



Technical/Process Safety

What is it?

Technical Safety and Process Safety are terms commonly used in the process industries to describe the safety requirements related to design and operation of hazardous processes. CRA provides key support services to help an operator meet regulatory requirements, e.g. COMAH regulations (onshore), PFEER (offshore), Offshore Safety Case regulations (OSCR), Borehole Regulations, Pipeline Safety regulations (PSR), Dangerous Substances Explosive Atmospheres Regulations (DSEAR).



CRA capabilities cover a wide range of technical studies from full management of process safety requirements for new design (e.g. six stage hazard study approach); or retrospective analysis of existing plant, e.g. Process Hazard Review (PHR) studies, retrospective HAZOP/HAZID studies. CRA also provides a full Quantitative Risk Assessment (QRA) service that will assess the risk from all process failures as well as fixed plant risk (parts count QRA). CRA also provides support in relation to ensuring the lifecycle integrity of safety related systems. In particular CRA has extensive experience in the important areas of process control system integrity and the functional safety requirements of Safety Instrumented Systems (SIS) to BSEN61508/61511 standards.

Why is it important?

The identification, assessment and control of major hazard risks are an essential part of achieving a tolerable level of risk for on-site workers, and for people attending to their daily business offsite. The Health & Safety Executive (HSE) document, Reducing Risk Protecting People (R2P2), provides clear guidance on what the UK HSE considers as tolerable risk levels to people from work activities. This underlines the requirement for plant operators to reduce risks to As Low As Reasonably Practicable (ALARP). The technical safety studies described here play a part in providing a robust demonstration that risks from process plant have been reduced to ALARP. In addition to the safety element there is also a clear business benefit from Identifying and minimising potential failures of plant which could lead to an accident or plant upset.

What we do

CRA offer the following technical safety studies

■ **QRA (Quantitative Risk Assessment)**

CRA provides a full QRA service

- Fault Tree Analysis
- Event Tree Analysis
- Process Failures- QRA
- Parts Count-QRA
- SIL QRA (see also SIS/ Functional Safety)
- FMEA/FMECA/ FMEDA
- Human Failure Analysis
- Individual Risk Contours
- Societal Risk Implications

■ **Consequence Analysis/Fire and Explosion Analysis (FEA)**

Consequence analysis can link to QRA studies or be carried out as a standalone study. It is essential to determine the effects that a major accident may have on plant and people on-site and off-site. CRA uses recognised consequence analysis tools such as DNV PHAST, SAFETI and company packages, such as BP's CIRRUS and Shell's FRED. For more detailed analysis CRA can also provide CFD modelling.

■ **Occupied Buildings Risk Assessment (OBRA)**

There is a requirement to demonstrate to HSE that the potential impact of major accidents on occupied buildings has been assessed and that risks have been reduced to ALARP. It is therefore a fundamental requirement that an OBRA is carried out for a major hazard site. The Chemical Industries Association (CIA) has published guidance on the type of assessment that should be carried out and the type of prevention, control and mitigation measures that should be applied. CRA can provide full support services to assist a client whether this is being done retrospectively or as part of a new project.

■ **Design Safety Reviews**

CRA can conduct design safety reviews for projects in the early stages of design. A satisfactory design safety review gives confidence that the main hazards have been addressed or actions raised to address them at the next stage of design.

■ **Safety Report/ Safety Case Preparation**

CRA has considerable experience in both assessing and producing safety cases/safety reports to comply with COMAH regulations, Pipeline Safety regulations (MAPD document), and Offshore Safety Case Regulations.

■ **HAZOP & HAZID Studies**

CRA regularly provides Hazard Study Leads/ Chairs to conduct HAZOP & HAZID studies, as well as ALARP workshops.

■ **DSEAR**

CRA provides support for DSEAR studies.

For example, Reg.5: Risk Assessment, Reg. 6: Elimination/Risk Reduction, Reg. 7: Hazardous Area Classification (HAC)/ EX Equipment Selection.

■ **Emergency Response**

CRA can provide support to a client when developing on-site and off-site emergency response plans. CRA also has experience in carrying out Offshore Evacuation Escape and Rescue (EERA) studies.



Firefighters Regroup at Buncefield Oil Terminal fire in December 2005.

■ **Process Safety Management: Existing Plant**

CRA can help a client develop a framework for the implementation of a robust Process Safety Management (PSM) system. This can include identification of Key Risk Control Systems (KRCS) and development of a set of leading and lagging Process Safety Performance Indicators (PSPI's).

■ **Project Process Safety Management**

CRA employs professionals who have a wide range of experience in project process/technical safety management for FEED and EPC stages of project development. For example, a common approach is to utilise a six stage hazard study approach to run concurrently with project progression, e.g.

- 1. Concept: Preliminary Hazard Studies
- 2. FEED: HAZID/Coarse HAZOP, LOPA, QRA, DSEAR
- 3. EPC: Final HAZOP, LOPA, DSEAR
- 4. Commissioning: Verification of safety systems performance
- 5. Handover and Operations: Further verification and overall validation of safety elements
- 6. Continued Safe Operations: A hazard study is usually carried out after 6 months of process operation to ensure suitable performance of safety related elements has been achieved.

It should be noted that the studies mentioned here are only indicative and a more comprehensive list of studies are usually tailored to suit the project.

■ **Safety Management Systems (SMS)**

CRA can help a client with setting up robust SMS. Either through overall company H&S Management (HSG 65) or more localised SMS at the plant level, e.g. Permit To Work Systems, Risk assessed procedures, Human Task Analysis.

■ **Safety Auditing/Incident Investigations**

CRA have a number of ex HSE specialists who are experienced in carrying safety audits in the major hazard process industries. They also have experience in carrying out major accident investigations and preparing expert witness statements/reports to the Crown Prosecution Service (CPS) in England and the Procurator Fiscal in Scotland. This experience is now being applied to assist clients who want a level of independence when investigating accident scenarios or plant upsets.

■ **Functional Safety : Safety Instrumented Systems (SIS)**

CRA provide a full SIS support service from SIL assessment through system design, installation, operation and continuing maintenance, inspection and testing. This work is in line with recognised industry standards BSEN/IEC 61508/61511, typical support areas include:

- SIS Management/ SIS Project Development Planning
- SIL Assessment: (Techniques- LOPA, SIL QRA, Risk Graph, Risks Matrix)
- Safety Requirements Specification
- Design realisation – supported by FMEDA/FMECA where required
- Determination of proof test requirements
- Independent design verification
- Independent SIS validation
- Functional Safety Assessments (Stages 1-6 as required)

See also RAM/Asset Integrity Capability Statement.

■ **Alarm Handling**

CRA provides full support to Alarm handling studies using EEMUA 191 guidance as a benchmark. CRA also has a Human Factors team to support the technical engineers with these studies. Both nuisance and Dynamic alarm handling studies can be carried out.