

# SIL DETERMINATION / LOPA WORKSHOP

*(Part 2 of SIL Workshop Series. Please also see Part 3: SIL Validation Workshop)*

	COURSE #	COURSE NAME	LOCATION	DATE
<b>2010</b>	010-431	SIL DET-LOPA	Calgary, AB	Sept 13 - 14
	010-465	SIL DET-LOPA	San Diego, CA	Oct 18 - 19
	010-440	SIL DET-LOPA	Calgary, AB	Nov 1 - 2

<b>2011</b>	011-404	SIL DET-LOPA	Calgary, AB	Jan 11-12
	011-414	SIL DET-LOPA	San Diego, CA	Feb 8-9
	011-424	SIL DET-LOPA	Calgary, AB	Mar 8-9
	011-434	SIL DET-LOPA	San Diego, CA	April 12-13
	011-444	SIL DET-LOPA	Calgary, AB	May 10-11
	011-454	SIL DET-LOPA	San Diego, CA	June 14-15
	011-464	SIL DET-LOPA	Calgary, AB	July 12-13
	011-474	SIL DET-LOPA	San Diego, CA	Aug 9-10
	011-484	SIL DET-LOPA	Calgary, AB	Sept 20-21
	011-494	SIL DET-LOPA	San Diego, CA	Oct 10-11
	012-404	SIL DET-LOPA	Calgary, AB	Nov 15-16
	012-414	SIL DET-LOPA	San Diego, CA	Dec 13-14

Course Fee: **\$1,418 CDN** per student

The course fee includes registration, lunch and refreshments, and course materials.  
Price is exclusive of applicable taxes. Courses held in the U.S are billed in U.S. dollars.

## SIL DETERMINATION / LOPA COURSE OBJECTIVE

This 2-day course is designed to deliver expert instruction on how to successfully plan and execute Safety Integrity Level (SIL) Determination studies efficiently, effectively and in accordance with the IEC 61511 standard. This includes understanding the principles behind three of the most commonly used SIL Determination methods (Layer of Protection Analysis, Calibrated Risk Graph and Safety Layer Matrix), learning how to deal with challenging personalities within the SIL team and how to avoid common pitfalls and traps so your studies run smoothly.

Note\* The SIL Determination / LOPA Workshop can be taking in conjunction with the SIL Validation Workshop to gain a more thorough understanding of the Safety Lifecycle process.

## WHO SHOULD ATTEND SIL / LOPA TRAINING?

This course teaches all the requirements to prepare team leaders to facilitate and document SIL Determination studies, including:

- ◆ Risk Assessment specialists
- ◆ SIL / PHA / HAZOP team leaders & scribes
- ◆ Process Safety Management (PSM) / Loss Management specialists
- ◆ Supervisors, managers and engineers responsible for SIL studies
- ◆ Project managers who need to understand the concepts and principles of IEC 61508 & 61511
- ◆ Engineers involved in any aspect of the SIS Safety Lifecycle

Participants should understand the process of executing a HAZOP study and be familiar with typical HAZOP reports.

## SIL / LOPA TRAINING COURSE INSTRUCTORS

### Malcolm Harrison, B.Sc. Mech. Eng., P.Eng., TÜV F. S. Expert

Mr. Harrison is a P. Eng. with over 40 years experience in Instrumentation and Controls. Malcolm spent over 35 years with Shell and has diversified upstream and midstream experience in the heavy oil, offshore, refining and gas processing sectors. He is an experienced SIL Determination facilitator and has worked on billion dollar projects ensuring horizontal I & C alignment between multiple EPCMs.

Malcolm is a TÜV Functional Safety Expert and leads training workshops globally for ACM.

### Ken Bingham, CET, TÜV F. S. Expert

Mr. Bingham is the Principal of ACM Facility Safety and a TÜV certified Functional Safety Expert. His background is in engineering design and management, involving safety, instrumentation, electrical and control systems. With Ken's 27 years on the client side, integration side and the SIL consulting side, he brings a holistic and practical perspective. Mr. Bingham has participated on ISA S84 SIL standard committees, has presented numerous papers and courses on SIL Analysis and is the Chief Technical Architect for ACM's field proven, IEC 61511 compliant Safety Integrity Level (SIL) Life Cycle tool, SilCore™.

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## SIL / LOPA TRAINING COURSE AGENDA

The course is comprised of two days of combined classroom instruction and workshop exercises. In addition to expert instruction from an experienced, professional SIL Determination facilitator, you will also form a study team with other participants and take turns leading the team through “practice” SIL Determination studies. The instructor will coach you and provide feedback on your performance. SilCore™ software is used throughout the workshop to demonstrate the SIL methods, document the SIL studies and produce typical SIL Determination reports.

The course follows the first two phases of the SIS Lifecycle within the IEC 61511 standard.

### Day 1

Background to SIL Determination  
SIL Determination Methods  
SIL Determination Method Selection Criteria  
SIL Documentation Issues  
SIL Teams

### Day 2

SIL Practices  
SIL Determination Workshop  
- Calibrated Risk Graph  
- Layer of Protection Analysis (LOPA)  
- Safety Layer Matrix

## SIL / LOPA WORKSHOP EXERCISE EXAMPLE

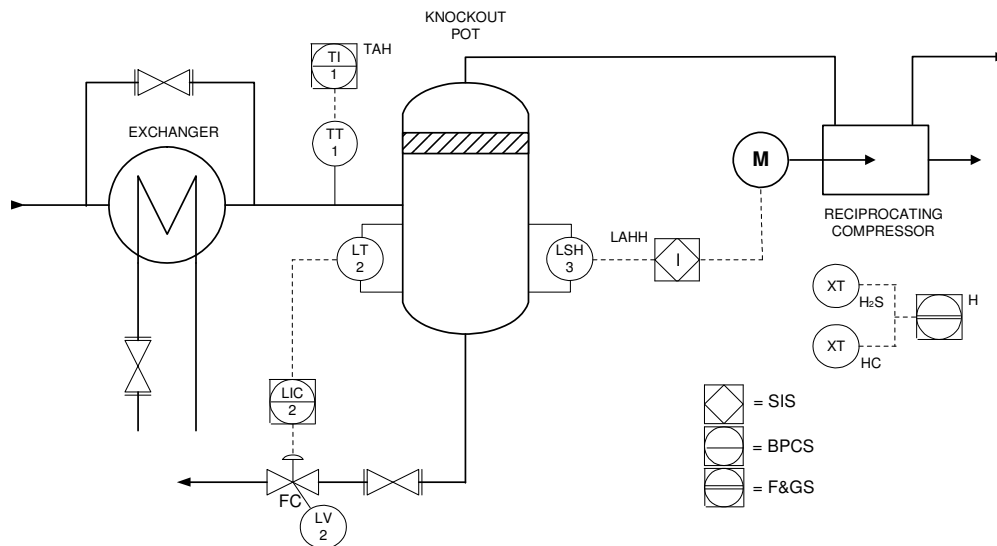
Given the following data, perform a SIL Determination study using LOPA (Layer of Protection Analysis), Risk Graph and Safety Layer Matrix techniques.

### Situation: Sour Hydrogen Gas Reciprocating Compressor

The hydrogen gas is highly flammable and very toxic (100 ppm H<sub>2</sub>S). The gas is cooled in an exchanger to knock out any liquids to prevent damage to the compressor.

#### Data Available:

- A HAZOP has been performed on the system
- LOPA Tolerable Frequency (TF) is one fatality in 1,000 years
- Economic and environmental risk cases are not to be determined
- The Risk Graphs are those shown in Slides #114 -118
- Process upstream upset: Every 3 months
- LV-2 MTTF: 12 years
- Operator error rate: 1 in every 100 attempts
- Exchanger bypass valve manipulation: Every two weeks
- Cooling water inlet valve operation: Every two years
- Knockout outlet pot valve operation: Every week
- Exchanger leak: Every 25 years



To Model: High liquid level in the knock out pot case with a Tolerable Frequency of one fatality in one thousand years.

By the end of this course each student should be able to successfully perform this SIL Determination exercise.




### CONTACT ACM TO REGISTER

Registration form available at : [www.acm.ab.ca/register](http://www.acm.ab.ca/register)

Contact Jacqueline Schmautz for further information at [jschmautz@acm.ab.ca](mailto:jschmautz@acm.ab.ca) or call toll free at 1-877-264-9637

- *ACM Facility Safety is a recognized global provider of Process Safety training, tools and methodologies*
- *ACM prides itself on neutral, third party unbiased workshop oriented training sessions developed from real life experiences of our instructors*
- *Our instructors have lived and implemented all phases of the IEC 61511 Safety Lifecycle during their careers at some of the world's largest operating companies*
- *Our lead instructors are practitioners with industry experience and are available for private in-house sessions at your facilities*

**OUR LEAD INSTRUCTORS**

"We developed these courses and workshops based on real life situations"	"Global Expertise"	"Lived all phases of the Safety Lifecycle"
 <p><b>Malcolm Harrison, B.Sc. Mech. Eng., P.Eng., TÜV F. S. Expert</b></p> <p>Mr. Harrison is a P. Eng. with over 40 years experience in Instrumentation and Controls. Malcolm spent over 35 years with Shell and has diversified upstream and midstream experience in the heavy oil, offshore, refining and gas processing sectors. He is an experienced SIL Determination facilitator and has worked on billion dollar projects ensuring horizontal I &amp; C alignment between multiple EPCMs. Malcolm is a TÜV Functional Safety Expert and leads training workshops globally for ACM.</p>	 <p><b>Marcel Leal-Valias, CET, PHA/PSM Expert</b></p> <p>Mr. Leal-Valias has 47 years experience in Engineering, Process Design &amp; Drafting, mechanical maintenance, and project management. Mr. Leal-Valias has been a Piping Manager, Construction Site Manager, Project Manager and for the last 20 years, he has developed and become an internationally respected Process Hazards Analysis (PHA/HAZOP) trainer and facilitator performing hundreds of PHA studies for all types of facilities. Mr. Leal-Valias has a broad operational understanding of all exploration, production and refining facets of the oil and gas industry as a result of 45 years spent in international postings in Brazil, Australia, and Canada.</p>	 <p><b>Ken Bingham, CET, TÜV F. S. Expert</b></p> <p>Mr. Bingham is the Principal of ACM Facility Safety, Chief Technology Officer and a TÜV certified Functional Safety Expert. His background is in engineering design and management, involving safety, instrumentation, electrical and control systems. With Ken's 27 years on the client side, integration side and the SIL consulting side, he brings a holistic and practical perspective. Mr. Bingham has participated on ISA S84 SIL standard committees, has presented numerous papers and courses on SIL Analysis and is the Chief Technical Architect for ACM's field proven, IEC 61511 compliant Safety Integrity Level (SIL) Life Cycle tool, SilCore™ the only tool in the world that prepares you in real time for loss of safeguards and ACM's MP Real-time risk exposure tool with contingency planning.</p>