



SOFTWARE

Effigy Fire & Gas Mapping

User's Manual

V 5.0.3 – Rev 7



Introduction

This guide describes how to use the Effigy Fire and Gas Mapping Software. Effigy is a module in the Kenexis Instrumented Safeguard Suite (KISS). KISS provides technical safety and security professionals with a cloud-based multi-user platform for the design of engineered safeguards.

Because new features are added frequently, you are encouraged to check the version number on the cover page of this manual to ensure that you are reading the most current version of this manual which corresponds with the active version of Effigy.

About Kenexis

Kenexis is an independent engineering consulting firm. We ensure the integrity of instrumented safeguards and industrial networks. Using skills in risk analysis, reliability engineering, and process engineering, we help establish the design and maintenance specification of instrumented safeguards, such as safety instrumented systems (SIS), alarm systems and fire and gas systems. We use the same skills for industrial control systems (ICS) network design, cyber security assessments, and industrial network performance analysis.

Table of Contents



- Introduction 2
- About Kenexis 2
- 1.1 Instructions for First Time Login 5
- 1.2 Login Troubles 7
- 1.3 Other Resources 9
- 2.1 The Navigation Toolbar 10
- 2.2 Study Object List View 12
 - 2.2.1 Fire Detector List View 12
 - 2.2.2 Gas Detector List View 13
 - 2.2.3 Equipment Items List View 14
- 2.3 Study Overview Page 15
 - 2.3.1 General Organization 16
 - 2.3.2 The Study Overview Tab 16
 - 2.3.3 The Grading Definitions Tab 18
 - 2.3.4 The Wind Data Tab 18
- 2.4 FGS Layout Page 19
- 2.5 Area Grading Page 21
- 2.6 Fire Geographic Coverage Page 22
 - 2.6.1 Fire Detector Coverage Map 22
 - 2.6.2 Numerical Coverage Results 23
- 2.7 Gas Geographic Coverage Page 23
 - 2.7.1 The Gas Detector Coverage Map 24
 - 2.7.2 Numerical Coverage Results 24
- 2.8 Fire Geographic Risk Page 25
- 2.9 Fire Residual Risk Page 26
- 2.10 Gas Geographic Risk Page 27
- 2.11 Gas Residual Risk Page 28
- 2.12 Run Calculations Page 29

Table of Contents



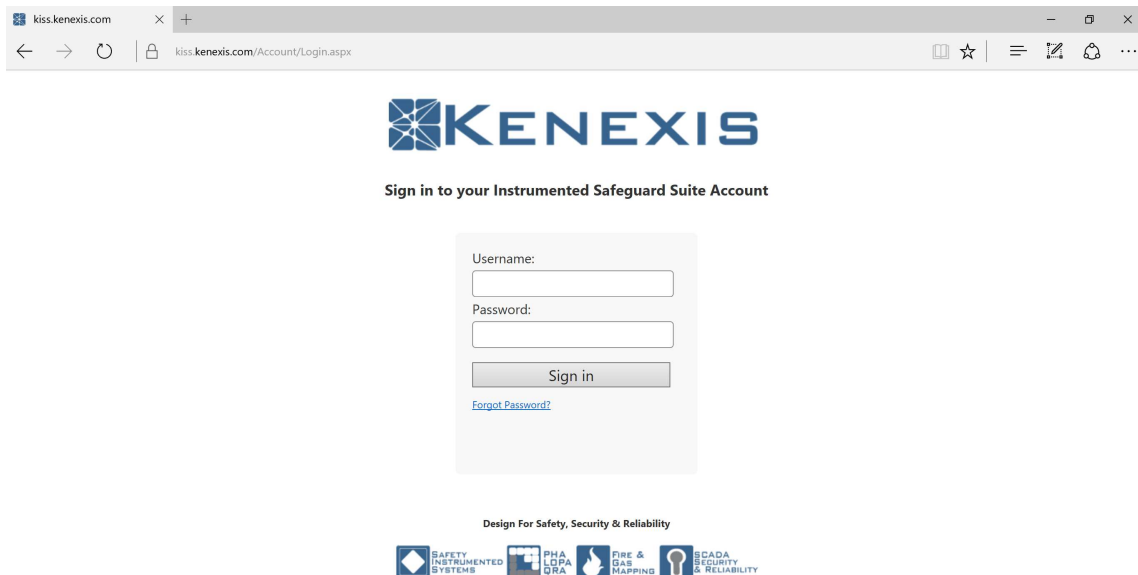
- 2.13 Study Settings Page 31
 - 2.13.1 General Settings Tab 31
 - 2.13.2 Default Fire Detector Settings 33
 - 2.13.3 Default Gas Detector Settings..... 33
- 2.14 Copying a Study 33
- 2.15 Deleting a Study..... 34
- 2.16 Exporting & Importing Study Data 35
 - 2.16.1 Exporting 35
 - 2.16.2 Importing 36
- 2.17 3D View Page 37
 - 2.17.1 View Controls 38
 - 2.17.2 Results..... 39
 - 2.17.3 Fire Detectors..... 40
 - 2.17.4 Gas Detectors..... 40
 - 2.14.5 Equipment Items..... 41
- 3.1 Advanced Topics..... 42
 - 3.1.1 Outdating of Results 42
 - 3.1.2 Units and Scaling..... 45
 - 3.1.3 Scenario Coverage – The Offset Function..... 46
 - 3.1.4 Fire Calculation Model 48
 - 3.1.5 Importing a 3D Model..... 51

Section 1 – Getting Started



1.1 Instructions for First Time Login

Welcome to Kenexis Instrumented Safeguard Suite (KISS). If you are new to the Kenexis Instrumented Safeguard Suite (KISS) you should have received a welcome package via email with your login credentials. Once you have received this package, it means that your account has been configured and is ready to use. You can access your account by directing your browser to <https://kiss.kenexis.com>. This will navigate your browser to the KISS login page, shown below.



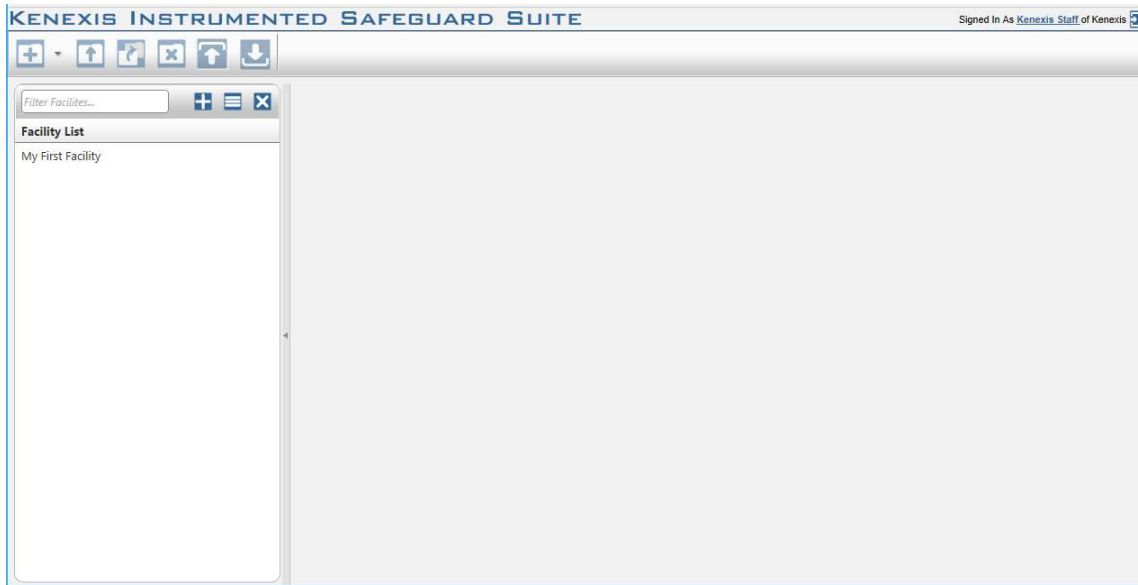
From here you can login using the login credentials provided in your KISS welcome email. If you’ve lost your temporary password, it can be restoring by using the “Forgot Password?” link. If you’ve lost your username, please contact support@kenexis.com for assistance.

Section 1 – Getting Started

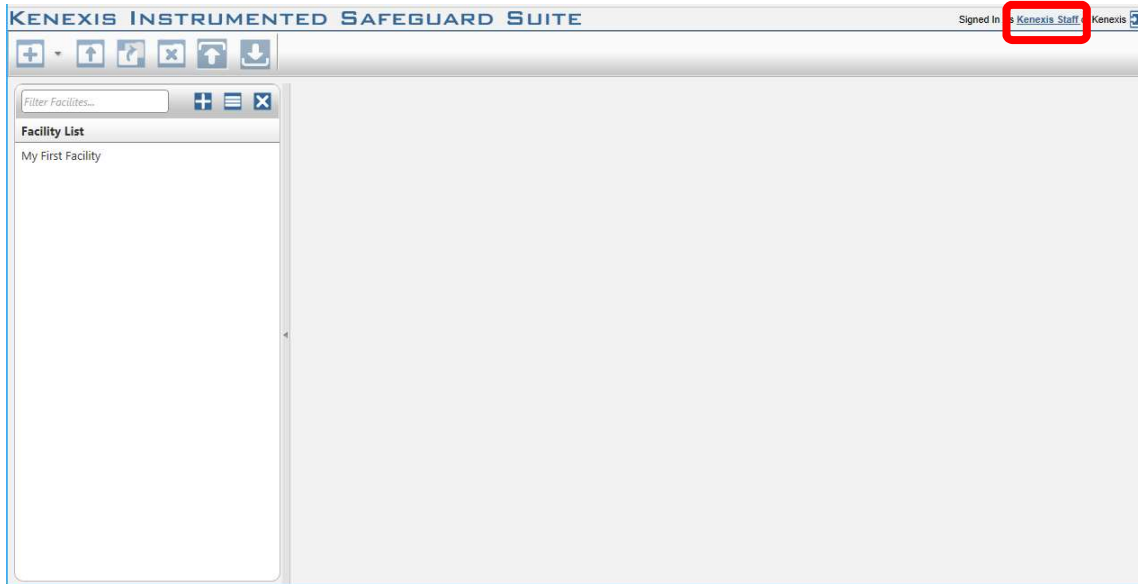


GETTING STARTED

After Successful login, you should arrive at the Study Manger page, shown below.



From here, it is highly recommended that you reset your temporary password. You can reset your password by clicking on your name in the top right corner.



This will open your account settings where you have the option to change your password.

Section 1 – Getting Started



Account Settings

User Information

Username: sean.cunningham@kenexis.com

First Name:

Last Name:

Default Print Size:

Change Password

Current Password:

New Password:

Confirm New Password:

Application Status

Name	Version	Access Type	Expiration Date	Certification Number	Certification Exp Date
Arbor	0.0.4.8	Edit	01 Jan 2025	Uncertified	N/A
FGS Design Basis	5.0.2.12	Edit	01 Jan 2023	FGS-EFF-900-001-L3	Jan 1 2023
KISS Manager	2.0.8.6		N/A	N/A	N/A

1.2 Login Troubles

This section describes some of the common causes and solutions for trouble with logging into the Kenexis Instrumented Safeguard Suite (KISS).

Problem #1: I forgot my password

Solution: Visit Kiss.Kenexis.com and click on the "Forgot Password?" link.

Problem #2: I forgot my username

Solution: Contact Support@Kenexis.com to restore your account

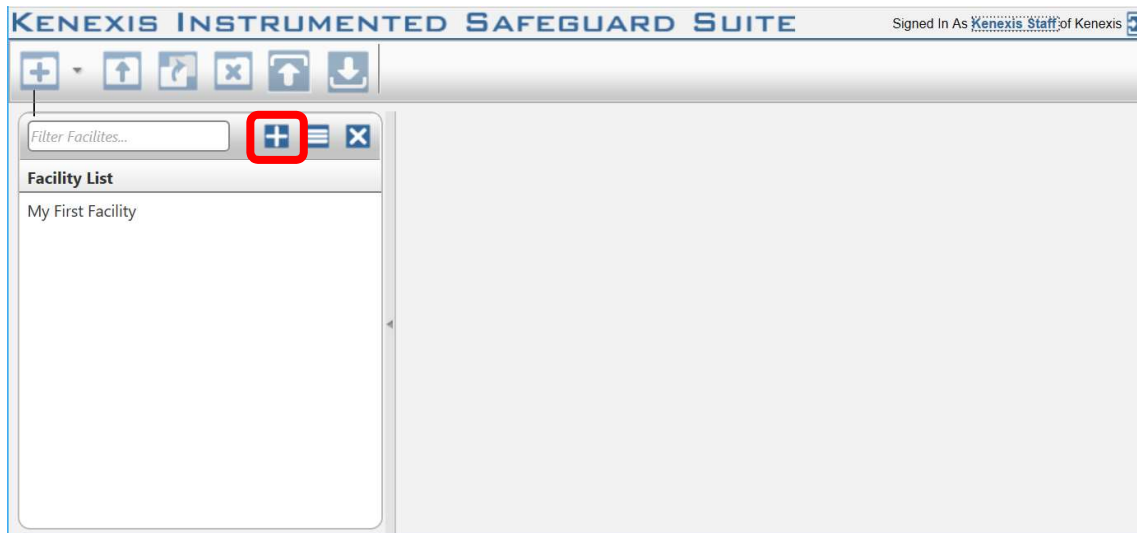
Problem #3: When I login I don't see any studies on the Study Manager Page

Solution: If you are not able to view any facilities or studies on the Study Manager page it is because you do not have access to any study information. Depending on your roles within your company you may have privileges to create a new facility by clicking on the Add Facility button (shown below).

Section 1 – Getting Started

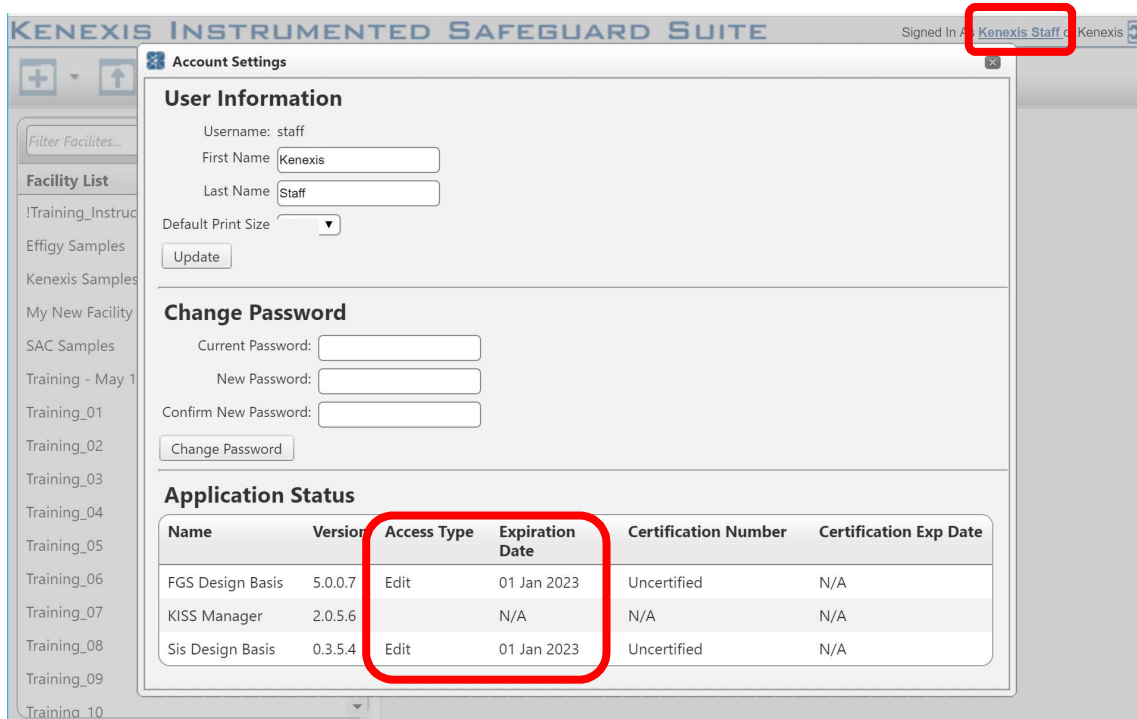


GETTING STARTED



If you are a first time user of Effigy and unfamiliar with the data structure you may want to consider following the "Creating Your First Study" tutorial.

Alternatively, if your account has been assigned read-only permissions you will need to contact your project manager/company administrator to grant you access to the desired studies. You can view your account permissions on your account settings window, which is accessed by clicking on your name in the top right corner.



Section 1 – Getting Started



1.3 Other Resources

In addition to the information provided in this user’s manual, help and support for use of the Effigy Fire and Gas Mapping Software can also be obtained from the following resources:

- Online or Instructor Based Training Course - A full list of these available courses can be found at www.kenexis.com/training.
 - Performance Based Fire and Gas System Design
 - Using the Kenexis Effigy Fire and Gas Mapping Toolkit
- Books and other Kenexis publications relating to reliability engineering methodologies, including:
 - Books
 - Kenexis Fire and Gas Systems Engineering Handbook
 - Papers and Magazine Articles
 - Kenexis Employee Blog Posts
- Live Support from Kenexis Staff. Support requests can be submitted to Kenexis staff via the Kenexis support system, which can be accessed from <https://support.kenexis.com>.






Section 2 - Interface



2.1 The Navigation Toolbar











The navigation toolbar serves as the primary means for navigating the Effigy study editor interface and appears on all pages in the editor. This section details the available buttons on the toolbar:

Button	Description
	The Overview button will navigate to the Study Dashboard page for the active study.
	The Fire Geo button will navigate to the Geographic Fire Detector Coverage Map for the active study. The Fire Geo page displays both numerical and graphical results of a geographic coverage mapping assessment.
	The Gas Geo button will navigate to the Geographic Gas Detector Coverage Map for the active study. The Gas Geo page displays both numerical and graphical results of a geographic coverage mapping assessment.
	The Fire Geo Risk button will navigate to the Fire Geographic Risk Map for the active study. The geographic risk map is used only for scenario coverage mapping.
	The Gas Geo Risk button will navigate to the Gas Geographic Risk Map for the active study. The geographic risk map is used only for scenario coverage mapping.
	The Fire Res Risk button will navigate to the Fire Residual Risk Map for the active study. The residual risk map is used only for scenario coverage mapping and reports both numerical and graphical results.


Section 2 - Interface



Button	Description
	<p>The Gas Res Risk button will navigate to the Gas Residual Risk Map for the active study. The residual risk map is used only for scenario coverage mapping and reports both numerical and graphical results.</p>
	<p>The FGS layout button will navigate to the fire and gas detector layout page for the active study. The fire and gas detector layout page displays a plot view diagram of the zone and all elements within the zone including fire detectors, gas detectors and obstructions.</p>
	<p>The grading button will navigate to the area grading diagram for the active study. The area grading diagram displays the locations of all graded areas within the zone.</p>
	<p>The 3D view button will navigate to the 3D view page. On this page you can interact with the model in 3 dimensions by rotating, panning and zooming.</p>
	<p>The run calculations button will navigate to the calculations page for the active study. The calculations page is used to begin the process of calculating fire and gas detector coverage and view the state of calculations / results for each calculation type.</p>
	<p>The print button is used to export information results for the current study. Use the selection tree to select information available for printing.</p>
	<p>The Study Settings button will navigate to the settings page for the active study. The study setting page contains various study-specific parameters such as units of length and calculation types.</p>
	<p>The export study button will allow you to export all the study data for your effigy study as worksheets in a Microsoft Excel file (.xlsx file format) as well as all of the image files associated with the study. This</p>

Section 2 - Interface



Button	Description
	includes, overlays and results images.. Exported studies can be modified in excel and imported back into effigy.
	The Back to Study List button will navigate to the Study Manager page.

2.2 Study Object List View

The study object list view is displayed on all pages in the Effigy study editor (with the exception of the 3D View page). The list view is used to select and display properties for elements within the active Effigy study. These elements include:

- Fire Detectors
- Gas Detectors
- Obstructions
- Fire Scenarios
- Gas Scenarios
- Graded Areas



2.2.1 Fire Detector List View

+ Add New Record									
NAME	TYPE	LOC X	LOC Y	LOC Z	DECLINATION	ROTATION	RHO (KW)	ENABLED	
<u>FD-001</u>	Generic MSIR	1	19	6	-35	-45	50	<input checked="" type="checkbox"/>	✖
<u>FD-002</u>	Generic MSIR	1.1	1	6	-35	45	50	<input type="checkbox"/>	✖
<u>FD-003</u>	Generic MSIR	19.5	1	6	-35	135	50	<input type="checkbox"/>	✖
<u>FD-004</u>	Generic MSIR	19.5	19	6	-35	-135	50	<input checked="" type="checkbox"/>	✖

Selecting “Fire Detectors” in the study object list view will navigate to the fire detector list view. This page provides details about the fire detectors that have been inserted

Section 2 - Interface



into the Effigy study. Detectors can be enabled and disabled by checking and unchecking the boxes on the right side of the list.

Fire detectors can be added by selecting “Add New Record” at the top of the fire detector list. Existing fire detector attributes can be modified by selecting the detector tag in the fire detector list. A form will be opened to specify attributes of the fire detector.

Fire Detector Details

Name

Manufacturer

Model

Hazard

Sensitivity

Location X m Y m Z m

Declination ° Rotation ° RHO kW

Attributes ° ° kW

2.2.2 Gas Detector List View

+ Add New Record

NAME	TYPE	LOC X	LOC Y	LOC Z	REC X	REC Y	REC Z	DETECTABLE CONCENTRATION	CRITICAL CLOUD DIAMETER	ENABLED
<input type="text"/>	<input type="text"/>									
1	Det-Tronics PIR9400	3	4	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
10	Det-Tronics PIR9400	15.75	4.25	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
2	Det-Tronics PIR9400	3	12.5	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
3	Det-Tronics PIR9400	11.5	4	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
4	Det-Tronics PIR9400	11.5	12.5	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
5	Det-Tronics PIR9400	20	4	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
6	Det-Tronics PIR9400	20	12.5	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
7	Det-Tronics PIR9400	7.25	4.25	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
8	Det-Tronics PIR9400	7.25	8.5	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>
9	Det-Tronics PIR9400	15.75	8.5	3	0	0	0	500	10	<input checked="" type="checkbox"/> <input type="checkbox"/>

Selecting “Gas Detectors” in the study object list view will navigate to the gas detector list view. This page provides details about the gas detectors that have been inserted into the Effigy study. Detectors can be enabled and disabled by checking and unchecking the boxes on the right side of the list.

Gas detectors can be added by selecting “Add New Record” at the top of the gas detector list. Existing gas detector attributes can be modified by selecting the detector tag in the gas detector list. A form will be opened to specify attributes of the gas detector.

Section 2 - Interface



The screenshot shows a dialog box titled "Gas Detector Details". It contains the following fields and controls:

- Name:
- Type:
- Location: X m, Y m, Z m
- Receiver Location: X m, Y m, Z m
- Detectable Concentration:
- Critical Cloud Diameter: m
- Buttons: Insert, Cancel

2.2.3 Equipment Items List View

+ Add New Record					Duplicate Records
OBSTRUCTION	OBSTRUCTION	GRADED AREA	FIRE SCENARIO	GAS SCENARIO	
deck_001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Deck_002	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Inst_Cabinet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
stairs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_002	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_003	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_004	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_005	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_006	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_007	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_008	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_009	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_010	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_011	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_012	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_013	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_014	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_015	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_016	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Selecting “Equipment Items” in the study object list view will navigate to the equipment item list view. This page provides details about the equipment items that have been inserted into the Effigy study. The checkboxes in the list can be used to define if an equipment item is defined as any one of combination of the following:

- Obstruction

Section 2 - Interface



- Graded Area
- Fire Scenario
- Gas Scenario

Insert / Update Equipment Item

Obstruction | Grading | Fire Scenario | Gas Scenario

Name:

Type:

Description:

Obstruction:

Location: X m Y m Z m

Size: Z m Radius m

Equipment items can be added by selecting “Add New Record” at the top of the equipment item list. Existing equipment item attributes can be modified by selecting the detector tag in the gas detector list. A form will be opened to specify attributes of the equipment item. There are separate tabs to change attributes of the different aspects of the equipment item.

Note: If a change to location or size needs to be updated on all aspects of the equipment item (e.g. Obstruction X Location and Grading X-Location), clicking the “Apply to All” button before the update button will apply the changes to all applicable tabs.

2.3 Study Overview Page

KEREXIS - EFFIGY Sample Wellbay Signed in as Kerexis Staff of Kerexis

Fire Detectors | Gas Detectors | Equipment Items

Overview | Grading Definitions | Wind Data

Name:

Asset Owner:

Project Number:

Zone Size: X m Y m Z m

North Orientation: Project True/False

Analysis: Elevation m

Detector Voting: Fire Gas

Revision Name:

Revision Notes:

The Study Overview page is the first page you will visit when either creating a new Effigy Study or editing an existing Effigy study. The Study Overview page provides high level details about the study you are viewing. Details on the study overview page include:

Section 2 - Interface



- Study Name
- General record keeping information (such are revision notes and project numbering)
- Zone Size and orientation information
- Detector Voting Configurations
- Definitions for FGS Grades
- Meteorological Data (for use in scenario coverage)

2.3.1 General Organization

The Study Overview page contains three primary sets of controls. At the top of the page the Action Ribbon is used to navigate between different pages within a study. At the left of the page the Study Object List View which is used to view details and properties for elements within a study. In the main work space is the overview, grading definitions and wind data tabs.

2.3.2 The Study Overview Tab

The Study Overview tab contains the following properties of an effigy study:

- Study Name - The study name is used to track and display the study in the Study Manager Table. Study names are not required to be unique. However, a study name must be entered before an effigy study can be created.
- Asset Owner - Text Field to allow for good record keeping. The asset owner field can be a null value.
- Project Number - Text Field to allow for good record keeping. The project number field can be a null value.
- Zone Size - X, Y & Z dimensions of the area to be analyzed in the study. Values are entered in "Display Units" which must be selected on the overview tab when a study is created. See display units below.
- North Orientation - Orientation of the zone with respect to True North and Project (Plant) North. These fields are used to display zone orientation on the printouts generated by Effigy. The intent is to provide the reader with a sense of direction when viewing a printout to make results more easily interpreted.
- Analysis Elevation - The desired elevation to graphically represent the Fire and Gas mapping results. Value is entered in "Display Units" which must be selected on the overview tab when a study is created. Also, see display units below. For more details on analysis elevation visit the Technical References help section.

Section 2 - Interface



- Detector Voting - The desired fire and gas detector voting configuration. These values are used to determine the detector coverage for scenario coverage mapping. Selecting 2ooN will require that two or more detectors are capable of detecting a scenario in order for the scenario to be "detectable". For more information on detector voting visit the Technical References help section.
- Revision Name - Text Field to allow for good record keeping. The revision name field can be a null value.
- Revision Notes - Text Field to allow for good record keeping. The revision notes field can be a null value. When creating a new effigy study the study overview must be completed before proceeding to other data input tasks.
- Overlay – The Overlay that will be used on all result maps. This is optional and can be left null.

Section 2 - Interface



2.3.3 The Grading Definitions Tab

The grading definitions tab is used to enter FGS grading parameters which are applied to all fire and gas graded areas within an Effigy study. In order to enter parameters on the grading definitions tab you first need to select the number of grades that will be used in the study. The number of grades used in the study is selected from the drop-down menu near the top of the tab. Selecting a non-zero value from this menu will enable the appropriate data input boxes on the tab.

Note: Graded Areas cannot be created in the Equipment List until grading is defined on the grading definitions tab.

Determining the appropriate coverage targets and inclusions distances is a complex task based on consequence and risk analysis methods. For many operating companies these targets and distances are often specified in corporate standards or guidelines on performance based fire and gas system design. When creating a new Effigy study these values will be prepopulated with targets and distances which are in line with typical values used by operating companies in the process industries. Adjusting the default values for coverage targets and inclusion distances is not recommended without a strong technical justification.

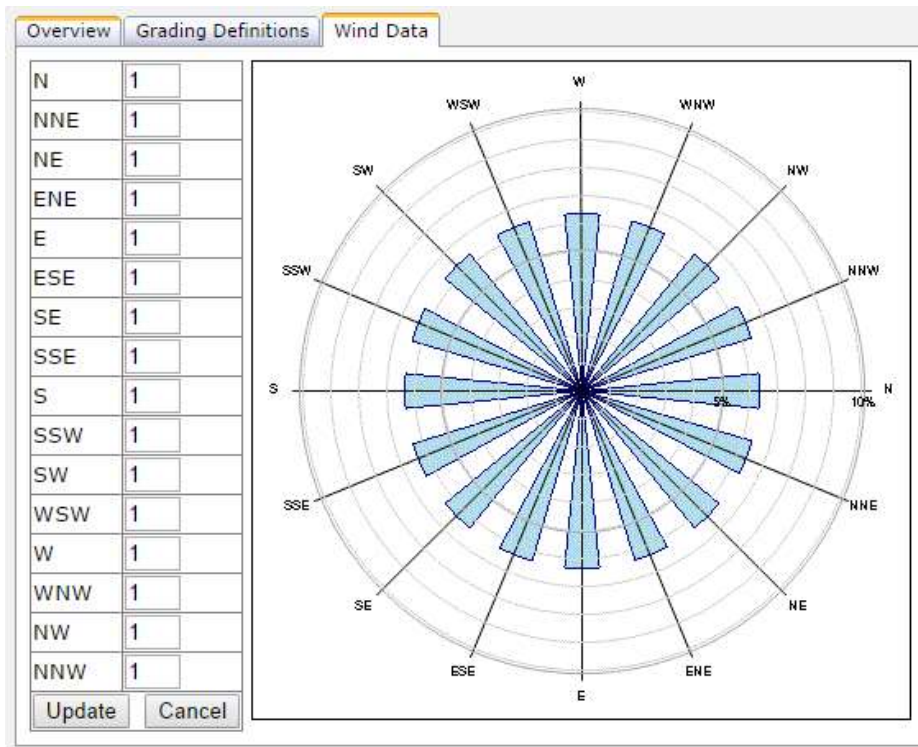
2.3.4 The Wind Data Tab

The wind data tab is used to enter information about meteorological conditions for an Effigy Study. Contained in the wind data tab is a wind rose that can be populated by probabilities of wind directions. Probabilities can be entered as decimal or integer values. Upon update of the wind data tab the probability values entered will be automatically normalized (i.e. all values will be summed and the probability for each direction will be calculated by dividing by the sum of all values entered). Wind probabilities entered on the wind data tab are used to determine the probability of directional gas releases in the gas scenario coverage calculations.

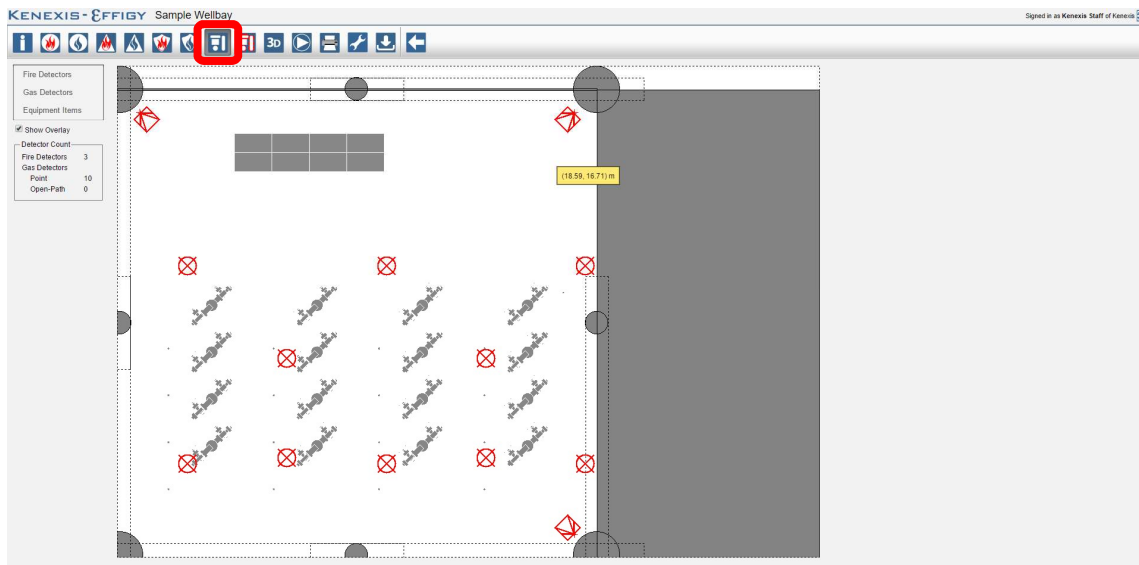
Section 2 - Interface



INTERFACE



2.4 FGS Layout Page




The FGS Layout page contains a plot view map of the locations of fire detectors, gas detectors and obstructions within an Effigy study. The exact location of the mouse pointer within the study can be viewed by hovering the mouse pointer over the layout. By placing the pointer over an object, its location can be determined. This will display a

Section 2 - Interface





tooltip with the x and y location of the object. Objects are represented with the following notations.

Representation of Flame Detectors


 Optical Flame detectors are represented by a square with several lines to represent the direction in which the detector is viewing. In the image to the left the detector is pointed to the right. The lines inside of the square do not necessarily represent the field of view of the detector. They are only intended to represent direction.

Representation of Gas Detectors

 Gas Detectors are represented by a circle with an "x" through it. Point type gas detectors are represented by a single circle, while open-path type gas detectors are represented by two circles with a blue dashed line connecting them. This blue dashed line represents the path of the detector's IR beam.



Representation of Obstructions

 Obstructions are represented by dashed black lines and/or grey areas. Areas which are displayed in grey represent the cross section of the obstruction at the elevation of the analysis plane. Areas outlined by a dashed black line represent the extents of obstruction in the x-y plane at its largest point. For example, the image below represents a horizontal pressure vessel which is not centered at the elevation of the analysis plane. The area which is colored grey depicts the cross-sectional area of the vessel at the elevation of the analysis plane. The area outlined by the black dashed line represents the largest footprint of the vessel with respect to the x-y plane. For a horizontal pressure vessel, this occurs at the elevation of the center of mass (halfway between the top and bottom of the vessel).

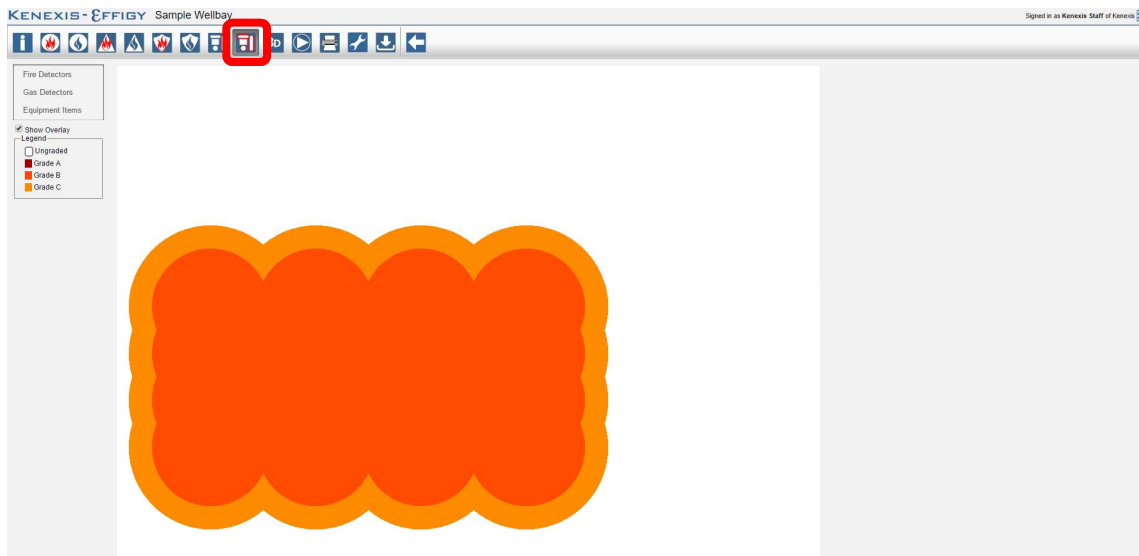
If an obstruction does not intersect the analysis plane at any point it is represented only as an outline.

Section 2 - Interface



INTERFACE

2.5 Area Grading Page

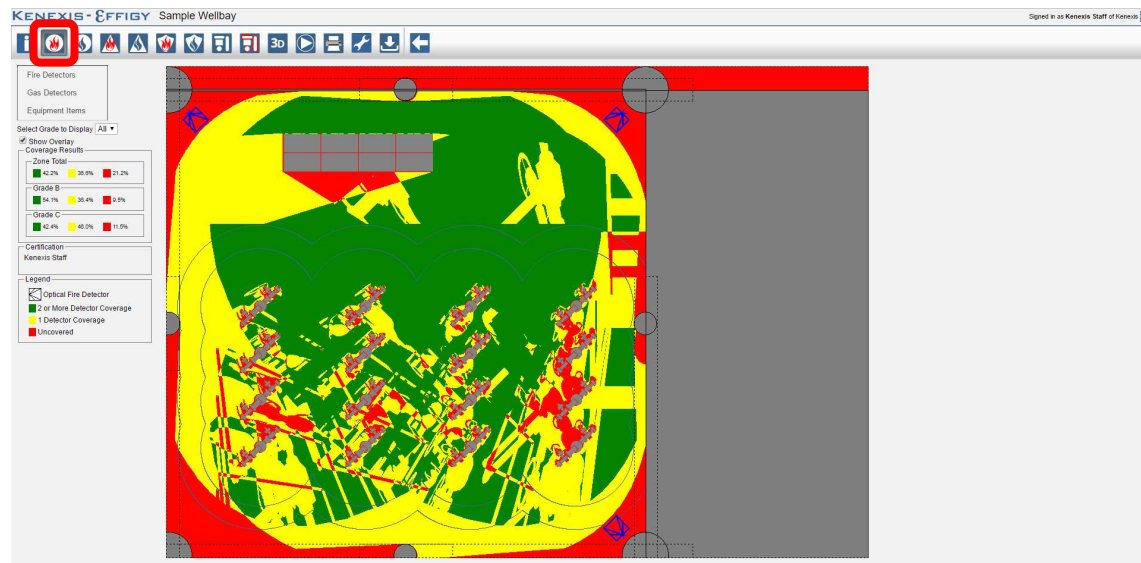


The area grading page contains a plot view of the graded areas within an Effigy Study. Graded areas are used to define an inclusion zone around a leak source that represents the area where a gas cloud or fire might exist if a release were to occur. The definitions for these extents are defined on the grading definitions tab of the study overview page. Once the coverage requirements and extents of graded areas have been defined on the study overview, specific graded can be entered in the tree view. These graded areas in the tree view represent potential leak sources, or areas of concern, where fire / gas detector coverage is required. The graded areas within an Effigy study are represented on the Area grading diagram with color coded areas which are defined by the legend on the left side of the page.

Section 2 - Interface



2.6 Fire Geographic Coverage Page



The Fire Geographic Coverage Page (Fire Geo) displays both graphical and numerical results for a geographic fire detector coverage calculation, including the fire detector coverage map and numerical percentage coverage results.

2.6.1 Fire Detector Coverage Map

The main workspace displays a two-dimensional representation of the detector coverage at the analysis elevation specified on the study overview page. This image is referred to as the Fire Detector Map. Objects (fire detectors and obstructions) are displayed on the map in the same fashion described on the FGS Layout Help Page. The extents of graded areas are also displayed as solid blue lines. In the above figure two graded area extents are present surrounding the horizontal pressure located near the center of the map.

Detector coverage is displayed based on a color-coded legend which is displayed below the study tree view. Areas which are green can be viewed by two or more detectors. Areas which are yellow can be viewed by one (and only one) detector. Areas which are red cannot be viewed by any detectors.

NOTE: The reported % coverage for 1 detector (yellow) does not correspond to 100N detector coverage, unless only a single detector is present in the study. In order to calculate the 100N coverage for a study with 2 or more detectors, the sum of the "% yellow" and the "% green" should be taken. The sum of these two values is the total area of the zone which is coverage by one or more detectors.

Section 2 - Interface



2.6.2 Numerical Coverage Results

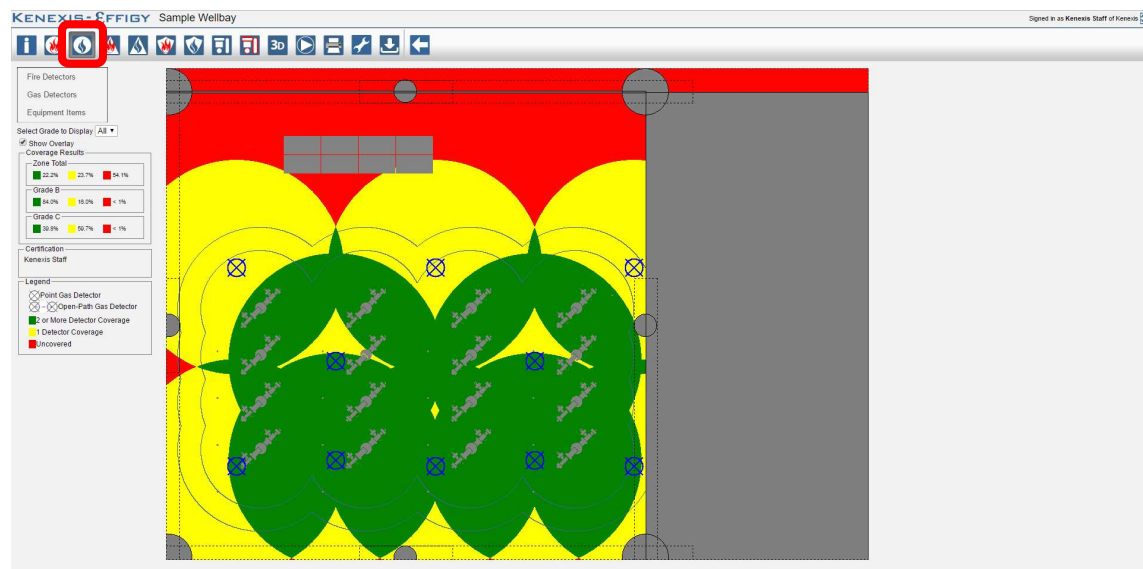
On the left side of the user interface below the study tree view are the following items:

Select Grade to Display Dropdown Menu - This control allows the user to select the area of the zone they would like to view. When the page is loaded this menu is set to show all areas of a zone. The area can be filtered to only include high risk, medium risk or low risk areas, where the level of risk is defined by the FGS grade. This control can be useful when optimizing detector placing by helping to identify where detector coverage is insufficient for each grade.

Coverage Results - This section of the page displays the numerical geographic coverage results. These results are presented in the form of a percent (%) coverage. For a geographic coverage assessment, these results represent the fraction of the geographic area which is covered by one or more flame detectors. For more details on interpreting the resulting, visit the interpreting geographic fire detector coverage map help page.

Certification - This section displays the zone certification status for the study.

2.7 Gas Geographic Coverage Page



The Gas Geographic Coverage Page (Gas Geo) displays both graphical and numerical results for a geographic gas detector coverage calculation, including the gas detector coverage map and numerical % coverage results.

Section 2 - Interface



2.7.1 The Gas Detector Coverage Map

The main workspace displays a two-dimensional representation of the detector coverage at the analysis elevation specified on the study overview page. This image is referred to as the Gas Detector Map. Objects (gas detectors and obstructions) are displayed on the map in the same fashion described on the FGS Layout Help Page. The extents of graded areas are also displayed as solid blue lines. In the above figure two graded area extents are present surrounding the horizontal pressure located near the center of the map.

Detector coverage is displayed based on a color-coded legend which is displayed below the study tree view. Areas which are green represents areas which are covered by two or more detectors. Areas which are yellow are covered by one (and only one) detector. Areas which are red are not covered (i.e. no detectors can detector a release from these areas).

NOTE: The reported % coverage for 1 detector (yellow) does not correspond to 100N detector coverage, unless only a single detector is present in the study. In order to calculate the 100N coverage for a study with 2 or more detectors, the sum of the "% yellow" and the "% green" should be taken. The sum of these two values is the total area of the zone which is coverage by one or more detectors.

2.7.2 Numerical Coverage Results

On the left side of the user interface below the study tree view are the following items:

Select Grade to Display Dropdown Menu - This control allows the user to selected the area of the zone which they would like to view. When the page is loaded, this menu is set to show all areas of a zone. The area can be filtered to only include high risk, medium risk or low risk areas where the level of risk is defined by the FGS grade. This control can be useful when optimizing detector placing by helping to identify where detector coverage is insufficient for each grade.

Coverage Results - This section of the page displays the numerical geographic coverage results. These results are presented in the form a percent (%) coverage. For a geographic coverage assessment, these results represent the fraction of the geographic area which is covered by one or more detectors. For more details on interpreting the resulting, visit the interpreting geographic gas detector coverage map help page.

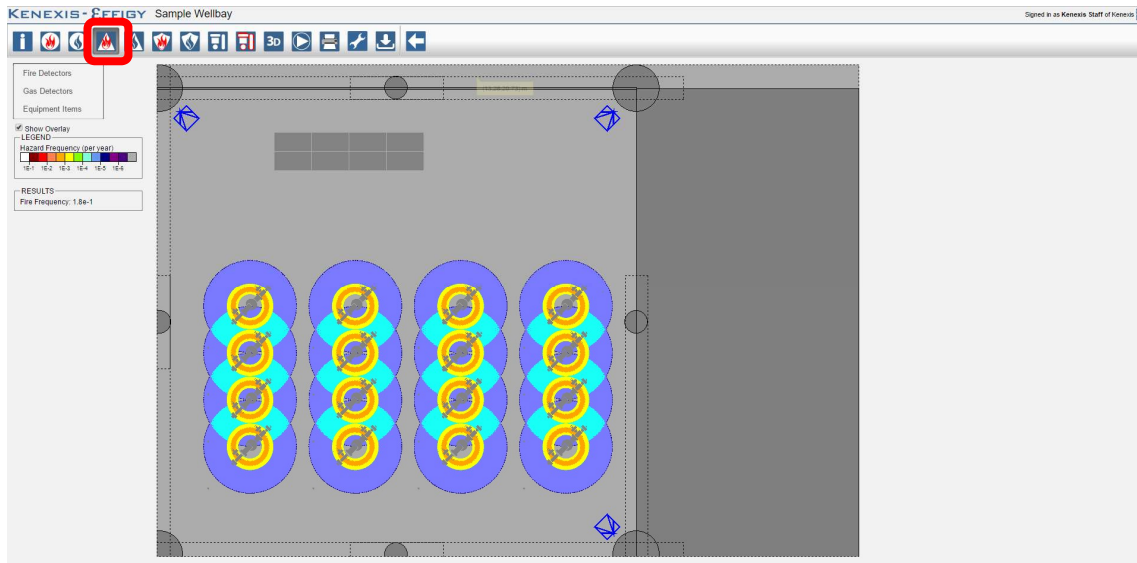
Certification - This section displays the user certification status for the study.

Section 2 - Interface

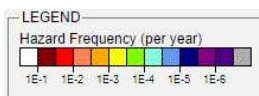


INTERFACE

2.8 Fire Geographic Risk Page



The Geographic Risk page displays both graphical and numerical results for a geographic risk assessment, which is part of the Effigy Detector Scenario Coverage calculation. The results of the geographic risk assessment are displayed graphically on the "Geographic Risk Map". The Geographic Risk Map displays geographic risk contours delineated by the color scheme defined in the legend to the left of the main workspace.



The colors in the legend are used as a proxy to represent the frequency of a fire or gas cloud at any given location. Each color represents a frequency range. For example, the color yellow represents a frequency from 1.0E-03 (1 in 1000 years) to 5.0E-03 (1 in 200 years). Note that this is a non-linear scale (i.e. each color does not represent an equal range of frequency. At the right side of the scale (low frequency) the range is small, while at the left side of the legend (high frequency) the range is large. The relationship between these ranges is logarithmic which ensures granularity in the risk contours regardless of the overall frequency of risk scenarios in the study.

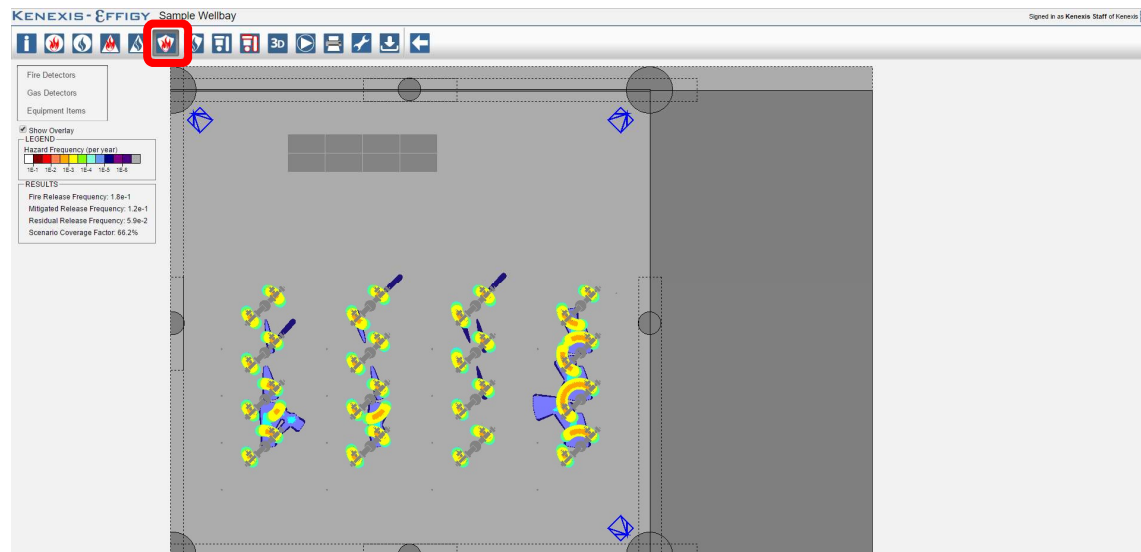
Below the legend, to the left of the main workspace, the overall frequency of a fire or gas release is reported. This is simply the summation of the frequency which was input for all fire scenarios within the study.

Section 2 - Interface

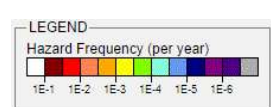


INTERFACE

2.9 Fire Residual Risk Page



The Residual Risk page displays both graphical and numerical results for a scenario coverage mapping assessment. In the context of FGS scenario coverage the residual risk is defined as the risk associated with fire or gas releases which are not detectable by the fire and gas system. These undetectable releases are displayed graphically on the "Scenario Coverage Map". The Scenario Coverage Map displays geographic risk contours delineated by the color scheme defined in the legend to the left of the main workspace.



The colors in the legend are used as a proxy to represent the frequency of a fire or gas cloud at any given location. Each color represents a frequency range. For example, the color yellow represents a frequency from 1.0E-03 (1 in 1000 years) to 5.0E-03 (1 in 200 years). Note that this is a non-linear scale (i.e. each color does not represent an equal range of frequency. At the right side of the scale (low frequency) the range is small, while at the left side of the legend (high frequency) the range is large. The relationship between this ranges is logarithmic which ensures granularity in the risk contours regardless of the overall frequency of risk scenarios in the study.

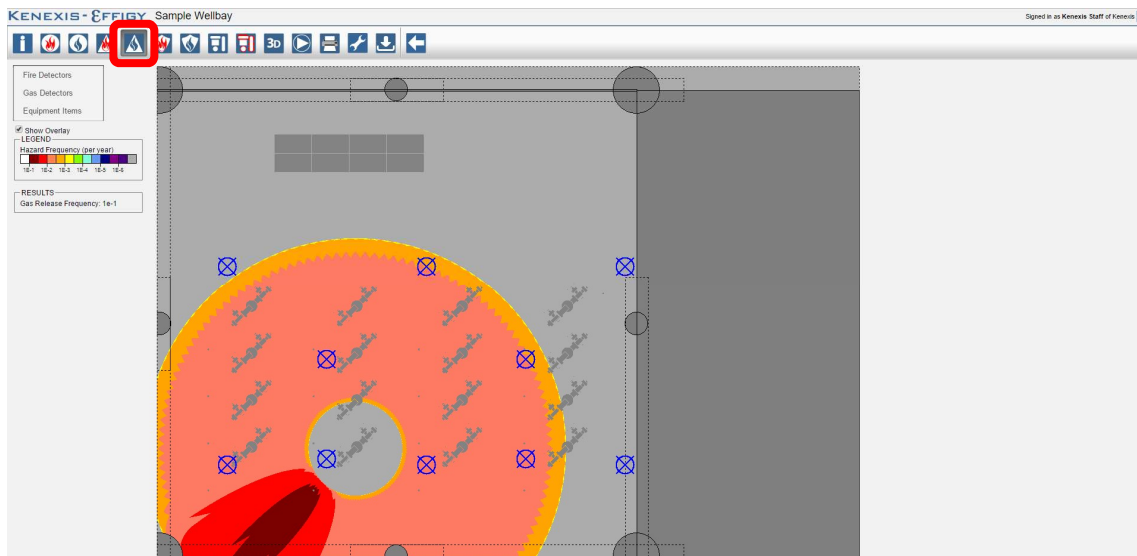
The numerical results of the scenario coverage assessment are displayed below the legend, to the left of the main workspace. The following results are tabulated.

Section 2 - Interface

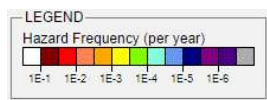


Results	Units	Description
Release Frequency	Events per year	The total event frequency for all fire scenarios in the study. Equal to the summation of the individual frequencies for each fire scenario.
Mitigated Release Frequency	Events per year	The total frequency of mitigated (detected) fires.
Residual Release Frequency	Events per year	The total frequency of unmitigated (undetected) fires.
Scenario Coverage	Percent (%)	The percentage of fires which are detectable.

2.10 Gas Geographic Risk Page



The Geographic Risk page displays both graphical and numerical results for a geographic risk assessment, which is part of the Effigy Detector Scenario Coverage calculation. The results of the geographic risk assessment are displayed graphically on the "Geographic Risk Map". The Geographic Risk Map displays geographic risk contours delineated by the color scheme defined in the legend to the left of the main workspace.



The colors in the legend are used as a proxy to represent the frequency of a fire or gas cloud at any given location. Each color represents a frequency range. For example, the color yellow

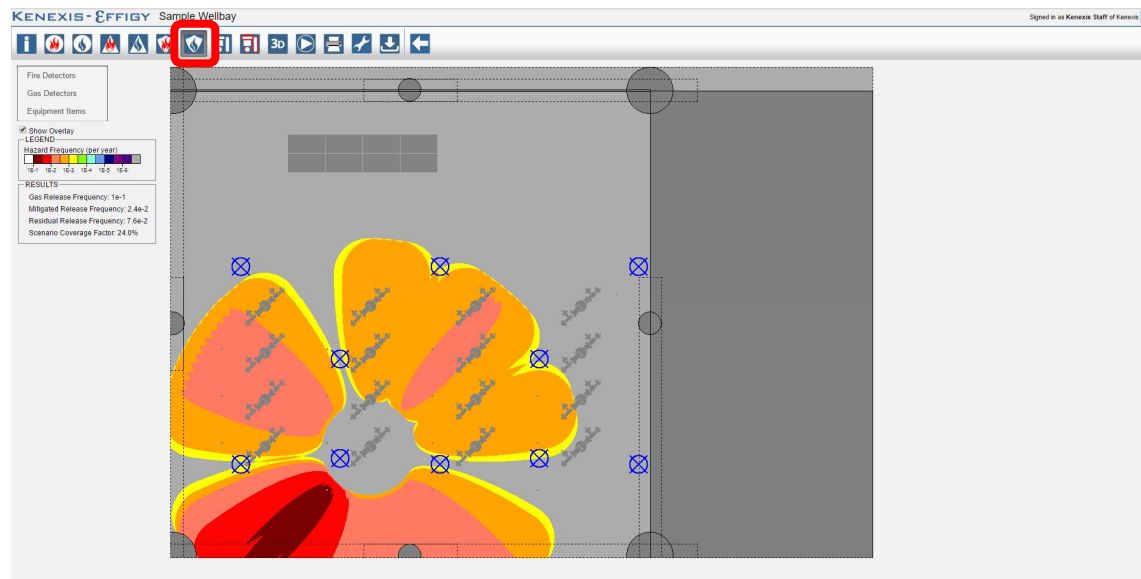
Section 2 - Interface



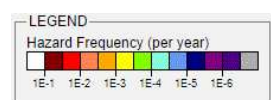
represents a frequency from 1.0E-03 (1 in 1000 years) to 5.0E-03 (1 in 200 years). Note that this is a non-linear scale (i.e. each color does not represent an equal range of frequency. At the right side of the scale (low frequency) the range is small, while at the left side of the legend (high frequency) the range is large. The relationship between these ranges is logarithmic which ensures granularity in the risk contours regardless of the overall frequency of risk scenarios in the study.

Below the legend, to the left of the main workspace the overall frequency of a fire or gas release is reported. This is simply the summation of the frequency which was input for all gas scenarios within the study.

2.11 Gas Residual Risk Page



The Residual Risk page displays both graphical and numerical results for a scenario coverage mapping assessment. In the context of FGS scenario coverage the residual risk is defined as the risk associated with fire or gas releases which are not detectable by the fire and gas system. These undetectable releases are displayed graphically on the "Scenario Coverage Map". The Scenario Coverage Map displays geographic risk contours delineated by the color scheme defined in the legend to the left of the main workspace.



The colors in the legend are used as a proxy to represent the frequency of a fire or gas cloud at any given location. Each color represents a frequency range. For example, the color yellow

represents a frequency from 1.0E-03 (1 in 1000 years) to 5.0E-03 (1 in 200 years). Note

Section 2 - Interface

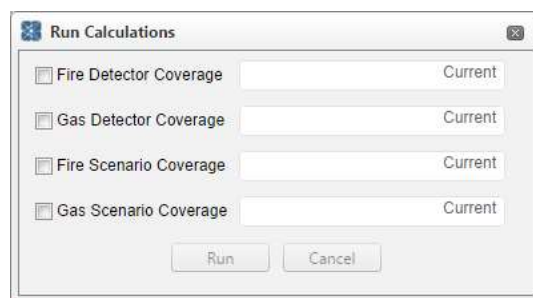


that this is a non-linear scale (i.e. each color does not represent an equal range of frequency. At the right side of the scale (low frequency) the range is small, while at the left side of the legend (high frequency) the range is large. The relationship between this ranges is logarithmic, this ensures granularity in the risk contours regardless of the overall frequency of risk scenarios in the study.

The numerical results of the scenario coverage assessment are displayed below the legend, to the left of the main workspace. The following results are tabulated.

Results	Units	Description
Release Frequency	Events per year	The total event frequency for all fire scenarios in the study. Equal to the summation of the individual frequencies for each fire scenario.
Mitigated Release Frequency	Events per year	The total frequency of mitigated (detected) fires.
Residual Release Frequency	Events per year	The total frequency of unmitigated (undetected) fires.
Scenario Coverage	Percent (%)	The percentage of fires which are detectable.

2.12 Run Calculations Page



All Fire and Gas mapping calculations are initiated from the run calculations page. The following four calculation types are available.

Section 2 - Interface



Fire Detector Coverage	This calculation will run a fire detector geographic coverage assessment. Results for this calculation are shown on the Fire Geographic Coverage Page.
Gas Detector Coverage	This calculation will run a gas detector geographic coverage assessment. Results for this calculation are shown on the Gas Geographic Coverage Page.
Fire Scenario Coverage	This calculation will run a fire detector scenario coverage assessment. A fire detector scenario coverage assessment includes both the calculation of geographic risk, which is reported on the Fire Geographic Risk Page, and calculation of residual risk/scenario coverage, which is reported on the Fire Residual Risk Page.
Gas Scenario Coverage	This calculation will run a gas detector scenario coverage assessment. A gas detector scenario coverage assessment includes both the calculation of geographic risk, which is reported on the Gas Geographic Risk Page, and calculation of residual risk/scenario coverage, which is reported on the Gas Residual Risk Page.

Each Calculation type can be selected independently by using the check boxes to the left of main workspace. Certain calculation types require other calculations to be completed first as an input to the model. In these cases, the required proceeding calculations will automatically be selected.

A calculation status bar is provided for each calculation type to provide feedback on the state of the calculations. The possible calculation statuses include:

None	No calculations have been performed, calculations are waiting to be run.
Out of Date	Calculations have previously been performed. A change has been made to variables in the study that require calculations to be performed again.
Current	The Results of the calculation are up to date.

Section 2 - Interface

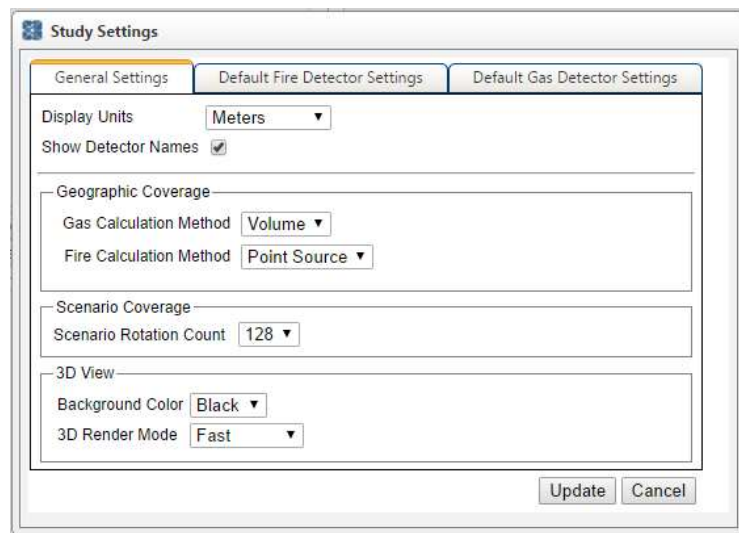


Pending The calculation is either underway or the calculation has been selected to be performed and the program is awaiting a decision from the user to "Run" or "Cancel" calculations.

Because fire and gas mapping studies can become large and calculations can become time consuming, it is possible to leave the run calculations page during a calculation. The calculation will be completed while you are away and a "complete" message will be displayed when you return. All calculations are performed server-side, meaning that even disconnecting from the KISS server will not prevent completion of calculations. Once the run button has been selected the calculations will be completed unless the cancel button is selected during the calculation.

2.13 Study Settings Page

The Study Settings page contains study specific settings and allows you to specify default settings for fire and gas detectors.



2.13.1 General Settings Tab

The general settings tab contains the following study specific settings:

Display Units This setting adjusts the engineering units of length which are used to input data into the study. This setting is a requirement be entered on the Study Overview Page when creating a new zone, but can be adjusted from the study settings page.

Section 2 - Interface



INTERFACE

	<p><i>NOTE: Changing the Display Units will NOT convert existing data in the study to the newly selected units. For example, changing from centimeters to meters will not convert 10 cm to 0.1 m. The program will recognize this data as 10 meters after display units are changed from centimeters to meters.</i></p>
Show Detector Names	When this option is selected the tag of a detector will be visible when hovered over with the pointer in the FGS Layout Page.
Gas Calculation Method	The type of calculation can be adjusted for gas geographic coverage to either analyze the coverage for the study volume or the study area at the analysis elevation. The calculation type is set by default to volumetric coverage, however area coverage is also selectable in order to allow for strict compliance with the guidance of the FGS mapping methodologies defined by ISA TR 84.00.07 .
Fire Calculation Method	<p>This setting allows the user to adjust the type of calculation for fire geographic coverage to either a point source model or a plume model. When plume model is selected, the option to set the plume height and plume width become available.</p> <p>See Section 3.1.4 for Fire Calculation Model details.</p>
Scenario Rotation Count	This setting adjusts the number of rotations that are performed for both Fire Scenario Coverage and Gas Scenario Coverage. Adjusting this setting will affect both the accuracy and the time required to run a scenario coverage model. More rotations will result in higher accuracy and longer run times. The fewer rotations will result in a lower degree of accuracy and faster run times. Typically, 128 rotations is sufficient for most applications.
Background Color	This setting allows the user to select the background color in the 3D View Page. The available options are black, white, and blue.

Section 2 - Interface



3D Render Mode	<p>This setting allows the user to select the level of detail that will be rendered in the 3D View Tab. The following modes are available:</p> <ul style="list-style-type: none">• Fast – Provides the least amount of detail but renders the model quickly.• Normal – Provides a medium amount of detail and renders the model at a medium speed.• Max Detail – Provides the most amount of detail and renders the model at the slowest speeds.
-----------------------	--

2.13.2 Default Fire Detector Settings

The Default Fire Detector Settings contains a series of default settings for fire detectors. When these settings are selected, all fire detectors placed in to a study will be prepopulated with these settings. The following attributes have the ability to be default settings:

- Manufacturer
- Model
- Hazard
- Sensitivity
- Default RHO

2.13.3 Default Gas Detector Settings

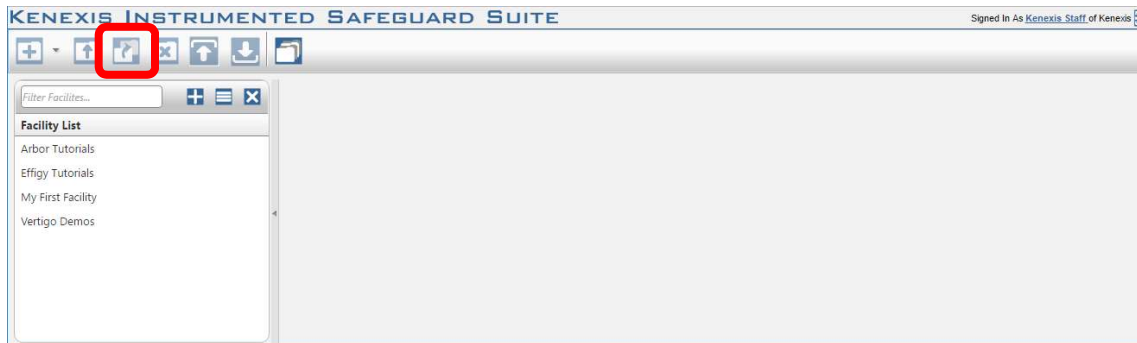
The Default Gas Detector Settings contains a series of default settings for gas detectors. When these settings are selected, all fire detectors placed in to a study will be prepopulated with the selected settings. The following attributes have the ability to be default settings:

- Detector Type
- Critical Cloud Diameter
- Point Detector Detectable Concentration
- Open-Path Detector Concentration

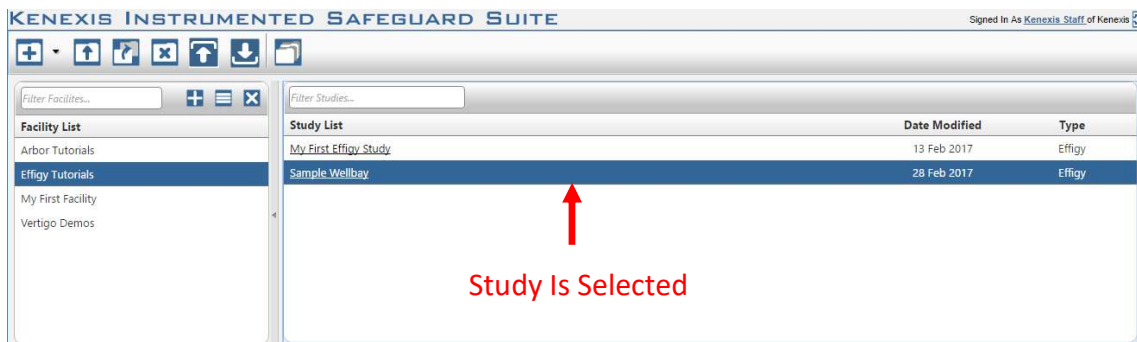
2.14 Copying a Study

An Effigy study can be copied from the KISS Manager Study manager page. The KISS study manager page is the main page in the KISS Manager application, it is the default landing page when logging into your KISS account, shown below.

Section 2 - Interface



Studies can be copied by clicking on the copy study button in the main navigation toolbar, highlighted above. If there is no study selected the copy study button will be disabled and rendered with transparency, as shown in the above figure. Once an Effigy study is selected, the copy study button will enable, allowing the selected study to be copied as shown below. An Effigy study can be selected from the Study List by left clicking on the row of the desired study. When selected, the row will be highlighted blue.

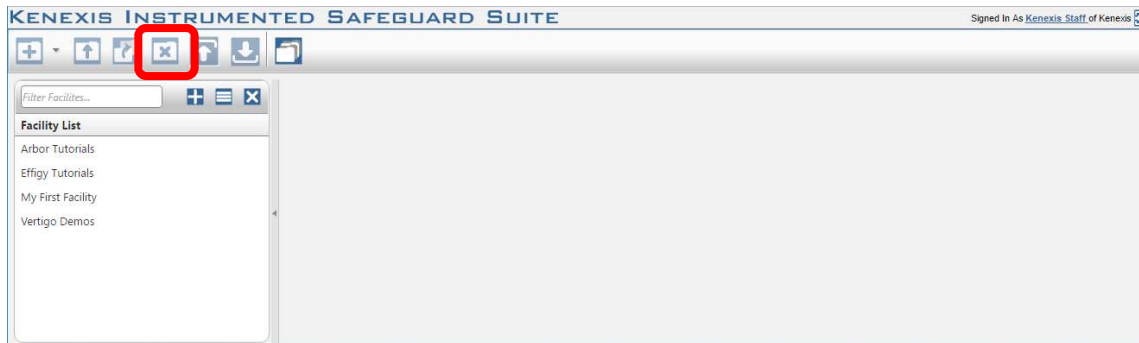


Studies can only be copied within the Facility where they were created. When a study is copied the new instance of the study will be renamed to “Study Name – Copy”. Where Study Name is the name of the original study. To create a copied instance of a study outside of the facility where it was created, use the Study Data Import / Export functionality described in Section 2.16 of this manual.

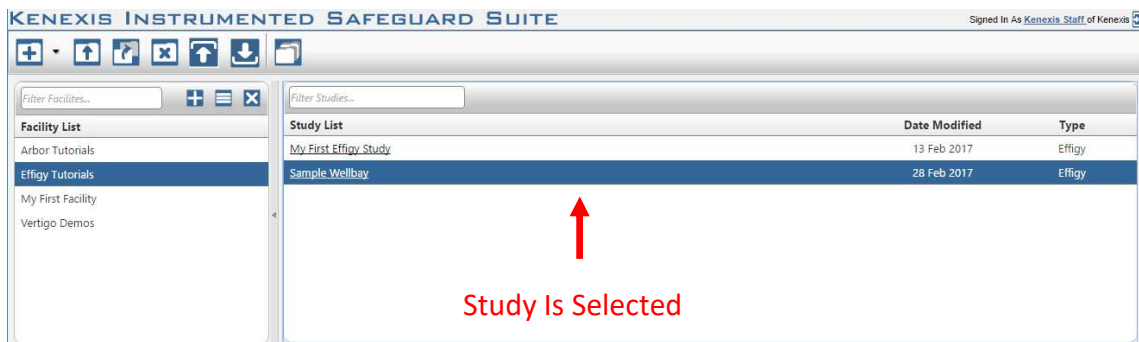
2.15 Deleting a Study

An Effigy study can be deleted from the KISS Manager Study manager page. The KISS study manager page is the main page in the KISS Manager application, it is the default landing page when logging into your KISS account, shown below.

Section 2 - Interface



Studies can be deleted by clicking on the delete study button in the main navigation toolbar, highlighted above. If there is no study selected the delete study button will be disabled and rendered with transparency, as shown in the above figure. Once an Effigy study is selected, the delete study button will enable, allowing the selected study to be copied as shown below. An Effigy study can be selected from the Study List by left clicking on the row of the desired study. When selected, the row will be highlighted blue.



2.16 Exporting & Importing Study Data

Effigy studies can be exported in a proprietary binary file format, *.arb. These files can't be edited. This binary import export functionality is primarily used by Kenexis for a variety of maintenance tasks however, the functionality is provided publicly to allow studies to be copied across facilities or servers.

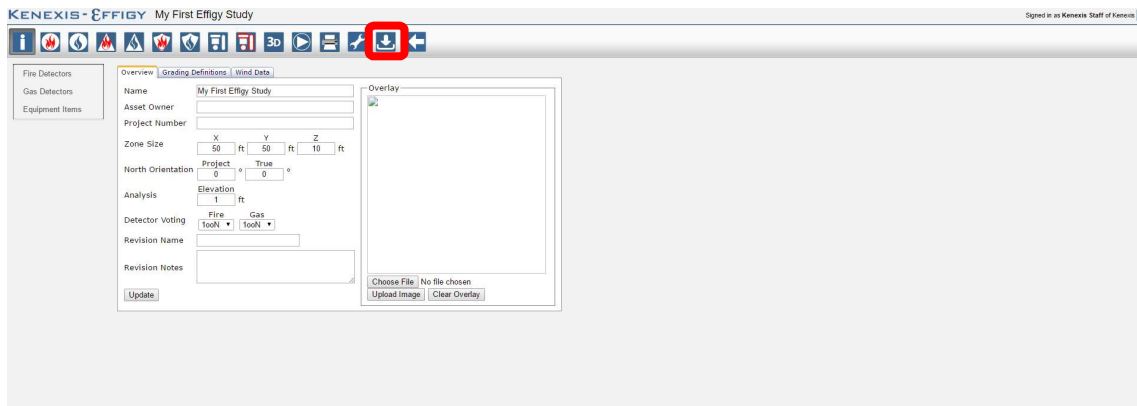
2.16.1 Exporting

An Effigy study can either be exported from the Study Manager page in KISS Manager, or from inside the Effigy application. In either case, an export is created by clicking on the download icon in the main navigation toolbar, shown below.

Section 2 - Interface



INTERFACE

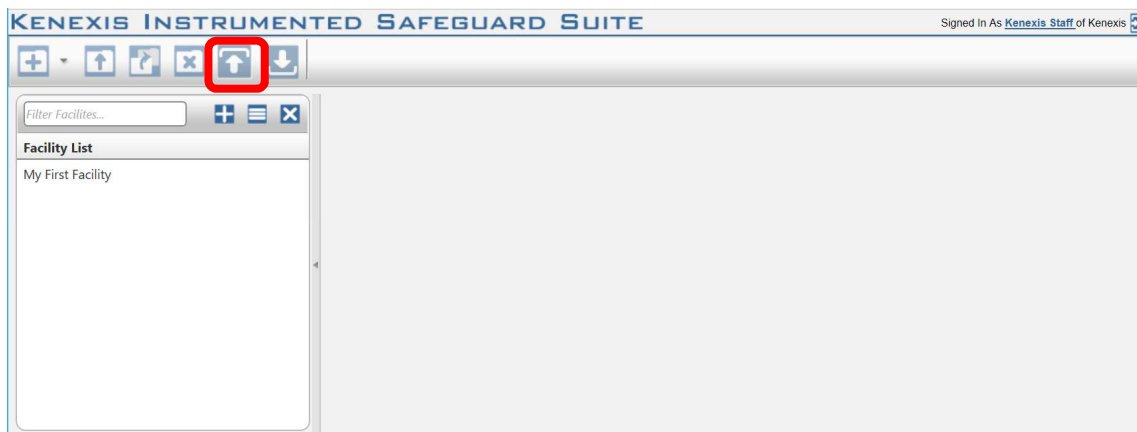


On the Study Manager navigation toolbar the export button will be disabled unless a study has been selected. See Sections 2.14 and 2.15 on copying and deleting studies for details on selecting studies on the Study Manager page.

When the export icon is clicked a download will begin of a file called “Study.zip”. This file contains all of the data associated with the Effigy study being exported. This file can later be imported using the method described below.

2.16.2 Importing

An Effigy study import can be done from the KISS Manager Study Manager page. The Study Manager page is the main page in the KISS Manager application, it is the default landing page when logging into your KISS account, shown below.



Studies can be imported by clicking on the import study icon in the main navigation toolbar, highlighted above. Before importing a study you must select a facility from the facility list on left side of the interface. Studies can't be imported without first selecting

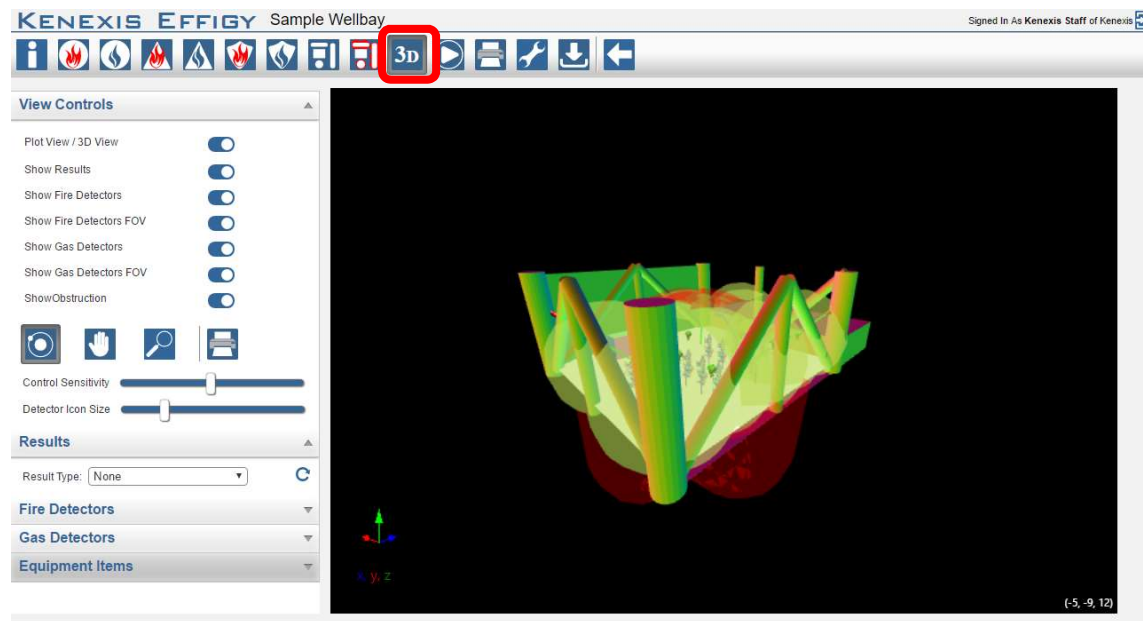
Section 2 - Interface



a facility where the study will be imported into. On a Facility is selected, the facility will be highlighted blue in the facility list and the import study icon will be enabled.

Clicking the import study button will open a file selection dialog which can be used to select the *.zip study you would like to import. If the data contained in the *.zip file is valid, the import will be performed and the imported study will be automatically opened in Effigy.

2.17 3D View Page



The 3D View Page contains the workspace that allows for the viewing and navigating of the study 3D model.

Section 2 - Interface



2.17.1 View Controls

The view control tab on the left side of the page contains toggle switches that allow for different components of the 3D model to be hidden or shown.







- Plot View / 3D View – View the study as a 3D model or as a plot view at the analysis elevation. The plot view is similar to views in the pages discussed earlier in this section.
- Show Results – View the selected results type as a plane in the 3D view or overlaid in the 2D view.
- Show Fire Detectors – Show or hide all fire detectors.
- Show Fire Detector FOV – In 3D view the cone of vision of each fire detector will also be shown or hidden.
- Show Gas Detectors – Show or hide all gas detectors.
- Show Gas Detector FOV – In 3D view the detection cloud of each gas detector will also be shown or hidden.
- Show Obstructions – Show or hide all obstructions. This includes any enabled STL models.
- Control Sensitivity – Adjusts the sensitivity of the view controls (e.g. orbit, pan, zoom). The further the slider is to the right, the more sensitive the control will be to mouse movement.
- Detector Icon Size – Adjusts the size of gas and fire detector icons. This will only have an effect when the Show Fire/Gas Detectors switches are toggled to the on position.

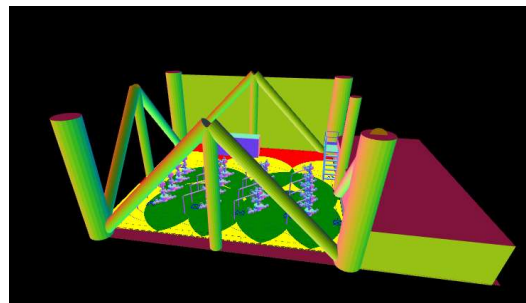
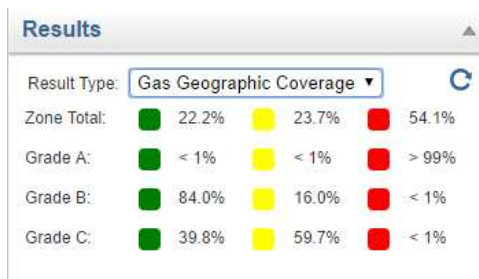
The view control tab also contains tools to aid in navigating the 3D model. These tools are listed below:

Section 2 - Interface



	<p>The orbit tool is used to change the orientation of the 3D model. As the cursor is dragged while left clicking, the view will remain fixed while the model rotates around the focal point of the camera.</p>
	<p>The pan tool is used to move the model up, down, left, and right. As the cursor is dragged while left clicking, the model will move in the same direction. For example, if the cursor is moved towards the right, the model will move to the right. Moving the model will also move the focal point of the camera, thus moving the pivot point of the orbit tool.</p>
	<p>The zoom tool is used to zoom in and out of the model. Zooming in is accomplished by left clicking and dragging the cursor up. Zooming out is accomplished by left clicking and dragging the cursor down. Zooming will occur about the camera focal point.</p>
	<p>The print tool in the view controls window is used to download an image of the current view in the 3D window. This image will download by default as “Effigy 3D View.png”.</p>

2.17.2 Results



The results tab contains a dropdown menu that allows for a specific result type to be specified. Once specified the selected results will be shown in the 3D model as a plane at the analysis elevation. In plot view mode, the results will be presented similar to the individual results pages discussed earlier in this section.

Section 2 - Interface



2.17.3 Fire Detectors

Fire Detectors ▲			
+ Add New Fire Detector			
Tag	Enabled		
FD-001	<input checked="" type="checkbox"/>		
FD-002	<input checked="" type="checkbox"/>		
FD-003	<input type="checkbox"/>		
FD-004	<input checked="" type="checkbox"/>		

The fire detectors tab contains a list of all fire detectors in the Effigy study. Detectors can be enabled and disabled by checking and unchecking the boxes. Existing detectors can be deleting by selecting the red “x” corresponding to that detector.

Fire detectors can be added by selecting “Add New Record” at the top of the fire detector list. Existing fire detector attributes can be modified by selecting the detector tag in the fire detector list. A form will be opened to specify attributes of the fire detector.

By the clicking the eye icon of a given detector the 3D model view will automatically be placed such that the user’s view is that of the detectors field of view. This is helpful to gain insight to how the detector can “see” the process area.

2.17.4 Gas Detectors

Gas Detectors ▲			
+ Add New Gas Detector			
Tag	Enabled		
1	<input checked="" type="checkbox"/>		
10	<input checked="" type="checkbox"/>		
2	<input checked="" type="checkbox"/>		
3	<input checked="" type="checkbox"/>		
4	<input checked="" type="checkbox"/>		
5	<input checked="" type="checkbox"/>		
6	<input checked="" type="checkbox"/>		
7	<input checked="" type="checkbox"/>		
8	<input checked="" type="checkbox"/>		
9	<input checked="" type="checkbox"/>		

The gas detectors tab contains a list of all gas detectors in the Effigy study. Detectors can be enabled and disabled by checking and unchecking the boxes on the right side of the list. Existing detectors can be deleting by selecting the red “x” corresponding to that detector.

Gas detectors can be added by selecting “Add New Record” at the top of the gas detector list. Existing gas detector attributes can be modified

by selecting the detector tag in the gas detector list. A form will be opened to specify attributes of the gas detector.

Section 2 - Interface



2.14.5 Equipment Items

Equipment Items					
+ Add New Equipment Item					
Tag	Obstruction	Graded Area	Fire Scenario	Gas Scenario	
deck_001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Deck_002	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_002	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_003	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_004	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_005	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_006	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_007	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_008	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_009	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_010	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
structure_011	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

The equipment items tab contains a list of all equipment items in the Effigy study. The checkboxes in the list can be used to define if an equipment item is defined as any one of combination of the following:

- Obstruction
- Graded Area
- Fire Scenario
- Gas Scenario

Equipment items can be added by selecting “Add New Record” at the top of the equipment item list. Existing equipment item attributes can be modified by selecting the detector tag in the gas detector list. A form will be opened to specify attributes of the equipment item. There are separate tabs to change attributes of the different aspects of the equipment item.

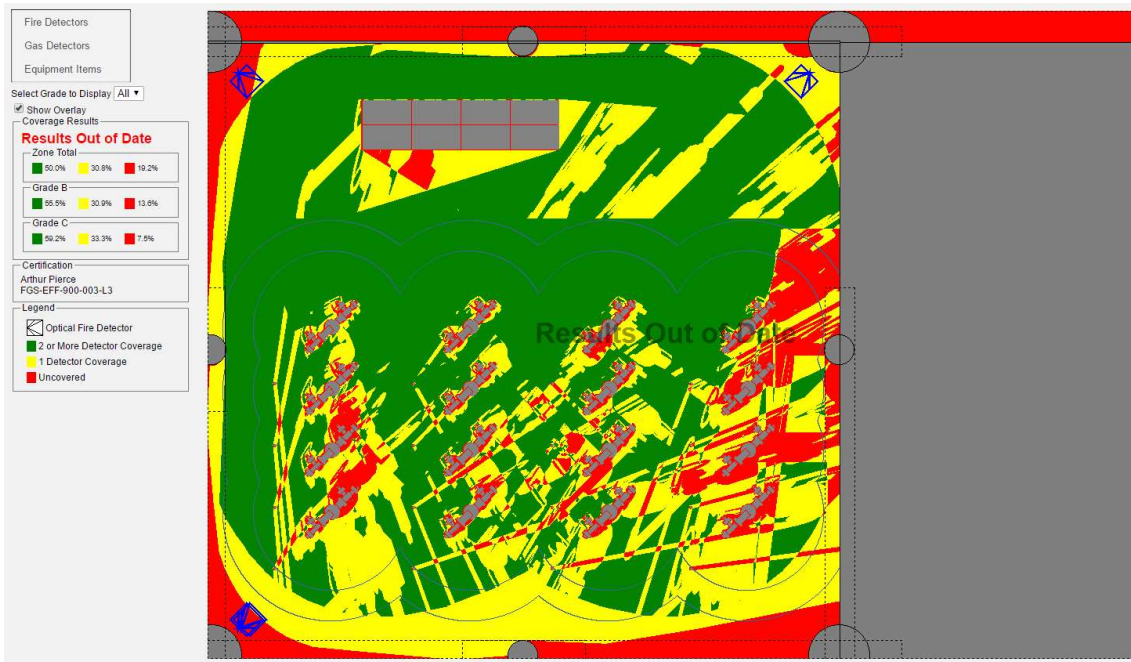
Section 3 – Calculation Details



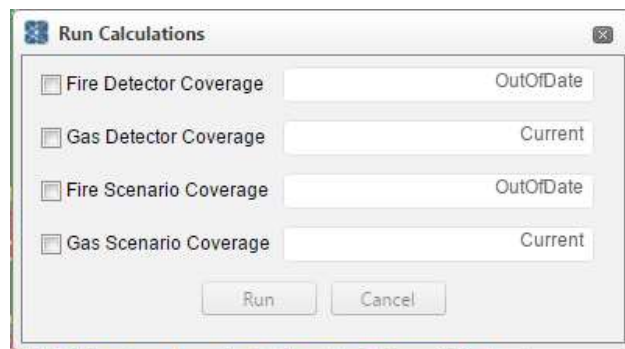
3.1 Advanced Topics

3.1.1 Outdating of Results

In some cases, making changes to study input parameters will invalidate the results of calculations which have already been done. In order to help you to manage your results and ensure that the reported results are accurate, the Effigy software will track the state of the calculated results. If results have been made invalid by changes to input parameters, the software will mark the result with an "out of date" watermark. This is shown in the figure below.



When results are marked out of date, an out of date icon will also appear on the run calculations page, as shown below.



Section 3 – Calculation Details



Calculation results will only be marked out of date if input parameters, which effect the calculated results, have changed since the last time the calculations were performed. The following table details the relationship between changes to input parameters and outdating of calculated results.

	Fire Geographic Coverage	Gas Geographic Coverage	Fire Scenario Coverage	Gas Scenario Coverage
Fire Detectors				
Insert	X		X	
Delete (Enabled Detector)	X		X	
Delete (Disabled Detector)				
Update (Enabled Detector)	X		X	
Update (Disabled Detector)	X		X	
Enable	X		X	
Disable	X		X	
Gas Detectors				
Insert		X		X
Delete (Enabled Detector)		X		X
Delete (Disabled Detector)				
Update (Enabled Detector)		X		X
Update (Disabled Detector)				
Enable		X		X
Disable		X		X
Obstruction				
Insert	X		X	
Delete (Enabled Obstruction)	X		X	
Delete (Disabled Obstruction)				
Update (Enabled Obstruction)	X		X	
Update (Disabled Obstruction)				
Enable	X		X	
Disable	X		X	
Update – Apply to All	X	X	X	X
Graded Area				

Section 3 – Calculation Details



CALCULATION DETAILS

	Fire Geographic Coverage	Gas Geographic Coverage	Fire Scenario Coverage	Gas Scenario Coverage
Insert				
Delete (Enabled/Disabled)				
Update (Enabled/Disabled)				
Enable				
Disable				
Update – Apply to All	X	X	X	X
Fire Scenario				
Insert			X	
Delete (Enabled Scenario)			X	
Delete (Disabled Scenario)				
Enable (Group)			X	
Disable (Group)			X	
Enable (Single Scenario)			X	
Disable (Single Scenario)			X	
Update (Enabled Scenario)			X	
Update (Disabled Scenario)				
Gas Scenario				
Insert				X
Delete (Enabled Scenario)				X
Delete (Disabled Scenario)				
Enable (Group)				X
Disable (Group)				X
Enable (Single Scenario)				X
Disable (Single Scenario)				X
Update (Enabled Scenario)				X
Update (Disabled Scenario)				
Overview Page				
Change Analysis Elevation	X	X	X	X
Change Zone Size	X	X	X	X
Change Fire Detector Voting			X	

Section 3 – Calculation Details



	Fire Geographic Coverage	Gas Geographic Coverage	Fire Scenario Coverage	Gas Scenario Coverage
Change Gas Detector Voting				X
Change Grading Definitions				
Change Wind Data				X
Settings Page				
Change Display Units	X	X	X	X
Change Gas Geo Calc Type		X		
Change Fire Geo Calc Type	X		X	
Change Scenario Rotation Count			X	X
3D View Background Color				
3D Render Mode				
Change Default Fire Detector Settings				
Change Default Gas Detector Settings				

3.1.2 Units and Scaling

When you create a new study in Effigy you will be prompted to select the unit of length that you would like to work with. This is done on the input form of the study overview page in the "display units" field. The available units are:

- Feet
- Inches
- Millimeters
- Centimeters
- Meters
- Yards

In Effigy, images are scaled based on the area of the zone you've specified (Zone Size X, Y, and Z) and the unit of length you've selected to work in. On most pages, including the Geographic Coverage, Geographic Risk and FGS Layout pages, the size of the image is scaled such that one pixel is equal to 1 square inch of area in the zone you are modeling. Therefore a 10 ft x 10 ft zone will appear as a 120 pixel by 120 pixel image on the FGS layout page. It is important to keep this in mind as specifying a very small zone or a very large zone can make a study difficult to work with.

Section 3 – Calculation Details

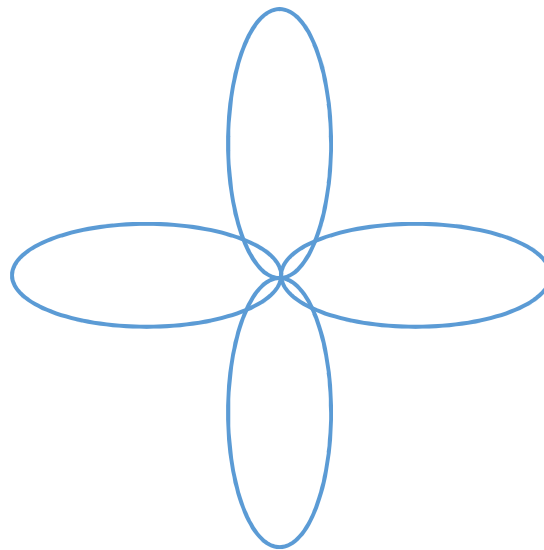
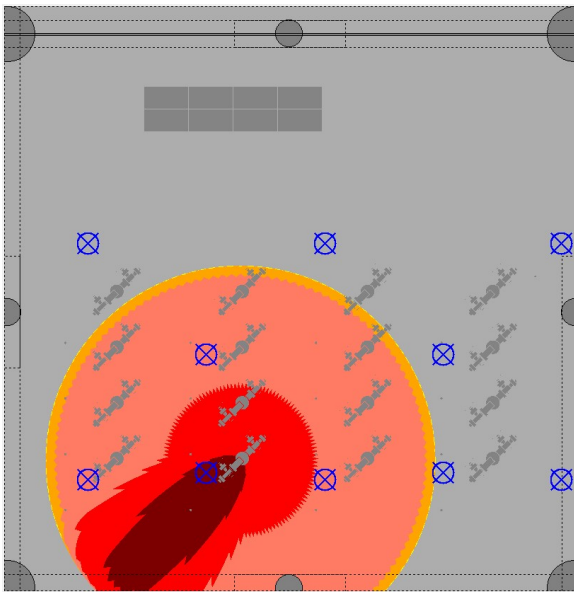


For existing studies, the Selected units can be changed from the study settings page.

3.1.3 Scenario Coverage – The Offset Function

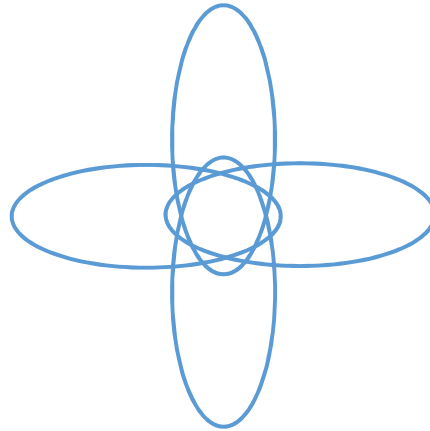
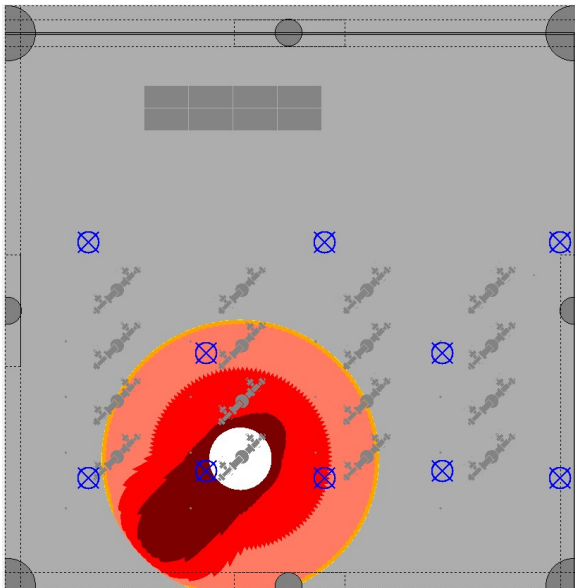
The offset function is used in defining fire or gas scenarios for the detector scenario coverage calculations. It functions by offsetting the “starting point” for each rotation of the scenario based on the value entered. An offset of zero means that each scenario will have its starting point located at the scenario location. A positive offset will relocate the scenario in the upwind direction a negative offset will relocate it in the downwind direction. The following images depict this:

Zero Offset

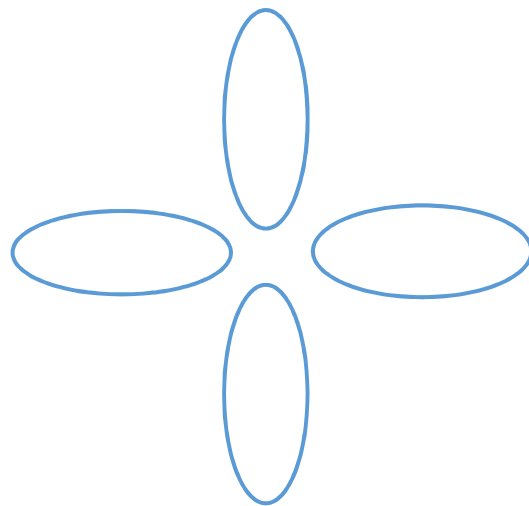
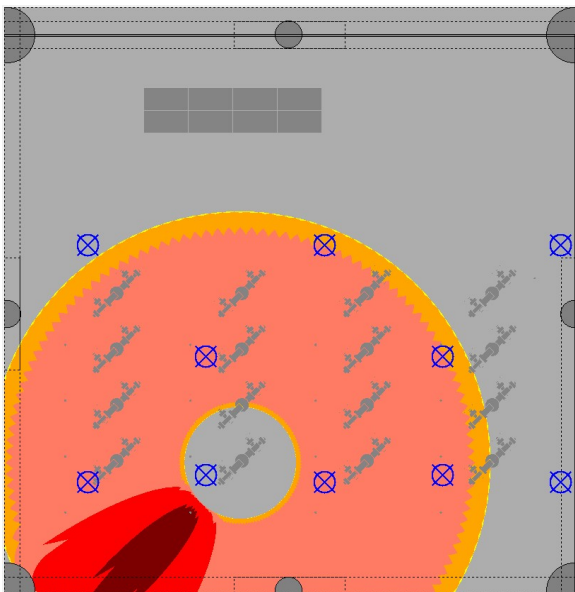


Positive Offset

Section 3 – Calculation Details



Negative Offset



The offset function is provided because many times releases need to be modeled which can't adequately be described with a zero-offset model. Below are some examples of when the offset function is useful:

Pool Fires: a pool fire, at a given location can be modeled by setting the scenario length, width and offset all equal to the pool diameter. This will cause all of the scenario rotations to converge a single point (at the scenario location) resulting in a circular fire centered at the scenario location.

Section 3 – Calculation Details



Modeling releases around a vertical vessel: Setting a negative offset equal to the radius of the vessel will result in scenarios being located at the perimeter of the vessel.

Jet Fires with Flame Lift-off: Flame lift is a common phenomenon for jet fires where the velocity at the leak source is too high for burning to occur, because oxygen can't diffuse into the fuel fast enough. Therefore, the location of the flame is some distance away from the leak source. This can be modeled by using a negative offset.

Impinged Gas Releases: If a gas release occurs in a highly-congested area, there is typically some upwind dispersion that occurs because the gas jet contacts physical objects that obstruct its downwind dispersion, causing some of the gas to disperse upwind from the leak source. Using a positive offset allows you to account for this effect.

Heavy Gas Releases from Elevated Locations: Typically, gas detectors for heavy gases are installed near ground level. However, leak sources may exist at elevated locations. A heavy gas leak from a elevated location may not result in measurable concentrations of the gas at the leak located near ground level because the momentum of the release causes dispersion to occur at an elevated location. However, release momentum decreases as the distance from the leak source increases, a decrease in momentum will result in an increase in buoyancy effects that will eventually result in the heavy gas reaching ground level at some distance away from the leak source. This effect can be modeled with the negative offset function.

3.1.4 Fire Calculation Model

The Point Source Fire Model

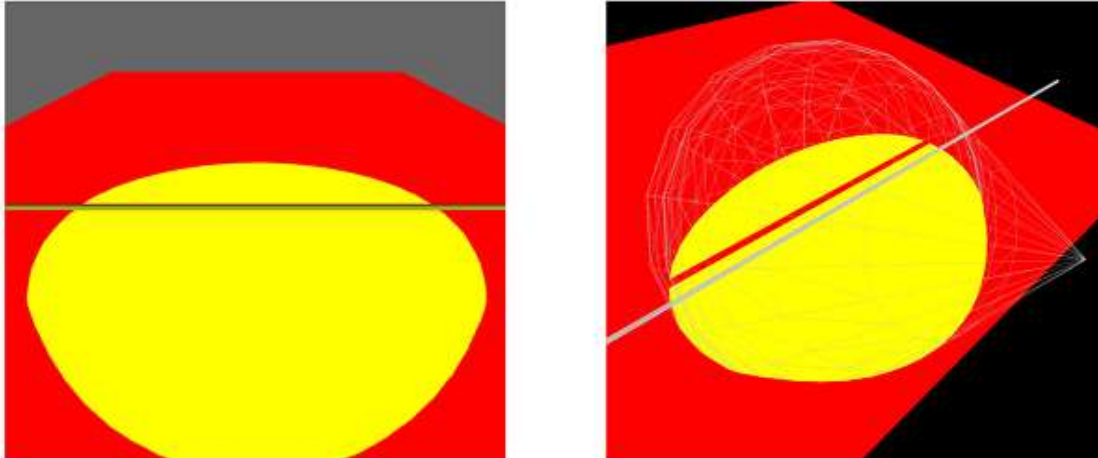
In the point source fire algorithm, a fire is assumed to occur at a single point in space (an infinitely small fire, radiating infinitely hot). This assumption results in a conservative calculation of coverage because, as we all know, a fire has volume. Making the assumption that a fire occurs at a single point in space is conservative even for the smallest fires of concern. This is why exclusions for minor obstructions when using the point source model is not only standard practice, but is often required to achieve an acceptable degree of coverage.

Let's look at an example. The images below show the field of view for a single optical flame detector. In both images, the field of view of the detector is shown by the yellow

Section 3 – Calculation Details



region. In the image to the left you'll notice a small green obstruction running horizontally across the image. This obstruction represents a 3 inch diameter pipe.



In the image to left, the field of view of the detector appears uninterrupted because your perspective is from the exact location of the detectors lens. However, when the image is rotated and the pipework is shown in wireframe, as shown on the right, you can clearly see that the point source coverage algorithm has predicted an area of uncovered space directly behind the pipe from the perspective of the detector. The point source model has predicted that a fire centered at any location along the red obstructed region caused by the pipe will be undetectable. However, we know that in reality fires are not infinitely small point sources; we know that fires have volume. Intuitively we know that a 3 inch diameter pipe will not significant impede the ability for a detector to detect a 1 ft diameter pool fire, this is why exclusions of such object is common practice.

When working with 3D models, what you will find is that operating with the conservative assumptions of the point source algorithm can result in overly conservative results because of the cumulative effect of these small diameter obstructions. For this reason, it is often necessary to implement a coverage algorithm which accounts for the volume of a fire. This algorithm is referred to as the “plume fire model”.

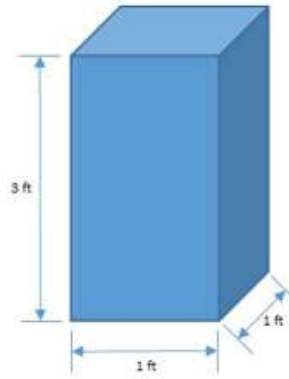
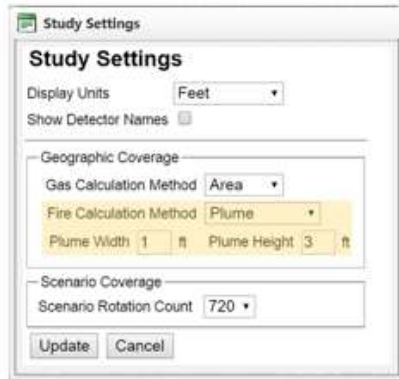
The Plume Fire Model

The plume fire model can be enabled on the Effigy study settings page as shown below. In the plume model a fire is represented as a 3-dimensional cuboid with equal x and y

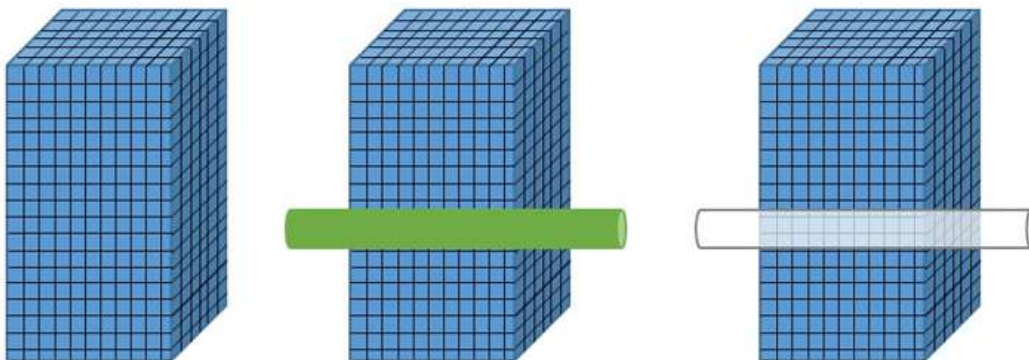
Section 3 – Calculation Details



dimensions. The size of the fire is defined by the user using the plume width and plume height parameters.

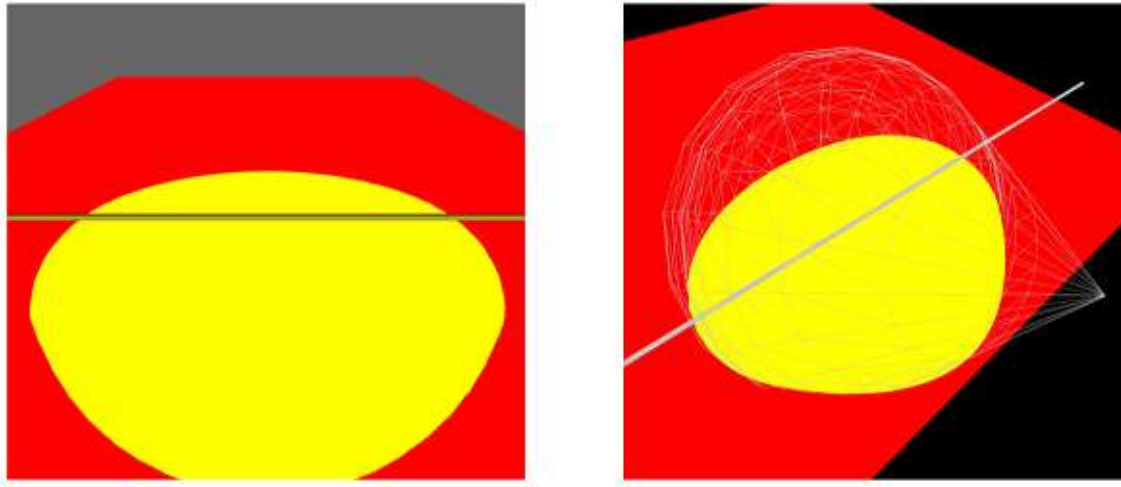


In the plume fire model, the fire is assumed to be emitting thermal radiation equally over its entire surface. When the fire geographic coverage algorithms are run, Effigy will calculate the fraction of the fire surface which is observable from the fire detector. In doing this, the fraction of the fires total radiant heat output which is viewable from the detector can be determined. This is shown in the below images where a grid has been superimposed onto the plume (far left). Adding a small diameter pipe between the detectors point of view and the plume will obstruct a fraction of the plume which is visible (middle). This fraction of the plume will then be ignored by the fire coverage algorithms. After this obstructed area is accounted for, Effigy will then determine whether a fire is detectable based on the remaining observable surfaces of the plume (far right).



Now let's look at the plume fire algorithm in action using Effigy.

Section 3 – Calculation Details



Just as before, we've introduced a 3 inch diameter pipe into the field of view of an optical flame detector. However, now the area directly behind the pipe is predicted as an unobstructed region.

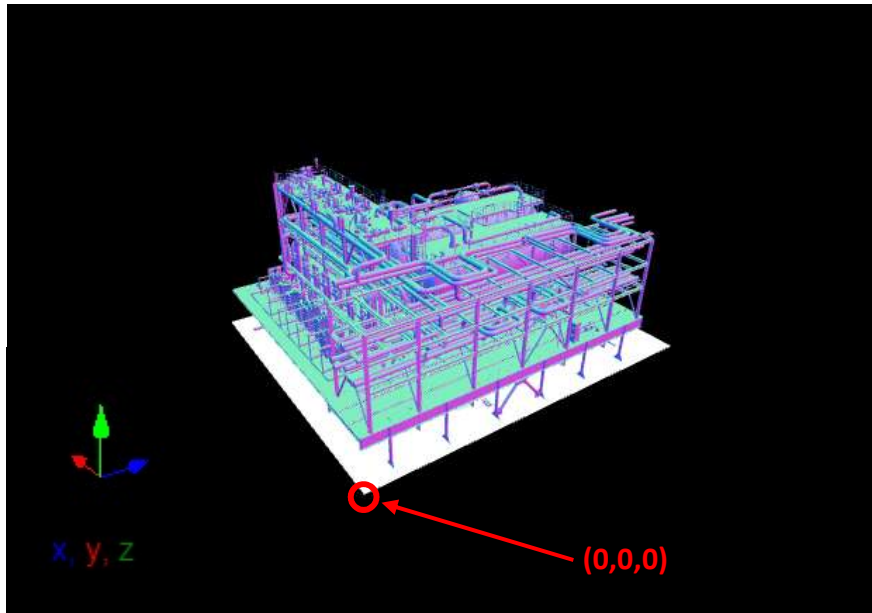
Why? This is because the volume of the fire is sufficient such that a fire centered at a location directly behind the pipe will result in a plume which is largely still visible to the detector. While the pipe may be obstructing 10%-15% of the fire surface, the detector is still receiving sufficient thermal radiation to cause the detector to reach an alarm state.

3.1.5 Importing a 3D Model

Effigy has the capability of importing a 3D model of zone. A 3D model must meet the following requirements to be successfully imported into Effigy:

- The 3D model must be a binary STL file (*.stl). Many of the commercially available 3D modeling software packages have the capability to export a 3D model to a *.stl file.
- The *.stl file must be less than 50 megabytes (MB) in size.
- The X, Y, and Z dimensions of the 3D model must be equal to the dimensions of the Effigy zone.
- The orientation of the 3D model must be the same as the orientation of the Effigy zone, i.e. plant north should be in the same direction as the Effigy study.
- The minimum extents of the 3D model must be defined as (0,0,0). See the below example:

Section 3 – Calculation Details



Kenexis offers STL Studio, a pre-processing software for STL models to be uploaded to Effigy. STL Studio is capable of the following major processes:

- Merging STL files
- Translation
- Scaling
- Clipping
- Rotation
- Reducing file size

This free Effigy companion application is available for download by visiting support.kenexis.com.

After ensuring that the 3D model meets the above requirements, the model can be imported into the Effigy software. To import a 3D model first navigate to the Equipment Items List View and select “Add New Record”. In the “Insert / Update Equipment Item” window select STL from the “Type” dropdown menu. The “Choose File” button is used to navigate to the 3D model *.stl file.

Section 3 – Calculation Details



CALCULATION DETAILS

Insert / Update Equipment Item

Obstruction Grading Fire Scenario Gas Scenario

Name: 3D Model

Type: Stl

Description:

Obstruction:

Location: X: 1 m Y: 1 m Z: 1 m

STL File: Choose File No file chosen

Insert