

Process Safety Congress 13th May 2026

Rethinking Valve Operation in Hazardous Areas

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A **Halma** company

Rethinking valve operation in Hazardous Areas

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Introduction



Halma: global group of life-saving technology companies.

Founded: 1894
Nr of employees: over 8,000 within more than 20 countries
Nr of companies: nearly 50 companies
Listed: London Stock Exchange (FTSE 100).

Sofis, a Halma company

With our expertise, global service team & partner network, we provide full support & site services.



A Halma company

2016 MERGED IN	30 YEARS OF EXPERIENCE	7 WORLDWIDE OFFICES
350000 TOTAL NUMBER OF INTERLOCKS INSTALLED	1985 MARKET LEADERS SINCE	100 NUMBER OF EMPLOYEES

Europe	Alphen a/d Rijn, The Netherlands Maldon, Essex, United Kingdom Stockstadt, Germany
Middle East & Asia	Vadodara, India Mumbai, India
Americas	Houston, Texas, USA

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Potential Hazardous Areas

Typical operator hazards during valve operation

- Exposure to flammable or toxic atmospheres
- Poor ergonomics and excessive torque
- Confined or elevated locations
- Difficulty to escape during escalation scenarios
- Surrounding Equipment
- Equipment Handling



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Potential Hazardous Areas

Exposure to flammable or toxic atmospheres

Risks

- Operators require PSA and backup



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Potential Hazardous Areas

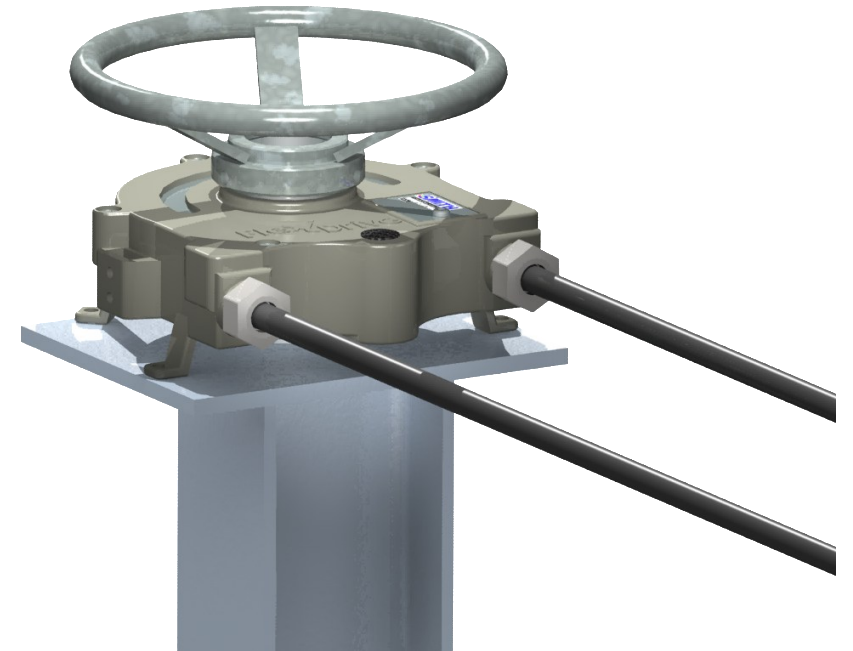
Exposure to flammable or toxic atmospheres

Risks

- Operators require PSA and backup

Risk Reduction Options

- Equip frequently operated valves with
 - Actuators
 - FlexiDrive



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Potential Hazardous Areas

Poor ergonomics and excessive torque

Risks

- Physical strain
- Back Injuries
- Unsafe operation of inaccessible valves



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Potential Hazardous Areas

Poor ergonomics and excessive torque

Risks

- Physical strain
- Back Injuries
- Unsafe operation of inaccessible valves

Risk Reduction Options

- Actuators
 - Stationary installed Actuator
 - Handheld Actuators like
 - EasiDrive
 - Power Wrench



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Potential Hazardous Areas

Confined or elevated locations

Risks

- Operators require PSA and backup to enter confined space
- Safety risk by falling chain wheels
- Operator stands below the chain wheel



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Potential Hazardous Areas

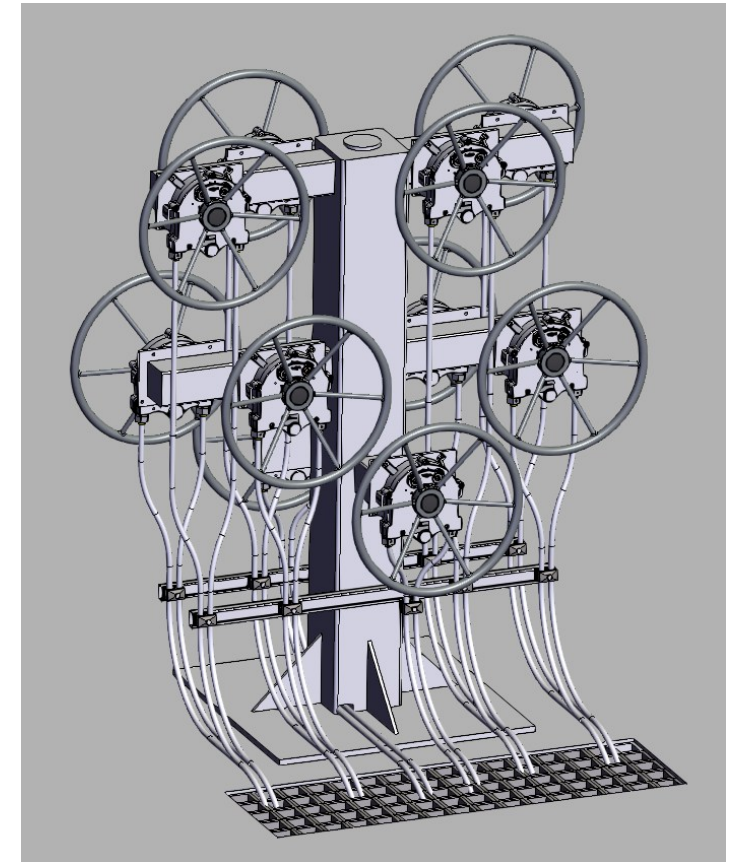
Confined or elevated locations

Risks

- Operators require PSA and backup to enter confined space
- Safety risk by falling chain wheels
- Operator stands below the chain wheel

Risk Reduction Options

- Equip frequently operated valves with
 - Actuators
 - FlexiDrive



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Potential Hazardous Areas

Difficulty to escape during escalation scenarios

Risks

- Operator has only one way to escape

Risk Reduction Options

- Equip frequently operated valves with
 - Actuators
 - FlexiDrive



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Potential Hazardous Areas

Surrounding Equipment

Risks

- Movement of the tank car during loading process
- Access to the track by unblocked derails
- Missing grounding during loading process

Risk Reduction Options

- Implement a captive key lock system for:
 - Derails
 - Tank Car trolley
 - Grounding
 - Loading arms



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Potential Hazardous Areas

Equipment Handling

Risks

- Open the piping / equipment under pressure



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Potential Hazardous Areas

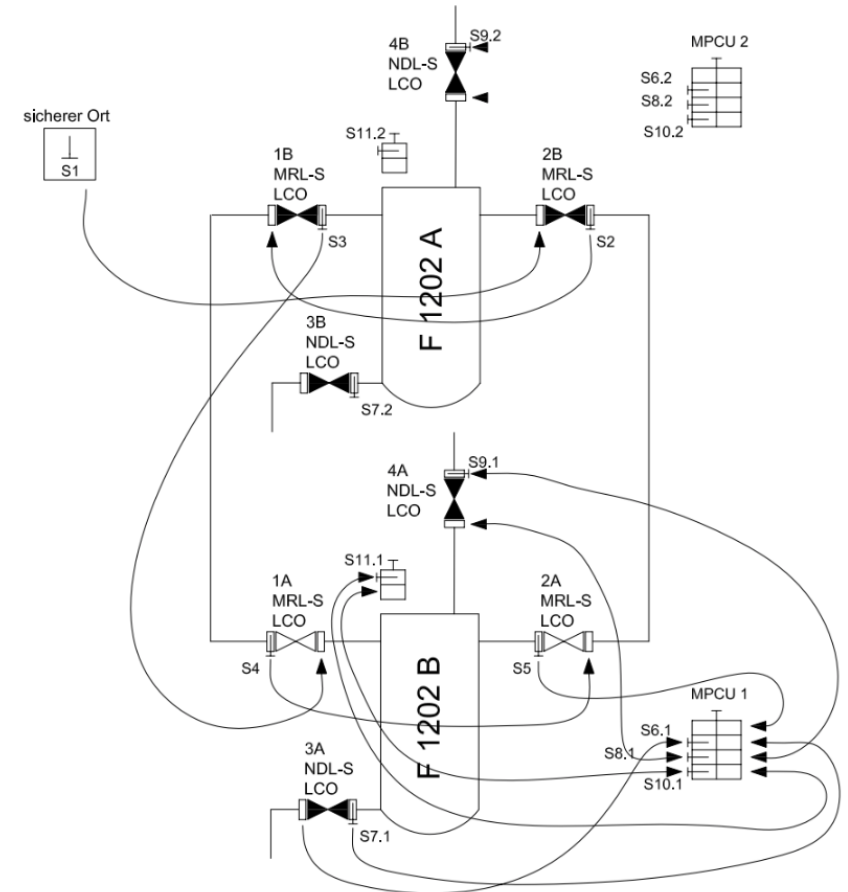
Equipment Handling

Risks

- Open the piping / equipment under pressure

Risk Reduction Options

- Implement a captive key lock system for:
 - Inlet- and Outlet Valves
 - Drain- and Vent Valves
 - Lit of filters / equipment
 - Grounding
 - Loading arms



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Impact of Risk Reduction Options to the Hazardous Area Classification

From a process safety perspective, hazardous areas exist because:

- Flammable substances are **processed, transferred, stored, or vented**
- Loss of containment is **credible during normal operation, start-up, shutdown, or maintenance**
- Ignition sources (electrical, mechanical, static, hot surfaces) are present



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Potential Hazardous Areas

Hazardous Area Classification – The Zone Concept

Gas, Vapour, Mist (ATEX Zones 0 / 1 / 2)

Zone	Definition (Simplified)	Typical Plant Locations
Zone 0	Explosive atmosphere present continuously or for long periods	Inside tanks, reactors, pipelines
Zone 1	Explosive atmosphere likely in normal operation	Pump seals, vents, valve glands, sampling points, pig traps
Zone 2	Explosive atmosphere unlikely and short-lived if it occurs	Flanges, valve stems, well-ventilated areas



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Hazardous Area Classification Philosophy

Simplified source of release method

At the basic design phase it is a simplified method to identify typical sources of release.

That would be adequate to provide a conservative representation of similar items and conditions in the facility.

A more accurate assessment need to be executed on a case by case basis.

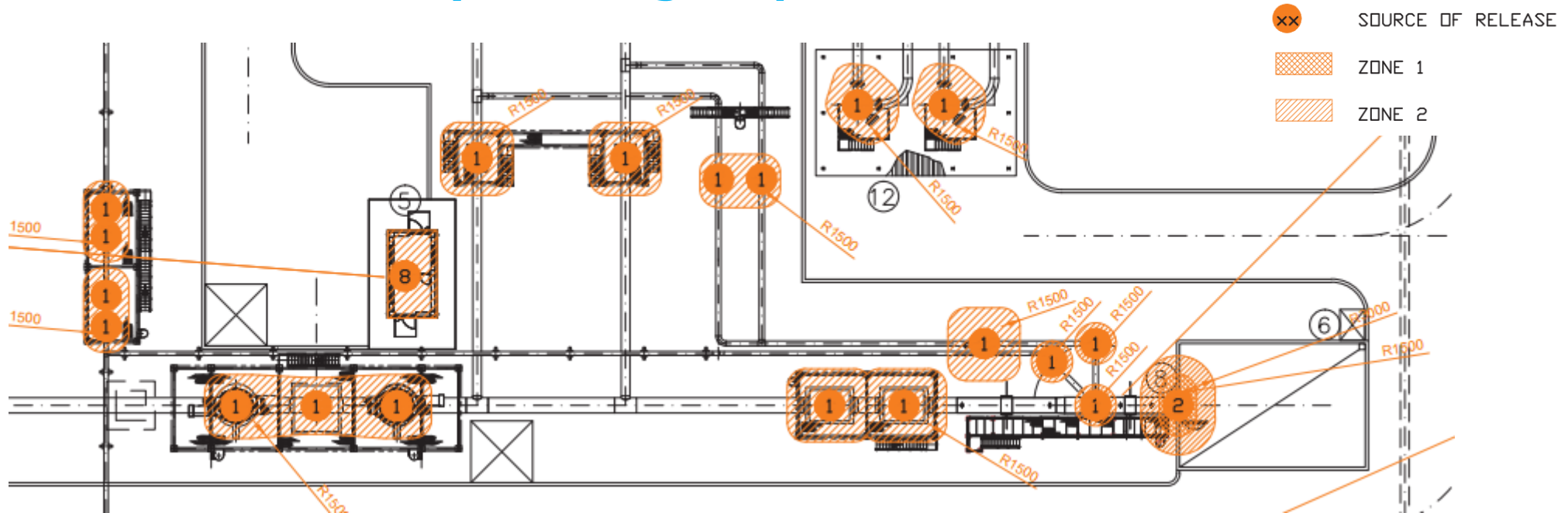
The approach can be summarized as follow:

1. Identify sources of release (types)
2. Determine release rate and grade of release
3. Assess ventilation or dilution conditions
4. Determine zone type
5. Determine extent of zone.

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Potential Hazardous Areas

Hazardous Area Layout – Pig Trap Area



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Typical Sources of Release for a Pig Trap

1. Valves and flanged connections

	Description
Fluid	Natural gas, Gas group IIA, Temperature class T1
Type of Release	Gas at high pressure
Grade of Release	Flanged connections, valve seals and gaskets, pipe fittings, sample points are not expected to release any flammable substance during normal operation and therefore are considered as secondary grade of release.
Release Rate	Release rate is calculated according to section B.7.2.3.2 3 of IEC 60079- 10-1
Type of Ventilation	Natural ventilation. As recommended in IEC 60079-10-1 (ref. /A1/), in open air situations the degree of dilution is medium and the availability is good.
Type of extent of hazardous zone	According to Table D.1 and Figure D.1 of IEC 60079-10-1 (ref. /A1/), these sources produce a Zone 2 with an extension of 1.5m.

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Typical Sources of Release for a Pig Trap

2. Pig Launchers / Receivers

	Description
Fluid	Natural gas, Gas group IIA, Temperature class T1
Type of Release	Gas at high pressure
Grade of Release	During normal operation, the pig trap is isolated and depressurized, not a source of release and can be considered as a non-classified area. Pigging operations are infrequent and the design of the system should guarantee permanent tightness during normal operation. Therefore, this equipment is considered as a secondary grade of release.
Type of Ventilation	Natural ventilation.
Type of extent of hazardous zone	For the Pig Launcher and Receiver Trap there is no adequate example in the IEC 60079-10-1. Therefore, for this application the recommendations of API RP 505 are followed. The area around the pig trap in an open and well ventilated area is classified as per Fig. 49 of API RP 505 as reported in Figure 2, namely: Zone 1 – 1.5m around end closure; Zone 2 – from zone 1 limits up to 3m.



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Typical Sources of Release for a Pig Trap

8. Analyzer rooms

	Description
Fluid	Natural gas, Gas group IIA, Temperature class T1
Type of Release	Gas at high pressure
Grade of Release	Instruments are not expected to release during normal operations and therefore are considered as secondary grade of release. Instrument vents are expected to be directed outside through a vent.
Type of Ventilation	Artificial ventilation – ventilation rate will be defined so as to ensure the analyzer room is classified maximum zone 2. Minimum ventilation to be 5 air changes per hour according to IEC 61285 unless a larger flow is required based on calculations as given in IEC 60079-10.
Type of extent of hazardous zone	In this preliminary phase, adequately ventilated enclosed areas containing gas chromatographs or other gas operated instruments are classified according to figure 55 of API RP 505 as reported in Figure 5, namely: Zone 2 – enclosed adequately ventilated area; Zone 0 – 0.15m radius from vent; Zone 1 – 0.5m from the vent; Zone 2 – 1m from the vent.



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Potential Hazardous Areas

Combined Hazardous Area Classification Data Sheet for Pig Trap

HAZARDOUS AREA CLASSIFICATION DATA SHEETS																	
Release sources list																	
No.	Source of release					Flammable substance				Ventilation			Hazardous Area				Any additional information
	Description	Location	Grade of Release	Rate of Release	Release Characteristics	Reference	Operating T (°C)	Operating P (barg)	State	Type	Degree of dilution	Availability	Zone Type	Zone Extent (m)		Reference	
														Vertical	Horizontal		
1	Valves and flanged connections	PTAR	II	0.01kg/s	GAS	1	40	218	G	N	M	G	2	1,5		IEC 60079-10-1 Fig. D.1	
2	Pig launchers 120-VL-1A01 120-VL-1B01	PTAR	II	-	GAS	1	40	220	G	N	M	G	1	1.5 (from pig launcher door)		API RP 505 Fig. 49	Operating Temperature and Pressure as per relevant P&ID.
													2	3 (from pig launcher door)			
8	Analyser Room	PTAR - Analyser Building	II	-	GAS	1	-	-	G	F (HOLD3)	M (HOLD3)	G (HOLD3)	0	0.15m radius at vent	0.15m radius at vent	API RP 505 Fig. 55	It is assumed that ventilation will be designed as to ensure the analyser room is classified maximum zone 2.
													1	around the vent with a sphere of 0.5 m radius	around the vent with a sphere of 0.5 m radius		
													2	1 m radius around the vent + Entire enclosed area of analyser house	1 m radius around the vent + Entire enclosed area of analyser house		

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Potential Hazardous Areas

Hazardous Area Classification – The Zone Concept

Worksheet

Company: [REDACTED]
 Facility: [REDACTED]
 Session: (1) [REDACTED] Revision: [REDACTED]
 Node: (1) Inlet Section
 Intention: Natural gas from compressor station CS through 2 Inlet lines to the Offshore pipeline, including pig launcher / receiver and associated kicker line.
 OT: 40°C, OP: 218 barg
 DT: -38°C / 60°C, DP: 221 barg
 Notes: [REDACTED]
 Drawings: [REDACTED]
 Parameter: Pigging Operation Intention: [REDACTED]

GW	DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	BY
Other Than	1.11. Other Than Pigging Operation	1.11.1. Incorrect sequence of pigging operation: opening of the pig trap in presence of methane inside the pig trap.	1.11.1.1. Explosive mixture formation leading to possible fire / explosion scenario and injuries / fatalities.	1.11.1.1.1. Purging procedure	26. Provide input to operating procedure to purge pig trap with inert gas and check the content. 27. Ensure that the interlock system is suitable to avoid the scenario.	
		1.11.2. Incorrect sequence of pigging operation: opening of the pig trap when pressurized.	1.11.2.1. Possible pressure wave against the operator scenario and injuries / fatalities.	1.11.2.1.1. Operating procedure combined with interlock system preventing the opening of pig trap when pressurized.	28. Ensure that the interlock system is suitable to avoid the scenario.	
		1.11.3. Pig launched in the pipeline before full opening of MOV- 1A01A/B.	1.11.3.1. Damage of MOVs and Pig.	1.11.3.1.1. Operating procedure combined with interlock system.	29. Ensure that the interlock system is suitable to avoid the scenario. Provide input to operating procedure to perform suitable sequence to avoid the scenario (opening of the kicker line valves after opening of the trap isolation valve is recommended).	
		1.11.4. Pig launched with simultaneous shut down request of ESD.	1.11.4.1. Potential damage of pig and shut down valve with inability to perform shut down. Potential loss of containment leading to fire / explosion scenario, injuries and fatalities. Loss of operation.	1.11.4.1.1. Second isolation valve is provided to complete the isolation action performed by ESD.	31. Provide quantitative analysis to calculate the probability of this scenario to be sufficiently low.	
		1.11.5. Presence of ILC ball valve MOV- 1A01A.	1.11.5.1. Inability to complete pressurize the pipe section between MOV-1A01A and MOV-1A01B.		32. Evaluate to remove MOV-1A01A from the interlock logic.	

Bridge from ATEX Theory to Operational Reality

Implementation of a Captive Key Lock solution would:

- Prevent the exposure of explosive gases by guarantee defined
 - Draining
 - Venting
 - Purging
- Prevent opening the pig trap when pressurized
- Prevent pig launching before full opening of the Isolation valves
- Prevent damages on the sample probe equipment by the pig
- Prevent backflow from vent system to pig trap during open pig trap door



Potential Benefit

- Move the Hazardous Area Classification from Zone 1 to Zone 2
Explosive atmosphere unlikely and short-lived if it occurs
- Eliminate the Hazardous for the Operator
- Prevention of an unauthorized operation of valves and accessories.
- Locking of a required open or closed position of a certain valve and accessories.
- Achievement of logical relationships due to process requirements
- Risk reduction by the implementation of an independent layer of safety



Thank you for your attention.