

BOILER

IN-SERVICE INSPECTION OF BOILERS AND PRESSURE VESSELS: NBIC PART 2, OSHA 1994 & PRCF REGULATIONS 2024 (10 CEP)



SEPTEMBER

14 & 15 SEPTEMBER 2026



Mile 9, Jalan Labuk Lama,
90000 Sandakan, Sabah



RM1,944 Inclusive 8% SST
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EVENING TEA BREAK



SPEAKER:

MOHAMAD HISWANDY BIN ISHAK



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your team's training needs.



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TWO-DAY PROFESSIONAL TRAINING PROGRAMME

Day 1 & Day 2 Course Agenda

In-Service Inspection of Boilers and
Pressure Vessels

NBIC Part 2

OSHA 1994

PRCF Regulations 2024

COURSE OVERVIEW AND TARGET AUDIENCE

Training Programme

In-Service Inspection of Boilers and Pressure Vessels

Duration: Two-Day Professional Training

A comprehensive two-day course structured into technical fundamentals and regulatory compliance.

DAY 1

Technical Focus

DAY 2

Malaysian Regulatory

Target Audience

- Authorized Inspectors and Competent Persons
- Plant Engineers and Maintenance Managers
- Safety Officers and Safety Health Officers (SHO)
- Process Engineers (Oil & Gas, Petrochemical, Utilities)
- Candidates for DOSH Competent Person licensing

Technical Standards Referenced

CORE INSPECTION CODES

NBIC NB-23 Part 2

API 510 (Pressure Vessels)

DAMAGE & FITNESS ANALYSIS

API 571 (Damage Mechanisms)

API 579-1 / ASME FFS-1

API RP 580 / 581 (RBI)

DESIGN & FABRICATION

ASME BPVC Section I (Power Boilers)

ASME BPVC Section IV (Heating Boilers)

ASME BPVC Section VIII Div 1

ASME BPVC Section V & IX

NDE CERTIFICATION

SNT-TC-1A

EN ISO 9712

DAY 1 LEARNING OUTCOMES

01

Framework & Classification

Describe the structure and scope of NBIC NB-23 Part 2 and identify/classify boilers, pressure vessels, and heat exchangers within the ASME code framework.

02

Damage & Inspection Protocols

Recognise 20+ damage mechanisms affecting in-service equipment and plan comprehensive external, internal, and on-stream inspections.

03

NDE & Safety Devices

Select appropriate NDE methods for specific damage mechanisms and evaluate pressure relief valve conditions to meet NBIC documentation standards.

04

Risk & Integrity Assessment

Apply Risk-Based Inspection (RBI) principles per API RP 580/581 and conduct Fitness-for-Service (FFS) screening assessments per API 579-1/ASME FFS-1.

MODULE 1: NBIC FUNDAMENTALS & EQUIPMENT OVERVIEW

NBIC CODE STRUCTURE

- > **Part 1:** Installation requirements
- > **Part 2:** In-service inspection procedures
- > **Part 3:** Repairs and alterations

EQUIPMENT CLASSIFICATION

- > **Boilers:** ASME Section I (Power) & IV (Heating)
- > **Vessels:** ASME VIII Div 1 (Unfired)
- > Special service: Lethal, Cryogenic, High-Pressure

REGULATORY FRAMEWORK

- > Jurisdictional requirements and legal mandates
- > Inspector qualifications and credentials
- > Role of the National Board (NBBI)

CERTIFICATIONS

- > **ASME Stamps:** U, S, H, PP, NB symbols
- > Manufacturer's Data Reports (MDR)
- > Nameplate data and traceability requirements

LEARNING OUTCOME

Identify and classify any pressure plant type and locate it within the NBIC/ASME code framework.

NBIC NB-23 | ASME
BPVC

MODULE 2: DAMAGE MECHANISMS



CORROSION & HYDROGEN

- General, Pitting, Crevice Corrosion
- Galvanic & Microbiological (MIC)
- Hydrogen-Induced Damage (HIC)
- Stress Oriented HIC (SOHIC)
- Sulfide Stress Cracking (SSC)
- High Temp Hydrogen Attack (HTHA)
- Nelson Curves Application



CRACKING & SURFACE

- Chloride & Caustic SCC
- Amine & Carbonate Cracking
- Corrosion Under Insulation (CUI)
- Erosion & Erosion-Corrosion
- Flow-Accelerated Corrosion (FAC)
- Boiler Waterside/Fireside Corrosion
- Weld Defects & Undercutting



MECHANICAL & MATERIAL

- Mechanical & Thermal Fatigue
- Vibration Induced Fatigue
- Creep & Omega Method Assessment
- Brittle Fracture & MDMT Limits
- Graphitization & Temper Embrittlement
- Sigma Phase Embrittlement
- Lamellar Tearing & Impact Testing

OUTCOME: Diagnose 20+ damage mechanisms from visual/NDE observations and specify appropriate remediation strategies following NBIC and API 571 standards.

MODULE 3: INSPECTION TYPES, PROCEDURES & INTERVALS

+ NBIC INSPECTION CATEGORIES

External: CUI assessment, nameplate, safety devices.

Internal: Detailed physical entry and examination.

On-stream: Non-intrusive monitoring during operation.

Initial / Special: Triggers by process upsets or near-misses.

Comprehensive: Full system integrity evaluation.

✓ 8-STEP INTERNAL PREPARATION

1. Isolation
2. Depressurization
3. Purge
4. Atmosphere Test
5. Cleaning
6. Ventilation
7. Lighting
8. Entry Permit

Sequence strictly regulated for personnel safety and data accuracy.

⚠️ CONFINED SPACE ENTRY (CSE)

REGULATORY COMPLIANCE: OSH 2010

Legal Req: OSH (Confined Space) Regulations 2010.

Permit System: Gas monitoring (O₂, LEL, H₂S, CO).

Atmosphere: Continuous monitoring and ventilation.

Safety: Standby person and rescue plan required.

📊 INTERVAL DETERMINATION

$$\text{Remaining Life} = (t_{\text{actual}} - t_{\text{min}}) / \text{Corrosion Rate}$$

API 510 Half-Life Rule Application

t_{min} Calculation: Design-based minimum thickness.

Corrosion Rate: Trending from thickness surveys.

Interval: Lesser of half-life or jurisdictional max.

MODULE 4: NDE METHODS AND TECHNIQUES

🕒 2 Hours | 25 Slides

CORE NDE METHODS

Visual Testing (VT)

Direct & remote methods; magnification and lighting standards.

Ultrasonic Testing (UT)

A/B/C-scan principles; wall thickness measurement.

Radiographic Testing (RT)

Conventional, Computed (CR), and Digital Radiography (DR).

Surface Methods (MT/PT)

Magnetic Particle (wet fluorescent) and Liquid Penetrant step-by-step.

ADVANCED & TUBING

Phased Array & TOFD

Sector/Linear scans; Time of Flight Diffraction for root cracking.

Eddy Current (ECT)

Heat exchanger bundles; Remote Field (RFEC) & IRIS techniques.

Automated UT

Corrosion mapping for large surface areas and weld profiles.

Guided Wave UT

Long-range pipe scanning for screening and monitoring.

EMERGING & PERSONNEL

Specialized Monitoring

Acoustic Emission (AE) and Pulsed Eddy Current (PEC) for CUI.

Robotics & Drones

UAV applications for hazardous access and confined space inspection.

Personnel Certification

- SNT-TC-1A (ASNT)
- EN ISO 9712 (International)

Selection Matrix

Matching damage mechanisms to optimal NDE methods.



LEARNING OUTCOME

Select, apply, and interpret the correct NDE method for any damage type and equipment configuration.

MODULE 5: RBI, FFS, SAFETY DEVICES AND CASE STUDIES

Application of Risk-Based Inspection and Fitness-for-Service principles, evaluation of pressure relief devices, and analysis of real-world failure case studies.

ADVANCED ASSESSMENT TOOLS

Risk-Based Inspection (RBI)

- Core Concept: Probability of Failure (PoF) vs. Consequence (CoF)
- Standards: API RP 580 (Principles) & API RP 581 (Methodology)
- Risk Matrix utilization for inspection interval optimization

Fitness-for-Service (FFS)

- Structure per API 579-1 / ASME FFS-1 standard
- Assessments: Metal loss (Part 4) & Crack-like flaws (Part 9)
- Three Assessment Levels: Screening (1) to Advanced (3)

SAFETY & OPERATIONAL CONTROLS

Pressure Relief Devices

- PRV Types: Conventional, Balanced Bellows, Pilot-Operated
- Testing: Bench testing and API 527 seat tightness criteria
- Auxiliaries: Rupture discs and boiler fusible plugs

NBIC Documentation

- Mandatory Records: R-Forms, NB-1, and Data Reports
- Corrosion rate calculation and trending analysis
- Asset Integrity Management (AIM) best practices

CASE STUDY ANALYSIS: REAL-WORLD FAILURES & LESSONS

CASE 1

CUI failure on insulated air receiver – missed internal inspection

CASE 2

Boiler explosion – expired certification & bypassed LWLCO safety

CASE 3

SCC in stainless steel vessel operating in amine service

CASE 4

Unauthorized weld repair – regulatory action & consequences

DAY 1 TRAINING SCHEDULE — TECHNICAL MODULES

TIME WINDOW	ACTIVITY & TRAINING MODULES
08:00 – 08:15	 Welcome, housekeeping, and Day 1 learning outcomes
08:15 – 09:30	 Module 1: NBIC Part 2 Fundamentals and Equipment Overview
09:30 – 09:45	 Morning Networking Break
09:45 – 11:45	 Module 2: Damage Mechanisms affecting boilers and pressure vessels
11:45 – 12:45	 Lunch Break
12:45 – 14:00	 Module 3: Inspection Types, Procedures, and Intervals
14:00 – 15:30	 Module 4: NDE Methods and Advanced Techniques
15:30 – 15:45	 Afternoon Networking Break
15:45 – 16:45	 Module 5: RBI, FFS, Safety Devices, Documentation, and Case Studies
16:45 – 17:00	 Day 1 Review, Q&A, and wrap-up



DAY 2 — MALAYSIAN REGULATORY FRAMEWORK

OSHA 1994, PRCF Regulations 2024 & DOSH Compliance

Regulatory duties, Certificate of Fitness process, Competent Person requirements, enforcement, PSTT and best-practice compliance management.

Director General of DOSH

Design Verification

PSTT

MyKKP

DAY 2 MODULE OVERVIEW

Malaysian regulatory requirements and practical compliance workflow for boilers and pressure vessels

01

OSHA 1994

- Employer and employee duties
- Inspector powers and notices
- 2022 amendment coverage and penalties

02

PRCF 2024

- CF process and MyKKP
- Design Verification
- PSTT-only extended intervals

03

COMPETENT PERSON

- Licensing and CPD
- DOSH inspection procedure
- Report submission to Director General

04

ENFORCEMENT

- Improvement and Prohibition Notices
- Section 52 personal liability
- Compliance case studies

05

BEST PRACTICES

- CF registry and audit readiness
- Inspection documentation
- Assessment and reference tables

DAY 2 TRAINING SCHEDULE — REGULATORY MODULES

TIME WINDOW	ACTIVITY & TRAINING MODULES
08:00 – 08:15	 Welcome, Day 1 recap, and Day 2 regulatory learning outcomes
08:15 – 09:45	 Module 1: OSHA 1994 — duties, coverage, inspector powers, notices and penalties
09:45 – 10:00	 Morning Networking Break
10:00 – 11:30	 Module 2: PRCF Regulations 2024 — CF, Design Verification, MyKKP and PSTT pathway
11:30 – 12:30	 Lunch Break
12:30 – 14:00	 Module 3: Competent Person qualifications and DOSH inspection procedure
14:00 – 15:15	 Module 4: Enforcement, penalties, compliance failures and PSTT case studies
15:15 – 15:30	 Afternoon Networking Break
15:30 – 16:45	 Module 5: Best practices, assessment, glossary and reference tables
16:45 – 17:00	 Final Review, Q&A and Course Closing



Training Time: 0800-1700



Correct terminology: Director General of DOSH, Design Verification, PSTT