a mixed phase release is no longer treated as equivalent to a vapour release.
- Ellipse contours can now be calculated for very larger simulation areas (e.g. 40 x 40 km). Previously some contours with small grid sizes were failing to be displayed.
- Fixed issue whereby hits from one simulation area could be recorded on objects in a second simulation area.
- Thermal Hit lists are now cleared correctly when the results are cleared, so additional hits no longer appear on repeated simulations. This could occur when a simulation included a domino leak and original exceedance calculations were being performed.
- Hits from leaks in ellipse objects that are defined as circular leaks are now labelled correctly in the right click hit lists – they were previously recorded as ellipse leaks.

4.2. User Interface

- The object name is now updated correctly after renaming in the Object Selector control. In previous versions, the object report showed the original name, if the object was not edited.
- The overpressures are now correctly calculated in the Area of Congestion Fuels page if the height is changed and the CAM page is not selected. Note that the values were always updated to the correct value during a simulation run in previous versions.
- Fixed issue where probability of early ignition fields in leak page become editable when a UKOOA ignition model has been selected. This is now corrected and fields remain calculated internally and displayed as read-only.
- Data validation for user defined Exceedance building (B10), did not prevent values of P0 or Q0 having the same value on two adjacent rows and caused risk to be underestimated. Updated the validation to preventing identical adjacent values. Note this does not affect the calculation in existing files.
- Duplicate wind speeds can no longer be set for a Pasquill category in the Wind Rose.
- Improved handling of Paste operation in the Wind Rose table to avoid Shepherd crashing if cells in Excel have been merged together.

4.3. Other

- A site report can now be generated over an existing site report of the same name outside of the working directory.
- Added validation check to ensure that an imported FRED fuel cannot be named "lpg".

5. Compatibility

Shepherd 3.2 has been tested using Windows 10 (64 bit) and Windows 7 (64 bit) and is compatible for these operating systems. It is expected that Shepherd 3.2 will work as expected on Windows 8 (Vista), but has not been officially tested.

Shepherd 3.2 has been tested with Microsoft One Drive and all functionality works as expected if files and working directory was on a local drive.

Shepherd 3.2 has also been tested with Office 2010 and O365, e.g. import from and export to Excel worked as expected.

One issue regarding scaling on older versions of Windows 10 has been noted. In version 1607 and older versions, Shepherd does not scale some of the dialogs/text correctly when the monitor scaling is not set to 100%. This has been identified as a Windows issue[1] and has been resolved in v1703 and v1709 of Windows 10.

Two workarounds for the scaling issue are:

- Set the scaling to 100%
- Right click the Shepherd executable and select properties. Select compatibility tab and switched on "Disable display scaling on high DPI settings"

[1] https://blogs.windows.com/buildingapps/2017/04/04/high-dpi-scaling-improvements-desktop-applications-windows-10-creators-update/

References

[1] SR.18.00691, "Shepherd User Guide", Steven Betteridge, March 2018

[2] SR.18.00692, "Shepherd Technical Guide", Steven Betteridge, March 2018

[3] SR.18.00008, "FRED Technical Guide", v8, Steven Betteridge, October 2017

Bibliographic information

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