

In this ISSUE

Topic of the Quarter

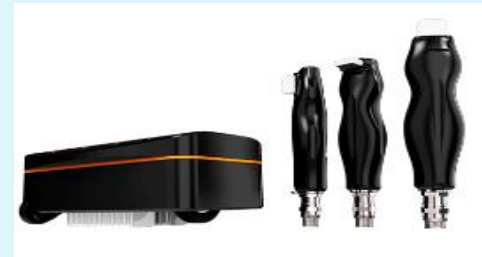
Certifications

Services Portfolio

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Trainings

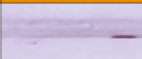
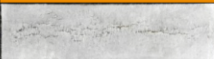

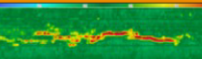
Eddy Current Array (ECA) Surface Inspection



Introduction

- An Eddy current array, in its simplest form, is a series of single elements arranged in a row, allowing users to cover a larger area in a single pass than conventional, single-coil probes (i.e., pencil probes using ECT). However, this could lead to suboptimal results. That's why ECA probes use multiplexing for smaller defect identification.

Comparative Analysis

	Liquid penetrant (PT)	Magnetic particles (MT)	ECT	ECA
Typical results				
Effective on coatings / paint	No	Yes	Yes	Yes
Computerized record keeping	No	No	Partial	Yes
3D / Advanced imaging	No	No	No	Yes
User dependence	High	High	High	Low
Speed	Very low	Very low	Low	Very high
Cleaning	Yes	Yes	Application-specific	Application-specific
Post-inspection analysis	No	No	No	Yes
Chemicals / consumables	Yes	Yes	No	No

Eddy current Array (ECA) Parent metal Inspection for Ferromagnetic and Non-Ferromagnetic material

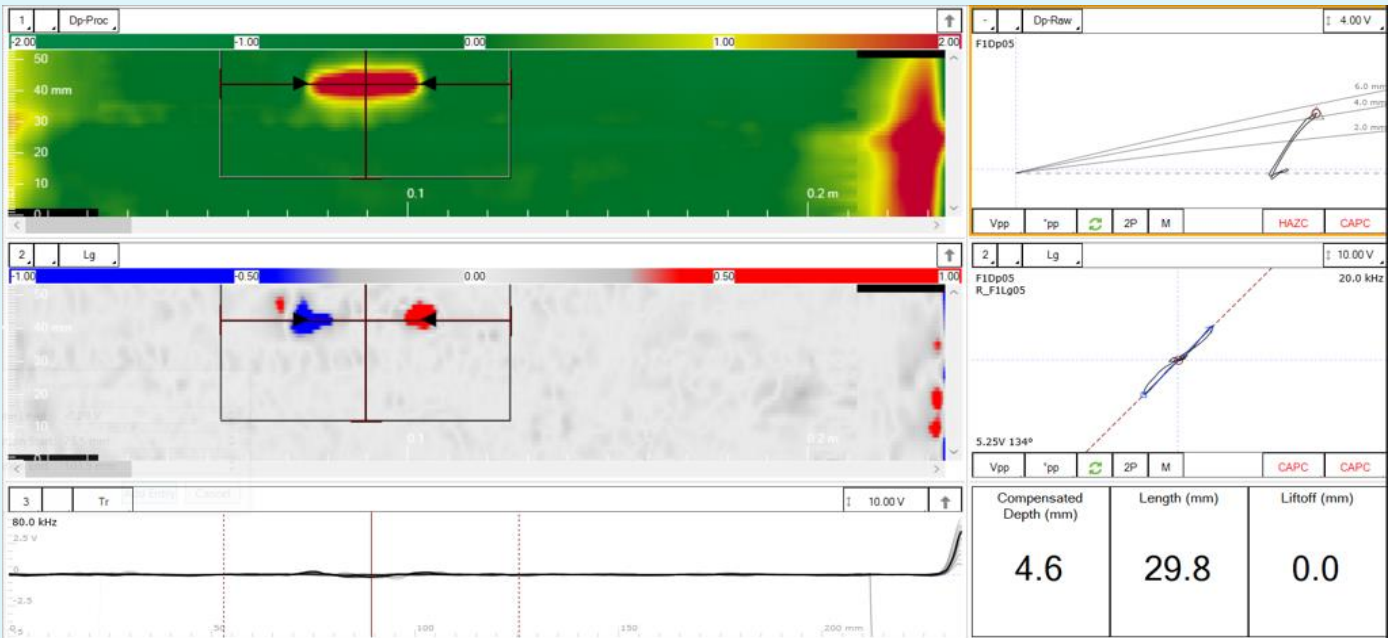


Benefits

ECA is a major improvement over single-element (ECT) because:

- Faster inspections
- Wider coverage
- Less operator dependent — eddy current array probes yield more consistent results compared to manual raster scans
- Better detection capabilities
- Easier analysis because of simpler scan patterns
- Improved positioning and sizing because of encoded data
- Eddy current array probes can easily be designed to be flexible or shaped to specifications, making hard-to-reach areas easier to inspect

Eddy current Array (ECA) Weld Inspection for Ferromagnetic and Non-Ferromagnetic material



Applications

ECA is a major improvement over single-element (ECT) because:

- Stress Corrosion Cracking Direct Assessment on Pipelines
- Cracks on High-Temperature Emulsion Pipelines
- Early-Stage Detection of Chloride Stress Corrosion Cracking (CSCC) in Stainless Steel Assets
- Storage tanks parent metal, Butt welds and fillet welds.
- LNG tank floors
- Pressure vessels
- Stainless steel tanks: food and beverage industry
- Yellow Jacket™ piping
- Corrosion underneath coatings
- Railway wheels and shafts
- Non-Ferromagnetic Cladding and welds

Approvals:

Aramco Approves TCR for Pipeline ECA

Engineering Critical Analysis (ECA) is a sophisticated approach employed to determine alternative acceptance criteria for weld defect lengths versus depths. As per the guidelines outlined in API 1104 – Option 2, ECA provides a framework to assess the structural integrity of pipeline girth welds by considering critical parameters such as fracture toughness, residual stresses, and combined axial stresses. This blog post delves into the detailed methodology for performing ECA in the context of Saudi Aramco's Jafurah Gas Compression Plants and PWIS (Package-1) project. TCR has undertaken this work as a vendor for MANARAH AL-JUBAIL CONT. CO. LTD., with Saudi Aramco being the end client.

Project Scope

The scope of this analysis includes:

Assessment of girth welds:

Full circumferential welding of the pipeline using the same Welding Procedure Specification (WPS) intended for actual fabrication.

Specimen preparation from specified positions of the pipe—12'o clock, 6'o clock, and either 3'o clock or 9'o clock positions.

Laboratory Testing:

Fracture Toughness Tests: Conduct six Crack Tip Opening Displacement (CTOD) tests—3 from weld metal and 3 from Heat Affected Zone (HAZ).

Impact Tests: Perform six tests—3 each from the weld and HAZ.

Tensile Tests: Conduct tests with the weld centered in the specimen (up to 3 samples).

Finite Element Analysis (FEA):

Utilize advanced FEA tools to model stress distribution and calculate the combined axial stresses (σ_a) and related factors.

ECA Report Submission:

Develop a comprehensive ECA report aligned with API 1104 – Annex A, Option 2.

Approvals: Aramco Approves TCR for Pipeline ECA

Detailed Methodology

A. Specimen Collection and Preparation

The customer is required to weld a full circumference of the pipe using the actual WPS for fabrication. From this, three cut pieces measuring 350mm x 350mm will be extracted from specific positions:

12'o clock: Top section.

6'o clock: Bottom section.

3'o clock or 9'o clock: Side sections.

These specimens will be sent to TCR's laboratory for further analysis without additional cutting to preserve their structural integrity.

B. Testing Procedures

1. Fracture Toughness Testing

Crack Tip Opening Displacement (CTOD) tests will be performed on:

3 samples from the weld metal.

3 samples from the HAZ.

This evaluates the material's toughness and its ability to withstand crack propagation at the Minimum Design Metal Temperature (MDMT).

2. Impact Testing

Impact energy absorption will be assessed on:

3 samples from the weld metal.

3 samples from the HAZ.

3. Tensile Testing

Tensile tests will be conducted to evaluate the weld joint's overall strength under uniaxial loading.

C. Finite Element Analysis (FEA)

Using advanced software, TCR experts will perform FEA to:

Model stress distributions across the girth weld joint.

Calculate combined axial stresses (σ_a).

Simulate real-world loading conditions.

D. ECA Report Compilation

A detailed report will be prepared based on the following:

Results from CTOD, impact, and tensile tests.

Stress analysis findings from FEA.

Tabulated tolerable defect sizes based on percentage of wall thickness (e.g., 10%, 20%, 30%, etc.) and circumferential length.

Approvals: Aramco Approves TCR for Pipeline ECA

API 1104 Compliance: Option 1 vs Option 2

Option 2: Comprehensive Analysis

This approach involves a detailed evaluation using multiple test specimens from different orientations, ensuring a robust assessment of weld integrity.

Option 1: Simplified Analysis

If a general ECA is required, the following will be performed:

One CTOD test.

One impact test.

One tensile test.

This approach provides a basic evaluation but may lack the depth of Option 2.

Key Considerations

Pipeline Wall Thickness: Each ECA assessment will address variations in pipeline wall thickness. The objective is to define tolerable defect sizes as a percentage of wall thickness and in absolute units (millimeters).

Residual Stresses: Residual stresses will be estimated following **Annexure 9D of API 579/ASME FFS-1**.

Material Restrictions: WPS must be limited to materials with carbon equivalents (CE-IIW) not exceeding the qualification coupon. This ensures adequate hardness and consistency with production conditions.

Conclusion

TCR's expertise in performing advanced ECA ensures comprehensive evaluation of pipeline girth welds. With capabilities extending to CTOD assessments, FEA, and real-world damage analysis, we deliver actionable insights to ensure the structural integrity and safety of critical pipeline systems. Whether you require API 1104-compliant evaluations or customized solutions, TCR in India as well TCR Arabia in Saudi Arabia are your partner in achieving excellence in engineering assessments.

Certifications:

ISO 9001-2015 Certificate

intertek
Total Quality. Assured.

CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

TCR Arabia Company Ltd.

Main Site: King Abdul Aziz Seaport Facility, P.O. Box 8143, Dammam
32211, Kingdom of Saudi Arabia

has been registered by Intertek as conforming to the requirements of:

ISO 9001:2015

The management system is applicable to:

Conventional Non-Destructive Testing Services (NDT), Advanced Non-Destructive Testing Services (ANDT), Metallurgical Services, Mechanical Laboratory Testing Services, Welding Inspection Service, Post Weld Heat Treatment (PWHT).

Certificate Number:

21111010003

Initial Certification Date:

25 March 2014

Date of Certification Decision:

02 March 2023

Issuing Date:

02 March 2023

Valid Until:

24 March 2026



intertek



014



Calin Moldovean

President, Business Assurance

Intertek Certification Limited, 10A Victory Park,
Victory Road, Derby DE24 8ZF, United Kingdom

Intertek Certification Limited is a UKAS
accredited body under schedule of
accreditation no. 014.



Certifications:

Mechanical Testing Lab of TCR Arabia is now ISO-17025 Accredited



Certifications:

TCR Arabia is now ISO 14001 & 45001 Accredited



CERTIFICATE

This is hereby certified that the Environmental Management System of

TCR ARABIA COMPANY LTD.

P.O. Box 8143, Dammam 32211, TCR Arabia Company Ltd. Gas Gardens, King Abdul Aziz Seaport Facility, Dammam, Kingdom of Saudi Arabia.

Has been found to comply with the requirements of

ISO 14001: 2015

This certificate is applicable for the following scope:

Conventional Non-Destructive Testing Services (NDT), Advanced Non-Destructive Testing Services (ANDT), Metallurgical Services, Mechanical Laboratory Testing Services, Welding Inspection Service, Post Weld Heat Treatment (PWHT).

Certificate Number: KAEM202405031

Date of initial registration:	13 May 2024
Surveillance audit on/before:	13 April 2025
Certificate expiry:	13 May 2025
Recertification due:	12 May 2027






Authorized Signatory
KVQA Assessment Pvt. Ltd.

Website: www.iso-registration.com | Email: info@iso-registration.com
 KVQA Assessment Private Limited is accredited to United Accreditation Foundation (IAF). IAF is internationally recognized by having a signatory status across multilateral recognition arrangement of International Accreditation Forum (IAF) and Asia Pacific Accreditation Cooperation (APAC).
 The certificate is valid subject to successful completion of surveillance audits. Verify validity/status on www.iso-registration.com or on email at info@iso-registration.com
 UAF address: 400, North Centre Dr, STE 202, Norfolk, VA23502, United States of America



CERTIFICATE

This is hereby certified that the Occupational Health & Safety Management System of

TCR ARABIA COMPANY LTD.

P.O. Box 8143, Dammam 32211, TCR Arabia Company Ltd. Gas Gardens, King Abdul Aziz Seaport Facility, Dammam, Kingdom of Saudi Arabia.

Has been found to comply with the requirements of

ISO 45001: 2018

This certificate is applicable for the following scope:

Conventional Non-Destructive Testing Services (NDT), Advanced Non-Destructive Testing Services (ANDT), Metallurgical Services, Mechanical Laboratory Testing Services, Welding Inspection Service, Post Weld Heat Treatment (PWHT).

Certificate Number: KAOH202405032

Date of initial registration:	13 May 2024
Surveillance audit on/before:	13 April 2025
Certificate expiry:	13 May 2025
Recertification due:	12 May 2027






Authorized Signatory
KVQA Assessment Pvt. Ltd.

Website: www.iso-registration.com | Email: info@iso-registration.com
 KVQA Assessment Private Limited is accredited to United Accreditation Foundation (UAF). UAF is internationally recognized by having a signatory status across multilateral recognition arrangement of International Accreditation Forum (IAF) and Asia Pacific Accreditation Cooperation (APAC).
 The certificate is valid subject to successful completion of surveillance audits. Verify validity/status on www.iso-registration.com or on email at info@iso-registration.com
 UAF address: 400, North Centre Dr, STE 202, Norfolk, VA23502, United States of America

Approvals:

TCR Arabia is now an approved contractor in SABIC for providing high-end inspection services like HTHA/FFS, Metallurgy Solutions and Root Cause Analysis.

Classification: Internal Use



Tuesday, August 20, 2019

Subject: APPROVED CONTRACTOR CONFIRMATION

Dear Mr. Darwin,

This is to confirm that "TCR Arabia Ltd. KSA" is an approved third party and part of "Approved Contractor List" (ACL) of SAUDI BASIC INDUSTRIES CORPORATION (SABIC) to conduct business as a third party inspection & testing contractor for onshore/ offshore services for SABIC site & Mega projects. The onshore/offshore services are:

- Conventional NDT techniques (RT,UT, PT, MPT, VT & PMI)
- Advanced NDT techniques (ToFD, PAUT, MFL & tube inspection).
- Material testing (destructive)
- Welder qualification
- HTHA/FFS services
- Metallurgy solutions
- Root Cause Analysis

However, this certificate has been issued upon the request of above named contractor for whatever purpose it may serve him without any liability on the part of SABIC.

Best Regards,



Gehad Al-Otaibi
Senior Manager
Global Suppliers relationship Management



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Shared Services
Global Procurement Services
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Kingdom of Saudi Arabia
T: 966 13 350 6600
F: +966 13 350 6333
www.sabic.com

Saudi Basic Industries Corporation
Saudi Joint Stock Corporation
Authorized capital: SAR 30 billion
CR: 1010010813

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شركة مساهمة سعودية
رأس المال المصرح به 30 بليون ريال
رقم التسجيل 1010010813

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الهاتف: +966 13 350 6600
الفاكس: +966 13 350 6333
www.sabic.com



ASNT Partner



ISO 9001-2015 Certified



ISO 17025 Accredited

Approvals:

TCR Arabia is an approved contractor in SAUDI ARAMCO for Welder Testing Agency.

Revision Date: May 06, 2024
Rev-09

أرامكو السعودية
saudi aramco



INSPECTION DEPARTMENT Service Provider Review Committee

Approved Welder Testing Agencies





TCR Arabia Company Limited

Inspection, Testing & Advisory Redefining Reliability

ARAMCO & SABIC Appreciation Letters:



Services Portfolio



TESTING

Material Testing

Mechanical

Tensile, Impact, Hardness, Bend, Elongation, Yield

Corrosion

ASTM A923, A262, G28, G48

Welder Qualification

WPS, PQR, WQT, Welder Certification

Civil Laboratory

Construction Material Testing, Concrete, Soil, Aggregates & Field Tests

Metallurgy Testing

In-situ Metallography,

Failure Investigation

Remaining Life Assessment

Fitness for Service



INSPECTION

Non-Destructive Testing (NDT)

Conventional NDT

RT, MT, PT, UT, UTT, FM, PMI, HT

Advanced NDT

ToFD, PAUT, Corrosion Mapping
Helium Leak, Thermography, MFL
ECT, RFT, IRIS, HTHA, High Temp UT

Robotic Inspection Services

Submersible Inspections

Inspection of buried & above ground assets

Non-Metallic Testing Lab.

FRP/GRP/Composite Lab Testing



CONSULTING

Inspection Manpower

NDT Technicians, Plant Inspectors, Inspection Engineers, Corrosion Engineers

- Stress Analysis
- Risk Based Inspections (RBI)
- Damage Mechanism Study
- Third Party Inspection
- Coker Drum Inspection
- Trainings (NDT, Metallurgy, Welding)
- Plant Asset Integrity Management
- Corrosion Study



TCR Arabia Company Limited

Inspection, Testing & Advisory

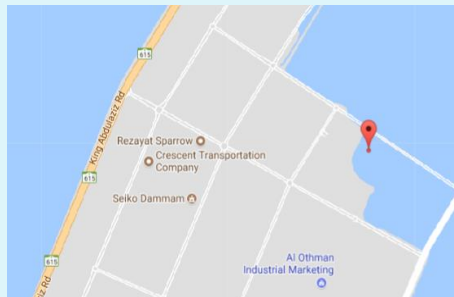
Redefining Reliability

Location

TCR Arabia Head Office & Labs are located in Dammam
Branch Offices in Jubail & Yanbu



GPS Location: 26.450525, 50.193787



ASNT Partner



ISO 9001-2015 Certified



ACCREDITED
Testing Laboratory
ISO 17025 Accredited

Events

TCR Arabia is featured on The Gulf Time newspaper page 8 under Energy dated 14 June 2023

TCR Arabia, an Indian JV company, completes 15 successful years in Kingdom of Saudi Arabia

One of the key reasons for TCR Arabia's success is the expertise of its founding companies

SAUDI ARABIA / GULF TIME

TCR Arabia is a company that specializes in engineering services specifically in the field of Material Testing, Advanced Non-Destructive Testing and Metallurgical investigation. Founded in 2007 as a joint venture between TCR Engineering Services (India) and GAS Arabian Service (Saudi Arabia). The company is based in Saudi Arabia and has rapidly established a reputation for reliability and quality in all sectors it services namely oil & gas, petrochemical, mining, desalination, power, fertilizer and other such process and manufacturing industries.

One of the key reasons for TCR Arabia's success is the expertise of its founding companies. TCR Engineering Services (India) has over 50 years of experience in providing engineering solutions for a wide range of industries, including oil and gas, power, and infrastructure. On the other hand, GAS Arabian Service is a leading provider of engineering services in the Middle East, with a strong reputation for delivering high-quality projects on time and within budget.

Together, TCR Arabia combines the best of both worlds: The experience and knowledge of TCR Engineering Services (India) with the local expertise and understanding of GAS Arabian Services. This unique combination of expertise enables TCR Arabia to provide a comprehensive range of engineering services to its clients in the region.

TCR Arabia offers a wide range of services, including Advanced Non-Destructive Testing Services, Material Testing Services (Mechanical, Metallurgical and Non-Metallic Products), Engineering & Consulting on all process related assets, Welding Inspections, Welder Qualifications, Heat Treatment etc. TCR Arabia has partnered with global specialized companies in providing solutions to clients on Robotic Inspections, Coke Drum Inspections, Boiler Inspection & Life Assessment etc.

As an ISO-9001-2015 Certified and ISO-17025 Accredited Organization, TCR Arabia ensures all its services are delivered to its clients as per global standards and prescribed procedures. Trained and qualified staff ensure that quality is not compromised at any level of testing and inspection works.

As an employee oriented organization, we value the contributions of every single employee in the growth of our organization. Our employees play a key role in planned expansion, strategic



development and technical expertise which results in winning the trust of our valued clients and to serve them to higher standards everytime. Today we are a strong team of qualified API Engineers, NDT Engineers, Corrosion Engineers, Metallurgists, Skilled Technicians.

One of the key factors that sets TCR Arabia apart from its competitors is its commitment to safety. The company places a strong emphasis on safety in all of its projects, and it has implemented strict safety procedures to ensure the safety of its employees, as well as its clients. TCR Arabia also carries out regular safety audits to ensure that all of its projects are being carried out in compliance with the highest safety standards.

TCR Arabia is committed to develop the local manpower (Saudi Nationals) by providing 'on the job' trainings, class-room trainings in the field of NDT & Material Testing. Consistent growth in the percentage of IKTVA (In-Kingdom Total Value Addition) has yielded positive results in the success of TCR Arabia.

In conclusion, TCR Arabia is a leading engineering services company in Saudi Arabia and the Middle East. Backed by the trust of its valued clients and the ability of its staff to deliver quality services, the organization is motivated to serve and deliver best results year after year.



Syed Ameen Hassan, Country Manager, TCR Arabia, Saudi Arabia

Syed Ameen heads the TCR Arabia operations in Saudi Arabia. MBA in Marketing and Finance, from Chifley University, Australia, Syed Ameen has been instrumental in developing the business of TCR Arabia from its inception stage. Experience of over 25 years in the Saudi Arabian and Middle East market, specifically in the down-stream industry business, helps Syed Ameen to reach out to the decision makers and also run the operations in a professional manner. Business plans, budgeting, decisions on CAPEX / OPEX and Resources Management are his key roles and reports to the EXCOM & Board Members on the performance of the Organization.

Under the leadership of Syed Ameen, the organization has grown from its incubation stage to one of the top Inspection & Testing Companies in Saudi Arabia. Ensuring routine business with all major clients is the key to sustenance of the Organization and Syed Ameen has been instrumental in gaining long term contracts with major clients like Saudi Aramco, SABIC, TASNEE, MAADEN, SWCC etc.

Expansion of the organization by setting up new service areas like Robotic Inspection Services, Welder Qualification Department, Mechanical Testing Lab, Metallurgical Testing Lab, Corrosion Testing Lab are some of key achievements.

Operational alliance with major international service providers like CANAP Engineering of India for Stress Analysis Studies, CIA of Canada for Coker Drum Inspections, Planys of India for Submersible Robotic Inspection and so on were formed under the leadership of Syed Ameen to provide advance inspection and technical support to all of TCR's valued clients in KSA. Adapting to the fast evolving Inspection Field with new and advanced techniques to help the client save loss of production time and improve profitability, TCR team is consistently working in offering safer, faster and reliable inspection and testing techniques to clients under the leadership of Syed Ameen.

An Active team player and a firm believer in Team Work, Syed Ameen has been able to develop a team of professional engineers, technicians, admin staff, and support staff to work towards a common goal of developing the organization.

TCR Arabia serves majority of its clients in the 'downstream industry' which includes Saudi Aramco, SABIC, TASNEE, CHEVRON, ADVANCED, SWCC, Saudi Electricity Company, Petrorabigh, SADARA, SATORF, MAADEN and so on. It also serves all major contracting companies in infrastructure development and maintenance projects

Events

Celebrating 50 years of TCR




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Since 1973, TCR Engineering Services is well known for its work ethics, precision, transparency, & reliability and has been trusted by over 3500 customers across India. TCR's expertise guarantees superior quality, safety, and reliability, empowering business to reach new heights while fueling the national economy through enhanced product performance, reduced downtime, and accelerated innovation. Together, we are the key drivers of the "Make in India" movement to build a vibrant and prosperous economy.

TCR has completed NDT works on over 3000 kms. of Cross-Country Pipeline for EPC companies on IOCL and GAIL sites. TCR offers specialized fatigue testing for Reinforcement Couplers and Grouter for Mechanical Splices of Bars in Concrete used in Infrastructure and Road construction projects. Defence industry vertical is served by undertaking Fracture Toughness and Fatigue Crack Growth Rate analysis. TCR has worked on over 5000 failure investigation cases, over 75 Fitness For Service assignments and over 300 boiler RLA projects.

TCR is approved by IOCL, GAIL, RIL, L&T, JSW, HAL, NMRL, DMRL, PDIL, DRDO, COAE, RITES, BMC, Mecon, EIL, BSE, NSE, Mazagon Dock, NPCIL, Customs Authority India and Saudi Aramco, SABIC, PDO, QCHEM, QAFCO, KOC, KNPC, Iraq Ministry of Oil, SHELL, National Oilwell Varco, Sakhalin Energy and many others internationally. TCR is the preferred laboratory for members of the Bombay Metal Exchange and the Mumbai Steel Traders Association.

TCR prides itself in being a Pan-India based material testing and inspection services company with global operations in Saudi Arabia, Qatar, Kuwait, Malaysia and Nigeria.

MATERIAL TESTING LAB

- Mechanical Testing
- Chemical Analysis Spectro
- NACE Sour Gas Corrosion
- CTOD & Fracture Toughness
- Coupler & Rebar Fatigue Test
- Railtrack butt joint Fatigue
- Microstructure Studies
- SEM & EDAX Analysis
- Welder Qualification
- Hot Tensile
- RoHS Compliance
- Construction/Civil Lab
- Composite Testing
- Wet Chemical

NDT & INSPECTION

- Cross Country Pipeline RT
- ToFD and PaUT
- Robotic Reformer Tube Inspect
- Robotic Tank Inspection
- Eddy Current Test for Tubes
- IRIS, RFET and MFL
- Metallographic Replica
- Helium Leak Detection
- PMI-Positive Material Id
- Gamma Radiography
- PWHT and Heat Treatment
- Civil NDT for Concrete
- Inspection of Bridges
- Third Party Inspection

ENGINEERING CONSULTING

- Asset Integrity Management
- Pipeline Integrity
- Fitness for Service
- Remaining Life Assessment
- Boiler Audit
- Failure Analysis Investigation
- Insurance & Litigation Referee
- Digitalization of RT Films
- Plant Relocation Advisory
- Manpower Supply for Turn Around
- CAD/CAM and Piping Stress Analysis
- Custom Research
- Welding Consulting
- Plant Reliability Training



TCR Arabia Company Limited

Inspection, Testing & Advisory

Redefining Reliability

Events

Celebrating 50 years of TCR



Mumbai Corporate Office
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ISO/IEC 17025 : 2017
Accredited Testing Laboratory by

NABL

Vide Certificate No. TC - 6905

Events

TCR Arabia will be participating in:

SABIC TECHNICAL MEETING 2025
January 26-30, 2025



CHEMISTRY THAT MATTERS™

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SABIC TECHNICAL MEETING 2025
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Jubail Industrial City, Saudi Arabia | 26th - 30th January 2025

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3rd ASSET INTEGRITY & PROCESS SAFETY 2025
May 13-15, 2025



3rd EDITION

**ASSET INTEGRITY
AND PROCESS SAFETY**
CONFERENCE & EXHIBITION 2025

Events

Best Employee Awards 3rd Quarter



Gold Award: Hasan Sadik



Silver Award: Ehsanullah



Bronze Award: Ahmed Raza



Events

SEC Audit



IRISS-TCR Event



Events

TCR Arabia participates in ISNT Conference in Chennai, India



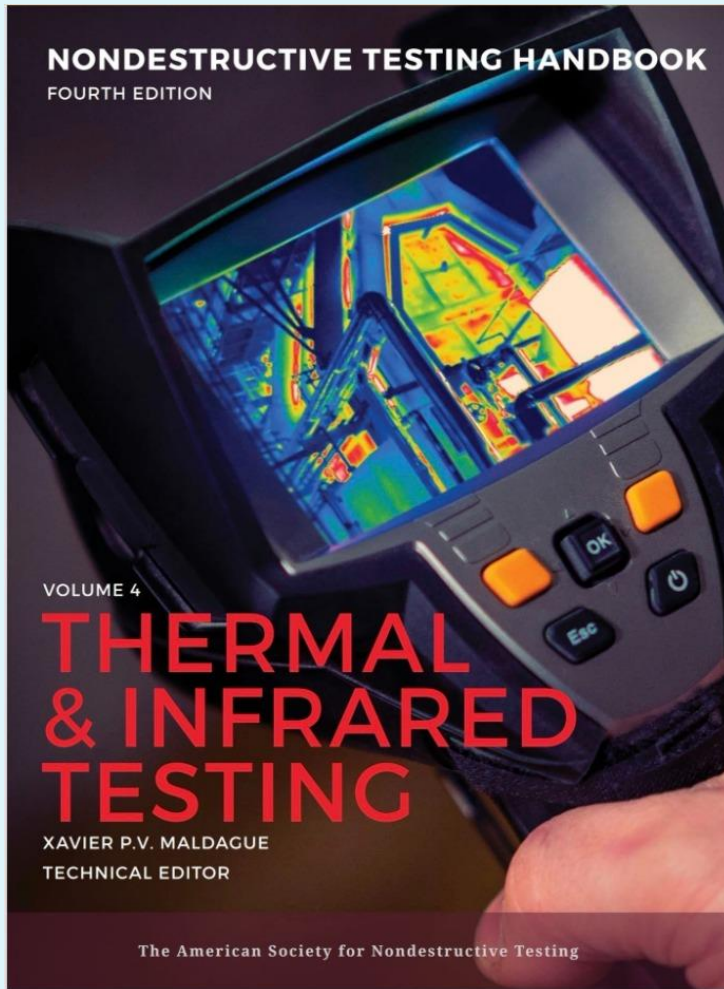
Events

ChampionX Visit TCR Arabia



Accreditation

Mr. Periasamy Senthil's contribution to American Society of Non-Destructive Testing (ASNT) in releasing the Volume 4 of Thermal and Infrared Testing



Nik Rajic, Defence Science and Technology Group
 Marco Ricci, University of Calabria
 Elisabetta Rosina, Politecnico di Milano
 Andres E. Rozlosnik, SI Termografia Intrarroja, Buenos Aires
 Agustín Salazar, University of the Basque Country, UPV/EHU
 Pierre Servais, Liège, Belgium
 Stefano Sferra, University of L'Aquila
 Concita Sibilla, Sapienza University of Rome
 Iyad S. M. Shatarah, Lodz University of Technology
 Steven M. Shepard, Thermal Wave Imaging Inc.
 Igor Solodov, University of Stuttgart
 Maria Strakowska, Lodz University of Technology
 Ning Tao, Capital Normal University, Beijing
 Abdoulaye Taram, ArcelorMittal
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