Safety & Risk Management Services

Hazard Identification Studies (HAZID)

Germanischer Lloyd – Service/Product Description

GL OPERATING 24/7

Hazard Identification Studies (HAZID)

Service Title: Safety & Risk Management Services

Lead Practice: GL Plants & Pipelines (Germany)

Contents

Service Description and Values Generated:

Motivation

The operator of a technical installation by which health and safety, the environment, assets and the operator's reputation could be affected is obliged by European legislation to:

- have an up-to-date knowledge about all safety-relevant aspects of their operations,
- prevent accidents or to limit their impacts/escalations (as per the Seveso II Directive),
- control hazards reliably and to minimise risks by identifying installations with risk potential regarding health and safety as well as the environment, evaluating their inherent risks and specifying risk mitigation measures (which is part of the risk management process),
- design, start up, operate and maintain workplaces in such a manner that the workforce can conduct work without putting their own safety and health or that of others at risk.

Objectives

The objectives of the HAZID procedure offered by Germanischer Lloyd (GL) are to identify main hazards, to review the effectiveness of selected safety measures and, where required, to expand the safety measures in order to achieve a tolerable residual risk. In compliance with the Seveso II Directive, besides facility safety concepts for new installations, also safety concepts for existing operational facilities have to be reviewed.

The analysis serves the operator as proof that installations are operated such that hazards for employees, third parties, the environment and the surroundings can largely be excluded. The operator's management gets an up-to-date picture of the present hazards and their possible effects.

By means of the HAZID analysis the primary process, but also non-process, hazards as well as their possible escalations can be identified due to the structured manner of the procedure. Employees can be advised of the relevant hazards concerning their working area. At the same time the outcomes can be taken as a support in compiling the required neighbourhood information. The facility designer considers the analysis results to improve safety concepts for new-built installations.

Frequency of Reviews

HAZID analyses are usually to be revised when considerable modifications, upgrades or re-design of existing facilities are carried out or if events like accidents, critical situations or near misses call for this. In this context a change, upgrade or re-design is to be considered as essential if process modifications associated with consequences for safety or safety related equipment are involved. This also applies for utilities including buildings, machinery, equipment etc. that do not necessarily contribute to the primary operating objective but which are associated with the process facilities in terms of layout or operation and that are safety relevant. Those being in charge of operations and those working in the facilities are obliged to indicate all identified possible changes. In principle operators are expected to repeat the analyses at least every 5 years in order to maintain the residual risk as low as reasonable practical.

Offered Service

The service offered in this matter is the provision of an experienced facilitator/chairman and a minute taker who guides through the HAZID sessions in a formal and consistent manner and captures the relevant results into the prepared HAZID spreadsheet. Subsequently upon completion of the sessions a report is prepared by the HAZID chairman and submitted to the client.

a. Hazard Identification

Hazard identification (HAZID) is "the process of identifying hazards, which forms the essential first step of a risk assessment. There are two possible purposes in identifying hazards:

- To obtain a list of hazards for subsequent evaluation using other risk assessment techniques. This is sometimes known as "failure case selection".
- To perform a qualitative evaluation of the significance of the hazards and the measures for reducing the risks from them. This is sometimes known as "hazard assessment".

During the hazard identification stage, the criteria used for the screening of the hazards will be established and possible hazards and accidents will be reviewed. For this purpose, the facility will be divided into several sections. Furthermore, the identified hazards will be classified into critical and non-critical hazards. It is of great importance that the hazards considered non-critical are clearly documented in order to demonstrate that the events in question could be safely disregarded.

This failure case selection will be executed by generating check lists, accident and failure statistics, hazard and operability Studies (HAZOPs) or by comparison with detailed studies and experience from previous projects.

The HAZID also includes the division of the plant into sections as mentioned above. An example of the section division is shown below:

For each of the areas which contain toxic or flammable inventories, the details are compiled, also including potential sources of ignition.

The following sources provide further information on HAZID techniques:

- ***CCPS (1992):*** HAZID techniques in the process industries
- ***CMPT (1999):*** HAZID techniques for offshore installations
- ***Ambion (1997):*** HAZID techniques for offshore safety cases

The aim of the hazard scenario identification is the grouping of similar outcomes of different hazards.

Based on the facts compiled in the HAZID stage, the major hazard scenarios can be identified. Usually the hazard scenarios include release, fire, explosion and dispersion situations. Example: For the hazard (or initiating event) "small release", the corresponding hazard scenarios are:

- BLEVE (Boiling Liquid Expanding Vapour Explosion), Fireball
- Escalation to large release fire
- Jetfire, no escalation
- Unignited release

Area	Designation	Details	Flammable Inventory	Toxic Inventory	Comments/Others	PID/PFD
1	1st stage seperator	1st seperator, process area, lower deck	hydrocarbons	-	-	3000-T-0208D841401C
2	Crude booster pumps	Crude booster pumps, process area, lower deck	hydrocarbons	-	-	3000-T-0208D841701C
3	Crude transfer pumps	Crude transfer pupms, process area, lower deck	hydrocarbons	-	-	3000-T-0208D842001C
4						
5						
6						
7						
8						
9						
10						
11						
12						

Table 1: HAZID section division. Example.

b. Team Composition

The HAZID Study team shall neither be over nor undersized. Ideally the study is carried out by a team of 3 to 5 people plus facilitator and secretary. The team should be composed of the following participants:

- the design engineer in charge for the respective facility
- project manager (for new installations)
- plant engineer in charge
- maintenance engineer
- foreman/technician
- facilitator and minute taker

c. Execution of the HAZID Sessions

HAZID Session Preparation

Prior to the HAZID session itself the facility in question will be divided into manageable, logical sections (systems or units). Section limits can be identified for example where there is a significant change in the process conditions, a change in location or in material phase and composition. Sections will preferably be identified in a way that one section contains either gas or liquid, not both at the same time. Reasonable divisions of a complex facility can be processing units and less comprehensive facilities could also be sub-divided into functional groups. The identified sections will be written in the GLO section division document shown in Annex. This preparatory sectioning work including the compilation of the work sheets for each defined unit as well as the HAZID section division document is generally carried out by the facilitator. Subsequent to completion the prepared documents are subject to discussion with the operator's representative.

d. HAZID Work Sheet

The HAZID work sheet within the HAZID workbook is divided into three steps:

Step 1: Hazard identification

Step 2: Risk estimation

Step 3: Recommended additional safety measures.

Step number one includes the columns "Determination of Hazards", "Hazard Potential Determination", "Progress of Escalation" and "Existing Safeguards". The sections "Determination of the hazards" [Table 2] and the hazard checklist described in the next paragraph are interlinked. For example by typing "1" into the outermost left column of the spreadsheet, the hazard in the corresponding row of the hazard checklist will be adopted and automatically transferred into the next column of the HAZID sheet (in the example case it would be "Hydrocarbons under pressure"). The "assumed event" in the HAZID sheet will be the potential event from the hazard checklist described in further detail.

Further to the right of the spreadsheet, in the "Hazard Potential Determination" section, the identification numbers of those plant sub-sections or pieces of equipment that are considered to be affected by the relevant hazard are entered in column 2 [Table 3]. The plant sub-sections to be referenced are listed in the lower left part of the spreadsheet. Additionally the corresponding safety relevant operating parameters (like max. operating pressure, temperature, etc.) are mentioned for each hazard.

Determination of hazards	
Hazards (1-18) s. Hazards checklist (letter/title)	Assumed Event
1 Hydrocarbons under pressure	
3 Liquids and Gases under High Pressure	
13 Safety Systems	
14 MSR-Systems	

Table 2: Excerpt from HAZID sheet: Step I - Determination of hazards.

Hazard potential determination	
Plant sectio/Individual Equipment (1,2,3...)	Safety relevant operating parameters
1-3	17 barg
1-3	-
1-3	-
1-3	-
1-3	-

Table 3: Excerpt from HAZID sheet: Step I - Hazard potential determination.

The next column includes the progress of the escalation. Here the possible escalating scenarios for the initiating event/hazard associated with the relevant plant sub-sections are described [Table 4].

The derived scenario originating from a gas leak might be an ignition followed by a fire (jet fire, pool fire). In the columns following to the right those technical and organisational safety measures already being in place are listed for each combination of initiating event and derived escalation [Table 5].

Progress of escalation (1.1,1.2...)	
(Subsequent Event/Encroachment onto other Systems)	
1.1-1.3	jet fire/pool fire, gas cloud formation, explosion
7.1-7.3	Fire
13.1-13.3	BLEVE
14.1 +14.3	carryover of liquids into gas stream, damage of compressor
14.1-14.3	pipe to flare fails to open, overpressure in vessel, rupture of piping, gas leak

Table 4: Excerpt from HAZID sheet: Step I – Development of escalation.

Existing Safeguards	
Aim: Disable hazards, avert hazards	
Technical Safeguards	Organisational Safeguards
gas detectors, smoke detectors, deluge, isolation	maintenance according to operating manual
deluge	maintenance according to operating manual
passive fire protection	maintenance according to operating manual
seperators upstream of compressors	maintenance according to operating manual

Table 5: Excerpt from HAZID sheet: Step I – Assignment of existing safety measures/safeguards.

In Step II a qualitative risks assessment for all derived scenarios is conducted. According to the beforehand agreed approach the risk estimation is applied to all four categories (i.e. persons, assets, environment and reputation) or just for one of them or a combination of these categories. In the case when the qualitative risk assessment is limited only to one category this is usually the category "persons". The risk estimation is carried out by means of the 5 by 5 risk matrix which is also part of the HAZID workbook. Usually the scenarios should be completed line by line, i.e. before moving to the next scenario the risk estimation should be carried out rather than going through all scenarios and subsequently carrying out the estimation. Once the estimation is carried out by typing the relevant alphanumerical combinations of probability of the event (A-E) and severity of the scenario (1-5) the corresponding cells in the HAZID spreadsheet are automatically colour coded in accordance to the referenced risk matrix when the macro button Apply Risk Matrix is clicked. This helps to more easily identify medium and higher risk scenarios. Cells within the risk estimation section that are not assigned an alphanumerical combination remain blank.

Annex

GL

Apply Risk Matrix

HAZID-Worksheet

Step I: Hazard Analysis

Determination of hazards		Hazard potential determination	
Hazards (1-18) s. Hazards checklist (letter/title)	Assumed Event	Plant sectio/Individual Equipment (1,2,3...)	Safety relevant operating parameters
1 Hydrocarbons under pressure		1-3	17 barg
3 Liquids and Gases under High Pressure		1-3	-
13 Safety Systems		1-3	-
14 MSR-Systems		1-3	-
		1-3	-

Description of the plant:	
Plant section:	
Unit of:	
1. 1st stage separator	**7.**
2. Piping	**8.**
3. Valves	**9.**
4.	**10.**
5.	**11.**
6.	**12.**

HAZID-Worksheet - Riskmatrix

Severity code		Consequences				Probability				
		Personnel (SP)	Assets (SA)	Environment (SU)	Reputation (SR)	A team does not know of any occurance in industry/ occurance appears unlikely	B has occured in the industry	C has occured within the operating company	D has occured within the operating company	E occurs within the operating company several times a year
minimal	1	negligable injuries /illness	negligable damage	negligable impact	negligable impact					
low	2	minor injuries /illness	minor damage	minor impact	minor impact					
medium	3	major injuries /illness	medium damage	locally limited impact	regional impact					
high	4	1 to 3 fatalities	major damage	major impact	superegional impact					
very high	5	several fatalities	total loss	massive impact	national impact					

Description of the plant:	Estak - A Platform
Plant Section:	1st stage separator

Step II: Risk estimation

Progress of escalation (1.1,1.2...)		Existing Safeguards		Effects on:							
(Subsequent Event/Encroachment onto other Systems)		Aim: Disable hazards, avert hazards			xxxxxx		xxxxxx		xxxxxx		xxxxxx	
		Technical Safeguards	Organisational Safeguards									
1.1-1.3	jet fire/pool fire, gas cloud formation, explosion	gas detectors, smoke detectors, deluge, isolation	maintenance according to operating manual	1.1-1.3	4	E	3	B				
7.1-7.3	Fire	deluge	maintenance according to operating manual	7.1-7.3	2	B						
13.1-13.3	BLEVE	passive fire protection	maintenance according to operating manual	13.1-13.3	5	B	4	B				
14.1 +14.3	carryover of liquids into gas stream, damage of compressor	seperators upstream of compressors	maintenance according to operating manual	14.1+ 14.3	1	C	2	C				
14.1-14.3	pipe to flare fails to open, overpressure in vessel, rupture of piping, gas leak			14.1-14.3	2	C	2	C				

Name:	**Name:**	**Name:**
Function:	**Function:**	**Function:**
Date:	**Date:**	**Date:**
Signature:	**Signature:**	**Signature:**
created by:	verified by:	approved by:

Severity		Possible Impact	Safety	Possible Impact	Assets, Equipment, Supplies	Possible Impact	Environment	Possible Impact	Reputation of the Company
minimal	1	negligible injuries / illness	no impact on personal ability to work	negligible damage	process is not stopped; repair costs < 10,000 Euros	negligible impact	small, locally limited leak (can be removed easily)	negligible impact	the public is not concerned when they learn about the failure
low	2	minor injuries / illness	impact on personal ability to work, must subsequently work on sheltered workplace; or inability to work for one week	minor damage	process is stopped briefly without following-up costs; repair costs < 50,000 Euros	minor impact	contamination has impact on environment, small, locally limited dimensions; no permanent impact	minor impact	concerns among local public with possible negative impact on the continuation of the location
medium	3	major injuries / illness	leeds to longterm inability to work or partial disablement to work	medium damage	partial shut-off of the facility (max. 1 day), process can (possibly) be continued; repair costs < 500,000 Euros	locally limited impact	impact on environment; contamination is large, but local (in the immediate surroundings of the facility = defined safety clearance)	regional impact	concerns among the public on a regional level; possibly response from politicians or lobby groups
high	4	1-3 fatalities	results in one or more fatalities or total disablements to work / occupational invalidities	major damage	partial shut-off of the facility for 2 days to max. 2 weeks; repair and follow-up costs < 5 million Euros	major impact	heavy environmental contamination outside of safety clearance; extensive measures to return environment to its original state	supraregional impact	concerns among the public on a supraregional level with possibly negative impact such as denial of operating licence
very high	5	1-3 fatalities	results in more than three fatalities or total disablements to work / occupational invalidities	1-3 fatalities	complete shut-off of the facility; repair and follow-up costs > 5 million Euros	massive impact	permanent, heavy contamination of environment over larger areas; contamination can only be removed with extensive measures or not at all	nationwide impact	concerns and negative attention in the nationwide public; might result in the revocation of existing operating licences with a severe impact on business operations

e. Hazard Checklist

a. Substance Specific Hazards

1. Hydrocarbons under pressure	**Possible Event:**
Examples: Natural Gas, Shallow Gas, Condensate, Crude Oil, LPG, Propane	Leakages
Conditions to Take Effect:	Corrosion; Technical Defect; Erosion; External Impact; Errors at Production/Assembly; Operating Error; Errors in Process Controlling; Failure of Structure; Wear and Tear; Failure of Valves; Failure of Stuffing Boxes and Sleeve Gaskets; Illegal Operation Parameters; Insufficient Safety Measures
Consequences of the Hazard - immediate / - escalating	Release of Energy; Fire; Explosion; Radiation / Radiant Heat; Splinter with High Kinetic Energy; Local Damages; Failure of Structure; Failure of Equipment; Secondary Damage of Facilities through Escalation; Environmental Damage; Injuries (Toxic Impact, Smoke Poisoning); Fatalities (Suffocation, Heavy Burns)
2. Toxic Substances, Hazardous Materials	**Possible Event:**
Examples: H2S, CL2, Smoke, HCl	Leakages
Example products: So2, HF, Benzol, CO2, asphyxiant gases, exhaust gases, intoxicating gases, hazardous waste, glycol, catalyst dust	
Conditions to Take Effect:	Corrosion; Erosion; External Impact; Errors at Production/ Assembly; Operating Error; Errors in Process Controlling; Failure of Structure; Wear and Tear; Failure of Valves; Failure of Stuffing Boxes and Sleeve Gaskets; Illegal Operation Parameters; Insufficient Safety Measures
Consequences of the Hazard - immediate / - escalating	Dust, Flue Gases and Fumes; Environmental Damage, Injuries (Toxic Impact), Fatalities (Suffocation, Toxic Impact)
3. Liquids and Gases under High Pressure	**Possible Event:**
Examples: injection water, instrument air/compressed air, steam, nitrogen	Leakages
Conditions to Take Effect	Corrosion; Erosion; External Impact; Errors at Production/ Assembly; Operating Error; Errors in Process Controlling; Failure of Structure; Wear and Tear; Failure of Valves; Failure of Stuffing Boxes and Sleeve Gaskets; Illegal Operation Parameters; Insufficient Safety Measures
Consequences of the Hazard - immediate / - escalating	Dust; Flue Gases and Fumes; Environmental Damage; Injuries (Toxic Impact); Fatalities (Suffocation, Toxic Impact)
4. Hot or cryogenic fluids	**Possible Event:**
Examples: Liquid Sulphur, Steam, pressure-liquified Fluids, heating substances, cryogenic-liqufied Nitrogen	Leakages
Conditions to Take Effect	Corrosion; Technical Defect; Erosion; Illegal Process Parameters; External Impact; Errors at Production/Assembly; Operating Error; Errors in Process Controlling; Wear and Tear; Loss of Isolation
Consequences of the Hazard - immediate / - escalating	Failure Misfunction; Release of Energy; Splinter with High Kinetic Energy; Local Damages; Dangerous Surface Temperatures; Injuries and Burnings; Fatalities
5. Blasting Agents, Explosive Substances	**Possible Event:**
Examples: seismic inspections, below ground work	Leakages
Conditions to Take Effect	Inappropriate Storage; Handling Errors; Technical Defects; External Impact; Interference at Radio Transmission; Fire
	Release of Energy; Splinter with High Kinetic Energy; Local Damages; Failure of Structure; Failure of Equipment; Secondary Damage of Facilities through Escalation; Fire; Injuries; Fatalities

b. Equipment Specific Hazards

6. Dangerous Equipment	**Possible Event:**
Fast Revolving Parts, Hydraulic Systems, Instruments under Pressure	Loss of functions
Conditions to Take Effect	Operations without Instrument Covers; Technical Defect; External Impact; Errors at Production/ Assembly; Operating Error; Errors in Process Controlling; Wear and Tear; Inappropriate Operations
Consequences of the Hazard - immediate / - escalating	Release of Energy; Splinters with High Kinetic Energy; Local Damages and Contaminations; Injuries; Fatalities
7. Ignition Sources	**Possible Event:**
Examples: Heating Systems, Electrical Installations, Exhaust System, Loaded Electrical Condensers, Static Electricity (non-grounded systems), pyrophoric materials, inappropriate equipment	Failure of Safety Systems (Protective Systems), Fire, Disregarding of Fire Breaks
Conditions to Take Effect	Maintenance of E-Facilities; Welding; Use of Equipment that Sparks Light; Cutting and Severing; Failure of Cladding of Machines; Containers and Circuits of Inflammable Materials; Operating Errors; Use of Open Fire; Cleaning (Wiping) with Dry Cloths
Consequences of the Hazard - immediate / - escalating	Fire; Explosion; Splinters with High Kinetic Energy; Local Damage; Smoke; Injuries (Smoke Poisoning, Burns); Fatalities (Suffocation, Heavy Burns)
8. Lifting Facilities	**Possible Event:**
Examples: conveyor cage, hoisting platforms, cranes, facilities for loading and unloading	Falling Parts
Conditions to Take Effect	Failure of Equipment; Overloading/ Overwork; Operational Error
Consequences of the Hazard - immediate / - escalating	Local Damage; Failure of Cladding of Machines; Containers and Circuits; Failure of Structures; Injuries; Fatalities
9. Ionising Radiation	**Possible Event:**
Examples: X-ray testing, radioactive monitoring of fill levels, waste/condensates	Leakages/Releases
Conditions to Take Effect	Inappropriate Handling; Operational Error; Controlling Error; Contaminated Product (due to an introduced radiation source); Equipment/Instruments with X-Rays; Errors at Production/Assembly; Errors at Using the PSA; Disregarding of Warnings
Consequences of the Hazard - immediate / - escalating	Toxic Impact; Environmental Damage; Injuries; Fatalities
10. General Radiation, not ionised	**Possible Event:**
Examples: Flare Lamps, Mercury Vapor Lamps, E-Welding	External Impact
Conditions to Take Effect	Fire; Sunlight; UV Light
Consequences of the Hazard - immediate / - escalating	Local Damage; Failure of Structure; Failure of Equipment; Failure of Cladding of Machines; Containers and Circuits; Fire; Injuries (Burns); Fatalities (Burns)

a. Substance Specific Hazards

11. Generation of Explosive Gases	**Possible Event:**
Examples: Battery Run Facilities, Fermentation Gas from Cavities/Caverns	Leakages
Conditions to Take Effect	Technical Defects; External Impact; Operational Error; Errors in Process Controlling; Corrosion
Consequences of the Hazard - immediate / - escalating	Fire; Explosion; Splinters with High Kinetic Energy; Smoke; Injuries (Smoke Poisoning, Burns); Fatalities (Suffocation, Heavy Burns)
12. Utility Facilities	**Possible Event:**
Examples: Heating Gas Systems, Instrument Air Systems, Water Supply Systems, Air Conditioning Systems, Energy Supply	Loss of Function
Conditions to Take Effect	Technical Defects; Errors at Production/ Assembly; Errors in Process Controlling; Operating Error
Consequences of the Hazard - immediate / - escalating	Leakages; Malfunctioning of Secondary/ Supplied Facilities; Escalation Due to Secondary Events
13. Safety Systems	**Possible Event:**
Examples: Blow Down Systems, Fire Extingui-shing Systems, CO2 Extinguishing Systems	Loss of Functions
Conditions to Take Effect	Technical Defects; Errors at Production/ Assembly; External Impact; Operating Error
Consequences of the Hazard - immediate / - escalating	Leakages; System Failures; Escalation due to Secondary Events
14. Instrumentation and Control Systems	**Possible Event:**
Examples: Process Control Systems, Remote Control Systems, Process Data Register	Loss of Control
Conditions to Take Effect	Technical Defects; Errors at Production/ Assembly; External Impact; Operating Error
Consequences of the Hazard - immediate / - escalating	Failure Malfunction; Local Damages; Failure of Cladding of Machines; Containers and Circuits Escalation Due to Secondary Events

c. General Hazards

15. Special Locations	**Possible Event:**
Examples: Facilities on Cricital Surfaces (Swamps, Water), Flood Areas, Offshore Platforms	Failure of Structure
Conditions to Take Effect	Corrosion; Technical Defect; Fatigue; Earthquake; Severe Weather; Scouring; Subsidence; Ice Floe; Ship Collision
Consequences of the Hazard - immediate / - escalating	Local Damages; Collapse of the Platform; Failure of Cladding of Machines, Containers and Circuits; Injuries; Fatalities
16. Transportation / Traffic	**Possible Event:**
Example: Airborne, Roads, Railways, Waterways	Collision
Conditions to Take Effect	Damaged Equipment; External Impact/ Events; Earthquakes; Severe Weather; Loss of Controll/Operations; Operational Error
Consequences of the Hazard - immediate / - escalating	Local Damage; Failure of Cladding of Machines, Containers and Circuits; Failure of Structures; Fire; Explosion; Environmental Damage; Injuries (to Thrid Persons) (Toxic or other Impact); Fatalities
17. Surrounding-Related Hazards	**Possible Event:**
Examples: Earthquake, Severe Weather (Windstorm, Precipitation), Dust	General Facility Damages
Conditions to Take Effect	Design Error; Operational Error; Insufficient Alarming; Errors at Using the PSA; External Impact
Consequences of the Hazard - immediate / - escalating	Impact on Personnel; Failure of Structure; Failure of Equipment; Failure of Cladding of Machines, Containers and Circuits; Loss of Protective Equipment; Escalation of Secondary Events; Injuries; Fatalities
18. General Safety	**Possible Event:**
Examples: Drilling Facitilies, Natural Gas Storage and Transporation Facilities	Loss of Control
Conditions to Take Effect	Activities of Unauthorized Third Persons; Strikes; Military Operations/Practices
Consequences of the Hazard - immediate / - escalating	Damage of Facilities; Injuries; Fatalities; Escalation due to Secondary Events

a. Natural Gas Cavern Storage

Date: 2007
Customer: German Subsidiary of European Natural Gas Producer and Supplier
Savings: Survey of the HSE status of the planned above ground facilities and safety enhancement by recommendation of additional mitigation measures

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Issue:

During the FEED phase of the projected expansion of an existing gas cavern storage facility the operator intended to get a detailed overview of the HSE status achieved by the foreseen or existing technical and organisational safeguards.

Methodology & Results:

In the forefront of the review eight different facility units inclusive of their tie-ins into the existing facility were defined. Altogether 151 scenarios were analysed with respect to implications on personnel and asset safety as well as on the environment and the company's reputation by applying the systematic HAZID methodology. This approach facilitated the identification of potential medium or higher risk scenarios that could occur during the operation of the facility and to identify possible additional safeguards to mitigate these risks.

Savings:

The result was the identification of eight scenarios that pose a medium risk, 108 lower risk scenarios and 35 scenarios that represented no risk. By recommendation of additional safeguards the risk levels of all medium risk scenarios could be decreased to the lower risk level and even lower risk scenarios could be reduced. By introducing the recommended additional safety measures the operator is enabled to reduce his operating risk significantly.

b. Maritime Oil Jetty in the River Danube

Date: 2008
Customer: European Operator of a Planned Maritime Port in the River Danube
Savings: Survey of the HSE status of the planned facilities and Safety enhancement by recommendation of additional mitigation measures

Issue:

During the FEED/Basic Design phase of the projected expansion of the existing port facilities the operator requested a detailed overview of HSE status achieved by the foreseen or existing technical and organisational safeguards. This was to identify the mutual interference between the existing oil jetty including its connected facilities and the planned dry cargo facilities respectively open storage area.

Methodology & Results:

Altogether 77 scenarios were analysed with respect to implications on personnel and asset safety as well as on the environment and the company's reputation by applying the systematic HAZID methodology. This approach facilitated the identification of potential medium or higher risk scenarios that could occur during the operation of the facility and to identify possible additional safeguards to mitigate these risks.

Savings:

The result was the identification of 48 scenarios that pose a medium risk and 29 lower risk scenarios. The recommendation of additional safeguards allowed the reduction of the risk levels of all medium risk scenarios to a level that is considered as low as reasonably practicable. By introducing the recommended additional safety measures the operator is enabled to reduce his operating risk significantly.

Safety & Risk Management Services

- Safety Case and Compliance Consultancy
- **Hazard Identification Studies (HAZID)**
- Hazard Operability Studies (HAZOP)
- SIL Studies (Safety Integrity Level)
- Consequence Evaluation (Fire, Release, Explosion, Dispersion), Including CFD
- EER Analysis (Escape, Evacuation, Rescue) (GL-Aeneas)
- Quantitative Risk Analysis (QRA)
- Decision Support (Risk Based Layout Studies)
- Performance Standards
- Large Scale Hazards Testing (Spadeadam)
- Incident Investigation

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