



Effigy

3D Fire & Gas Mapping Software

The Kenexis Effigy™ fire and gas mapping software is the most technically sophisticated and accurate application available. The fire and gas engineering and risk analysis experts at Kenexis have engineered this software tool to provide the flexibility to model virtually any facility with unparalleled accuracy and ease of use.

Server Hardware Specifications

Effigy is built on cloud based architecture to create a multi-site multi-user global enterprise software experience. The core of the application framework are Kenexis' powerful server computers that run the application code and store data.

Server Operating System:	Windows Server - 2013
Database Engine:	Microsoft SQL Server – Latest Version
Web Server Engine:	Microsoft Internet Information Services – Latest Version
Server Hardware:	Multi-Core Multi-threaded High Performance Processor Array
Data Storage:	RAID Multi-Drive
Availability:	>99% Guaranteed
Data Backup:	Daily – Offsite; 30 days of backup available; Offsite Annual backup maintained for 5 years

Client Requirements

Users of Effigy access Kenexis' powerful server architecture through their own client devices through a simple web browser. Effigy can be access by almost any computer, in almost any location – worldwide, at any time. This allows diverse work teams across the globe to seamlessly work together regardless of time zone or computer system.

Client Device Types:	Computers (and laptops), Tablet Computers, Smart Phones
Supported Operating Systems:	Windows, Mac OS, Linux, iOS, Android, Windows Phone
Supported Web Browsers¹:	Internet Explorer, Chrome, Firebox, Safari
Connectivity:	Any variety of internet connectivity

Client Accounts

Kenexis is robust enterprise software, but is has the flexibility to allow organizations and individual users to set up accounts to meet their own needs.

¹ Some more advanced features, such as 3D model graphic manipulation, are only supported by the most recent version of a browser. Otherwise, Kenexis supports the past three versions of each browser listed.

**Account Types:**

Professional – Named User – This account is accessed from the Kenexis Public Server (shared application code and database). Only the single named user associated with the account is licensed to access the software and associated data. Professional Accounts are available in Annual or Project (60 day) durations.

Professional – Simultaneous User - This account is accessed from the Kenexis Public Server (shared application code and database). Unlimited users from a single organization are licensed to access the software and associated data, but only the specified number (minimum of two) can access the application simultaneously. Professional Accounts are available in Annual or Project (60 day) durations.

Operating Enterprise – This account can be accessed from the Kenexis Public Server (shared application code and database), but a dedicated server or dedicated node is recommended. Unlimited users from a single organization are licensed to access the software and associated data with no limit on the number of simultaneous users. Operating Enterprise Accounts are available in and annual duration and licensing is based on the number of tags in the database.

Private Node:

As an option, any user or group of users, can obtain a private node. The private node is operating by the same powerful Kenexis server system that operates the public server, but in a private node the group maintains a separate set of application code and a separate database for results storage. Private nodes can also be customized with custom graphics and custom URL for access.

Private Server:

As an option, any user or group of users, can obtain a private server. The private server allows for complete physical and functional separation from any other users of the Kenexis instrumented safeguard suite. This option provides for a completely separate and dedicated computer system for the user group.

Handling Multiple Project

Effigy, through the KISS project manager, allows for the creation, manipulation, and management of an unlimited number of project.

Project Types:

Effigy – Fire and Gas Mapping
Vertigo – Safety Integrity Level Verification and SRS (Sold Separately)
Strata – PHA/Layer of Protection Analysis (Sold Separately)
Audit – Audit and Assessment Database (Sold Separately)



Effigy

3D Fire & Gas Mapping Software

Tracked Project Data:	Study Name, Study Type, Study Facility, Study Owner (User Name and Full Name), Date Modified, Current Revision
Project Actions:	Load Study, Copy Study, Delete Study, Baseline Study (Set Revision), Import Study ²

Data Libraries

Effigy contains data libraries that allow for fast and accurate modeling of specific fire and gas sensors. Kenexis has compiled data for most fire and gas detection equipment vendors

Available Libraries:	Fire Detectors, Gas Detectors
Fire Detector Attributes:	Detector Make, Detector Model, Detected Chemical, Sensitivity Setting, Curve Characterization Parameters, Design Basis Detection Distance
Fire Detector Data Source:	FM 3260 Reports – Vendor Literature
Fire Detector Vendors Included:	Chubb, Detronics, Drager, General Monitors, Honeywell, Micropack, MSA, Net Safety (Emerson), Sierra Monitors, Spectrex, Tyco – Multiple Models available, each with different sensitivity settings, and measured chemicals. Other vendors and makes can be added within minutes upon submittal of FM 3260 certification report style testing results
Gas Detector Attributes:	Detector Make, Detector Model, Detected Chemical, Sensitivity Setting
Fire Detector Vendors Included:	Detronics, Drager, General Monitors, Honeywell, Net Safety (Emerson), Sieger, Spectrex – Multiple Models available, each with different sensitivity settings, and measured chemicals. Other vendors and makes can be added within minutes

General Study Data Inputs

Effigy defines the process facility study area, or zone, using a variety of attributes. These attributes include the physical description of the facility along with the conditions that affect the fire and gas mapping study, such as weather.

Facility Tracking Information:	Name, Asset Owner, Facility Description, Project Number
Facility Dimension Information:	x dimension, y dimension, z dimension, true north angle, project north angle

² Importing of complete studies can be performed from an export file generated by Effigy or other KISS applications. The import file will be a .zip file containing an .xlsx file with database data, and any number of associated graphic files. Export/Import files allow transfer of data amount multiple different servers.



Effigy

3D Fire & Gas Mapping Software

Analysis Elevation:	In accordance with ISA TR 84.00.07 coverage results are presented as areas of an elevation of interest. This elevation of interest is user defined, and can be changed, or calculated multiple times for different elevations, as required.
Detector Voting:	1ooN or NooN for gas – selectable, 1ooN or NooN for fire – selectable
Overlay Image:	An overlay image is a graphic file that is overlaid on mapping results to provide context.
Supported Image Formats:	JPG, JPEG, GIF, TIFF, PNG, BMP
Graded Area Definitions:	Define graded area names, primary inclusion distance, secondary inclusion distance, secondary grade
Wind Direction Data:	Wind direction data is critical for distributing release scenario locations depending on wind. Effigy allows input for up to 16 wind direction, and defines the fraction of time the wind is coming from each direction in a non-dimensional format.

Fire Detector Input Data and Results

Users define fire detectors in Effigy. Multiple data options are available to define fire detectors, and multiple calculated results are available on a per fire detector basis.

Detector Information:	Detector Tag Name, Detector Make (Vendor), Detector Model, Detector Hazard of Concern (Chemical Combusted), Detector Sensitivity Setting
Detector Location/Orientation:	x dimension, y dimension, z dimension, declination angle, rotation angle
Design Basis Fire Size:	Input of design basis fire size in terms of Radiant Heat Output in kilowatts. Effigy automatically scales the cone of vision dimensions based on the design basis fire size.
Enabled/Disabled:	Each detector can be individually enabled or disabled from the study to allow calculation of the results without the benefit of the detector – allowing quick and easy sensitivity analysis.
Per Detector Results:	Geographic Coverage for the Detector, Geographic Coverage without the Detector, 3D view from the face of the detector, Scenario Coverage of the Detector, Scenario Coverage without the Detector

Gas Detector Input Data and Results

Users define gas detectors in Effigy. Multiple data options are available to define gas detectors, and multiple calculated results are available on a per gas detector basis.

Detector Information:	Detector Tag Name, Detector Make and Model, Detector Hazard of Concern (Chemical Combusted), Detector Set Point
Detector Location/Orientation:	x, y, and z dimensions of the detector (for open path options x,y,z coordinates of the emitter and received



Critical Cloud Diameter:	Input of critical cloud diameter Radiant Heat Output in multiple different distance units. Critical cloud size determined separately based on release parameters or fire and gas system philosophy.
Detectable Concentration:	Set point of detector, and parameter for determining exceedance of set point for open path gas detection equipment.
Per Detector Results:	Geographic Coverage for the Detector, Geographic Coverage without the Detector, Scenario Coverage of the Detector, Scenario Coverage without the Detector

Equipment Item Input Data

Users define the physical attributes of the facility by creating or importing one or more equipment items. These equipment items are physical pieces of equipment that can serve as obstructions to detector view, gradable leak sources that require FGS coverage, and sources of gas leak scenarios and fire scenarios.

Equipment Item Information:	Equipment Tag Name and Service Description
Equipment Item Attributes:	Each equipment item can be defined to be any combination of the following: an obstruction, graded area, fire scenario, or gas scenario, but checking the appropriate checkbox in the equipment item definition
Equipment Location/Orientation:	X, Y, and Z coordinates of 3D solid, or imported STL file center, Rotation Angle, Inclination Angle
Type (3D Solid):	If the equipment item is defined as a 3D solid, the type of solid – cuboid, sphere, cylinder, pressure vessel (cylinder with spherical ends)
Equipment Dimensions:	length, height, width, radius, as required for the 3D solid (Not applicable to imported STL file)
Imported³ 3D CAD File⁴:	Filename of imported 3D CAD file. Binary stereo lithograph (.stl) file format (< 10 MB). Binary STL format is supported by all major 3D CAD software vendors – Aveva PDMS ⁵ , AutoCAD, Bentley Microstation

³ Imported STL files are currently done through Kenexis support (support@kenexis.com). An STL file is submitted to Kenexis support along with user account and study name. The file will be inserted into the study within 48 hours. Direct user import will be available in the next major software revision.

⁴ Facility data in Effigy can be built or directly imported. Allowing Effigy much more flexibility than any other FGS mapping application. Equipment items can be built from individual 3D solids for individual equipment items. In this case, Effigy will convert the 3D solid into a stereolithograph (STL) file for use in the calculation engine. Effigy can also use imported STL files. This STL file can be limited to a single piece of equipment or it can comprise an entire facility. Effigy's flexibility in input of plant data allows individual equipment items to be added or deleted from a study where other software applications would require that the entire study be recreated if the underlying CAD drawing were to become outdated.

⁵ AVEVA PDMS exports to STEP file format, which can be converted to STL through third party converters

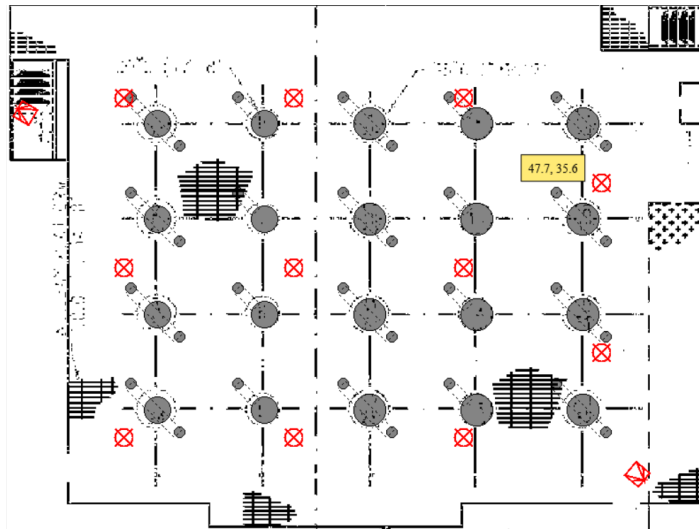


- Graded Areas:** Graded areas are defined by selecting location (automatically associated with equipment location), and one or more set-off distances away from the equipment items to define the covered volumes. Each graded area can select from multiple different defined grades.
- Fire Scenarios:** Fire scenarios are definitions of the sizes of fires that can occur as the result of a release from a piece of process equipment. An unlimited amount of scenarios can be defined for each equipment item. Each fire scenario includes a location (x, y, z), fire dimensions (length, width), fire frequency (per year), and offset from the release location. Also, each scenario can be individually enabled and disabled.
- Gas Scenarios:** Gas scenarios are definitions of the sizes of gas clouds that can occur as the result of a release from a piece of process equipment. An unlimited amount of scenarios can be defined for each equipment item. Each gas release scenario includes a location (x, y, z), gas cloud dimensions (length, width), concentration related to the release dimensions, release frequency (per year), and offset from the release location. Also, each scenario can be individually enabled and disabled.

Detector Layout Drawing

Effigy allows users to view the facility definition in terms of equipment items and detectors (both fire and gas) in a plan view format on the detector layout page.

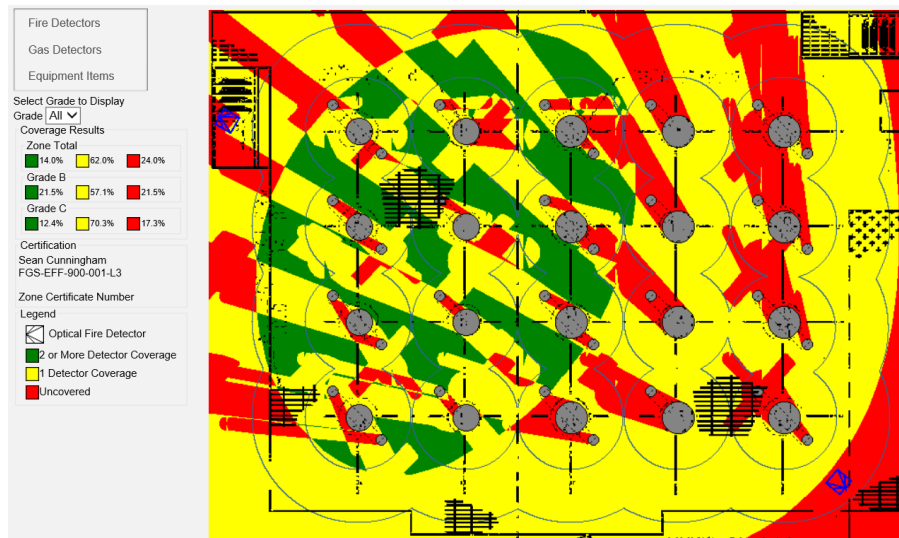
- Facility Overlay:** All equipment items and detectors are drawn on top of the facility overlay graphic to provide context.
- Detector Locations:** Fire detectors and gas detectors are down on the overlay in red. Gas detectors show location. For open path gas detector emitter and receiver locations are shown with a linkage between the two. For fire detectors orientation is also shown.
- Equipment Item Location:** Equipment item location is drawn on the overlay. Extents of equipment items are shown in dashed lines. Intersection with the elevation of interest is shown in gray.
- Location Tool Tip:** At all times, a “tool tip” attached to the mouse presents to location of the mouse on the overlay in engineering units.



Geographic Coverage Results

Effigy provides geographic coverage results of the FGS mapping activity. Geographic coverage is defined in ISA TR 84.00.07 as the fraction of area of an elevation of interest where if a fire or gas cloud were to exist, would be detected by the FGS detector array. Separate results are prepared for gas detection and for fire detection.

- | | |
|---------------------------------|--|
| Geographic Coverage Map: | A colorized map is provided that shows the areas that are uncovered, covered by only one detector, and covered by two or more detectors. |
| Grade Display Selector: | The colorized coverage map can either be displayed for the zone as whole or individually for each graded area (e.g., A, B, or C) |
| Tabular Results: | Tabular results are also calculated. The tabular results are presented as a percentage coverage and are presented for the zone as a whole and each individual grade of the zone. |
| Certification: | Analysis certification (both of the analyst and the zone) are presented |



Scenario Coverage Results

Effigy provides scenario coverage results of the FGS mapping activity. Scenario coverage is defined in ISA TR 84.00.07 as the fraction of release scenarios at an elevation of interest where if a fire or gas cloud were to exist, would be detected by the FGS detector array. Separate results are prepared for gas detection and for fire detection.

Geographic Risk Map:

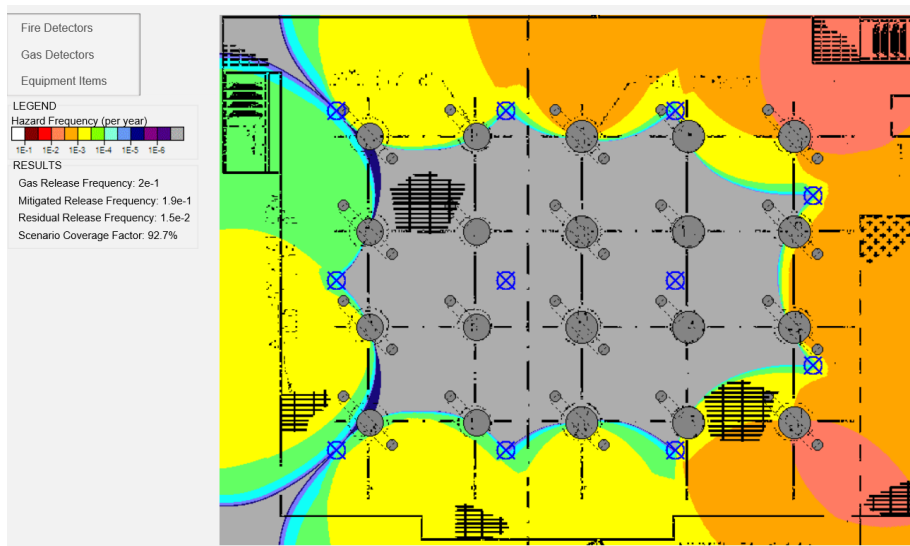
Since scenario coverage cannot be visualized directly, a geographic RISK map is used to visualize risk and coverage. A colorized map is provided that, by way of color, the frequency at which a gas cloud or a fire will exist in a given location. These maps can be generated in unmitigated and mitigated versions. The unmitigated simply shows all of the releases, whereas the mitigated map removes the detected scenarios, only showing the frequency of scenarios that are not detected.

Tabular Results:

Tabular results are also calculated. The tabular include the total release frequency, the total frequency of detected scenarios, the total frequency of undetected scenarios (residual), and the calculated scenario coverage as a percentage.

Certification:

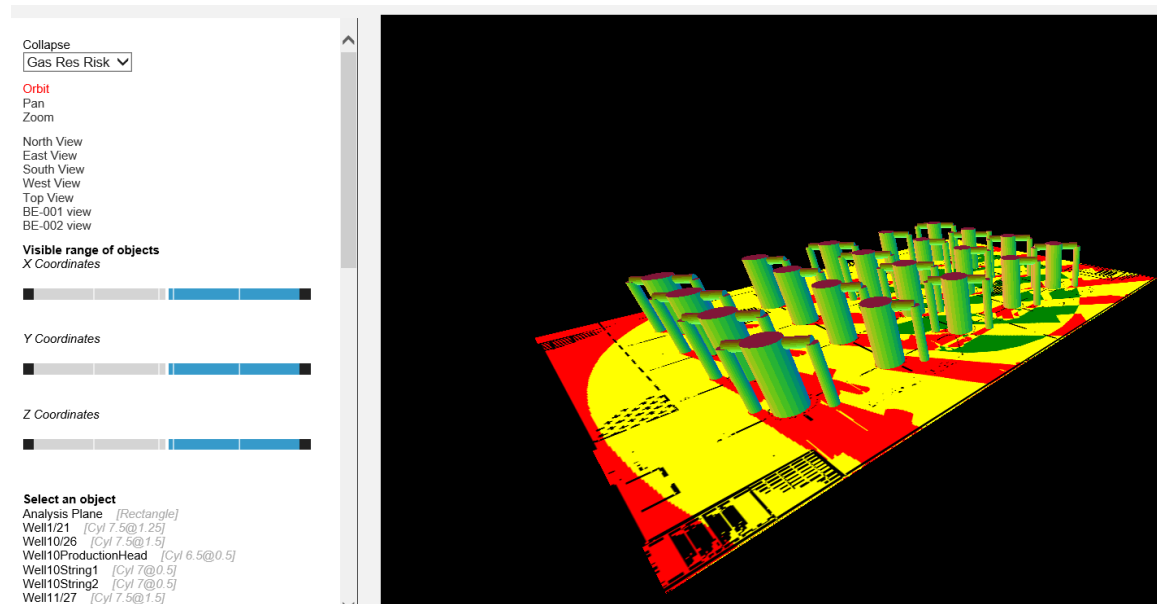
Analysis certification (both of the analyst and the zone) are presented



3D Viewer

While the ISA 84.00.07 technical report defines coverage in terms of area of an elevation of interest, there is a great deal of value provided by view and manipulating a process facility (and the associated mapping) fully in three dimensions. Effigy provide a three dimensional viewer for this purpose.

- 3D View Controls:** Viewing in 3D is done by mouse actions depending on the view control mode. The view control modes are Pan, Zoon, and Orbit.
- Overlay:** The overlay graphic and the elevation of interest mapping results can be displayed in the 3D graphic. The specific set of results to be presented is user selectable.
- Predefined Views:** Several pre-defined views can be selected, including the 4 compass points, Top, Bottom, and the view of each optical fire detector.
- Equipment List:** Each equipment item is shown and listed. Each item can also be selected and removed from the view. When a specific item is selected, all other items are shown in wireframe.
- Detector List:** A three dimensional representation of the field of view or field of coverage for all detectors is presented. Each of these views can be selectively removed or added – one at a time.



Validation

Effigy has been extensively validated to demonstrate that the results presented are accurate. The validation include checks for faithful reproduction of vendor cone-of-vision data in multiple different angles and a multiple different sensitivity and fire size RHO settings, checks for faithful determination of obstruction shadow creation for multiple obstruction geometries, and checks for faithful scenario development and detection.