



Health Safety & Environment (HSE) Incident Investigation

Course Introduction:

In high-hazard industries, incidents—ranging from near misses to major accidents—are critical indicators of system weaknesses, operational gaps, and latent hazards. A robust and structured approach to **Health, Safety, and Environmental (HSE) Incident Investigation** is therefore essential to identify root causes, prevent recurrence, and strengthen the overall safety management system.

This advanced five-day training program offers a **comprehensive technical deep dive into the systematic methodologies, legal implications, human and organizational factors, and forensic techniques** essential for effective incident investigation. It emphasizes **fact-based, root cause-driven analysis** using globally recognized methodologies such as **Root Cause Analysis (RCA), 5-Whys, Fishbone (Ishikawa) Diagrams, Fault Tree Analysis (FTA), Event and Causal Factor Charts (ECFC), Bow-Tie Analysis, and TapRoot®**.

Participants will develop the technical competence to:

- Recognize and categorize incidents (including HIPO – High Potential Events).
- Apply structured analysis frameworks to collect, validate, and interpret evidence.
- Reconstruct event sequences using **timeline analysis** and **barrier analysis**.
- Distinguish between immediate, underlying, and root causes using multi-level failure logic.
- Identify **systemic gaps in procedures, training, equipment, or management systems**.
- Develop effective Corrective and Preventive Actions (CAPAs) based on risk-based prioritization.

The course also integrates elements of **legal and regulatory compliance** (e.g., OSHA, ISO 45001, IOGP, API RP 754), **interviewing techniques**, and **report writing**, ensuring investigators can generate technically defensible reports and interface with legal, regulatory, and insurance stakeholders when required. Real-world case studies from the oil & gas, chemical, and energy sectors will provide applied context.

Course Objectives:

Upon successful completion of this course, the delegates will be able to:

- Comprehensively understand incident classification, causation models, and regulatory requirements.
- Apply structured incident investigation methodologies to identify immediate, underlying, and root causes.
- Utilize advanced tools such as Bow-Tie Analysis, 5-Whys, Fault Tree Analysis (FTA), and TapRooT® for root cause identification.
- Conduct fact-based interviews and collect high-integrity data during investigations.
- Construct technical incident timelines and causal sequence mapping.
- Develop corrective and preventive actions (CAPA) aligned with ISO and OSHA standards.
- Produce formal, audit-ready HSE incident investigation reports with defensibility in court or regulatory inquiries.
- Promote a learning and prevention-focused safety culture through incident analysis.

Who Should Attend?

This course is recommended for:

- HSE Managers, Officers, and Coordinators
- Process Safety Engineers and Operational Supervisors
- Quality Assurance and Compliance Specialists
- Emergency Response and Risk Managers
- Regulatory Affairs and Legal Compliance Teams
- Auditors and Incident Review Board Members
- Training and Competency Managers in high-risk industries
- Engineering Managers and Maintenance Personnel.

Course Outline:

Day 1: Foundations of Incident Investigation in High-Hazard Petrochemical Operations

5.1 Understanding the Petrochemical Process Safety Environment

- Process safety fundamentals specific to refineries, olefin units, and chemical plants
- Hazardous process characteristics (toxic releases, flammables, pressurized systems)
- Key regulatory and global frameworks: OSHA 1910.119, API 754, CCPS guidelines

- Classification of incidents: Process Safety Incidents (Tier 1-4), personal safety incidents, environmental events

5.2 Structure and Governance of HSE Incident Investigations

- Incident investigation policies and management system requirements (ISO 45001, ISO 14001, API RP 585)
- Roles and responsibilities: Lead investigator, HSE manager, line supervisor, technical expert
- Confidentiality, legal privilege, and preservation of evidence in high-risk industries
- Setting investigation scope: Near miss vs. catastrophic failure

5.3 Pre-Investigation Actions and Emergency Response Integration

- Scene preservation protocols under COMAH/SEVESO III requirements
- Interface between emergency response and root cause analysis teams
- Immediate data logging: DCS records, ESD triggers, pressure/flow alarms
- Establishing preliminary event timeline with shift logs and SCADA outputs.

Day 2: Evidence Collection and Incident Scene Management

5.4 Physical Evidence Collection at Process Sites

- Scene examination techniques: P&ID overlay analysis, isolation lockout logs, flare event timelines
- Sample collection: hydrocarbon residues, corroded pipe coupons, instrument air filter traps
- Photos, 3D scanning, and drone use for inaccessible or explosive environments
- Evidence tagging, chain of custody, and secure storage procedures

5.5 Human Factor Data Gathering in Complex Petrochemical Settings

- Conducting structured interviews: DCS operators, maintenance staff, control room supervisors
- Behavioral-based analysis and job-task interface review
- Utilizing Human Factors Analysis and Classification System (HFACS) for error modeling
- Cognitive bias management and leading questioning avoidance

5.6 Systems and Documentation Review

- Control room logs, permit-to-work (PTW) systems, shift handover sheets
- Reviewing maintenance records, SIS bypass logs, MoC approvals, and alarm management audits

- Interlock register and instrument loop diagram verification
- Documenting deviations from operating procedures and PHA recommendations.

Day 3: Root Cause Analysis (RCA) and Technical Failure Diagnostics

5.7 Root Cause Analysis Techniques for the Petrochemical Sector

- Structured RCA tools: 5-Whys, Fishbone (Ishikawa), Barrier Analysis, Fault Tree Analysis
- API RP 585 and CCPS incident investigation workflow alignment
- Use of TapRooT® and Bow-Tie XP in process safety investigations
- Integrating Layer of Protection Analysis (LOPA) results into RCA

5.8 Engineering Forensics and Mechanical Failure Diagnosis

- Analysis of material failure: creep, fatigue, corrosion under insulation (CUI), hydrogen embrittlement
- Instrumentation malfunction: signal loss, zero drift, loop calibration failures
- Mechanical seal leakage, pump trip root analysis, PSV chatter and lift signatures
- Static equipment failures: pressure vessel overpressure, piping vibration, flange leakage

5.9 Control System and Automation Failures

- PLC logic misconfigurations, SIS logic solver response delays, alarm rationalization issues
- Failure of override interlocks, fire and gas detection logic lapses
- DCS/HMI interface errors and human-machine interface (HMI) usability audits
- Control system cyber-attack vectors and compromised diagnostics.

Day 4: Report Development, Communication, and Legal Interface

5.10 Technical Report Structuring and Evidence Presentation

- Structuring investigation reports with executive summaries, evidence matrices, and causal chains
- Use of timeline event mapping and fault propagation diagrams
- Effective use of appendices: piping isometrics, event chronologies, and C&E matrices
- Graphical risk reduction maps (bow-tie outcome integration)

5.11 Regulatory and Legal Considerations

- Interaction with regulatory authorities (MOCCAE, ADNOC, OSHA, EPA, HSE UK)
- Legal privilege, litigation risks, and compliance documentation

- Managing communication with third parties, contractors, and insurance investigators
- Protecting proprietary technology and incident privacy in multi-stakeholder environments

5.12 Communication Strategy and Stakeholder Briefing

- Briefing internal stakeholders: executive leadership, process teams, and board representatives
- External communication strategy: media handling, public statements, and regulatory disclosures
- Developing CAPA presentation materials with risk reclassification outcomes.

Day 5: Corrective/Preventive Actions (CAPA), Risk Reassessment, and Learning Integration

5.13 Corrective and Preventive Action Planning in the Petrochemical Context

- Action hierarchy: engineering redesign, administrative controls, training reinforcement
- API RP 754 metrics and leading/lagging indicator validation
- Safety Integrity Level (SIL) reassessment and revision of IPLs (Independent Protection Layers)
- Case-based group exercise: CAPA development for a column overpressure event

5.14 Management of Change (MoC) and HSSE System Feedback Loop

- Updating PSM elements: training needs analysis (TNA), operating procedures, and P&ID revisions
- MoC governance in light of incident findings: system software, equipment, raw materials
- Risk register updates and bow-tie revisions to reflect new understanding
- Re-validating Process Hazard Analysis (PHA) assumptions

5.15 Case Study Workshop and Final Simulation

- Integrated incident simulation using actual case (e.g., heat exchanger rupture, runaway reaction)
- Group-based investigation: technical fault identification, RCA mapping, CAPA definition
- Peer review panel simulation: presenting findings to an executive HSE board
- Scoring methodology based on technical depth, regulatory compliance, and systemic recommendations.

Course Certificate:

International Center for Training & Development (ICTD) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Methodology:

A variety of methodologies will be used during the course that includes:

- **Instructor-Led Training (ILT)**
- **Multimedia Presentations** using real-world incident scenarios
- **Group Workshops** and Team-Based Case Studies
- **Simulation of Investigations** using industrial examples
- **Use of Templates and Checklists** for real-world applications
- **Assessment Tools:** Daily quizzes, RCA exercises, and final evaluation

Course Fees:

To be advised as per the course location. This rate includes participant's manual, Hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:30	Recess (Prayer Break & Lunch)
13:30 - 15:00	Last Session