

STOP-IT

Økt beredskap gjennom stresstesting: Erfaringer fra Oslo VAV

Gema Raspati og Camillo Bosco (SINTEF)
Kebebe Tefera (Oslo VAV)



STOP-IT



Vannforeningen
- sammen for vannet

Søk i vannforeningen

Søk

Tidsskriftet VANN ▾

Fagtreff og seminarer ▾

Medlemskap/Abonnement

Studentshipend

Om foreningen ▾

About us

Tidsskriftet VANN

Cyber-sikkerhet i VA-sektoren og bidraget fra STOP-IT-prosjektet

*Av Rita Ugarelli, Gema Raspati, Ingrid Selseth, Martin Gilje Jaatun,
Jon Røstum, Harald Rishovd og Kjetil Furuberg*

Rita Ugarelli (Ph.D) er sjefforsker i SINTEF Community og professor II ved NTNU.

Gema Raspati (Ph.D) er forsker i SINTEF Community.

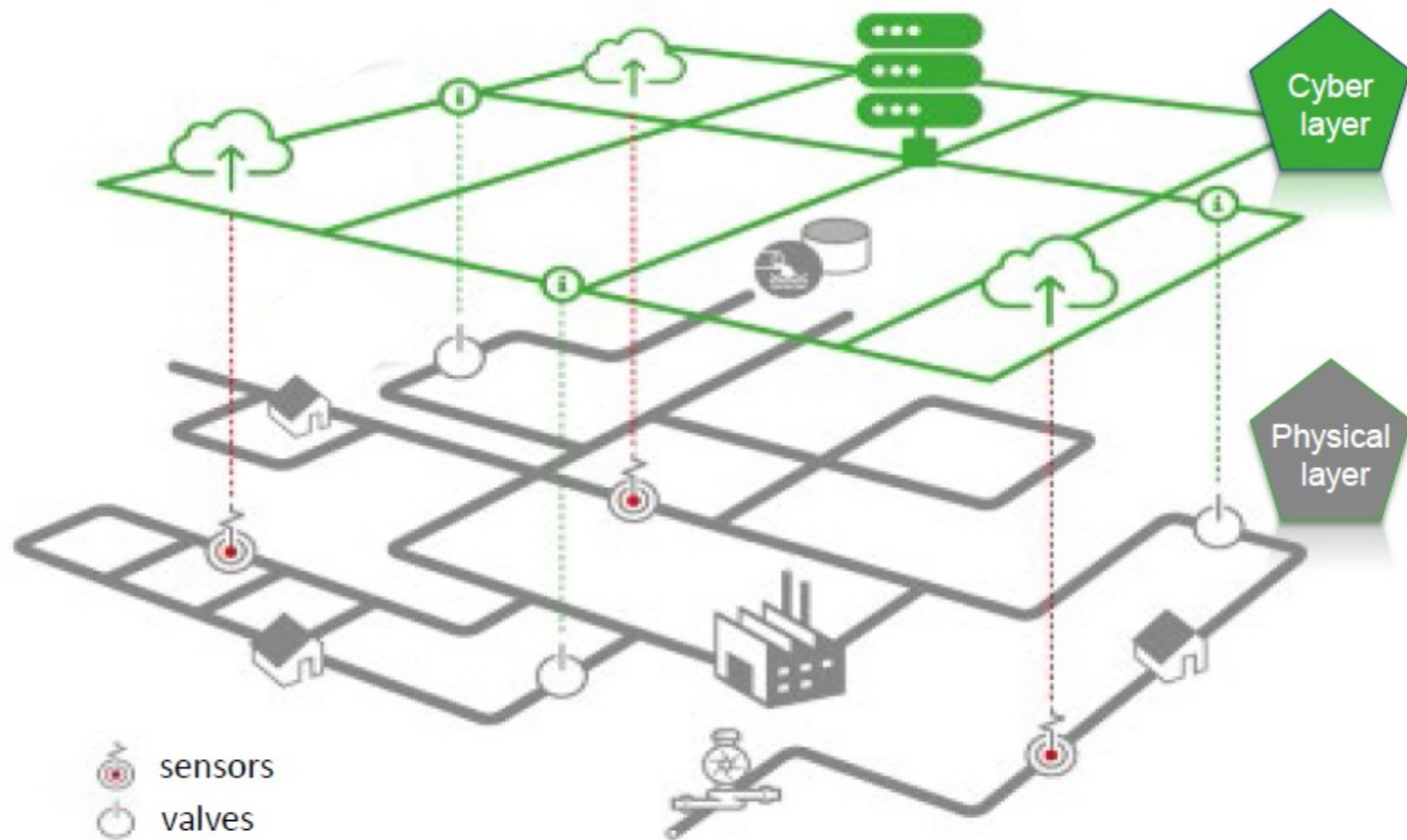
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Harald Rishovd (M.Sc) er seniorkonsulent i Oslo kommune, Vann- og avløpsetaten.

Kjetil Furuberg (M.Sc) er prosjektleder i Norsk Vann.



We argue that since the **cyber** and **physical** systems interact continuously, and **cascading effects** between them are not easy to track (or back-track to improve designs or identify sources of attacks) we need to combine cyber and hydraulic engineering knowledge to develop **cyber-physical security concepts and tools**.



Modular components of
the STOP-IT risk management platform

**Strategic &
Tactical**

Operational

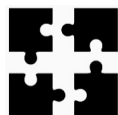
Solutions that support:

- **Strategic/tactical planning and post action assessment**
- **Operational decision making**

towards cyber-physical security of water infrastructures



Scalable



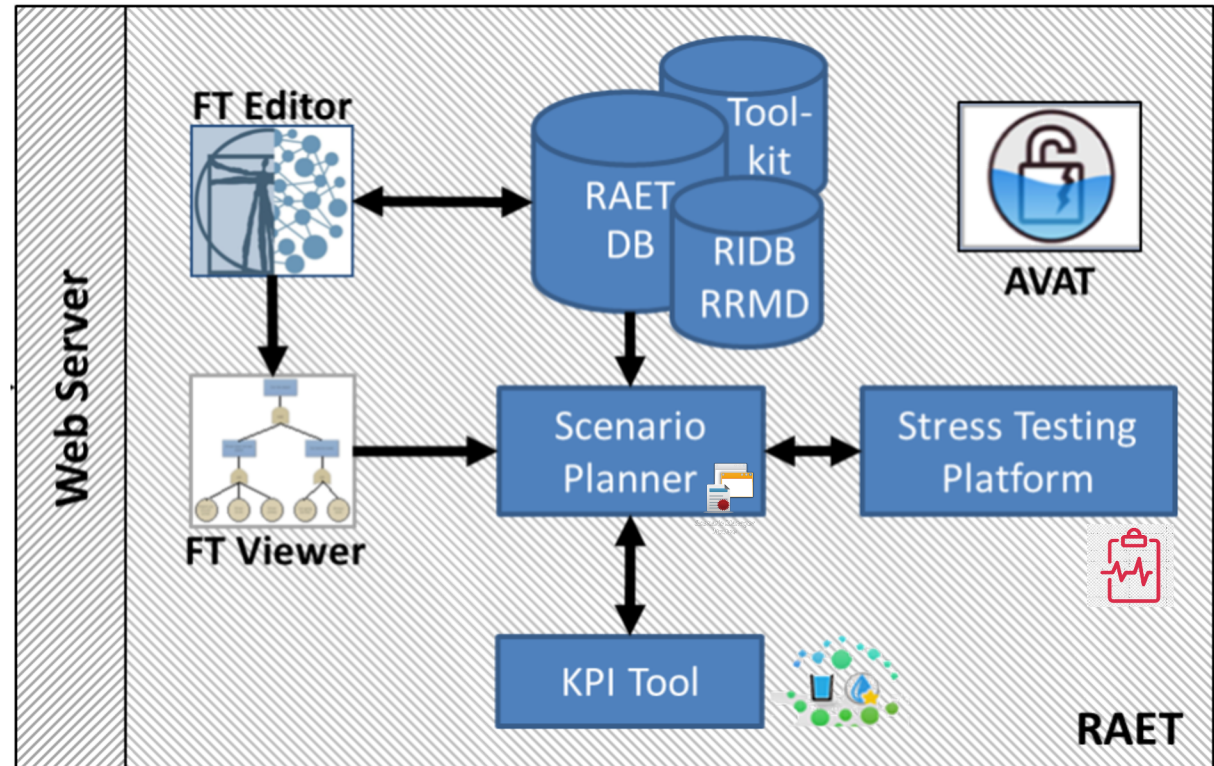
Adaptable



Flexible

STOP-IT modules:

- ❑ **Module1: Risk Assessment & Treatment Framework**
- ❑ Module 2: Secure wireless sensor communications module
- ❑ Module 3: Toolbox of technologies for securing IT and SCADA
- ❑ Module 4: Toolbox of technologies for protecting against physical threats in CI
- ❑ Module 5: Cyber Threat Incident Service
- ❑ Module 6: Real-Time anomaly detection system
- ❑ Module 7: Public Warning System-Secure Information Exchange Technologies
- ❑ Module 8: Reasoning Engine
- ❑ Module 9: Enhanced Visualisation Interface for the water utilities



High level use-cases of Module I components:

1. **Assess vulnerability (AVAT)**
2. **Navigate through potential risks & design/configure multiple risks scenarios**
3. **Simulate physical system interacting with their cyber layer**
4. **Visualise system's response and quantify/assess overall impacts**
5. **Assess scenarios of measure(s) implementation to the system**



4 Journal Papers

- D. Nikolopoulos, G. Moraitis, D. Bouziotas, A. Lykou, G. Karavokiros, and C. Makropoulos, **Cyber-physical stress-testing platform for water distribution networks**, Journal of Environmental Engineering, 146 (7), 04020061, 2020.
- G. Moraitis, D. Nikolopoulos, D. Bouziotas, A. Lykou, G. Karavokiros, and C. Makropoulos, **Quantifying failure for critical water Infrastructures under cyber-physical threats**, Journal of Environmental Engineering, 146 (9), 2020.
- D. Nikolopoulos, A. Ostfeld, E. Salomons, and C. Makropoulos, **Resilience assessment of water quality sensor designs under cyber-physical attacks**, Water, 13 (5), 647, 2021.
- D. Nikolopoulos and C. Makropoulos, **Stress-testing Water Distribution Networks for Cyber-Physical Attacks on Water Quality**, Urban Water Journal, 2021.

1 Book Chapter

- D. Nikolopoulos, G. Moraitis and C. Makropoulos, *Strategic and Tactical Cyber-Physical Security for Critical Water Infrastructures*, in “Cyber-Physical Threat Intelligence for Critical Infrastructures Security”, 2021.

5 Conference Papers

- C. Makropoulos, R. Ugarelli, D. Nikolopoulos, D. Kalogeras, I. Tsoukalas, P. van Thienen and M. Morley, **Developing a stress-testing platform for cyber-physical water infrastructure**, IWA, Tokyo, 2018.
- D. Nikolopoulos, C. Makropoulos, D. Kalogeras, K. Monokrousou, and I. Tsoukalas, **Developing a stress-testing platform for cyber-physical water infrastructure**, 2018 International Workshop on Cyber-Physical Systems for Smart Water Networks (CySWater), Porto, 2018.
- D. Nikolopoulos, G. Moraitis, D. Bouziotas, A. Lykou, G. Karavokiros, and C. Makropoulos, **RISKNOUGHT: A cyber-physical stress-testing platform for water distribution networks**, 11th World Congress on Water Resources and Environment “Managing Water Resources for a Sustainable Future”, Madrid, EWRA, 2019.
- D. Nikolopoulos, G. Moraitis, D. Bouziotas, A. Lykou, G. Karavokiros, and C. Makropoulos, **RISKNOUGHT: Stress-testing platform for cyber-physical water distribution networks**, EGU, 2020
- G. Moraitis, G. Karavokiros, D. Nikolopoulos, A. Lykou and C. Makropoulos, **Introducing a Risk Analysis and Evaluation Toolkit (RAET) for cyber-physical preparedness and planning of critical water infrastructures**, IWA Digital World Water Congress, 2021



STOP-IT - Homepage

localhost:8000

Home FT SP Wizard Lists Search Admin Search...

Risk Analysis and Evaluation Toolkit

Identify Risks

Identify risks based on Fault Tree Analysis.

Identify Vulnerabilities

Identify the most vulnerable components of your infrastructure.

Check for Tools

Check the library for appropriate tools capable to simulate events.

Create your Scenario

Create a new threat scenario for your utility and run a simulation with the model of your choice.

Stress-Test your Network

Create stress-test scenarios and evaluate the performance of your network.

Secure your Infrastructure

Check for possible risk reduction measures that address the identified risks.

☐ Scenario Planner

Identify risks and build a network specific **threat scenario**



☐ Stress Test Platform

Simulate the scenario

☐ KPI tool

Evaluate the scenario consequences

☐ Risk reduction measures database

Explore appropriate **treatment** options



A **user-friendly graphical environment** for the investigation of threat and cascading effect scenarios

The screenshot displays the 'Fault Trees' section of the STOP-IT application. At the top, there is a navigation bar with links for Home, FT, SP Wizard, Lists, Search, and Admin. Below this, the 'Fault Trees' title is centered. A table lists two entries:

| Operations | Name | Description | Root Event | Nr of Events | Created |
|------------|---------------------|--|------------|------------------------------|-------------------------|
| | STOP-IT Quantity FT | STOP-IT Water Quantity Fault Tree based on the Urban Water Cycle | Gate 147 | Gates: 87, Basic events: 141 | May 10, 2019, 6:24 a.m. |
| | STOP-IT Quality FT | STOP-IT Water Quality Fault Tree based on the Urban Water Cycle | Gate 120 | Gates: 56, Basic events: 77 | May 10, 2019, 6:56 a.m. |

Below the table, it says 'Showing 1 to 2 of 2 entries'. There is a 'New FT' button and pagination controls showing 'Previous', '1', and 'Next'.

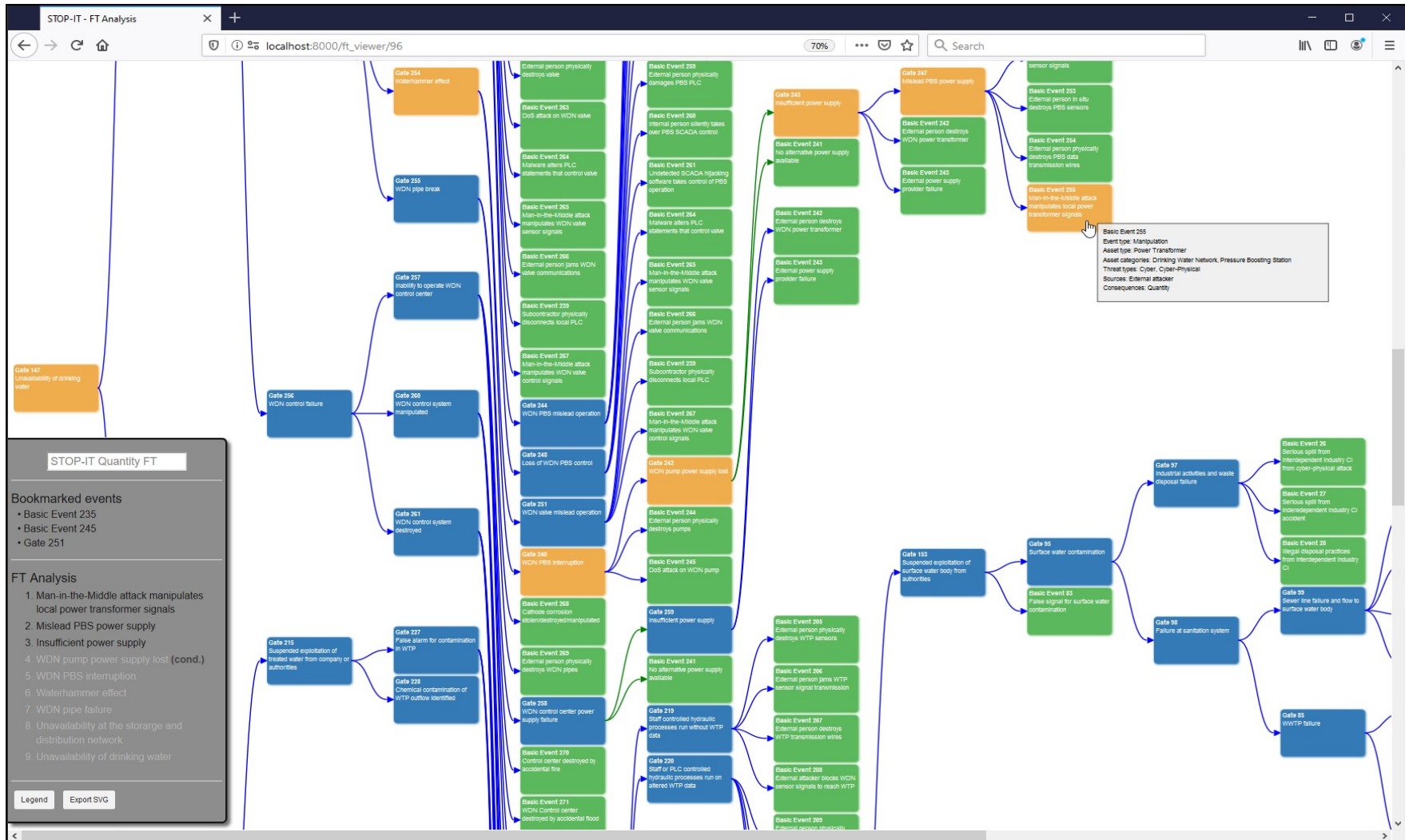
GUI of FT Viewer of SP

Users may utilise any Quantity or Quality FT:

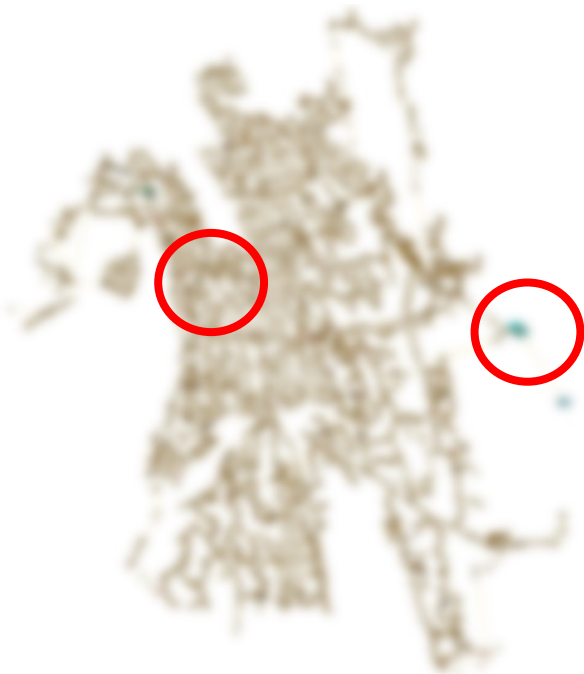
- **Interact with STOP-IT generic predefined FTs** for an all hazard approach (cyber-physical attacks, natural disasters, human error, etc.). *OR*
- **Customise existing FTs or create new FTs** by using the PSA Explorer and then **Load the user- developed FTs** (based on an open PSA format)



STOP-IT Scenario Planner: Identifying risks through FTs

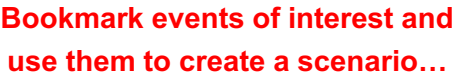


Use a FT architecture to visualise the **event cascade** from a basic event (e.g. an attack) to the undesired end event (e.g. water supply disruption)



| | |
|----------------------|------|
| Number of Junctions | 5223 |
| Number of Reservoirs | 1 |
| Number of Tanks | 3 |
| Number of Pipes | 5482 |

| # | Risk Short name | Risk description |
|---|-----------------|---|
| 1 | Risk Scenario 1 | <i>Cyber-physical caused manipulation of control system affecting drinking water tanks (Event ID 57 from RIBD)</i> |
| 2 | Risk Scenario 2 | <i>Combination of Risk Scenario 1 (Event ID 57 from RIBD) and Physical caused destruction of water tank or pipeline (Event ID 31 from RIBD)</i> |
| 3 | Risk Scenario 3 | <i>Manipulation of level sensor in a tank used for firefighting</i> |





STOP-IT Scenario Planner: Building a scenario

GUI of SP: Building a RISKNOUGHT scenario

New Epanet CPA Scenario

Main Data

Name: IWA webinar scenario
A unique name for the scenario

Description: Manipulation of a C-Town tank sensor (ID: T2) for the purposes of IWA webinar - Structured and seamless risk management workflow in the STOP-IT RAET hub
Short description of the scenario

Base scenario: C-Town BAS
Scenario to be used as Base scenario for this one

☐ This is a Base scenario

Cancel Save

Creating a scenario

Events

1. Event 2. Asset 3. Parameters

Select from overall 5 events the one associated with the scenario

| ID | Name | Description | Asset Type | Event Type | Basic or Intermediate |
|------|-----------------|--|-------------------------|--------------|-----------------------|
| 4482 | Basic Event 235 | External person in situ manipulates WDN tank level sensor | Sensor | Manipulation | Basic |
| 4492 | Basic Event 252 | Man-in-the-Middle attack manipulates WDN PBS sensor signals | Sensor | Manipulation | Basic |
| 4496 | Basic Event 250 | Malware alters PLC statements that control pump | Control System | Manipulation | Basic |
| 4509 | Basic Event 267 | Man-in-the-Middle attack manipulates WDN valve control signals | Transferred Information | Manipulation | Basic |
| 4957 | Basic Event 153 | External attacker manipulates WTP transmission devices | Transmission Devices | Manipulation | Basic |

Showing 1 to 5 of 5 entries

Filter
Use filters to narrow down the list of events
Search event...
☒ Bookmarked events
Event Type (1)
☐ Destruction
☐ Interruption
☒ Manipulation
☐ Pollution
Asset Type
Fault Tree

Previous Next Cancel

Defining an event/threat

1. Event 2. Asset 3. Parameters

Selected event: Basic Event 235: External person in situ manipulates WDN tank level sensor
Select an asset that is affected by the event

| Asset ID | RIDB Asset Type ID | RIDB Asset Type | EPANET Asset Type ID | Modeled Asset Type | Relation |
|----------|--------------------|-----------------|----------------------|--------------------|---------------------|
| T1 | 14 | Sensor | 100 | Sensor | Related asset: Tank |
| T2 | 14 | Sensor | 100 | Sensor | Related asset: Tank |
| T3 | 14 | Sensor | 100 | Sensor | Related asset: Tank |
| T4 | 14 | Sensor | 100 | Sensor | Related asset: Tank |
| T5 | 14 | Sensor | 100 | Sensor | Related asset: Tank |
| T6 | 14 | Sensor | 100 | Sensor | Related asset: Tank |
| T7 | 14 | Sensor | 100 | Sensor | Related asset: Tank |

Showing 1 to 7 of 7 entries

Previous Next Cancel

Defining the asset(s) affected

1. Event 2. Asset 3. Parameters

Selected event: Basic Event 235: External person in situ manipulates WDN tank level sensor
Selected asset: T2 (Sensor)
Specify parameter values for the scenario

Duration: 15
Duration in full hours for which the event will last. During this time the service provided by the asset will be interrupted completely. After the specified time the asset will resume full operation.

Value: 6.2
A real number indicating the fake tank level in metres

Start time: 5
An integer indicating the beginning of the event in hours after simulation start.

Cancel Save

Previous Finish Cancel

Defining the simulation parameters



STOP-IT - Homepage

localhost:8000

Home FT SP Wizard Lists Search Admin Search...

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Scenario Planner

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Stress Test Platform

Simulate the scenario

KPI tool

Evaluate the scenario consequences










Risk reduction measures database

Explore appropriate **treatment** options



Stress-Test Procedures

Show 10 entries

| Operations | Name | Base scenario | Created |
|--|-----------------------------------|--------------------------------------|------------|
|    | ST procedure 2 | Tank level sensor manipulation 2-10h | 2020-04-06 |
|    | ST Procedure 3 | Tank level sensor manipulation 2-20h | 2020-04-06 |
|    | Pollution and sensor manipulation | Pollution and sensor manipulation | 2020-05-05 |

Show 1 to 3 of 3 entries



Creating a ST procedure



Stress-Test Procedure

Name*
A unique name for the stress-testing procedure

Description
Short description of the stress-testing procedure

Base scenario*
Select the base scenario for stress-testing. Excluded are scenarios having no parameters to calibrate

Specifying ST procedure attributes

(*) Required fields

Control variables

| Name | Minimum | Maximum | Method | Nr. of values | Event |
|------------|----------------------------------|----------------------------------|---|--------------------------------|--|
| Duration | <input type="text" value="0"/> | <input type="text" value="16"/> | <input type="text" value="Incremental"/> | <input type="text" value="4"/> | Event: Basic Event 235 Asset: T2 (Sensor) |
| Value | <input type="text" value="5.5"/> | <input type="text" value="5.9"/> | <input type="text" value="Random selection"/> | <input type="text" value="4"/> | Event: Basic Event 235 Asset: T2 (Sensor) |
| Start time | <input type="text" value="2"/> | <input type="text" value="6"/> | <input type="text" value="Random selection"/> | <input type="text" value="2"/> | Event: Basic Event 235 Asset: T2 (Sensor) |

Cancel Save

Specifying the values for the control variables

| | | |
|--------------------------|--------------------------------------|--|
| Name | New ST procedure | Control Variables |
| Description | | |
| Base scenario | Tank level sensor manipulation 2-10h | 1. External person in situ manipulates WDN tank level sensor (Basic Event 235), Asset: T2, Values: 8-16, Method: Incremental |
| Tool | Epanet CPA | 2. External person in situ manipulates WDN tank level sensor (Basic Event 235), Asset: T2, Values: 5.7-5.7, Method: Random selection |
| Created | 2020-05-31 08:35 | 3. External person in situ manipulates WDN tank level sensor (Basic Event 235), Asset: T2, Values: 2-8, Method: Random selection |
| Modified | 2020-05-31 21:15 | |
| Completed runs | 5 out of 16 | |
| Estimated remaining time | 6' 8" | KPI1: Customer minutes lost [Customer Minutes] |
| Status | Running | KPI2: Customers experiencing insufficient service [Customers] |
| | | KPI3: Nodes insufficiently supplied [Nodes] |
| | | KPI4: System service hours lost [Hours] |
| | | KPI5: Unmet demand [liters] |

Interrupt Run Clear

Copy

CSV

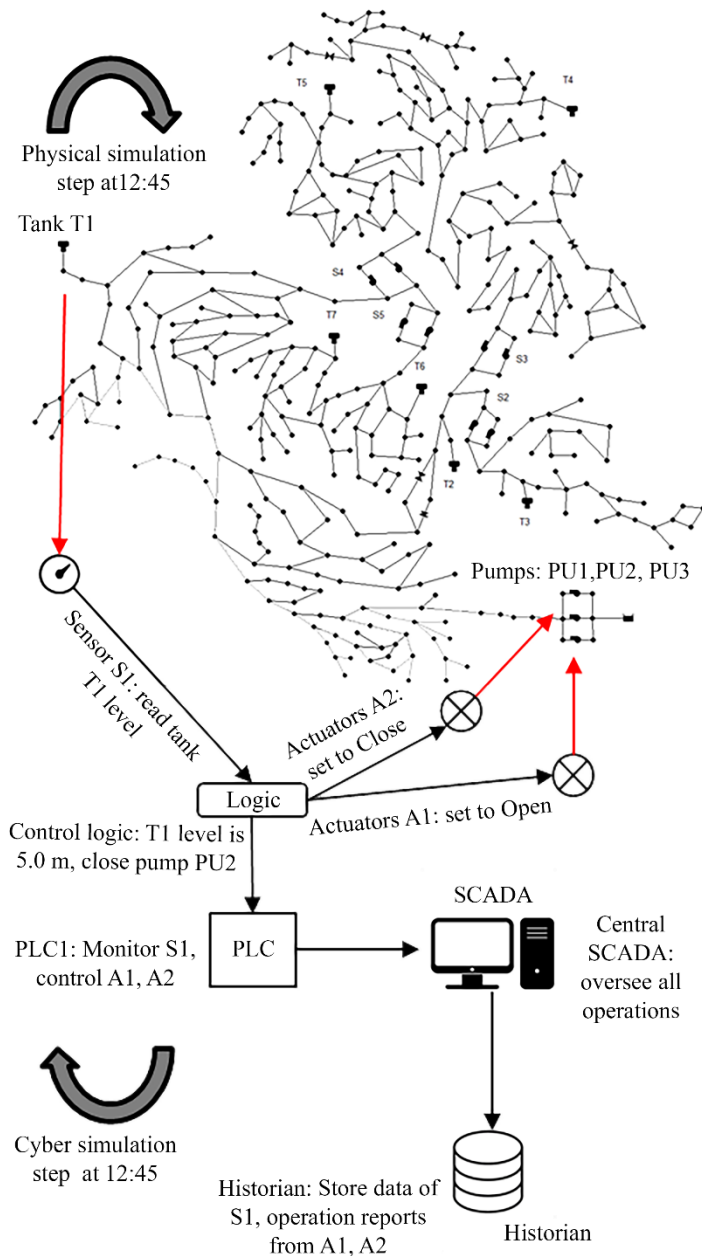
| Nr | Executed | Control variables | Time [s] | KPI1 | KPI2 | KPI3 | KPI4 | KPI5 |
|----|------------------|---------------------------------------|----------|------------|----------|--------|------|-----------|
| 5 | 2020-05-31 21:18 | Duration 10, Value 5.70, Start time 2 | 29.60 | 4326947.42 | 44674.20 | 174.00 | 4.00 | 603318.96 |
| 4 | 2020-05-31 21:17 | Duration 8, Value 5.70, Start time 6 | 30.57 | 0.00 | 26719.98 | 118.00 | 0.00 | 2981.16 |
| 3 | 2020-05-31 21:17 | Duration 8, Value 5.70, Start time 3 | 29.68 | 0.00 | 27060.31 | 119.00 | 0.00 | 1042.92 |
| 2 | 2020-05-31 21:16 | Duration 8, Value 5.70, Start time 2 | 30.55 | 1875542.69 | 39869.37 | 173.00 | 2.00 | 261876.60 |
| 1 | 2020-05-31 21:16 | Duration 8, Value 5.70, Start time 2 | 46.80 | 1875542.69 | 39869.37 | 173.00 | 2.00 | 261876.60 |

Create a series of scenario variants

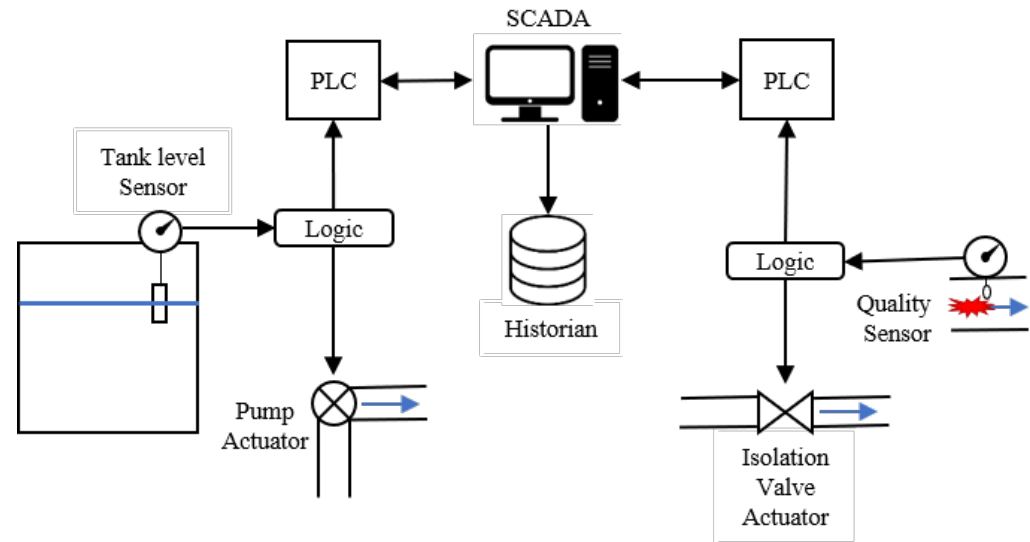




STOP-IT Stress-Testing Platform: RISKNOUGHT










- **RISKNOUGHT** simulates the **flow of information within the cyber layer (SCADA)** and the **interconnection with physical processes (hydraulic model)**
- **Control logic** of the WDN is explicitly formulated
- **Hydraulics** are solved interactively with EPANET (using **PDA equations**)







STOP-IT Stress-Testing Platform: Running the scenarios

| Scenarios | | | | | | | |
|--|------------|---------------|--------------------------------------|---|--------|------------------|------------------|
| Operations | Tools | Base scenario | Name | Description | Events | Created | Executed |
|  | Epanet CPA | C-Town BAS | IWA webinar scenario | Manipulation of a C-Town tank sensor (ID: T2) for the purposes of IWA webinar - Structured and seamless risk managem... | 1 | 2020-05-31 19:11 | |
|  | RISKNOUGHT | | Sensor manipulation | Sensor manipulation at junction J411 | 1 | 2020-05-05 19:03 | 2020-05-05 20:25 |
|  | RISKNOUGHT | | Pollution only | Pollution at junction J411 | 1 | 2020-05-05 19:00 | 2020-05-05 19:11 |
|  | RISKNOUGHT | | Pollution and sensor manipulation | Pollution and sensor manipulation at junction J411 | 2 | 2020-05-05 16:30 | 2020-05-05 16:56 |
|  | Epanet CPA | C-Town BAS | Tank level sensor manipulation 2-20h | | 1 | 2020-04-06 07:56 | 2020-04-06 07:56 |
|  | Epanet CPA | C-Town BAS | Tank level sensor manipulation 2-10h | Tank level sensor manipulation 2-10h and storage tank failure | 1 | 2020-04-06 07:52 | 2020-04-06 07:52 |
|  | Epanet CPA | C-Town BAS | C-Town BAS | Business-As-Usual Scenario of C-Town | 0 | 2019-03-20 13:56 | 2019-03-22 17:02 |

✓ **Scenario Planner**
Identify risks and build a network specific **threat scenario**

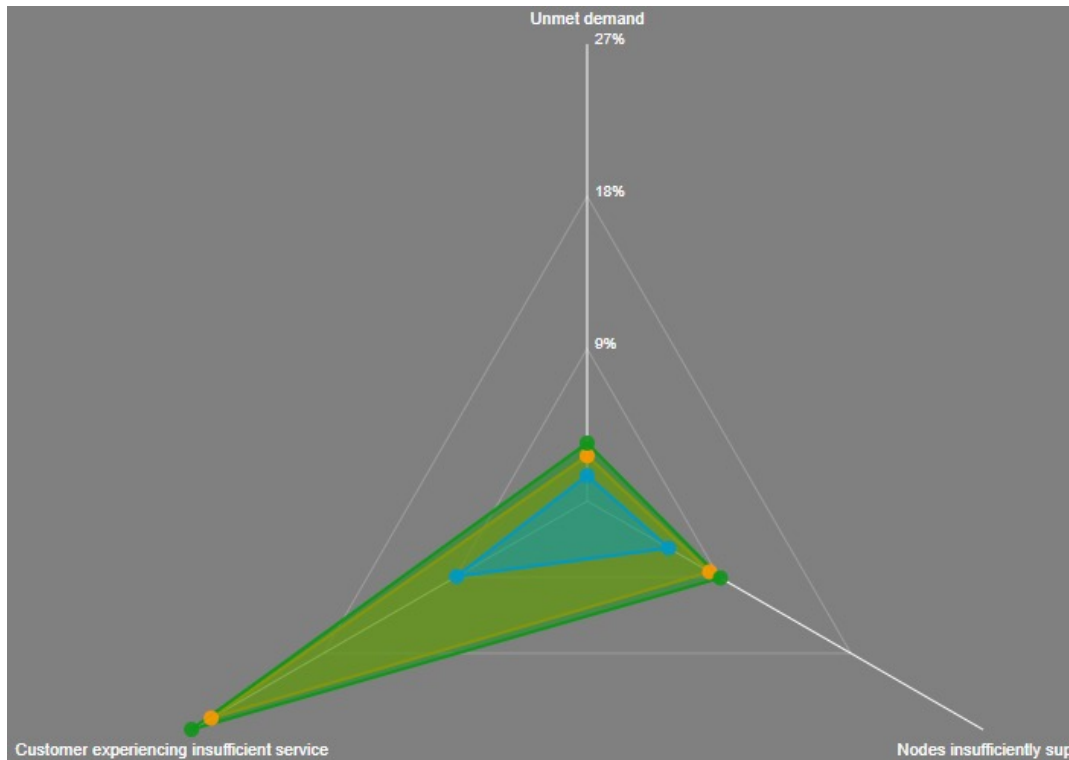
❑ **Stress Test Platform**
Simulate the scenario  

❑ **KPI tool**
Evaluate the scenario consequences

❑ **RRMD-RIDB**
Explore appropriate **treatment** options



STOP-IT Stress-Testing Platform: Comparing impacts



✓ **Scenario Planner**
Identify risks and
build a network specific
threat scenario

✓ **Stress Test Platform**
Simulate the scenario

❑ **KPI tool**
Evaluate the scenario
consequences



❑ **Risk reduction**
measures database
Explore appropriate
treatment options



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☐ Stress Test Platform

Simulate the scenario

☐ KPI tool

Evaluate the scenario consequences

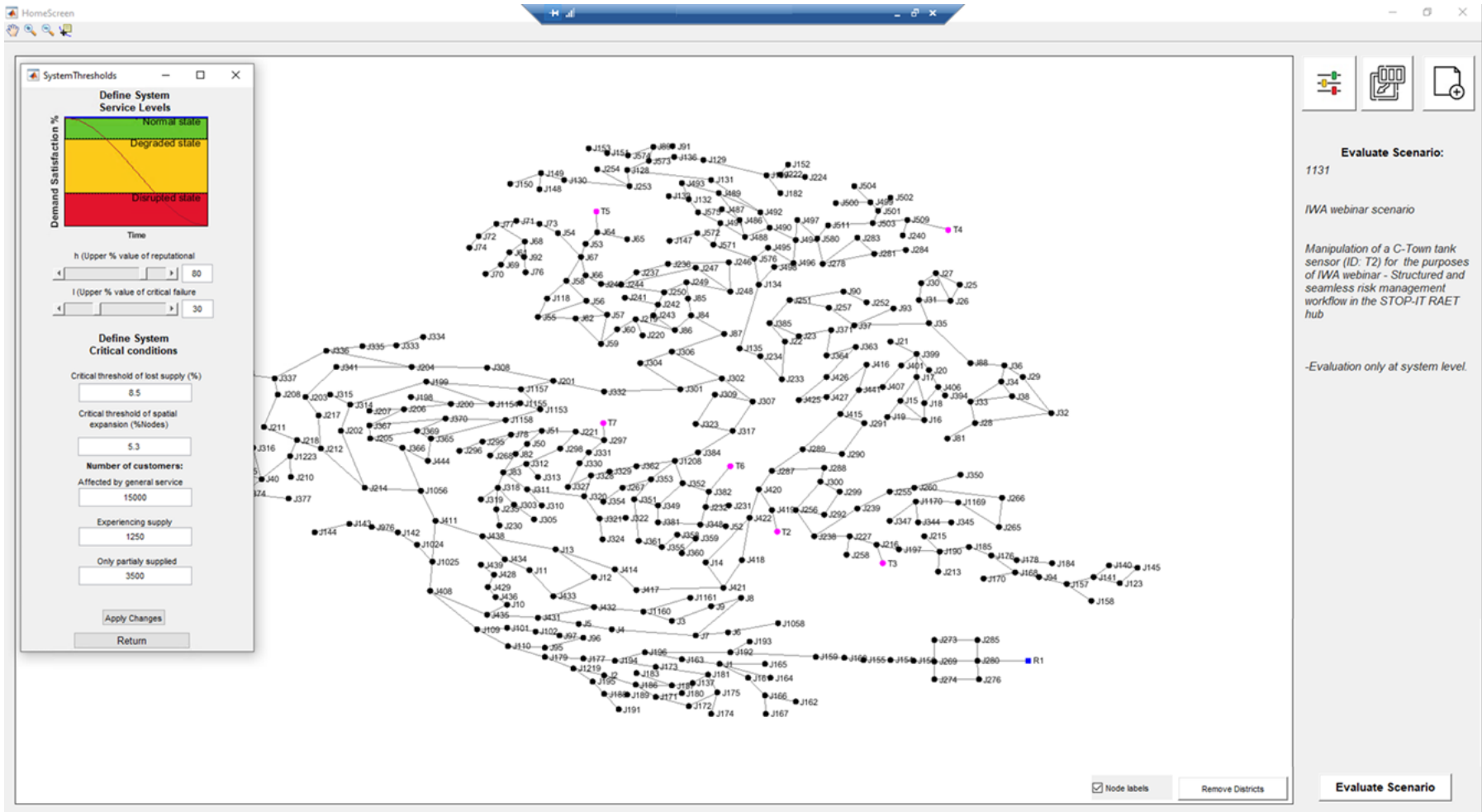
☐ Risk reduction measures database

Explore appropriate **treatment** options



STOP-IT

KPI tool: Assessment and detailed visualisation of results



Users can:

- ❑ Can set the **service levels** for **different districts** & different thresholds for **critical customers**
- ❑ Visualise results and STOP-IT KPIs for any grouping they choose (DMAs etc.)



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KPI tool: Interactive dashboard to assess and evaluate

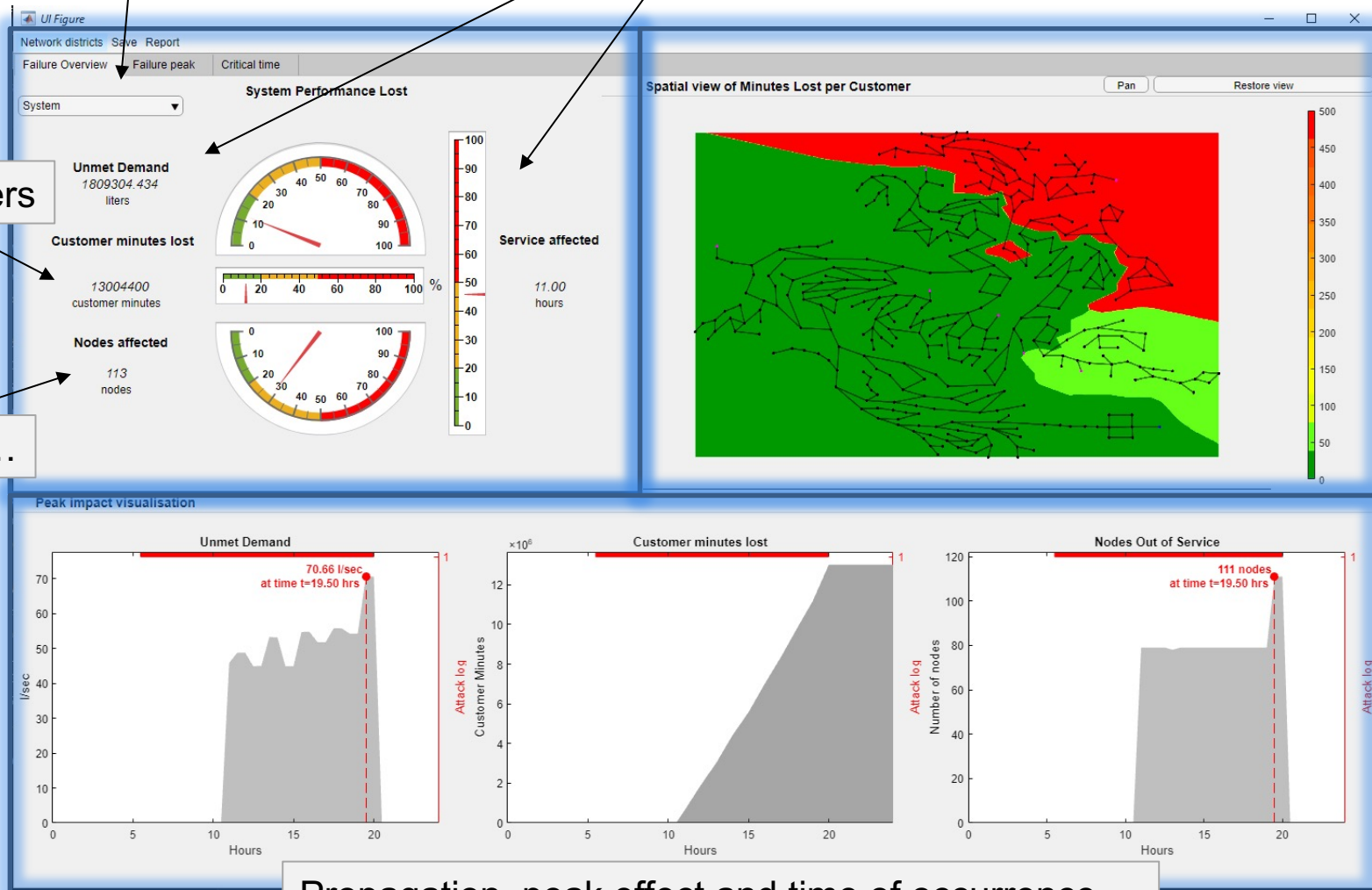
For the system.. Or each district

Supply...

Time

Customers

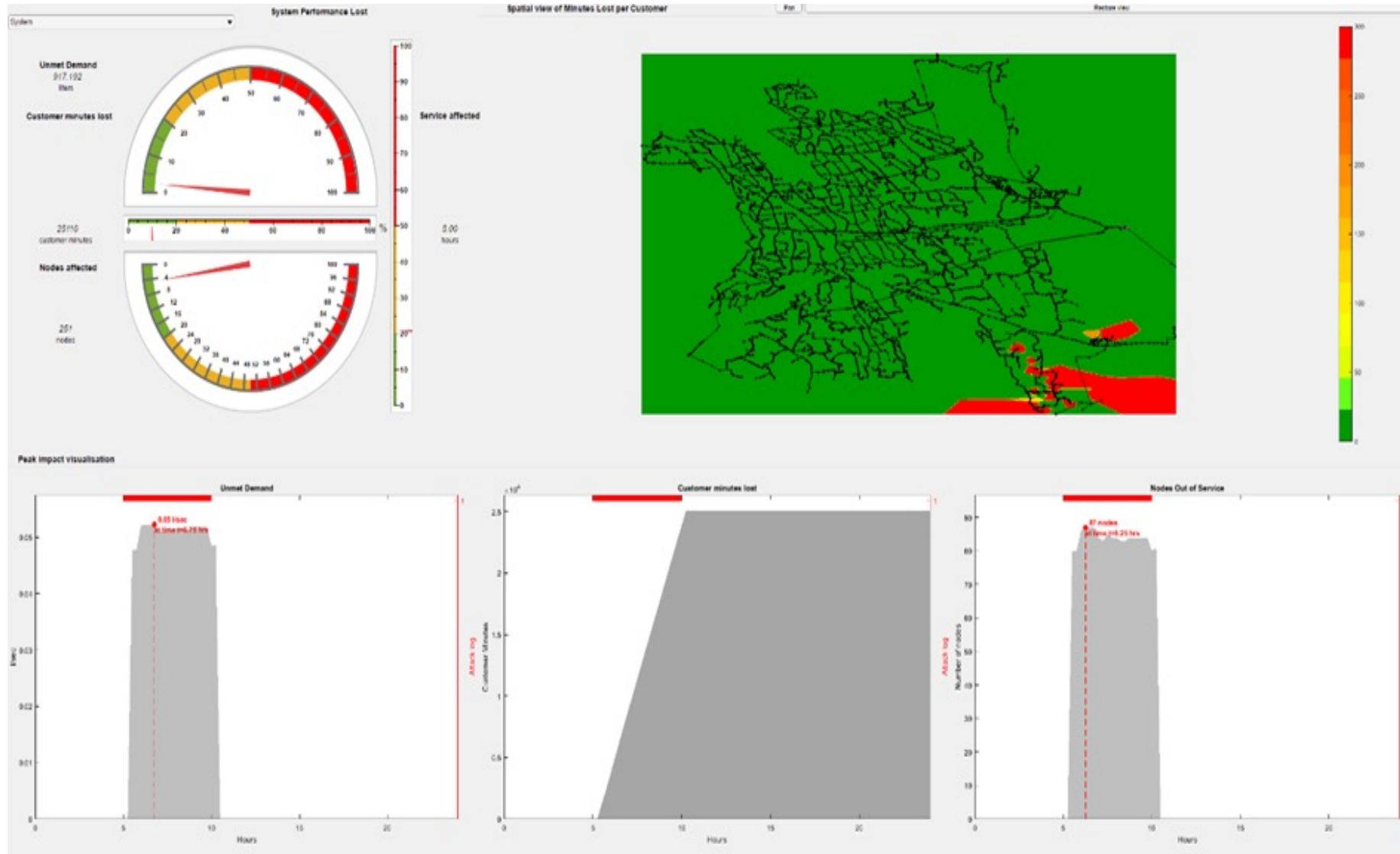
Nodes...



Propagation, peak effect and time of occurrence...



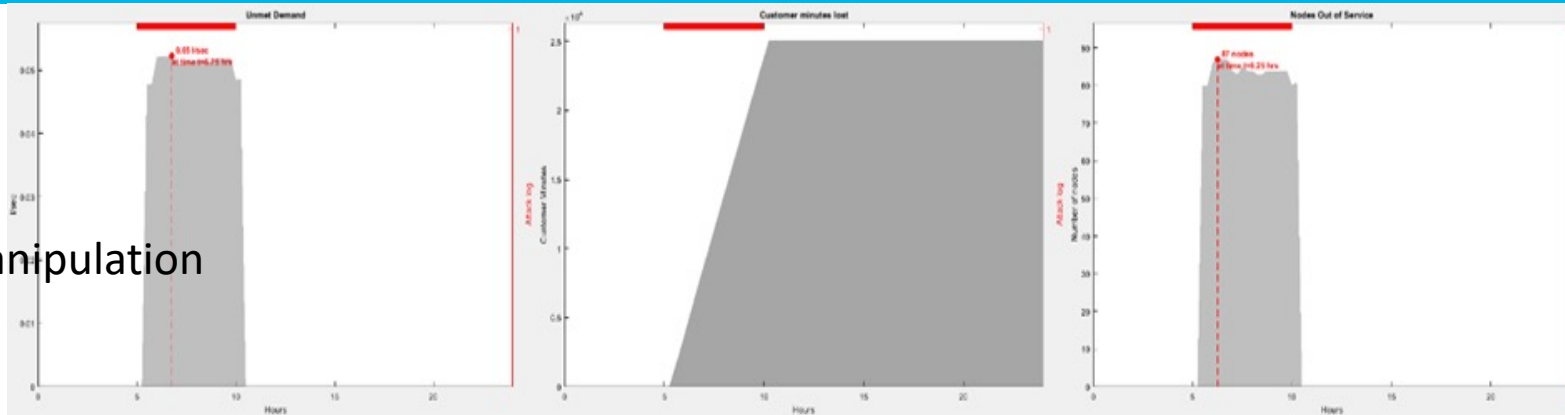
STOP-IT KPI tool: Oslo VAV demonstration



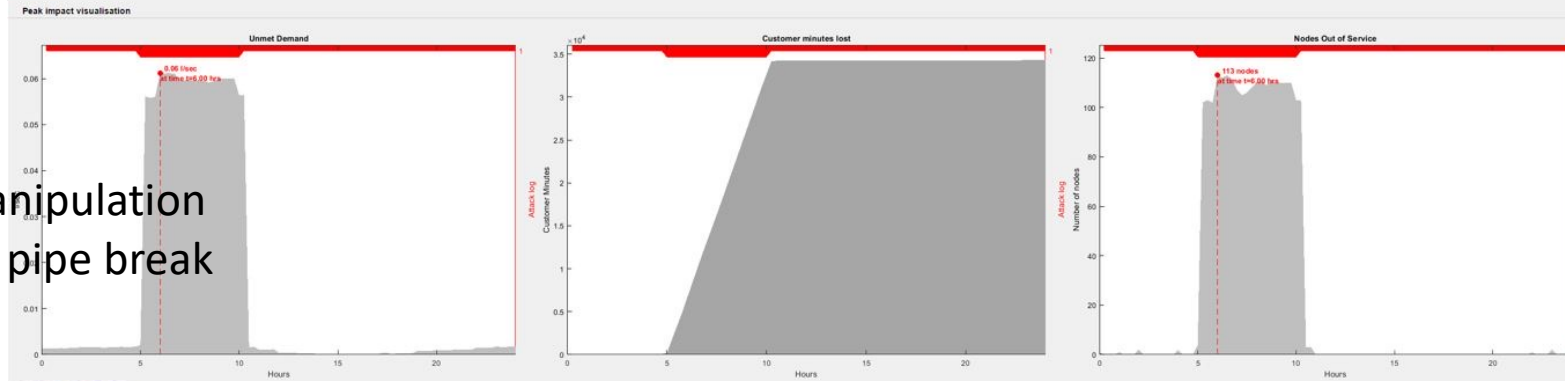


STOP-IT KPI tool: Oslo VAV demonstration

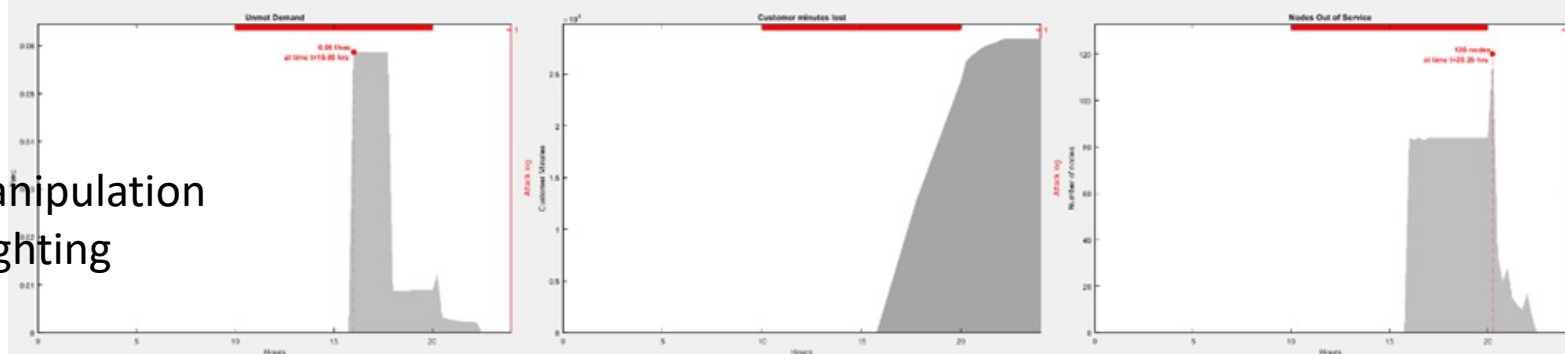
Risk scenario 1
Level sensor manipulation
Tank 2

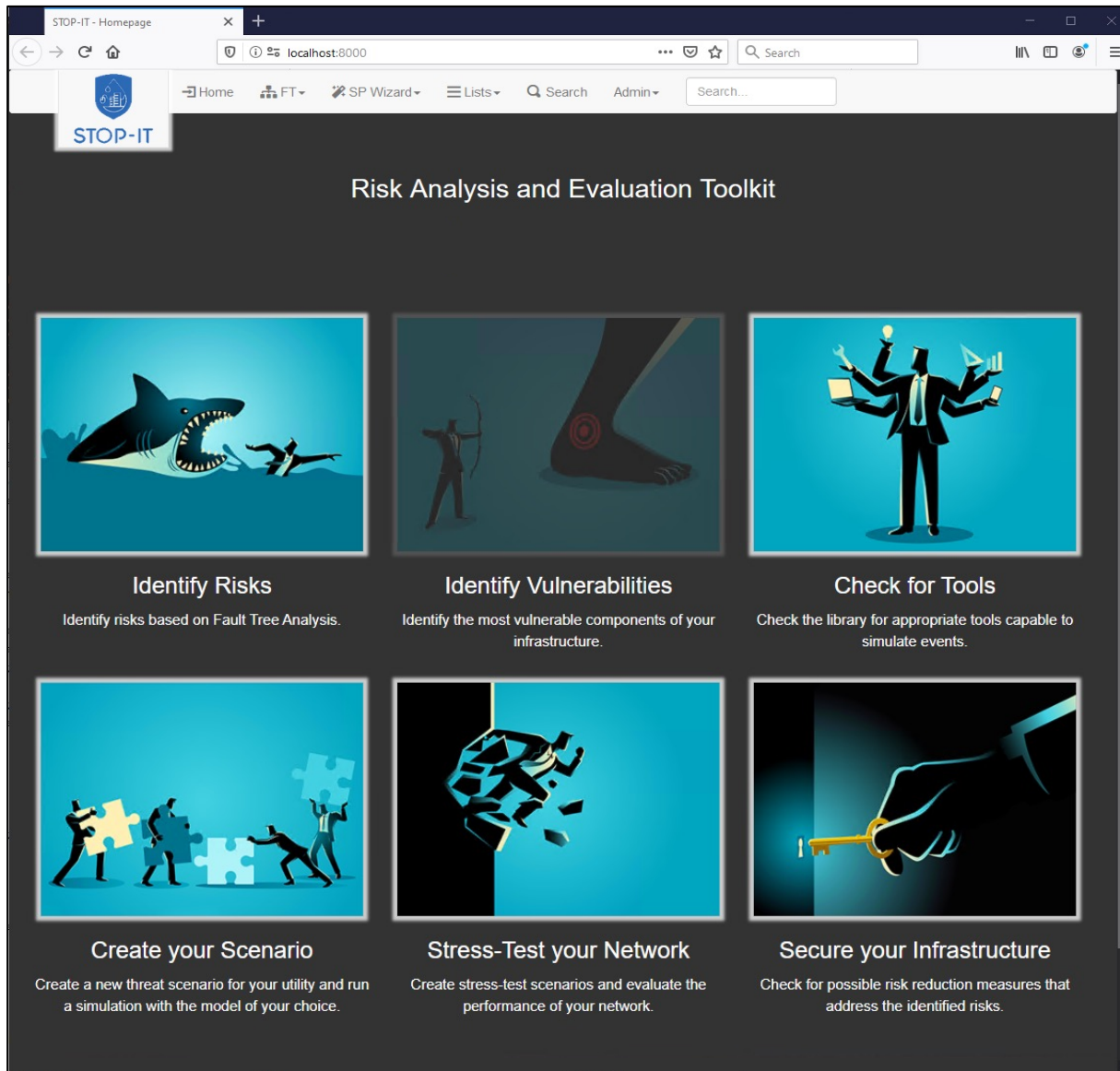


Risk scenario 2
Level sensor manipulation
Tank 2 + critical pipe break



Risk scenario 3
Level sensor manipulation
Tank 3 for firefighting





✓ **Scenario Planner**
Identify risks and
build a network specific
threat scenario

✓ **Stress Test Platform**
Simulate the scenario

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Evaluate the scenario
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measures database**
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STOP-IT

Matching Risks with Potential Risk Reduction Measures

Main event characteristics

Matching attributes, common in RIDB and RRMD

Models & Tools capable to simulate events

| ID | Name | Description | Direct Consequence | Node | Fault Tree | Asset Type | Event Type | Asset Category | Threat Categories | Event Source Types | Event Consequences | Related tools | Event supported by RAET | Risk Reduction Measures |
|------|----------------|--|--|--------------|--------------------------|----------------|--------------|--|-------------------------|---|--------------------|-----------------------|-------------------------|-------------------------|
| 5271 | Gate 96 | Contamination from farming activities | Groundwater contamination | Intermediate | STOP-IT Water Quality FT | Groundwater | Pollution | Catchment Area | Physical | Human fault | Quality | Epanet MSX RISKNOUGHT | RISKNOUGHT | 14 |
| 5161 | Basic Event 27 | Serious spill from interdependent Industry CI accident | Industrial activities and waste disposal failure | Basic | STOP-IT Quantity FT | Surface Water | Pollution | Catchment Area Raw Water Bodies | Physical | Human fault Interdependent CI | Quantity | Epanet MSX RISKNOUGHT | RISKNOUGHT | 15 |
| 5199 | Basic Event 33 | Pesticide seepage to groundwater catchment | Contamination from farming activities | Basic | STOP-IT Quantity FT | Groundwater | Pollution | Catchment Area Raw Water Bodies | Physical | Human fault | Quantity | Epanet MSX RISKNOUGHT | RISKNOUGHT | 12 |
| 5200 | Basic Event 34 | Nutrient pollution of groundwater catchment | Contamination from farming activities | Basic | STOP-IT Quantity FT | Groundwater | Pollution | Catchment Area Raw Water Bodies | Physical | Human fault Natural phenomena | Quantity | Epanet MSX RISKNOUGHT | RISKNOUGHT | 12 |
| 5162 | Basic Event 28 | Illegal disposal practices from interdependent Industry CI | Industrial activities and waste disposal failure | Basic | STOP-IT Quantity FT | Surface Water | Pollution | Catchment Area Raw Water Bodies | Physical | Interdependent CI | Quantity | Epanet MSX RISKNOUGHT | RISKNOUGHT | 7 |
| 5198 | Basic Event 36 | Seepage of Interdependent Industry CI waste to groundwater catchment | Groundwater contamination | Basic | STOP-IT Quantity FT | Groundwater | Pollution | Catchment Area Raw Water Bodies | Physical | Interdependent CI | Quantity | | | |
| 5160 | Basic Event 26 | Serious spill from Interdependent Industry CI from cyber-physical attack | Industrial activities and waste disposal failure | Basic | STOP-IT Quantity FT | Surface Water | Pollution | Catchment Area Raw Water Bodies | Physical Cyber-Physical | Interdependent CI | Quantity | | | |
| 5065 | Gate 190 | Surface water system mismanagement | Unavailability from reservoir | Intermediate | STOP-IT Quantity FT | Control System | Manipulation | Catchment Area Raw Water Bodies Water Abstraction Points | | | Quantity | | | |
| 5066 | Gate 191 | Mislead surface water management system | Surface water system mismanagement | Intermediate | STOP-IT Quantity FT | Control System | Manipulation | Catchment Area Raw Water Bodies Water Abstraction Points | | External attacker Internal attacker Human fault | Quantity | | | |
| 5064 | Gate 155 | Unavailability from reservoir | Unavailability from surface catchment area | Intermediate | STOP-IT Quantity FT | Surface Water | Interruption | Catchment Area Raw Water Bodies Water Abstraction Points | | | Quantity | | | |
| 5068 | Gate 193 | Surface water management system functions on altered data | Mislead surface water management system | Intermediate | STOP-IT Quantity FT | Control System | Manipulation | Catchment Area Raw Water Bodies Water | Cyber Cyber-Physical | External attacker Internal attacker | Quantity | | | |

Number of potential RRM

List of RRM

Show 10 entries

Search:

| Measure ID | Name | Description | Comments | Terms and Keywords | Risk reduction mechanism |
|------------|-----------------------------------|---|---|--------------------|-------------------------------------|
| M12 | SupervisionOfExternals | Supervision of any external people entering the water utility or sensitive sites. Any people who enter sites and who are ... | | | Frequency/Likelihood |
| M16 | SourceWaterQualityControl | Control of raw water quality. The aim is to control the raw water quality in order to select the best ... | | | Frequency/Likelihood & Consequences |
| M19 | FiltersInAerationProcesses | All air for aeration purposes in water treatment plants and water storage tanks should be filtered. Thus it is aimed ... | Filters should be installed at every air intake for aeration purposes. Furthermore, no openings for aeration purposes should be built ... | | Frequency/Likelihood |
| M27 | EmployeesTrainings | Regular trainings, seminars, updates and informations on security issues should be implemented for all employees. Thus the staff is always ... | | | Frequency/Likelihood & Consequences |
| M29 | EmergencyPlans | Setting up of emergency plans. Thus clear responsibilities, courses of action, procedures and contacts are defined and documented for emergency ... | A complete crisis plan should exist including responsibilities, pending tasks, important contacts etc. All tasks from the evaluation of the ... | | Consequences |
| M30 | RedundantAssetsAndInfrastructures | Constructions of redundant infrastructures and assets along the whole water supply chain. Thus the failure of one component can, at ... | Redundant infrastructures could exist in the water extraction (wells, river extractions, reservoir extractions, spring water), water treatment infrastructures (filtration, adsorption, ... | | Consequences |
| M33 | AdditionalStorageCapacity | Construction of additional storage tanks. Thus periods of water scarcity can be bridged easier due to a higher amount of ... | | | Consequences |



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RISK REDUCTION MEASURES DATABASE (RRMD): Incorporating measures

| Measures | | | | | |
|-----------------|--------------------------------|---|---|--------------------|--------------------------|
| Show 10 entries | | | | | |
| | | | | Advanced Search | Reassess relations |
| | | | | Search: | |
| Measure ID | Name | Description | Comments | Terms and Keywords | Risk reduction mechanism |
| M51 | PressureAndFlowSensors | Installation of pressure and flow sensors at different positions in the water distribution network. Thus it can be checked if ... | With this network destruct | | |
| M52 | SecureLocks | Installation of secure locks. Thus the picking of locks is substantially complicated. The aim is to prevent that attackers can ... | | | |
| M53 | LevelSensors | Installation of sensors indicating the filling level of storage tanks or additive reservoirs. Thus it can be supervised if any ... | | | |
| M54 | ValvePositionSensors | Installation of sensors indicating the position of valves. Thus it can be checked if all valves are in the ... | | | |
| M55 | PlausibilityChecks | Realization of automatic or manual plausibility checks of different operating and quality parameters. Thus contradictions in different signals can be ... | | | |
| M56 | OperatingParameterSurveillance | Surveillance of operating parameters from the catchment to the final distribution point. Thus any damages, malfunctions or manipulations in the ... | Potential volume t different losses ... | | |
| M30 | EmployeesTrainings | Regular trainings, seminars, updates or similar on security issues should be implemented for all employees. Thus the staff is always ... | | | |

GUI of RRMD: navigating through the measures available in the RRMD

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Home FT SP Wizard Lists Search Admin

Structured search page

You are searching for Measures related with Events having fault tree STOP-IT Quantity FT having asset type Sensor having event type Manipulation related with Scenarios having Name IWA webinar scenario having no Is running

21 items found

Cancel Show me

Event

Name (String)

Description (String)

bookmarked

Probability (Range of real)

fault tree

Parents

asset type

event type

STOP-IT Quantity FT

Any

Sensor

Manipulation

Scenario

Name (String)

Description (String)

created (Date)

executed (Date)

Is running

IWA webinar scenario

Earliest to Latest

Earliest to Latest

Yes No

Event Scenario

GUI of RRMD supporting multiple filtering capabilities

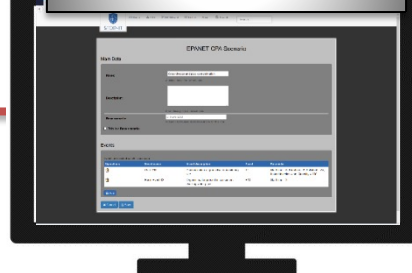
Incorporating measure(s) into scenarios and assessing their impact to system's performance



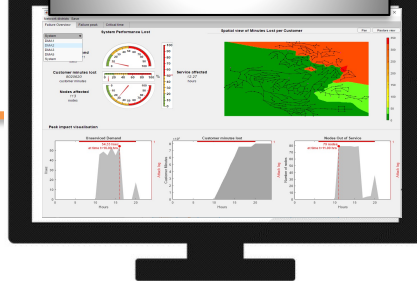
Navigate through risks



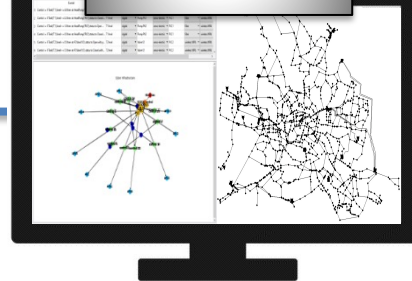
Configure scenario(s)



Evaluate simulations



Run simulations

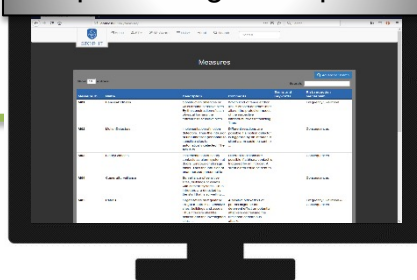


✓ **Scenario Planner**
Identify risks and
build a network specific
threat scenario

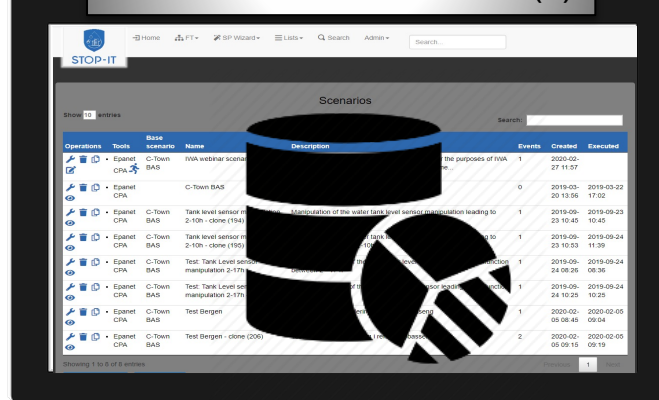
✓ **Stress Test Platform**
Simulate the scenario

✓ **KPI tool**
Evaluate the scenario
consequences

Explore mitigation options



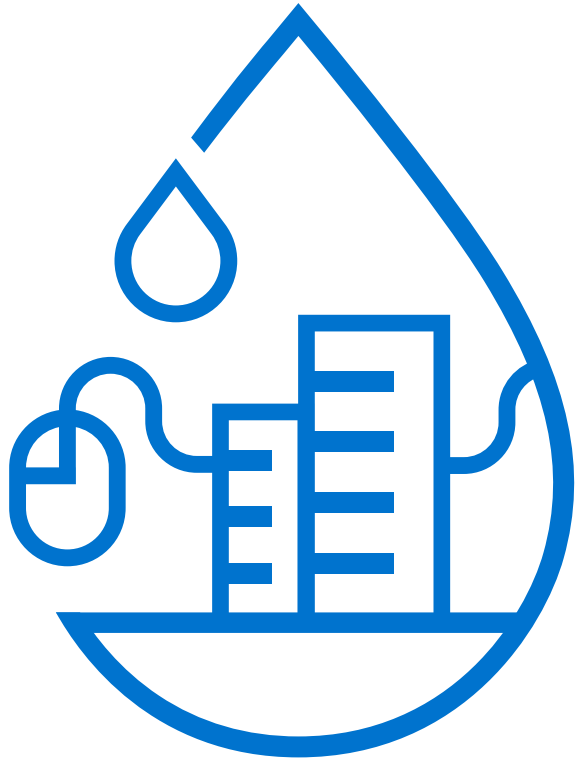
RAET archive of scenario(s)



✓ **Risk reduction
measures database**
Explore appropriate
treatment options



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VAVs erfaring med STOP-IT





- Å lage ledningsnett slik det passer for denne programvaren
 - Importere ledningsnett fra MU til EPANETT
 - Justering av tegn som semikolon, kolon, punktum og minustegn
 - ID-nummer på objekter må forandres
 - Justering av regler
- Installering av ekstern server og programvare:
 - RAET
 - EPANET 2.2
- Diskusjon/møte
 - Internt og eksternt (SINTEF; ICCS; KWR; TECHNION)
- Veksling av erfaring fra kolleger i:
 - Hellas, Berlin, Barcelona, Israel var veldig spennende og lærerikt og man kan bruke det for videre arbeid.



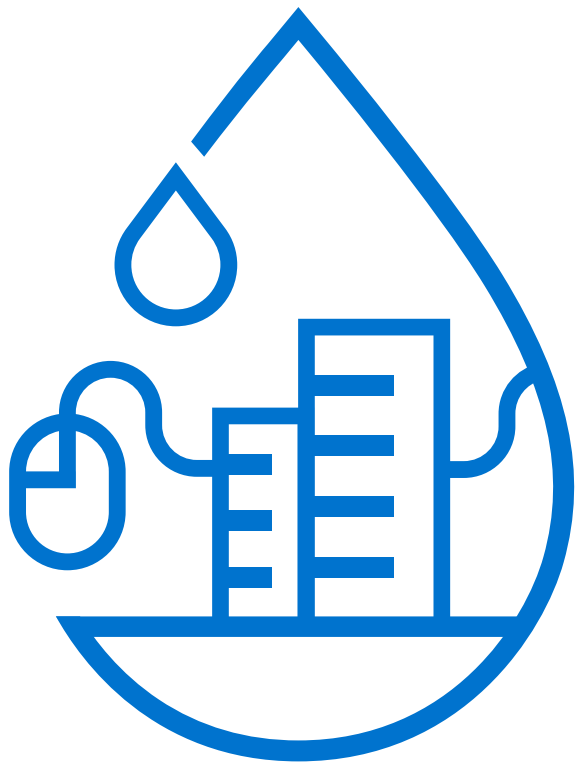
- Gir mer forståelse av ledningsnett
- Enkelt å lage forskjellige senarioer ved bruk av flytskjema
 - Den har ca. 300 forskjellige senarioer
 - For alle type objekter
- Hjelper for å planlegge i forhold til
 - Tid (Hvor lang tid det tar før en vannkrise kan oppstå ved brudd på stor ledning)
 - Antall kummer (størrelsen på området)
 - Antall mennesker/bedrifter som er berørt/forsynt
 - Hvor mange m3 vann en kan miste i løpet av en krise
- Gir god dokumentasjon og lett å forstå/bruke



- Et planleggingsverktøy for ledningsnett
- Gir mer forståelse og er ryddig
- Andre programvarer som vi bruker har ikke flytskjemamulighet
- Man får estimert tid, områder (kummer), mennesker eller bedrifter som er berørt.
- Dokumentasjon kan lages som bilder, grafer, tabeller eller tall.



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