

# GUIDELINES FOR THE CONDUCT OF OIL, GAS & PETROCHEMICAL RISK ENGINEERING SURVEYS

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# TABLE OF CONTENTS

SECTION A: INTRODUCTION TO THIS DOCUMENT .....	3
1. Purpose.....	3
2. Background.....	3
3. Scope .....	3
4. General Principles.....	4
SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY .....	6
5. The (Re)Insured .....	6
6. Pre-Survey Preparation .....	6
7. Conducting the Survey .....	7
SECTION C: APPENDIX TO THIS DOCUMENT.....	11
8. Pre-Survey Information Request List.....	11
9. Recommended Survey Agenda .....	13

## SECTION A: INTRODUCTION TO THIS DOCUMENT

### 1. Purpose

The purpose of this document is provide guidance to risk engineers in the planning, preparation and execution of oil, gas and petrochemical risk engineering surveys. The aim is to ensure that surveys are conducted in such a way that the key information required by (Re)Insurers is obtained during the survey.

This document is intended to improve the existing risk engineering survey process and the quality of information provided in the resulting risk engineering survey reports ('market reports').

### 2. Background

The survey process and the subsequent market reports have remained essentially the same over a number of years and it is considered that a review is required to refocus and modernise the approach in line with industry process safety developments and insurance loss experience.

It is (Re)Insurers' belief that surveys should be planned and conducted in line with the following principles:

- A focus on process safety and loss prevention.
- An awareness of the common causes of losses in the industry.
- The importance of evidence-based risk engineering opinion.
- The effectiveness of implementation and compliance with site and best practice standards and procedures.
- Reporting of critical measures of process safety and loss prevention performance such as Process Safety Performance Indicators (PSPIs)

Not only will the above approach provide the information requested by (Re)Insurers, it should also result in a more effective process for the (Re)Insured and will provide important process safety improvement opportunities.

The development of this document has been led by Ron Jarvis (Swiss Re London) and Andy Goddard (Talbot Syndicate London) with review and technical input from risk engineering representatives from a number of major London insurance markets. As far as possible, it is therefore considered to represent a consensus position across the London market.

### 3. Scope

This document is intended to apply to a standard single site survey. It is recognised that other survey formats may be carried out such as property only coverage or recommendation follow up visits. For non-standard surveys this document can be adapted as necessary.

This document has been developed for onshore oil, gas & petrochemical assets.

This document has been developed by the Lloyd's Market Association (LMA) and hence is principally for reports produced for the London market, although this guidance could be adopted in other global markets.

## SECTION A: INTRODUCTION TO THIS DOCUMENT

LMA OG&P IGRES 2015/001 'KEY INFORMATION GUIDELINES FOR OIL, GAS & PETROCHEMICAL RISK ENGINEERING SURVEY REPORTS' provides full details of the key information required by (Re)Insurers. It is important that this is used in conjunction with this document when preparing and carrying out the survey.

### 4. General Principles

The following points are intended as general principles applicable to conducting risk engineering surveys. Planning and conduct of the survey should aim to obtain the information as detailed in LMA OG&P IGRES 2015/001.

#### Focus on process safety and loss prevention

The focus of risk engineering surveys should be on process safety aspects with a view to assessing the adequacy of loss control elements. Whilst loss *mitigation* elements remain important, it is failures of loss *prevention* elements which lead to incidents and ultimately insurance claims and therefore there should be an increased focus on the latter.

#### Focus on the causes of major losses

Following an analysis of some of the largest insured losses primarily over the last 10 years including both property damage and business interruption, it is recommended that insurance risk engineers should give special attention to the following during their risk engineering surveys:

- Mechanical integrity failure (piping and equipment inspection programmes).
- Operating practices and procedures.
- Hazard identification studies.
- Unsafe maintenance, equipment isolation & Permit To Work (PTW).
- Management of Change (MoC).
- Remotely Operated Isolation Valves (ROIVs).

Specific guidance on areas to focus is provided in LMA OG&P IGRES 2015/001.

#### Evidence-based opinion

The risk engineer's opinion of the quality of individual risk control elements is a critical measurement for (Re)Insurers. Opinion should be based on a review of relevant documentation, records and data and observations in the field. Opinion should be benchmarked against recognised good industry practice based on experience of other risks worldwide, with supporting evidence to justify the opinion to the (Re)Insured and (Re)Insurers.

#### Implementation and compliance

A description of the features of each risk control element, for example the risk control procedure, is normally provided during surveys. However commentary and evidence, to support the *actual* implementation of an apparently sound system, is often missing. Failures in implementation and non-compliance with established systems of work and procedures are a significant contributor to major losses and therefore this is an important aspect to address during the survey.

## SECTION A: INTRODUCTION TO THIS DOCUMENT

### Performance data

Wherever possible, relevant performance data in the form of Process Safety Performance Indicators (PSPIs) and other Key Performance Indicators (KPIs) should be obtained as evidence to support opinion and effective implementation (as above). Where possible, it is also important to consider any trends and any exceptions to ensure the data is meaningful to the risk engineer. A list of PSPIs is provided in LMA OG&P IGRES 2015/001.

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

### 5. The (Re)Insured

#### 5.1. Survey preparation

The purpose and format of the survey should be explained to the (Re)Insured in advance of the survey such that the site can prepare in an appropriate manner. Surveys are not audits and should not require excessive preparatory work on the part of the (Re)Insured. In order to aid the (Re)Insured, it is recommended that copies of this document and LMA OG&P IGRES 2015/001 are provided to the (Re)Insured in advance.

Rather than a series of formal presentations, surveys should be conducted through open question and answer sessions with knowledgeable personnel who can provide access to supporting documentation where necessary. Time limitations prevent any kind of rigorous process safety audit approach but rather the survey team will sample specific loss control activities based upon personal and industry loss experience.

#### 5.2. Survey Coordinator

The (Re)Insured should nominate a Survey Coordinator whose role is to ensure that the pre-survey preparation is completed, that the agenda runs smoothly and that any information requested prior to and during the survey is provided. The Survey Coordinator should be from a process safety, operations or technical background rather than a finance or insurance function.

#### 5.3. Corporate Process Safety Representation

It is important to encourage the involvement of the (Re)Insured corporate process safety department where this exists. It is often the case that they are able to communicate important findings to senior management in the organisation, or are aware of corporate procedures, practices, initiatives and programmes that the individual sites may not be aware of.

### 6. Pre-Survey Preparation

#### 6.1. Number in Survey Team

The number of engineers on the survey team is important. If the team is too large it is impossible to focus in any great detail in any specific areas. It also encourages Boardroom style surveys with formal presentations rather than a small team of engineers, getting out on the plant to observe practices and conditions and verifying performance and compliance through review of documentation. A survey team of maximum 4-5 risk engineers is usually the most effective and it is recommended that numbers be actively managed to achieve this.

#### 6.2. Factual Update of Previous Report

Whilst it is intended that the focus of the survey is on performance assessment, it is recognised that the survey team leader is still required to update the market report to ensure it remains factually accurate. It is recommended that a copy of the latest market report (if this exists) be issued to the (Re)Insured in advance of the survey with a request that it is reviewed and marked up with any changes since the last survey. The reviewed

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

and marked up copy should be made available by the (Re)Insured to the survey team ideally in advance of the survey but, if not, at the kick-off meeting.

### 6.3. Agenda

A proposed agenda should be sent to the (Re)Insured well in advance of the survey. A suggested template for a standard three day survey is provided within the Appendix but this may be tailored to the specific situation.

The relative time spent in each area is intended to be representative of the perceived importance to (Re)Insurers including consideration of the causes of major losses highlighted in section 4 of this document. Consideration should be given to the inherent process hazards when developing the agenda. For example, process piping inspection is critical for refineries but may be less so when considering some petrochemical processes with more limited internal degradation mechanisms where perhaps an increased focus on operating practices and procedures may be warranted.

To aid the preparation of the (Re)Insured, it is suggested that relevant documentation required for review should be indicated for each of the sessions within the agenda.

### 6.4. Information Request List

Along with the agenda, an information request list should be sent to the (Re)Insured well in advance of the survey. A suggested information request list is provided within the Appendix to this document which has been based upon LMA OG&P IGRES 2015/001. This list may need to be tailored to the specific survey.

Ideally this information should be provided to the survey team in advance of the survey but as a minimum should be made available at the kick-off meeting. Receipt of such information after the survey is of limited value as the opportunity to discuss is lost (an exception to this would be factual information required to update the market report).

## 7. Conducting the Survey

### 7.1. Use of Presentations

Excessive use of PowerPoint (or similar) presentations should be avoided as these inhibit the free flow of what should be question and answer sessions and review of supporting documentation. Whilst they can be a good information tool, presentations are often a statement of how things should be done but not necessarily representative of how things are *actually* done. PowerPoint (or similar) presentations are often prepared by the (Re)Insured out of a misunderstanding of the purpose of the survey and the needs of the survey team. Reducing PowerPoint (or similar) presentations would also reduce the burden upon the (Re)Insured.

Generally, formal presentations should be limited to the survey kick-off meeting and perhaps a brief opening introduction to each departmental meeting.

### 7.2. Access to Documentation

It is important that the (Re)Insured make available knowledgeable personnel able to conduct an open question and answer session on the relevant agenda topic. Ready access to supporting documentation during the sessions is an important aspect and to facilitate this it is normally preferable to hold the sessions within the departmental offices rather than a central meeting room. On occasions, documentation may be available

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

electronically through the site intranet in which case a central meeting room may be appropriate.

In addition to the documentation requested in advance of the survey, access to further documentation items are likely to be requested during the survey. It is recommended that a data room, containing the information requested during the survey and in the Appendix to this document, is made available to the survey team during the survey.

### 7.3. Kick-Off & Wrap-Up Meetings

The kick-off meeting should comprise managers from each of the departments on the agenda as well as from senior management. This is to ensure that the site fully understands the purpose of the survey and that all managers are able to meet the expectations of the survey team.

The wrap-up meeting should consist of the same management personnel as the kick-off meeting. This is to ensure that each manager fully understands the observations of the survey team and the background to any risk improvement recommendations. The wrap-up meeting is an important opportunity for discussion and to resolve any misunderstandings.

### 7.4. Focus Areas

Although the survey should aim to obtain the information as detailed in LMA OG&P IGRES 2015/001, as mentioned earlier specific focus should be given to the following:

- Mechanical integrity failure (piping and equipment inspection programmes).
- Operating practices and procedures.
- Hazard identification studies.
- Unsafe maintenance, equipment isolation & Permit to Work (PTW).
- Management of Change (MoC).
- Remotely Operated Isolation Valves (ROIVs).

For each of the above, this may be achieved as follows:

- Review/understanding of the site programme, procedures and practices.
- Review PSPIs (those reported by the (Re)Insured and/or those listed in LMA OG&P IGRES 2015/001. Departmental monthly reports are a useful source of performance data).
- Selection of examples either specifically from the field or more generally (typically select up to 2 examples).
- Review/verify data and records (follow up of the selected examples).

Example (Process piping inspection):

- Verify the inspection requirements of process piping by discussion and review of the site programme and procedures.
- Review the Re(Insured) Inspection Department monthly reports and PSPIs to establish the status of process piping inspection.

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

- Select 1 or 2 piping examples. LMA OG&P IGRES 2015/001 provides some background but focus on high consequence failure locations, piping where internal corrosion is most likely, locations that are hard to access for inspection, piping likely to be vulnerable to external corrosion under insulation, unexpected rapid corrosion caused by the installation of incorrect materials of construction and positive material identification activities.
- Interrogate the inspection records to verify that the appropriate inspections have been carried out.

### Example (Operating practices and procedures):

- Verify, by discussion, the procedures and practices with respect to the management of the bypassing and disabling of safety critical instruments (safety critical trips and interlocks).
- Review the Re(Insured) status reports and PSPIs to establish the status of safety critical instruments.
- Select 1 or 2 examples in the control room/in the field.
- Review the safety critical instruments bypass and status logbook to determine status and compliance (authorisation and sign off, reporting to management, overdues, effectiveness of temporary safeguards, escalation to temporary MoC).

### Example (Hazard identification studies):

- Verify, by discussion, the standards and procedures with respect to hazard identification studies.
- Determine the status of hazard identification studies for each unit versus the established programme.
- Select one high risk unit for specific review.
- Make a judgement on the quality of the last available hazard identification study with a focus on the status and follow up of the recommendations made and studies of associated safety critical instrumented systems and devices.
- Select an example safety critical instrument and verify that the appropriate maintenance and inspection programmes have been carried out on these devices.

### Example (Unsafe maintenance, equipment isolation & PTW):

- Verify, by discussion, the procedures and practices with respect to the permit to work and safe isolation practices.
- Select 1 or 2 examples of work being carried out in the field and inspect the work site permit to work, safe work practices and isolation practices.
- Review the practices compliance against (Re)Insured procedures and best practices.
- Pay particular attention to "non-standard" operator activities where a safe isolation permit to work might not be required (such as operator isolation blinds or when remotely operated valves are used to isolate for maintenance).
- Consider the effectiveness of the hot work permit system management.

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

### Example (Management of Change):

- Verify, by discussion, the procedure with respect to management of change.
- Review the change log to gauge the nature and number of changes made during a period of say the last 12 months.
- Verify that temporary MoC are escalated to an MoC in accordance with established time limits.
- Select a specific example either from the change log or from an observation made in the field.
- Review the MoC documentation for the change, especially the thoroughness of hazard identification studies carried out, the decision process whether or not a HAZOP was necessary and the status of any recommendations.

### Example (Remotely Operated Isolation Valves):

- Verify, by discussion, the (Re)Insured site and corporate standards with respect to Remotely Operated Isolation Valves (including retrospective installation).
- Establish the current status on the plant with respect to compliance against the standards and any improvement programmes in place.
- Review in the field some examples where Remotely Operated Isolation Valves are installed or would be expected to be installed.
- Compare compliance against site standards.

### 7.5. Control Room Visits

The control room visit is a critical part of the survey as it contains much of the information required by (Re)Insurers. However, control room visits are often unsatisfactory with a number of engineers congregating in a typically restricted space wishing to ask questions whilst the panel operators are trying to safely run the plant. It is suggested that the initial discussion be moved away from the control room to an adjacent meeting room where access to certain documentation could also be provided. The subsequent visit to the control room itself could then be targeted at specific items.

### 7.6. Site (Field) Tours

A walking tour of the facilities (including the ability to take photographs) is a critical part of the survey but, as time is limited, certain areas should be targeted. The site tour should focus upon the high process risk areas where historically major loss incidents and insurance claims have occurred. For large risks comprising process and offsites areas, whether visits to offsite and utility areas (such as tank farms, jetties and power plants) are necessary should be agreed by the survey team.

## SECTION C: APPENDIX TO THIS DOCUMENT

### 1. Pre-Survey Information Request List

The following information should be provided before the site survey commences preferably in electronic format. All information should be legible and reproducible. It is recommended that a hard copy data room, containing the information requested, is made available to the survey team during the survey.

#### 1.1. Asset Details

- 1.1.1. List of process units (including year of original commissioning and any subsequent revamps, technology licensor, current design capacity and current status, e.g. idled).
- 1.1.2. Overall simplified process Block Flow Diagram including onsite interdependency between process units.
- 1.1.3. Basic details of the steam and electrical power supply systems including current site demand versus supply balance, redundancy and reliability.
- 1.1.4. Site plot plan (separate file for legibility).
- 1.1.5. Management level organisation chart.
- 1.1.6. Breakdown of declared values by process unit and off-sites (Property Damage (PD) and Business Interruption (BI))
- 1.1.7. List of potential liquefied flammable products vapour cloud source terms (usually light hydrocarbon inventories in process units). List equipment with liquid hold-ups > 5 m<sup>3</sup>.
- 1.1.8. List of large business critical rotating machinery (include basic design details, approximate replacement cost, impact on production in the event of failure, spares holding and estimated time to repair/replace).
- 1.1.9. List of any large business critical transformers ((include basic design details, impact on production in the event of failure, spares holding and estimated time to repair/replace). For large facilities list the 10 key transformers with accompanying single line electrical diagram.

#### 1.2. Performance Data

- 1.2.1. Operations report including monthly production data for the last 12 months and indicating the number of unplanned shutdowns.
- 1.2.2. Process Safety report including the site's suite of PSPIs and monthly process safety incident data for the last 12 months.
- 1.2.3. Maintenance report including maintenance KPIs for the last 12 months.
- 1.2.4. Inspection report including Inspection KPIs for the last 12 months.

#### 1.3. Systems & Procedures

- 1.3.1. Permit to Work (PTW) procedure and forms including Hot Work permit.
- 1.3.2. Equipment isolation procedure.

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

- 1.3.3. Safety critical instrumentation override procedure including override form.
- 1.3.4. Samples of root cause analysis studies and lessons learned from process incidents including recommendations made and their current status.
- 1.3.5. Process Hazard Analysis (HAZOP) procedure including HAZOP recommendation status report for existing facilities.
- 1.3.6. Management of Change (MoC) procedure.
- 1.3.7. Pre-Startup Safety Review (PSSR) procedure.
- 1.3.8. Firewater pump test procedure and most recent test results.
- 1.3.9. Fire protection systems impairment procedure including impairment form.

## 2. Recommended Survey Agenda

For detailed content relating to each Agenda item, please see the relevant section of LMA OG&P IGRES 2015/001 indicated within the table. These are suggestions only as it is recognised that information is often gleaned throughout the survey and not necessarily dedicated to a specific session.

<b>DAY 1</b>			
<b>Session</b>	<b>Format</b>	<b>Duration</b>	<b>LMA OG&amp;P IGRES 2015/001 Cross-Reference</b>
<b>Kick-off Meeting/Site Overview</b> <ul style="list-style-type: none"> <li>• Review of agenda</li> <li>• Collection and review of pre-survey information request list</li> <li>• Site overview presentation</li> </ul>	Brief PowerPoint (or similar) presentation by the site management team followed by Q&A  Location: Meeting Room & Data Room	1hr	Sections 6, 7, 8 & 12
<b>Process Safety</b> <ul style="list-style-type: none"> <li>• Process safety framework</li> <li>• PSPIs</li> <li>• Process safety incidents</li> <li>• Process safety auditing</li> </ul>	Q&A and review of sample documentation/data  Location: Process Safety Department	1hr	Section 13
<b>Operations &amp; Control Room</b> <ul style="list-style-type: none"> <li>• Organisation</li> <li>• Shift handover</li> <li>• SOPs/EOPs</li> <li>• Training &amp; competence assurance</li> <li>• Permit To Work (PTW)</li> <li>• Equipment isolation</li> <li>• Safety critical instrumentation override management</li> <li>• Alarm management &amp; Safe Operating Limits (SOLs)</li> </ul>	Q&A and review of sample documentation/data  Location: Control Room Building	2hrs	Sections 11.4 & 14
<b>Site Tour I</b>	Walking tour of selected process units and offsites	3hrs	Sections 11.1, 11.2, 18, 19.1 & 19.3

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

<b>DAY 2</b>			
<b>Session</b>	<b>Format</b>	<b>Duration</b>	<b>LMA OG&amp;P IGRES 2015/001 Cross-Reference</b>
<b>Site Tour II</b>	Walking tour of selected process units and offsites	3hrs	Sections 11.1, 11.2, 18, 19.1 & 19.3
<b>Production Planning BI Scenarios</b>	Q&A  Location: Production Planning Department	1hr	Section 9.2, 10.2, 10.3, 10.4
<b>Maintenance Planning &amp; Rotating</b> <ul style="list-style-type: none"> <li>• Organisation</li> <li>• Basis of programmes</li> <li>• Planning, prioritization &amp; performance</li> <li>• Reliability</li> <li>• Rotating programmes</li> </ul>	Q&A and review of sample documentation/data  Location: Maintenance Department	1hr	Sections 15.1, 15.2, 15.3, 15.4 & 15.5
<b>Maintenance Electrical &amp; Instrumentation</b> <ul style="list-style-type: none"> <li>• Testing of safety critical instrumentation</li> <li>• Electrical programmes</li> </ul>	Q&A and review of sample documentation/data  Location: Maintenance Department	1hr	Sections 15.6 & 15.7
<b>Fire Fighting &amp; Emergency Response</b> <ul style="list-style-type: none"> <li>• Active protection</li> <li>• Emergency response</li> </ul>	Q&A and review of sample documentation/data  Location: Emergency Response Building	1hr	Sections 19 & 20

## SECTION B: PREPARING FOR AND CONDUCTING THE SURVEY

<b>DAY 3</b>			
<b>Session</b>	<b>Format</b>	<b>Duration</b>	<b>LMA OG&amp;P IGRES 2015/001 Cross-Reference</b>
<b>Inspection (Mechanical Integrity)</b> <ul style="list-style-type: none"> <li>• Organisation</li> <li>• Basis of programmes</li> <li>• Equipment specific programmes</li> <li>• Planning &amp; deferment management</li> <li>• Equipment deficiency management</li> <li>• Operational changes &amp; deviations</li> <li>• Material verification</li> <li>• Records &amp; analysis</li> <li>• Performance monitoring &amp; audits</li> </ul>	Q&A and review of sample documentation/data  Location: Inspection Department	3hrs	Section 16
<b>Technical/Engineering</b> <ul style="list-style-type: none"> <li>• Basic process control, emergency shutdown &amp; isolation</li> <li>• Equipment safeguarding</li> <li>• Process Hazard Analysis (PHA)</li> <li>• Management of Change (MoC)</li> <li>• Safety Integrity Level (SIL) Assessment</li> </ul>	Q&A and review of sample documentation/data  Location: Engineering Department	2hrs	Sections 11.1, 11.2, 11.3 & 17
<b>Wrap-Up Meeting preparation</b>	Survey team preparation time  Location: Data Room	1hr	-
<b>Wrap-Up Meeting</b>	PowerPoint (or similar) presentation by the survey team to the site management team  Location: Meeting Room	1hr	Section 21