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## Safety

### References

- Kongsberg K-Safe Product Description, 163875/G
- Kongsberg Functional Design Document Safety, Offshore, 1032518/D
- K-Safe Operator Manual, 343964/A

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2



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## Content

- Safety system description
- K-Safe hierarchy
- F & G
- ESD
- Interface / Topology
- Safety View Topology
- Safety Mimic
- Online C&E View
- Safety Indications
- Safety Operations
- F&G Operation Steps



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## K-Safe

**K-Safe** is the Kongsberg product for operation of a Safety Instrumentation System (SIS), also referred to as SAS (Safety Automation System).

Our goal is to teach the operators how to operate the K-Safe system in a safe and efficient way.





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## Safety System Description

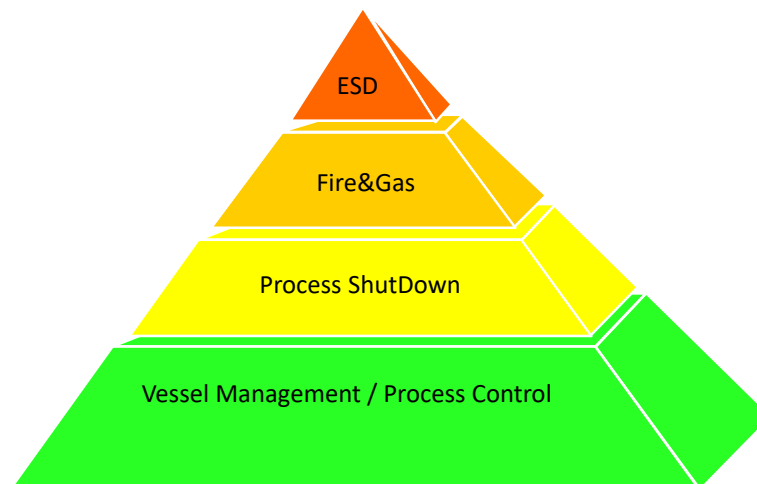
The safety system is defined as an independent system.

- ✓ The safety system, K-Safe, is a part of the integrated control & safety system delivered from KM, K-Chief 700
  
- ✓ The systems will share information and use the same operation stations (OS):
  - an event in the control system will not prevent the safety system from bringing the installation to the safe state



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## K-Safe Hierarchy





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## Application – Emergency ShutDown System

### Purpose:

- Ensure the safest possible condition of the installation
- To minimize the consequences due to uncontrolled releases of hydrocarbons

### Typical Inputs:

- The ESD system processes input signals
- Manual pushbuttons
- Field mounted transmitters
- Confirmed fire/gas from F&G (project specific)



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## Application – Emergency ShutDown System

### Typical ESD levels:

- AVS / ESD 0
- ESD High / ESD 1
- ESD Low / ESD 2

### Cascade function:

- Higher level activate a lower level
- AVS activate ESD1 & 2

### Each ESD level has a C&E diagram:

- Shows the relation between inputs to ESD level and corresponding actions
- One pushbutton may close valves and trip switchboards

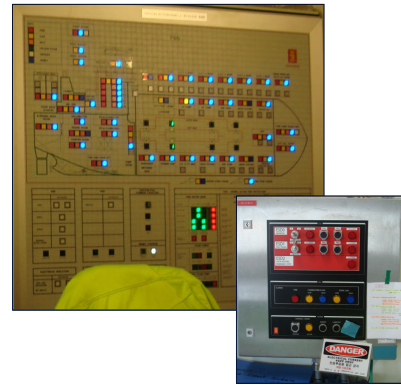
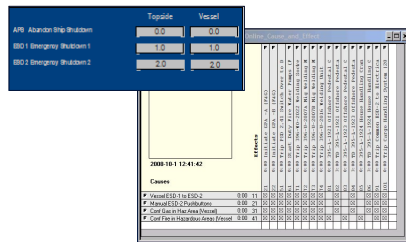


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## Application – Emergency ShutDown System

### Operator Interfaces:

- Operator Station(s)
- CAAP - Critical Action & Alarm Panel (hardwired)



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9



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## Application – Fire & Gas System

### Purpose:

- Provide early and reliable detection of fire or gas, wherever such events are likely to occur
- Initiate alarm, initiate protective actions, shutdown equipment and alert personnel
- Limit the fire escalation, by the zone's placement and boundary

### Typical Inputs:

- Signals from the field mounted detectors, addressable detectors, manual call points and ESD



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## Application – Fire & Gas System

### Typical Outputs:

- Alert personnel
- Release fire fighting system
- Stop flow of minor hydrocarbon sources
- Isolate local electric equipment
- Ventilation shutdown
- Close watertight doors and fire doors



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## Application – Fire & Gas System

### F&G levels:

- Classified as Hazardous/Non-Hazardous areas
- Each section of the installation will be divided into fire zones to limit the fire escalation

### Each fire zone shall include:

- Fire detection (smoke/heat/flame detectors or manual alarm buttons)
- Gas detection (if gas may reach the area)
- Fire protection equipment

### Each Fire Zone has a C&E diagram



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## Application – Fire & Gas System

### Operator Interfaces:

- Operator Station(s)
- CAAP - Critical Action & Alarm Panel (hardwired)
- Fire Central



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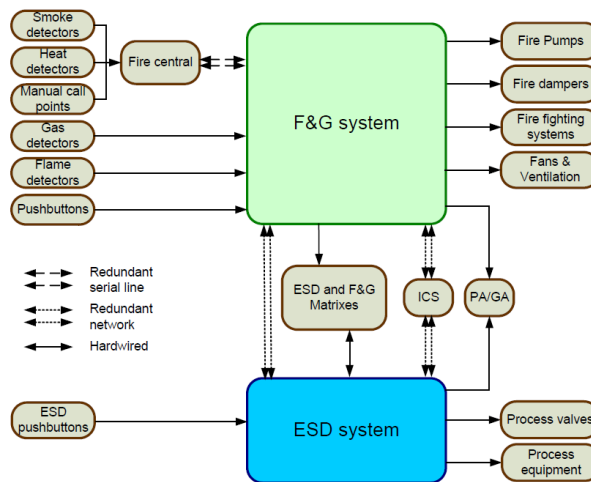
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13



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## F & G and ESD Interface



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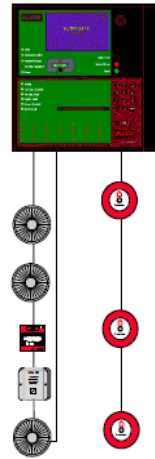
14



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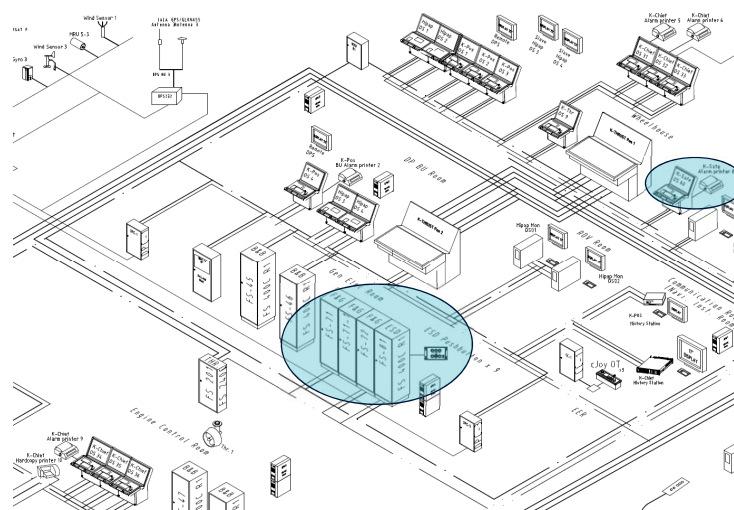
## Fire central and Loops

- Autosafe4 Fire central
- Addressable units connected in loops
- Manual call points, smoke detectors and heat detectors
- All status and commands to be shown and executed from the K-Safe system



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## Topology



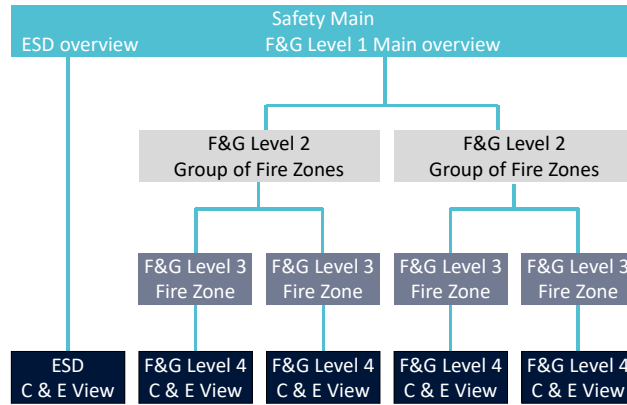




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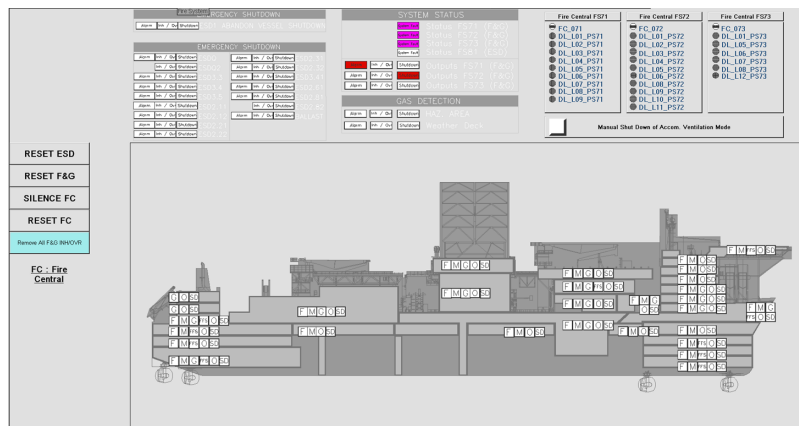
## K-Safe view topology

- The view topology is built like a tree structure
- Level one contains the main displays
- Level two shows the group of fire zones, e.g. one deck
- Level three shows the detailed fire zone
- Level four shows C&E



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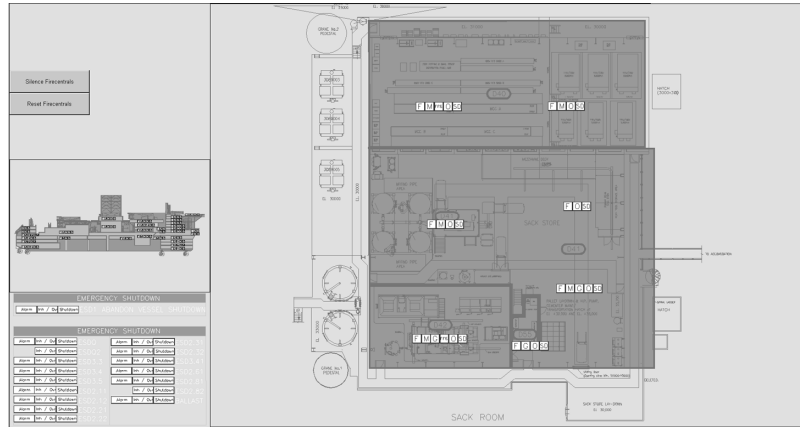
## F&G Main (with ESD) Overview (Level 1)





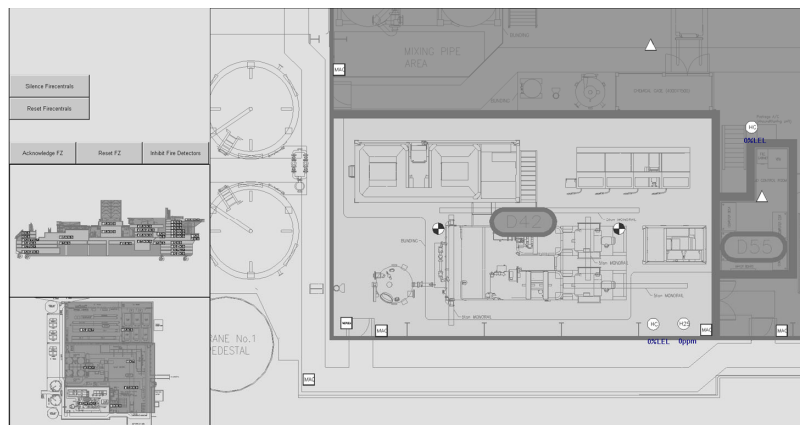
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## F&G Mimic Deck view (Level 2)



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## F&G Mimic Fire Zone / Detector view (Level 3)





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# F&G Mimic Online Cause & Effect view (Level 4)

The screenshot shows a software interface for 'VDU1:FG-S1-VSA2-T02 Online Cause and Effect'. It features a central table with columns for 'Causes', 'Del. Int.', and 'Effects'. Callouts provide the following information:

- Identification of the Fire Zone, ESD level or PSD level:** Points to the 'T02' label at the top.
- Note field:** A text box containing the note: 'TICK = 4, effect is not activated if alarm is ack'd in 2 minutes.'
- Name of the Fire Zone, ESD level or PSD level:** Points to the 'Fire Area - T02 Loading: 1005 (142)' label.
- Level buttons:** Points to the '2012-12-10 10:39:37' timestamp.
- Unique ID for a cause line:** Points to the 'F Manual alarm Toon' entry in the Causes table.
- Description of the cause line:** Points to the 'F Manual alarm Toon' text.
- Effect line:** Points to the 'Fire effect - P.A.' entry in the Effects table.
- Timer:** Points to the 'Del. Int.' column, which shows a value of 0.00.
- Unique ID for an effect line:** Points to the 'E 38' entry in the Effects table.
- X indicator:** Points to an 'X' in the 'Effects' column, indicating that the cause will activate the corresponding effect.

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# Online Cause & Effect Opened from a detector operator menu.

The screenshot shows a software interface for 'PrimaryWindow(SF-092212 - Online\_Cause\_and\_Effect)'. It features a central table with columns for 'Causes', 'Del. Int.', and 'Effects'. The interface includes a 'Reset FZ' button and a 'Cause & Effect' table. The Causes table lists various detector and alarm events, such as 'H2 Gas Detector (L) HAZ Area Cnt 1' and 'H2 Gas Detector (S) PPM'. The Effects table lists various system actions, such as 'Inhibit On', 'Test Off', and 'Online C&E'. The interface also includes a 'Cause & Effect' table with columns for 'Cause', 'Effect', and 'Status'.

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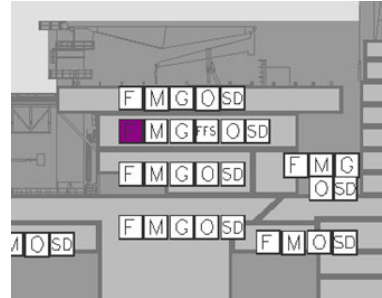
22



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## Safety Indications

- Alarm status lamp for each level
- Alarm colour will reflect the alarm with highest priority
- Shutdown status lamps – defined by project
- Inhibit/override status lamps (or border) – cyan



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## Legend

Level 1 and 2:

F	Fire	O	Inh/Ovr
M	Manual	SD	Shutdown
G	Gas	FFS	Fire Fight. Sys

Level 3:

	Smoke Detector		Alarm: Emergency Priority
	Heat Detector		Alarm: High Priority
	Flame Detector		Alarm: Low Priority
	Manual Call Point		Status: Inhibit/Over Activ
	HC Detector		Status: Test Activ
	H2S Detector		



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## Alarm Priority (KFDD Drilling)

Pri.	Description	ESD	F&G
Emergency	Safety Critical Alarms (MAGENTA)	ESD Activated Redundancy deviation Network failure	Fire Detection Gas Detection Redundancy deviation Network failure
High	Safety Alarms (RED)	Feedback errors on outputs I/O failure Conflict Faults	Feedback errors on outputs I/O failure Conflict Faults
Low	Non Critical Warning Alarm (YELLOW)	Pre-warning	Pre-warning
UnPri	Non Critical System Alarms (WHITE)		



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## F&G Operation Steps (for smoke and heat detectors)

- Acknowledge alarms
  - For a single smoke detector, if not acknowledge within 2 minutes, PAGA sound
    - Acknowledge from Detector or Alarm Line
- Normalize input from the field e.g. clear smoke
- Reset Fire Central
  - Reset Fire Central from Safety Main mimic
- Reset Effect
  - Reset from Cause & Effect view or Safety Main mimic

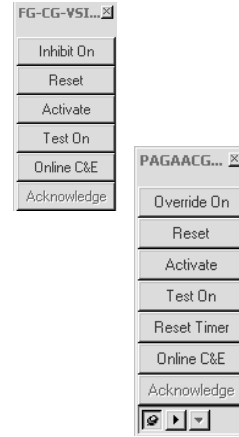


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## Safety Operations

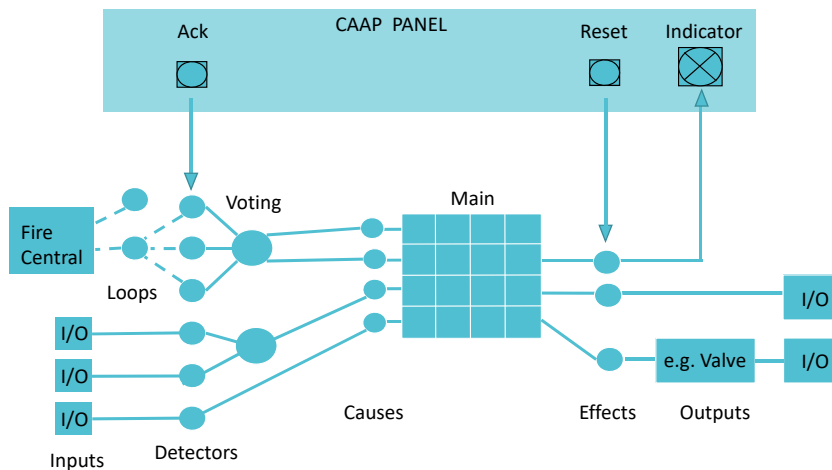
- **Test** function to simulate shutdown
- **Acknowledge** Alarms
- **Inhibit** detector or cause line to block a shutdown
- **Override** effect to block a shutdown
- **Activate** shutdown from the cause line or effect line
- Inhibit/override/activate requires Access control

**Note:** Test function may not work between PS's



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## Typical F&G Software configuration

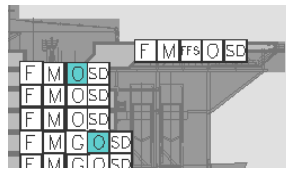




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## Inhibit

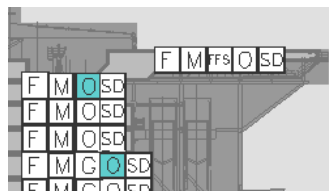
- Inhibit is a way of stopping the signal that normally will be sent from a detector when a situation occur, but the alarm will be activated
- Inhibit is performed from a detector operation menu or cause line operation menu
- Inhibit is indicated on level 1 and 2  
In addition: if the inhibit is set from a detector, the detector symbol will have tagmark "i" and cyan colour
- Inhibit is normally used when doing "hot work" in an area



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## Override

- Override is preventing the effect of a situation
- Override is used in test and maintenance to prevent a shutdown, where the operator wants to see that the system is performing according to specifications
- Override is performed from the effect line operation menu
- The operator can still manually activate the output without removing the override
- Override is indicated on level 1 and 2





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## Exercises:

- Safety



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## Learning Objectives

- Identify ESD and F&G as two independent systems
- Identify the main units belonging to K-Safe
- Recognise the four levels of safety views
- Carry out navigation between the safety views
- Explain the safety symbols
- Explain the alarm priority and colour codes used in K-Safe
- Interpret the information given in online C&E
- Perform normalization of the K-Safe
- Carry out inhibit for a detector
- Carry out inhibit for a cause line
- Predict consequences of inhibit
- Carry out override for an effect line
- Predict consequences of override
- Identify Inhibit/override status in K-Safe
- Conclude on which equipment are inhibited or overridden





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**End of the  
presentation**

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