MLC SERVICES · 13

# Safety Studies

Multidisciplinary studies across fire, electrical, civil, chemical and process safety.

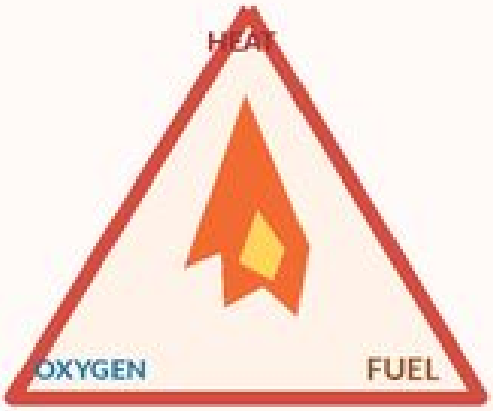
MLC offers multidisciplinary safety studies across fire, electrical, civil, chemical and process safety, plus the wider workplace and emergency reviews below. Every study is scoped around your facility and operations, and reported with findings and recommendations your teams, authorities and insurers can act on. The current portfolio is listed below.

## Fire Safety

# Fire Load Calculation

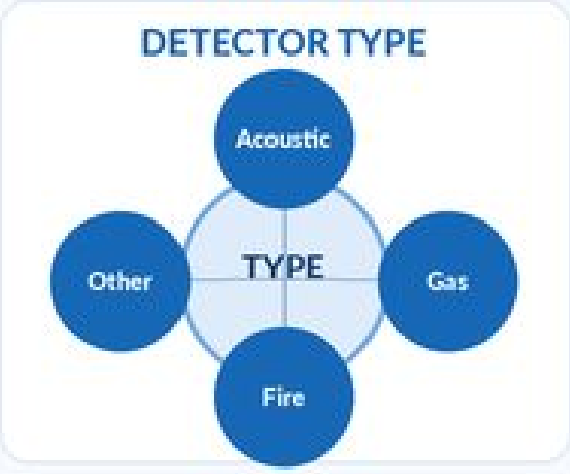
Assessing potential fire severity

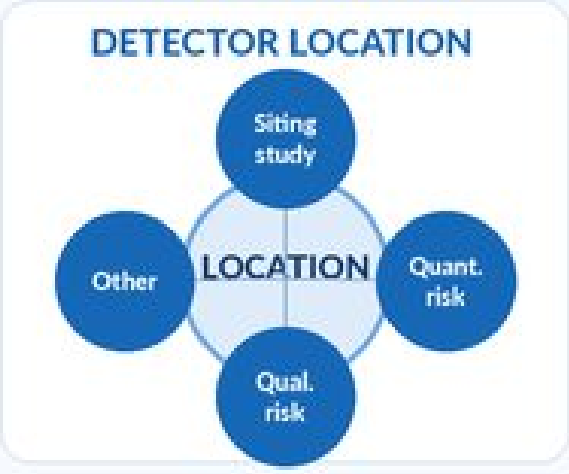
- **Fire load significance**
  Combustible energy
- **Building classification**
  Occupancy & use
- **Calorific value**
  Fuel heat content
- **Fire prevention**
  Risk reduction

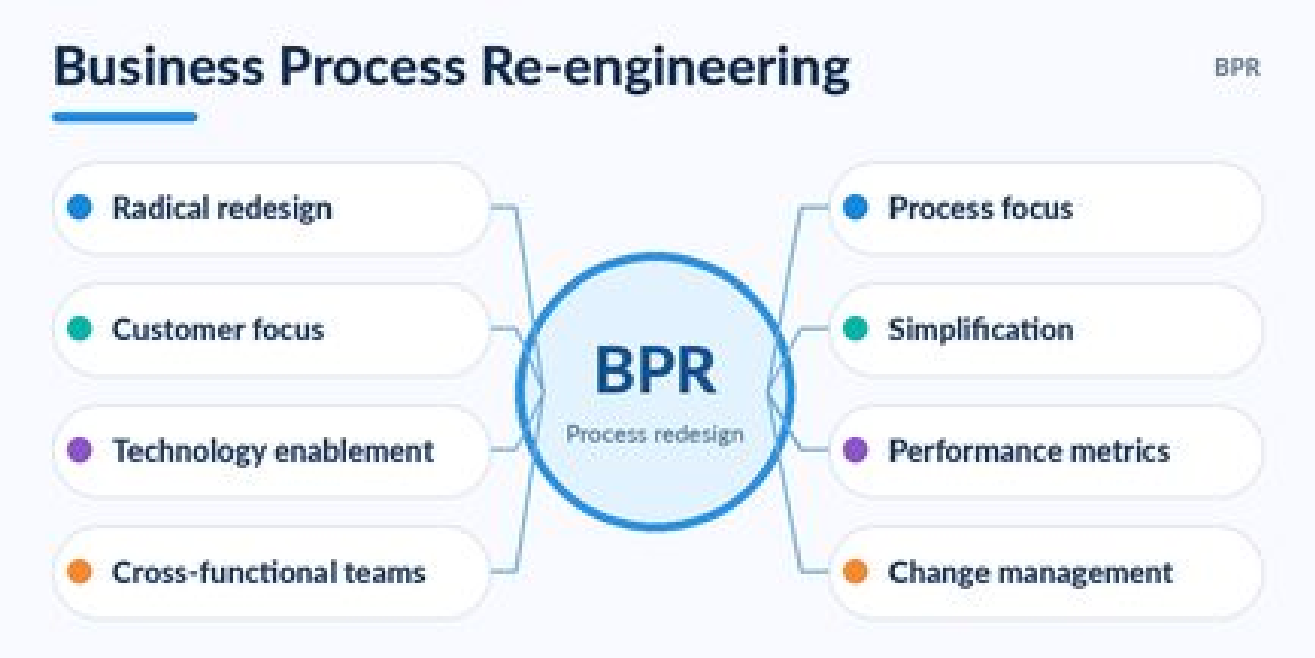



# Fire & Gas Detector Mapping

TYPE + LOCATION

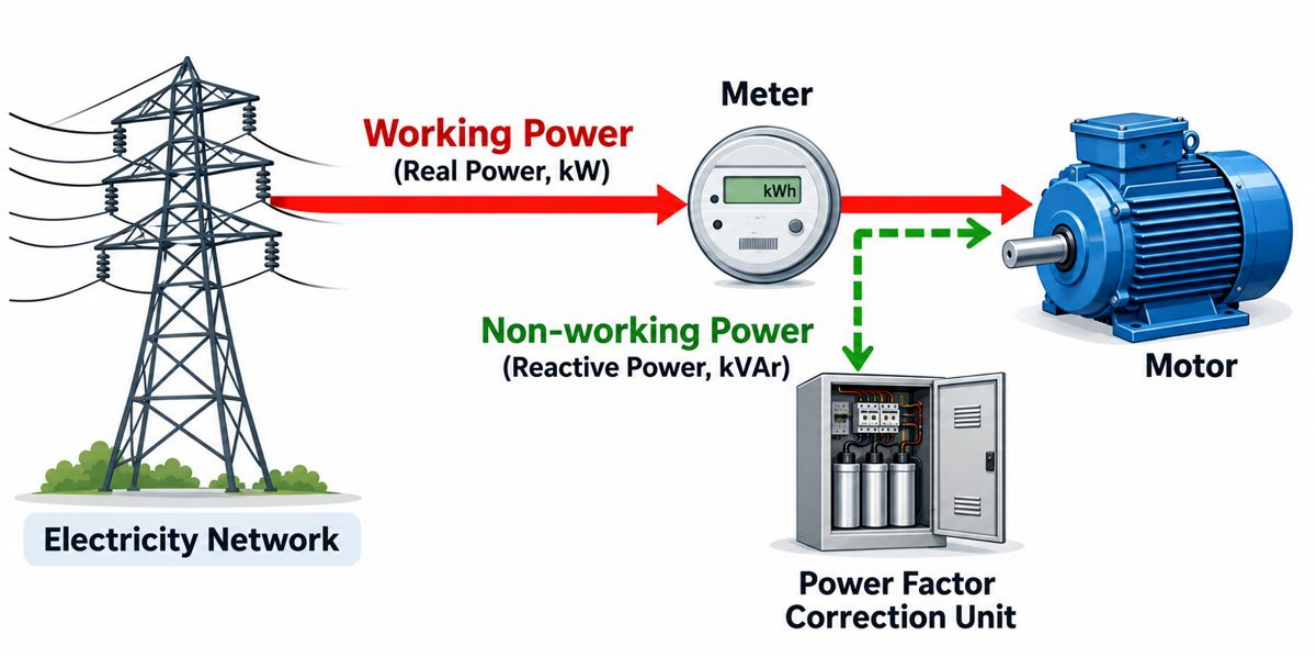


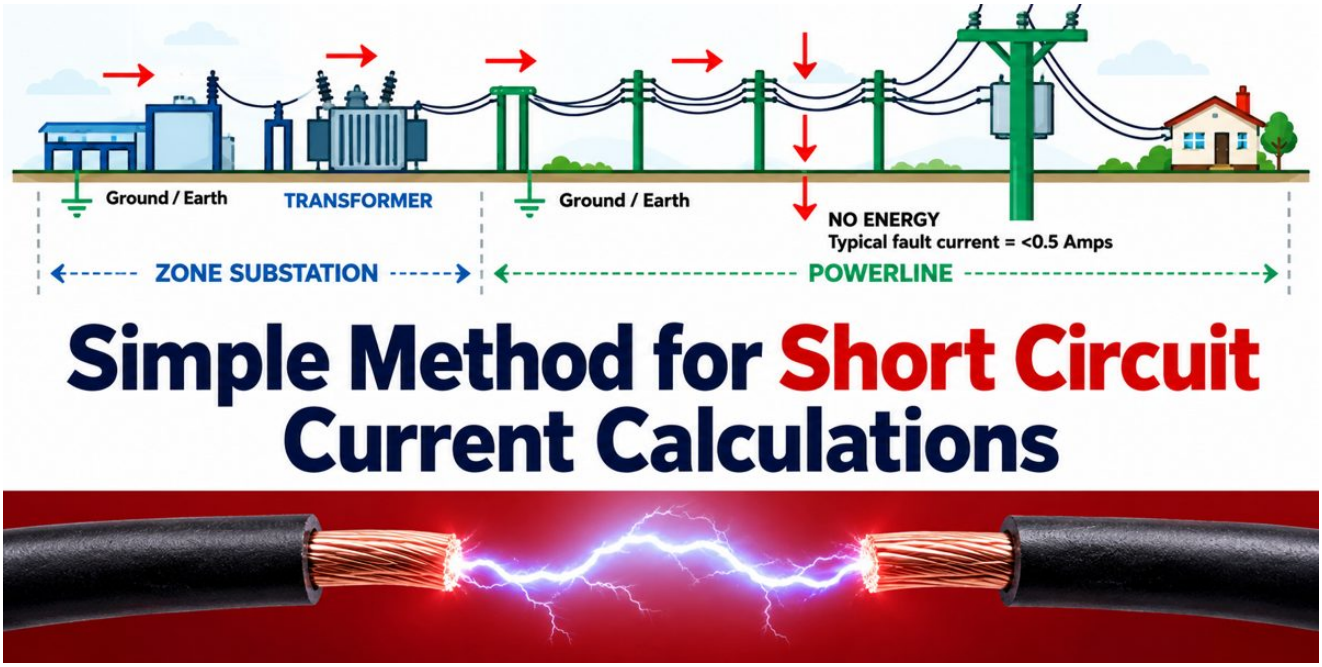





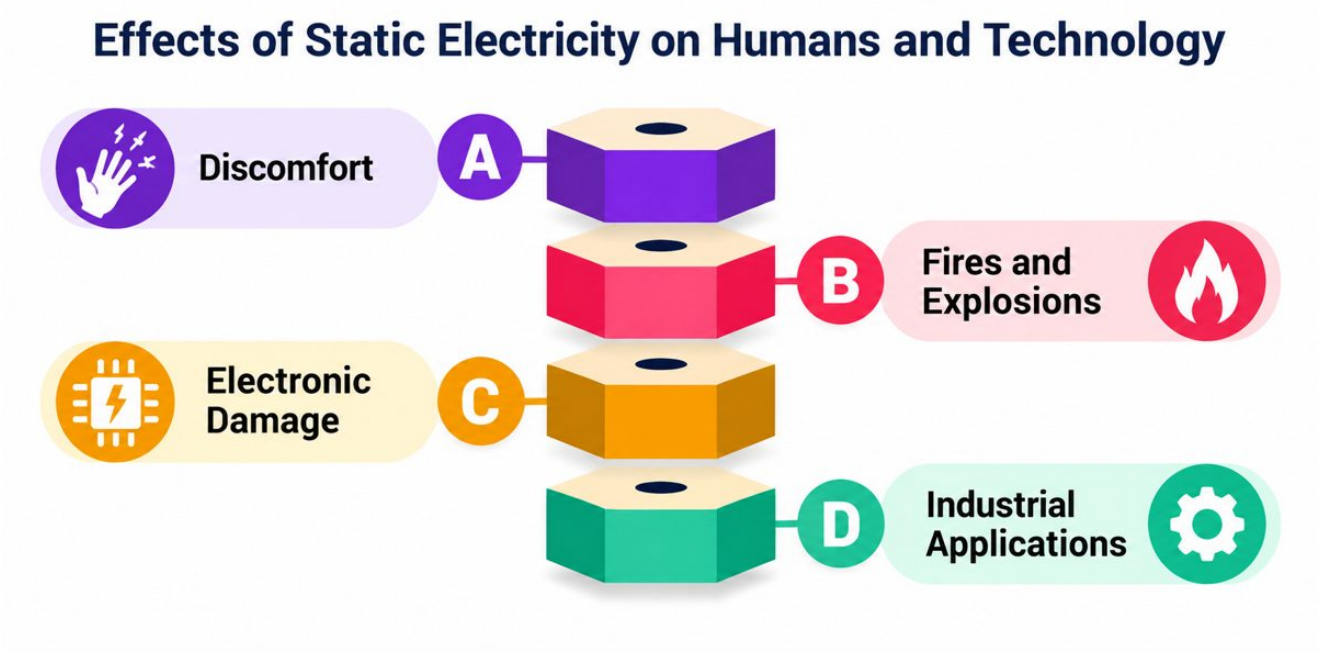

- Fire & Gas Detection Mapping Study
- Design Adequacy of Fire Protection System
- Business Process Re-Engineering
- Fire Load Calculations
- Fire Risk Assessment / Fire Safety Audit

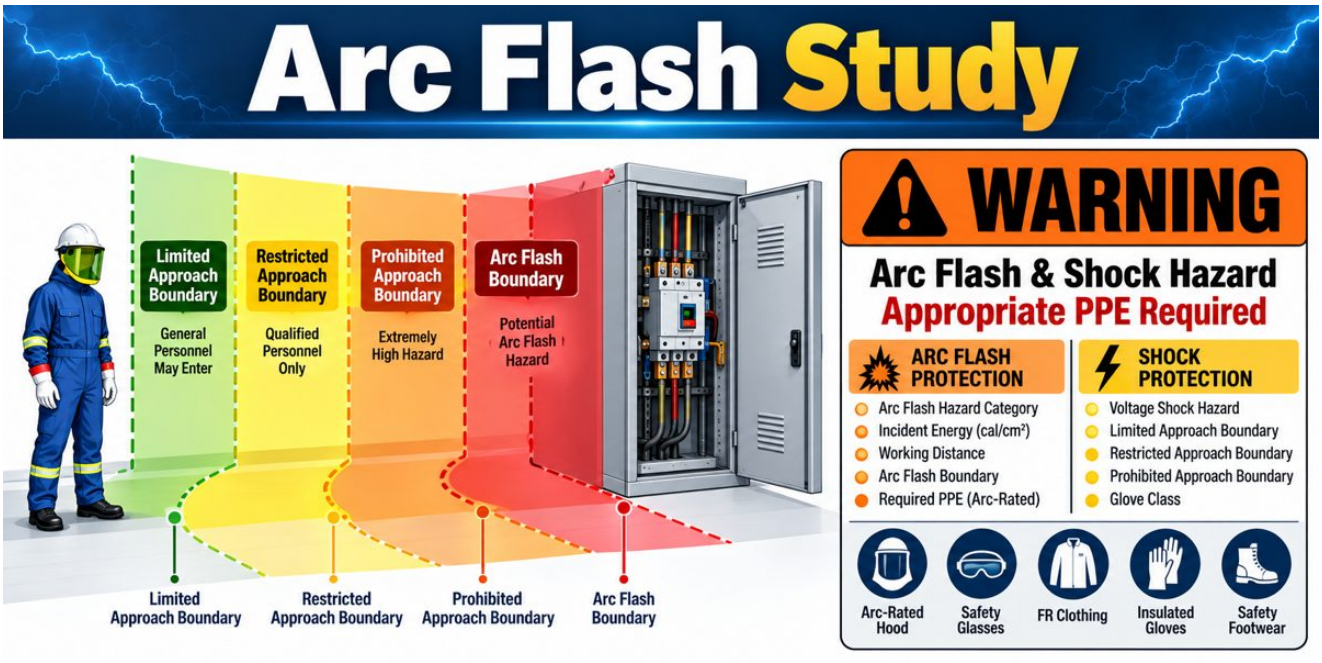
# Electrical Safety



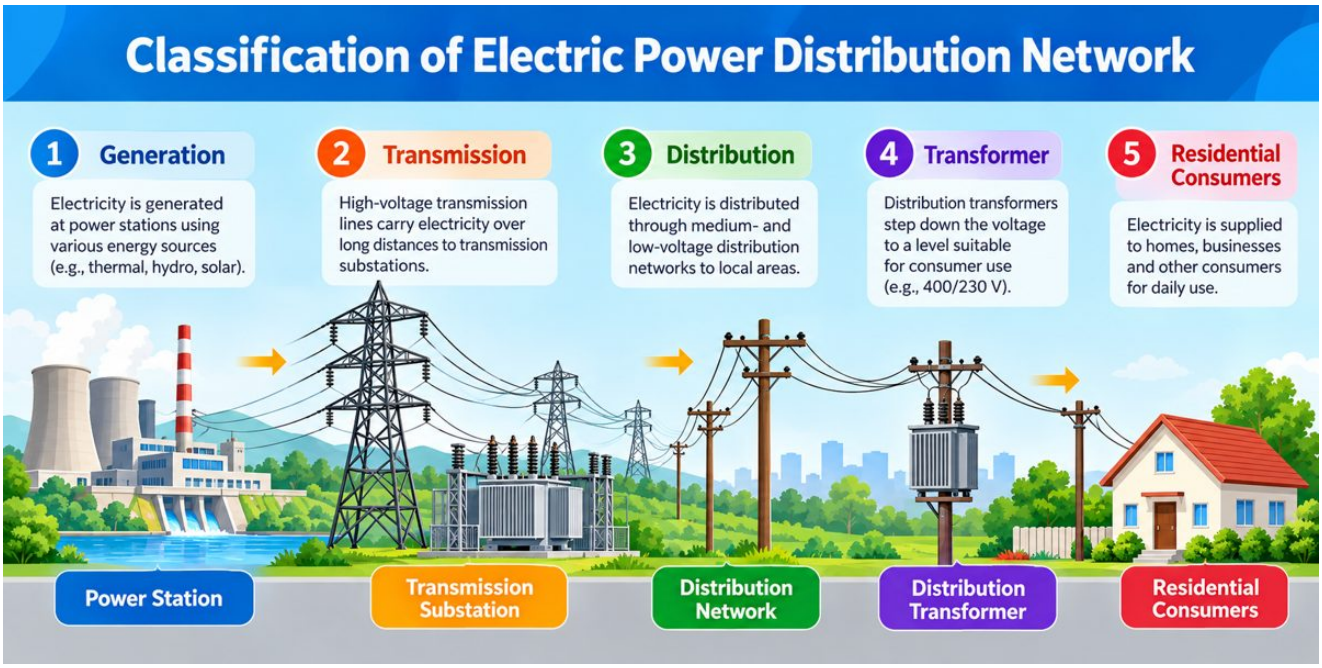

Ground / Earth
TRANSFORMER
Ground / Earth
NO ENERGY
Typical fault current = <0.5 Amps
ZONE SUBSTATION
POWERLINE
Simple Method for Short Circuit Current Calculations

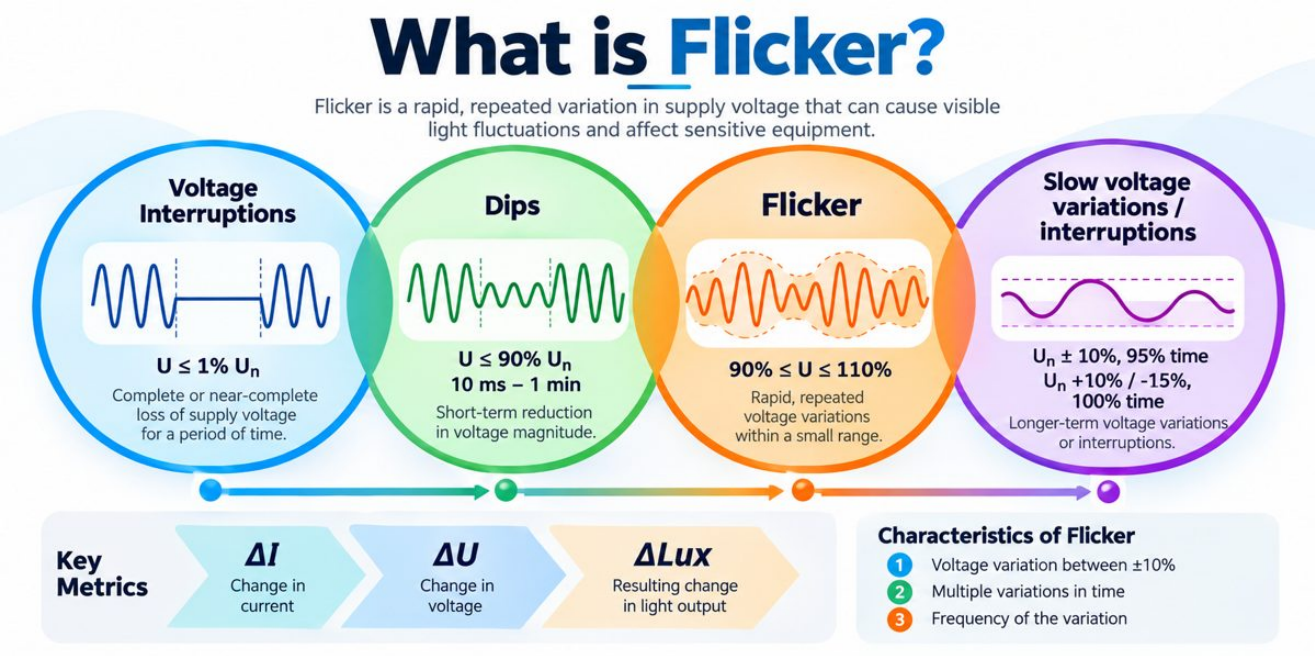
Thermography Testing is
Essential for
Electrical Maintenance


Effects of Static Electricity on Humans and Technology
Discomfort
A
B
Fires and Explosions
Electronic Damage
C
D
Industrial Applications


Arc Flash Study
Limited Approach Boundary
General Personnel May Enter
Restricted Approach Boundary
Qualified Personnel Only
Prohibited Approach Boundary
Extremely High Hazard
Arc Flash Boundary
Potential Arc Flash Hazard
Limited Approach Boundary
Restricted Approach Boundary
Prohibited Approach Boundary
Arc Flash Boundary
WARNING
Arc Flash & Shock Hazard
Appropriate PPE Required
ARC FLASH PROTECTION
Arc Flash Hazard Category
Incident Energy (cal/cm²)
Working Distance
Arc Flash Boundary
Required PPE (Arc-Rated)
SHOCK PROTECTION
Voltage Shock Hazard
Limited Approach Boundary
Restricted Approach Boundary
Prohibited Approach Boundary
Glove Class
Arc-Rated Hood
Safety Glasses
FR Clothing
Insulated Gloves
Safety Footwear

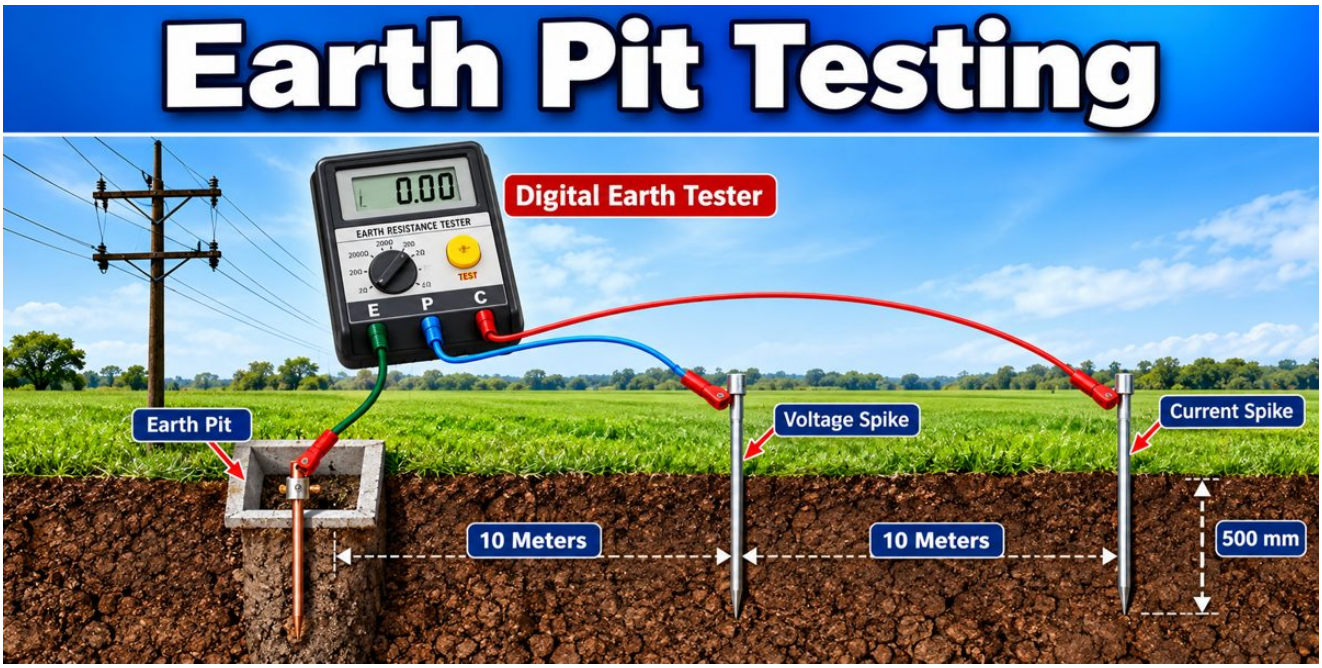
Electrical
HAZOP

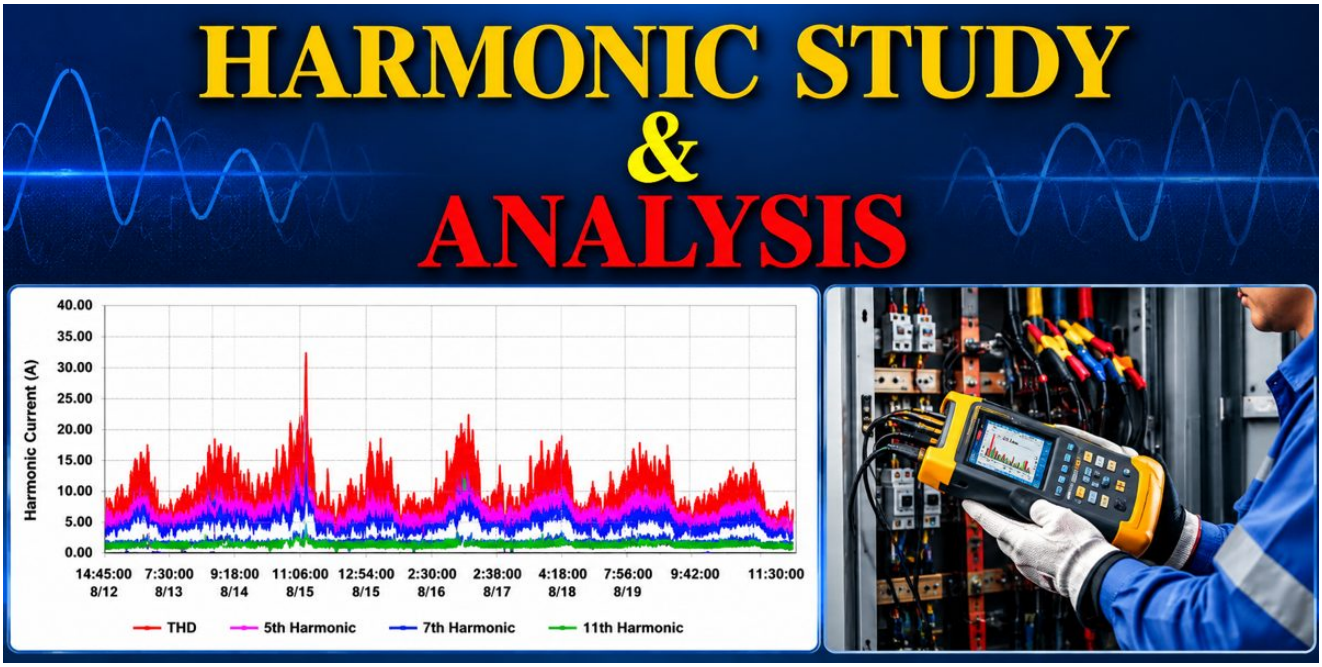

Classification of Electric Power Distribution Network
1 Generation
Electricity is generated at power stations using various energy sources (e.g., thermal, hydro, solar).
2 Transmission
High-voltage transmission lines carry electricity over long distances to transmission substations.
3 Distribution
Electricity is distributed through medium- and low-voltage distribution networks to local areas.
4 Transformer
Distribution transformers step down the voltage to a level suitable for consumer use (e.g., 400/230 V).
5 Residential Consumers
Electricity is supplied to homes, businesses and other consumers for daily use.
Power Station
Transmission Substation
Distribution Network
Distribution Transformer
Residential Consumers


What is Flicker?
Flicker is a rapid, repeated variation in supply voltage that can cause visible light fluctuations and affect sensitive equipment.
Voltage Interruptions
U ≤ 1% Un
Complete or near-complete loss of supply voltage for a period of time.
Dips
U ≤ 90% Un
10 ms – 1 min
Short-term reduction in voltage magnitude.
Flicker
90% ≤ U ≤ 110%
Rapid, repeated voltage variations within a small range.
Slow voltage variations / interruptions
Un ± 10%, 95% time
Un +10% / -15%, 100% time
Longer-term voltage variations or interruptions.
Key Metrics
ΔI
Change in current
ΔU
Change in voltage
ΔLux
Resulting change in light output
Characteristics of Flicker
1 Voltage variation between ±10%
2 Multiple variations in time
3 Frequency of the variation

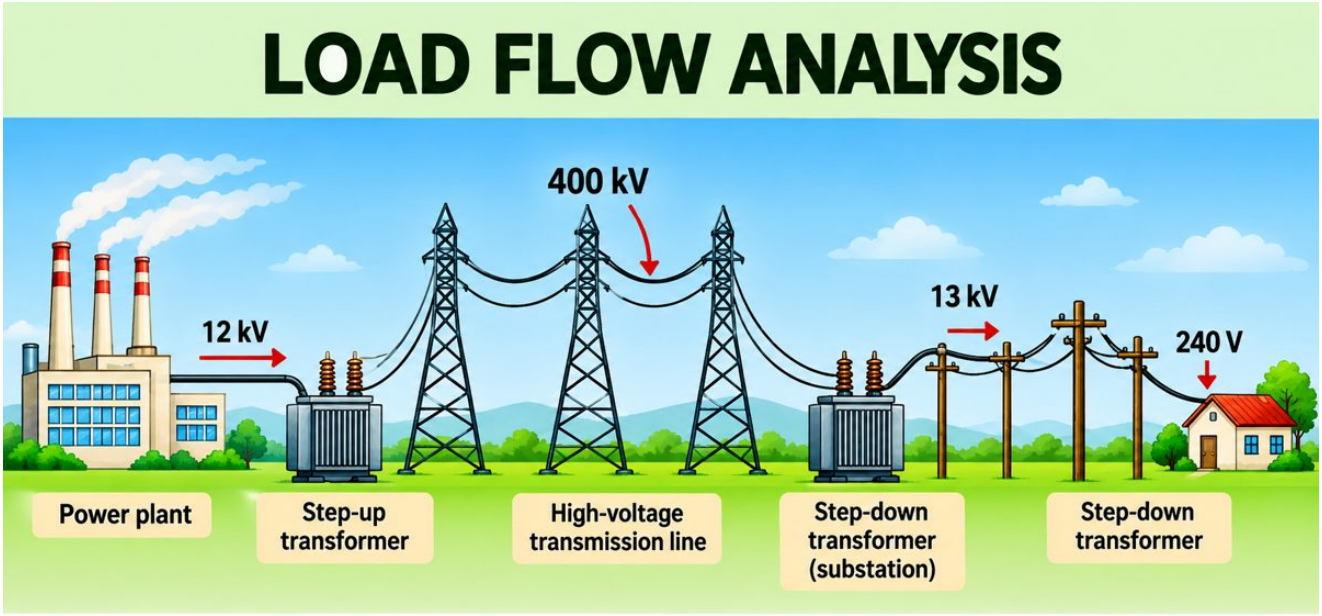
Earthing Audit
Ensure Electrical Safety, Compliance and Reliable Operation
Safety Assurance
Testing & Verification
Compliance & Reporting
AUDIT REPORT
0.85Ω

Lightning
Protection
Risk Assessment
Calculator


Earth Pit Testing
0.00
EARTH RESISTANCE TESTER
TEST
E
P
C
Digital Earth Tester
Earth Pit
Voltage Spike
Current Spike
10 Meters
10 Meters
500 mm


HARMONIC STUDY
&
ANALYSIS
Harmonic Current (A)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
14:45:00 8/12
7:30:00 8/13
9:18:00 8/14
11:06:00 8/15
12:54:00 8/15
2:30:00 8/16
2:38:00 8/17
4:18:00 8/18
7:56:00 8/19
9:42:00
11:30:00
THD
5th Harmonic
7th Harmonic
11th Harmonic

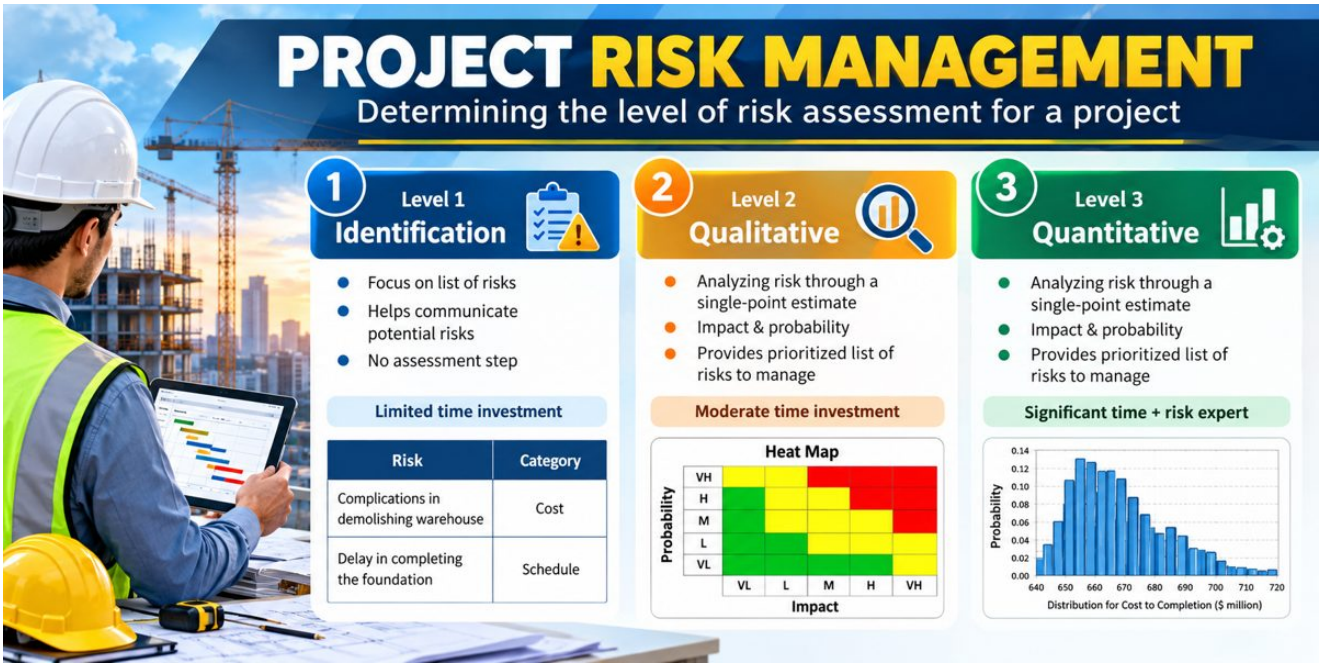
Power Audit




- Arc Flash Study
- Lightning Risk Assessment and Design of Lightning Protection System
- Hazardous Area Classification (HAC) – ATEX Study
- Thermography
- Electrical Safety Audit
- E HAZOP
- Inspection of Flameproof Electrical Equipment's
- Static Electricity Study
- Energy Conservation Audit
- Electrical Thermography
- Mechanical Thermography
- Building Thermography
- Thermovision scanning in Cold Storage, Pharmaceutics
- Medical Thermography
- Thermovision Scanning in Transmission lines
- Thermovision Scanning in Cement Boilers, refinery
- Thermography in Paper, Pulp, Printing, Packing
- Thermography in Hotel, food, beverage, Polymer, fiber, Glass, Milk dairy, Textile
- Power Quality services and Harmonic study
- Power Quality Analysis Audit Services
- Harmonic study
- Energy Audit
- Power Audit
- Power Factor Audit
- Transients Audit

- Load Flow Analysis
- Flicker Study
- UPS &Generator Study
- Earthing Audit and Insulation Resistance Measurement

## Civil Safety


PROJECT RISK MANAGEMENT
Determining the level of risk assessment for a project
1
Level 1
Identification
Focus on list of risks
Helps communicate potential risks
No assessment step
Limited time investment
Risk
Category
Complications in demolishing warehouse
Cost
Delay in completing the foundation
Schedule
2
Level 2
Qualitative
Analyzing risk through a single-point estimate
Impact & probability
Provides prioritized list of risks to manage
Moderate time investment
Heat Map
Probability
VH
H
M
L
VL
VL
L
M
H
VH
Impact
3
Level 3
Quantitative
Analyzing risk through a single-point estimate
Impact & probability
Provides prioritized list of risks to manage
Significant time + risk expert
Probability
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
640
650
660
670
680
690
700
710
720
Distribution for Cost to Completion ($ million)

Non-Destructive
Testing

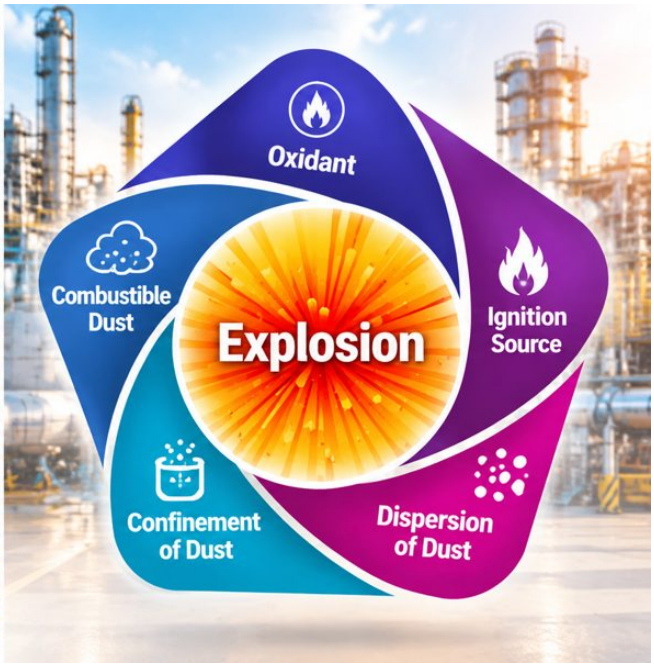
- Building Structural Stability Study
- Building Risk Assessment – using Non-Destructive Testing
- PHSER Study
- Project Risk Assessment
- Construction Site Safety Audit

## Chemical Safety

Main Elements for Good
Chemical Risk Management
01
Training and awareness on chemical risk
02
Definition of responsibilities
03
Availability of material and technical resources
04
Safe handling of chemicals
05
Drawing up documents relating to chemical risks
06
Adapted and appropriate storage conditions

CHEMICAL SAFETY
5.2
1.1
1
4
2
1.6
1
CHEMICAL SAFETY

Chemical Storage
Safety measures
In Industry
Safety in Warehouse
Safe practices for storing hazardous substances
Dos and Don'ts of handling & storing of chemicals


Oxidant
Combustible Dust
Explosion
Ignition Source
Confinement of Dust
Dispersion of Dust

HAZARD AND OPERABILITY STUDY
HAZOP
Purpose of HAZOP
HAZOP
01
To identify credible causes, consequences, and safeguards before INCIDENTS occur.
02
To define recommendations to minimize the HAZARD by eliminating or controlling the cause or providing "lines of defense."
03
Provide compatible information for subsequent Process Safety efforts (i.e., LOPA scenarios).
04
Comply with regulatory Process Safety requirements.

HAZOP
Study Process
01
Build a HAZOP team
02
Identify processes, P&ID, and HAZOP nodes
03
Define the parameters, determine deviations, and select guide words
04
Identify controls and establish safety monitoring
05
Communicate HAZOP results and improve processes

Independent Layers Of Protection
Initiating event
Cause of incident
Safety provision 1
Safety provision 2
Incident

Minimum
Ignition
Energy
(MIE)

Minimum
Ignition
Temperature
(MIT Layer)

Pre-Startup Safety Review (PSSR)
Common Mistakes
Missing safety checks
Improper approvals
Can your share more?
PSSR Mistakes
Skipping the PSSR
Incomplete teams
Rushing the process

Quantitative
Risk Assessment
(QRA)

| Safety Integrity Level | Risk Reduction Factor | Probability of Failure on Demand |
|---|---|---|
| SIL 4 | 100,000 to 10,000 | $10^{-5}$ to $10^{-4}$ |
| SIL 3 | 10,000 to 1,000 | $10^{-4}$ to $10^{-3}$ |
| SIL 2 | 1,000 to 100 | $10^{-3}$ to $10^{-2}$ |
| SIL 1 | 100 to 10 | $10^{-2}$ to $10^{-1}$ |

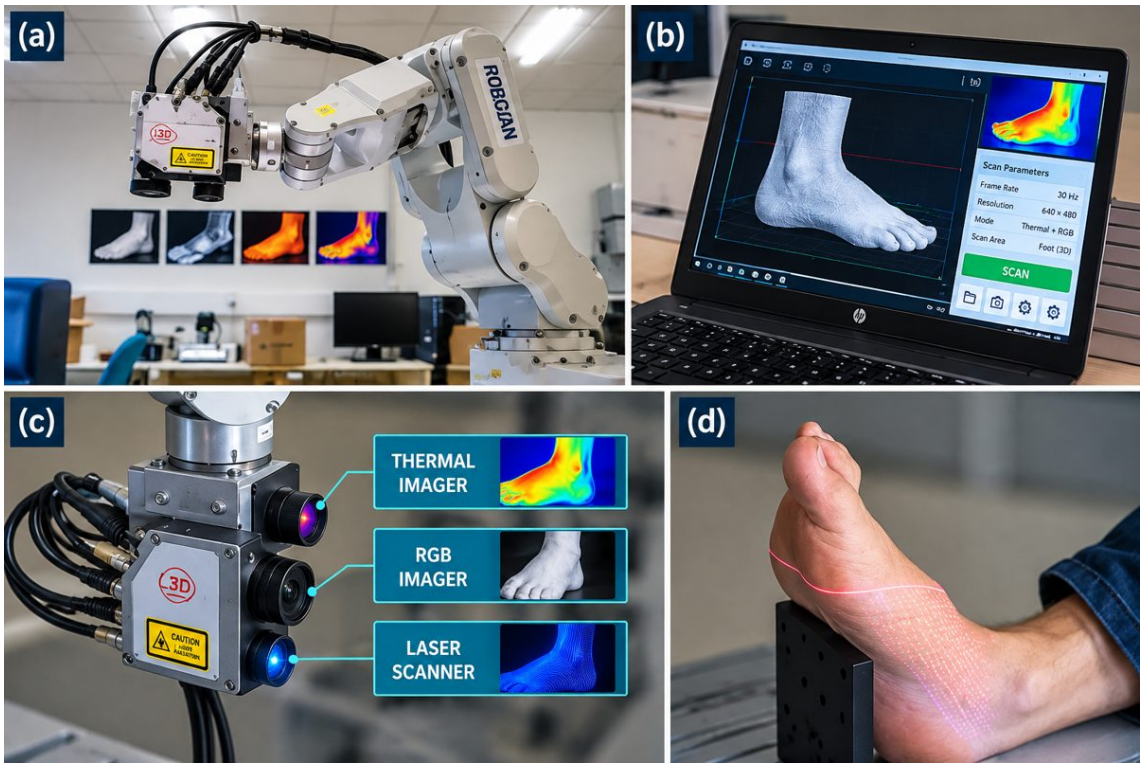
| Frequency | | | | | |
|---|---|---|---|---|---|
| 5 | SIL 3 | SIL 4 | X | X | X |
| 4 | SIL 2 | SIL 3 | SIL 4 | X | X |
| 3 | SIL 1 | SIL 2 | SIL 3 | SIL 4 | X |
| 2 | - | SIL 1 | SIL 2 | SIL 3 | SIL 4 |
| 1 | - | - | SIL 1 | SIL 2 | SIL 3 |
| | 1 | 2 | 3 | 4 | 5 |
| | Severity of Consequence | | | | |

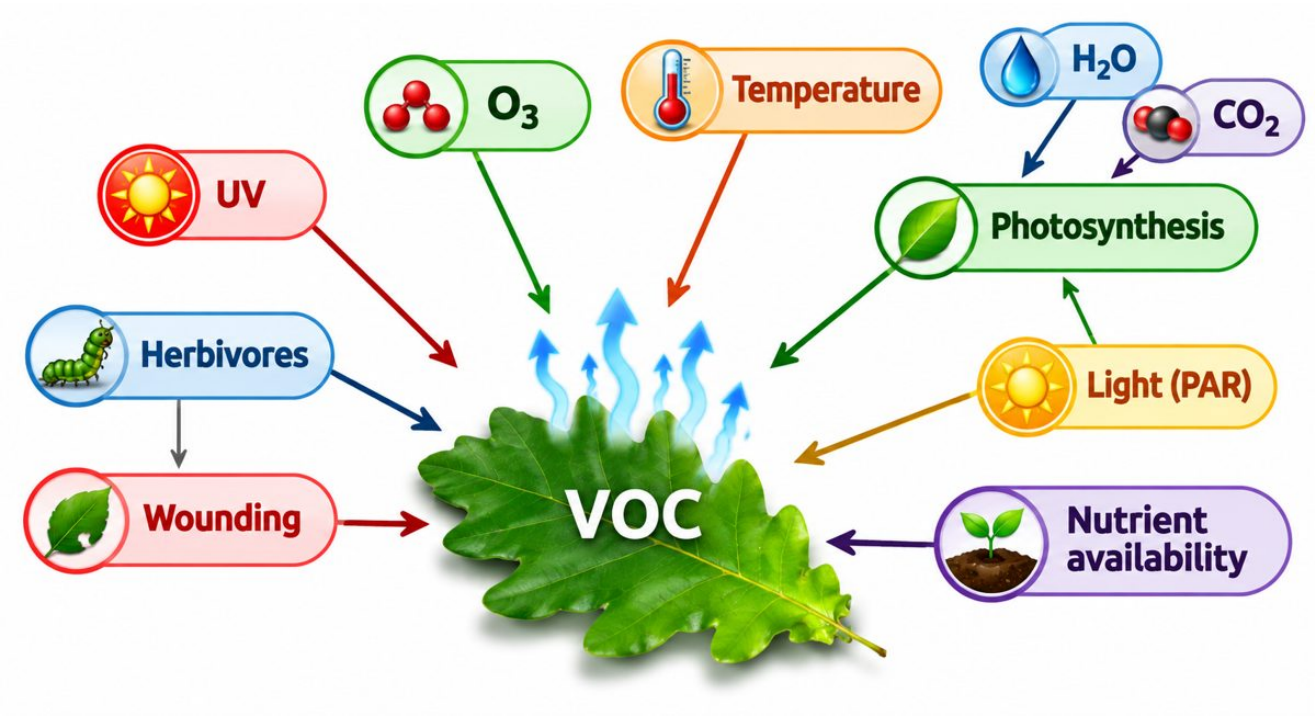
- Chemical Compatibility Study
- Respiratory Fit Testing
- Personal Exposure Study / Workplace Monitoring Study / VOC Study / Chemical Exposure Monitoring Study (IDLH, STEL, TLV)
- Dust Explosion Study
- Dispersion Modeling (Flare, SRV, Dump tanks, Scrubbing Vent Hazards)
- Minimum Ignition Energy Study
- Minimum Ignition Temperature Study
- Bulk Chemical Storage Risk Assessment

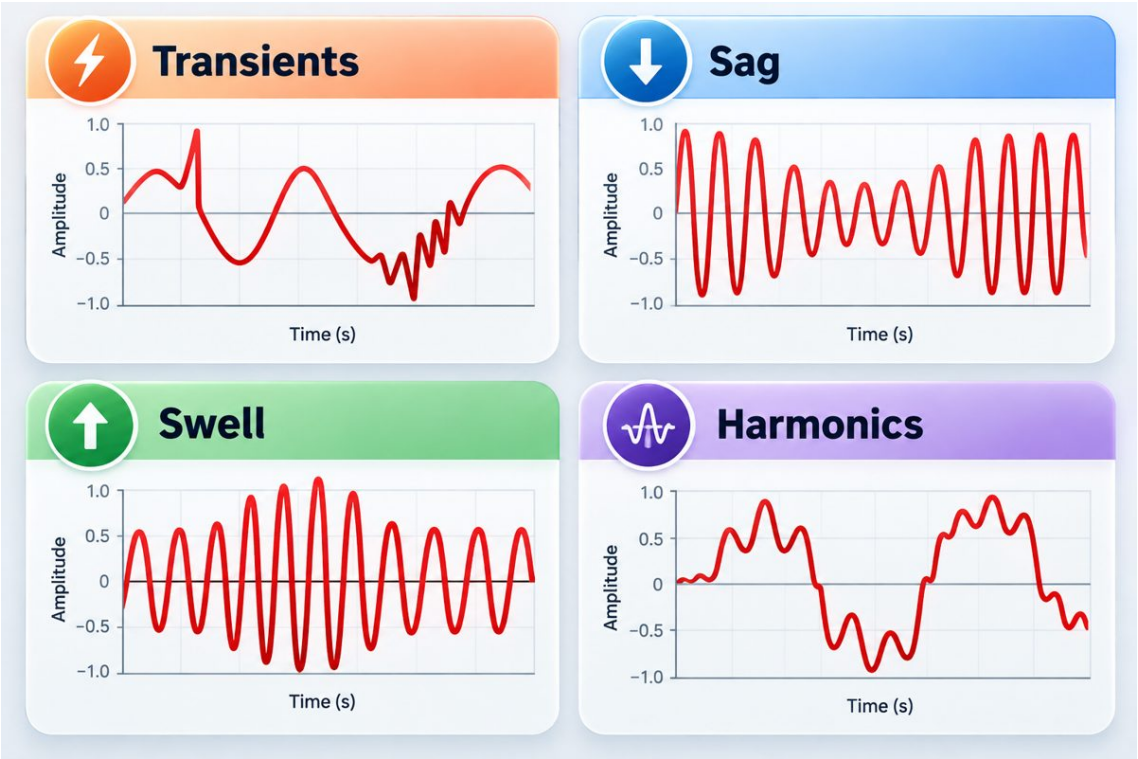
# Process Safety

- PSM Gap Analysis
- Process Safety Management (PSM) Implementation
- Quantitative Risk Assessment (QRA)
- Safety Integrity Level (SIL) Study / LOPA / Functional Safety
- Hazard Identification and Risk Assessment (HIRA) / HARA / HAZID Study
- Hazard & Operability Study (HAZOP)
- Pre-Startup Review
- Business Process Reengineering
- Business Continuity Plan
- Process Hazard Analysis (PHA Study)
- Job Safety Analysis

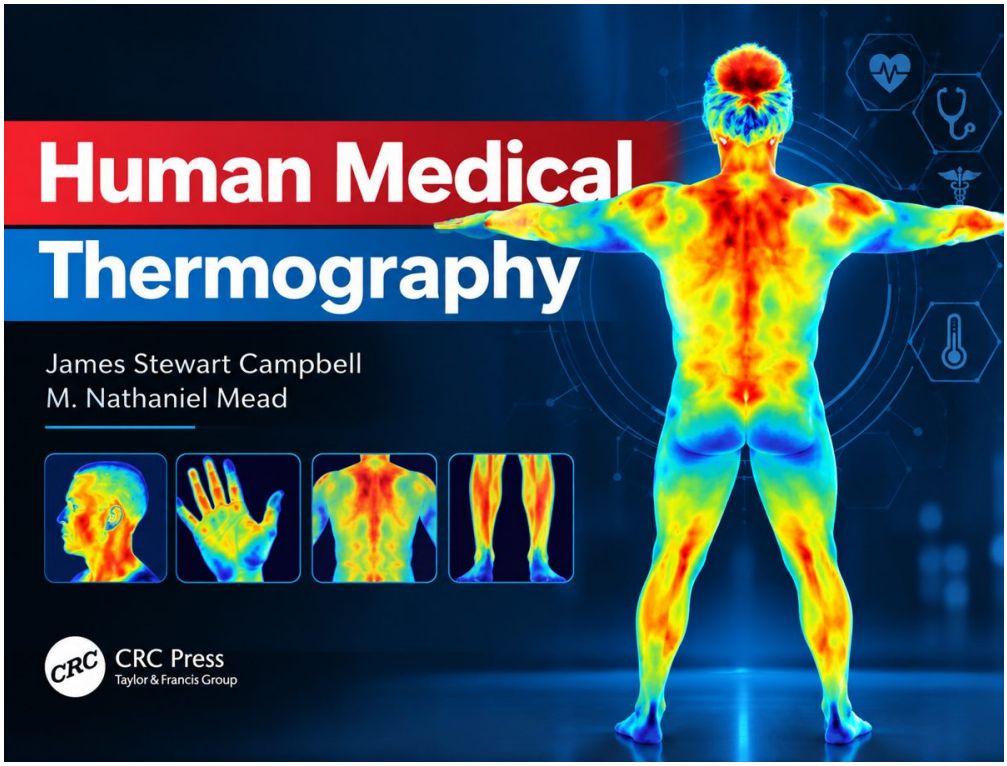
## Others


(a)
ROBCAN
(b)
Scan Parameters
Frame Rate 30 Hz
Resolution 640 × 480
Mode Thermal + RGB
Scan Area Foot (3D)
SCAN
(c)
THERMAL IMAGER
RGB IMAGER
LASER SCANNER
(d)


$O_3$
Temperature
$H_2O$
$CO_2$
UV
Photosynthesis
Herbivores
Light (PAR)
Wounding
VOC
Nutrient availability


Transients
Sag
Swell
Harmonics
Amplitude
Time (s)
1.0
0.5
0
−0.5
−1.0

76.0
2.6


Human Medical
Thermography
James Stewart Campbell
M. Nathaniel Mead
CRC Press
Taylor & Francis Group

I
Project Conceptual Design
II
FEED (Front End / Basic Engineering Design)
III
Detailed Engineering Design
IV
Construction
V
Pre-Commissioning / Commissioning
VI
Post-Commissioning
VII
Abandonment

DON'T WAIT FOR FAILURE!
THE ULTIMATE GUIDE TO
MECHANICAL THERMAL INSPECTION
120.0°C
20.0°C
F1
F2
Detect Overheating
Prevent Equipment Failure
Ensure Operational Safety

HAZID:
HAZID means
(Hazard Identification)
It's a general risk analysis tool for early identification of hazards or threats, where the purpose is to identify possible unwanted incidents within a discipline, operation or area.
HAZID

- Human Factor Engineering and Ergonomic Studies
- Statutory Safety Audit/Comprehensive Safety Audit
- Preparation or Vetting of On-Site Emergency Plan
- Preparation or Vetting of Off-Site Emergency Plan
- Pre-Occupancy Audit
- Behavior Based Safety / Safety Culture Survey
- Industrial Hygiene Monitoring Study
- Security Vulnerability Assessment (Security Audit)
- Machinery Risk Assessment
- Logistics Risk Assessment (inside or outside the plant truck movement)
- COPE and Probable Maximum Loss Study (PML) Study
- Inspection behalf of insurance & Brokerage firms (for underwriting or value addition or safety improvement) Training

## FAQ

**Q. What kinds of safety studies does MLC offer?**

Studies across fire, electrical, civil, chemical and process safety, plus emergency planning, behaviour-based safety and security assessments.

**Q. Which process safety studies are included?**

PSM gap analysis and implementation, QRA, SIL/LOPA, HIRA/HAZID, HAZOP, pre-startup reviews, process hazard analysis and job safety analysis.

**Q. What electrical safety studies are available?**

Arc flash studies, lightning risk assessment, hazardous area classification, electrical safety audits, thermography, power quality and harmonic studies, and earthing audits.

**Q. Can MLC prepare emergency plans?**

Yes. MLC prepares or vets on-site and off-site emergency plans.

**Q. Does MLC work with insurers?**

Yes. MLC carries out inspections on behalf of insurance and brokerage firms, including probable maximum loss (PML) studies.

## Useful details to share when you enquire

- Facility and process overview
- Study objective and areas of concern
- Available drawings, assessments and incident records

**TALK TO MLC**

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