



Designed for Safety, Security, and Reliability

P2SAC Research Projects

Kenexis Sponsored and Facilitated

Sponsored Research Studies

- 2017 – CFD Validation of LPG Release
- 2018 – Open PHA Data Structure Definition
 - Data Mining for similar hazards – consistent Consequence/Safeguards
 - Basis for Unified Hazard Assessment
- 2019 – Minimum Sufficient CFD Scenarios (MS Program)
 - Estimate Minimum Scenarios for Repeatable Detector Placement
- 2019 – PHA Gamification (MS Program)
 - Convert PHA information into Quiz Questions
 - Improve Employee Knowledge of Process Hazards
- 2019 – Smart Mobile Operator Assistance Tools (Kenexis Internal)

“Open PHA” Data Schema Definition

- Define the expected data and types of a JSON object

Overview

Study Name

Study Coordinator

Study Coordinator Contact Info

Facility

Facility Location

Facility Owner

Unit

Project Number

Report Number

Project Description

```
Quantum.html  {} Chemical Properties.json  {} stream 001.json  {} Demo.json x
```

```
1  {"Overview":
2    {"Study_Name":"General Oil and Gas Chemical Company Bayou City Plant",
3     "Study_Coordinator":"Edward M. Marszal",
4     "Study_Coordinator_Contact_Info":"edward.marszal@kenexis.com",
5     "Facility":"Bayou City Plant",
6     "Facility_Location":"Bayou City Texas",
7     "Facility_Owner":"","
8     "Unit":"","
9     "Project_Number":"","
10    "Report_Number":"","
11    "Project_Description":"","
12    "General_Notes":"","
13    "Settings":{"
14      "Ds_Rev":5,
```

```
1 {
2   "$id": "http://example.com/example.json",
3   "type": "object",
4   "definitions": {},
5   "$schema": "http://json-schema.org/draft-07/schema#",
6   "properties": {
7     "streamName": {
8       "$id": "/properties/streamName",
9       "type": "string",
10      "title": "The Streamname Schema ",
11      "default": "",
12      "examples": [
13        "001"
14      ]
15    },
16    "temperature": {
17      "$id": "/properties/temperature",
18      "type": "string",
19      "title": "The Temperature Schema ",
20      "default": "",
21      "examples": [
22        "273"
23      ]
24    },
25    "temperatureUnits": {
26      "$id": "/properties/temperatureUnits",
27      "type": "string",
28      "title": "The Temperatureunits Schema ",
29      "default": "",
30      "examples": [
31        "F"
32      ]
33    },
34  }
```



Hazard Indexing Leads to Unified Hazard Structure

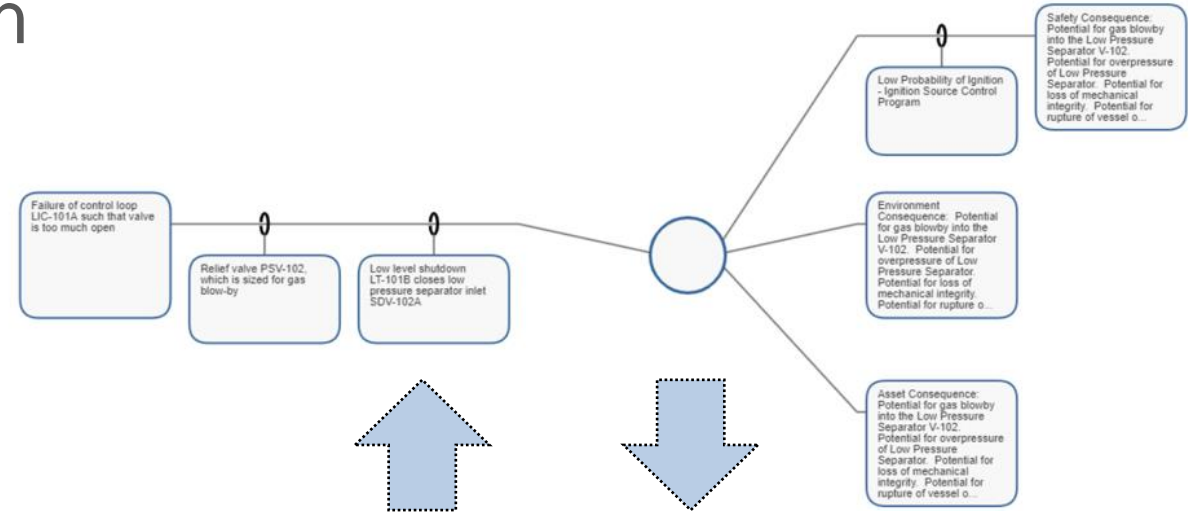
- Identify Similar Hazard Scenario in Other Studies

- Cause Indexed
- Consequence Indexed

– **Hazard Indexed**

- Hazard Indexing Allows Single Structure

- HAZOP
- LOPA
- Bowtie
- Hazard Register



Customer Relationship Manag... x Add New Post - Kenexis - Word x Kenexis Open PHA - Texas City C x

https://kiss.kenexis.com/OpenPha/Default.aspx#

KENEXIS OPEN PHA Texas City Gas Plant HAZOP Signed in as Edward Marsal of Kenexis

Study Data Nodes Deviations PHA Worksheets LOPA Worksheets Recommendations Safeguards Parking Lot Risk Criteria Premium Tools Back

LOPA Worksheets

1. (HP Gas) Production Header through High Pressure Separator (V-101) to Gas Export Pipeline

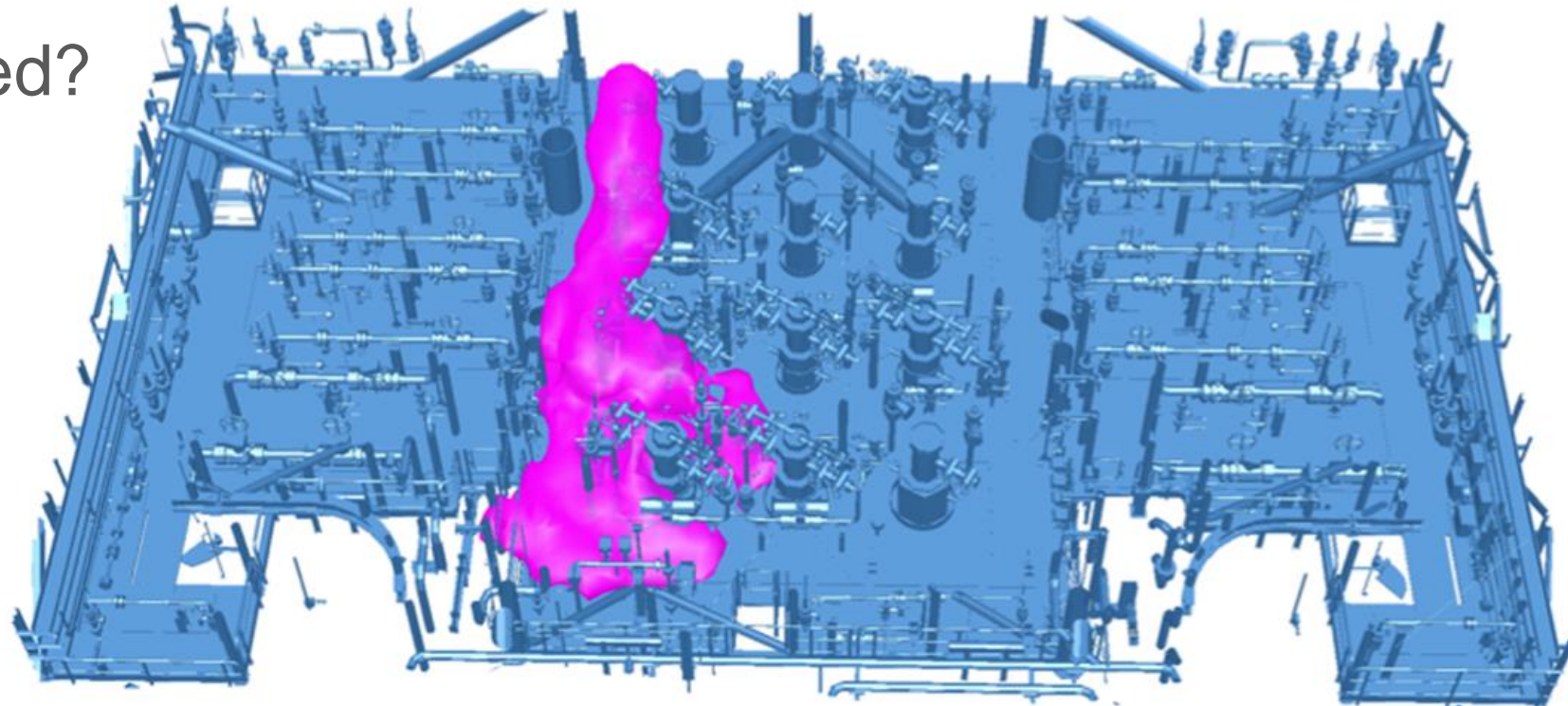
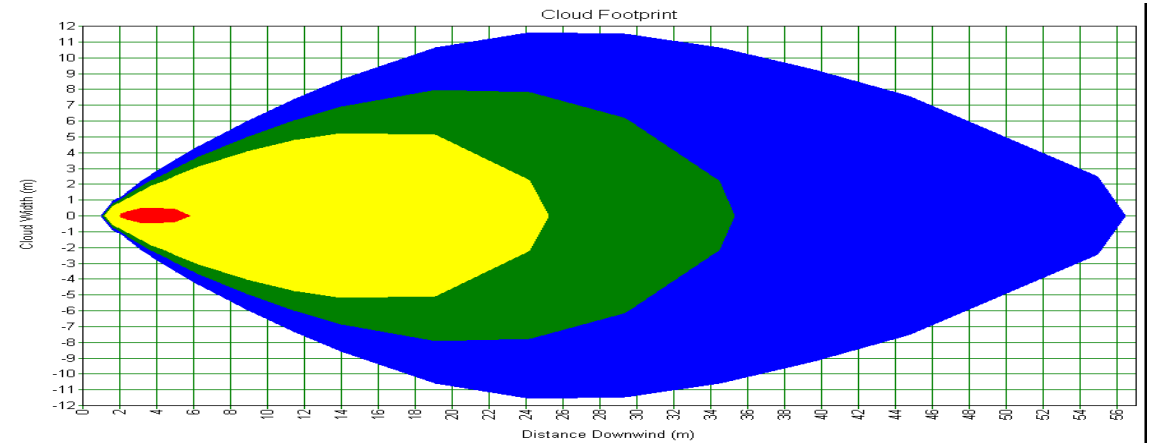
Deviation	Consequence	S	TMEL Safety	Cause	Frequency	Causes	
						IPL	IPL Tag
1.6 Low Level	1.6.1 Potential for gas blowby into the Low Pressure Separator V-102. Potential for overpressure of Low Pressure Separator. Potential for loss of mechanical integrity. Potential for rupture of vessel or associated piping. Potential release of flammable materials. Potential fire/explosion.	5	1E-5	1.6.1.1 Failure of control loop LIC-101A such that valve is too much open	0.1	5 Relief valve PSV-102, which is sized for gas blow-by	PSV-102
						6 Low level shutdown LT-101B closes low pressure separator inlet SDV-102A	UZC-101C

Report Generator
Spell Check
Translate Study
Revision Manager
Synchronize with Vertigo
Import From PHA-Works
Bowtie Diagram

https://kiss.kenexis.com/OpenPha/Default.aspx#

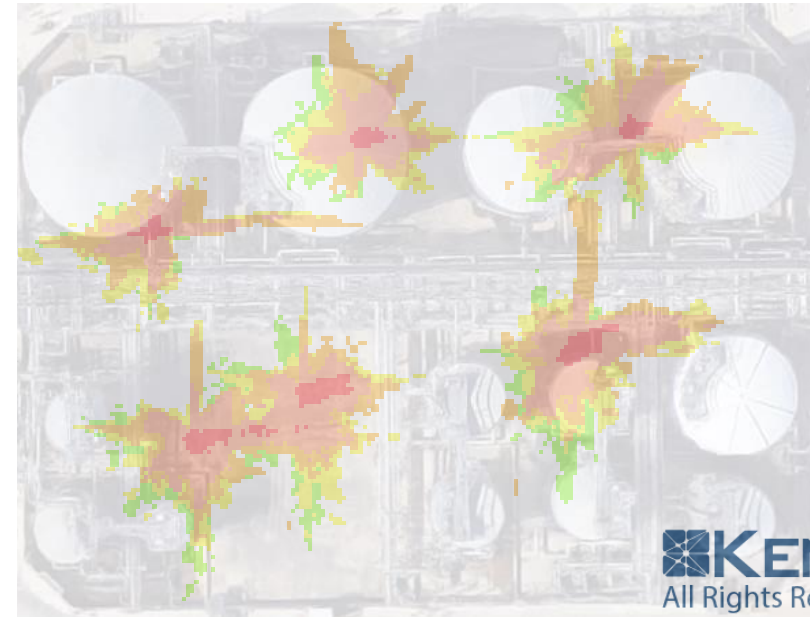
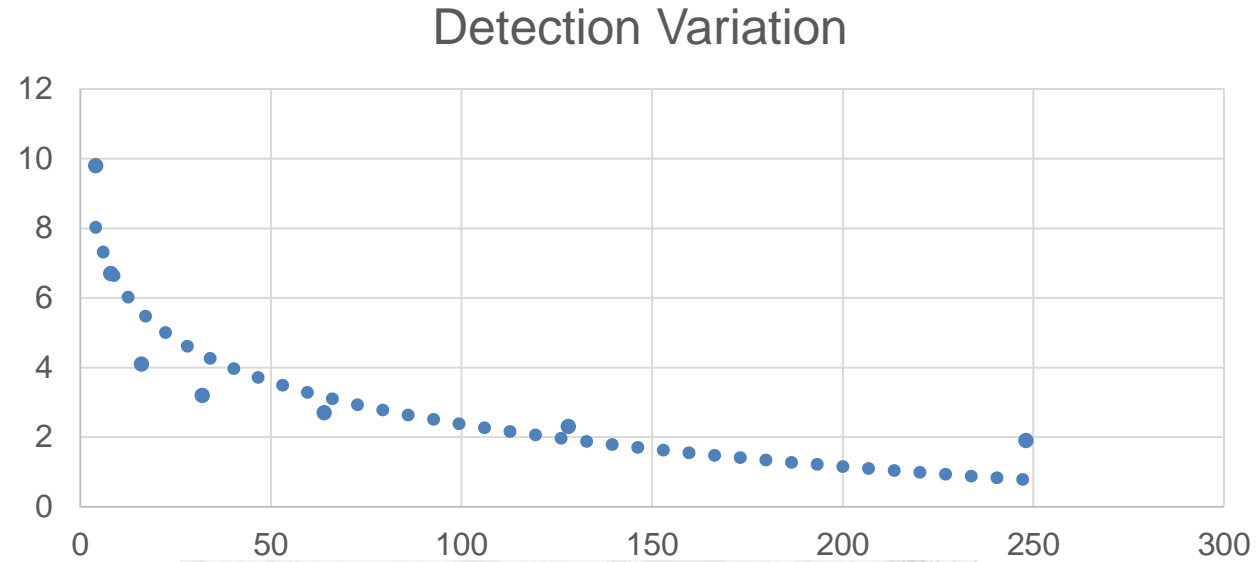
Minimum Sufficient CFD Scenarios

- CFD Modeling More Accurate but more costly
- Accuracy of Detector Placement Increased with Number of Scenarios
- How many are required?



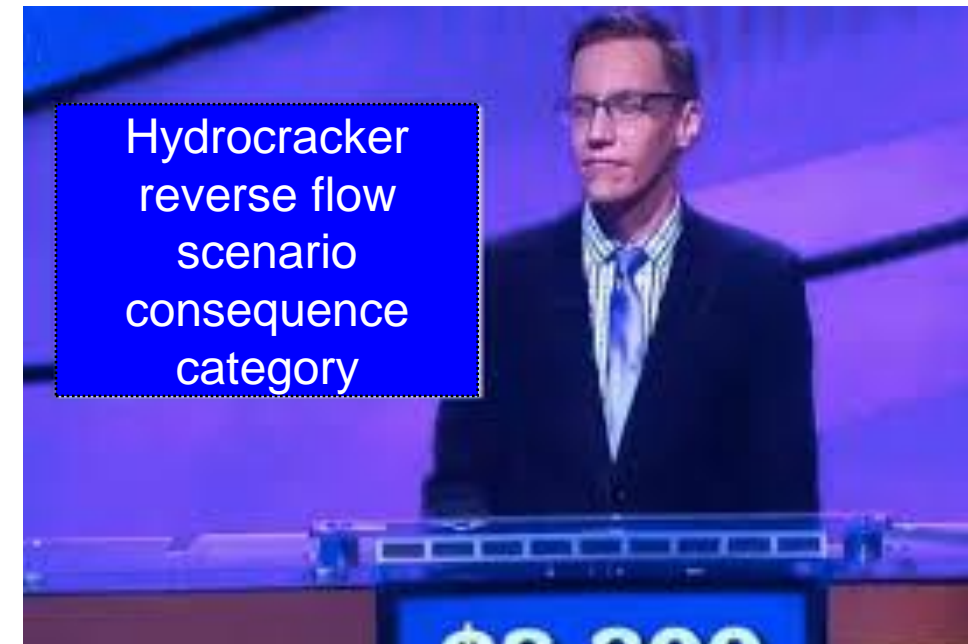
Estimate Minimum Sufficient Scenarios

1. Perform a subset of scenarios
 - Weather Conditions
 - Release Orientations
 - Equipment Items
2. Optimize Detector Placement
3. Increase Scenario Count
4. Optimize Detector Placement
5. Calculate Detector Variation
6. Repeat Until Change in Detector Variation is small



PHA Gamification

- Understanding Process Hazards is Critical
- Teaching this Information is Dry and Boring
- Employ Gamification Techniques to Enhance Learning
- Automatic Development of Questions Based on Open PHA Data Structure
- Prizes and recognition for winning scores



Mobile Operator Support Tools

- Member Discussion Key Point “We need tools to help our people work more safely”
- Increased use of mobile phone technology in field
- Software to assist operations / maintenance to not make mistakes



Procedure Assistance and Tracking - OpScope™

- Mobile Procedures
 - Task Information
 - Picture/Video Explanation
 - Location (GPS/Map)
 - Equipment Confirmation with QE Code
 - Centralized Status Tracking of all procedures

The screenshot displays the OpScope mobile application interface. At the top, the header shows 'KENEXIS OPSCOPE' and 'GOGO Texas City', with a user login 'Signed in as Edward Marszal of Kenexis'. Below the header is a navigation bar with icons for information, document, clipboard, location, search, timer, and back. The main content area is divided into two sections: a 'Procedure Step List' and 'Step Details'.

Procedure Step List:

1. Verify Permit
2. Outlet Valve Divert to Drain
3. Verify Feed Inlet Valve Closed
4. Open Flush Inlet Valve
5. Start Flush Pump (highlighted)
6. Verify Flush Rate
7. Maintain Flush

Step Details:

Step Number: 5

Step Title: Start Flush Pump

Step Description: Start the flush pump, P-001 by pressing the start button on the pump's start stop station

Step Duration (minutes):

Minimum: 2

Maximum: 10

Expected: 5

Step Video:

Remove Video

Step Location:

Location: Flush Pump Deck

Location Description: The flush pump is located on a concrete pad at the northeast corner of the building.

Longitude: -83.0821536395191

Latitude: 40.0576859215065

Has Image?: No

Require QR Code Scan?:

Edit Location Clear Location

Permissive:

Permissive: HV-002 Confirmed Open

Permissive Description: Limit Switch of HV-002 is such that HV-002 is confirmed to be in the open state.

Edit Permissive Clear Permissive

What's Next?

- Sound power characterization from leaks
- Radiation poisoning of optical fire detectors
- Massive parallel computing for CFD
- You tell me!





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Contact

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