COMPANY PROFILE
AND
PRE-QUALIFICATION DOCUMENT
2024

TCR Arabia

NDT, Inspection, Metallurgy, Material Testing (Mechanical & Civil), Heat Treatment, Engineering Consulting, Welder Qualification, Calibration Services, Inspection Manpower

P.O. Box 32211, Gas Gardens,
King Abdulaziz Seaport Facility, Dammam, Kingdom of Saudi Arabia
Tel: +966-13-8475784/85 | Fax: +966-13-8475768
E-Mail: sales@tcr-arabia.com | URL: www.tcr-arabia.com

1. Executive Summary

TCR Arabia is a Quality Assurance, Material Testing, NDT and Inspection Services Company headquartered in Dammam, Kingdom of Saudi Arabia with site offices in the western and central region as well. Founded in 2007, as a result of a joint venture between GAS Arabian Services (KSA) and TCR Engineering Services (India), the company aims to provide outstanding quality assurance services to Aerospace, Automotive, Oil Refineries, Petro-chemical plants, Chemical Processing, Defense, Electronics, Nuclear Power and Capital Goods manufacturing industries in the Kingdom of Saudi Arabia.

Founded in 1973, TCR Engineering Services is India's leading ISO 17025 accredited Materials Testing Company with offices in Washington DC, Kuwait, Dubai, Mumbai, Vadodara, Johannesburg and Kuala Lumpur. Till date, TCR has worked with more than 2000+ quality driven clients (from all over the world)including reputed multi-national companies including Reliance, Caterpillar, Halliburton, Chevron, ONGC, L&T, Equate, Petronas, Kuwait Oil Company, Hyundai, Weatherford, GE and many others. TCR's advantage comes from its international network and the strength and breadth of their business relationships.

TCR Arabia, based in Dammam, provides timely and accurate results reporting of materials properties through its dedicated destructive testing laboratory, strong NDT and plant shutdown management, stringent product inspections, in-depth engineering consulting and contract research to ensurematerials and products have assured quality and enhanced performance; giving customers a competitive advantage in the marketplace.

TCR Arabia believes that people are its biggest strength. With deep commitment to their tasks, and a quest to better their achievements, TCR Arabia's highly skilled teams are known to constantly endeavor to develop innovative and superior solutions for all its customers. Simply stated, TCR's team members undertake quality assurance services that make your plants better and your operations more efficient.

TCR Arabia provides the following range of services using its multi-disciplinary certified and experienced personnel team of professionals:

- Materials Testing Lab (Destructive Testing)
- Contract Research and Development
- Engineering Consulting
- Root Cause Failure Analysis and RLA
- Plant Shutdown Management
- Risk Based Inspection/Fitness for Service
- Civil Lab Testing
- Conventional Non Destructive Testing Services
- Advanced NDT Services
- Heat Treatment
- Welder Qualification
- Technical Training Courses
- Calibration Services

The in-house destructive testing laboratory of TCR Arabia in Dammam, KSA boasts of strong metallurgical talent coupled with duly calibrated machines to undertake mechanical testing, chemical analysis, corrosion studies including sour gas corrosion detection and metallographic examination. TCR Arabia undertakes material testing as per international standards and specifications as defined by ASTM, NACE, AWS, API, ASME, ISO and others. Testing can also be done as per client-supplied specifications.

TCR Arabia partners with PP SIMTECH of UK to bring innovative solutions in the areas of Risk Based Inspection (RBI) and Fitness for Service.PP SIMTECH has successfully implemented RBI at BP, Dow Chemicals, GPIC, ADNOC-Fertil, Norsk Hydro, BASF, INEOS.

A dedicated technical training course curriculum is also taught by TCR Arabia to enhance the knowledgebase of plant operations, maintenance and inspection personnel working at leading companies in Saudi Arabia.
TCR Arabia also markets a number of inspection related products in the Kingdom of Saudi Arabia from companies such as Modsonic (India), Oxford (Finland) etc..
This corporate profile demonstrates TCR Arabia's keenness to undertake projects in KSA and showcases the company's engineering and metallurgical consulting expertise.

A. Services Overview

Materials Testing Laboratory
Tensile Testing
Bend Testing
Hardness Testing
Impact Testing
Welder Qualification
Chemical Analysis Spectrometer
Intergranular Corrosion Tests
Salt Spray
Sour Gas Corrosion (HIC/SSC)
Metallography
Micro and Macro Examination
Microstructure Analysis (SEM/EDAX)
Civil Laboratory

Contract Research & Development
Heat Treatment Studies
2D to 3D Conversion
Finite Element Modeling
Computer Aided Engineering (CAE)
Piping Stress Analysis
Advise on Materials

Engineering Consulting
Risk Based Inspection
Fitness For Service
Damage Mechanism Study
Third Party Inspection

Root Cause Failure Analysis and RLA
Fatigue Failure
Corrosion Related Failure
Operations Failure
Remaining Life Assessment
RLA and Condition Assessment of Boilers
Fitness for Service

Plant Shutdown Management
Manpower Supply
API 510 Pressure Vessel Inspectors
API 570 Piping Inspectors
API 653 Tank Inspectors
ASNT Level III Experts
BGas Paint Inspectors
Multi-Skilled NDT Level II Technicians
CSWIP/AWS Certified Welding Inspectors
QA/QC Inspectors and Engineers
NACE Cathodic& Coating Inspectors
Reliability Engineers

Conventional NDT Services
Ultrasonic Flaw Examination
Ultrasonic Thickness Measurement
Magnetic Particle Testing
Radiographic Testing
Liquid Penetrant Testing
Radiography Evaluation
Ferrite Measurement
Portable Hardness Measurement
Paint and Coating Thickness
Holiday Detection
Positive Material Identification

Advanced NDT Services
Time of Flight Diffraction (ToFD)
Phased Array (normal & high temperature)
In-Situ Metallography
Tube Inspection (ECT, RFET, MFL, IRIS)
Acoustic Eye Tube Inspection
Automated Reformer Tube Inspection System
Corrosion Mapping (normal & high temperature)
Helium Leak Testing
Thermography
High Temperature Hydrogen Attack (HTHA)
Hydrogen Induced Cracking (HIC)
Alternating Current Field Measurement (ACFM)*
Long Range Ultrasonic Testing (LRUT)
Robotic Crawler Video Inspection*
OTIS - In Service Robotic Tank Inspection*
HD 200 - In Service Robotic Tank Cleaning*
Close Interval Potential Survey (CIPS)*
Direct Current Voltage Gradient Survey (DCVG)*

Heat Treatment Services
Post Weld Heat Treatment
Oil Firing on Pressure Vessels

Technical Training Courses
Mechanical Metallurgy Laboratory – Level I and II
Microstructure Characterization
Metallurgy for Plant Executives and NDT Inspectors
Metallurgy for Non Metallurgists
Understanding Corrosion Damage Mechanisms
Sour Gas Corrosion Testing – Level I and II
Fitness for Service Assessment Training
Understanding API 571 damage Mechanisms
Implementing RBI best practices in Plants
Failure and Root Cause Analysis : Guide

Introduction to NDT for Plant Executives
Ultrasonic Testing – Level I and II
Magnetic Particle Testing – Level I and II
Dye Penetrant Testing – Level I and II
Eddy Current Testing – Level I and II
Radiography Testing – Level II
Visual Testing – Level II
Thermography – Level I
Gas Tungsten Arc Welding for Qualified Welder
Shield Metal Arc Welding for Qualified Welder

Inspection and Testing Products
Modsonic – UT Flaw Detectors, Thickness
Oxford Instrument/Sanco - XRF and OES
MiC – Image Analysis Software and LIMS

TCR – HIC/SSC Lab Equipment and Glassware
Time – Portable Hardness

Calibration Services

Dimensional
- Vernier Calipers
- Dial Calipers
- Inside / Outside Micrometer
- Coating Thickness Gauge
- Measuring Tape
- Height Gauge

Mechanical
- Digital and Analog Pressure gauge
- Pressure relief valves
- Torque
- Balance

Thermal
- Ovens
- Thermometer
- Water bath
- Welding Machine
- Clamp Meter

Items marked as * are performed by TCR Arabia in association with external partners from overseas.

B. Advantage TCR Arabia

TCR Arabia presents itself as an excellent resource for providing engineering consulting to meet the Saudi Aramco, SABIC, SWCC, SEC compliance standards. Some of the highlights that TCR Arabia brings to KSA include:

- TCR Arabia is registered with all major companies in the Kingdom of Saudi Arabia including Saudi Aramco, SABIC, SWCC, SEC, SATORP, TASNEE, SADARA, MARAFIQ, MAADEN, ADVANCED, SCHEM, LUBEREF, SAMREF, Petrorabigh etc.
- TCR brings its experience gained over the last 40 years in the field of material testing, inspection and quality assurance to Saudi Arabia. TCR also brings its strong commitment and adherence to the ISO 17025 standards. All laboratory personnel at TCR Arabia have strong experience.
- TCR has set up Mechanical, Metallurgical, Civil, Microbiological Testing Laboratories in Dammam with state of art equipment to serve its clients in KSA and the Middle East.
- TCR Arabia is an ISO 9001-2015 Certified & ISO – 17025 Accredited Company.
- TCR Arabia is an ASNT Corporate Partner
- Experienced by conducting over 2500 failure analysis projects. TCR is on the approved list of SABIC, Tasnee, APPC, Schlumberger and Reliance for Failure Analysis Services. The company has access to Scanning Electron Microscopy with EDAX and Optical Inverted Metallurgical Microscopes.
- Technical Training Courses conducted by TCR Arabia aims to provide in-depth knowledge and expertise to all plant operations and inspection personnel in Saudi Arabia. Experts teaching this class each have over 15 years of industry experience.
- Access to backend laboratory in India for in-depth chemical analysis using GDS, ICP, AAS and a complete wet chemistry laboratory.
- Use of Advanced NDT techniques including ToFD, Infrared Thermography, Eddy Current, Acoustic Eye Tube Inspection, Automated Reformer Tube Inspection System, Helium Leak Testing and more. Automated UT using ToFD is fast replacing Radiography as a preferred method for faster scanning of weld joints. TCR compliments this service with a range of conventional NDT services.
- Assisting RLA studies by conducting in-situ metallography (Metallographic Replication) by a talented and experienced team that has won praises from SABIC, APPC, Tasnee, Shell, Reliance, KOC and other large Oil and Gas Companies.
- Access to a pool of resource talents, ability to undertake faster mobilization and committed to work under good safety, health and environment principles.
- Customers all over the world use TCR's services to dramatically improve and certify their products, validate material quality, ensure innovation in the marketplace, and to achieve significant competitive advantages. As a result, these companies are bringing the right products to market, at the right time, at the right cost.

ASNT Corporate Partner

C. ISO 9001 Certification

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
UKAS MANAGEMENT SYSTEMS 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.

In the issuance of this certificate, Intertek assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification Agreement. This certificate's validity is subject to the organization maintaining their system in accordance with Intertek's requirements for systems certification. Validity may be confirmed via email at certificate.validation@intertek.com or by scanning the code to the right with a smartphone. The certificate remains the property of Intertek, to whom it must be returned upon request.

D. ISO 17025/IAS Certification

ilac-MRA IAS INTERNATIONAL ACCREDITATION SERVICE®

CERTIFICATE OF ACCREDITATION

This is to attest that

TCR ARABIA COMPANY LTD
KING ABDUL AZIZ SEAPORT ROAD
DAMMAM 32224, KINGDOM OF SAUDI ARABIA

Testing Laboratory TL-783

has met the requirements of AC89, *IAS Accreditation Criteria for Testing Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date October 29, 2022

IAS ACCREDITED

President

Visit www.iasonline.org for current accreditation information.

SCOPE OF ACCREDITATION

International Accreditation Service, Inc.
3060 Saturn Street, Suite 100, Brea, California 92821, U.S.A. | www.iasonline.org

TCR ARABIA COMPANY LTD

www.tcr-arabia.com

Contact Name Senthil Periyasamy **Contact Phone** +966-13-8475784/85

Accredited to ISO/IEC 17025:2017 *Effective Date October 29, 2022*

Mechanical Testing	
Tensile Test	
API 1104	Standard for Welding Pipelines and Related Facilities (Section 5.6.2)
ASME Sec IX	Boiler and Pressure Vessel Code (Article 1, QW-150 Tension Test)
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products (Section 6-14)
ASTM E8	Standard Test Methods for Tension Testing of Metallic Materials
Bend Test	
API 1104	Standard for Welding of Pipelines and Related Facilities (Sections 5.6.4 and 5.6.5)
ASME Sec IX	Boiler and Pressure Vessel Code (Article 1, QW-160 Guided Bend Tests)
ASTM A370	Standard Test Methods of Definitions for Mechanical Testing of Steel Products (Section 15)
Impact Test	
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products (Sections 20-30)
ASTM E23	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials
Vickers Hardness Test	
ASTM E92	Standard Test Methods for Vickers Hardness and Knoop Hardness of Metallic Materials
Rockwell Hardness Test	
ASTM A370	Standard Test Methods and Definition for Mechanical Testing of Steel Products (Section 18)
ASTM E18	Standard Test Methods for Rockwell Hardness of Metallic Materials
Brinell Hardness Test	

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TCR ARABIA COMPANY LTD

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SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

3060 Saturn Street, Suite 100, Brea, California 92821, U.S.A. | www.iasonline.org

ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products (Section 17)
ASTM E10	Standard Test Methods for Brinell Hardness of Metallic Materials
Flattening Test	
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products (Annexure A2.5.2.1)
Nick Break Test	
API 1104	Standard for Welding Pipelines and Related Facilities (5.6.3)
Proof Load Test	
ISO 898-1	Tensile Test of fasteners made carbon steel and alloy steel – Part 1: Bolts, screws and studs with specified property classes – Coarse thread and fine pitch thread
Metallurgy	
IGC Test (Intergranular attack in stainless steel	
ASTM A262	Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels (Practice E)
Macro Test	
ASTM A923	Standard Test Methods for detecting Detrimental Intermetallic Phase in Duplex, Austenitic/Ferritic Stainless Steels – Method C
ASTM E340	Standard Practice for Macroetching Metals and Alloys
ASTM G28	Standard Test Method for Detecting Susceptibility to Intergranular Corrosion in Wrought, Nickel Rich Chromium – Bearing Alloys - Method A
ASTM G48	Standard Test Methods for Pitting & Crevice Corrosion Resistance of Stainless Steel and Related Alloys by Use of Ferric Chloride solution – Method A

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ilac-MRA IAS INTERNATIONAL ACCREDITATION SERVICE

E. TCR Arabia Commitment and Values

TCR Arabia commitment is to put our customers first by providing excellent service and great quality assurance experiences. This is what we do and this is why we exist.

TCR Arabia is a corporate partner of ASNT as well as an active member in the local NDT community and regularly participates in the chapters of the Saudi Arabian Section (SAS) of the American Society for Nondestructive Testing as well as the Bahrain Society of Engineers (BSE). As part of this activity, TCR Arabia also actively participated by way of an exhibition booth at the Middle East Nondestructive Testing Conference and Exhibition which is held on a bi-annual basis in Bahrain.

By focusing on its customers and being a responsible member of our communities, TCR Arabia will prove to be a trusted QA company, create meaningful work for ourselves and provide something of lasting value for society. As a result, TCR Arabia will be recognized as a great company. In order to keep this commitment, we need to always honor our core values:

INTEGRITY
Integrity is at the heart of everything we do. We are honest, ethical and upfront because trust is at the foundation of our relationships with our customers, our communities, our stakeholders and each other.

RESPECT
We know it is critical that we respect everyone at every level of our business. We champion diversity, embrace individuality and listen carefully when others speak.

PERFORMANCE EXCELLENCE
We hold ourselves to a very high standard of performance. We prize innovative ideas and the teamwork it takes to make them realities. We never stop asking ourselves how we can make the customer experience better, and every day, we find an answer.

ACCOUNTABILITY
We take responsibility for our actions as individuals, as team members, and as an organization. We work together, support one another and never let the customer — or our coworkers — down. Great companies are judged by what they do, not by what they say. To be the best, we're going to keep pushing ourselves in new and exciting directions. These values will guide our every action.

2. Establishment in the Kingdom of Saudi Arabia

TCR Arabia has a commercial license to operate in the Kingdom of Saudi Arabia.

The company also has the Saudi Arabian General Investment Authority (SAGIA) approval.

شهادة تسجيل شركة

وزارة التجارة والصناعة
Ministry of Commerce and Industry

الرقم: ٢٠٥٠٠٠٥٩٨٤٥
التاريخ: ١٤٢٩/٠٤/١٥
٧٠٠١٥٥٦٧١٦

الاسم التجاري للشركة: شركة تي سي آر العربية المحدودة
نوعها: ذات مسئولية محدودة مختلطة
جنسيتها: مصرية

مدة الشركة: ٠١٠ سنوات تبدأ من: ١٤٢٩/٠٤/١٥ وتنتهي في: ١٤٣٩/٠٤/١٤

مركزها الرئيسي: الدمام ٩ شارع الملك سعود

ص.ب: ٢٤٢٢ الرمز البريدي: ٨٢٥١٥٠٠ هاتف: ٨٣١١٤٠٠ فاكس:

النشاط: تنفيذ عقود خدمات الفحص والاختبار والصيانة ونظم إدارة الجودة للمواد الصناعية والغذائية والاستهلاكية وتجهيز المختبرات وتشغيلها وصيانة أجهزتها والمعالجة الحرارية بموجب ترخيص الهيئة العامة للاستثمار رقم (١٧٢٠٢٩٠٣١١٢٤) وتاريخ ١٤٢٨/١١/٠١ ١١١١١١٤٢٨

رأس المال: ٥٠٠٠٠٠٠٠ ر.س سعودي

المديرون:
١- فيصل خالد عبدالله الدبل
٢-
٣- عبدالرحمن خالد عبدالله الدبل
٤-
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١١-
١٢-

سلطات المدير / المديرون: حسب ما تم عليه عقد الشركة

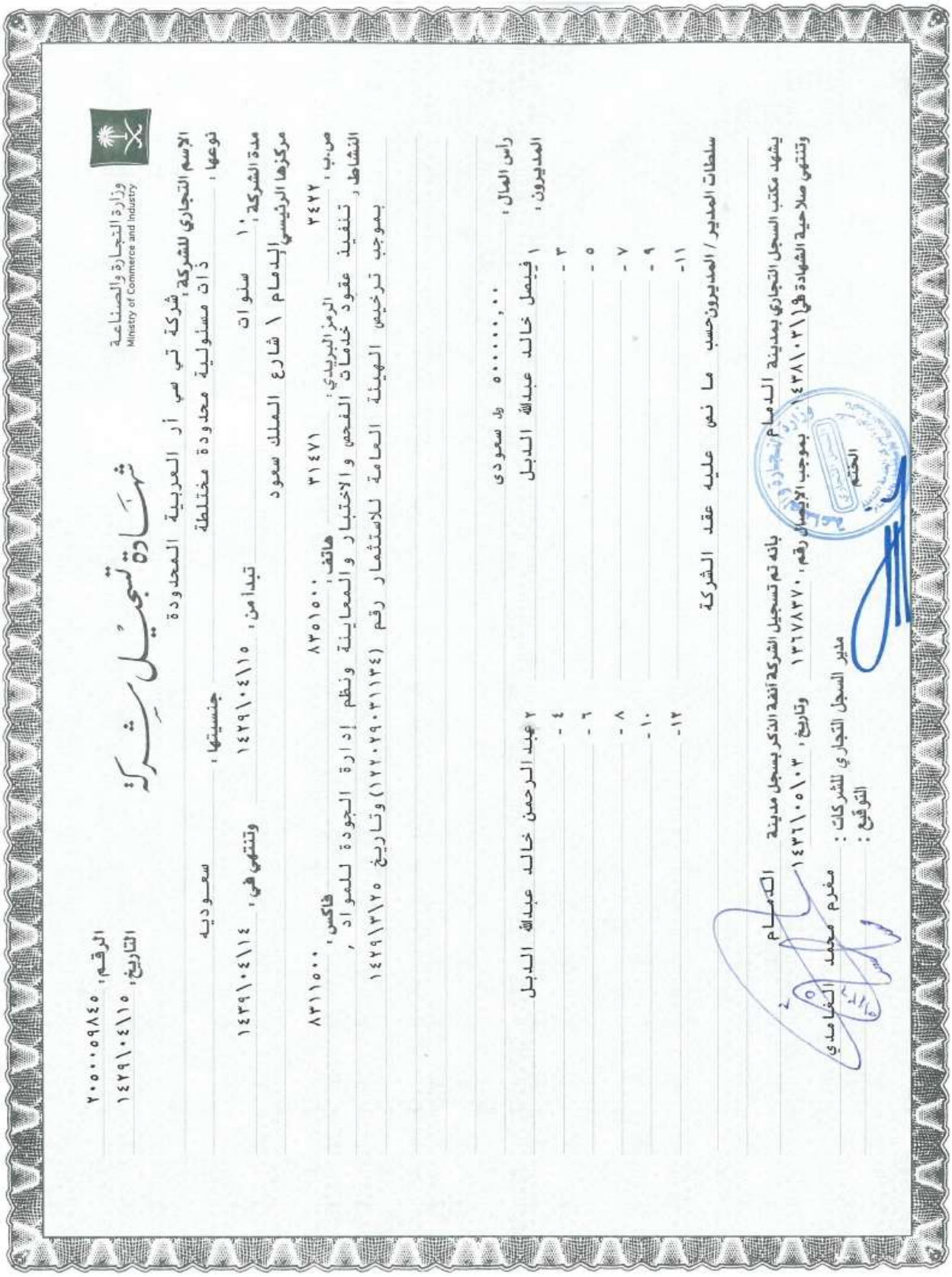
يشهد مكتب السجل التجاري بمدينة الدمام أن فرع الشركة المذكورة أعلاه بمدينة الدمام وتنتهي صلاحية الشهادة في ١٤٤٠/٠٢/١٧ هـ الموافق ٢٠١٨/١٠/٢٧ م

تاريخ: ١٤٣٨/٠٢/١٢٤

مدير السجل التجاري للشركات: مقرم محمد الغامدي

التوقيع:

Figure 1: Commercial Registration of TCR Arabia in Saudi Arabia



وزارة التجارة والصناعة
Ministry of Commerce and Industry

الرقم: ٢٠٥٠٠٠٥٩٨٤٥
التاريخ: ١٤٢٩/٠٤/١٥

شهادة تسجيل شركة

الإسم التجاري للشركة: شركة تي سي أر العربية المحدودة
ذات مسئولية محدودة مختلطة
نوعها: جنسيتها: سعودية
مدة الشركة: ١٠ سنوات تبدأ من: ١٤٢٩/٠٤/١٥ وتنتهي في: ١٤٣٩/٠٤/١٤
مركزها الرئيسي: الدمام / شارع الملك سعود
ص.ب: ٣٤٢٢ الرمز البريدي: ٣١٤٧١ هاتف: ٨٣٥١٥٠٠ فاكس: ٨٣١١٥٠٠
النشاط: تنفيذ عقود خدمات الفحص والاختبار والمعاينة ونظم إدارة الجودة للمواد
بموجب ترخيص الهيئة العامة للاستثمار رقم (١٢٢٠٢٩٠٣١٣٤) وتاريخ ١٤٢٩/٠٣/٢٥

رأس المال: ٥٠٠٠٠٠٠٫٠٠ ر.س سعودي

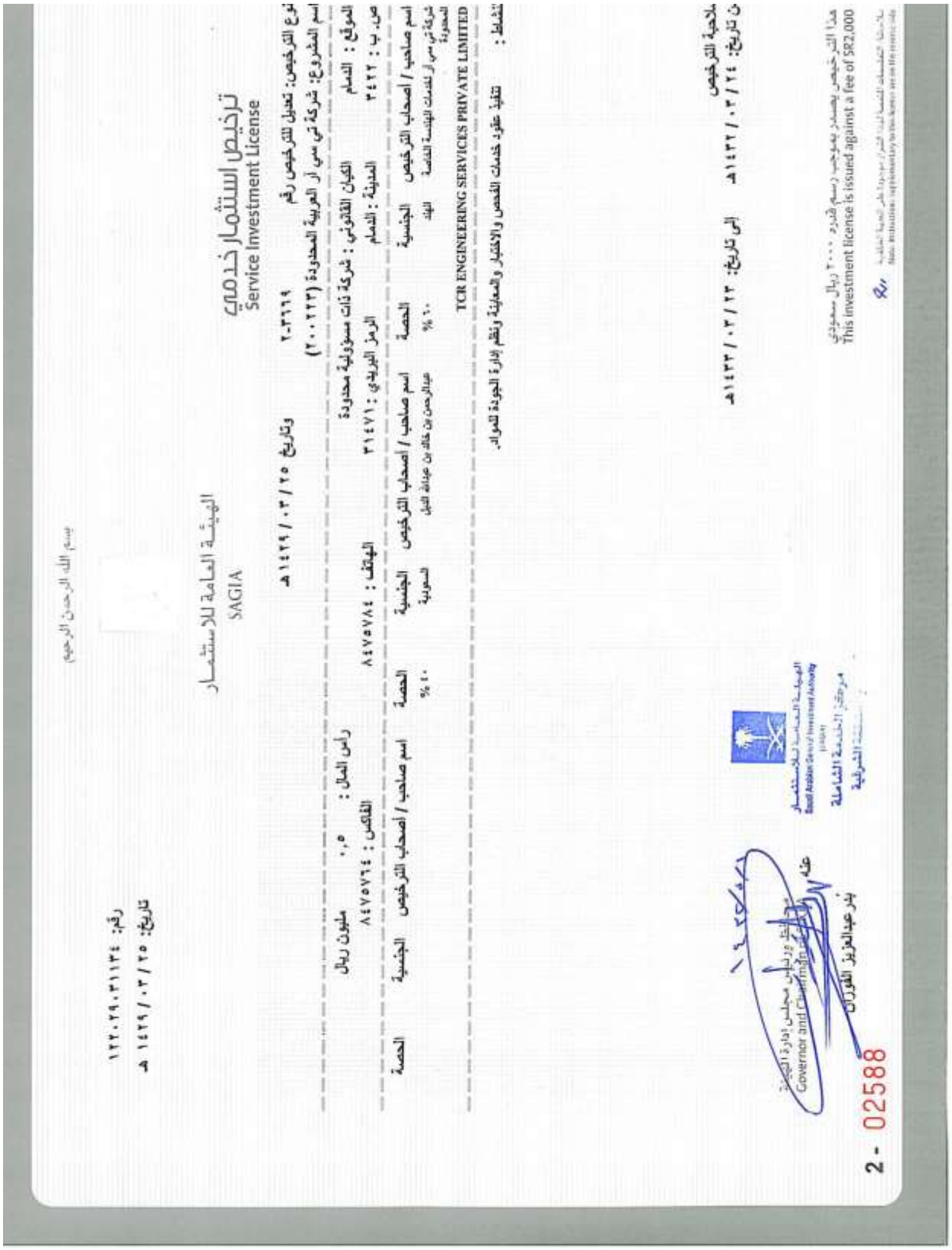
المديرون:
١ فيصل خالد عبدالله الدبل
٢ عبد الرحمن خالد عبدالله الدبل
٣ -
٤ -
٥ -
٦ -
٧ -
٨ -
٩ -
١٠ -
١١ -
١٢ -

سلطات المدير / المديرون حسب ما نص عليه عقد الشركة

يشهد مكتب السجل التجاري بمدينة الدمام بأنه تم تسجيل الشركة أنفة الذكر بسجل مدينة الدمام ١٤٣٦١٠٥١٠٣ وتاريخ ١٣٦٧٨٣٧٠ بموجب الإيصال رقم ١٤٣٨١٠٣١ وتنتهي صلاحية الشهادة في

مدير السجل التجاري للشركات: مغرم محمد الغامدي
التوقيع:
الختم

Figure 2: Commercial Registration of TCR Arabia in Saudi Arabia



بسم الله الرحمن الرحيم

الهيئة العامة للاستثمار
SAGIA

ترخيص استثمار خدمي
Service Investment License

رقم: ١٢٢٠٢٩٠٣١١٣٤
تاريخ: ١٤٢٩/٠٣/٢٥ هـ

نوع الترخيص: تعديل للترخيص رقم ٢٠٣٦٦٩ وتاريخ ١٤٢٩/٠٣/٢٥ هـ
اسم المشروع: شركة تي سي أر العربية المحدودة (٢٠٠٠٢٢٣)
الموقع: الدمام الكيان القانوني: شركة ذات مسئولية محدودة
ص.ب: ٣٤٢٢ المدينة: الدمام الرمز البريدي: ٣١٤٧١ الهاتف: ٨٤٧٥٧٨٤
اسم صاحب / أصحاب الترخيص الجنسية الحصة اسم صاحب / أصحاب الترخيص الجنسية الحصة
شركة تي سي أر لخدمات الهندسة الخاصة المحدودة الهند ٩٠ % عبدالرحمن بن خالد بن عبدالله النيل السعودية ١٠ %
TCR ENGINEERING SERVICES PRIVATE LIMITED
نشاط: تنفيذ عقود خدمات الفحص والاختبار والمعاينة ونظم إدارة الجودة للموا.

رأس المال: ٥,٠ مليون ريال
الفاكس: ٨٤٧٥٧٦٤

ملاحظة الترخيص
من تاريخ: ١٤٣٢/٠٣/٢٤ هـ إلى تاريخ: ١٤٣٢/٠٣/٢٣ هـ

هذا الترخيص يصدر بموجب رسم قدره ٢٠٠٠ ريال سعودي
This investment license is issued against a fee of SR2,000

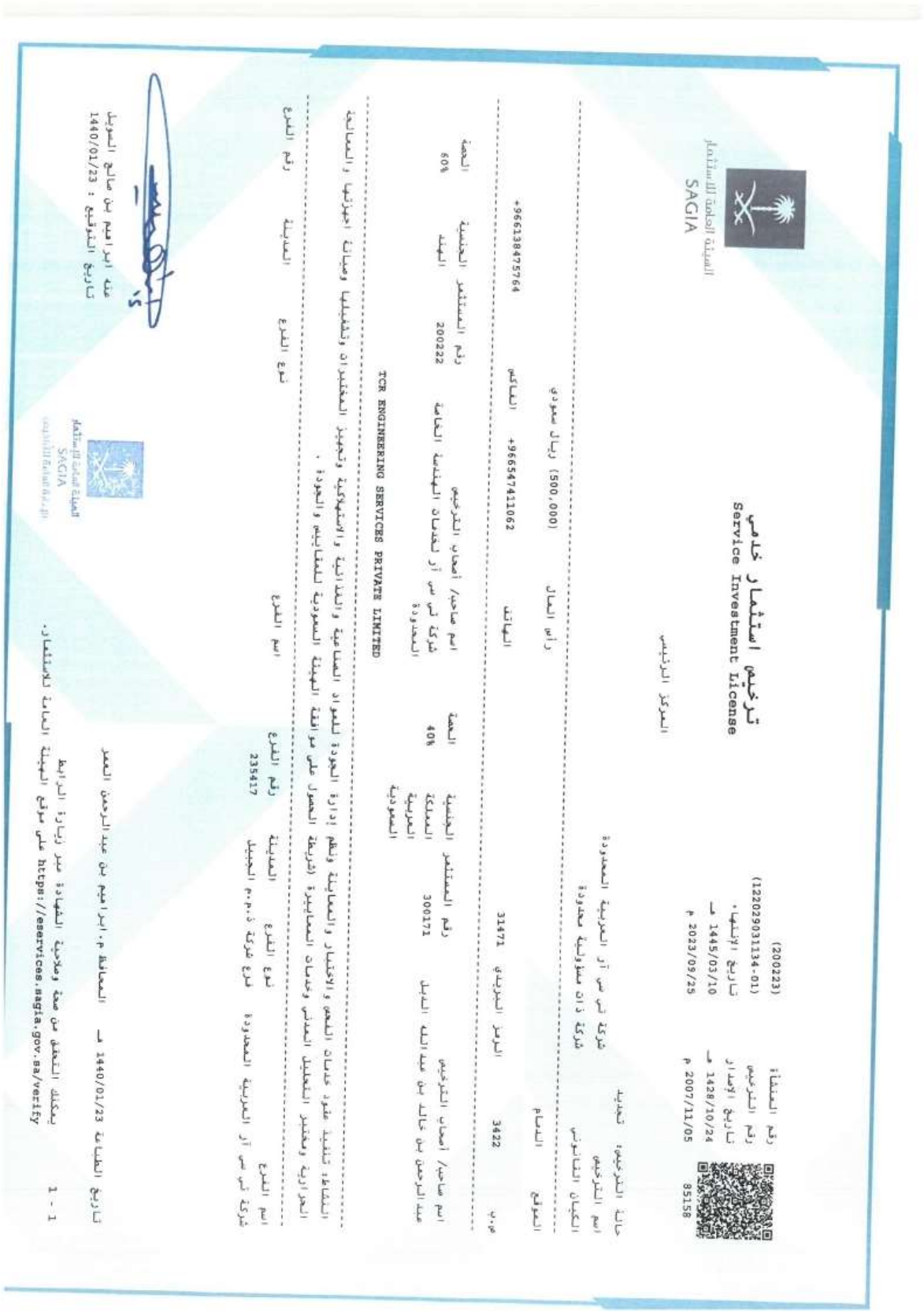
الهيئة العامة للاستثمار
Saudi Arabian General Investment Authority

مركز الخدمة الشاملة
الشرقية

عنه
بدر عبدالعزيز الفوزان
Governor and Chairman of the Board of Directors

2 - 02588

Figure 3: SAGIA Approval for TCR Arabia in Arabic



ترخيص استثمار خدمي
Service Investment License

المركز الرئيسي

رقم المنشأة (200223)
رقم الترخيص (1220290311340-01)
تاريخ الإصدار 1428/10/24 هـ
تاريخ الإنتهاء 1445/03/10 هـ
2007/11/05 م
2023/09/25 م

حالة الترخيص: تعديل
اسم الترخيص شركة تي سي آر العربية المحدودة
الكيان القانوني شركة ذات مسئولية محدودة

الموقع الدمام
ص.ب 3422 الرمز البريدي 31471
اسم صاحب/ أصحاب الترخيص شركة تي سي آر لخدمات الهندسة الخاصة المحدودة
الجنسية المملكة العربية السعودية
الحصة 40%
عبد الرحمن بن خالد بن عبد الله الدبيل
رقم المستثمر 300171

TCR ENGINEERING SERVICES PRIVATE LIMITED

الجنسية الهند
الحصة 60%
رقم المستثمر 200222
رأس المال (500,000) ريال سعودي
الهاتف +966547411062 الفاكس +966138475764

النشاط: تنفيذ عقود خدمات الطحن والاختبار والمعايرة ونظم إدارة الجودة للمواد الصناعية والخدماتية والاستهلاكية وتجهيز المختبرات وتشغيلها وصيانة اجهزتها والمعالجة الحرارية ومختبر التحليل الحدثي وخدمات المعايرة (شريطة الحصول على موافقة الهيئة السعودية للمقاييس والجودة .

اسم الفرع شركة تي سي آر العربية المحدودة نوع الفرع فرع شركة ذ.م.م الجبيل رقم الفرع 235417 المدينة الدمام

المعاينة م. ابراهيم بن عبد الرحمن العمر بتاريخ 1440/01/23 هـ
تاريخ الطباعة 1440/01/23 هـ
يمكنك التحقق من صحة وملاءمة الشهادة عبر زيارة الرابط https://eservices.sagia.gov.sa/verify على موقع الهيئة العامة للاستثمار.
1 - 1

اسم الفرع المدينة نوع الفرع رقم الفرع

عنه ابراهيم بن صالح السويل
تاريخ التوقيع : 1440/01/23

Figure 4: SAGIA TCR Arabia in Arabic 2023

التاريخ ١٤٤٤/٠٧/٠٨
الموافق ٣٠/٠١/٢٠٢٣
رمز الشهادة ٥٢١٠٠٠٩٧

المؤسسة العامة للتأمينات الاجتماعية
General Organization for Social Insurance

شهادة

إسم المنشأة : شركة تي سي أر العربية المحدودة
ص.ب : ٣٤٢٢ الدمام ٣١٤٧١
السعودية
رقم الإشتراك : ٥٠٢٣٥٣٧٦٤
رقم السجل التجاري: ٢٠٥٠٠٥٩٨٤٥

مصدره :

	رقما	كتابة
عدد المشتركين السعوديين	٣٣	ثلاثة و ثلاثون مشتركا
عدد المشتركين غير السعوديين	٣٢	اثنان و ثلاثون مشتركا
المجموع	٦٥	خمسة و ستون مشتركا

تشهد المؤسسة العامة للتأمينات الإجتماعية بأن المنشأة المذكورة أعلاه قد أوفت بإلتزاماتها تجاه المؤسسة وفق البيانات المقدمة منها حتى تاريخ إصدار هذه الشهادة ، والتي تم منحها لتقديمها لأية جهة تطلبها ، وهي صالحة لجميع الأغراض التي نص عليها نظام التأمينات الإجتماعية في المادة (١٩/٦) منه.

هذه الشهادة سارية المفعول حتى ١٤٤٤/٠٨/٠٨ هـ

يلزم التحقق من صحة وصلاحية الشهادة عبر زيارة الرابط أدناه في الموقع الإلكتروني للمؤسسة العامة للتأمينات الإجتماعية أو عن طريق استخدام الرمز المعرف التالي :

www.gosi.gov.sa/vc

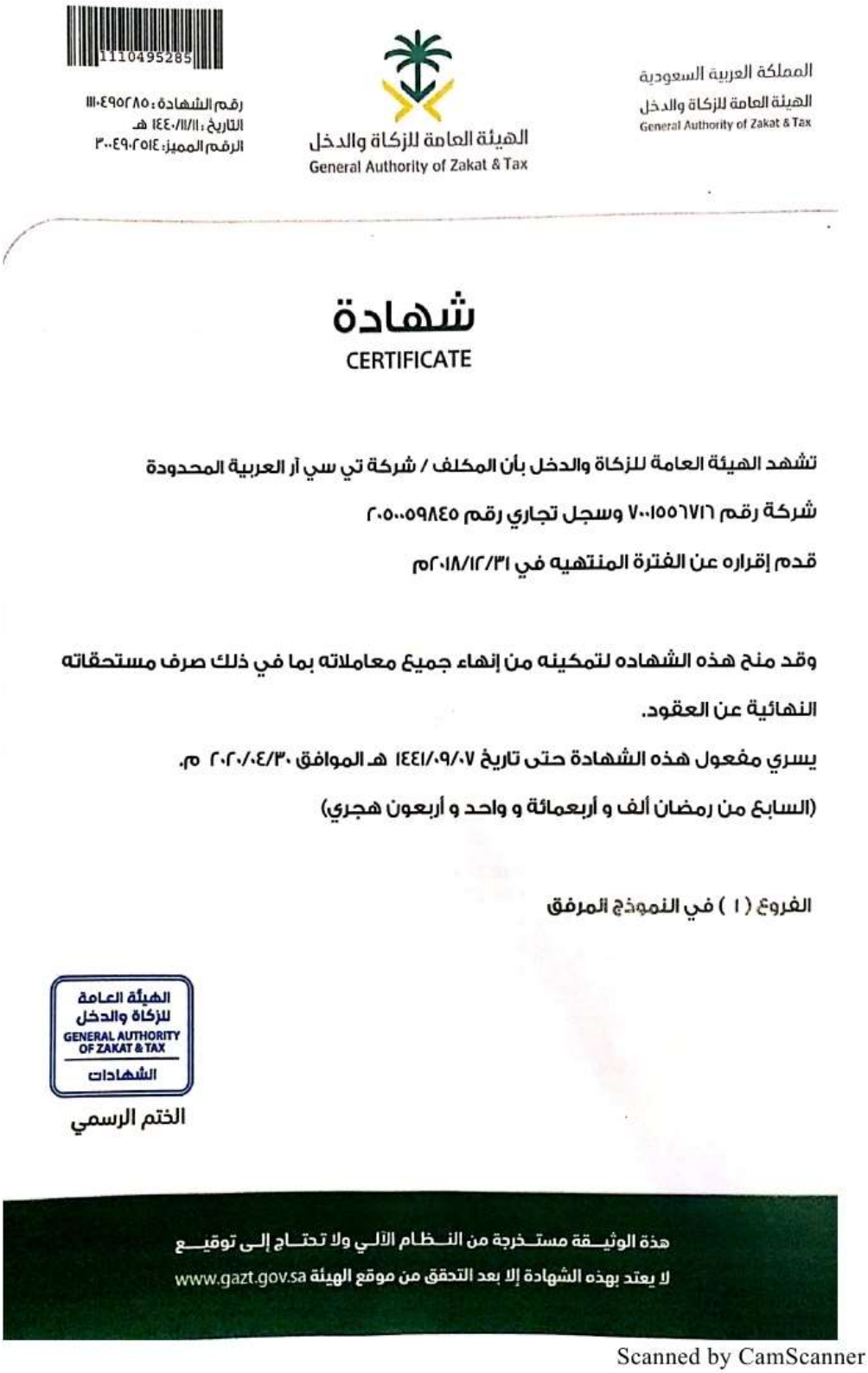
(الشهادة معتمدة من صاحب الصلاحية ولا تحتاج إلى توقيع أو ختم)

www.gosi.gov.sa
800 1243344

تعد هذه الشهادة من الوثائق الالكترونية الحكومية الرسمية ، ويحظر قطعيا تقليدها أو إدخال أي تعديلات عليها سواء بالإضافة أو الحذف أو التغيير في بياناتها أو غير ذلك من انواع التعديل ، وتعد الشهادة لاغية إذا شابها شيء من ذلك ، كما تعرض صاحبها للملاحقة النظامية أمام الجهات المختصة بالإضافة إلى ماقد يفرضه نظام التأمينات الاجتماعية من عقوبات ، ولايجوز تداول الشهادة إلا في الأغراض التي أصدرت لأجلها وفقا لأحكام نظام التأمينات الاجتماعية ، والمؤسسة العامة للتأمينات الاجتماعية غير مسؤوله عن أي آثار أخرى مترتبة قبل الغير عن الشهادة وغير مسؤولة عن أي عملية تزوير أو تعديل تتم على البيانات الواردة فيها .

GOSI التأمينات الإلكترونية بامكانك من مكانك

Figure 5: General Organization of Social Insurance



المملكة العربية السعودية
الهيئة العامة للزكاة والدخل
General Authority of Zakat & Tax

الهيئة العامة للزكاة والدخل
General Authority of Zakat & Tax

1110495285

رقم الشهادة: ١١١٠٤٩٥٢٨٥
التاريخ: ١٤٤٠/١١/١١ هـ
الرقم المميز: ٣٠٠٤٩٠٢٥١٤

شهادة
CERTIFICATE

تشهد الهيئة العامة للزكاة والدخل بأن المكلف / شركة تي سي آر العربية المحدودة

شركة رقم ٧٠٠١٥٥٦٧١٦ وسجل تجاري رقم ٢٠٥٠٠٥٩٨٤٥

قدم إقراره عن الفترة المنتهيه في ٢٠١٨/١٢/٣١م

وقد منح هذه الشهاده لتمكينه من إنهاء جميع معاملاته بما في ذلك صرف مستحقاته النهائية عن العقود.

يسري مفعول هذه الشهادة حتى تاريخ ١٤٤١/٠٩/٠٧ هـ الموافق ٢٠٢٠/٠٤/٣٠ م.

(السابع من رمضان ألف و أربعمائة و واحد و أربعون هجري)

الفروع (١) في النموذج المرفق

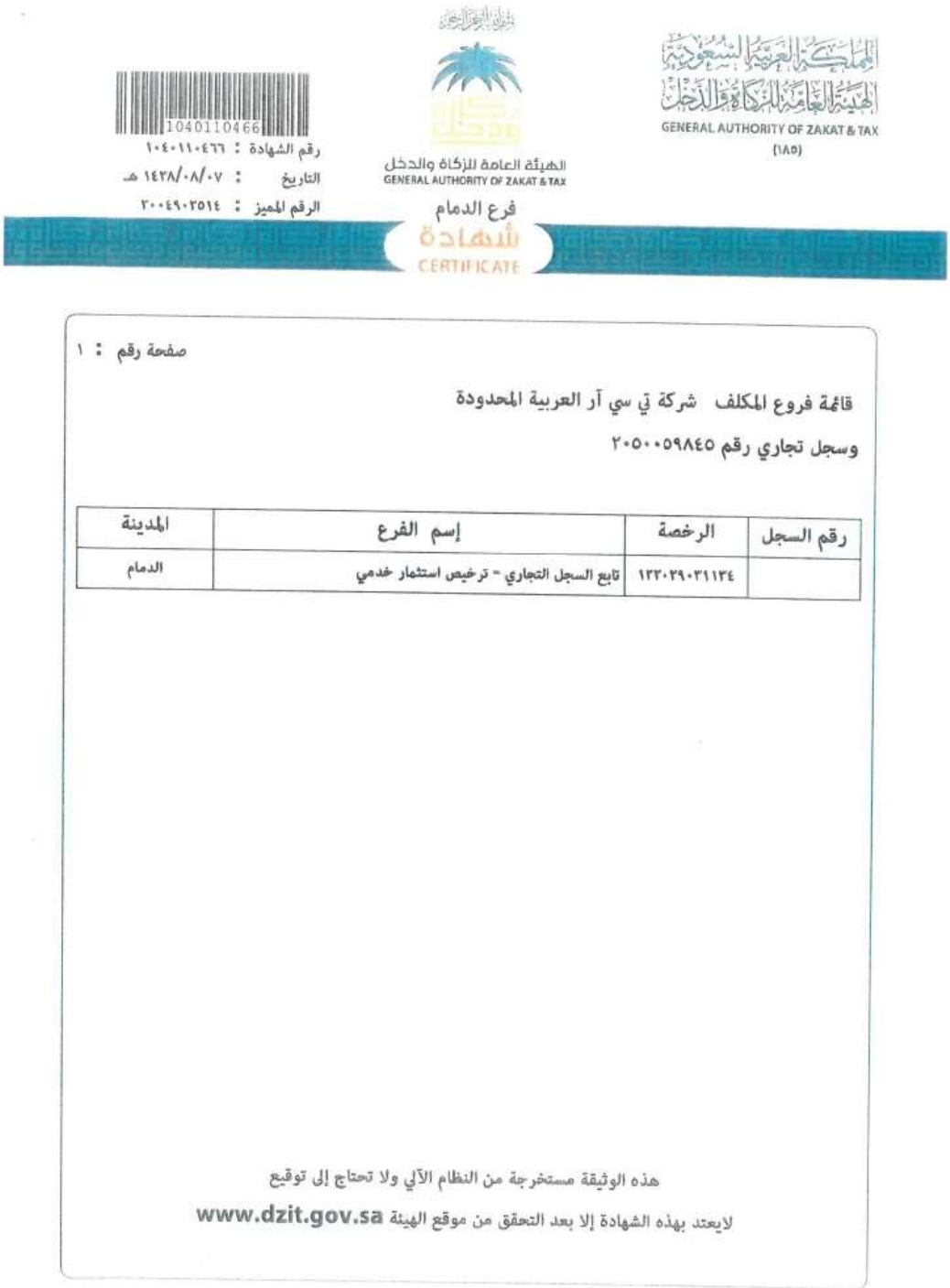
الهيئة العامة للزكاة والدخل
GENERAL AUTHORITY OF ZAKAT & TAX
الشهادات

الختم الرسمي

هذة الوثيقة مستخرجة من النظام الآلي ولا تحتاج إلى توقيع
لا يعتد بهذه الشهادة إلا بعد التحقق من موقع الهيئة www.gazt.gov.sa

Scanned by CamScanner

Figure 6: Zakat Certificate



المملكة العربية السعودية
الهيئة العامة للزكاة والدخل
GENERAL AUTHORITY OF ZAKAT & TAX
(١٨٥)

الهيئة العامة للزكاة والدخل
GENERAL AUTHORITY OF ZAKAT & TAX

1040110466

رقم الشهادة : ١٠٤٠١١٠٤٦٦
التاريخ : ١٤٢٨/٠٨/٠٧ هـ
الرقم المميز : ٣٠٠٤٩٠٣٥١٤

فرع الدمام

شهادة
CERTIFICATE

صفحة رقم : ١

قائمة فروع المكلف شركة تي سي آر العربية المحدودة

وسجل تجاري رقم ٢٠٥٠٠٥٩٨٤٥

رقم السجل	الرخصة	إسم الفرع	المدينة
	١٣٢٠٢٩٠٣١١٣٤	تابع السجل التجاري - ترخيص استثمار خدمي	الدمام

هذه الوثيقة مستخرجة من النظام الآلي ولا تحتاج إلى توقيع

لايعتد بهذه الشهادة إلا بعد التحقق من موقع الهيئة www.dzit.gov.sa

Figure 7: Zakat Certificate

Figure 08: Saudiazation Certificate

غـــرفـــة الشرقيـــة
ASHARQIA CHAMBER

شهادة اشتراك

رقم العضوية: 98211
الدرجة : الثانية
تاريخ الاصدار: 1440/02/14

تشهد الغرفة التجارية الصناعية بالمنطقة الشرقية بأن :
شركة تي سي آر العربية المحدودة
المقيدة بالسجل التجاري / الترخيص رقم (2050059845)
مشتركة لدينا لهذا العام
وينتهي سريان هذه الشهادة في 1445/02/17

صندوق البريد 3422 الدمام 31471

صدرت في 1440/02/14 الموافق 2018/10/23 م
رقم السند: 1-43947651 تاريخ الاشتراك: 1429/05/06 هـ 13703

P.O.Box 3422 DAMMAM 31471

التوقيع

Membership No :98211
Classification: Second
Date of Issue: 23/10/2018

Asharqia Chamber Certifies that :
T.C.R Arabia Company limited
Commercial Register No (2050059845)
Registered for this year
The certificate expires on2/9/2023

الرقم الموحد ٦١ ٣ ٠٠٠ ٩٢
فاكس ٠١٣ ٨٥٧٠٦٠٧

Unified number 92000 1361
Fax 013 8570607

نعمل معاً... لغد أفضل

www.chamber.org.sa
E-mail: info@chamber.org.sa

أو كشط أو تعديل في هذه الشهادة يلغيها

SF-MB-04/REV.05 / 01/07 / 2012

Figure 09: Chamber of Commerce

المملكة العربية السعودية
وزارة الداخلية
المديرية العامة للدفاع المدني
مديرية الدفاع المدني بالمنطقة الشرقية
إدارة الدفاع المدني بالدمام
مركز شرق الدمام

الدفاع المدني

تصريح الدفاع المدني

رقم التصريح : ١٤٣٤٠٧١٣٥٣٦٢ نوع التصريح : تجديد الفئة : ب
تاريخ الإصدار : ١٤٣٤/٠٧/١٣ هـ تاريخ الإنتهاء : ١٤٣٦/٠٧/١٣ هـ المدة : سنتان
اسم صاحب التصريح : شركة تي سي أر العربية المحدودة
السجل التجاري رقم : ٢٠٥٠٠٥٩٨٤٥ التاريخ : ١٤٢٩/٠٤/١٥ هـ المصدر : الدمام

الاسم التجاري : شركة تي سي أر العربية المحدودة
نوع النشاط : تنفيذ عقود خدمات الفحص والاختبار والمعاينة
العنوان : الخالدية الثانية شارع :
التقاطع : المساحة : ٢٤٤٠م٢ عدد الأدوار : ٢

وسائل السلامة المتوفرة

نوع الطفايات	السعة بالرطل	العدد
بودرة متعددة الأغراض		٦
ثاني أكسيد الكربون		٥
هالون		٠
مياه		٠
طفاية على عجل		٠
خراطيم مياه حريق بطول ٣٠متر	مقاس : ١,٥	٢
مضخة حريق أتوماتيكية تعمل على الديزل بقوة ٥٠جالون		٣

النوع	العدد	النوع	العدد
كاشف دخان	٤٠	أنوار طوارئ	٤
كاشف تسرب غاز	٠	صيدلية إسعاف أولية	١
أجراس إنذار	٠	لوحات تحذيرية	٨
نظام الرش الأوماتيكي	٠	مخارج طوارئ	٠
معدات الحماية الشخصية			
مولد كهربائي احتياطي / ديزل			
شبكة انذار حريق مبكر أتوماتيكية بلوحة تحكم			

مفتش السلامة
الاسم : إبراهيم أحمد حكمي
الرتبة : ملازم أول
التوقيع :

رئيس قسم العمليات
الاسم : ثامر عبدالرحمن الملحم
الرتبة : نقيب
التوقيع :

مدير مركز الدفاع المدني بشرق الدمام
الاسم : أحمد بن عبدالله العمري
الرتبة : رائد
التوقيع :

Figure 10: Civil Defense Certificate

100191004815740

تاريخ الإصدار: 2019/01/22
الرقم المميز: 3004902514

الهيئة العامة للزكاة والدخل
General Authority of Zakat & Tax

ضريبة القيمة المضافة
VAT

شهادة تسجيل في ضريبة القيمة المضافة
VAT Registration Certificate

تشهد الهيئة العامة للزكاة والدخل بأن المكلف أدناه مسجل في ضريبة القيمة المضافة بتاريخ 2017/08/24

Hereby, The General Authority of Zakat & Tax (GAZT) certifies that the taxpayer below is VAT registered on 24/08/2017

Taxpayer Name:	شركة تي سي آر العربية المحدودة	اسم المكلف:
VAT Registration Number:	300490251400003	رقم التسجيل الضريبي:
Effective Registration Date:	2018/01/01	تاريخ نفاذ التسجيل:
Taxpayer Address:	الدمام،الخالدية الجنوبية،طريق الملك عبد العزيز ،32224	عنوان المكلف:

كمكلف مسجل في ضريبة القيمة المضافة، لا يجوز لك تحصيل ضريبة القيمة المضافة من عملائك قبل تاريخ نفاذ التسجيل بالضريبة. في حال تبين غير ذلك، ستقوم الهيئة العامة للزكاة والدخل بتنفيذ الغرامات المستحقة

هذه الوثيقة مرسلة من النظام الآلي ولا تحتاج إلى توقيع
- الهيئة العامة للزكاة والدخل -

Figure 11: VAT Certificate

3. Organization Chart and Team Member Profiles

At TCR Arabia, we are dedicated to the belief that people are our most important asset. Whatever the nature of the challenge, whether meeting the quality assurance needs of our customers or the training needs of students, it is our passionate, committed and empowered people who ultimately make the difference. Trust is at the core of all ethical business dealings. Trust that others will do as they say and trust that we will live up to our commitments.

One key to building trust is being transparent in the way we communicate with others, and by providing timely and accurate information.

TCR Arabia's diverse and experienced professionals work together toward a common goal of excellence in every aspect of the business.

Our people are our strength. With deep commitment to their tasks, and a thirst to better their achievements, our highly skilled teams constantly push the envelope to develop innovative and superior solutions for all our clients.

During our recruitment process we identify the individual's skill sets and knowledge, which we then align with specific requirements of the role, our corporate culture, client expectations and our business goals. Each employee goes through rigorous training, which taps their immense talent and empowers them to maximize their potential, thus shaping them, from the very beginning, to deliver their best. Apart from the regular training, we offer our employees in-house NDT courses and metallurgical/failure analysis workshops.

A. Organization Chart

TCR Arabia has a strong organization with a culturally and geographically diverse population.

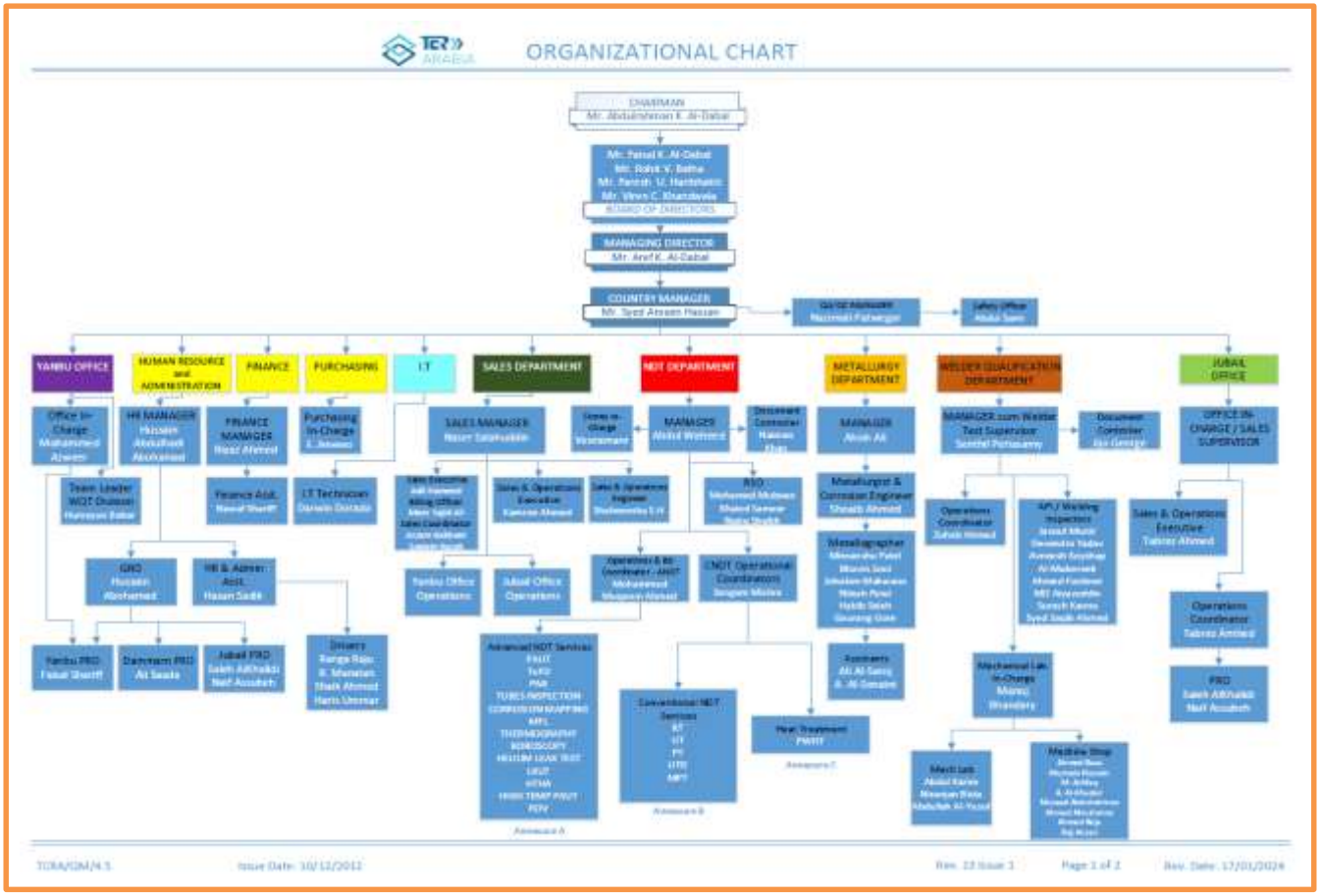


Figure 12: Organization Chart

B. Abdulrahman K. Al-Dabal, Chairman

Mr. Abdulrahman K. Al-Dabal is the President and CEO of Gas Arabian Services and Chairman of TCR Arabia.
BA in Business Economics from Ferris State College, Michigan, USA and Master of Business Administration (MBA – Finance) from KFUPM, Saudi Arabia. Mr. Abdulrahman K. Al-Dabal started GAS Arabian Services in the year 1992 and successfully developed business and formed several joint ventures with a vision of providing quality industrial products & services to all major clients in the Kingdom of Saudi Arabia. TCR Arabia was formed in 2007 as a result of a Joint Venture between GAS Arabian Services and TCR Engineering of India. Mr. Abdulrahman K. Al-Dabal has vast experience in supervising, managing and directing the organizations for a better growth. He has been instrumental in ensuring that safety & quality standards are adhered in all his organizations. Under the leadership of Mr. Abdulrahman K. Al-Dabal, TCR Arabia has managed to reach out to all major clients in KSA and other middle east countries offering wide range of advanced inspection and testing services.

C. V.K. Bafna, Director, TCR Arabia

Mr. V.K. Bafna is the Founder and Managing Director of TCR Engineering Services, Mumbai, India, a partner at TCR Advanced Engineering Services in Baroda, India and a JV partner of TCR Arabia, Kingdom of Saudi Arabia.

Mr. Bafna started TCR Engineering Services in 1973 and successfully led the company with outstanding year after year financial results. A visionary with sound material sciences experience, strong business acumen and relentless sincerity, he is the father of this organization and the key management executive to mold and mature the organization. With clear sense of purpose and urgency, realizing the need of

the industry TCR became India's reliable and leading ISO 17025 accredited materials testing & contract research firm.

Through hard work, dedication, integrity and love for his field, Mr. Bafna gained 38 years of practical experience in the areas of corrosion detection, chemical analysis, mechanical testing, failure analysis and materials characterization. He has introduced innovative methods for Corrosion Studies, Non Destructive Testing and is a pioneer in showcasing the advantages of XRF-based positive material identification to the industry.

With strong domestic and international management experience driving market share, revenue, profit growth coupled with specialized material sciences knowledge, Mr. Bafna´s leadership has resulted in exceptional annual growth rates. Under his direction, TCR continues to build a seasoned management team and organically expand across multiple geographies, verticals, and practice lines. TCR today has two test laboratories in Mumbai - India, a state-of-the-art laboratory in Baroda – India, another testing laboratory in Kuwait, and a Sales Office in Maryland, USA. His superior strategic aptitude has widened the horizons of TCR to include RoHS, Inspection Services, Material Sciences Training Institute and Resource Outsourcing.

Building a customer base of Fortune 1000 companies with trusted leadership and advice, Mr. Bafna has developed and defined a new approach to the material testing, research and inspection services delivery model that increases the speed and efficiency while maintaining the high quality standards of the laboratory.
Mr. Bafna, is a gold medalist from the University of Indore and has two masters degrees to his credit. He has done Master of Engineering from the University of Toronto, Canada and Master of Industrial Management from the Clarkson College of Technology, Potsdam, New York.

V.K. Bafna is a member of various professional organizations such as American Society for Testing and Materials, Institute of Standard Engineers, ASM International, NACE, Non Destructive Testing Society of India, and Indian Institute of Metals. He is an ex-committee member of ASM India chapter.

Mr. Bafna's vast expertise in the field of laboratory testing has brought numerous laurels to TCR notable amongst them is an award of appreciation from the Indian Space Research Organization (ISRO) for the company's contribution to the Project ASLV. He has conducted workshop on "Value Driven Maintenance and Reliability for Process Industries" at International Quality and Productivity Center (IQPC) at Abu Dhabi, UAE in Sept. 2006 as well as conducted a seminar on "World Class Laboratory Management" at the Asia-Pac Conference, Mumbai, India in June 2006.

D. Paresh Haribhakti, Director TCR Arabia and Chief Failure Analyst

Mr. Paresh Haribhakti is the Managing Director of TCR Advanced Engineering Services in Baroda, India (a TCR Engineering Services partner company) as well as a director at TCR Arabia.

With more than 250 failure investigation cases of power plants, fertilizers, chemicals and petrochemicals industries, Mr. Haribhakti has intensive work experience to his credentials. He has solved materials engineering problems and performed failure analysis on components from petrochemical plants, oil and gas transmission pipelines, offshore structures, ships, pharmaceutical plants, food processing equipment, gas turbine engine components, and weldments.

Mr. Haribhakti investigates the available physical evidence, and performs the necessary tests to develop the most probable accident scenario. He simplifies complex engineering theory into easy to understand and useable concepts. He uses simple analogies, every day examples, and laymen terms to explain data and findings so clients, corporate executives, government officials, or attorneys may easily understand engineering concepts.

Mr. Haribhakti has specific experience in welding, heat treating and materials technology for oil & gas drilling and production applications, including production tubing, casing and downhole motor failures. Recently, Mr. Haribhakti was lead member of the Failure Investigation team consulting to Asia's largest refinery, RIL-Jamnagar, India for damage assessment work during a fire incident in their VGO-HT2 Plant. He has provided damage assessment of Hydrocracker reactors at Baiji refinery Iraq and also helped a customer procure second hand equipment from Taiwan by a Health assessment approach.

He is skilled in the use and application of scanning electron microscopy (SEM) in support of failure analysis and fracture identification. Mr. Haribhakti also undertakes Optical metallography and interpretation of microstructures, Remaining Life Assessment, provides Heat treatment solutions and studies the degradation of microstructure under high temperature high pressure conditions. He has done extensive research in study of hydrogen embrittlement of steels and stainless steels.

Research oriented creativeness of Mr. Haribhakti spearheaded the development of a powerful image analysis software for Metallurgical use - the Microstructure Characterizer Software (MiC). He has also developed a well respected chemical composition mapping method for identification of dilution in weld zone. He performs color metallography to increase the capabilities of interpretation of microstructure. He has also developed custom electrolytic polishing for carbon and alloy steel material.

Mr. Haribhakti has extensive knowledge of failure investigations on metallic components related to chemical/refinery plants and to general engineering. Experience ranges from cast iron, engineering steels, aluminum, copper alloys, stainless steels, and nickel base alloys to titanium. This includes all aspects of metallurgical investigations of offshore, marine, refinery and automotive components such as; turbine blades, compressors, gearboxes, motors, pumps, rotors, shafts, valves, pipe work, fasteners, boilers, pressure vessels, plain bearings, rolling bearings, gears, pistons, spark plugs, crankshafts, camshafts, engine valves and associated valve components.

Mr. Haribhakti is a Founder member of Metallography Society of India. He is an active member of the Institute of Engineers, Institute of Foundry Man, Indian Institute of Metals and Indian Institute of Welding. Mr. Haribhakti is a B.E. (Metallurgy) and M.E. (Materials Technology) from M.S. University, Vadodara.

E. Rohit Bafna, Director TCR Arabia

Rohit is currently Director Global Sales based in TCR World at Washington DC, USA. Rohit is responsible for sales operations of TCR Arabia in the Kingdom of Saudi Arabia and TCR in Kuwait, UAE, Malaysia and South Africa.

Rohit Bafna uses his social and web-media expertise coupled with exemplary global networking skills in a creative manner to play a pivotal strategic and creative role in driving brand growth for small growth companies. He has demonstrated experience in developing successful business plans and marketing/retail programs for services related businesses.

Rohit also plays a key role in developing and overseeing sales policies, objectives and initiatives. Rohit provides input on international cultural and legal issues as they pertain to sales and is involved in formulating marketing strategies to enhance company's position in all regions of the globe.

Under the leadership of Rohit Bafna, TCR, a Materials Testing and Engineering Services company expanded from being 120 India based employees to over 300 professionals worldwide working in offices in Saudi Arabia, Kuwait, Kenya, UAE, South Africa, India and Malaysia in 4 years. TCR has a strong roster of clients including Saudi Aramco, SABIC, Sasol, ADNOC, Petronas, Petrobras and Mombasa Refinery.

From 2001-2007, Rohit was working at the Data Center Operations for Verizon in Maryland, USA. At Verizon, Rohit was Head Unix Operations and was responsible for managing the Data Center with over 20,000 servers. Rohit has hands on technical abilities in IT and Web media which he used to win top clients for the company including Novartis, Yahoo, Four Seasons Hotels and Fedex.

From 1997-2001, Rohit worked at the International Business Development Head for MphasiS, an India headquartered software development company. As part of the initial group of employees, Rohit played a vital part in growing the company to over 3000 employees and secured large contracts including JP Morgan Chase, Singapore Airlines and ABN Ambro.

Prior to 1997, Rohit was the CEO of CyberAds Studio, a web-design and new media company. The company was a pioneer start-up in India and won business from large corporate houses including Essar, Skypak and Mahindra & Mahindra.

Rohit has excellent communication and presentation skills, is well travelled with strong interpersonal skills with ability to lead and motivate teams. Mr. Bafna has over 16 years of International Sales and Marketing experience. Rohit Bafna has a Bachelor's degree in Computer Sciences from California.

At TCR Arabia, Mr. Rohit Bafna has the cost and technical responsibility for execution of specific contract(s), including devising the planning, directing, and coordinating of project activities to ensure that project objectives are accomplished within the prescribed time and funding parameters. Where subcontracts are required, Mr. Bafna manages the development of specifications, statements of work, evaluation criteria, and requests for proposal. Mr. Bafna works with the material testing laboratory and engineering consulting divisions to analyze proposals with respect to cost/risk/quality, lead source selections and negotiation teams, and monitors subcontract costs, schedules, and technical performance. Mr. Bafna has over 10 years of Sales and Marketing in the Material Testing and Quality Assurance business. Rohit has undergone extensive training on Ultrasonic Testing using Time of Flight Diffraction (TOFD) at Olympus in Quebec, Canada.

F. Mr. Aref K. Al Dabal, Managing Director, BE Chemical Engineering

Mr. Aref K. Al-Dabal is TCR Arabia's managing director. Highly experience in the area of operational management. He is and strategist who always transform vision and strategic plans into workable outputs and benchmark achievements against main operational targets or goals. His key focal point maintain corporate effective costing and management. An executive with proven capacity in achieving business plans based from long term perspectives, he is also an advocate of organizational growth from both the aspects of financial and resources management. A great motivator and mentor of complex workforce from various nationalities. His proven track record of delivering optimal result in the areas of planning, management and leadership helps TCR Arabia attain its corporate goals lining with mission, vision and core values.

G. Syed Ameen Hassan, Country Manager, B Com, MBA (Chifley, Australia)

Mr. Syed Ameen leads the TCR Arabia operations in Saudi Arabia. MBA in Marketing and Finance, from Chifley University, Australia. Mr. Syed Ameen has been instrumental in developing the business of TCR Arabia from its inception stage. Experience of over 17 years in the Saudi Arabian and Middle East market helps Mr. Syed Ameen to reach out to the decision makers and also run the operations in a professional manner. He monitors and regularly reports on sales goal progress. He Plans, budgets, monitors, controls and reports on expenditures in area of responsibility.

Under the leadership of Mr. Syed the KSA office has grown from its incubation stage to one which is now profitable. Syed Ameen has been instrumental in gaining long term contracts with major clients like Saudi Aramco, SABIC, TASNEE, MAADEN, PETRORABIGH etc.

Expansion of the organization by setting up new service areas like Microbiology Lab, Welder Qualification Department, Mechanical Testing Lab are some of key achievements, Operational alliance with major international service providers like PP Simtech of UK for RBI Studies, CANAP Engineering of India for stress analysis studies, CIA of Canada for Coker Drum Inspections, Cronhlom of Sweden for advance inspection were formed by Syed Ameen to provide advance inspection and technical support to all of TCR's valued clients in KSA.

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.

H. Abdul Waheed, NDT Manager, ASNT Level III, NDT Expert

Mr. Abdul Waheed is a Mechanical Engineer and leads TCR Arabia's ANDT Department in Saudi Arabia. He has a vast field experience of eight years in Advanced NDT inspection in major Refineries, petrochemical plants, Power plants, Pipe lines In-service, FPSO and Offshore projects around the globe.
holds ASNT NDT Level 3 & PCN Level 2 International Certifications, he has been influential in leading advance non-destructive testing services in TCR Arabia.

He has proven leadership capabilities, strives for quick solution. He is updated with the latest codes & techniques and believes in simplicity, which helps him to work impressively.

He has an expertise in handling various NDT Equipment's and conduct in-house training for development of Quality workforce. His unique ability to work creates technical solutions. professional experience includes Tube inspection, PAUT, LRUT, SRUT, Corrosion Inspection (high temperature),CUI, CUS, Leak testing, MFL inspection and highly skilled in Developing Scan plans, technique sheets, and procedures. Data Interpretation in the Oil/Gas and petrochemical industries for Tube Inspection, PAUT, TOFD of Heat exchangers, fabricated & in-service pipelines, new constructed vessels, in service vessels, reactor and Gas Coolers.

I. Syed Ahsan Ali, Metallurgist, BE Materials Engineering, API 510/653/571/580

Mr. Ahsan is a seasoned Metallurgist, hands-on practitioner, and expert having in excess of 6 years of broad spectrum of Metallurgical experience. He gained experience in conducting Metallurgical Consulting Failure Investigations especially on power utility boilers and pressure vessels including numerous other types of component, Corrosion Failures, Welding defects, and General Metallurgical Failure investigations. Have performed FI studies for different SABIC affiliates, MAADEN Phosphate and Saudi Railway on a range of equipment.

With a wealth of Metallurgical Experience and Expertise relating to the Metallurgical Condition Monitoring / Assessment of the microstructural remnant life of high temperature components - BOILERS, MAIN STEAM LINES & PRESSURE VESSELS - by means of the In-Situ Replication Technique, thus undertake & conduct Metallurgical Condition Assessment Assignments for numerous organizations abroad and locally. Have mastered the Technique of In-Situ Metallographic Replication (REPLICAS) so as to produce the finest microstructural images and the artifacts of the most difficult and tough to access components irrespective of the type of material in question.

J. Periasamy Senthil – Welders Qualification Department Head

Mr. Senthil is a Mechanical Engineer, He holds CSWIP,AWS, SCWI, API, AWS-SCNI Certification and ASNT Level III in Ultrasonic testing, Visual Testing, PCN Level II in Radiographic Interpretation, Liquid Penetrant Testing, MPT (Magnetic Particle Testing).

Mr. Senthil plays a role of Welders Qualification Department Head in TCR-ARABIA. As a Head he performs daily Inspection of piping fabrication, Inspection of daily fit-up, weld visual inspection and preparation of documents, Monitoring welder performance and weld repair status on weekly basis, Preparing QA/QC reports, Prepare the pre-punch list prior to hydro test, Documentation of Welding, NDT reports, Preparation of reports for client submittal, Welding material control, Welder control, Welding and welding repairs, Responsible to complete necessary documents for all witnessed items, Co-ordinating with construction supervisor / engineer, Reporting for poor workmanship and violation and Co-ordination with NDT crew and third party agencies.

Mr. Senthil has over 15 years of strong project management experience. He has the ability to read technical documentation, motivate team members and do resource allocation. Mr. Senthil co-ordinates with team members to ensure that all client or vendor provided drawings and specifications, technical surveys and major equipment reviews are in compliance with corporate and international standards.

K. Shoaib Ahmed, Metallurgist & Corrosion Engineer, BE Materials Engineering, API 571/580 Certified

Meticolous and methodical practitioner with over 3 years of experience across ME in Oil and Gas service industry, in analyzing and advising on Material Welding and Corrosion related issues in upstream and downstream equipments.
A diversely skilled Material and Corrosion Engineer with deep expertise across multiple functions including Mechanical and Metallurgical evaluation of materials, Material charazterization, identifying and characterizing welding defects, Corrosion related assessments, Corrosion studies, Corrosion testing, Welding Procedure Qualifications, Damage mechanism assessments for Fitness for Service (FFS) studies, Remaining Life Assessment studies and Failure analysis for integrity related studies.

L. Mohammed Salahuddin Naser, Sales Manager, Bachelor of Commerce

Mr. Naser Salahuddin has vast experience in Sales & Business Development. With over 9 years of experience in the field of Inspection, Non-Destructive Testing & related activites, he is capable of managing a team of Engineers & Coordinators to achive the set targets. Familiar with Saudi Arabian market, Naser has been instrumental in bringing major projects from SABIC, SATORP, Saudi Aramco and other notable clients in KSA.

Naser responsibilities include setting up sales plan and execute the same with the support from team of engineers and coordinators. On other hand he organize technical gatherings and manage TCR Arabia's presence in all conference and exhibition across Middle East.

M. Manoj Kumar Bhandari, Mech. Lab. In-Charge, BSC Chem, ASNT Level-2, UT,MPT,PT

Mr. Bhandari has 9 years of Experience in Inspection and Quality control activities for Destructive Testing's, Welding qualification (PQR-WQT), Macro-Etching, Reporting. Mr. Bhandari also done site project for TCR Arabia for PMI & insitu-metallography. Mr. Bhandari also attended ISO 17025:2005 internal Auditor training, Awareness & implantation, Estimation of Measurement Uncertainty.

His technical ability leads Mechanical laboratory in TCR-Arabia performs well. On-time data gathering, generating on-time report and sometimes urgent depending on how clients requested it. Mr. Bhandari

N. Mohamed Mubeen, ASNT Level III, RSO

Mr. Mohamed Mubeen is Radiation Safety Officer and ASNT Level III in TCR Arabia. He was graduated in B. Tech Mechanical Engineering and secured First Class with distinction. He holds NRRC approved RSO license, API and ASNT NDT Level III- RT certification.

A diversely skilled Inspection Engineer with logical approach to challenges across multiple functions including administration of department, provide training and qualifying NDT Level-II technicians & documentation to meet code/client requirements. Provide assurance, through established Management procedures, that the systems meet the requirements for continued safe work practice. To conduct Radiation risk assessment and to ensure the safety compliance of facility through radiation protection program. Expertise in dealing with export and import of radioactive materials. He has wide exposure to conventional and advanced NDT techniques. Performing inspection on piping & static equipment such as Pressure Vessel & Boilers, Towers, Columns, Reactors, Storage tank, Heat Exchangers etc.

Having hands-on experience in various engineering practice specialization, quality control management, good interpretations skills in international codes & standards and difference client requirement & specification like Saudi Aramco, SABIC, Royal Commission, etc.

O. Nazimali Petwegar, Civil Laboratory In-Charge

Mr. Nazim Ali is a graduate of M.Sc Chemistry and he has 5 years experience working in Qatar as laboratory in charge, his training and experience is exceptional, TCR believes that he can start and contribute on growth of organization by introducing Civil Laboratory works.

4. List of Equipment

TCR Arabia constantly spends a lot on capital purchases of the latest instruments. Our currently available list of instruments is enclosed in this section.

Destructive Testing

Name of Equipment	Model/ Type/ Make & IN SERVICE	Range/ Accuracy	Traceability
Universal Testing Machine with extensometer	MTS, USA	0-1000 kN ±1%	NPL
CharpyIzod Impact Testing Machine	MTS, USA	Charpy-300J Izod-156J	NPL
Brinell / Vickers Hardness Tester	Akash/FIE	HBW 80-400 Hv5 40-1200 Hv10- 80-1000±2%	NPL
Rockwell Hardness tester	RA/FIE	HRB 30-100 HRC 20-70 ±1%	NPL
V Notching Machine		2 mm V Notch	-
Hydraulic Test Pump	Electro-pneumatic	600kg/cm2	-
Muffle furnace	TCR	0-1000 Deg C	NPL
Salt Spray Tank temp. Controller Chamber Temp. Controller	Salt spray controller	0-85 Deg C	
Olympus inverted microscope	Olympus – GX51 inverted system	50X- 1000X	-
Optical Emission Spectrometer	Arcmet 8000	±10 % of Concentration	Daily Calibration
Electronic Weighing Machine	Metler, Swiss	±0.1mg	
Dial Vernier Caliper	Mitutoyo	0-150 mm	
External Micrometer	Mitutoyo	0-25 mm	
External Micrometer	Mitutoyo	0-25 mm	
Tube Micrometer	Mitutoyo	25-50 mm	
External Micrometer	Mitutoyo	25 mm	
Pipe Micrometer	Mitutoyo	0-15 mm	
Dial Vernier Caliper	TESA	0-15 cm	
Vernier Caliper	Aero space	0-20 mm	
Digital Vernier Caliper	TCR/DC/01	0-150 mm	
Vernier Caliper	Aero space	0-600 mm	
Dial Vernier Caliper	Mitutoyo	0-200 mm	
Pressure Gauges(Corrosion Lab)	TCR	0-70 Kg/Cm2	
Digital Thermometer with Sensor (New) for impact test	RTD	-196 To 50 Deg C	
High Pressure vessel (Autoclave)			
Acrylic vessel			
P H Meter			
HIC Lab Setup including Vessel, Cylinder, Controller and Detector			
SSC Lab Setup for 4 point bend test			
H2S Mask			
Temperature Sensors	2K408THC1666 to 69 & Sensor 5		
Constant temp.(Water)Bath	TCR	0-100	
Proving Rings	Sr. No.02035	12 kN	

Machine Shop

The machine shop includes wire cut machine, milling and lathe machines, hacksaw, drilling machine, stress-free grinding equipment, saws, surface grinders, and other tools.

Non Destructive Testing

Automated UT Using ToFD	OmniScan MX UT from Olympus, Canada with 8 channels capable of operating in both pulse-echo and through modes with HSMT-Flex Scanner and the following probes: 2 x C563-SM : 10MHz, 3mm TOFD composite probes 2 x C543-SM : 5MHz, 6mm TOFD composite probes 2 x ST1-45L (45 degree angle) 2 x ST1-60L (60 degree angle) 2 x ST1-70L (70 degree angle) 2 x Creeping TRL4FS45 2 x 3.5MHz probes 10mm 2 x SPE2-60S Remote pulser/receiver 200V / 40dB Tomoview software capable of collecting and storing full waveform signals and displaying the data in standard B-scan and C-scan imaging as well as TOFD imaging with vertical sizing algorithms.	Quantity: 6 machines
Helium Leak Testing	Alcatel ASM 142 with Helium Spray Probe, 10M Extension To Lds Probe, He Cal.Leak With Valve 1/3.10-9 DN25	Quantity: 1 machine
Eddy Current Testing	ect MAD 8D from Eddy Current Technology Incorporated (USA). This system is capable of inspecting any heat exchanger tube in the world (ferrous or nonferrous).	Quantity: 6 machine
Positive Material Identification (XRF)	Innox-Sys Alpha 2000 portable XRF alloy analyzer	Quantity: 3 machine
	Oxford Instruments Xmet 3000TX portable XRF alloy analyzer	Quantity: 3 machine
Positive Material Identification (OES)	Oxford Instruments Arcmet 8000 Bruker	Quantity: 3 machine
Acoustic Eye Tube Inspection		Quantity: 1 set
Automated Reformer Tube Inspection System		Quantity: 1 set
Dye Penetrant Testing	Consumables will be purchased as needed and will include: Penetrant Aerosol Cans Cleaner Aerosol Cans Developer Aerosol Cans	As Needed
Magnetic Particle Inspection	Parker Electromagnetic yoke (AC/DC) Ultraviolet Lamp (Black light) Extra U.V. Bulb ASTM Field Indicator Florescent Powder Wet visible Magnetic Powder Dry Magnetic Powder Centrifuge Tube with Stand White contrast Spray can	As Needed
Ultrasonic Testing	Modsonic (Einstein II DGS) Ultrasonic Testing Machine with built-in DGS/AVG curves for time proven flaw size evaluation. It has TCG (Time Controlled Gain) which compensates for amplitude decay with distance. Dynamic DAC curves which allow change of Test Range and Gain after plotting them	Quantity: multiple machines
Ultrasonic Corrosion Mapping (conventional method for piping or small locations)	Panametric Epoch LT	Quantity: 2 sets
Portable Hardness	Time HL-200	Quantity: multiple sets

Pipelines Thickness survey	Modsonic Ultrasonic Digital thickness gauge D-meter which gives readings in mm. Memory of 2000 Readings.	Quantity: 4 machine
Micro-Structural Analysis (including insitu-replica)	Kit includes: Microscope/ image analysis software such as TCR's MiC 2.0 /cutting/mounting/polishing and fume chamber for etching. For in-situ metallography: portable units like grinder/polisher/portable electrolytic polishing and etching unit. (Insipol 200)/portable microscope/ lab consumables/portable hardness tester.	Quantity: 4 Kits
Paint Inspection	Kit includes Wet paint thickness gauge(s), Dry paint film thickness gauge(s), Holiday detector(s), Hygrometer with dew point calculator and Metal surface thermometer.	Quantity: 2 Kit
Holiday Detection	P60 pulse porosity detector (thick coating) and PCI Wetsponge Pinhole detector (thin coating)	Quantity: 1 Kit
Ferrite Measurement	Fisher MP 30	Quantity: 1 machine
ROV Camera	Robotic Visual Inspection system for pipelines inspections	Quantity: 02 sets

Phased Array Instruments for Advanced NDT Inspection

Qty.	Part No.	Description
6 EA	U8100029	OmniScan MX and 16:128 Phased Array Acquisition Module for Manual UT Inspection (with 1 UT Channel). Included: AC ADAPTOR, 1 Battery, Small Carrying Case, 2GB CompactFlash Card, CompactFlash Reader, CD-ROM Including OmniScan Software User Manuals.
6 EA	U8143007	Multigroup option for phased array software versions 1.4 or 2.0 only
4 EA	U8143005	OmniScan TOFD Acquisition and Analysis software option including calibration tools. cursors. sizing. hyperbolic cursors. and lateral wave synchronization.
4 EA	U8330806	5L64-38.4X10-A12-P-10-OM PROBE
4 EA	U8330648	5-L-16-9.6X10-A10-P-2.5-OM,SXT : XAAB-0171: Phased-Array Ang
4 EA	U8720545	Standard wedge for angle beam phased-array probe A10. normal scan. 55-degree shear wave. plain wedge (without irrigation holes and carbides)
4 EA	U8721019	Custom wedge for angle beam phased-array probe A10, Normal scan, 0-degree Longitudinal wave, plain wedge (without irrigation, holes, carbides). With a delay line of 55mm of rexolite
4 EA	U8720650	Standard Removabe IHC Option for SA10 Wedges. Work with the ADIX655 Fork (40mm large).
4 EA	U8720550	Standard Wedge for Angle Beam Phased Array Probe A12, Normal Scan, 55° Shear Wave, Plain Wedge (Without Irrigation Holes and Carbides).
4 EA	U8720708	Removable IHC (Irrigation Holes and Cabides) Ring for SA12 Wedges.
4 EA	U8720549	Standard wedge for angle beam phased-array probe A12. normal scan. 0-degree longitudinal wave. plain wedge (without irrigation. holes. carbides).
6 EA	U8780197	Mini encoder. 2.5Â m cable. waterproof with DE15 connector for OmniScan MX. Includes bracket kit.
4 EA	U8330094	3.5L16-25.6X16-A3-P-2.5-OM PROBE
2 EA	U8750015	HS10-X01 HAND SCANNER MOUSE TYPE
4 EA	U8720140	SA3-0L-IHC STANDARD WEDGE
4 EA	U8720143	SA3-N45S STANDARD WEDGE
4 EA	U8720147	SA3-N60S STANDARD WEDGE
4 EA	U8780217	MOUNTING RACKET FOR ENC1 Mounting Brackets for mini wheel encoder OMNI-A-ENC1. Compatible with Standard Phased-Array probe/wedge assembly for manual encoded scan

Heat Treatment

Electric Resistance PWHT	70 KVA Power Source Forced air cooled with 6 Way Contactorised Energy Regulator Control "H" Class Insulation with Transformer over Temperature Protection Input Supply – 380/415/440 Volts, 3 Phase, 50 Hz 3 Wire System, Output 32/ 42/65 Volt. Each 70KVA Power source can feed 24 heating elements of 32/42/65 V Cabling System for 70KVA Power 30 Sq.mm HOFR Supply and Return cable 25m long with Male & Female Cam locks (12 Numbers). 4 Way Splitter Cable (12 Numbers) 6 Channel Fully Automatic Micro-Processor based Ramp Soak PID / ON-OFF Programmer for carrying out PWHT in Auto mode (West U.K Make) with Input supply 85 to230V. Chino make 12 Point temperature recorder, housed in Steel casing with Panel mounting T/C socket ,180mm chart width, range 0-1200 Deg. C Input supply 110 or 230V. Model EH-100 Thermocouple Attachment Unit (Input supply 230V) Ceramic Mat Heaters 60 / 65 Volts, 2.7 / 3.25 KW Rating of the following sizes - CP-6 (36 Numbers), CP-8 (36 Numbers), CP-10 (36 Numbers), CP-12 (36 Numbers), CP-16 (36 Numbers), CP-48 (18 Numbers) 21/22 s.w.g. K Type insulated Thermocouple wire 100m roll (10 rolls). Compensating Cable, 25m long with plug and socket (12 Numbers)	Quantity: 15 machines

TCRA-PWHT-001	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/06/103, Programmer : Sl# PC-6/1514/07-08 Recorder S#:70313842	1 set	India
TCRA-PWHT-002	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/06-07/106, Programmer : Sl# PC-6/1515/07-08 Recorder S#:80214864	1 set	India
TCRA-PWHT-003	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/06-07/108, Programmer : Sl # PC-6/1516/07-08 Reorder S#:80214863	1 set	India
TCRA-PWHT-004	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/06-07/107, Programmer : Sl # PC-6/1517/07-08 Recorder S#:80214929	1 set	India

TCRA-PWHT-005	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/08-09/104, Programmer : Sl # PC-6/1518/07-08 Recorder S#:80315348	1 set	India
TCRA-PWHT-006	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/08-09/113, Programmer : Sl # PC-6/1519/07-08 Recorder S#:8061674	1 set	India
TCRA-PWHT-007	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/1112/139, Programmer : Sl # PC-6-1562-11-12, Recorder S#:12026862	1 set	India
TCRA-PWHT-008	**PWHT - Main Unit 70 KVA, Programmer & Recorder**	Main Unit : Sl # PS/70/1112/140, Programmer : Sl # PC-6-1561-11-12, Recorder S#11115084	1 set	India
TCRA-TOFD-001	**ToFD - Olympus Omni scan Machine**	S/N: 5197/1640	1 no.	Canada
TCRA-TOFD-002	**ToFD - Olympus Omni scan Machine**	100609/5264	1 no.	Canada
TCRA-PAUT-001	**Phased Array - Omniscan MX1**	101704 / 600686	1 no.	Canada
TCRA-PAUT-002	**Phased Array - Omniscan MX2 (Touch Screen)**	101704 / 600686	1 no.	Canada
TCRA-PAUT-003	**Phased Array - Omniscan MX2 (Touch Screen)**	103576/ QC-008725	1 no.	Canada
TCRA-TD-HS-001 & 002	**TD Handy-Scan RX (AUT corrossion Mapping)**	HS0174	1 no.	USA
TCRA-TD-HS-001	**TD Handy-Scan RX (AUT corrossion Mapping)**	RX00124	1 no.	USA
TCRA-TD-HS-001 & 002	**Thermal Scan - Industrial Automated Inspection Scanner**	SN: 2012	2 nos.	USA
TCRA-ECT-001	**ECT - 48 LT 4F8C, Computer & ECT 4F,8C Board - One set**	D 1703, 2238	1 no.	USA
TCRA-ECT-002	**ECT- Technofour Eddy Current Tester "SD-PC-11**	SDPC/57/12	1 no.	USA
TCRA-ECT-003	**MS5800 ECT/RFT/MFL/IRIS 1ch US**	941134	1 no.	Canada
TCRA-ECT-004	**ECT EDDIFY Ectane 2 Tube Inspection**	1507801	1 no.	UK
TCRA-UFD-001	**UT - Digital Ultrasonic Flaw Detector Modsonic**	E1288-1007	1 no.	India
TCRA-UFD-002	**UT - Digital Ultrasonic Flaw Detector Modsonic**	E1814-1108	1 no.	India
TCRA-UFD-003	**UT - Digital Ultrasonic Flaw Detector Modsonic**	D0155-4509	1 no.	India

TCRA-UFD-004	**UT - Digital Ultrasonic Flaw Detector Modsonic**	E3321-0412	1 no.	India
TCRA-UFD-005	**UT - Digital Ultrasonic Flaw Detector Modsonic**	E3494-0912	1 no.	India
TCRA-UFD-006	**UT - Digital Ultrasonic Flaw Detector Modsonic**	D0238-3812	1 no.	India
TCRA-UFD-007	**UT - Digital Ultrasonic Flaw Detector (SonoScreen ST 10)**	10160	1 no.	Germany
TCRA-UFD-008	**UT - Digital Ultrasonic Flaw Detector (SonoScreen ST 10)**	10161	1 no.	Germany
TCRA-UTG-001	**UTG - Ultrasonic Thickness Gauge (Olympus) MG2XT 7906SM-E**	90626601	1 no.	Canada
TCRA-UTG-002	**UTG - Ultrasonic Thickness Gauge (Olympus) 38 DLP**	120544111	1 no.	Canada
TCRA-UTG-003	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG**	130189308	1 no.	Canada
TCRA-UTG-004	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG**	130191608	1 no.	Canada
TCRA-UTG-005	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG**	130214709	1 no.	Canada
TCRA-UTG-006	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG**	130214809	1 no.	Canada
TCRA-UTG-007	**UTG - Ultrasonic Thickness Gauge (EHC-09DL-W)**	5056461	1 no.	Canada
TCRA-UTG-008	**UTG - Ultrasonic Thickness Gauge (Olympus) 37 DLP**	101788303	1 no.	Canada
TCRA-UTG-009	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG (w/ A-Scan)**	140506012	1 no.	Canada
TCRA-UTG-010	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG (w/ A-Scan)**	140505912	1 no.	Canada
TCRA-UTG-011	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG (w/ A-Scan)**	140483110	1 no.	Canada
TCRA-UTG-012	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG (w/ A-Scan)**	150524601	1 no.	Canada
TCRA-UTG-013	**UTG - Ultrasonic Thickness Gauge (Olympus) 45MG (w/ A-Scan)**	150523901	1 no.	Canada
TCRA-PMIO-001	**PMI (OES) Machine (ARCMET 8000)**	800517	1 no.	USA
TCRA-PMIO-002	**PMI (OES) Q4 Mobile (Bruker)**	4565	1 no.	Germany
TCRA-PMIX-001	**PMI (XRF) Machine (Innov-X Alpha 2000) 1-3500**	541233	1 no.	Canada

TCRA-PMIX-002	**PMI (XRF) Machine DPO-2000-CC**	9511	1 no.	Canada
TCRA-TC-001	**Thermography Camera (FLIR T620)**	55904756	1 no.	USA
TCRA-TC-002	**Thermography Camera (FLIR T620)**	55907168	1 no.	USA
TCRA-BS-001	**Boroscope IV88100LI-IPLEX - LX**	Y203143	1 no.	Canada
TCRA-BS-002	**Boroscope IV88200L2-IPLEX - LX/LT**	Y70T863	1 no.	Canada
TCRA-HT-001	**HT - Hardness Testing Machine - Mitec**	8587	1 no.	UK
TCRA-HT-002	**HT - Hardness Testing Machine - (HL 200) DIGITAL**	HL0116062701	1 no.	China
TCRA-HT-003	**HT - Hardness Testing Machine - (HL 200) DIGITAL**	HL0116062702	1 no.	China
TCRA-FM-001	**Ferrite Meter (MP30) - Fischer (with Calibration or V-Block-N0-0484)**	S/N: 150002380	1 no.	USA
TCRA-Rep-001	**Replica Kit**		3 nos	India
TCRA-MsM-001 - 003	**INSIPOL 2000 Microstructure Machine (Replica)**	S/N: 2K15110201	3 nos	India
TCRA-MFL-001-A	**MFL Machine FM3D**	S/N: 2361208	1 no.	UK
TCRA-MFL-001-B	**MFL Hand Scan Machine**	S/N: 2371208	1 no.	UK
TCRA-MFL-001-C	**MFL HS/PS Electronic Module - Site Master**	S/N: 2371208E	1 no.	UK
TCRA-HLM-001	**Helium Leak Machine**	S/N: FC13001117	1 no.	Germany
TCRA-MPI-001 - 006	**MPI Yokes 110v & 220V**	24728	8 nos.	USA

Thermography:

Thermography Camera: FLIR T620	QTY 3 NO	

Camera Specifications	
Resolution	640 x 480
Total Pixels	307,200
Thermal Sensitivity	0.045C
Accuracy	+/-2% or 2C
Temperature Range	-4F to 1,202F (-20C to 650C)
Lens Options	Standard:25; Optional: 45, 15, 100, 50
Zoom	4x Continuous Digital
Focus	Auto & Manual
Uncooled Microbolometer	Yes
Color LCD Touchscreen	4.3" Bright Touch
Video Camera with Lamp	5 MP
Fusion	PIP Scalable & Moveable
Laser Spot	Yes
Video Out	HDMI/DVI
Frame Rate	30Hz
Analysis	
Professional	Yes
Delta T	Yes
Annotation	
Voice (60 seconds)	Yes
Text & Sketch	Yes
Draw Direct	Yes
Periodic Image Storage	Yes
Other	
Joystick Control	Yes
Wi-Fi to Mobile Devices	Yes
Bluetooth to PC/Smartphone	Yes
MeterLink	Yes
Instant Report	Yes
FLIR Tools	Yes
Weight	2.87 lb (1.3 kg)
Warranty	2 Years Parts & Labor
Warranty (Battery)	5 Years
Warranty (Detector)	10 Years

5. Customers and Project Completion

TCR Arabia believes in establishing long-term, strategic relationships with fewer clients as opposed to short-term, opportunity-based relationships with many. In our constant endeavor to deliver superior value, right from our visual inspection down to each of our engagements, our focus remains on translating our clients' QA vision into solid, measurable value. As a result we hold ourselves accountable for delivering quality results, all the way from the top down to each member of an engagement. We are also willing and interested in making mutual investments in key areas for our clients in order to deliver win-win outcomes for everyone.

One of our major differentiators remains our ability and commitment to develop and sustain strong relationships at senior levels with our clients. The cornerstone of our partnership approach lies in our belief that in order for any partnership to succeed, both partners have to value and respect each other as equals.

TCR Arabia greatly values the relationships that it has established with several customers in Saudi Arabia and is delighted to meet the technical needs of the client as well as meet the approval of inspection agencies such as Flour Daniel, Technicas, Technip, Foster Wheeler, Saudi Aramco and others.

A. Projects Completed by TCR Arabia

The current list of major projects completed by TCR Arabia in the Kingdom of Saudi Arabia includes:

CLIENT	LOCATION	SERVICES	DATE
ADVANCED NDT SERVICES			
SINOPEC, Petrorabigh	Petrorabigh Site	ToFD services	5-Jan-08
ENCOCORP, Jeddah	KAIA Site, Jeddah Airport	ToFD services	19-Jun-08
TEKFEN, Khurais	Khurais, Saudi Aramco	ToFD services	18-Aug-08
TEKFEN, Khurais	Khurais, Saudi Aramco	ToFD services	18-Aug-08
TEKFEN, Petrorabigh	Petrorabigh Site	ToFD services	10-Oct-07
Husseini Inspection	Al-Bayroni- Jubail	ToFD services	10-Sep-09
Petrolsteel ToFd	Jubail	ToFD services	13-Apr-10
Petrolsteel	Jubail	ToFD services	2-Oct-10
Petrorabigh Shut down Job	Rabigh	ToFD services	2-Apr-11
SinSina	Qurayyah	ToFD services	16-Oct-11
KUWAIT OIL COMPANY – KOC	Kuwait	ToFD services	2008
TEKFEN – PETRORABIGH	Rabigh	ToFD services	2008
SINOPEC – PETRORABIGH	Rabigh	ToFD services	2008
TEKFEN - SAUDI ARAMCO	Khurais	ToFD services	2009
ENCOCORP - KAIA AIRPORT	Jeddah	ToFD services	2010
SABIC - AL BAYRONI	Jubail	ToFD services	2010
ADVANCED PETROCHEMICAL COMPANY	Jubail	ToFD services	2011
MC. DERMOTT – FMQ	Khursaniyah	ToFD services	2011
PETRORABIGH	Rabigh	ToFD services	2011
SINOPEC	Rabigh revamp	ToFD services	2012
SABIC – UNITED	Jubail	ToFD services	2012
ZAMIL HEAVY INDUSTRIES	Jeddah	ToFD services	2012
SIN SINA	Qurrayah	ToFD services	2011
TURB ARABIA	Qurrayah	ToFD services	2012
SABIC – STC	Jubail		2013
SAUDI ARAMCO	Safaniyah	ToFD services	2013
SAUDI ARAMCO	Qatif	ToFD services	2013
ADVANCED PETROCHEMICAL COMPANY	Jubail	ToFD services	2014

SAUDI ARAMCO	Khursaniyah	ToFD services	2014
U-SONIX INSPECTION SOLUTIONS PVT LTD	Jeddah	ToFD services	2015
SHAMS MOHSEN CONTRACTING	Rastanoura	ToFD services	2015
SABIC - SAUDI KAYAN	Jubail	ToFD services	2016
SAUDI ARAMCO	Hawiya	ToFD services	2016
GE POWER & WATER	Jordan	ToFD services	2017
SAUDI ARAMCO	Udhaliyah	ToFD services	2017
GULF PETROCHEMICAL INDUSTRIES CO	Bahrain	ToFD services	2017
SATORP	Jubail	ToFD services	2018
APPC	Jubail	ToFD services	2018
SINOPEC-Safco IBB	Jubail	ToFD services	2018
Zamil HEAVY INDUSTRIES	Dammam	ToFD services	2019
PETRORABIGH	Rabigh	ToFD services	2019
Safco	Jubail	ToFD services	2019
Sabic Yansab	Yanbu	ToFD services	2019
Zamil	Dammam	ToFD services	2020
Petro Rabigh	Yanbu	ToFD services	2020
SAFCO-IBB	Jubail	ToFD services	2020
SAFCO	Jubail	ToFD services	2021

ADVANCED PETROCHEMICAL COMPANY	Jubail	PAUT Service	2013
TASNEE (SAUDI ETHYLENE &POLYETHYLENE CO)	Jubail	PAUT Service	2013
SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)	Rastanoura	PAUT Service	2013
PROFESSIONAL INDUSTRIAL SERVICES EST.(PISCO)	Jubail	PAUT Service	2013
FARABI PETROCHEMICALS CO.	Jubail	PAUT Service	2013
GE ENERGY POWER & WATER	Dammam	PAUT Service	2014
AL - WAHA PETROCHEMICALS COMPANY	Jubail	PAUT Service	2014
SABIC - IBN ZAHR	Jubail	PAUT Service	2014
SABIC - UNITED	Jubail	PAUT Service	2014
GE ENERGY MANUFACTURING TECHNOLOGY	Dammam	PAUT Service	2014
SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)	KHURSANIYAH	PAUT Service	2015
SEIMENS - ISCOSA	Dammam	PAUT Service	2015
SABIC - SAFCO	Jubail	PAUT Service	2015

SAMSUNG SAUDI ARABIA	Shayba	PAUT Service	2015
SABIC - SAUDI KAYAN	Jubail	PAUT Service	2015
SENDAN INTERNATIONAL	Jubail	PAUT Service	2015
KANOOZ INDUSTRIAL SERVICES	Jubail	PAUT Service	2015
H.K. AL SADIQ SONS CONTRACTING CO. LTD	Jubail	PAUT Service	2015
NTS SAUDI CO. LTD	Dammam	PAUT Service	2015
NORTHERN REGION CEMENT CO.	Najran	PAUT Service	2016
GREAT LAKES DREDGE & DOCKS - SEA PORT	Dammam	PAUT Service	2016
TASNEE (SAUDI ETHYLENE &POLYETHYLENE CO)	Jubail	PAUT Service	2016
SABIC - UNITED	Jubail	PAUT Service	2016
SHAMS MOHSEN CONTRACTING - ARAMCO	Rastanoura	PAUT Service	2016
CTCI - IBN SINA	Jubail	PAUT Service	2016
SABIC - IBN ZAHR	Jubail	PAUT Service	2016
SABIC - UNITED	Jubail	PAUT Service	2016
SABIC - SAFCO	Jubail	PAUT Service	2016
MOHD. BIN HASAN BIN MAKKI AL - MUZAIN	Jubail	PAUT Service	2017
ADVANCED PETROCHEMICAL COMPANY	Jubail	PAUT Service	2017
SABIC - SAFCO	Jubail	PAUT Service	2017
AL RUSHAID CONSTRUCTION CO. LTD	Jubail	PAUT Service	2017
SABIC - SHARQ	Jubail	PAUT Service	2017
INDUSTRIAL MINERALS COMPANY (MAADEN)	RAS AL KHAIR	PAUT Service	2017
SABIC - SABTANK	Jubail	PAUT Service	2017
H.K AL SADIQ SONS CONTRACTING CO. LTD	Jubail	PAUT Service	2017
SENDAN INTERNATIONAL COMPANY - ARRAZI	Jubail	PAUT Service	2017
NORTHERN REGION CEMENT CO.	Najran	PAUT Service	2017
SABIC - SHARQ	Jubail	PAUT Service	2017
SABIC - IBN ZAHR	Jubail	PAUT Service	2017
MUZAIN - SAFCO	Jubail	PAUT Service	2017
BAXTER COMPANY LIMITED	Dammam	PAUT Service	2017
SABIC - UNITED	Jubail	PAUT Service	2017
SABIC - SHARQ	Jubail	PAUT Service	2017
INDUSTRIAL MINERALS COMPANY (MAADEN)	Ras Al-Khair	PAUT Service	2017
SENDAN INTERNATIONAL COMPANY (PETROKEMYA)	Jubail	PAUT Service	2017

SENDAN INTERNATIONAL COMPANY (AR - RAZI)	Jubail	PAUT Service	2017
NDT CCS - SAFCO	Jubail	PAUT Service	2017
TASNEE (SAUDI ETHYLENE &POLYETHYLENE CO)	Jubail	PAUT Service	2017
SENDAN INTERNATIONAL COMPANY - ARRAZI	Jubail	PAUT Service	2017
SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)	KHURSANIYAH	PAUT Service	2017
SEIMENS - ISCOSA	DAMMAM	PAUT Service	2017
AL RUSHAID CONSTRUCTION CO. LTD - ARAMCO	RAS TANURA	PAUT Service	2017
MUZAIN - SAFCO	Jubail	PAUT Service	2017
ENPRO - ARRAZI	Jubail	PAUT Service	2017
SABIC - IBN AL BAYTAR	Jubail	PAUT Service	2017
SABIC - ARRAZI (ESD - IV)	Jubail	PAUT Service	2017
AL RUSHAID CONSTRUCTION CO. LTD - SAFCO	Jubail	PAUT Service	2017
PETROFAC SAUDI ARABIA CO. LTD.	Jubail	PAUT Service	2017
GE ENERGY POWER & WATER	Jordan	PAUT Service	2017
SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)	Aqaiaq	PAUT Service	2017
SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)	Hawiya	PAUT Service	2017
SABIC - SAFCO (IV)	Jubail	PAUT Service	2017
SABIC - ARRAZI (ESD - III)	Jubail	PAUT Service	2017
SABIC - SHARQ	Jubail	PAUT Service	2017
SATORP	Jubail	PAUT Service	2017
ADVANCED PETROCHEMICAL COMPANY	Jubail	PAUT Service	2017
ENGIE DHURUMA O & M	Riyadh	PAUT Service	2017
SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)	Qurrayah	PAUT Service	2017
GULF PETROCHEMICAL INDUSTRIES CO	Bharain	PAUT Service	2017
SATORP	Al Jubail	PAUT Service	2018
ADVANCED PETROCHEMICAL COMPANY	Al Jubail	PAUT Service	2018
Al Muzran-Rabigh	Ribigh	PAUT Service	2018
Saudi Cement	Dammam	PAUT Service	2018
SABTANK-Misa Arabia	Al Jubail	PAUT Service	2018
Dhurma O & M	Riyadh	PAUT Service	2018
IBNZAHR-Al Muzain	Al Jubail	PAUT Service	2018
Sendan International	Al Jubail	PAUT Service	2018
SMH Industrial Service	Al Jubail	PAUT Service	2018

MISA	Al Jubail	PAUT Service	2018
Star International	Al Jubail	PAUT Service	2018
SAFCO-IBB	Al Jubail	PAUT Service	2018
Sinopec -IBB	Al Jubail	PAUT Service	2019
KANOOZ INDUSTRIAL SERVICES	Jeddah	PAUT Service	2019
Sabic Yansab	Yanbu	PAUT Service	2019
Al Muzain / IBNZAHR	Al Jubail	PAUT Service	2019
Saudi Cement	Al Hufof	PAUT Service	2019
Sharq	Al Jubail	PAUT Service	2019
Weldding Alloy Middle East	Dammam	PAUT Service	2019
SWCC	Al Jubail	PAUT Service	2019
IBNZAHR	Al Jubail	PAUT Service	2019
Saudi KKEM	Al Jubail	PAUT Service	2019
Ar Razi	Al Jubail	PAUT Service	2019
TASNEE (SAUDI ETHYLENE &POLYETHYLENE CO)	Al Jubail	PAUT Service	2019
Sendan	Al Jubail	PAUT Service	2019
Safco 2	Al Jubail	PAUT Service	2019
Safco 3	Al Jubail	PAUT Service	2019
Arabian Bemco	Bahrain	PAUT Service	2019
Zamil	Al Jubail	PAUT Service	2020
Sendan	Al Jubail	PAUT Service	2020
Petrokemyah North	Al Jubail	PAUT Service	2020
IBB	Al Jubail	PAUT Service	2020
Petro Rabigh	Al Jubail	PAUT Service	2020
Sharq TCC	Al Jubail	PAUT Service	2020
Zamil	Al Jubail	PAUT Service	2020
HKSS	Al Jubail	PAUT Service	2020
Baxter	Al Jubail	PAUT Service	2020
JUPC	Al Jubail	PAUT Service	2020
SIPCHEM	Al Jubail	PAUT Service	2020
NTS	Al Jubail	PAUT Service	2020
Yanpet	Al Jubail	HIGH TEMPRATUREPAUT SERVICE	2020

Yanpet	Al Jubail	PAUT Service	2020
IBNZAHR	Al Jubail	PAUT Service	2020
Al Muzain	Al Jubail	PAUT Service	2020
Kemya	Al Jubail	PAUT Service	2020
SAFCO-IBB	Al Jubail	PAUT Service	2020
Ibnsina	Al Jubail	PAUT Service	2021
SaudiKayan	Al Jubail	PAUT Service	2021
Saudi Cement	Al Hofuf	PAUT Service	2021
SAFCO	Al Jubail	PAUT Service	2021
TASNEE (SAUDI ETHYLENE &POLYETHYLENE CO)	Al Jubail	PAUT Service	2021
Yansab	Yanbu	PAUT Service	2021
Aminat	Jubail	PAUT Service	2021
Petrokemyah North	Jubail	PAUT Service	2021
Safco -IBB	Jubail	PAUT Service	2021
Safco V	Jubail	PAUT Service	2021
SAFCO IV	Jubail	PAUT Service	2021
Sabic-United	Jubail	PAUT Service	2021
Sipchem	Jubail	PAUT Service	2021
Safco-Al Bayroni	Jubail	PAUT Service	2021
Dhurma -PP11	Dhurma	PAUT Service	2021
Sharq	Jubail	PAUT Service	2021

CONVENTIONAL NDT/TRAINING SERVICES			
Petrorabigh	Rabigh	Level I Training	28-Sep-08
TASNEE	Jubail	PT, MPI & UT Shutdown	22-Dec-08
Olayan Descon	Dammam	UT Training	18-Feb-09
CEPCO - SWCC Jubail Job	SWCC Jubail	NDT Services	11-Feb-09
SABIC (Ibn Sina)	Ibn-Sina, Jubail	NDT Services	16-Mar-09
Saudi Binladin	Mecca - Haram Site	PT Services	3-May-09
Husseini Inspection	Al-Bayroni- Jubail	ToFD, UT, MPT	10-Sep-09
TUV Rheinland	Dammam	Training - RT (II)	5-Nov-09
GATCO (Global Aqua Technologies)	Gizan/Abu Arish	UT Services	15-Dec-09

Gulf Power International Bisha Power Plant	Bisha Power Plant	ECT, UT, PT & MPT	25-Feb-10
SABIC (Ibn Sina)	Jubail	UT & PT Serivces	9-Mar-10
HYUNDAI	Jubail IWPP Project	ECT job	11-Mar-10
SAABIC (JUPC)	Jubail	NDT & Replica Job	26-Nov-10
Petrorabigh Shut down Job	Rabigh	ToFD & Ect Services	2-Apr-11
Al Tuwairiqi (THI) Job # 030	Dammam	NDT Services	7-Jun-11
Tecnicas Reunidas	Manifa	Boroscopic Inspection	12-Jul-11
Gulf Heavy Industries	Jubail	UT Services	11-Dec-11
Olayan Kimberly-Clark Co	Bahrain	Thermography Services	27-Dec-11

ENGINEERING CONSULTING/SHUTDOWN MANPOWER SERVICES			
SABIC (Ibn Zahr)	Ibn-Zahr, Jubail	Manpower	9-Jun-09
SIPCHEM	SIPCHEM Site, Jubail	Manpower	22-Jun-09
SWCC, Jubail	SWCC Jubail	RLA (Boiler 6, Phase 1)	22-Jun-09
SABIC (Safco)	SAFCO, Jubail	Manpower	4-Aug-09
SABIC (Ibn Zahr)	Jubail	Supply of NDT Technicians	22-Dec-09
GAS / Ibn-Zahr	Jubail	Insepection Engineers	28-Dec-09
SWCC, Jubail	Jubail	RLA	29-Dec-09
APPC	Jubail	Inspection Engineer	9-Feb-10
SABIC (Ibn Sina)	Jubail	Inspection Engineer	23-Feb-10
Kuwait Oil Company	Kuwait	Tanks Inspection	28-Feb-10
Saudi Aramco	Quraiyah	Failure Investigation	20-Apr-10
Underwriters Laboratories Inc.	KSA	Manpower (INSPECTION ENGINEER)	15-Jul-10
CTCI	Jubail	Failure Investigation	1-Jun-11
SABIC (Ibn Zahr)	Jubail	Manpower(API)	5-Jul-11
SABIC (JUPC)	Jubail	Manpower	16-Jul-11
SinSina	Qurayyah	Manpower	16-Oct-11
Arabian Pipes Company	Riyadh	Manpower Services	12-Dec-11

METALLURGICAL/CHEMICAL SERVICES			
TEKFEN, Petrorabigh	Petrorabigh Site	PMI Services	5-Feb-08
TEKFEN, Khurais	Khurais, Saudi Aramco	PMI Services	11-Mar-08
Saipem	Khurais, Saudi Aramco	PMI Services	22-Dec-08
Nasser Al-Hajri	Al-Hajri Yard, Dammam	PMI Services (OES)	12-Jan-09
Nasser Al-Hajri	SIPCHEM Site, Jubail	PMI Services (XRF)	12-Jan-09
Nasser Al-Hajri	Sharq Site, Jubail	Ferrite Testing	19-May-09
GAS / Ibn-SINA Job	Jubail	Corrosion Mapping	15-Oct-09
Jeddah cables Company	Jeddah	Chemical analysis	26-Feb-11
FMQ Karan Projects Department	Khursaniyah Site	PMI Service	13-Apr-10
Al Rushaid Const Co	Dammam	Chemical analysis	27-Apr-11
SAABIC (JUPC)	Jubail	NDT & Replica Job	26-Nov-10
Tamimi Industrial Services Est.	Jubail	Insitu Replication and Reporting	16-Jan-11
Petro Rabigh	Rabigh	Replica	7-Feb-11
GE-MEELSA	Dammam	Replica Job	7-Apr-11
ISCOSA	Dammam	Replica Job	5-Jun-11
Sinopec (Satorp)	Jubail	PMI Services	4-Jul-11
Saudi Arabian Engineering Co Ltd.	Dammam	PMI Services	16-Aug-11

MATERIAL TESTING SERVICES			
Zamil Air Conditioners	Dammam	Material testing	23-Mar-09
Axis International	Bahrain	Material testing	22-Sep-09
Unirol, Bahrain	Bahrain	Material testing	22-Oct-09
Tamimi Global	Dammam	PQR Tests	9-Jun-10
SAECO	Dammam	Material testing	4-Sep-10
Yanbu Steel	Yanbu	Tensile Test	18-Sep-10
Zamil Steel (III-Batch)	Dammam	Material testing	28-May-11
DAELIM Saudi arabia co.ltd	Jubail	Material testing	11-Jun-11
Metal Services for Trad. & Cont. Co.	Dammam	PWHT & Hardness	17-Dec-11
Saudi Aramco SGPD/SGMSD	Dharan	Material testing	2021
Ali Al Nassar	Dammam	Material testing	2021
Jiddha Steel	Jeddah	Material testing	2021
Saudhi Syprus	Riyadh	Material testing	2021
Sinopec Ningbo Engineering Company Ltd.	Dammam	Material testing	2021
Abdul Aziz & Saad Almoajil Trading Investment Co.	Dammam	Material testing	2021

Novel Arabia Middle East Ltd.	Jubai	Material testing	2021
FAHSS/TUV Nord Group	Jubail	Material testing	2021
TECO Middle East	Dammam	Material testing	2021
Arabian CBI Ltd.(Mcdermott)	Uthmaniyah	Material testing	2021
ArcelorMittal Tubular Products Jubail Co.	Jubail	Material testing	2021
Gulf Quality Control Co Ltd	Dharan	Material testing	2021
Tamimi PEB	Jubail	Material testing	2021
Industrial reservoir	Khobar	Material testing	2021
Quality Wire Products W.L.L	Bahrain	Material testing	2021
Al-Jazera Factories for Steel Products Ltd.	Jeddah	Material testing	2021
Baker Hughes	Dammam	Material testing	2021
Al Bawardi Steel Industries	Dammam	Material testing	2021
Al-Khodariyah Turnery Est.	Dammam	Material testing	2021
AlKhorayef Petroleum	Dammam	Material testing	2021
Saudi National Steel Company	Dammam	Material testing	2021
Ferrotech International Fze (Saudigrate)	Ajman	Material testing	2021
Sherbiny Systemd Integration.	Jubail	Material testing	2021
Speed Architectural Technology Est.	Rahima	Material testing	2021
UNISTAR Contracting Co.	Rahima	Material testing	2021
ZAMIL Steel Company	Dammam	Material testing	2021
Winteco Premir Co. Ltd.	Dammam	Material testing	2021
Zeeplin	Jubail	Material testing	2021
Aries Marine Services	Shaybah	Material testing	2021
Ghassan Ahmed Trading	Haradh	Material testing	2021
Piping Systems Co	Dammam	Material testing	2021
Mia Arabia	Dammam	Material testing	2021
Petronash	Dammam	Material testing	2021
Cougar Drilling systems	Rahima	Material Testing /PQR	2021
Kinetic Energy	Dammam	Material testing	2021
Saudi Inspection Services	Dammam	Material testing	2021
SAMMA	Dammam	Material testing	2021
Bureau Veritas	Jubail	Material testing	2021
AIM Inspection Services	Jubail	Material testing	2021
Garab National Co.	Dammam	Material testing	2021
Gerab Inspection Services	Dammam	Material testing	2021
Voltas Inspection	Dammam	Material testing	2021
Universal Inspection	Jubail	Material testing	2021
Reliance Holding Co	Dammam	Material testing	2021
Masdar Techincal Services	Jubail	Material testing	2021
AYTB	Dammam	Material testing	2021
Nales Plant	Dammam	Material testing	2021
Altas Chapter	Dammam	Material testing	2021
Al Jazeera	Jubail	Material testing	2021
Neles Plant	Jubail	Material testing	2021
Exact Fabrications	Jubail / Jizan	Material testing	2021
Royal Saudi Force	Jubail	Material testing	2021

Al Bawardi Steel Industries	Dammam	Material testing	2021
Jomel	Jubail	Material testing	2021
Best Quality Services	Rastanura	Material testing	2021
Hissco	Jubail	Material testing	2021
RMA middle east	Jubail	Material testing	2021
Global Insigina Techinical	Jubail	PQR/Material Testing	2021
Universal Laboratories Baharain	Dammam	Material testing	2021
Scholler Bleckmann	Jubail	PQR/Material Testing	2021
Bandariyah International Services	Dammam	WQT/PQR/Material Testing	2021
Mitawali steel Co.	Jubail	Material testing	2021
Asia Bolts	Jubail	Material testing	2021
Ali Gashash Al omari Trading Est	Dammam	WQT/PQR/Material Testing	2021
CPP	Dammam	Material testing	2021
Aries Marine Services	Jubail	Material testing	2021
Ghassan Ahmed Trading	Riyadh	Material testing	2021
SAMA Oil & Tools	Jubail	Material testing	2021
Aasia Steel	Jubail	PQR & Material Testing	2021
Kubota	Dammam	Material testing	2021
Technical Consultation	Jubail	Material testing	2021
Industrial Fabrication Factory	Dammam	Material testing	2021
Mitwalli Steel Products	Dammam	WQT/PQR/Material Testing	2021
Global Insignia for Technical Services	Dammam	Material testing	2021
HISCO	Dammam	Material testing	2021
Standard Arabia	Jubail	Material testing	2021
Royal Saudi Navel force	Jubail	Material testing	2021
Al Babtain	Dammam	Material testing	2021

POST WELD HEAT TREATMENT SERVICES			
Al-Toukhi, Riyadh	SEC PP-8 Site	PWHT Services	13-Feb-08
TEKFEN, Khurais	Khurais, Saudi Aramco	PWHT Services	11-Mar-08
Al-Tawleed, Shoaiba	Shoaiba IWPP Site	PWHT Services	30-Sep-07
Al-Hammam, Yanbu	Yanbu Gas Plant, Yanbu	PWHT Services	12-Oct-08
Arabian Bemco, Juaymah	Juaymah Gas Plant, Juaymah	PWHT Services	12-Oct-08
FMQ	Al Khobar	PWHT	22-Mar-10
MIS Arabia	Jubail	PWHT	22-Mar-10
Santek Jizan Site	Jizan	PWHT	13-Apr-10
SinSina	Qurayyah	PWHT	16-Oct-11

Metal Services for Trad. & Cont. Co.	Dammam	PWHT & Hardness	17-Dec-11

HEAT TREATMENT SERVICES		
CLIENT	**LOCATION**	**SERVICES**
SAUDI ARAMCO	HAWIYAH GAS PLANT	PLANT PIPING
MARAFIQ	MARAFIQ (JUBAIL)	PLANT PIPING
SAUDI ARAMCO	HAWIYAH GAS PLANT	STABILIZATION HT
SABIC (IBN ZAHR)	MTBE II TA,2016	HC HEADER
AL RUSHAID MID EST	AL JUBAIL	CS PIPING HT
SAUDI ARAMCO	SHEDGUM	FACE FLANGE
MIS ARABIA	JUBAIL, SAUDI ARABIA	CS PLATE HT
WELDING ALLOYS	NAJRAN CEMENT FACTORY	HEAT TREATMENT
PROMECH	DAMMAM 1ST INDUSTRIAL	SPOOL HT
WELDING ALLOYS	TURAIF CEMENT FACTORY	HEAT TREATMENT
AL-TAWLEED	SHOAIBA - IWPP PROJECT	PLANT PIPING
AL-TOUKHI	PP-8 SITE - SEC PROJECT	PLANT PIPING
TEKFEN	KHURAIS, SAUDI ARAMCO	PLANT PIPING
NASSER AL-HAJRI	SAUDI KAYAN PROJECT	PLANT PIPING
MIS ARABIA	SAUDI ARAMCO PROJECT	PRESSURE VESSEL
MEPCO	JEDDAH	PLANT PIPING
SANTEK	JIZAN, SWCC PROJECT	STORAGE TANKS
GATCO	JIZAN, SWCC PROJECT	STORAGE TANKS
AL-HAMMAM	YANBU, SABIC PROJECT	PLANT PIPING
ARABIAN BEMCO	JUAYMAH, SAUDI ARAMCO	PLANT PIPING
FMQ	KARAN (KGP) SAUDI ARAMCO	PLANT PIPING
MIS ARABIA	JUABAIL	PRESSURE VESSEL
AL FARABI	SAUDI ARAMCO PROJECT	PLANT PIPING
SABIC (IBN SINA)	MEOH -TAM	PLANT PIPING
SAUDI ARAMCO	HARADH GAS PLANT	PLANT PIPING
SINSINA CORNER CO	QURAYYAH	PLANT PIPING
GEO TECHNICAL CENTER	RIYADH	PLANT PIPING
BEMCO INTERNATIONAL	RIYADH	PLANT PIPING

MIPE CO	SHUQAIQ	PLANT PIPING
METAL SERVICES TRADING	DAMMAM	PLANT PIPING
AL NAJIM SAUDI ARABIA	JUBAIL	PLANT PIPING
JEDDAH NATIONAL STEEL	JEDDAH	PLANT PIPING
METAL FABRICATIONS	JEDDAH	PLANT PIPING
UNIVERSAL INSPECTIONS	JUBAIL	PLANT PIPING
SABIC (IBN RUSHAID)	YANBU	PLANT PIPING
SABIC (UNITED)	AL JUBAIL	PLANT PIPING
ZIMIPCO	DAMMAM	PLANT PIPING
BASIC CHEMICAL CO	DAMMAM	PLANT PIPING
TASNEE	AA PLANT TAM	FLANGE - NOZZLE
SABIC (IBN ZAHR)	MTBE TAM	BOILER - PIPING
SAUDI ARAMCO	HAWIYAH GAS PLANT	STABILIZATION HT
GAS ARABIA	DHURUMA	PLANT PIPING
NTS SAUDI CO LTD	DAMMAM 1ST INDUSTRIAL	PLATES & PIPES
KUWAIT PETROLEUM (KNPC)	KUWAIT	PLANT PIPING
CASTOLIN EUTECTIC	RIYADH	PLANT PIPING

CORROSION MAPPING SERVICES			
PETRORABIGH	CORROSION MAPPING	RABIGH	2014
SAUDI ARAMCO	CORROSION MAPPING	RASTANURA	2014
SAUDI ARAMCO	CORROSION MAPPING	SHAYBAH	2014
SAUDI ARAMCO	CORROSION MAPPING	KHURSANIYAH	2014
SAUDI ARAMCO	CORROSION MAPPING	RASTANURA	2014
SAUDI ARAMCO	CORROSION MAPPING	KHURSANIYAH	2015
SAUDI ARAMCO (HGP)	CORROSION MAPPING	HARADH	2015
SAUDI ARAMCO	CORROSION MAPPING	KHURAIS	2015
SAUDI ARAMCO	CORROSION MAPPING	DHAHRAN	2015
SAUDI ARAMCO (HGP)	CORROSION MAPPING	HAWAIYAH	2015
SAUDI ARAMCO (HGP)	CORROSION MAPPING	HAWAIYAH	2016
SAUDI ARAMCO	CORROSION MAPPING	UDHALIYAH	2016
SAUDI ARAMCO	CORROSION MAPPING	KHURSANIYAH	2016
SAUDI ARAMCO	CORROSION MAPPING	ABQAIQ	2016
SAUDI ARAMCO	CORROSION MAPPING	JEDDAH	2016
SAUDI ARAMCO (HGP)	CORROSION MAPPING	HAWAIYAH	2016
SAUDI ARAMCO	CORROSION MAPPING	SHAYBAH	2016
SAUDI ARAMCO	CORROSION MAPPING	DHAHRAN	2016
SAUDI ARAMCO	CORROSION MAPPING	RASTANURA	2016

SAUDI ARAMCO	CORROSION MAPPING	ABQAIQ	2017
SAUDI ARAMCO	CORROSION MAPPING	KHURSANIYAH	2017
SAUDI ARAMCO	CORROSION MAPPING	QURRAYAH	2017
SAUDI ARAMCO	CORROSION MAPPING	DHAHRAN	2017
SAUDI ARAMCO (HGP)	CORROSION MAPPING	HAWAIYAH	2017
SAUDI ARAMCO	CORROSION MAPPING	KHURSANIYAH	2017
SAUDI ARAMCO	CORROSION MAPPING	DHAHRAN	2017
SAUDI ARAMCO	CORROSION MAPPING	UTHMANIYAH	2017
SAUDI ARAMCO	CORROSION MAPPING	DHAHRAN	2017
SAUDI ARAMCO	CORROSION MAPPING	KHURSANIYAH	2017
SAUDI ARAMCO	CORROSION MAPPING	SHEDGUM	2017
SATORP	CORROSION MAPPING	Jubail	2018
SABIC – IBN Zahr	CORROSION MAPPING	Jubail	2018
SABIC – SAFCO	CORROSION MAPPING	Jubail	2018
SABIC – Yansab	CORROSION MAPPING	Yanbu	2019
SABIC – IBN Zahr	CORROSION MAPPING	Jubail	2019
SABIC – Al Bayroni	CORROSION MAPPING	Jubail	2021

WELDER QUALIFICATION SERVICES		
Morden Insulation Industries Co.Ltd (MIIC)	Riyadh	WQT
Wahaj	Riyadh	WQT
Alderley	Dammam	PQR
Voestalpine TSSA	Riyadh	WQT
SEPCO	Riyadh	WQT
CPP - Branch of China Petroleum Pipelines Co.	Dammam	PQR
Zahid industries	Yanbu	WQT
SAECO	Al Khobar	WQT
Cristal	Yanbu	WQT
Happco Fabrication Devision	Jubail	WQT
Sensortech Saudi Manafacturing Co.	Al Khobar	PQR
Alfanar Technical Services	Riyadh	WQT
Al-Latifia Trading & Concrating Compny	Riyadh	WQT
AL-Robaya Holding Co	Safaniyana	WQT
SADARA	Al Khobar	PQR
Rapco Group	Rastanura	WQT
BILFAL Heavy Industries	Jubail	WQT
Inspection Quality	Jubail	PQR / WQT
PROMECH	Jubail	WQT
Saad El Essa	Jubail	WQT
Saudi ProTech Valves Manafacturing	Dammam	PQR
Qas Arabia	Dammam	WQT
Keller Turki Co Ltd	Dammam	WQT
Technical Development	Dammam	WQT
Al Marri Hadi Bin Fahd	Al Khobar	WQT
Al Latifia Trading & Concrating Co	Riyadh	WQT
Al Mubarak	Qatif	WQT
SABIC (SAFCO)	Jubail	WQT

Kanoo Tank Saervices	Dammam	WQT
Saheel Al Hajri Company	Al khobar	WQT
MH Sherbiny for Commerce Industrial Services	Al khobar	PQR
DLPS (Diversified Lines For Petroleum Services)	Abqaiq	WQT
KPC - Al Khaleeb Petroleum Company	Al Hasa	WQT
Obeikan	Riyadh	WQT
SAMSUNG Engineering	shaybah	PQR & WQT
SAMSUNG Engineering	Jubail	PQR & WQT
Br. C.A.T International Co. LTD.	Dammam	PQR & WQT
Br. C.A.T International Co. LTD.	Hawaiyah	PQR & WQT
Br. C.A.T International Co. LTD.	Khurshaniyah	PQR & WQT
Br. C.A.T International Co. LTD.	juyamah	PQR & WQT
Br. C.A.T International Co. LTD.	Riyad	PQR & WQT
Br. C.A.T International Co. LTD.	shaybah	PQR & WQT
Contemporary Structures	Dammam	WQT
Minah Co. Ltd	Jubail	PQR & WQT
SAUDI ARABIAN ENGG.CO.LTD	Dammam	PQR & WQT
Wasmi Holding Co. Ltd.	Abqaiq	PQR & WQT
Wasmi Holding Co. Ltd.	shaybah	PQR & WQT
GAS ARABIAN SERVICES	Jubail	PQR & WQT
CRYSTAL GLOBAL	Yanbu	WQT
AL HERQEL GROUP	Dammam	WQT
AL SHUWAYER SONS	Dammam	WQT
FAUD AL ESSA & PARTNER Co.	Uthmaniyah	PQR & WQT
FAUD AL ESSA & PARTNER Co.	Abqaiq	PQR & WQT
FAUD AL ESSA & PARTNER Co.	Yanbu	PQR & WQT
DEMAG CRANES	Dammam	WQT
WEATHERFORD	Dammam	PQR & WQT
Hadi AL Hammam Est.	Ras Tanurah	PQR & WQT
SAUDI SCAFFOLDING	Dammam	WQT
NTS Middle East	Dammam	WQT
Olyan Descon	Dammam	PQR & WQT
Olyan Descon	Yanbu	PQR & WQT
Ghazween Star Steel Mfg. Est	Dammam	WQT
Maritime Industrial Services Arabia Co.Ltd.	Jubail	PQR & WQT
Amaco Manufacturing & Ind. Ser. Pvt Ltd	Jubail	WQT
DAT For Electromechanical Contracting	Jubail	WQT
AL RASHED Engineering	Dammam	PQR & WQT
ALI Abdullah AL Mubarak EST.	Dammam	WQT
GBN Factory For Metal Products	Dammam	WQT
Al-Rajhi Metal Industries	Dammam	WQT
Hilal Al-Arabia Cont. Est.	Jubail	PQR & WQT
Saudi Arabian Kentz Co. Ltd.	shaybah	PQR & WQT
SAUDI FAN INDUSTRIES	Dammam	WQT
Advanced Precision Services	Dammam	PQR & WQT
Al-Babtain Power & Telecommunication Ltd Co.	Riyadh	PQR & WQT
Al RUSHAID CONSTRUCTION Co. Ltd	Jubail	PQR & WQT
Al RUSHAID CONSTRUCTION Co. Ltd	Yanbu	PQR & WQT
Diversified Lines Petroleum Services Est	shaybah	PQR & WQT
Diversified Lines Petroleum Services Est	Dammam	PQR & WQT
United Specialized Industrial Services	Jubail	PQR & WQT

ISCOSA	Jubail	PQR & WQT
PROFESSIONAL MECHANICAL REPAIR SER. CO. LTD.	Dammam	PQR
SAUDI KAYAN PETROCHEMICAL COMPANY	Jubail	PQR
TAMIMI Industrial Services	Jubail	PQR & WQT
Petrojet	Abqaiq	PQR
AL Nazim	Jubail	PQR & WQT
BEMCO	Riyadh	PQR & WQT
EES Vessels Head	Jubail	PQR
GULF METALS ENGG.	Dammam	WQT
SEYANA O,M & I Services	Jubail	PQR
Sherbiny Systemd Integration.	Dammam	PQR & WQT
Speed Architectural Technology Est.	Dammam	PQR & WQT
UNISTAR Contracting Co.	Riyadh	PQR & WQT
ZAMIL Steel Company	Dammam	PQR & WQT
Winteco Premir Co. Ltd.	Jubail	PQR & WQT
SABIC - Ar-Razi	Jubail	PQR

Metallurgy Major Projects		
Client	Details	Year
ADVANCED Petrochemicals Company	Failure Investigation of Air Outlet Nozzle Liners And Expansion Joints of Air Outlet Header Catofin Reactors	
	Failure investigation of sea water pump roller bearing	
	Failure investigation of2-E-5001 Baffle Plate Bolt	
	Failure investigation of fin fan shaft	
	Failure investigation of roller bearing	
	Failure investigation of bearing samples	2016
	Failure investigation of propylene pump motor (5-PM-8201) bearing	2017
SABIC (KEMYA)	Failure investigation of fin fan blade	
Nesma& Partners Company	Failure investigation of 90 deg. Elbow 2" (304SS)	
Saudi Chevron Company (SCHEM)	Failure investigation of U-bolts	
	Failure investigation of process water pipe	
	Failure investigation of water wall tube	
	Failure investigation of superheater tube	
	Failure investigation of U Tube of Exchanger	
	Failure investigation of Radiant tube	2016
SIPCHEM	Failure investigation of air compressor rotor	
SABIC (Saudi Kayan)	Failure investigation of tube	
	Failure investigation of primary quench exchanger	
	Failure investigation of shaft	
	Failure investigation of pipe	
	Failure investigation of de-superheater	
	Failure investigation of thinned tube	
	Failure investigation of cracked tube	
	Failure investigation of Cu-Ni tube	
	Failure investigation of valve stem	
	Failure investigation of U-bend tube	
	Failure investigation of 4" spool piece	
	Failure investigation of equal Tee 3/4" Stress line	2016

	Failure investigation of annular plate samples	2016
	Failure investigation of broken pieces of shaft	2016
	Failure investigation of flexible hose	2016
	Failure investigation of non-metallic nozzle	2016
	Failure investigation of flexible hose pipe of lube oil pump discharge line	2017
	Failure investigation of bucket conveyor	2017
	Failure investigation of failed internally line elbow	2017
TASNEE	Failure investigation of shaft	
	Failure investigation of heat exchanger tude	
	Failure investigation of elbow	
	Failure investigation of outlet nozzle	
	Failure investigation of 4” pipe	
	Failure investigation of 4” tie rod	
	Failure investigation of valve stem	
	Failure investigation of furnace drain pipe	
	Failure investigation of studs	
	Failure investigation of 90 deg. elbow	
	Failure investigation of finned tube	
	Failure investigation of hyper compressor 2C cylinder	
	Failure investigation ofconnection rod of BOG Compressor	
	Failure investigation of76mm diameter Radiant Coil	
	Failure investigation of(3/8") diameter of pump tube	
	Failure investigation of super-heater coil	
	Failure Investigation of Piston Rod	2017
SABIC (UNITED)	Failure investigation of shaft	
	Failure investigation of shell	
	Failure investigation of valve stem	
Crystal Global Co., Yanbu	Failure investigation of elbow	
Cristal Company	Failure investigation of pipe	
	failure investigation of Tickle preheater pipe A and B from B-301 A coils	
	failure investigation of flexible hose	
MAADEN	Failure investigation of bolts	
	Failure investigation of super-heater tube	
	Failure investigation of damper plate	2016
	Failure investigation of pinion shaft in phosphoric acid plant	2016
	Failure investigation of belt support roller	2017
	Failure investigation of tube of sulfuric acid cooler	2017
	Failure investigation of Sulfuric Acid Plant (SAP 5A) cooler 5A53-E01 tube	2017
SABIC TECHNOLOGY CENTER	Failure investigation of Elbow	
	Failure investigation of Thermowell	
	M24 U-bolts	
	Eo Gas Cooler Tube Sheet Welds	
	SD-10-0015 (boiler bank tube)	
	Bowel & shaft	
	Tubes	
	Boiler feed water pump	

	Economiser weld joint	
	SF-10-0035 (scrubber tube)	
	Tube Sheet Knuckle	
	SF-10-0036 (condenser tube)	
	SS bolts	
	dehydrator cooler tubes	
	26" elbow	
	Shell plates	
	Flanges	
	Bearing case	
	Chilled water evaporator copper tube	
	Multi stage pump shaft	
	Single stage pump shaft	
Luberef	Failure investigation of Pipe spool of services water line	
	Failure investigation of LP Condensate Line	
	Failure investigation of M-1001-C-Ejector	
SIPCHEM	Failure investigation of Heat-exchanger tubes	
GPIC, Bahrain	Failure investigation of Methanol Storage Tank – Bottom Plate	
	Failure investigation of Methanol Storage Tank – Annular Plate	
	Failure investigation of Boiler Furnace Tube – B5203	
	Failure investigation of Ferrules in Waste Heat Boiler E0801	
	Failure investigation of ruptured boiler tube	2017
	Failure investigation of dented boiler tube	2017
	Failure investigation of leaked economizer tube	2017
Saudi Railway	Failure Investigation of 14 broken springs	2016
NOMAC	Failure investigation of broken stud	2016
Q-Chem	Failure investigation of PTFE gas inlet nozzle	2016
	Failure investigation of feed 2 preheater tubes of furnace convection section	2016
	Failure investigation of HS piping and weld	2017
Shelf Drilling	Failure investigation of drilling pipe	2016
Samsung Engineering	Failure investigation of 3 No of failed cooling water pipes	2016
Chemanol	Failure investigation of outer tubes of H335 twin pass re-boiler	2017
	Failure investigation of methanol reformer tube	2017
MARAFIQ (YANBU)	Failure investigation of tube: MED-10 evaporator Effect	2017
SAHARA	Failure investigation of PDH reactor outer screen weld failure	2017
	Failure investigation of PDH rectore inner screen bottom ring failure	2017
NATPET	Failure investigation of damaged shell of dryer scrubber	2017
YASREF (SANKYU)	Failure investigation of jacket flexible hose	2017

Remaining Life Assesment (RLA) & Condition Assessment Projects

Sr. No.	Client	Details	Year

1	CTCI	Assessment of Metallurgical Degradation in Tanks (68007)	
		Assessment of Metallurgical Degradation in Tanks (68008)	
2	Saline Water Conversion Corporation (SWCC) Al-Jubail, Kingdom of Saudi Arabia	Remaining life assessment of Super heater tubes of unit #05 boiler, by Internal oxide scale measurement approach	
		RLA study of Boiler Unit-6	
		Life Assessment of Main Steam Common Header Boiler Unit 1,3,4 & 6	
		Life Assessment of Boiler Parts, Phase 1, Unit 2 & Turbine Blade	
3	Axis Inspection	Condition Assessment of 8 elbows, 4 reducers and 2 T-joints	
4	CTCI	Condition assessment of Tank TK-5121	2016
		Condition assessment of Tank TK-4445	2016
		Condition assessment of Tank TK-4701	2016
		Condition assessment of Tank TK-7202	2016
		Condition assessment of Tank TK-7608	2016
		Condition assessment of Tank TK-7612	2016
5	CHIYODA ALMANA	Condition assessment of internal liners for bellows	2017

Fitness For Service (FFS) Projects

Sr. No.	Client	Details	Year
1	ADVANCED PETROCHEMICALS COMPANY, KSA	Fitness For Service Assessment Of Powder Ko Drum (3-V-3001)	
2	SAFCO – JUBAIL, KINGDOM OF SAUDI ARABIA (Total: 15 jobs)	Level – 1 Fitness For Service (FFS) Assessment As Per Guidelines of API 579	
3	SAUDI CHEVRON	Fitness for service assessment of tubes of radiant coils and outlet headers F3301 As per API579 ASME FFS1-2007 Part 10 Level-2 assessment	2017

Metallographic Replication / Insitu Replica Projects

Sr. No.	Client	Details	Year
1	SABIC-PETROKEMYA	Emergency requirement	2016, 2017
2	SAUDI KAYAN	Shutdown Job & Emergency requirements	2016, 2017
3	LABORELEC	PP-11 Shutdown, Marafiq & Shoaiba Power Plant Emergency requirement	2016, 2017
4	SATORP	Emergency requirement	2016, 2017
5	SAECO	Routine Jobs Replica+ Macro+ Hardness	2016, 2017
6	SAUDI ARAMCO-RASTANURA	Shutdown Job	2016, 2017
7	SABIC-IBN ZAHR	Shutdown Job	2016, 2017
8	SABIC-UNITED	Shutdown Job	2016, 2017
9	SABIC-SAFCO	Shutdown Job, Emergency requirement	2016, 2017
10	Axis Inspection	Emergency requirement for Hadeed, Ibn Sina, Sadaf & PetroRabigh	2016
11	RGF	Emergency requirement for Shoaiba Power Plant & Alstom	2016
12	NOMAC	Emergency requirement	2016
13	SABIC-IBN SINA	Shutdown	2016, 2017
14	SABIC-SADAF	Emergency requirement	2016, 2017
15	TASNEE	Shutdown Job	2016, 2017
16	YANSAB	Emergency requirement	2016
17	MAADEN PHOSPHATE	Emergency requirement	2016, 2017
18	NDTCCS	Emergency requirement for Maaden Phosphate	2016, 2017

19	SABIC-AR RAZI	Emergency Shutdown Job	2016, 2017
20	CTCI	Emergency requirement	2016, 2017
21	BAPCO REFINERY BAHRAIN	Shutdown Job	2016, 2017
22	SABIC-SAFCO_IBB	Shutdown Job	2016, 2017
23	GPIC-BAHRAIN	Emergency requirements	2017
24	AL-EZZEL POWER PLANT-BAHRAIN	Emergency requirements	2017
25	SADARA	Emergency requirements	2016, 2017
26	TAMIMI	Emergency requirements	2017
27	QPP (QURRAYAH POWER PLANT)	Emergency requirements	2016
28	PP11 Riyadh	Emergency requirements	2016, 2017
29	GEMTECH	Emergency requirements & Routine jobs	2016, 2017

Armed with the support of numerous faithful customers and a dedicated team of professionals, TCR continues to add to its expertise and capabilities to better address more of the analytical and testing requirements of the community of engineering materials users.

B. Approved and Registered with Major Companies in KSA

TCR Arabia is registered and approved with the following major companies in the Kingdom of Saudi Arabia:

Customer	Reg. No.
RABIGH REFINING & PETROCHEMICAL CO.	100764
YASREF	100657
PETRO RABIGH	100764.
SADARA	1000001784
SABIC	505239
SABIC GLOBAL CONTRACT	4900001302
SAUDI ARAMCO	10040677
SAUDI ELECTRICITY COMPANY (SEC)	5002205/62006
MAADEN	10118
TASNEE	101972
NESMA PARTNERS	SP000277
SIPCHEM	102111
SATORP	10175
SALINE WATER CONVERSION CORPORATION - *SWCC*	2522
ADVANCED PETROCHEMICAL COMPANY	100561
AL TUWAIRQI INDUSTRIES	2005248
GE ENERGY – P&RS	E72311-101
ARABIAN BEMCO CONTRACTING CO LTD.	80794
SAHARA PETROCHEMICALS CO	100692
SAUDI ARAMCO BASE OIL CO - LUBEREF	0000062147
MOHAMMED AL MOJIL GROUP (MMG)	103137
MARAFIQ	3645
PETROLEUM CHEMICALS & MINING CO.LTD (PCMC)	94219
FARABI PETROCHEMICAL COMPANY (NEW)	8001388.
FARABI PETROCHEMICAL COMPANY (OLD)	102095
SAUDI POLYMERS COMPANY (S-CHEM)	128729
AL BABTAIN CO	1788
ARABIAN BEMCO CONT CO	80794
AL RUSHAID CO.	009558

ETA STAR CO.	143188
CUSTOMER	REGISTRATION #
ISCOSA	50157633
NESMA TRADING CO	LS-400876
EL SELF ENGINEERING CO.	12034227
AL KIFAH PLANT	5021210420
TABUK AGRICULTURE CO. (TADCO)	SL3608
NOMAC CO	T9999
NATIONAL WATER WORKS CO	LOC-9999
OLAYAN KIMBERLY CLARK	0010059012
JOMEL	30145
AL FANAR CO (JUBAIL)	VL 0834
DEMAG CRANES & COMPONENT MIDDLE EAST	V00420
NORTHERN REGION CEMENT CO.	300772
BAKER HUGHES	10087956
CRISTAL GLOBAL	39735
WESTERN TRANSFORMERS	WT01/17/03
NAJRAN CEMENT CO	NCC-258/2013
DHURUMA O & M COMPANY	20209
HALLIBURTON ENERGY SERVICES	1257236
WEATHERFORD COMPANY	3140574
ARABIAN FAL COMPANY	2400180
INMA UTILITIES CONTRACTING CO	80794
YANBU STEEL	1517
SHELF DRILLING	50004563
AYTB	16362
RIYADH CEMENT CO	101934
NASSER SAEED AL HAJRI & PARTNERS CONT CO	CL02509
M.S AL SUWAIDI HEAVY INDUSTRIES CO LTD	305706
NOV SAUDI ARABIA CO LTD	102717
INTERNATIONAL CLIENTS	
CUSTOMER	REGISTRATION #
GULF PETROCHEMICAL CO (GPIC) - BAHRAIN	106836
QATAR CHEMICAL COMPANY LTD - QATAR	1501377
OMAN LNG - OMAN	14360
GREEN TECHNOLOGY - KUWAIT	
GENERAL ELECTRIC - JORDON	E72311-101
TATA CONSULTING ENGINEERS LTD - INDIA	TCE-10709A
MCSC LLC - BAHRAIN	001453
WELDING ALLOYS MIDDLE EAST FZC - UAE	
BAHRAIN PETROLEUM CO (BAPCO) - BAHRAIN	
RMA MIDDLE EAST S.P.C - BAHRAIN	289002
SMART SCREENING TECHNOLOGY - BAHRAIN	
HIDD POWER COMPANY - BAHRAIN	11338
PETROFAC - UAE	
JONES LANG LA SALLE PTY LTD - AUSTRALIA	3192852
LABORELEC MIDDLE EAST - UAE	9400000001
JOHNS HOPKINS ARAMCO HEALTHCARE	1000002211

C. Appreciation Letters:

فرع شركة ذا فيفث كونستركشن كومبني اوف سينوبك
Branch of The Fifth Construction Company of SINOPEC

To,
TCR Arabia,
Dammam, KSA

Date : 15th June, 2008

Attention : Mr. Syed Ameen Hassan
Sales Supervisor.

Subject : ToFD Services in our Petrorabigh Project
Reference : 1800-RD1-SUB-MEC-005

Dear Sir:

We would like to express our sincere appreciation to the TCR Arabia team for their contribution towards the completion of our Petrorabigh Project.

The efforts & dedication shown by the TCR Arabia team was exceptional in carrying out their activities and assisting us in executing the project in time. We certainly look forward for a long term relationship with TCR Arabia by getting the wide range of NDT & Inspection Services offered by them in all our projects across the Kingdom of Saudi Arabia.

On behalf of SINOPEC, we thank you once again for your support in our project which completed in the end of May, 2008.

Best regards,

YANG SHILEI QA/QC MANAGER
The Fifth Construction Company of SINOPEC

P.O Box691 Dhahran Airport 31932 Tel: 00966-3-8675878 Fax: 00966-3-8675874

Rabigh Refining & Petrochemicals Co

28 July 2007

Mr. Rohit Bafna
Director - Global Sales
TCR Engineering Services

Mr. Bafna,

PetroRabigh Logistics & Interface Division–Directorate Quality Team would like to thank TCR for its presentation/demonstration on the 24th June, 2007 at our facilities. We believe that the presentation/ demonstration provided an excellent forum for the attendees as it provided both the theoretical background and principles behind ToFD as well as the excellent functional demonstration of your equipment and technique.

The teams NDT Level III was particularly impressed with your equipments ability to discern the additional 'features' he had designed into the material sample on which you performed your demonstration and has commented that he believes the technology could provide a great level of support to our contractors on the project.

We sincerely hope you and your firm is chosen to work on this project and we look forward to working with you.

Thanks and Kind Regards,

Carl Ash
Quality Assurance Engineer
PetroRabigh
Directorate Building #3, Office #7
P.O. Box 666, Rabigh 21911
Kingdom of Saudi Arabia

المتحدة
united

Appreciation Letter

SABIC (United) appreciates the efforts of TCR Arabia in providing quality NDT Services during the EG1 plant Shutdown in December, 2010.

Efforts of Inspectors from TCR Arabia helped us complete the desired Turnaround in the specified time.

We wish TCR Arabia great success and anticipate availing their services in future.

Best regards,

Homam Al-Madini
Inspection & Corrosion Section Head

ابن سينا
ibn sina

Certificate of Appreciation

THIS CERTIFICATE IS AWARDED TO

TCR Arabia Company Ltd.

On behalf of IBN SINA Management, we would like to Recognize them, for their valuable contribution in successful completion of "Corrosion Napping Services of Piping System" for both Ibn Sina plants, from January 2010 up to June 2011.

Ali G. Al-Ghamdi
Reliability Inspection
Section Head –A

Abdullah A. Al-Soufi
Reliability Manager

شركة الطوخي للصناعة والتجارة والمقاولات
Al-Toukhi Company for Industry, Trading & Contracting
AlToukhi الطوخي

To,
Mr. Faisal K. Al-Dabal,
TCR Arabia,
Dammam, KSA.

Date : 1st July, 2008

Subject : Appreciation Letter
Reference : Post Weld Heat Treatment Services – PP8 Project

Dear Sir,

This is to express our deep appreciation for the Post Weld Heat Treatment Services offered by TCR Arabia in our PP8 Project in Riyadh.

The dedication and commitment shown by TCR Arabia to meet our targeted completion date by designating a professional team of operators played a major role in the success of our PP8 Project. We certainly look forward to work with TCR Arabia in our future projects.

Best regards,

Engr. Marwan Khader
Project Manager

بتـــرورابـــغ
Petro Rabigh

Ref. No.

Date: 19th Oct. 2008

NDT TRAINING COMPLETION CERTIFICATE

This is to certify that Mr. Nilesh Pathare (ASNT NDT LEVEL III) of TCR ARABIA COMPANY LTD, DAMMAM has visited PETRORabigh refinery from 05th Oct. To 19th Oct. 2008 and conducted the NDT LEVEL I course for employees of PETRORabigh - Engineering & Inspection Dept.

He has conducted NDT LEVEL I Training, Examination for certification as per SNT –TC -1A of ASNT for PETRORabigh Engineers in following four Methods:

1. ULTRASONIC TESTING (UT)
2. MAGNETIC PARTICLE TESTING (MT)
3. PENETRANT TESTING (PT)
4. VISUAL TESTING (VT)

This certificate is issued after successful completion of the NDT Level I Training and Examination in above mentioned four NDT methods.

TCR ARABIA COMPANY LTD shall declare the results for the above NDT examinations and shall send the certificates for the passed candidates within two weeks after completion of this training as per contract.

Approved By: Masazumi Narimatsu
Manager, Engineering

TEKFEN

TEKFEN İNŞAAT VE TESİSAT A.Ş.

P.O. Box 2575, Al-Khobar, 31952-Saudi Arabia - Phone 966-3-882 9594- Fax: 966-3-882 9595
Email: tekfen@tekfen.com.tr

Mr. Rohit Bafna,
Director – Global Sales,
TCR Arabia – GAS Arabian,
Dammam, KSA.

Date : 18th June, 2008
Ref. : ToFD Services
Pages : 01

Subject : Appreciation Letter
Reference : ToFD Services in our UOU Project in Petrorabigh

Dear Mr. Bafna:

Vide letter dated 18th June, 2008, it has been officially informed to TCR Arabia that the scope of ToFD services is now complete in our UOU Project at Petrorabigh.

It gives us great pleasure to have recognized a committed company offering the NDT & Inspection Services and displaying high degree of professionalism in carrying out the job at site since October, 2007. Your cooperation and dedication during the course of this project was phenomenal. TCR Arabia's team effort has undoubtedly been a part of our success in this project.

TEKFEN will be pleased to avail the services of TCR Arabia in all its projects across the Kingdom of Saudi Arabia.

We once again thank you for the great support and commitment displayed by TCR Arabia in our project.

Best regards,

Sukru Aytemiz
Project Manager

TEKFEN

الشركة السعودية العالمية للبتروكيماويات
(شركة مساهمة سعودية)
Saudi International Petrochemical Company
(Saudi Joint Stock Company)

Appreciation Letter

Sipchem Reliability & Inspection Department would like to appreciate TCR Arabia Company Limited for their contribution and the support extended during the first major turnaround of IDC, IMC & UNO plant in August, 2009.

Services rendered by TCR Arabia's Inspectors and Technicians during this turnaround deserve great appreciation which enabled us to execute the activities on time.

We anticipate the same response and services during our future requirements.

Wishing your organization success in the future.

Regards,

Majed S. Al-Rassi
Inspection & Reliability Section Manager

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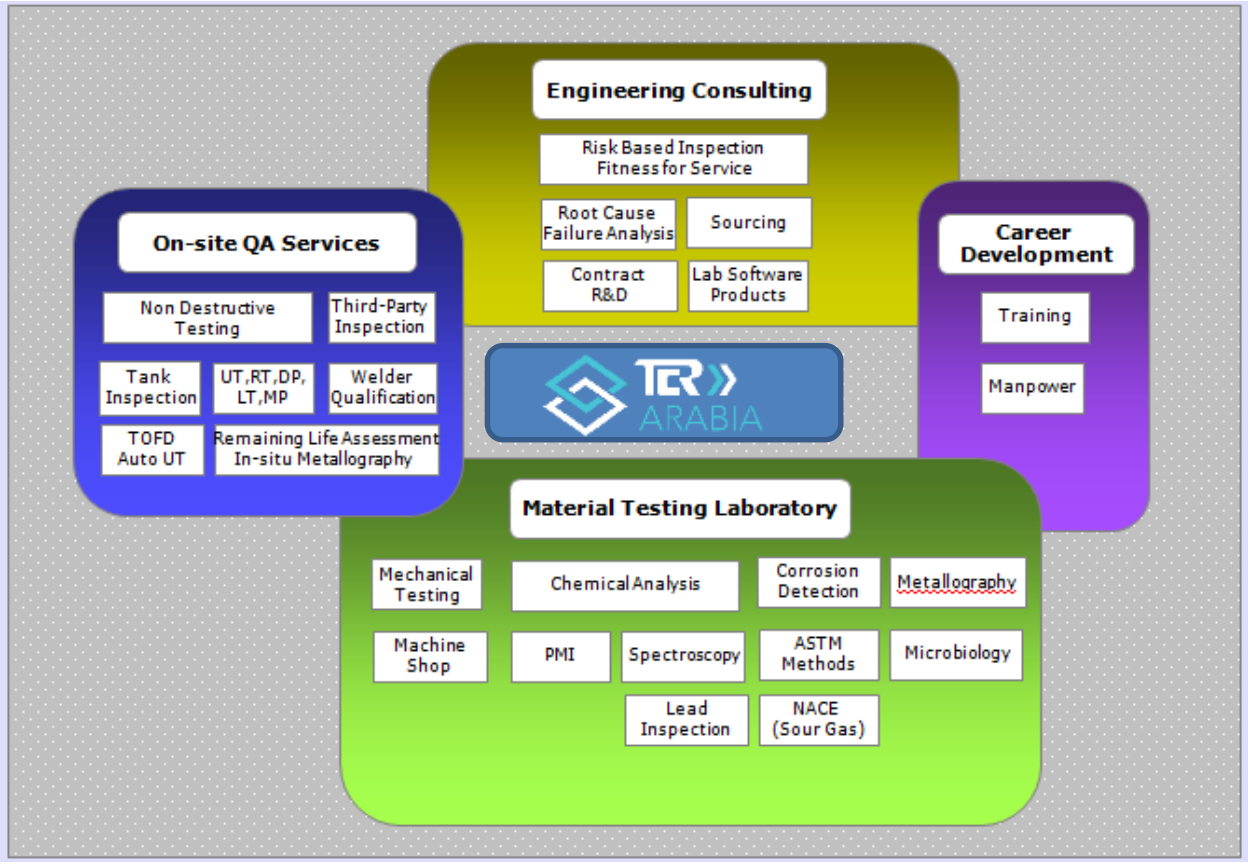
ص.ب ١٢٠٢١ مدينة الجبيل الصناعية ٣١٩٦١
المملكة العربية السعودية
هاتف : ٩٩٩٩ ٣٥٩ (٣) ٩٦٦
فاكس: ٩٨٨٨ ٣٥٩ (٣) ٩٦٦

6. Material Testing and Inspection Services

TCR Arabia's ability to provide value to our metal testing customers is based on organizing multiple talents into a focused set of technological capabilities. TCR provides several testing services, but, no matter which discipline you choose, one thing is certain. When you send a sample to TCR, you can have confidence in the results, because you are working with a company that has a reputation for being meticulous.



A. Material Testing Laboratory - Mechanical

TCR Arabia has a comprehensive range of Mechanical Testing services with a dedicated machine shop to assist in sample preparation.

The Mechanical Testing Facility at TCR Arabia conducts tensile tests for understanding the strength characteristics of a material and provides precise determination of Proof Stress by the attachment of various electronic controls and extensometers. Testing temperatures range from 50°C to 850°C and beyond for particularly high temperature applications. The Mechanical Testing department at TCR performs a range of Impact tests, including Izod and Charpy testing from 100°C to -196°C. Highly specialized pressure test facilities are also available.

TCR is well equipped to determine mechanical properties of materials and solve a wide variety of technical problems for industry. Mechanical Testing Facilities available at TCR Arabia include:
Universal Testing Machine of Capacity 100 T with Electronic Extensometer
Charpylzod Impact Tester
Brinell / Vickers Hardness Tester and Rockwell Hardness Tester
Rockwell Superficial Hardness Tester, Micro Hardness Tester
Hydraulic Test Pump

Superior technology, responsive versatility, and quality performance ensures reliable and fast turnaround on all test results. A dedicated in-house sample machine shop ensures that all test samples are machined onsite. Experts in the Machine shop are capable of low stress grinding and machining sub-size specimens to very close tolerances. Professionals in the machine shop can custom design fixtures, mount specimens for metallography examinations, and custom fabricate TOFD weld blocks for NDT operators.

Equipment at the machine shop includes wire cut machine, milling and lathe machines, hacksaw, drilling machine, stress-free grinding equipment, saws, surface grinders, and other tools.

Complete List of Mechanical Testing services at TCR include:

Tensile / Transverse/Compression test
Tensile test at an elevated temperature upto 850 Deg C
Ball Test
Bend test / Reverse bend / Rebend / Root / Face / side bend test
Flattening / Flaring Test
Re- bend test including ageing
Proof load test on Nut up to and over 40000kg
Full size breaking of bolt
Wedge load test / Head soundness test
Compression test of springs (upto 3 readings)
Tensile test for fine wires/foils
Charpy V notch Impact Test (a) R. T. as per ASTM E23, upto – 60°C and below – 60°C
Hardness test Rockwell A, B, C
Vickers hardness test
Brinell hardness test
Jominy end quench test (without normalizing heat treatment)
Sectional weight of CTD bars
Surface Characteristics of CTD Bars
Hydraulic / Pneumatic Test inclusive of sample preparation charges
Proof Load / Slip Test on fabricated items such as clamps and assemblies
Welder Qualification Tests

B. Material Testing Laboratory – Civil

Construction Material Testing Services / Civil Laboratory & Field Inspection Services

The Material technology and testing department covers a wide range of specialized services, which extends from routine testing of construction material to consultation on complex problems related to material technology and its applications. TCR Arabia provides CIVIL Laboratory & Field Inspection Services for Construction materials, like Concrete, Cement, Precast concrete units, Masonry units, Natural Building stones, rocks, Soil, Aggregates, & Sand. TCR Arabia also provides Services for Structural Assessment (Delamination Surveys) / Concrete deterioration Analysis.

The Material testing in TCR Arabia is conducted in accordance with American Standards (ASTM), British Standards (BS), German Standards (DIN), European standards (EN), or International Standards Organization (ISO).

Field Sampling & Testing:
Properties of fresh concrete usually determined are slump, temperature, air content, density, sampling and specimen preparation of fresh concrete.
It also includes Taking samples of aggregate from stock piles, Soil sampling from stockpile or from laydown area, Insitu density by sand replacement method and sampling of building blocks.
Specialist site teams for non-destructive and destructive testing to determine the depth of cover to concrete, the condition of the reinforcement bars, crack monitoring, visual surveys, delamination surveys, UPV surveys, core and dust sampling.

Advisory Services:
We offer consultancy services on many aspects of construction and materials technology. These include appraisal of specifications, establishment of QA and QC schemes for material / product assessment, failure investigations and statistical analysis of performance tests. We are also able to devise test methods where no suitable standard exists.

The range of services in Civil Laboratory at TCR Arabia include:

Structural assessment (Delamination Surveys):
- Visual inspection of concrete structure (Structural assessment) – ASTM C823
- Petrographic Examination – ASTM C856
- Crack Mapping (Crack measurement)
- Cutting of Concrete Core (Extraction of concrete core) – ASTM C42
- Rebound Hammer Test for Hardened Concrete (Hardness) – ASTM C805 / BSEN 12504-2
- Determination of ultrasonic pulse velocity – ASTM C597 / BSEN 12504-4
- Determination of concrete cover to reinforcement (Pachometer test) – BS 1881-204
- Pull off test (Bond Test) – ASTM D4541

Concrete Tests:
- Compressive Strength of Hydraulic Cement Mortars – ASTM C109/109M / BSEN 445
- Air Content of Freshly prepared Concrete – ASTM C231 / BSEN 12350-7
- Bleeding test of fresh concrete – ASTM C232 / BSEN 480-4
- Water absorption for Hardened concrete – ASTM C642 / BS1881-122
- Sampling, Dimensions, Absorption & Compressive Strength Testing of Concrete Masonry Units/Hollow Blocks – ASTM C140 / BS 6073-1&2
- Water absorption and Bulk Specific Gravity of dimension stones (Kerb stones, Concrete flags, Beam, etc.) – ASTM C97/C97M
- Determination of Flexural strength & Modulus of rupture of dimension stones (Kerb stones, Concrete flags, Beam, etc.) – ASTM C880 & ASTM C99
- Unconfined compressive strength of intact rock core specimens - ASTM D2938
- Dimension measurement, Compressive strength and Water absorption of precast Paving Blocks – ASTM C936/C936M
- Cutting of Concrete Core (Concrete coring on site) – ASTM C42
- Curing, Capping, Compressive Strength & Fracture Type Analysis of Concrete Cores in Laboratory - ASTM C39, C42 & C617
- Compressive strength of dimension stone – ASTM C170

Soil Tests:

- Soil Sampling – ASTM D75
- Particle-Size Distribution (Gradation) of Soils – ASTM D6913/C136 / BS 1377 – Clause 9.2 & 9.3
- Modified/Standard Proctor Test (Determination of dry density/moisture content relationship) – ASTM D1557/D698 / BS 1377-4
- Liquid Limit, Plastic Limit & Plasticity Index (Casagrande) – ASTM D4318 / BS 1377-2 Clause 4.3/5
- Material Finer Than # 200 Sieve (75µm) – ASTM D1140 / BSEN 933-1
- California Bearing Ratio (CBR) – ASTM D1883 / BS 1377-4 Clause7
- Sand equivalent value of soils and fine aggregates – ASTM D2419
- Oversize Correction for MDD & Moisture Content – ASTM D4718 / BS 1377-4 Clause 3.3, 3.4, 3.5 & 3.6
- Classification of Soil – ASTM D2487, D2488
- In-situ density tests- Sand replacement method for fine, medium & coarse grained soils – ASTM D1556/1556M / BS 1377-9 Clause 2.1&2.2

Aggregate Tests:

- Sampling of Aggregates – ASTM D75 / BSEN 932-1 Clause8.8 / BS 812-102
- Sieve Analysis of aggregates – ASTM C136 / BSEN 933-1 / BS 812-103 Section 103.1
- Material Finer than # 200 – ASTM C117
- Clay Lumps & Friable Particles – ASTM C142
- Specific Gravity and Water Absorption (Particle density) – ASTM C127&C128 / BSEN 1097-6 Clause 7,8&9
- Sand Equivalent Test – ASTM D2419
- Moisture content of aggregates (oven dry method) – ASTM C566 / BS 812-109. Clause-6
- Percentage of fractured particles in coarse aggregate – ASTM D5821
- Soundness of aggregates by sodium sulphate and magnesium sulphate – ASTM C88
- Test method for unit weight for aggregates – ASTM C29

C. Chemical Analysis by Spectrometer and Wet Chemistry

An inherent strength of TCR Arabia is the ability to successfully undertake analytical chemistry assignments. At its facility in Dammam, TCR Arabia can provide complete chemical composition analysis.Some tests will be outsourced by TCR Arabia to the TCR labs in Mumbai, India.

With an ever-expanding senior staffed team of highly qualified Analytical Chemists experienced in using the full range of analytical instruments which include state-of-the-art Spectrometers and Wet Chemistry lab facilities, TCR can cater to all analytical requirements for Ferrous, Non Ferrous Metals, Ceramics, Glass, Refractory, Minerals and Ferro Alloys. The chemical department can analyze samples in all forms including drillings or turnings, solid samples and liquids.

State-of-the-art equipment available at TCR includes :

- Optical Emissions Spectrometer (OES)
- Inductively Coupled Plasma (ICP) Spectrometer
- Glow Discharge spectrometer (GDS)
- Atomic Absorption Spectrometer
- Automatic Carbon SulphurDeterminators

The Classical Wet Chemistry (bench chemistry) department uses Gravimetry and Titrimetry procedures to analyze chemical composition of materials, and assists in the identification of unknown materials and gaining an understanding of their chemical composition, structure and function.Most classical wet chemical methods can accommodate comparatively small amounts of a sample in diverse shapes or forms. Fully compliant to environmental standards of India, the wet chemistry department at TCR is sought by leading companies all over the world for trace chemical analysis to very low detection levels.

The complete range of Chemical Analysis Services at TCR includes:

Chemical Analysis by Classical Wet Method Ferrous metals (including) C, S, P, Mn, Cr, Mo, Ni Non Ferrous Refractory, Ceramics and Minerals Ferro alloys (Fe-Mn, Fe-Si, Fe-Mn-Si, Fe-Mg-Si, Low C Fe-Cr, Fe-Mo) Non Ferrous metals (each additional element) Elements such as Co, Al, W, Cu, Sn, Ti, Mg, V in steel Nitrogen / Boron / Palladium (each element) Purity of Cu Purity of Al, Zn, Pb, Ni, Bi, Cd, Sn, Mg, W, Ti Oxygen Analysis and Hydrogen Analysis Chemical Analysis by Spectrometers EDAX analysis Complete Chemical Analysis upto 8 elements Impurities in PPM Level using AAS or ICP Ferro Alloys Analysis of Main Element, Each Subsequent element Other Tests pH Value Determination Sand Content (as Sio2) Acid Insolubles Sulphates, Chlorides, Silicates, Carbonates, Oxides of Iron per element Elemental analysis – Ca, Mg, K, Na, Fe	Steel and Cast Iron Determination of any one element (%C) Determination of any one element (Mn, Si) Determination of any one element (Ni, Cr, S, P) Determination of C, Mn, Si, S, P Complete analysis of Low Alloy Steel up to 8 elements including C, S, P, Si, Mn, Ni, Cr, Mo Complete Analysis of Stainless Steel up to 8 elements Determination of High Alloy element (Cr, Ni, Mn) Determination of some special element (Cu, Ti, Co, V, W, Al) per element Complete analysis of High Speed Steel (8 elements) per element Determination of Mo% Determination of V% Nitrogen in steel Non Ferrous Material Copper Base Alloys Determination of any one element Complete Analysis of 6 elements Purity Test of Cu Purity test of other non ferrous element Tin, Aluminum, Lead Base Determination of any one element Complete Analysis of upto 8 elements Purity Test Only Aluminum %

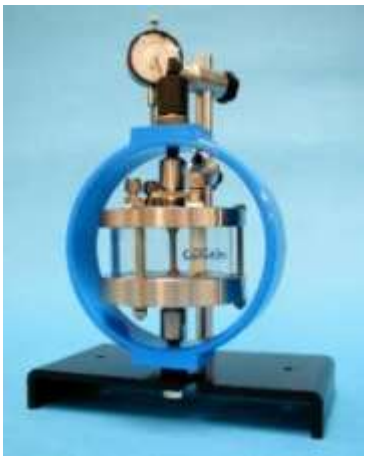
D. Corrosion Testing

TCR Arabia undertakes a wide range of corrosion and stress corrosion test per ASTM, NACE or as per an individual client's requirements. Senior staff members are available to provide corrosion consulting, advice on corrosion prevention and corrosion control services including materials selection in laboratory or on-site inspection.The objective of the corrosion detection department at TCR is to provide quality service at a reasonable price and work with all clients as an extension of their QA team.

A wide variety of corrosion related tests can be undertaken at TCR Arabia to determine weight loss corrosion, inter-granular attack, pitting corrosion, corrosion fatigue, stress corrosion cracking, sulfide stress cracking, and hydrogen-induced cracking.

TCR's Sour Gas Service Corrosion Testing department undertakes Small Scale Tests and Full Ring Testing for SSCC (NACE TM 0177, EFC 16 and 17) and HIC (NACE TM 0284). The range of instruments available to perform these tests in unrivalled in our operating regions. Highly experienced and qualified engineers within the group routinely undertake corrosion studies to include all observations as per NACE MR 0175.

TCR offers comprehensive corrosion study program, including:



Inter-Granular Corrosion Test as per ASTM 262 Practice A with photograph (Oxalic Acid Etch test)
Inter-Granular Corrosion Test as per ASTM 262 Practice B (Streicher Test)
Inter-Granular Corrosion Test as per ASTM 262 Practice C (Huey Test)
Inter-Granular Corrosion Test as per ASTM 262 Practice D
Inter-Granular Corrosion Test as per ASTM 262 Practice E (Strauss Test)
Inter-Granular Corrosion Test as per ASTM 262 Practice E for 72 hours
Inter-Granular Corrosion Test as per ASTM 262 Practice F
Stress Corrosion test as per ASTM G 36
IGC test as per DIN EN ISO 3651 – 2, method A, B and C
Pitting corrosion test as per G48 method A for 24 hours
Pitting corrosion test as per A923 method C for 24 hours
Pitting corrosion test as per A923 method A
Corrosion Rate by Potentiostatic method
Crevice Corrosion Test as per ASTM G48 method B
Chloride Stress Corrosion Cracking for 500 hours
Hydrogen Induced Cracking Testing per NACE TM0284 for Plate/Forgings, Tubes, Bars Studs
Sulfide Stress Corrosion Cracking per NACE TM 0177 at 24 Deg C, ATM Pressure for 720 hours.
Sulfide Stress Corrosion Cracking per NACE TM 0177 at 90 Deg C, 16 bar Pressure for 720 hours.
Huey Test with microstructure examination with Inclusion rating, Oxalic acid etch, Sodium cyanide etching
Salt Spray Test as per ASTM B117, The size of chamber at TCR is 400 mm X 400 mm X 300 mm.

Inter-granular corrosion: Inter-granular corrosion attack in stainless steels may result from precipitation of carbides, nitrides or inter-metallic phases. Per ASTM A262, the corrosion team at TCR carefully chooses a method which is suitable for the steel grade and grain boundary composition to be tested.

Hydrogen-Induced Cracking (HIC) Test, NACE TM0284: HIC Test by TCR evaluates the resistance of pipeline and pressure vessel plate steels to Hydrogen Inducted Cracking caused by hydrogen absorption from aqueous sulfide corrosion.

Sulfide Stress Corrosion Cracking (SSCC), NACE TM0177, EFC 16 and 17: Sulfide stress corrosion cracking (SSCC) test by TCR is done when a susceptible material is exposed to a corrosive environment containing water and H2S at a critical level of applied or residual tensile stress.

Pitting Corrosion Test

TCR can undertake Pitting Corrosion as per ASTM G48 Method B, Ferric Chloride Test which involves exposing a specimen to a highly oxidizing acid chloride environment, to determine the extent of pitting. We can also undertake Pitting Corrosion test as per ASTM A923 Method C.

We are approved laboratory to perform corrosion testing for SAUDI ARAMCO and their vendors. We provide following corrosion testing services to serve our customer best:

- Inter-granular Corrosion attack in Austenitic Stainless Steels with **ASTM A262 Practice A, B, C, E**
- Inter-granular Corrosion attack in Stainless Steels with **ASTM A763 Method W, X, Y, Z**
- Detecting Detrimental Intermetallic Phase in Austenitic/Ferritic (Duplex) Stainless Steel with **ASTM A923 method A, B, C**
- Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys with **ASTM G48 Method A, B, C, D, E, F**
- NACE MR0175/ISO 15156: Petroleum and Natural Gas Industries- Materials for use in H2S-containing Environments in Oil and Gas production with **NACE TM0284, NACE TM0103, NACE TM0177 & NACE TM0316**
- Metallic Material and Coated Metallic Subtrate with **ASTM B117, ISO 9227**
- Inter-granular Corrosion attack in Nickel-Rich Chromium bearing Alloys with **ASTM G28 Method A**

E. Metallography and Microstructure Examination

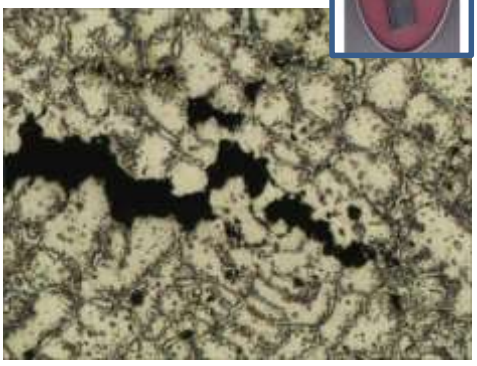
Qualified metallurgists at TCR Arabia are experts in Metallographic preparation & examination to evaluate the characteristics of metals. They can access a material's heat treatment condition, microstructure, and forming process. The team undertakes Macro and Micro examination including Weld Examination, Case Depth and Decarburization Measurement. Micro Hardness Testing and Coating/Plating evaluation is also undertaken.

The Metallography department of TCR Arabia has the state-of-the-art Inverted Metallurgical Microscope Olympus GX51 with an Image Analysis System. The team uses the MiC 3.0 microstructure characterizer software for analysis of images to determine the micro structural degradation due to creep. The software can also calculate the graphitization, depth or width of decarburization, phase/volume percentage, grain growth, inclusion rating, particle size, volume percentage, particle count, porosity and coating thickness.

TCR Arabia can undertake also metallurgical evaluation using SEM, EDAX, XRD and TEM as well by utilizing its partner laboratory in India.

The range of services in metallography at TCR Arabia include:

Microstructure Examination (Routine) with two photographs
NDT microstructure with two photographs
Microstructure with Comment on Heat Treatment
Microstructure examination for failure related study
Grain size distribution chart on Image Analysis (With print out)
Prior austenite grain size measurement (including heat treatment charges)
Prior austenite grain size measurement by Mc Quid Ehn method (including carburizing)
Oxide-scale/Nitriding/Carburizing/Decarburizing/Coating – Measurements. (Avg. of 3 readings)
Grain size Measurement as per ASTM E112 with photograph
Linear measurement, up to 3 measurements,
Inclusion Rating as per ASTM E45 Method A with photograph
Inclusion rating as per ASTM E454 with photograph
Color Metallography (With two Photos)
Delta ferrite from SS weld microstructure, Sigma phase, volume fraction by microstructure examination
% Nodularity, Nodule Count as per ASTM A247
Porosity Analysis as per ASTM 276
Decarbization level as per ASTM E 1077
Phase Distribution as per ASTM E 562 / 1245
Powder particle size measurement (Avg. 5 frames)
Coating Thickness Measurement as per ASTM B 487
Retained Austenite measurement with electro polish and copper deposition method
Micro-Hardness Testing
Micro hardness profile for case depth measurement (max. 10 readings)
Macro Etch Test (Including Photo & Comments)
Fractography by Stereo Microscope and SEM
Coating thickness by SEM
Microstructure Examination Test with Photographs, Grain Size Comment on Carbide Precipitation, Nitrides & Intermetallic Phases In HAZ, Parent, Weld as Per A-262,E-112 for Inclusion Rating
Hydrogen Embrittlement on Copper
Ferrite as per ASTM E562 per phase per sample
Intermetallic Phase (Chi, Sigma, Laves Nitrate Carbide) per phase per sample
Intermetallic Phases in Weld, Parent Material (PM), Heat Affected Zone (HAZ) per phase per sample
Microstructure test with photograph (for Sigma Phase and for Ferrite content)
Analysis of a given SEM Image for particle size and particle size distribution (max/min, size/frequency information) of the dispersed phase in a continuous phase matrix.
Delta Ferrite Measurement by Ferritscope
Pit Dimension Measurement
EDAX / EDS Analysis, XRD Analysis



7. Conventional Non-Destructive Services

TCR Arabia's conventional NDT Services includes:

- Radiography Testing (Conventional RT, Saferad, Digital RT)
- Ultrasonic Flaw Examination
- Ultrasonic Thickness Measurement
- Magnetic Particle Testing
- Liquid Penetrant Testing
- Ferrite Measurement
- Portable Hardness Measurement
- Paint and Coating Thickness
- Holiday Detection
- Positive Material Identification (XRF & Spectro based)

TCR Arabia's on-site inspection and testing team has access to over several highly sophisticated Portable Alloy Analyzer Spectrometers which can in-situ non-destructively and accurately measure the chemical composition of materials. TCR Arabia's Positive Material Identification service is fast becoming an integral part of process safety management in the petroleum refining, petrochemical and electric power generation industries in KSA.

Using portable alloy analyzer spectrometers, TCR Arabia's engineers can provide elemental identification and quantitative determination without regard to form, size and shape. No samples need to be cut for PMI. Elements that can be identified using PMI include: Ti, V, Cr, Mn, Co, Fe, Cu, Zn, Ni, Se, Nb, Mo. TCR can also deploy the portable optical emission spectrometer that can detect C, S, P, Mn and Si.

The TCR Arabia's PMI division has expert engineering and inspection personnel to undertake incoming material inspection and can provide on-site alloy verification for Quality Control and Stock control purposes. TCR can analyze Melt and Weld and can provide a comprehensive maintenance assessment.

Using portable XRF analyzers, TCR provides scrap traders in India with the information necessary to make quick, confident decisions on material purchases, and the speed and throughput necessary to quickly sort volumes of materials and take advantage of sales opportunities.

TCR provides PMI services to a number of Metal producers, Foundries, Metal fabricators, Scrap yards, Scrap traders in the industry, Electric utility companies, Fossil and nuclear power plants, Refining and petrochemical industry, Construction engineering, and the Chemical process industry.

The range of equipments available for undertaking Positive Material Identification (PMI) at TCR is unparalleled in India. The PMI Services Team has Portable X-Ray Florescence (XRF) based instruments including Oxford InstrumentsXMet 3000TX and XMet 3000T, NitonXLt and the InnovX-Sys.

The team also has the ARC MET 8000, a Portable Optical Emission Spectrometer and Bruker Spectormeter. The portable optical emission spectrometer can detect low carbon levels in 316 L Stainless Steel and provide accurate results reporting.

Inspection services team members of TCR assist the Recycle and Resell Scrap traders in increasing their profit margins by measuring precious metals in electronics - Pt, Ir, Ru, Rh, Pd. This helps traders to quickly sort inventory to sell at optimum prices for each business transaction.

A. Radiographic Testing

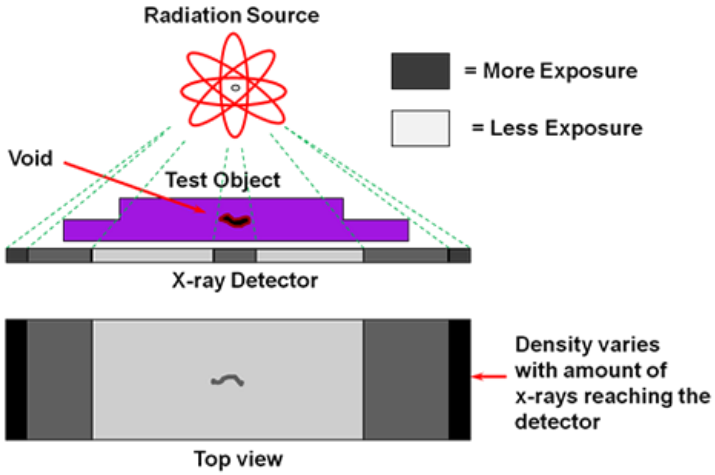
Industrial radiography is a method of non-destructive testing where many types of manufactured components can be examined to verify the internal structure and integrity of the specimen. Industrial Radiography can be performed utilizing either X-rays or gamma rays. Both are forms of electromagnetic radiation. The difference between various forms of electromagnetic energy is related to the

wavelength. X and gamma rays have the shortest wavelength and this property leads to the ability to penetrate, travel through, and exit various materials such as carbon steel and other metals.

Compared to other NDE techniques, radiography has several advantages. It is highly reproducible, can be used on a variety of materials, and the data gathered can be stored for later analysis. Radiography is an effective tool that requires very little surface preparation. Moreover, many radiographic systems are portable, which allows for use in the field and at elevated positions.

Conventional radiography uses a sensitive film which reacts to the emitted radiation to capture an image of the part being tested. This image can then be examined for evidence of damage or flaws. The biggest limitation to this technique is that films can only be used once and they take a long time to process and interpret.

In Radiography Testing the test-part is placed between the radiation source and film (or detector). The material density and thickness differences of the test-part will attenuate (i.e. reduce) the penetrating radiation through interaction processes involving scattering and/or absorption. The differences in absorption are then recorded on film(s) or through an electronic means. In industrial radiography there are several imaging methods available, techniques to display the final image, i.e. Film Radiography, Real Time Radiography (RTR), Computed Tomography (CT), Digital Radiography (DR), and Computed Radiography (CR).



Benefits

- Can inspect assembled components
- Minimum surface preparation required
- Detects both surface and subsurface defects
- Provides a permanent record of the inspection
- Verify internal flaws on complex structures
- Isolate and inspect internal components
- Automatically detect and measure internal flaws
- Measure dimensions and angles within the sample without sectioning
- Sensitive to changes in thickness, corrosion, flaws and material density changes

Application

Radiographic Testing is widely used in the:

- Aerospace industries
- Military defense
- Offshore industries
- Marine industries
- Power-gen industries
- Petrochem industries
- Waste Management
- Automotive industries
- Manufacturing industries
- Transport industries

8. Advanced NDT Services

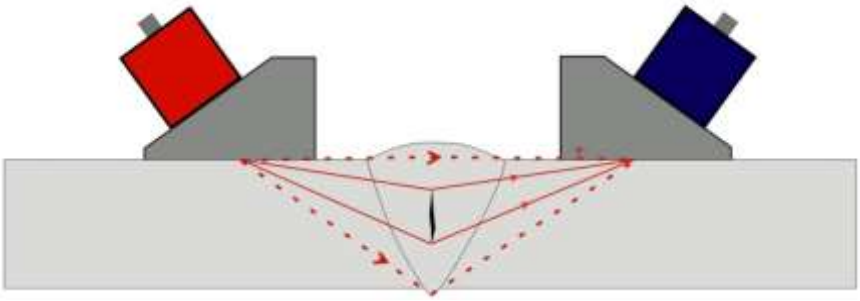
A. ToFD

TCR Arabia is well experienced in Time of Flight Diffraction (TOFD) which is an advanced and automated weld examination technique that assists in Fitness For Purpose (FFP) inspections. Using TOFD, the expert NDT team members at TCR perform amplitude-independent accurate

flaw sizing on a wide coverage area. TCR Arabia has 4 crews duly qualified from Saudi Arabia ready to perform ToFD inspections in KSA.

TOFD is a fast and efficient way to scan a lot of weld area in a very short time period. Dead zones near the front and back surface can be enhanced using combined TOFD and conventional pulse echo techniques.TOFD is a quick and accurate tool for flaw sizing. Phased Array technology (using a TCG or DAC) and flaw location indicators with experienced analysts is also recommended.

ASME Boiler and Pressure Vessel Standard Section VIII Code Case 2235-9 states that is acceptable to use the TOFD for Ultrasonic examination in accordance with ASME Section V, Article 4. ASME Code Case 2235-9 mentions about replacing RT with UT and has resulted in incorporating TOFD into pressure vessel work for both detection and sizing of flaws. This now allows TOFD to be used on all Section VIII pressure vessels.TOFD is perfectly acceptable to use as per Code Case 181 and Code Case 179 of ASME B 31.3 for piping products.



Time-of-flight diffraction (TOFD) technique is an ultrasonic NDT technique which relies on the diffraction of ultrasonic energies from 'corners' and 'ends' of internal structures (primarily defects) in a component being tested. Using TOFD, the expert NDT team members at TCR Arabia perform amplitude-independent accurate flaw sizing on a wide coverage area.TOFD is a fast and efficient way to scan a lot of weld area in a very short time period. Dead zones near the front and back surface can be enhanced using combined TOFD and conventional pulse echo techniques.

This technique has many advantages:

- Wide coverage area using a pair of transducers
- Accurate flaw sizing; amplitude-independent, Sizing technique using time-of-flight information
- One-line volume inspection, provides very fast scanning
- Setup independent of weld configuration
- Very sensitive to all kinds of defects. No sensitivity to defect orientation
- Amplitude-insensitive, acoustical coupling less critical

While TOFD is a very powerful and efficient technique, it suffers from limited coverage resulting from two dead inspection zones. The first dead zone is near the surface, as a result of the lateral wave; the second is at the back wall, resulting from the width of the back wall reflection. TCR Arabia's NDT equipment allows inspections simultaneously combining TOFD with conventional pulse echo. Pulse echo complements TOFD and covers the dead zones.

Experienced analysts from TCR will have clues to the characterization of these types of flaws using TOFD however at times the definitive conclusions may be rare. In the case of Phased Array technology an experienced analyst has a greater chance of determining flaw type based on the percentage of sound transmitted back to the probe.

TCR Arabia uses products from Olympus's OmniScan technology which has capabilities to indicate to the operator the exact location of a flaw with respect to the weld centerline and bevel face. An experienced analyst from TCR Arabia is able to characterize fusion flaws based on location and amplitude response.

B. Phased Array

Phased array ultrasonic systems utilise multi-element probes, which are individually excited under computer control. By exciting each element in a controlled manner, a focused beam of ultrasound can be generated. Software enables the beam to be steered. Two and three dimensional views can be generated showing the sizes and locations of any flaws detected.

TCR Arabia's team of qualified technicians provide PAUT services to our valued clients using state of art equipment and probes manufactured by Olympus. Multiple crews are available to take up major projects. The technical team is trained by Eclipse Scientific of Canada.

High Temperature PAUT

Custom made high temperature probes and wedges are built from plastics resistant to high temperature degradation, and equipped with a cooling jacket around the array or cooling irrigation holes for air and water flow.

- Heat resistant material engineered to handle temperatures up to 350°C.
- Vastly increased inspection angle range and sizing accuracy.
- Improved water jacket design, compatible with corrosion mapping and weld inspection wedges that achieves increased cooling capacity of probe mounting face.

Benefits of Our High Temperature NDT Inspection Services:

High-temperature ANDT inspection offers considerable benefits for defect detection, monitoring defects and corrosion during plant systems operation as mentioned below.

- Reduced down time of the plant, by improved maintenance planning
- Reduced shutdown time by improved RBI input
- Reduced production losses as inspection of an industrial plant can be carried out online

- Determine corrosion rates and monitor defect growth rates for FFS -engineering evaluations
- Monitoring of cracking growth and corrosion spots during production
- Inspection of on-line repaired areas, in accordance with ASME code case
- Wall thickness mapping of the area, before making hottaps
- Accurate corrosion monitoring and defcet detection up to 350 deg C, on critical positions
- Significant reduced risk on weld repairs during the construction phase of heavy wall vessels or "golden" welds
- Provides immediate feedback.
- Digitised inspection records for future reference and verification
- Highest consideration of your health, safety and environment (HSE) rules

C. Tube Inspection: ECT, MFL, RFET, IRIS

TCR Arabia in Saudi Arabia undertakes eddy current, Remote Field Eddy Current, Magnetic Flux Leakage and Internal Rotary Tube Inspection (IRIS) testing of tubular products using internal diameter probe coil (bobbin) for non-ferrous materials and ferrous materials (with magnetic saturation). TCR Arabia has a portable Eddy Current Testing unit that can inspect any heat exchanger from the largest power plant condenser to the smallest feed water heater. The eddy current instrument at TCR Arabia is capable of operating at test frequencies upto 8 kHZ with a high speed of 2-Meter Per Second Inspection Speed.

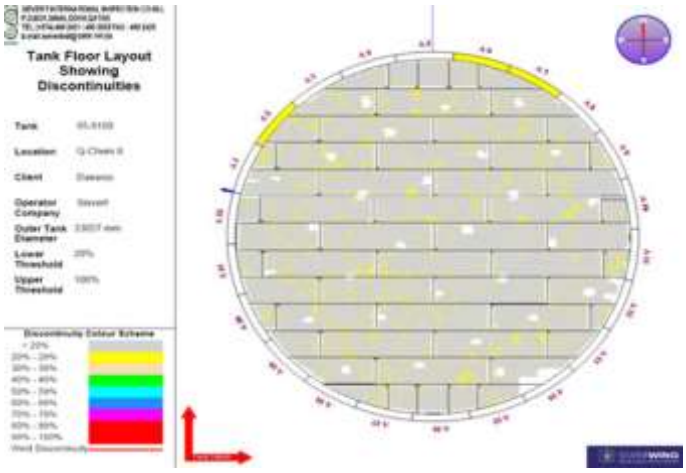
Prior to the testing, all tubes must be cleaned. Cleaning shall be done using hydro jetting with typical cleaning pressures between 280kg/m² and 560 kg/cm². The adequacy of cleaning must be checked by inserting an appropriate dummy probe / rod.

The electronic apparatus used for the test will be capable of energizing the test coil with alternating currents of suitable frequencies (for example 1 to 125 kHz) and will be capable of sensing the changes in the electromagnetic response of the coils. The instrument will be balanced with the probe in a defect free position of the calibration tube. The spot will be central on the impedance plane display of screen for differential testing and at one division from the top of the screen for absolute testing.
The expert Eddy Current technicians of TCR Arabia take the flaw signals generated in tubes under test and then compare it with the signals of the calibration standard.

D. MFL Tank Flow Inspection

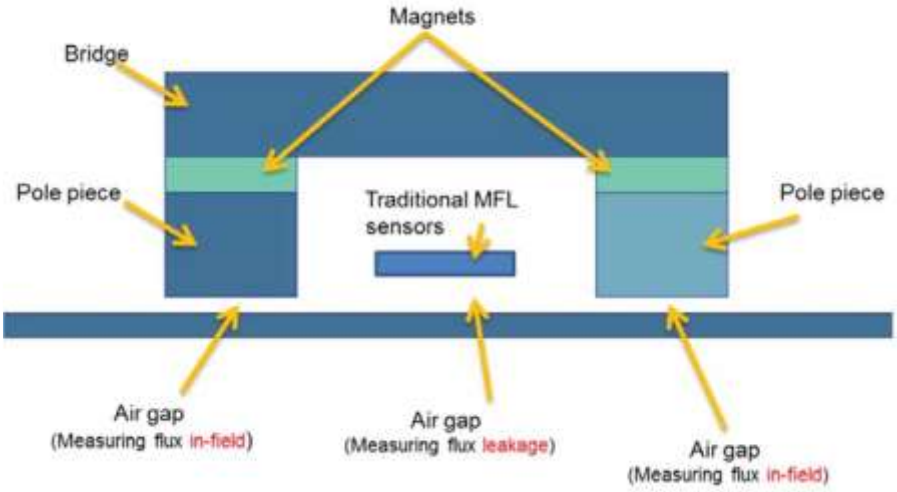
Magnetic Flux Leakage (Tanks Inspection)

The magnetic flux leakage (MFL) approach is extensively used for the non-destructive testing (NDT) of large steel structures such as aboveground storage tank (ASTs). MFL testing is well suited to the inspection AST floors due to its ability to cover vast areas quickly. These areas can be hundreds of *m*2, requiring the MFL tool to find and ideally determine the size of any material loss with diameters in the region of *mm*'s. This means that MFL equipment must be able to provide *mm* positional accuracy and report severity of material loss for defects. However, it is the accuracy, repeatability and reliability of MFL signals for defect sizing that appears to be a common concern of the MFL community.



Principle of MFL:

The basic principle of inspecting a ferrous specimen with MFL is to suitably saturate the local area of interest with a magnetic field. In the vicinity of a defect or flaw, the reluctance to the induced magnetic field increases and if high enough, the magnetic field will diverge around the absence of material. This field can circumvent the defect within the surrounding material and also 'leak' outside its confides. The amount of leaking magnetic field can be measured by suitably placed magnetic sensors which are normally located near the surface. To perform rapid inspection of an AST floor, a scanner with an array of sensors is normally used and arranged in a linear manner that is perpendicular to the direction of travel so that an area can be covered with one sweep, mapping the material loss.



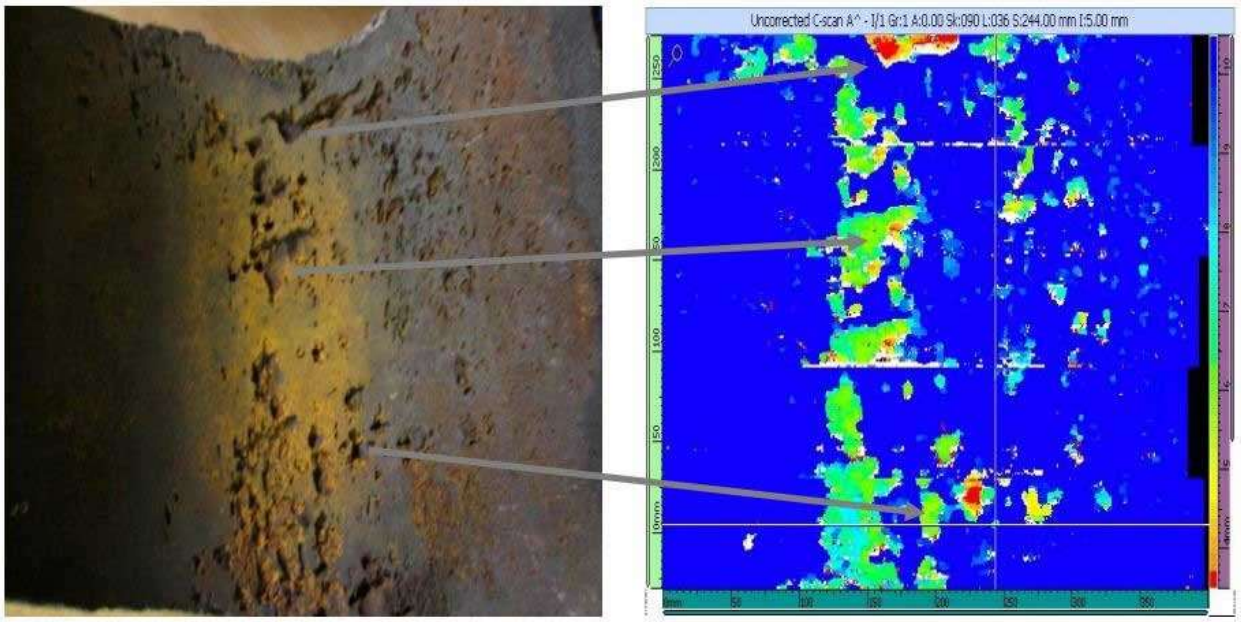
The magnetic circuit is generated with the yoke arrangement shown in Figure 1. And comprises two magnets, a bridge, and two pole pieces. The magnetic yoke is situated in close proximity to the inspection surface at a height of approximately 4 *mm*. Traditionally, the lateral position of the magnetic sensors to capture theMFLis situated at an equidistant position between the two poles. The height of the MFL sensors from the surface of the specimen can be used to amplify the MFL signal when in closer proximity to the surface.

E. Corrosion Mapping: Normal and High Temperature

Corrosion mapping is an ultrasonic technique which maps and identifies variations in material thickness due to corrosion. Corrosion is the deterioration of a metallic material by chemical (or electrochemical) attack. This is normally caused by the environment (most often water), and sometimes by another material. There are several types of corrosion:

- Uniform corrosion that extends evenly across the surface
- Pitting corrosion that is uneven and has smaller deep areas (pits)
- Exfoliation corrosion that moves along layers of elongated grains
- Inter-granular corrosion that grows along grain boundaries

To perform corrosion mapping an automatic or semi-automatic scanner is used to scan an inspection surface, using various ultrasonic techniques including pulse echo, eddy current and phased array. Corrosion mapping is widely used in the oil, gas and nuclear industries for the inspection of pipework, pressure vessels, storage tanks and reactors. In the Aerospace sector, corrosion mapping is often referred to as 'C-Scan' for the inspection of composite materials. Results for corrosion mapping provide a high degree of repeatability and the advantage of position and size data for every flaw which can be compared for repeat scans of the same area to track flaw growth or corrosion rates both generally and for individual pits.



Scanners used in Corrosion Mapping

High Temperature Corrosion Mapping:

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- Heat resistant material engineered to handle temperatures up to 350°C.
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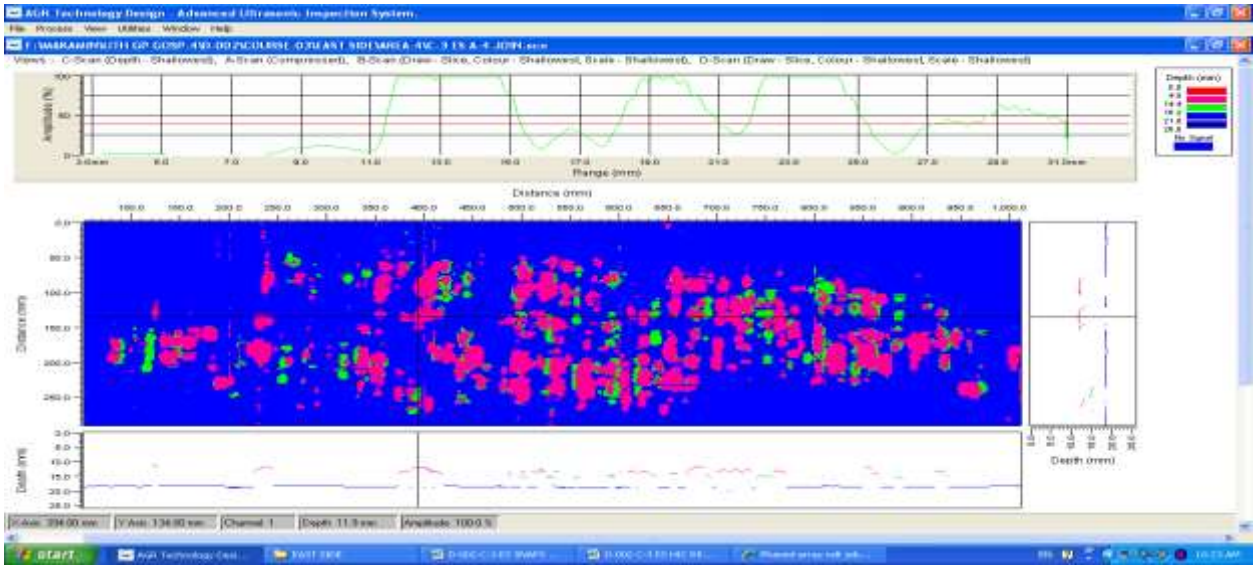

Benefits of Our High Temperature NDT Inspection Services:

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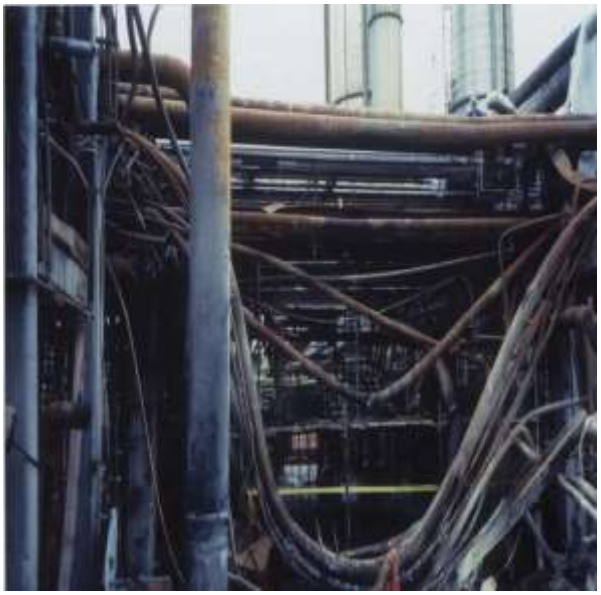
F. Hydrogen Induced Cracking (HIC) Inspection / HTHA

High Temperature Hydrogen Attack (HTHA)

High temperature hydrogen attack (HTHA) is a phenomenon of metal degradation that is well known in the petrochemical and refinery industry. HTHA occurs in carbon and low steels exposed to high partial pressure of hydrogen at elevated temperatures. Such damage occurs over time on the long-term exposure of steels in hydrogen service. Equipment designed to be safe as per engineering codes has experienced such damages as well. Detection of hydrogen attack is important to assure safe operation of pressure vessels and piping susceptible to such damage. HTHA can lead to failure of equipment and major accidents (See Fig 1 & 2).



The damage is caused by the seepage of hydrogen that reacts with metal carbides (MC) to form methane (CH4). The source of hydrogen is from the flow stream (hydrocarbons) that seeps into the metal causes such damage. This Hydrogen Reacts with carbides in steel and decarburizes the steel, the loss of carbide causes an overall loss in strength and lowers the toughness of steel without necessarily a loss of thickness. Methane pressure builds up, produces micro fissures that may combine to form cracks. Low alloy steels are most at risk to this damage mechanism. Carbone steel, 0.5Mo, 1Cr-0.5Mo, 1.25Cr-0.5Mo, 2Cr-0.5Mo, 2.25Cr-1Mo, 2.25Cr-1Mo-V, 3Cr-1Mo & 5Cr-0.5Mo Etc.

<u>Equipment susceptible to HTHA damage:</u>

High Temperature Hydrogen attack has number of typical units where Temp. is greater than 400 F (200C) and a hydrogen partial pressure among other factors.

- Catalytic Reformers (CCR & Cyclic)
- Hydro treating Units (Hydrogen Desulfurization and Hydro cracking)
- Isomerization Units (Butamer…..other Names)
- Ammonia plant

- Hydrogen Reformers
- Highly stressed locations of above equipment's/Units are most suspect, flanges, reducers, elbows, other pipe fittings in piping and long seam, Nozzle to head junctions, reducers of equipment.

Associated Inspection Techniques:

- **Time of flight diffraction (ToFD) Technique**
- **Automated ultrasonic inspection for HIC/SWC (AUT-P-SCAN)**
- **Phased Array Ultrasonic Testing (PAUT) Technique**
- **Advance Ultrasonic Back scatter (AUBT-L) Technique using longitudinal wave**
- **Advance Ultrasonic Back scatter (AUBT-S) Technique Using shear wave**

G. Helium Leak Testing

TCR Arabia in KSA now offer all its clients advanced Helium Leak Testing services.

TCR Arabia's Helium Leak Testing instrument has a roughing capacity of 10 m3/h (7 cfm) with usable helium sensitivity in the 10-11 atm cc/s range. The unit has a dedicated sniffing unit, based on a well-proven leak testing concept, and is also available for outboard leak testing applications.

TCR Arabia has experienced operators will come directly to a customer site and perform most any leak tests. The crew has performed this test on sites from nuclear carriers, polymer plants, oil refineries, gas and steam turbine power plants in Saudi Arabia and India. The technicians are higly mobile and perform helium leak testing on heat exchangers, steam turbines and condensers, distillation towers, buried pipelines and many other systems and components.

TCR Arabia's services include vacuum leak testing for any type of vacuum vessel or system and pressure probe testing for systems that normally operate at or above ambient pressure. Virtually any system that has a requirement for leak tightness or that is suspected of causing a problem due to leakage can be tested by one of these methods of helium leak testing with a high degree of reliability.

The Helium Leak Testing unit of TCR Arabia utilizes has a proven mechanical vacuum pump technology designed specifically for heavy usage in very harsh industrial environments. The helium stability of the rotary vane pump guarantees excellent stability of the helium signal. The low rotational speed of the M.D.P. (Molecular Drag Pump) at 27,000 rpm makes this unit totally bullet proof against accidental air inrushes. Further, it allows the leak detector to be moved while in operation.

The high compression ratio of the M.D.P. facilitates the gross leak test at a high pressure (7.5 Torr / 10 mbar) which speeds up the leak test process of outgassing parts. The internal layout of the unit allows easy access to all the components.

H. Acoustic Eye Tube Inspection

TCR Arabia are engaged in advanced NDT inspection of Heat Exchanger and Boiler tubes employing latest Acoustic Eye tube inspection technology to discerning users for the safety and integrity of their process equipment. Acoustic Eye) tube inspection is Fast (10 seconds per tube, up to 2000 tubes inspection in one shift of 12 hours), Non-invasive and provides in-built computerized signal analysis tools to quickly identify tube faults (e.g. pitting/ wall loss, erosions, holes/ leakage, blockage, bulging) in heat exchangers/condensers/boilers/chillers/reactor tubes.

Main advantages:

- Non-Traversing NDT system with no moving parts
- Fast inspection of tubes, each tube irrespective of length it takes 10 seconds for inspection
- Tube wall material independent, can be used for tubes of any material
- Tube configuration independent (fin tubes, U-tubes, multi bends, 90 deg turns)
- Extremely accurate
- Self-Analyzing special software does automatic analysis using Matlab and C++
- Automatic report Generation (in PDF/HTML format)
- Can be used for tubes from 7 mm ID to 70 mm ID

User benefits:

- Fast and accurate detection of tube faults and type, position/ location and size/extent of faults
- Resultant time saving in taking corrective actions on tubes with defects
- Faster turn-around of equipment contributing to faster unit/plant startup

I. Automated Reformer Tube Inspection System

TCR's custom developed tool, ARTiS, is designed to solve the major concern in the maintenance of primary reformer which is to predict the behavior of the reformer tubes. The prediction is based on selection of suitable inspection methods. Most importantly, the creep strain, mid-wall fissure detection and bowing measurement. ARTiS can perform all these tests at a time, providing integrated and interactive digital inspection record. ARTiS has leading advantage to inspect from external surface without needing removal of catalyst. The system measures creep strain with high precision IR sensors. Mid-wall fissures are detected through ultrasonic flaw detection. Use of gyroscopes measures precise level of bowing. More than a gigabyte of data is gathered for each tube inspected inclusive of flaw detection dB levels with screen captures, bowing and creep strain. Precision encoders used in crawling ensure accurate location of defectives and generation of 3D plots across length of tube.

Inspection Benefits:

- Inspection without catalyst removal,
- No surface cleaning needed
- Automated crawling action avoids need for scaffolding
- Faster – precise PC controlled movement
- Full coverage across length of tube
- Built-in water tank for ease of ultrasound coupling. No need for overhead water drums arrangement

ARTiSallow's TCR's inspectors to perform multiple inspections on Reformer Tubes including Fissure detection, Creep Strain measurement, Visual Aid and Bowing Measurement.

J. Infrared Thermography

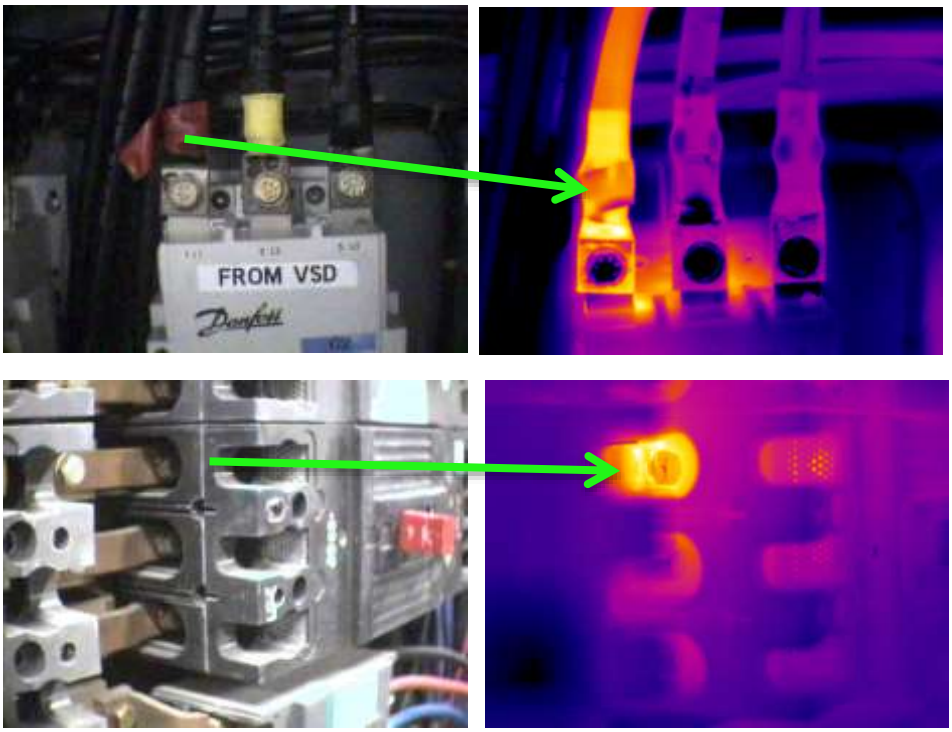
TCR Arabia in Saudi Arabia undertakes thermographic survey of installed thermal insulation on pipework and equipment when in service. The purpose of the inspection/survey is to verify by the measurement of surface temperature that the insulation materials have been applied in a thermally efficient manner, and that the insulation materials are conforming within the ambient conditions, operating conditions and the insulation specifications.

Work is undertaken in adherence to the codes specified in BS 5422, the use of thermal insulating materials and in BS 5970, thermal insulation of pipe work and equipment (in the temperature range minus 100°C to plus 870°C).

The survey is be carried out using fully portable infrared thermal imaging equipment with both "live" and "freeze-frame" recording facilities. All thermography equipment used is from Flir instruments utilizing their latest FUSION functionality which allows for easier identification and interpretation of infrared images. This advanced technology enhances the value of an infrared image by allowing the technician to overlay it directly over the corresponding visible image. The functionality combines the benefits of both the infrared image ad visual picture at the push of a button. The thermography camera of TCR Arabia does this in real-time and the overlay function can be easily adjusted to suit any application such as electrical surveys, building diagnostics, and mechanical inspections.

The technician from TCR Arabia that will be designated to conduct the survey will be fully trained in the operation of the thermal imaging equipment/recording equipment and shall be fully conversant with insulation systems and basic heat transfer physics. Technician will be trained in the analysis of results, identification of anomalies and shall prepare factual report of findings together with recommendations. The level of survey conducted and extent of reporting shall be dependent on the clients requirements, objectives etc., which can be determined prior to the survey commencing.

TCR Arabia's expert inspectors and technicians will on completion of the site survey document all findings and recordings into the final report. Where applicable floppy disk images recorded during the survey will be enhanced and printed in the report. The video recording made during the survey shall form part of the report. All findings shall be summarized and the report shall recommend actions that need to be taken.



K. Contract Research and Development

TCR Arabia can effectively operate and manage an in-house laboratory for a corporation while retaining the innovative, professional and superior quality service. TCR brings to these engagements, its strong process, our management expertise as well as results reporting method based on integrity and reliability. TCR Arabia's dedicated engineering and metallurgical consulting team in KSA is a perfect partner for solving manufacturing and product

quality problems. Several senior consultants with many years' experience are available to help and advice on corrosion or materials selection queries. Our team can also advise on your welding engineering and heat treatment problems.

From initial product design, through final production, TCR Arabia's in-depth engineering consulting services ensures that clients are producing the best possible product.

Areas of routine research assistance include:

- Determining the right material for a product
- Corrosion engineering, corrosion testing and corrosion investigations
- Metallurgical failure analysis and welding evaluations.
- Investigate the effect of environmental conditions on a product or material
- Prepare material and process specifications for in-house quality control
- Compare vendor or competitive products
- Identify equivalents between local and foreign specifications
- Assist to solve product quality problems
- Assist in cost-benefit analysis post failure analysis
- Reverse Engineering and Rapid Prototyping

TCR Arabia also undertakes research projects in the areas of Computer Aided Designing (CAD) including Engineering Design, Legacy Data Conversion, Detailing Plant & Process Layout, CAM, Computer Aided Engineering (CAE) including Finite Element Modeling, Structural Analysis and Noise, Vibration, Harshness (NVH) analysis, and Project Management Services.

L. Engineering Consulting – Risk Based Inspection

The reliable and proven Risk based Inspection (RBI) technology process developed by PP SIMTECH (UK), with key guidance from API 580/581 and UK HSE, has been accepted globally as good engineering practice by leading international companies. PP SIMTECH has successfully implemented RBI at BP, Dow Chemicals, GPIC, ADNOC-Fertil, Norsk Hydro, BASF, INEOS.

In Saudi Arabia, PP SIMTECH (UK) has partnered with TCR Arabia and the joint team of TCR Arabia – PP SIMTECH includes Mechanical Engineers, Metallurgists, Corrosion Engineers, NDT Experts, RBI Experts and Project Managers and provides plants with RBI, Fitness-For-Service (API 579), Material Damage Mechanisms Assessment, Metallurgical Investigation & Failure Analysis and In-service Inspection.

RBI technology offers oil and petrochemical industries, chemical, fertilizer and power plants the immense benefits of a risk-based approach to inspection which includes an increase in plant availability and cost saving, minimum duration of shutdowns, change in inspection strategies and intervals and improved safety compliance. The RBI team study also improves the team working and communication between all plant departments.

rbiAsyst™, a fully auditable & transparent software system developed by PP SIMTECH, is designed to facilitate the RBI team study and successful implementation of RBI technology process at a plant site.

The RBI team study facilitated by TCR Arabia - PP SIMTECH and rbiAsyst™ software provides all plant management and operations team to identify and resolve complex item technical issues associated with static equipment including reactors, furnaces, strippers, distillation columns, heat exchangers, pressure vessels, reformers, boilers, fired heaters with associated items such as interconnected piping and storage tanks.

Reliable assessment and calculation of risk profile of an item, based on its "active" and "potential" Damage Mechanism ensures that the resulting inspection interval for the item is reliably optimized in a safe and cost-effective manner. The approach to risk-based inspection is based on a strong co-operation between the plant personnel and TCR PP SIMTECH experts. The adopted process of guided expert judgment is based on operational experiences and sound technical basis for the evaluation of possible degradation mechanisms.

Benefits of RBI include:

- Increased safety and equipment reliability
- Fewer planned shutdowns
- Fewer unplanned shutdowns
- Longer inspection intervals
- Potential fewer inspection and maintenance costs
- Evaluation of effectiveness of inspection activities
- Increased consistency of inspection planning
- Identification of potential damage mechanisms
- Priorisation of inspection
- Identification of key process parameters affecting degradation rates
- Assessment of proposed process changes that could impact degradation rates
- Documentation of current plant configuration and materials of construction
- Improved team working and communication between all departments

The hallmark of TCR Arabia – PP Simtech's RBI technology process is the method used to reliably assess and calculate the risk profile of an item, based on its "active" and "potential" Damage Mechanism identified by the RBI study team, which in turn ensures that the resulting inspection interval for the item is reliably optimized in a safe and cost-effective manner. Operating limits are also defined by the RBI team to prevent increase in damage rate or initiation of a new damage mechanism. Where the business or safety risks are unacceptable, risk mitigating options are also recommended as part of the output.

M. Fitness for Service

TCR Arabia undertake FFS Assessment work based on BS 7910 standards (which covers more areas than API 579). Essentially, the fracture mechanics procedure in API 579 is mainly copied / reworded from the procedure in BS 7910 (and previously PD 6493). The BS 7910 fracture mechanics methodology and its application has been successfully proven worldwide by many companies including those in US for at least 35 yrs (from nuclear pressure vessels to high consequence items in the exploration, refining & petrochemical industry, irrespective of the Item code of construction), many times over compared to API 579. The assessment we propose to do is Level 2 to BS 7910.

Fitness for service assessment is performed to make sure that process plant equipment, such as pressure vessels, piping, and tanks, will operate safely and reliably for some desired future period. API Recommended Practice 579 provides a general procedure for assessing fitness for service. The assessment procedure evaluates the remaining strength of the equipment in its current condition, which may be degraded from its original conditions. Common degradation mechanisms include corrosion, localized corrosion, pitting and crevice corrosion, hydrogen attack, embrittlement, fatigue, high-temperature creep, and mechanical distortion. Methods for evaluating the strength and remaining service life of equipment containing these types of degradation are presented and reviewed. Examples are presented to illustrate the application of these methods to process plant equipment.

Process plant equipment is often exposed to corrosive environments and/or elevated temperatures. Under these conditions, the material used in this equipment can degrade or age with time in service. As important equipment such as pressure vessels, piping, and storage tanks become older, the plant operator must decide if they can continue to operate safely and reliably to avoid injuries to personnel and the public, environmental damage, and unexpected shutdowns. Fitness for service assessment procedures provide a means for helping the plant operator make these decisions based on sound, established engineering principles.

Fitness for service assessment is a multi-disciplinary engineering analysis of equipment to determine if it is fit for continued service until the end of a desired period of operation, such as until next turnaround or planned shutdown. Common reasons for assessing the fitness for service of equipment include the discovery of a flaw such as a locally thin area (LTA) or crack, failure to meet current design standards, and plans for operating under more severe conditions than originally expected. The main products of fitness for service assessment are (1) a decision

to run, alter, repair, monitor, or replace the equipment and (2) guidance on inspection interval for the equipment. Fitness for service assessment applies analytical methods to evaluate flaws, damage, and material aging.

The analytical methods are based on stress analysis, but they also require information on equipment operations, non-destructive examination (NDE), and material properties. Stress analysis may be performed using standard handbook or design code formulas or by means of finite element analysis (FEA). With modern computer technology, the use of FEA is quite common. Fitness for service assessment requires both knowledge of past operating conditions and a forecast of future operating conditions. Interaction with operations personnel is required to obtain these data. NDE is used to locate, size, and characterize flaws. The material properties should include information of material damage mechanisms and behaviour in the service environment, especially on the effects of corrosion and temperature.

N. Third Party Inspection

TCR Arabia can provide third party inspection services in KSA, Kuwait and India. TCR Arabia undertakes Independent, third party inspection and quality assurance services, including Factory Audits, OEM Development, Raw Material Inspection, Initial Production Check, In-Production Check, Random Inspection and Loading Supervision directly on-site at a given vendor / supplier location in India. TCR's independent, third-party quality assurance services results in improved product quality, with a reduction in customer complaints, noncompliance and product recalls.

TCR Arabia's Factory Audit service verifies the capability of a manufacturer to meet contract conditions for quality, quantity and delivery terms. Such assessments are often tailor-made as per a client's needs and requirements. By availing of this service, TCR eliminates the need for a client to be present on-site at the manufacturer's plant or factory.

Quality control is a key success factor for companies dealing with International or non-standard suppliers. A stringent quality assurance program helps businesses to:

- Reduce risks associated with poor quality, loading, storage, transportation and non-compliance with regulatory requirements
- Get informed in advance about production problems and shipping delays
- Ensure that contractual obligations are met: specifications, packaging, marking and delivery
- Identify problems before products are shipped or distributed
- Establish and maintain a high-performance vendor base and lower costs

Typically TCR's inspectors undertake:

- Review of suppliers internal records, test certificates for identified stages in the approved Quality Plan or material procurement for verifying conformance of requirements of the equipment's / systems as per Purchase Orders, agreed Technical Specifications / approved drawings / data sheets, approved Quality Plan and other documents available with the contractor.
- Carry out stage and final inspection at works as per above documents. Inspection could be by TCR alone or along with Customer's representatives.

- Verification of calibration status of all the inspection, test and measuring instruments used by vendor/supplier for inspection.
- Preparation and submission of Inspection Reports in the prescribed format along with the necessary supporting documents such as Stage Inspection Reports / Test Certificates, etc. as per approved technical documentation and approved quality plans.
- Identify any deviations to our requirements and indicate along with supplier the proposed corrective actions.
- The Inspection reports along with all the necessary supporting documents such as Stage Inspection reports / Test certificates, etc. are sent through courier immediately to the Client by post or email

TCR follows the most widely accepted sampling methods as defined in ISO 2859 tables (also known as AQL tables). This proven method is widely used to decide whether or not to accept or reject a production lot without checking every single item of the lot. Performed on randomly-selected sample items, once the production lot has been completed and packed, this standard is recognized by every industrial company.

O. Root Cause Failure Analysis (RCA) and Remaining Life Assessment (RLA)

TCR has completed more than 800 failure investigation assignments, including 80 major projects on manufacturing and metallurgical failures on ASME boiler and pressure vessels, gas turbine engine components, oil and gas transmission pipelines, food processing equipments, heat exchangers, medical supplies, refineries, petrochemical plants, aircraft/aerospace, offshore structures, industrial machinery, weldments and ships. The failure analysis team's strength is in evaluating high temperature and high pressure failures.

The team has access to the complete range of testing facilities at our network of laboratories including access of optical microscopes, Scanning Electron Microscopes (SEM) equipped with Energy Dispersive Spectrometry (EDS), microstructure analysis software and photographic instruments.

Methodology for Failure Investigation

TCR Engineering works with clients to plan the failure analysis before conducting the investigation. A large amount of time and effort is spent carefully considering the background of failure and studying the general features before the actual investigation begins.

In the course of the various steps listed below preliminary conclusions are often formulated. If the probable fundamental cause of the metallurgical failure becomes evident early on in the examination, the rest of the investigation focuses on confirming the probable cause and eliminating other possibilities. The metallurgical failure analyst compiles the results of preliminary conclusions carefully considering all aspects of the failure including visual examination of a fracture surface, the inspection of a single metallographic specimen, and the history of similar failures.

Procedure to conduct a Failure Analysis

Cause of failure is determined using state-of-the-art analytical and mechanical procedures and often includes simulated service testing. A combination of analysis and physical testing locates problems and provides recommendations for solutions. The investigation team produces detailed written reports to ensure that clients fully understand and are able to independently examine the analytical results and conclusions.

The complete evaluation sequence is summarized as under:

- Collection of background data and selection of samples
- Preliminary examination of the failed part
- Complete metallurgical analysis of failed material
- A through examination of the failed part including Macroscopic and Microscopic examination and analysis (electron microscopy, if needed)
- If necessary tests may also include Weld Examination, Case Depth, Decarburization Measurement, Coating/Plating Evaluation, Surface Evaluation and/or Grain Size Determination

- Chemical analysis (bulk, local, surface corrosion products, deposits or coating and microprobe analysis)
- Selection and testing of alternative products and/or procedures that will significantly improve performance
- On-site evaluation and consulting services and Formulation of conclusions and writing the report (Including recommendations)

P. RLA and Condition Assessment of Boilers:

TCR Arabia has a strong practice in accessing boilers for their condition and remaining life.

There are two RLA approaches viz., Level – II assessment and Level-III assessment.

A pragmatic approach is adopted by TCR Arabia in handling the cases of remaining life assessment. Efforts are put in to collect as much data as possible on the component / equipment history. Often brain storming sessions are conducted with the concerned people using the equipment including the outside experts who are familiar with the operational details. To collect opinions and ideas, which are evaluated vis-à-vis the testing and studies conducted at a later stage.

CALCULATION BASED APPROACH

Calculation procedures are often employed to determine the expanded lives of components under creep, fatigue and creep fatigue conditions. From plant records, information on temperature and cycling history is gathered. By use of standard material properties and damage rules, the fractional life expended up to a given point in time can be estimated.

DESIGN APPROACH

Components which are operated bellow creep regime are generally designed on the basis of yield strength, tensile strength and fatigue strength with suitable safety factors. Under normal condition deformation and fracture is not time dependant. As long as the applied stresses do not exceed the design stresses these components should last indefinitely; but in practice various factors causes reduction in life.

The Remaining life assessment approach is derived as under:

1. Understanding the actual degradation mechanism
    - FATIGUE
    - THERMAL FATIGUE
    - THERMO MECHANICAL FATIGUE
    - THERMAL AGING
    - CREEP
    - EMBITTERMENT
    - CORROSION
2. Visual examination
3. NDT involving In-situ Metallography, Ultrasonic Testing, Magnetic Particle Inspection, DP Test, Ferrite Measurement.
4. STRESS ANALYSIS - Stress analysis is carried out to know the strength of the material.
5. NON DESTRUCTIVE TESTING - NDT inspection data provide an good in-site to the component integrity.
6. LABORATORY TESTING - Laboratory testing of cut samples provide valuable information about the material soundness.
7. JUDGMENT OF FITNESS OF THE EQUIPMENT- Based on available data, a judgement of the fitness of the equipment is done.
8. SUGGESTIONS ON REPAIRING IF ANY - If required, repairing of the equipment is suggested, for life extension.
9. JUDGMENT OF REMAINING LIFE BASED ON ANALYSIS - Finally, the estimates for remaining life is carried out.

Often the physical properties are verified and not so common tests like Stress ruptures are conducted. Having ascertained the extent of degradation, judgment on the remaining life is made. In addition to this periodic inspection procedures are spelled out to monitor the health of the equipment during the course of operation. The results point out if any operational mistake, restriction in free movement by

thermal expansion or any other damage mechanism prevailing is revealed and preventive maintenance approach can be formulated.

DEFINITIONS OF COMPONENT LIFE- When RLA is performed:

HISTORY BASED CRITERIA: 30 to 40 years have elapsed, Statistics of prior failures indicate impending failure, Frequency of repair renders continued operation uneconomical, Calculations indicate life exhaustion

PERFORMANCE BASED CRITERIA: Severe loss of efficiency indicating component degradation, Large crack manifested by leakage, severe vibration or other malfunction, Catastrophic burst

INSPECTION BASED CRITERIA: Dimensional changes have occurred, leading to distortions and changes in clearances, Inspection shows microscopic damage, Inspection shows crack initiation, Inspection shows large crack approaching critical size

CRITERIA BASED ON DESTRUCTIVE EVALUATION: Metallography or mechanical testing indicates life exhaustion

DATA REQUIREMENT FOR LIFE ASSESSMENT

Item	Level – II	Level – III
Feature	More detail	Most detail
Failure history	Plant records	Plant records
Dimensions	Measured or nominal	Measured
Condition	Inspection	Detailed inspection
Temperature and pressure	Operational or measured	Measured
Stresses	Simple calculation	Refined analysis
Material properties	Minimum	Actual material
Material samples required?	No	Yes

LEVEL – II ASSESSMENT

For Level-II assessment, TCR Arabia will undertake following approach.

1) Collection of back ground data and history of Boiler Operation.
2) Thorough visual examination by an expert
3) Dimensional measurement at critical locations
4) Collection of scale and deposits samples and it's analysis.
5) Detailed Thickness Survey
6) Internal oxide scale measurement at Super Heater Tube and Re-heater Tube
7) WFMPI of main weld joints of Header and Steam Drum
8) In-Situ metallograpy to find out thermal ageing and creep related problem for RLA point of view.
9) In-Situ hardness measurement with portable hardness tester.

Under level-II assessment no destructive analysis of tube sample and boroscopy is included. A detailed report along with evidences of damage of any and recommendations will be provided by estimation of RLA

LEVEL – III ASSESSMENT

Under level-III assessment, detailed assessment of Boiler for which the details approached are given below.

Sr. No.	COMPONENT	VIS	UT	MPI	LPT	IMG	DT	DEPO	IOT	ACRT	DIM	FIBRO	HARD
B1	Boiler Drun	√	√	√	√	√	–	√	-	-	√	-	-
B2	Boiler Pass I & II maintenance												
	I) Furnace	√	√	-	-	-	√	√	-	-	√	-	-
	II) 2nd Pass water wall tubes	√	√	-	-	-	√	√	-	-	√	-	-
	III) Economizer	√	√	-	√ (If required)	-	√	√	-	-	√	-	-
	IV)) Primary Super Heater	√	√	-	-	-	√	√	-	-	√	-	-
	V) Secondary Super Heater	√	√	-	-	√	√	√	√	√	√	-	-
	VI) Headers	√	√	√	√	√	-	-	-	-	√	√	√
Sr. No.	COMPONENT	VIS	UT	MPI	LPT	IMG	DT	DEPO	IOT	ACRT	DIM	FIBRO	HARD
B3	Ducts												
	I) Ducts	√	-	-	√	-	-	-	-	-	√	-	-
	II) Expansion Joints (at gas side)	√	-	-	√	-	-	-	-	-	√	-	-
B13	Soot Blower	√											

Special Tests :- Hanger Inspection, Alignment Check

FEA	Finite Elemental Analysis
VIS	Visual Inspection
UT	Ultrasonic Test
MPI	Magnetic Particle Inspection
LPT	Liquid Penetration Test
IMG	In-Situ Metallography
DT	Destructive Test of Sample
DEPO	Deposit Analysis
IOT	In-Situ Oxide Thickness Measurement
ACRT	Accelerated Creep Rupture Test
DIM	Dimensional Measurement
FIBRO	Fibroscopy Examination
HARD	In-Situ Hardness Test

A detailed report along with evidences of damage of any and recommendations will be provided by estimation of RLA.Typically, at TCR Arabia we propose following line of approach to undertake the RLA of package boiler

1. Visual Examination
2. Thickness Measurement of critical areas.
3. Ultrasonic test on critical joints

4. Collection of scales/ water from different sections and analysis in the laboratory.
5. In situ metallography on critical locations.
6. In situ hardness testing
7. Literature survey and experience of other in assessing the extent of judgments.

Correlation of all testing, process parameter history of operation would be undertake to assess reaming life of Boiler. Recommendations would be made to attain longer, reliable and safe operation of boiler. The final report would be submitted with results of testing, explanation of damages observed during testing and observation in document form.

Following table show details of the nature of NDT to be conducted on Package Boilers.

Sr. No.	Component	Tests	Location to be checked
1	Main Cylindrical Shell	Visual	100% after removal of insulation
		Thickness Measurement	Random
		WFMPI/UT	Weld joints, Side holes, mud holes and blow down outlet
		Replica & Hardness	Replica & hardness shall be on weld/HAZ & parent
2	Furnace tubes with bowling hoops	Visual	100% thru the hot gases side with weld joints
		Thickness Measurement	Random
		WFMPI & UT	Weld Joints
		Replica & Hardness	Replica & hardness shall be on weld/HAZ & parent
3	Smoke Tubes and Stay Tubes	Visual	100%
		WFMPI	Tube to Tube Plate weld joints
		Thickness Measurement	Random
		Replica & Hardness	Replica & hardness shall be on weld/HAZ & parent
4	Front & rear tube plates and end plates of wet back	Visual	External Side
		WFMPI/UT	Circumferential Weld seam
		Thickness Measurement	Random
		Replica & Hardness	Replica & hardness shall be on weld/HAZ & parent
5	Reversal Chamber	Visual	
		WFMPI	Weld Joints
		Replica & Hardness	Replica & hardness shall be on weld/HAZ & parent

WFMPI=Wet Fluorescent Magnetic Particle Inspection, UT=Ultrasonic Test
MPT : The technique adopted shall depend on dia of the pipe welds - MPT shall be preferred for Dia>=4 inches
MPT: The technique adopted shall also depend on surface condition of the welds.

* Only those parts / components which are assessable, bare and thoroughly cleaned would be attended and examined.

Q. Plant Shutdown Management

TCR Arabia can rapidly source and deploy a strong and talented NDT manpower for Petrochemical and Power industry in KSA on contract. In recent times, TCR Arabia has assisted SIPCHEM as well as SABIC plants such as IBN-Zahr in locating experienced manpower to assist in their shutdown.

TCR Arabia works with industry organizations, research and development facilities, and clients to develop new inspection equipment, applications and procedures. This ensures that we will always be able to offer our clients the best technology available for their needs. Using the most up to date technologies helps TCR Arabia minimize our client's down time and ensure they get the most comprehensive information possible on the condition of their equipment.

TCR Arabia's highly trained NDE professionals go through rigorous training and meet or exceed all industry requirements. In addition, TCR Arabia provides extensive in-house training and ensures all of our NDT professionals are current on all relevant industry codes and regulations. TCR Arabia has an ongoing commitment to continually bring new inspection solutions to our clients that will help provide them with better information to make decisions as well as help save them money with their integrity management programs.

With over 100 professional NDT technicians, our size and expertise make TCR the logical choice to meet your inspection requirements. Whether it is for daily inspection activities or large turn around projects, TCR provides clients with the industry's best integrity management solutions.

TCR's qualified personnel have worked on various projects in India and in the Gulf region in various disciplines of NDT such as Radiography, Ultrasonic, Welding, MPI, In-situ Metallography & Positive Material Identification. The inspection personnel have worked on design, fabrication, construction, inspection and erection of Pressure Vessels, Heat Exchangers, Towers, Stacks, Tanks, Plant Pressure Piping, Offshore oil wells and many advanced projects.

ASNT Level III personnel have a minimum of 7-15 years of experience and Level II personnel have 5-10 years of experience. Senior experience team members are also available; some with over 25 years of experience. Junior NDT inspectors have 2-5 years of experience and can undertake visual inspection, ferrite assessment, PMI operations, etc.

Skill Sets of NDT Personnel available for Shutdown projects with TCR Arabia include:

- API 510 Pressure Vessel Inspectors
- API 570 Piping Inspectors
- API 653 Tank Inspectors
- ASNT Level III Experts
- BGas Paint Inspectors
- Multi-Skilled NDT Level II Technicians
- CSWIP/AWS Certified Welding Inspectors
- QA/QC Inspectors and Engineers
- NACE Cathodic& Coating Inspectors
- NDT Level III in multiple subjects (with Welding Inspector Qualification)
- NDT Level II in UT with Auto UT, Phased Array and TOFD Experience
- NDT Level II with extensive experience on pressure vessels and Multi-Skilled Usage
- ASNT MSLT Level II with Leak Testing experience
- ASNT Level II in Eddy Current (ET)
- ASNT UT Level II with TKY experience
- ASNT RT Level II and RTFI
- QA/QC Inspectors with Rotating Equipment Experience
- Electrical Inspectors
- Ultrasonic Inspection (UT), Magnetic Particle Inspection (MPI), Radiography

R. In-Situ Metallography

Performed as an NDT service, In-Situ Metallography from TCR Arabia determines in-service degradation of critical components of process plants operating under high temperature, high pressure or corrosive atmosphere. TCR's Metallurgists have strong experience in the interpretation of microstructures. The Metallurgists have more than 15,000 replica microstructure interpretations that have been logged and captured to our databases. These databases contain extensive information from various plants that have been captured over the course of us performing this service. The databases also include rare collections of varying microstructure damage levels for various industries such as power, oil and gas, petrochemical, fertilizers, and other process industries.

The In-Situ Metallography team is highly skilled in the art of replica preparation. TCR has custom developed special purpose in-situ polishing devices which assist to enable metallographic polishing in difficult locations and allows the field services team to carry out high quality replication even on warm components.

The team has 5 sets of In-Situ Metallography equipments that include the Insipol 2000 and advanced electrolytic flow type polisher and etcher, portable rough grinder with self adhesive papers, portable

microscope capable up to 400x magnification and replica kits with plastic based slides for replica preservation.

S. Paint Inspection

TCR Arabia in Saudi Arabia undertakes inspection of paint and / or coatings as applied to metal surfaces. Senior TCR paint inispectors are qualified BGas (British Gas Corporation) and NACE certified inspectors. The inspector will be responsible for verifying that the following items (as required) conform in all respects to the specific requirements of the relevant specification.

- The blasting and coating materials
- The blasting and coating equipment
- The temperature and humidity
- The surface condition
- The application procedure(s)

The paint and coating inspection team of TCR Arabia is fully equipped and has at it's disposal Wet paint thickness gauge(s), Dry paint film thickness gauge(s), Holiday detector(s), Hygrometer with dew point calculator and Metal surface thermometer. The expert paint and coating inspectors of TCR Arabia are responsible for monitoring and verifying that work inspected conforms in all respects to the specific requirements of the relevant code, specification and/or standard with respect to the paint/coating procedure, the physical application as well as the te physical examination, including testing.

TCR Arabia's expert inspectors undertake and are responsible for the preparation of concise but detailed records, including records as required, for the following:

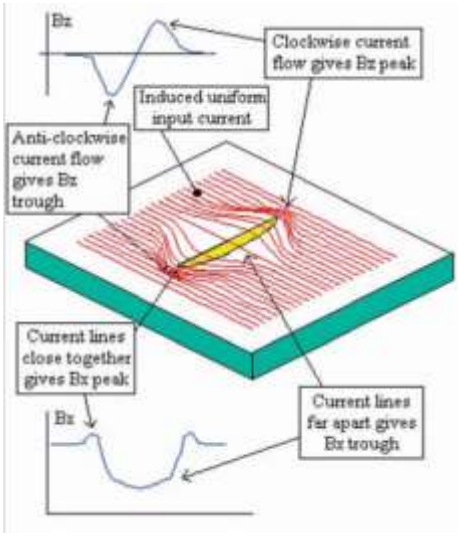
a) Materials control and identification
b) Climatic conditions and Surface condition
c) Details of abrasive(s) and application procedure
d) Abrasive/wire brush standard
e) Details of coating and application procedure
f) Equipment calibration
g) Inspection results

T. Alternating Current Field Measurement (ACFM)*

Alternating Current Field Measurement also referred to as ACFM is a one-pass method to inspect welds and most other materials to locate and size surface breaking cracks. TCR Arabia performs ACFM in association with its international partner. This technique replaces conventional dye penetrants and magnetic particle testing and the ultrasonic's required to size defects.

Digital Crack Detection Method

- Sizes Cracks (Length & Depth) Applications
- Detects through Coatings, Paint & Scale
- No Recoating Required
- No Metal Contact Required
- More Precise than Conventional Methods
- High Temperature Applications



An electromagnetic field is induced into the surface being inspected. When the probe is passed over a surface breaking crack, the electromagnetic field isdisturbed allowing detection of the anomaly.

This field is measured using the proprietary software which allows crack depth and length measurements in real-time.

Probes of almost any configuration can be customized for nearly any application imaginable.

Applications of ACFM include:

- Structural Welds on Platforms
- Structural Welds on Drilling Rigs
- Pipeline Girth Welds &Supports
- Pressure Vessel System Welds
- Cooling Tower Welds
- Compressor Fin Surfaces &Threads
- Drill Collar Threads

U. Electro-Magnetic Acoustic Transmission (EMAT)

Using EMAT technique with panametric probes, TCR Arabia can take the high temperature thickness measurement only upto a surface temperature of around 325 C. Above this temperature the thickness readings are not stable, reliable and repeatable. Hence thickness measurement shall not be done for lines and equipment with temperature above 325 C.

The surface for thickness shall be clean from rust, scale or any other kind of deposits and shall be fairly smooth. A metallic file, wire brush, small chisel and emery paper can be used for cleaning and getting a clean surface for thickness survey. No hammering is permitted for removal of scale/deposits. In case the above method does not yield the desired cleaning, then mechanical cleaning by power brush should be used. Grinding shall be used as a method for cleaning only as an exceptional case with prior permission from inspection engineer.

Thickness can be taken on painted surface provided the paint is visually seen to be adhering to the surface without any blisters. For critical measurement where the corrosion rate calculations are important from remaining life point of view, paint removal should be done before doing thickness survey.

Piping

In case of piping, corrosion loops shall be the basis for carrying out thickness survey for all on-site piping. Offsite piping and tank farm piping may have special loops made for thickness monitoring. Each corrosion loop in case of on-site piping shall have a combined isometric shown. The TML's are serially marked on the combined isometric. Base readings if any being taken (before commissioning) shall be random values measured on the components. Routine on stream or shutdown thickness measurement at these locations shall be done in the form of a scanning. The scanning format shall be in a grid of size 1.5" x 1.5". The component on which the scanning is to be done shall have the grid marked with a chalk before thickness scanning. All the TML's need not be scanned. Out of all the locations some TML's shall be identified for regular scanning. The select TML's shall be identified by inspection engineer based on probability of corrosion at these locations (as compared to other locations in the loop) and accessibility considerations. Access for thickness scanning by way of ladders, scaffolding or portable trolleys shall be provided by respective maintenance department. In case corrosion is observed in these TML's then other TML's in the loop shall also be included for thickness scanning.

HOT TAP LOCATIONS

In case of thickness survey of equipment piping for hot tap locations the following steps shall be follows.

Maintenance shall mark the location of the new nozzle. The locations shall be as per exact type and dimensions of the component to be welded on the parent pipe. Inspection engineer shall also verify the type of component to be welded viz, weldolet, pipe of pipe connection, nozzle with reinforcement pad, split sleeve nozzle etc.

Inspection engineer shall mark the center line of the proposed weld joint. A width of 1.5" to 2" shall be marked on either side of the proposed weld center line. A close thickness survey shall be taken along the center line and on the either sides. The minimum thickness measured shall be reported in the hot tap file.

If the thickness measured is comparable to nominal or the previous measured values (if available at the same locations or at different locations in the same pipe) then it could be assumed that there is no corrosion at the location.

If the thickness measurement indicates severe corrosion, and thickness measured is very close to the minimum allowable for hot tapping then hot tapping should be avoided at the location as it will be difficult to pick up a thickness point with minimum thickness by this procedure.

Minimum thickness required for hot tapping is 4.8mm. If the pipe is corroded and actual thickness is in the range 6 – 8mm, then alternate methods should be used to check the pipe thickness and certifying the same fit for hot tap.

THICKNESS LOCATIONS IN TANKS

In case of storage tanks, thickness shall be measured from outside as follows on the first and second shell course from bottom. In all other shell courses thickness shall be measured along the staircases. Few thickness points shall be taken near the weld and few at the center of the shell course plate. In case of roof plate, thickness shall be measured on each plate. Two thickness points at the center of each plate and one thickness point at the corner of each plate. In case of bottom plate, thickness measurement is possible only during an internal inspection. Thickness shall be measured on each plate. . Two thickness points at the center of each plate and one thickness point at the corner of each plate.

RECORDING OF THICKNESS MEASURED

We will measure the thickness and record it on a format that has the following details.

- Plant
- Tag Number of equipment/pipeline or appropriate description in case tag number does not exist for the component/job.
- Date of measurement
- Sl. No Meter used for thickness measurement
- Details of the meter used for thickness measurement like frequency etc.
- Identification number of the standard block used for calibration of the meter before starting the job
- Nominal thickness of the component being checked for thickness
- Name of the technician measuring the thickness

In case of piping, where spot readings have been measured at TML's the TML number shall be written and the readings measured shall be entered against the TML number.

In case of equipment a development drawing of the equipment shall be submitted approx. showing the location of thickness measurements. The thickness may be entered on the sketch itself. Alternately the TML's can be marked on the sketch and corresponding thickness valves for each TML may be submitted separately.

In case of close scanning of a location in an equipment or a piping location, the readings shall be submitted as a grid. The grid will have the orientation of the grid (N/S/E/W) with possible reference from a nearby nozzle, weld etc. The grid identification at site is required so as to check the thickness at the same location and compare the same for corrosion, if any. The grid size shall be clearly mentioned on the sketch.

THICKNESS VALUES MORE THAN PREVIOUS THICKNESS READINGS.

It is also not unusual to record thickness values more than the previous measured readings at the same locations or in the same grid. This is considering the inherent limitations in the thickness measurement technique. Some of the factor that contribute to the increase in thickness could be

- Inability to put the probe exactly at the same location. If the probe is kept even a couple of millimeters away from previous location there could be different and probably a higher reading.
- Corroded surface profile on the inside surface of the component from where the sound waves are reflected back.
- Surface preparation prior to the thickness survey

The inherent accuracy of the thickness meter itself is +/- 0.1mm. Hence a thickness value 0.2–0.3mm more than the previous measured value. is considered to be acceptable.

A measured thickness value more than the above mentioned limits needs to be re-checked again especially in a grid scanning exercise. The following steps could be followed for verification of the readings.

- Check the calibration of the instrument using a step wedge and using a standard block of thickness close to the thickness range being measured.
- Check the thickness measured with another meter and probe at the same location

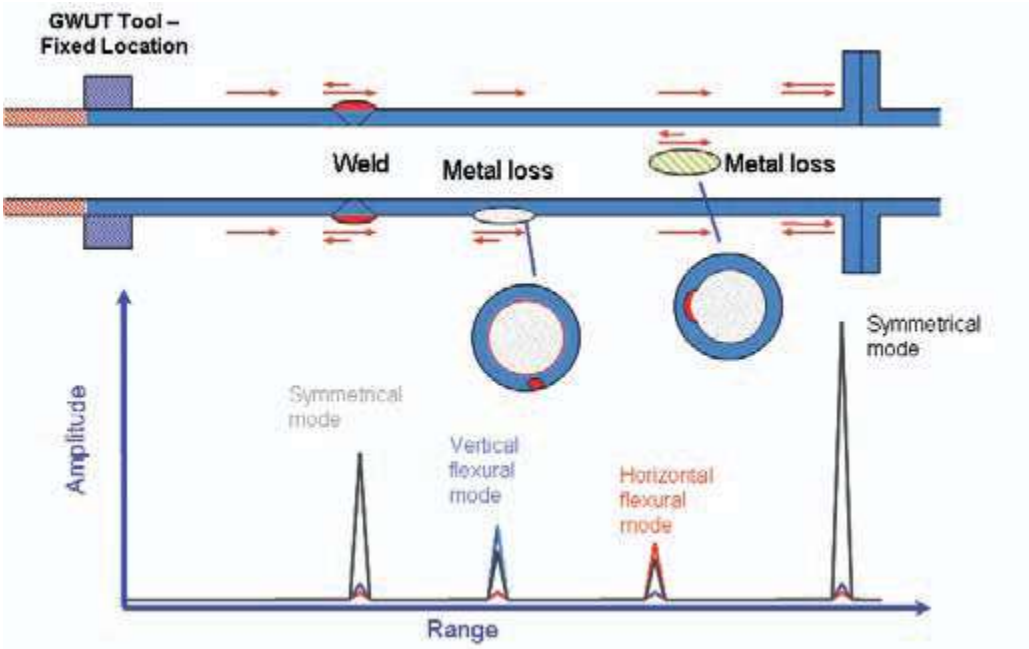
- Check surface preparation before taking readings

Based on the repeat thickness survey report can be verified and corrected if required.

V. Long Range Guided Wave Ultrasonic Testing (LRGWUT)*

The Long Range Guided Wave Ultrasonic Technique (LRGUT) was designed to inspect 100 percent of a pipe segment from one single location.

Torsional or longitudinal guided waves are induced into the pipe body and propagated along the pipe segment being inspected. When these guided waves identify an anomaly or pipe feature, they mode convert into laminar waves and reflect back to the tools original location. Using a laptop these signals are digitally captured. The time-of-flight for each signature is calculated to determine it's distance from the tool. The cross sectional area is calculated by amplitude and then the circumferential extent determined by the focused beams (broken down in octants) to determine the significance of the defect.



TCR Arabia performs LRGWUT in association with its international partner. This partner meets and exceeds the PHMSA 18 points to examine casings and crossings.

LRGWUT's primary application is within the Oil and Gas Refining, Petrochemical, Storage, Offshore and Pipeline Transportation industries used to inspect difficult to access piping systems such as:

- Insulated Pipe in Refineries
- Offshore Pipeline Risers
- Cased Road or Railway Crossings
- Loading Lines and associated Pipe work
- Tank Dyke Pipeline Crossings
- Above Ground or Buried Flow Lines
- River or Bridge Pipeline Crossings
- As part of ECDA & ICDA Methodologies

W. Robotic Crawler Video Inspection*

TCR Arabia performs Robotic Crawler Video inspection in association with its international partner. As part of this technique, inspectors from TCR Arabia can inspect the Underside of Fixed Roof & Roof Support Columns of a given above ground storage tank without Service Disruption

TCR Arabia with its international partner offers Quik-Look™ for inspection of underside of AST fixed roof and roof support columns without removing the tank from service.

TCR Arabia with its international partner can inspect the underside of AST fixed roof, roof support structure and the internal shell above the product all while the tank is in service with Quik-Look™.

Quik-Look™ is a compact, portable video camera inspection service used to determine the amount and distribution of material in the tank as well as tank conditions such as corrosion and scaling.

Quik-Look™ has pan, tilt and zoom capabilities and is installed thru the man way of AST fixed roof and held in the vapor space between fixed roof and the product (or floating roof) to visually inspect every visible item above the product level (or floating roof).

X. OTIS - In Service Robotic Tank Inspection &In Service Robotic Tank Cleaning*

TCR Arabia with its international partners offers high-density Ultrasonic Thickness (UT) scanning of storage tank floor while the tank is full and in service.

The total cost of conventional inspections far greater than the expense of cleaning and MFE inspection. The cost of material transfer, product downgrades and tank downtime can be enormous. The hidden cost of premature repair scan be just as high. When the tank is empty, in a conventional norm, you have to complete all repairs quickly. This usually means paying a premium for service – and completing repairs that aren't necessary for another five to ten years.

Now you can reduce costs by completing an API 653 inspection of your ASTs (Above-Ground Storage Tanks) without taking them down for manual cleaning and inspection.

InTANK robotic inspection service can scan the floor of a full tank while in-service and provide you with a quantitative assessment of tank floor integrity — all with greater reliability and precision than you've ever had before.

- Eliminate the high cost of taking down your tanks
- Complete an API 653 inspection in days instead of weeks or months
- Avoid disruptions in normal service and keep revenue consistent
- Perform repairs only as needed
- Minimize impact to your costs and operations
- Reduce environmental and safety risks without opening the tank or due to manned entry

The InTANK service systematically scans the tank bottom with an array of eight ultrasonic transducers, and relays high-volume UT data for analysis. The robot pushed sludge aside as it travels making cleaning and waste disposal unnecessary in many cases.

The tank inspection report provides a complete, 10-year API 653 report on the condition of your tank. The report will include:

- Top-side and bottom-side corrosion locations
- Floor-plate thickness and pitting
- Videotape of roof underside and vapor space structures
- Fiberglass coating measurement

TechCorr Services' tank inspection report also gives you a recommended timetable for future repairs. This powerful tool enables you to manage costs and cash flow by scheduling out-of-service cleaning and repairs efficiently.

High-density UT scanning reveals more about the true condition of your tank.

The InTANK service systematically scans the tank floor and collects a high volume of UT data for analysis. Unlike traditional inspection technologies, the InTANK scanning system is not affected by tank coatings, including fiberglass. Incoming data streams pinpoint areas of corrosion and quantify the remaining plate thickness.

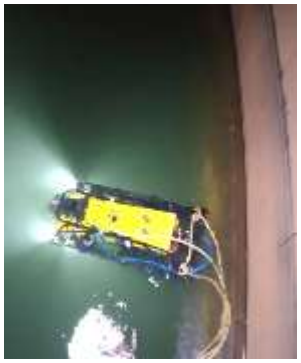
Verification Studies prove that this is the API 653 inspection you can rely on.

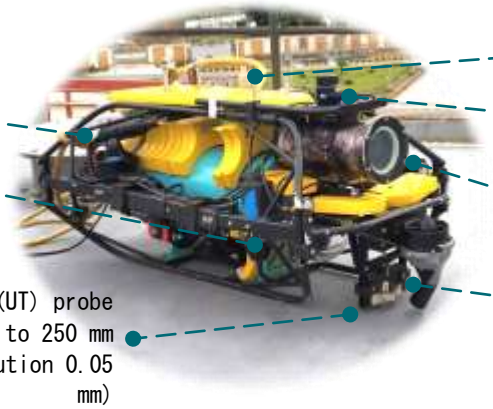
Y. Online Underwater Robotic Inspection of Above Ground Water Storage Tank

- Above-ground water storage tanks are inspected periodically to avoid catastrophic damages or unplanned shutdowns
- Conventionally, tanks are emptied and manually inspected by certified personnel. This is expensive, requires unwanted shutdown and often hazardous to personnel
- Using an **Remotely operated unmanned underwater robotic inspection system (ROV)** mitigates the risk involved to personnel, reduces cost, turnaround time and providing accurate inspection data

Entry through 20" or greater manhole diameter

- Capabilities include **Videography**, **Thickness Measurement** and **Silt Estimation**
- Most suited for tank floor /annular/**bottom plate**, **shell** and internal **roof inspection**
- Can be deployed in **desalinated** water tanks, **potable** water tank, **fire-water/hydrant** tanks, **de-mineralised** water tank & storage tanks
- Also suitable for inspecting sumps, intake/outfall structures/pipelines, channels & reservoirs





Works on external power supply of AC 230V 50/60Hz @ 6 kW

SONAR for silt assessment

Ultrasonic Thickness (UT) probe with gimbal (Range 3 to 250 mm @ 2.25 MHz ; resolution 0.05 mm)

Portable ~35 kgs in weight

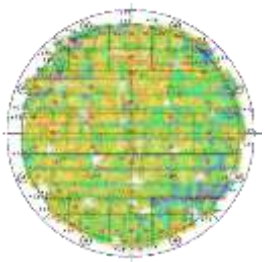
Accurate position and depth sensors

High Definition (HD) cameras for visual inspection/ live streaming with powerful lights

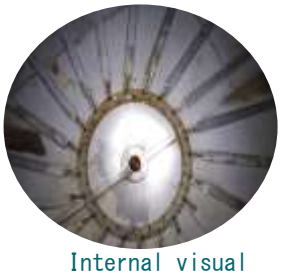
Thickness measurement over various coatings

Digital Reporting Platform enables quick informed decision making for maintenance & repairs!

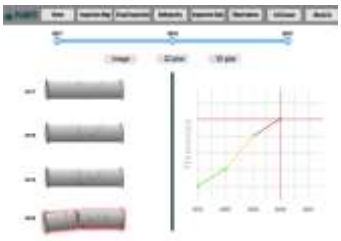
- ✓ Geotagging of data with defects
- ✓ Localised defect videos
- ✓ Data Enhancement
- ✓ Central Data Repository
- ✓ Comparison across years
- ✓ Prediction and Trend Analysis
- ✓ Risk based Inspection (RBI)



Illustratory UT map of the bottom plates



Internal visual inspection of roof



Cross-comparison across years of data

ADVANTAGES

- Safer Robotic Inspection
- Live Result Monitoring
- Save costs by delaying turnaround
- No Shutdown Required
- Online Rapid & accurate Inspection
- Digital Reporting Dashboard

Z. Structural Audit of Bridges Using Modern Technologies and Innovation

- Bridge structural audits are vital for public safety. Structural defects should be identified & repaired. It is also critical to **maintain historical data** over its life cycle to compute remaining life at any point
- Today, bridges are manually inspected by **traditional equipment**. These techniques are often hazardous for the personnel or overall inaccurate/inefficient, non-digital and do not overcome modern challenges
- Planys provides **innovative & cutting edge** inspection solutions that are safer, digital and cost-effective

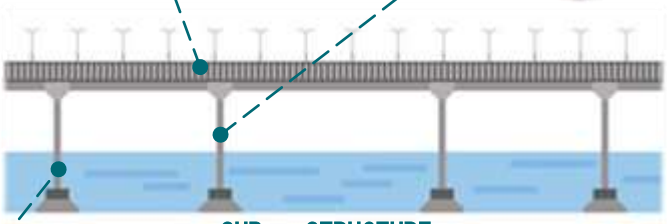
Aerial Drone

- **Visual inspection** of piers, girders, bearing, joints etc.
- **Thermal** Imaging
- Detection of **defects** – corrosion, cracks, joints etc.
- **No scaffolding** required
- With **GPS positioning**
- Gimbal Stabilized(3 axes)
- **10X Optical Zoom** camera

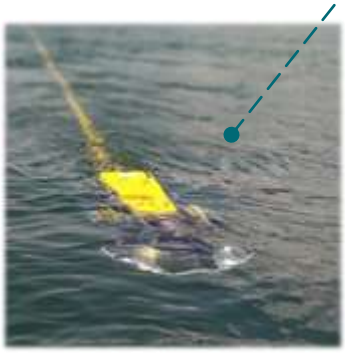
SUPER STRUCTURE (for Concrete & Masonry)

Non-Destructive Testing (NDT)

- **Ultrasonic Pulse Velocity**
- Cover Meter
- Schmidt Hammer
- **Chemical Tests** (pH, Chloride & Sulphate)
- Impulse response
- Half-cell potential
- **Impulse-Echo**



SUB - STRUCTURE
Underwater Remotely Operated Vehicle (ROV)



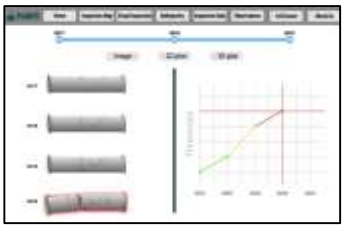
- Capabilities include **Underwater Videography** to defects/cracks/spalling/ cavities
- **High Definition** Live streaming at site
- Defects quantification (width x length)
- **Geo-Tagging** of identified defects
- Inspection in **extremely turbid waters**
- **Bathymetry** of water body surrounding the bridge

Digital Reporting Platform enables quick informed decision making for maintenance & repairs!

- ✓ Geotagging of data with defects
- ✓ Localised defect videos
- ✓ Computer Vision/Enhancement
- ✓ Manage multiple assets
- ✓ Central Data Repository
- ✓ Prediction and Trend Analysis

Enhanced vision system

Defect Quantification



Comparison across years

ADVANTAGES

- Safer Robotic Inspection
- Live Monitoring & Customizability
- Quick Turnaround
- Data Enhancement
- Best accuracy to time benchmark in industry
- Digital Reporting Dashboard

9. Welder Certification and Procedure Qualification

TCR Arabia has expanded its quality assurance and third party inspection services to include a comprehensive welder certification and welding procedure qualification program.

As part of this enhanced service offering, TCR undertakes the following:

- Welder Qualification Testing for performance qualification and certification of welders (a welder / welding operator performance qualification - WQT) to ASME, ANSI, AWS, API code
- Preparation of Weld Procedure Qualification as per client or project requirements.
- Coupon testing as per Weld Procedure Qualification which includes visual examination, mechanical testing, metallographic examination and non destructive testing.
- Documentation of the Procedure Qualification Record as per ASME, ANSI, AWS, API codes
- In depth weld inspection to include review of the applicable qualification e.g. weld procedure specification, welder performance qualification and validity for process materials and consumable items, equipment, set up and other factors, including certificates of calibration and/or conformity governing the work.
- Check safety of set up and operation having due regard for self, welder and other workers in vicinity, particular in respect of ultraviolet radiation from arc during welding.

All TCR welding inspectors are generally certified in accordance with the requirements of at least one of the following schemes - Certification Scheme for Weld Inspection Personnel (CSWIP), American Welding Society (AWS), BGAS (previously British Gas ERS), and/or ASNT Level II VT. All inspectors have the ability to interpret various standards including ASME B&PV Code, Section IX, API Std. 1104 and ANSI / AWS D1.1.

10. Calibration Services

TCR Arabia Co. Ltd. Has started calibration Laboratory with full capabilities and qualified resources. The Calibration laboratory is capable to produce the traceable calibration certificates under the following scope:

Dimensional

- Vernier Calipers
- Dial Calipers
- Inside / Outside Micrometer
- Coating Thickness Gauge
- Measuring Tape
- Height Gauge

Mechanical

- Digital and Analog Pressure gauge
- Pressure relief valves
- Torque
- Balance

Thermal

- Ovens
- Thermometer
- Water bath
- Welding Machine
- Clamp Meter

11. Heat Treatment Services

A. Post Weld Heat Treatment using Electrical Resistance

TCR Arabia offers post weld heat treatment by using electricity as source of heating for stress relieving of weld joints. All TCR Arabia heat treatment services are designed to minimize downtime, improve structural integrity, and enhance effective plant life. Additionally, depending on the mobility of the required equipment many of our heating processes can be applied on-site or at your facility.

TCR Arabia has specialized personnel and equipment to carry out a wide range of heat treatment processes like post weld heat treatment of vessels, piping, spheres and fabricated spools.

TCR Arabia specializes in local Post weld heat treatment of carbon steel piping welds (pipe-work, headers, flange joints, valves and branches) by means of the electrical resistance method, in the form of ceramic heater pads.

All PWHT equipment in use by TCR Arabia is purpose built and have a valid current calibration certificate. Electric power sources are 380/415/440V 3 phase 50Hz primary supply step down transformer secondary output (heat treatment unit) giving low voltage circuits. Temperature control equipment is either manually operated through energy regulators or automatically operated using modular controls. Recording of temperature, for the electrical resistance method, or the induction heating method is by means of calibrated chart type temperature recorder. Calibration frequency of recorders will be one year.

B. Oil Firing on Pressure Vessels

TCR Arabia has a talented crew that uses diesel fuel as source of heating for stress relieving for pressure vessels with the sole objective of reinforcing process and component integrity and quality. The experience heat treaters from TCR Arabia have the experience, equipment, and expertise to develop custom configuration for your particular process. Our heating processes include low-Range, Mid-Range & High-Range Temperature Heating.

TCR Arabia's high velocity burners enable excellent temperature distribution and uniformity at all times due to the intense scrubbing action. TCR Arabia is also able to construct temporary furnaces at our clients sites where internal firing is not a practical or cost effective option.

The heat treatment operation will be effected by the firing of the furnace using one or more gas/oil high velocity burners with a nominal rating of 1,500.000 Kcals/hr (6,000,000 Btu/hr) per burner. Armoured flexible hosing to Combustion Air Fan (s), with a maximum output of 2800/Nm3 per hour via a 150mm diameter outlet, at a pressure of 700mm W.G, will connect each burner. Each burner will be fitted with a (25/20) stainless steel outlet nozzle designed to clear the furnace wall adjacent to the intended opening(s) and in such a way as to eliminate the possibility of any direct impingement on components.

Technical Training Courses

TCR Arabia is a leading provider of technical courses targeted towards plant inspection, maintenance and operations personnel in the Kingdom of Saudi Arabia in the areas of Metallurgy, Corrosion Studies including sour gas corrosion detection, Remaining Life and Failure Investigation. TCR Arabia also offers a results-oriented and focused curriculum for training on Non Destructive Testing (NDT) in a number of subjects.

The training curriculum from TCR Arabia is formalized to provide custom training programs, best practices and leading knowledge in material testing. The training facility is equipped with latest technologies. You will find an opportunity to improve the skills of your metallurgist, engineers and technicians.

TCR Arabia has formed a partnership with PP SIMTECH Solutions Ltd (UK), acclaimed specialists in providing asset integrity managing technology services and related training globally. Due to this alliance, we are providing jointly with PP SIMTECH, training courses in application of the three core technological areas in modern asset integrity management, i.e. Risk Based Inspection, Damage Mechanisms and Fitness-for-Service.

TCR Arabia's trainers have several years of experience in the technical training industry. The training style is highly effective, and our trainers are all professionals in the technical education field, most with years of experience both in the classroom and with applied technology skills. TCR Arabia's classrooms and training facilities are second to none.

At TCR Arabia, we believe in a "coaching" approach to training. An effort is made to try to ensure that the students spend most of their time in class actively learning with exercises and lab work. Our ASNT Level II certification is based on ASNT standard SNT-TC-1A as well as the newly released CP-189 standard.

TCR Arabia understands the changing and dynamic nature of this industry. A dedicated Curriculum Developer researches and qualifies new courseware for purchase, licensing, or develops/ partners with a vendor for courseware ensuring that our courseware standards and materials stay current.

Unlike other training schools, TCR Arabia adopts and promotes the train-the-trainer approach. Should you like the trainer to stay and interact with your team post-training phase, we can assist in the same. TCR Arabia can also custom tailor a class to suit your company´s unique requirement. To conduct these courses we require minimum 4 students and can accommodate a max of 10 students per class.

The technical training fees include theoretical training, practical, and examination. The classes are run on dedicated equipment with trainers that have over 10 years of teaching experience. Unlike other classes, our curriculum is closely aligned with industry requirements and has close parallels to the working style of active projects that are run at large companies.

All courses are designed to impart practical knowledge that can be applied immediately to the outside world. These will provide engineers and technicians with the capability to improve their testing techniques, learn how to perform advanced tests, and help assure how to meet standards. From novice to an expert, courses are designed to learn more in the field of material sciences. Courses can be personalized based on the needs of our clients. TCR has the capability to conduct a course for 20 candidates at the same time.
Candidates will receive training from experienced metallurgists, engineers and laboratory technicians. Our instructors have a minimum of 15+ years of experience in the industry. Each NDT trainer is ASNT Level III certified. TCR trainers have field experience in the areas of Aerospace, Defense, Automotive, Chemical Processing, Defense, Nuclear Power, Scrap and Capital Goods manufacturing.

TCR Arabia runs the technical courses from its training centre in Dammam, KSA, in addition to providing on-site training where required.

A. Technical Training Courses Offered by TCR Arabia

The courses offered by TCR Arabia include:

Metallurgy
Mechanical Metallurgy Laboratory – Level I
Mechanical Metallurgy Laboratory – Level II
Microstructure Characterization
Metallurgy for Plant Executives and NDT Inspectors
Metallurgy for Non Metallurgists

Corrosion Studies
Sour Gas Corrosion Testing – Level I
Sour Gas Corrosion Testing – Level II

Asset Integrity Managing Technologies
Living With Defects - Fitness for Service (FFS) Assessment
Arm Yourself With Damage Mechanisms (DMs) Knowledge
Requirements for Implementing Risk Based Inspection (RBI) Best Practice

Failure and Root Cause Analysis : Guide and Techniques

Non Destructive Testing
Introduction to NDT for Plant Executives
Ultrasonic Testing – Level I
Ultrasonic Testing – Level II
Magnetic Particle Testing – Level I and II
Dye Penetrant Testing – Level I and II
Eddy Current Testing – Level I
Eddy Current Testing – Level II
Radiography Testing – Level II
Visual Testing – Level II
Thermography – Level I

Welding Courses
Gas Tungsten Arc Welding for Qualified Welder (TIG, 6G)
Shield Metal Arc Welding (SMAW) for Qualified Welder

Plant Operations, Inspection and Reliability

All courses, unless specified in advanced with the client will be conducted at TCR Arabia's training room at its office in Dammam located at:

TCR Arabia Company Limited,
P.O. Box-32211
Gas Gardens, King Abdulaziz Seaport Facility
Dammam, Kingdom of Saudi Arabia
(T) +966-3-8475784/8475785
(F) +966-3-8475768
(M) +966-504997683
(e) syed@tcr-arabia.com
Attention: Syed Ameen Hassan (M) 00966-504997683

Dates for scheduling of each class will be announced when a minimum of at least 6 students sign up for a given batch.

B. Metallurgy

The multi-disciplinary certified and experienced personnel team of professionals at TCR Arabia includes: metallurgical, mechanical, electrical, and chemical engineers; materials scientists; chemists; physicists; NDT inspectors and computer scientists who have the qualifications, the education and the experience to meet rigorous standards in the testing field, whether serving the Private and Public Sector, Government or the Military.

I. Mechanical Metallurgy Laboratory – Level I

This course covers the following topics:

Part I Mechanical fundamentals

- Introduction to mechanical metallurgy
- Stress and strain relationships of elastic behavior
- Elements of the theory of elasticity

Part II Metallurgical fundamentals

- Plastic deformation of single crystals
- Dislocation theory
- Strengthening mechanisms
- Fracture

Upon completing this course the students will have a good understanding on the subject area including:

Interaction of stress and strain on materials in elastic and plastic manners will be understood.

Deformation behavior of metals due to dislocation interaction as well as strengthening mechanisms of metals will be addressed.

Different methods of mechanical testing will be highlighted along with the interpretation of sensible information from the obtained data such that mechanical assessments are appropriately selected for the required applications.

Metallurgical aspects which affect mechanical properties of materials will be discussed.
Finally cause of material failure will be possible solutions will be discussed.

The duration of this course is 3 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

II. Mechanical Metallurgy Laboratory – Level II

This course covers the following topics:
Part III Applications to materials testing

- Tensile test
- Hardness test
- Bend test
- Engineering Measurements
- Brittle fracture and impact testing
- Fatigue of materials
- Creep and stress rupture

This course aims to provide practical skills on mechanical testing of metals including hardness, tensile, torsion, creep, impact, bending and fatigue testing. Students are required to extract and interpret sensible information from mechanical test data as well as to give explanation on relationships between metallurgy of the metals and their mechanical properties.

Upon completing this course the students will have a good understanding on the subject area including:

- Students will understand the principles and the use of engineering measurements by employing different measuring tools and methods in order to suit the desired applications.
- To understand the meaning of the measured values in engineering applications.
- Students will understand the principles of hardness testing, i.e., Rockwell, Brinell and Vickers hardness tests.

- Students are able to explain variations in hardness properties of selected materials such as aluminium, steel, brass and welded metals and can explain factors that might affects their hardness properties.
- Students can select appropriate macro-micro hardness testing techniques for suitable materials-property analysis.
- Students are able to analyze the obtained hardness values in relevant to the nature of each material to be measured and use this information as a tool for selecting suitable materials for engineering applications.
- Students will understand the principle of a uniaxial tensile testing and gain their practices on operating the tensile testing machine to achieve the required tensile properties.
- Students are able to explain load-extension and stress-strain relationships and represent them in graphical forms.
- To evaluate the values of ultimate tensile strength, yield strength, % elongation, fracture strain and Young's Modulus of the selected metals when subjected to uniaxial tensile loading.
- Students can explain deformation and fracture characteristics of different materials such as aluminium, steels or brass when subjected to uniaxial tensile loading.
- Students will to study and understand the principle of impact testing using metals which are susceptible to brittle fracture such as mild steels.
- Types of fracture in metals are investigated using the fracture energy absorption criterion.
- Students can explain the meaning and use of Ductile-to-Brittle-Transition-Temperature Curve (DBTT) and explain the relationship between the absorbed energy of the specimen and its fracture surfaces. Identify the transition temperature of the tested materials.
- Students are capable of interpreting the obtained experimental data for the selection of engineering materials.
- Students will study the principles of bend testing, practice their testing skills and interpreting the experimental results of the provided materials when failed under three-point bending.
- Investigate responses of metals when subjected to bending
- Determine parameters such as bend strength, yield strength in bending and elastic modulus.
- Students can interpret the obtained test data and select appropriate engineering materials for their intended uses in order to prevent creep failures.
- Students will understand the principles of torsion testing, practice their testing skills and interpreting the experimental results of the provided materials when failed under torsion.
- To determine the maximum shearing stress, shear stress at proportional limit, shear modulus or modulus of rigidity and relationships between torque and degree of rotation of the tested materials.
- Students are able to differentiate the ability of materials such as cast iron and brass to withstand torque prior to torsion failure. Analysis and interpretation of the test parameters obtained should be carried out in relation to the failure nature of each material.
- Students are capable of selecting materials for engineering applications associated with torsion.
- Students will study the principal of creep testing and practice the testing procedure.
- Students should be able to explain the causes of creep in metals, creep deformation and be able to indicate factors influencing creep behavior in metals.
- Students can analyze the obtained creep data and use it for the selection of appropriate engineering materials to prevent creep failures.

The duration of this course is 10 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

III. Microstructure Characterization Training

Good understanding of microstructures is the hallmark of any metallurgist. Students taking this course from TCR Arabia will get hands on experience in working with microscopes; replica's as well as we performing analysis on TCR's uniquely designed MiC 3.0 software.

Students will be able to get a basic understanding of Macro and Micro examination including Weld Examination, Case Depth and Decarburization Measurement. Micro Hardness Testing and Coating/Plating evaluation.

The students will be able to:

- Determine the micro structural degradation due to creep

- Calculate the graphitization
- Evaluate the depth or width of decarburization
- Determine the phase/volume percentage
- Calculate grain growth
- Inclusion Rating Determination
- Particle Size Measurement
- Volume Percentage Calculation
- Particle Count Measurement
- Porosity Evaluation
- Coating Thickness Measurement

The duration of this course is for 5 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

IV. Metallurgy for Plant Executives and NDT Inspectors

This dynamic three-day course for non metallurgists, including designers, engineers, technicians, sales engineers and purchasers, is designed to give your company a strong competitive edge in today's rapidly changing marketplace.

The course focus is on translating complex principles and procedures into easy to understand terms that will enable participants to gain a valuable working understanding of the fundamental principles of metallurgy as well as the basic structure, properties, heat treatment and processing of metals and alloys.

Metallurgy pervades the full gamut of engineering product design and processes. It is the basis from which optimum properties for a given design are determined. Product life and maintenance are key issues in all manufacturing product design using metals. Component properties must be adequate to ensure the desired product life in complex environments involving wear, corrosion, and elevated temperatures.

Metallurgy is thus a vital basis of every major engineering field, and it contributes to virtually all engineering applications where a metallic component or system experiences use.

Practical training with significant benefits.

This interactive, highly practical course will be of significant benefit to anyone who needs a working understanding of metals and their applications, those with no previous training in metallurgy, technical, laboratory, and sales personnel, engineers from other disciplines, management and administrative staff, and non-technical support staff. Participants will gain a technical familiarization with ferrous and non-ferrous metals and their processing and optimization to meet specific product needs.

Emphasis will be given to the foundational concepts of metallic structures and phases and the latest developments in material processing, in combination with an overview of metallurgy, which will provide a solid foundation and understanding of the significance and impact of metallurgy in product design, whether you:

- Are seeking ways to cut costs, improve performance and increase profitability.
- Have employees who want to learn more about complementary or competitive technologies.
- Have employees who want to update present knowledge of metals, processing, and optimization.
- Have employees who are just starting out in the field and need a basic knowledge of metallurgy.

Participants will join in discussions guided by course instructors, who will encourage questions, comments, and participation at all times. There will also be opportunities to exchange ideas with the instructors and other participants during breaks, lunch, and after class adjourns. With this interactive format and the dynamic instructors, participants will find this intensive course to be extremely beneficial, as well as motivating and thoroughly enjoyable.

Key Course Topics.

The ways in which metal alloys are structured, how the structure affects their performance, how mechanical properties of metals are measured, and what influences these properties; what steels and cast irons are and what processing and chemical parameters influence their performance; what aluminum alloy metallurgy is and what influences their mechanical properties; how the environment affects the performance and durability of metals -- and much more, as shown in the Course Highlights listed below.

Introduction: Why Metallurgy?

Metal Basics: Characteristics of metals, atomic arrangements and bonding, crystal structures, grains and precipitates, strengthening mechanisms, deformation, and phase diagrams.

Real Engineering Materials: Basic processing and properties, Fe-C diagram, metals and materials types.

Shape Forming: Melt/cast, cold/warm work, forge, draw, extrude, powder metallurgy shaping.

Heat Treatment: Processes, properties/microstructure effects, steels, cast irons, super alloys, and non-ferrous including Al and Ti alloys.

Mechanical Properties: Hardness, stress-strain, fatigue, toughness, creep, property envelopes.

Joining: Welding, brazing, soldering, cladding.

Emerging Materials/Processes: Composites, nano materials, grain boundary engineering.

Failure Analysis: Wear and corrosion mechanisms: Hardness, stress-strain, fatigue, toughness, creep, property envelopes.

Surface Engineering: Failure mechanism solutions, coatings and diffusion based treatments.

Summary: Course summary and group discussion.

The duration of this course is for 3 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

V. Metallurgy for Non-Metallurgists

This course will cover the following topics:

1. Introduction to Metals: - Scope and Applications, Important metals used.
2. Structure of Metals: - Crystal structure, thermal curve for solidification , simple binary diagrams, allotropic modifications of iron, iron carbon diagram, Various phases of iron, corresponding microstructures.
3. Steels: - Effect of alloying elements on the properties of iron, major types of steels, Stainless steels.
4. Heat Treatment of Metals: - TTT and CCT diagrams, Hardenability, different heat treatments for steel, procedures, equipments, quechants, Introduction to case and surface hardening.
5. Non-Ferrous Metals: - industrial applications, major groups, heat treating procedures.
6. Casting Methods and Cast Irons: - Sand casting, die casting, centrifugal casting, investment casting, processing of castings.
7. Types of cast irons, microsturctural features and salient charactertics.
8. Metal Forming: - Cold and Hot working, Forging, rolling, extrusion and swaging at high temperature. Cold rolling, wire drawing, cutting piercing etc.
9. Joining: - Basic of welding, sources of energy, methods of shielding, types of welding methods, SMAW, GTAW, GMAW , SAW. Methods of cutting.

10. Performance during Service: - Failure of metals during service, Failure modes, Failure due to Fatigue, Wear and high temp, Definition of corrosion, different types, methods of prevention.

11. Mechanical Testing & NDT: - Description of testing methods, NDT methods.

The duration of this course is for 3 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

C. Corrosion Studies

I. Understanding Corrosion Damage Mechanisms

The objective of this course is to Build upon the basics of metallurgy, understand the relationship between various corrosion mechanisms and associated metallurgy as well as to Understand inspection techniques for the different metallurgies and corrosion mechanisms.During this course students will be taught the following modules:

Module 1: Materials of Construction
Part I (Introduction)
1. Steel
2. Carbon Steel
3. Cast Iron
4. C-MoSteel
5. Cr-Mo Steels
6. Killed Steel
7. Stainless Steels

Part II
8. How Steel and Cast Iron Differ
9. Stress Relieving
10. Annealing and normalizing
11. Dehydrogenation

Module 2: Stress Corrosion Cracking (SCC), Environmental - Assisted Cracking
1. Chloride SCC
2. Corrosion Fatigue
3. Caustic SCC (Caustic Embrittlement)
4. Ammonia Stress Corrosion Cracking
5. Liquid Metal Embrittlement (LME)
6. Hydrogen Embrittlement
7. Polythionic Acid SCC
8. Amine SCC
9. Wet H2S Cracking
    a. Hydrogen Induced Cracking (HIC), b. Stress Orientated HIC (SOHIC), c. Sulfide SCC (SCC)
10. Hydrogen Stress Cracking – HF
11. Carbonate SCC

Module 3: High Temperature Corrosion (400+ F)
1. Sulfidation
2. Carburization
3. Decarburization
4. Metal Dusting
5. Oxidation
6. Fuel Ash Corrosion
7. Nitriding
8. Graphitization
9. Softening (Spheroidization)
10. Temper Embrittlement
11. Strain Aging
12. 885 F Embrittlement

13. Sigma Phase Embrittlement
14. Brittle Fracture
15. Creep / Stress Rupture
16. Thermal Fatigue
17. Short Term Overheating – Stress Rupture

Module 4: General Damage Mechanisms (All Industries)

1. Steam Blanketing
2. Dissimilar Metal Weld Cracking
3. Thermal Shock
4. Erosion / Erosion – Corrosion
5. Cavitation
6. Mechanical Fatigue
7. Vibration – Induced Corrosion
8. Refractory Degradation
9. Reheat Cracking
10. The mechanics of corrosion mechanisms

Module 5: Uniform or Localized Loss of Thickness

1. Galvanic Corrosion
2. Atmospheric Corrosion
3. Corrosion Under Insulation (CUI)
4. Cooling Water Corrosion
5. Microbiologically Induced Corrosion (MIC)
6. Dealloying
7. Graphitic Corrosion
8. Boiler Water condensate Corrosion
9. CO2 Corrosion
10. Flue Gas Dew. Point Corrosion
11. Soil Corrosion
12. Caustic Corrosion

Module 6: General Damage Mechanisms - Refining Industries

1. Amie Corrosion
2. Ammonium Bisulfide Corrosion (Alkaline Sour Water)
3. Ammonium Chloride Corrosion
4. Hydrochloric Acid (HCl) Corrosion
5. High Temp H2/H2S Corrosion
6. Hydroflouric (HF) Corrosion
7. Naphthenic Acid Corrosion
8. Phenol (Carbonic Acid) Corrosion
9. Phosphoric Acid Corrosion
10. Sour Water Corrosion (Acidic)
11. Sulfuric Acid Corrosion

Module 7: General Damage Mechanisms - Process Units

1. Crude Unit / Vacuum
2. Delayed Coker
3. Fluid Catalytic Cracking (FCC)
4. FCC Light Ends Recovery
5. Catalytic Reforming (CCR)
6. Hydroprocessing Units – Hydrotreating / Hydrocracking
7. Sulfuric Acid Alkylation
8. HF Alkylation
9. Amine Treating
10. Sulfur Recovery
11. Sour Water Stripper
12. Isomerization
13. Hydrogen Reforming

The duration of this course is for 10 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

II. Sour Gas Corrosion Testing – Level I

Corrosion of metals has imposed a serious threat on industry, the society and the nation in terms of both money and manpower. General statistics reveals that overall cost due to corrosion of metals amounts to at least 2-4% of GNP. This loss not only included the cost of replacement of metals, but also the damage to products by contamination, shut down of production, loss of efficiency and in psychological factors associated with failure or explosion of equipments. This loss can be reduced effectively to the tune of 20-25% by the application of appropriate and upgraded knowledge of corrosion and corrosion control science. Present course is an attempt in this direction which includes the basics and applied aspects of diffraction forms of corrosion and introduces to the recent developments in corrosion science and engineering with special emphasis on sour gas corrosion.

Module 1: Basics of Sour Gas Corrosion
HIC and SSC

Module 2: Review of Standards
Understanding of NACE TM0284 - resistance of pipeline and pressure vessel plate steels to Hydrogen Inducted Cracking caused by hydrogen absorption from aqueous sulfide corrosion.

Understanding of NACE TM 0177, EFC 16 and 17 - Sulfide stress corrosion cracking (SSCC) test occurs when a susceptible material is exposed to a corrosive environment containing water and H_2S at a critical level of applied or residual tensile stress.

Module 3: Sample Preparation

Module 4: Review Sample under Microscope

Module 5: Hardness Testing
Selection of type of harness based on type of steel grade and geometry of specimen.
Operation of hardness testing Machines. Calibration of hardness machine andSelection of indenter.
Standard practice of harness testing as per ASTM E384, E10 , E92 and E18 .
Calculation of hardness number .
Conversion of one hardness to other type of hardness as per ASTM E140.

Module 6: Grain Size Analysis:
Selection of sample for grain size analysis.
Micro constituent of steel.
Standard practice of grain size analysis as per ASTM E112, E930, E1382.
Parameter setting for optical microscope for grain size analysis
Evaluation of Grain size

Module 7: Determination of Inclusion Rating:
Basic Knowledge of different type of non metallic inclusions in steel
Selection of sample for inclusion rating
Physical appearance of inclusions in cast steel/iron
Physical appearance of inclusion rolled product.
Standard practice for inclusion rating as per ASTM E45 and ASTM E1245 specification
Calibration of optical microscope
Parameter setting for optical microscope for inclusion analysis
Evaluation of inclusion content in steel.

The duration of this course is for 5 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

III. Sour Gas Corrosion Testing – Level II

The topics covered in this course include:

Module 1: Hydrogen Induce Cracking (HIC) and Sulfide Stress Corrosion Cracking (SSCC) - 4 point bend Test
Measuring dimension of samples and calculating required test solution volume.
Cleaning and test for degreasing as per ASTM F21.
Calculation of deflection based on applied load which depends on steel grade.
Entering required data for the test.
N2 purging and H2S gas bubbling for HIC and SSCC (4 point bend test) .
Idiomatic titration of test solution.
Monitoring and inspection of test.
Neutralization of test solution before deposing to waste tank.
Record of chemical consumption and waste solution.
Evaluate test result .

Module 2: Sulfide Stress corrosion cracking (SSCC) test, Uni-axial Constant Tensile Load
Calculate applied load based on the steel grade.
Loading and un loading of test specimen into the testing machine .
Familiarization with gas management.
Selection of required parameters to enter the test mask.
Evaluation of results.

Module 3: Ultrasonic Crack Detector
Setting ultrasonic crack detector's parameters for Ist and 2nd operational level .
Select appropriate speed and resolution to get correct value.
Calibration of machine .
Select proper analysis line for calculating HIC parameters .
Print and save the raw data of scanned samples.

The duration of this course is for 5 days and it is conducted by a Senior Metallurgist. Students will be given a course completion certificate at the end of this course.

D. Engineering Consulting

Advanced levels of training are offered by TCR Arabia from experts who have the best theoretical knowledge with decades of hands-on experience in plant sites. Training on Fitness for Service, API 571 and Risk based Inspection is provided by an operational alliance between TCR Arabia and UK based PP Simtech.

Engineers from TCR Arabia-PP Simtech (TCRAPPS) have been involved in and have been at the forefront of the development of best practices in RBI technology having successfully implemented it at various plant sites globally for more than 12 years. Engineers from TCRAPPS are members of the British Standards Institute technical committee (>15 years) and have been responsible for the development of the Fitness for Service assessment code BS 7910 and Pressure Vessel design code BS 5500.

Experts have decades of experience covering facture mechanics to assess critical defect sizes of various types of cracking damage mechanisms, fatigue, creep, localized thinning, low temperature service suitability etc.

I. Fitness for Service Assessment Training

When plant items are replaced or when repairs are carried out simply because of non-compliance with the original design code or the corrosion allowance has been used up, the cost implication to companies are enormous. The application of proven Fitness for Service (FFS) technology is changing the way in which such decisions are made to optimize spend safely and reliably.

Engineers attending this training will acquire a valuable appreciation of when to apply FFS technology; be able to choose the appropriate method or combination of methods to solve a given problem; understand the results of the assessments to help make informed decisions, for example:

- To 'run item as is' and at 'what optimum inspection interval'
- To 'monitor defect' and at 'what optimum monitoring frequency'
- To 'repair or replace' item and 'latest date it should be carried out'
- To 'revise operating conditions' to match condition of item
- To 'modify design' and/or 'upgrade material'

The duration of this course is for 5 days and it is conducted by experts from TCRAPPS. Students will be given a course completion certificate at the end of this course.

II. Understanding API 571 damage Mechanisms

A structured approach to economic, safe and reliable management of static equipment assets involves 2 critical technologies – RBI (Risk Based Inspection) and FFS (Fitness for Service). They are closely linked and complement each other in demonstrating integrity of an item throughout its lifetime at optimum costs.

The knowledge of damage mechanisms and their root causes in static equipment deterioration is central to this process. Only this information can support the reliable application of these technologies, so that it gives the required confidence in assessment results. The importance of all engineers involved in inspection, integrity, process and plant operations having a good understanding of these Damage Mechanisms is therefore critical as each of these disciplines have an important role to play in managing asset integrity.

This training course covers all Damage Mechanisms (including those in API 571) and teaches the following:

- Damage Mechanisms (descriptions, key conditions which initiate damage, characteristics)
- Key factors that influence damage (detrimental factors versus beneficial factors)
- Where Found / Area for inspection (general location and specific location)
- Inspection Methods and Monitoring (types of NDT; physical and operational monitoring)
- Mitigation (related to material, design, process and operating envelope)

The duration of this course is for 5 days and it is conducted experts from TCRAPPS. Students will be given a course completion certificate at the end of this course.

III. Implementing RBI best practices in Plants

Only the implementation of best practices in Risk Based Inspection (RBI) brings immense benefits to plant sites. However, it is emphasized that there are no short cuts to this process. For example, compromising the quality of the RBI team study by not providing sufficient study time in order to reduce project timescales or project costs will have a detrimental effect on the confidence that can be placed on the RBI study output.As such the claimed outcomes of improvements in plant reliability, safety and financial benefits are questionable and so is the management decision to buy into this output and implement it in the hope that they are going to achieve the claimed benefits.

Those who attend this training will acquire a valuable appreciation of what constitutes a reliable RBI technology and the best practice for implementation. This understanding is crucial to Engineers and Managers responsible for championing the RBI project, which will enable them to ensure total confidence in the RBI process and the RBI output. Including:

- Reliability of the RBI technology process
- Management commitment and obligation when implanting RBI
- RBI study team and comprehensiveness of the team study
- Implementation of the RBI study output and outcome
- Subsequent updates following inspection or operational changes

The duration of this course is for 1 day and it is conducted by experts from TCRAPPS. Students will be given a course completion certificate at the end of this course.

IV. Failure and Root Cause Analysis: Guide and Techniques

The training module aims to integrate mechanical design, manufacturing processes, mechanical behaviour and microstructural analysis. In the interactive and modular course, the participants learn to determine the root causes of metallurgical failures. The participants are explained how to perform nondestructive, mechanical, metallurgical, and chemical tests by both portable and laboratory metallographic techniques. Optical and scanning electron micrographs and fractographs will be studied. The multi disciplinary nature of failure analysis benefits participants by integrating many subjects and requiring the use of modern equipments.

This training program provides an extensive analysis into the different types of material and component failures observed in industrial enterprises. Take this opportunity to also discuss solutions to manufacturing problems and get advice from the workshop leaders and your peers towards selecting the appropriate materials to improve overall product quality, reduce costs, and enhance customer satisfaction. You will also have time to discuss welding problems and hear solutions to improve the weld process.

In this workshop, you will address and resolve:

- Typical root cause metallurgical failure mechanisms
- Boiler, heat exchanger and pressure vessel failure
- Pipeline failure
- Lifting equipment and fastener failures
- Gear, shaft and weld failure analysis
- Root cause analysis through metallurgical approach
- Analysis procedure
- Preventing reoccurrence of the failure by in-situ metallography approach

By attending this training program, you will benefit by:

- Developing in-house solutions to your manufacturing problems
- Improving overall product quality through appropriate materials selection
- Quickly recognizing the different types of failure for particular units

The duration of this course is for 1 day and it is conducted by failure analysis experts from TCR Arabia. Students will be given a course completion certificate at the end of this course.

E. Non Destructive Testing

I. Introduction to NDT for Plant Executives

This course introduces all NDT Methods. The course is designed for individuals who want to have basic knowledge about NDT. The course will include demonstrations.

Topics covered in this course will include:

Material Processes 2 hours
Defects in Castings, forgings, drawing, maching

Visual Testing 6 hours
Welding processes
Weld defects, weld inspections
Visual inspection tools

Liquid Penetrant Testing 4 hours

Magnetic Particle Testing 4 hours

Ultrasonic Testing 8 hours
Thickness measurements
Crack detection

Radiography Testing 8 hours
Inspection process and interpretation

Eddy Current Testing 6 hours

Surface inspection
Tubing inspection

Personnel Certification 2 hours
SNT-TC-1A
CP-189

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given a course completion certificate at the end of this course.

II. Ultrasonic Testing – Level I

This course introduces the basic principles of ultrasonics and prepares the candidate for Thickness Measurement and other 0-degree inspections. (See Level II Course Outline for Angle Beam Testing)

This course prepares a candidate to
- Perform Specific Calibrations
- Specific NDT
- Specific Evaluations for Accept or Reject Determinations according to written Instructions
- Record Results

TRAINING
Training Material is presented in Module that are followed by Quizzes

CERTIFICATION MODULE
Personnel Certification: ASNT SNT-TC-1A. Candidates must score a minimum of 70 % in each test and a minimum of 80% average for all the three tests.

MODULE 1: MANUFACTURING DISCONTINUITIES
- Types of Discontinuities: – Inherent, Processing and Service
- Casting Discontinuities: - Hot Tear, Cold Shut, Porosity, Shrinkage
- Primary Processing Discontinuities including discontinuities in Rolling, Forging, Drawing, Extruding
- Secondary Processing Discontinuities including discontinuities in Grinding, Heat Treating, Machining, Welding, Plating
- Service Discontinuities:- Erosion, Wear, Fatigue, Corrosion, Creep, Hydrogen Attack

MODULE 2: WAVE MODES
- Time Period and Frequency
- Wavelength
- Wave Modes including Longitudinal, Shear, Surface and Lamb Waves
- Velocity of Waves
- Calculation of Velocity
- Factors Affecting Velocity - Temperature, Stress
- Laboratory Measurement of Velocity

MODULE 3: ACOUSTIC IMPEDANCE
- Acoustic Impedance
- Calculation of Acoustic Impedance
- Reflection and Transmission Coefficients
- Transmission through a layer

MODULE 4: REFRACTION AND REFLECTION (Covered in Level I and II training)
- Reflection and Refraction
- Snell's Law
- Mode Conversion
- First and Second Critical Angle
- Creeping Waves
- Problems on Mode Conversion

MODULE 5: PIEZOELECTRIC TRANSDUCER
- Wave Interference: Constructive and Destructive
- Sound Field
- Near Field
- Far Field
- Beam Spread

- Problems on Near Field and Beam Spread
- Laboratory measurement of Beam Spread
- Principles of Piezoelectricity
- Curie Temperature
- Transducer damping
- Bandwidth
- Type of Transducers
- Contact and Immersion Transducers
- Dual Element, Delay Line, Angle Beam Transducer
- Couplant

MODULE 6: PULSER RECEIVER

- Ultrasonic Instrumentation - Analog
- Ultrasonic Instrumentation - Digital
- Time Base
- Pulse Repetition Rate
- Types of Ultrasonic Display – A, B and C Scan
- Gates
- Calibration of Ultrasonic Equipment - Time and Amplitude Linearity (Level II)

MODULE 7: ATTENUATION

- Sound Attenuation
- Causes for Attenuation
- Attenuation Measurement
- Calculation of Amplification
- Laboratory - Measurement of Attenuation

MODULE 8: THICKNESS MEASUREMENT

- Test Modes
- Thickness Measurement
- Thickness Measurement Frequency
- Screen Calibration
- Problems
- Laboratory - Thickness measurement, Corrosion Mapping

MODULE 9: IMMERSION TESTING

- Advantages and Limitations of Immersion Testing
- Technique
- Minimum Water Path calculation
- Types of Immersion Testing Transducers
- Bubbler/Squirter Technique
- Wheel Type Transducer

MODULE 10: FLAW DETECTION - 0 DEGREE

- Lamination, Corrosion Mapping, Base Metal defects, Bolts
- Laboratory scanning on lamination and forged sample as per SA-578 and SA-388

PRACTICALS

- Velocity measurement
- Thickness Measurement
- Thickness Scanning
- Plates
- Tubes
- Corroded samples
- Bolt Inspection
- Laminated Plates

EXAMINATIONS

- General
- Specific and Practical

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level I certificate at the end of this course.

III. Ultrasonic Testing – Level II

Prerequisite for this Class is Level I Ultrasonics

SCOPE

This course introduces the basic principles of ultrasonics and prepares the candidate for Angle Beam Inspections.

This course prepares a candidate to

- Perform Specific Calibrations
- Specific NDT
- Interpretation of Codes
- Evaluations for Accept or Reject Determinations according to written Instructions
- Record Results

TRAINING

Training Material is presented in Module that are followed by Quizzes

CERTIFICATION MODULE (Covered in Level I Training)

MODULE 1: MANUFACTURING DISCONTINUITIES (Covered in Level I Training)

MODULE 2: WAVE MODES (Covered in Level I Training)

MODULE 3: ACOUSTIC IMPEDANCE (Covered in Level I Training)

MODULE 4: REFRACTION AND REFLECTION (Covered in Level I and II)

- Reflection and Refraction
- Snell's Law
- Mode Conversion
- First and Second Critical Angle
- Creeping Waves
- Problems on Mode Conversion

MODULE 5: PIEZOELECTRIC TRANSDUCER (Covered in Level I Training)

MODULE 6: PULSER RECEIVER

- Calibration of Ultrasonic Equipment - Time and Amplitude Linearity
- All other Topics Covered in Level I Training

MODULE 7: ATTENUATION (Covered in Level I Training)

MODULE 8: THICKNESS MEASUREMENT (Covered in Level I Training)

MODULE 9: IMMERSION TESTING (Covered in Level I Training)

MODULE 10: FLAW DETECTION - 0 DEGREE (Covered in Level I Training)

MODULE 11: CALIBRATION BLOCKS

- IIW Block Type I
- IIW Block Type II
- Miniature Angle Beam / Rompass Block
- DSC Block
- AWS Resolution Block
- Step Wedge
- Area- Amplitude Block
- Distance- Amplitude Block

MODULE 12: ANGLE BEAM INSPECTION

- Selection of Screen Range
- Measurement of Beam Exit Point
- Measurement of Actual Refracted Angle
- Calibration using IIW, Rompass and DSC Block
- Sensitivity and Resolution
- Reference Amplitude
- Distance Amplitude Correction Curve
- Distance Gain Size
- Discontinuity Length Sizing using 6 dB and 20 dB drop method
- Discontinuity Evaluation

- Angle Selection
- Surface Distance, Skip Distance, Depth, Full V Path
- Plotting of Discontinuities like Crack, Lack of Fusion, Lack of Penetration, Slag, Porosity in welds
- Worksheet: Plotting of discontinuities for butt welds

MODULE 13: WRITING AN ULTRASONIC PROCEDURE

- ASME Section V
- Essential Variables
- Non Essential Variables

MODULE 14: CODES AND STANDARDS

- ASME Section V, Article 4, 2004 Edition
- ASME Section VIII

Additional Codes Standards as per student's requirements (please discuss this at the time of registration)

INTRODUCTION TO ADVANCED TECHNIQUES

Time of Flight Diffraction
Phased Arrays

PRACTICALS

Shear Wave Testing on API Pipe Samples with Weld defects – ID Cracks, OD Cracks, Slag, Porosity, Lack of Fusion, and Lack of Penetration

EXAMINATIONS

General
Specific
Practical

Candidates must score a minimum of 70 % in each test and a minimum of 80% average for all the three tests.

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level II certificate at the end of this course.

IV. Phase Array Level II Topical Outline

Note: It is recommended that this course have a minimum pre-requisite of an Ultrasonic testing Level II unrestricted certification.

The intent of this document is to provide "basic" knowledge on phased array ultrasonic testing consistent with other methods and to acknowledge phased array (PA) as unique enough to warrant an additional body of knowledge and qualification requirements.

Phased Array Evaluation Course

1.0 Introduction
- 1.1 Terminology of PA
- 1.2 History of PA – medical ultrasound, etc.
- 1.3 Responsibilities of levels of cetification

2.0 Basic Principles of PA
- 2.1 Review of ultrasonic wave theory: longitudinal and shear wave
- 2.2 Introduction to PA concepts and theory

3.0 Equipment
- 3.1 Computer based systems
  - 3.1.1 Processors
  - 3.1.2 Control panel including input and output sockets
  - 3.1.3 Block diagram showing basic internal circuit modules
  - 3.1.4 Multi-element/multi-channel configurations
  - 3.1.5 Portable battery operated versus full computer-based systems
- 3.2 Focal law generation
  - 3.2.1 Onboard focal law generator
  - 3.2.2 External focal law generator
- 3.3 Probes
  - 3.3.1 Composite material
  - 3.3.2 Pitch, gap, and size
  - 3.3.3 Passive planes

- 3.3.4 Active planes
- 3.3.5 Arrays: ID, 2D, polar, annular, special shape, etc.
- 3.3.6 Beam and wave forming
- 3.3.7 Grating lobes

3.4 Wedges
- 3.4.1 Type of wedge designs

3.5 Scanners
- 3.5.1 Mechanized
- 3.5.2 Manual

4.0 Testing Techniques
- 4.1 Linear scans
- 4.2 Sectorial scans
- 4.3 Electronic scans

5.0 Calibration
- 5.1 Active element and probe checks
- 5.2 Wedge delay
- 5.3 Velocity
- 5.4 Exit point verifications
- 5.5 Refraction angle verifications
- 5.6 Sensitivity
- 5.7 DAC, TCG, TVG, and ACG variables and parameters
- 5.8 Effects of curvature
- 5.9 Focusing effects
- 5.10 Beam steering
- 5.11 Acquisition gates

6.0 Data collections
- 6.1 Single probes
- 6.2 Multiple probes
- 6.3 Multiple groups or multiplexing single/multiple probes
- 6.4 Non-encoded scans
  - 6.4.1 Time-based data storage
- 6.5 Encoded scans
  - 6.5.1 Line scans
  - 6.5.2 Raster scan
- 6.6 Zone discrimination
- 6.7 Scan plans and exam coverages
  - 6.7.1 Sectorial
  - 6.7.2 Linear
  - 6.7.3 Electronic raster scans
  - 6.7.4 Probe offsets and indexing

7.0 Procedures
- 7.1 Specific applications
  - 7.1.1 Material evaluations
  - 7.1.2 Non-metallic materials
  - 7.1.3 Metallic materials
  - 7.1.4 Base material can
  - 7.1.5 Bar, rod. And rail
  - 7.1.6 Forgings
  - 7.1.7 Castings

7.1.2 Component evaluations
- 7.1.2.1 Ease with complex geometries
  - 7.1.2.1.1 Turbines (blades, dovetails, rotors)
  - 7.1.2.1.2 Shafts, keyways, etc.
  - 7.1.2.1.3 Nozzles
  - 7.1.2.1.4 Flanges
- 7.1.2.2 Geometric limitations

7.1.3 Weld inspections
- 7.1.3.1 Fabrication/in-service
- 7.1.3.2 Differences in material: carbon steel, stainless steel, high-temperature nickel chromium alloy, etc

7.1.3.3 Review of welding discontinuities
7.1.3.4 Responses from various discontuinuities
7.3 Data evaluation
7.3.1 Codes/standard (A-scan, B-scan, and C-scan)
7.3.2 Flaw characterization
7.3.2 Flaw dimensioning
7.3.4 Geometry
7.3.5 Software tools
7.3.6 Evaluation gates
7.4 Reporting
7.4.1 Imaging outputs
7.4.2 Onboard reporting tools
7.4.3 Plotting, ACAD, etc.

V. Time of Flight Diffraction Level II Topical Outline

Note: It is recommended that this course have as a minimum pre-requisite and Ultrasonic Testing Level II unrestricted certifications.

The intent of this document is to provide "basic" knowledge on time of flight diffraction (ToFD) ultrasonic testing consistent with other methods and to acknowledge ToFD as unique enough to warrant an additional body of knowledge and qualification requirements.

Time of Flight Diffraction Evaluation Course
1.0 Introduction
1.1 Terminology of time of flight diffraction (ToFD)
1.2 History of ToFD (e.g., M.G. Silk)
1.3 Responsibilities of levels of certification
2.0 Basic principles of ToFD
2.1 Review of ultrasonic wave theory, refracted longitudinal waves
2.2 Introduction to ToFD concepts and theory
2.3 Techniqe limitations
3.0 Equipment
3.1 Computer-based systems
3.1.1 Processors
3.1.2 Control panel including input and outout sockets
3.1.3 Block diagram showing basic internal circuit modules
3.1.4 Portable battery-operated versus full computer-based systems
3.2 Beam profile tools
3.2.1 Probe center separation (PCS) calculators for FLAT material/components
3.2.2 PCS calculators for CURVE surfaces
3.2.3 Beam spread effects and control
3.2.4 Multiple zone coverage and limitations
3.3 Probes
3.3.1 Composite materials
3.3.2 Damping characteristics
3.3.3 Selection of frequency and diameter
3.4 Wedges
3.4.1 Incident and refracted angle selections
3.4.2 High-temperature applications
3.5 Scanners
3.5.1 Mechanized
3.5.2 Manual
4.0 Testing Techniques
4.1 Line scans (single tandem probe setups)
4.2 Line scans (multiple probe setups)
4.3 Raster scans
5.0 Calibration
5.1 Metarial velocity calculations
5.2 Combined probe delay(s) calculation(s)
5.3 Digitization rates and sampling
5.4 Signal averaging

5.5 Pulse width control
5.6 PCS and angle selection
5.7 Sensitivity
5.8 Preamplifiers
5.9 Effects of curvature
6.0 Data Collection
6.1 Single probe setups
6.2 Multiple probe setups
6.3 Non-encoded scans
6.3.1 Time-based data storage
6.4 Encoded scans
6.4.1 Line scans
6.4.2 Raster scans
6.5 Probe offsets and indexing
7.0 Procedures
7.1 Specific applications
7.1.1 Material evaluations
7.1.1.1 Base material scans
7.1.2 Weld inspections
7.1.2.1 Detection and evaluation of fabrication welding flaws
7.1.2.2 Detection and evaluation on inservice cracking
7.1.2.3 Detection of volumetric loss such as weld root erosion and partial penetration weld dimensional verification
7.1.2.4 Geometric limitations
7.1.2.5 Cladding thickness and integrity evaluations
7.1.3 Complex geometrics
7.1.3.1 Transitions, nozzles, branch connections, tees, saddles, etc.
7.2 Data presentation
7.2.1 Standard (A-scan, D-scan)
7.2.2 Other (B-scan, C-scan)
7.3 Data evaluation
7.3.1 Codes/standards/specifications
7.3.2 Flw characterization
7.3.3 Flaw dimensioning
7.3.4 Geometry
7.3.5 Software tools
7.3.5.1 Linearization
7.3.5.2 Lateral/back wall straightening and removal
7.3.5.3 Synthetic aperture focusing technique (SAFT)
7.3.5.4 Spectrum processing
7.3.5.5 Curved surface compensation
7.3.6 Parabolic cursor(s)
7.4 Reporting
7.4.1 Imaging outputs
7.4.2 Onboard reporting tools
7.4.3 Plotting, ACAD, etc.

VI. Magnetic Particle Testing – Level I and Level II

SCOPE

This course covers the principles of Magnetic Particle Testing and prepares a candidate to

- Setup and calibrate equipment
- Interpret and Evaluate Results with respect to Applicable Codes, Standards and Specifications
- Familiar with the scope and limitations of the Methods
- Write test reports.

TRAINING

Training Material is presented in Module that are followed by Quizzes

GENERAL TRAINING

Personnel Certification: ASNT SNT-TC-1A

MODULE 1: MANUFACTURING DISCONTINUITIES

- Types of Discontinuities: Inherent, Processing and Service
- Casting Discontinuities: Hot Tear, Cold Shut, Porosity, Shrinkage
- Primary Processing Discontinuities including discontinuities in Rolling, Forging, Drawing, Extruding
- Secondary Processing Discontinuities including discontinuities in Grinding, Heat Treating, Machining, Welding, Plating
- Service Discontinuities: Erosion, Wear, Fatigue, Corrosion, Creep, Hydrogen Attack

MODULE 2: THEORY OF MAGNETISM

- Magnetic field, Lines of force, Flux density
- Definitions of Permeability, Reluctance, Retentivity, Residual Magnetism and Coercive Force
- Diamagnetic, Paramagnetic and Ferromagnetic materials
- Leakage flux
- Fleming's Right Hand and Left Hand Rule
- Types of Magnetic Fields: Circular, Longitudinal, Vector
- Hysteresis Curve

MODULE 3: METHODS OF MAGNETIZATION

- Magnetization By Means of Electric Current
- Types of current AC, HWDC
- Circular field: Head Shot (Direct Contact), Prods and Central Conductor Techniques, Offset Central Conductor
- Advantages and disadvantages of circular field
- Longitudinal field: Coils and Yoke
- Advantages and disadvantages of Longitudinal Field
- AC and DC Field Distribution in a Magnetic and a Nonmagnetic Conductor
- Demagnetization

MODULE 4: EQUIPMENT

- Equipment consideration
- Wet Horizontal, Mobile and Portable Equipments
- Fluorescent testing, Black Light
- Accessories

MODLULE 5: MEDIUMS AND THEIR PREPARATION

- Dry and Wet method
- Particles: Dry and Wet
- Properties of particles
- Visibility of particles
- Methods of Application
- Contamination of Magnetic Particles
- Settling Test Procedure
- Concentration for Wet suspensions as per ASME Sec V Article 7
- Bath Maintenance

MODLULE 6: APPLICATIONS

- Residual and Continuous Method
- Magnetic Particle Inspection of Solid Cylindrical Parts, Gears, Multiple diameter Articles, Discs, Hollow Cylindrical Articles
- Selection of proper method of magnetization
- Verification of magnetic fields
- Checking the adequacy of field using the Pie gauge, shims
- Magnetic Rubber Inspection

MODULE 7: TYPES OF INDICATIONS

- Interpretation including Relevant, False, Non-relevant indications

MODULE 8: Codes and Standards (SPECIFIC TRAINING)

- MT Inspection Procedures

Codes

- ASME Section V Article 7 2004
- ASME Section VIII (Accept/Reject Criteria)
- ASME B 31.1 – Power Piping
- ASME B 31.3 – Petrochemical Piping

Standards

- ASTM E-709
- ASTM E-1444

Other codes and standards can be discussed if prearranged with the instructor at the time of registration

PRACTICAL TRAINING

- MT Yoke: Dry Visible, Wet Visible, Wet Fluorescent
- Central Conductor
- Coil Shot - Longitudinal
- Ketos (Betz) Ring – Depth of penetration
- Training on Weld defect samples

EXAMINATIONS

- General
- Specific
- Practical

Candidates must score a minimum of 70 % in each individual test and a minimum average of 80% in all three tests.

The duration of this course is for 3 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level II certificate at the end of this course.

VII. Liquid/Dye Penetrant Testing – Level I and Level II

SCOPE

This course covers the principles of Liquid Penetrant Testing and prepares a candidate to

- Setup and calibrate equipment
- Interpret and Evaluate Results with respect to Applicable Codes, Standards and Specifications
- Familiar with the scope and limitations of the Methods
- Write test reports.

TRAINING

Training Material is presented in Module that are followed by Quizzes

GENERAL TRAINING

Personnel Certification: ASNT SNT-TC-1A

MODULE 1: MANUFACTURING DISCONTINUITIES

- Types of Discontinuities: Inherent, Processing and Service
- Casting Discontinuities: Hot Tear, Cold Shut, Porosity, Shrinkage
- Primary Processing Discontinuities including discontinuities in Rolling, Forging, Drawing, Extruding
- Secondary Processing Discontinuities including discontinuities in Grinding, Heat Treating, Machining, Welding, Plating
- Service Discontinuities:- Erosion, Wear, Fatigue, Corrosion, Creep, Hydrogen Attack

MODULE 2: PRINCIPLES

- Purpose of Liquid Penetrant Testing
- Physical Principles
- Wetting Characteristics and Contact Angle
- Wetting Ability
- Force of Cohesion and Surface Tension
- Capillary Action
- Viscosity
- Application of Penetrant: Dwell Time
- Reversed Capillary Action
- Visibility of Indication
- Categories of Test Processes
- Types of Dye: Type I and Type II
- Methods of Removal of excess Penetrant including Water Washable, Emulsifiers and Solvent Removable
- Sensitivity Levels – ½, 1, 2, 3, 4
- Selection of Process
- Limitations of Penetrant Testing

MODULE 3: BASIC STEPS

This module covers the basic steps involved in the following processes

- Method A – Water Washable
- Method B – Lipophilic Emulsifier
- Method C – Solvent Removable
- Method D – Hydrophilic Emulsifier

MODULE 4: PRE AND POST CLEANING

- Choice of Cleaning Method
- Different Cleaning Methods including Detergent, Solvent, Alkaline, Steam, Ultrasonic cleaning, Vapor Degreasing

MODULE 5: APPLICATION OF PENETRANTS AND DEVELOPERS

- Different ways of applying penetrants
- Standard Temperature Limits
- Dwell time
- Drying
- Drying Parameters
- Drying Time Limits
- Application of Developers
- Types of Developers
- Developing Time
- Fluorescent Inspection
- Black Light, Black Light Warm Up Time,
- Visual Adaptation
- Post Cleaning

MODULE 6: INTERPRETATION

- Interpretation of Test Results
- Flow Chart for Interpretation
- Types of Indications like True, False, Relevant and Non Relevant indications
- Categories of Indications: - Rounded and Linear
- Evaluation of Indications
- ASTM E-433 Reference Photographs of Indications types

MODULE 7: CODES & STANDARDS (SPECIFIC TRAINING)

Codes

- ASME Section V, Article 6
- ASME Section VIII, Appendix 8 (Accept/Reject Criteria)

Standards

- ASTM E-165
- ASTM E –1417
- Other codes and standards can be discussed at the request of the students. Please make such requests at time of registration

PRACTICAL TRAINING

Visible
- Solvent Removable

Fluorescent
- Water Washable
- Solvent Removable
- Emulsifier both Hydrophilic and Lipophilic

Tests on Weld samples

EXAMINATIONS
- General
- Specific
- Practical Tests

Candidates must score a minimum of 70 % in each test and a minimum of 80% average for all the three tests.

The duration of this course is for 3 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level II certificate at the end of this course.

VIII. Visual Testing – Level II

SCOPE

This in-depth course prepares a candidate to conduct Visual Examinations.

This course prepares a candidate to:
- Setup and calibrate equipment
- Interpret and Evaluate Results with respect to Applicable Codes, Standards and Specifications
- Familiar with the scope and limitations of the Methods and ability to write test reports

GENERAL TRAINING

1. **Introduction:-**
   - Definition of visual testing.
   - History of visual testing applications.
   - Overview of visual testing applications.
2. **Definitions :-**
   - Standard terms and their meanings in the employer's industry.
3. **Fundamentals:-**
   - Vision
   - Lighting
   - Materials attributes
   - Environmental factors
   - Visual perception
   - Direct and indirect methods
4. **Equipments (as applicable)**
   - Mirrors
   - Magnifier
   - Borescopes
   - Fiberscopes
   - Closed-circuit television
   - Light sources and special lighting
   - Gages, templates, scales, micrometers, calipers, special tools, etc.
   - Automated System
   - Computer-enhanced systems
5. Manufacturing Processes
   - Inherent and Processing Discontinuities

- Casting and its defects
- Forging, rolling, drawing and defects
- Surface Texture

6. In-Service Defects
- Fatigue
- Corrosion
- Wear

7. Welding
- Expectations of a weld
- Welding terms
- Welding processes: SMAW, GTAW, GMAW, & FCAW
- Welding codes: ASME, AWS, API and NBIC
- Welding filler materials (F and A numbers)
- Base materials (P numbers)
- Weld nomenclature (parts of a weld)
- Welding joints
- Welding symbols
- Welding defects: Their causes, detection, repairs, and prevention
- Inspection acceptance criteria: ASME and AWS
- What is the purpose of a visual welding inspector ?
- Weld inspection tools: Fillet welds gage, high-low gage, stud weld test gage, etc.
- Heat treatments
- Pumps and Valves
- Bolting

8. Employer-Defined Application
(Includes a description of inherent, processing and service discontinuities)
- Materials-based materials
- Metallic materials, including welds.
- Organic-based materials
- Other materials (employer-defined)

9. Visual Testing to specific procedures
- Selection of parameters
  1) Inspection objectives
  2) Inspection checkpoints
  3) Sampling plans
  4) Inspection patterns
  5) Documented procedures
- Test standards/calibrations
- Classification of indications per acceptance criteria
- Reports and documentation.

10. Vision
- The eye
- Vision Limitations
- Disorders
- Employer's vision examination methods

11. Lighting
- Fundamentals of light
- Lighting measurements
- Recommended lighting levels
- Lighting techniques for inspection

12. Materials Attributes
- Cleanliness
- Color
- Condition
- Shape
- Size
- Temperature

- Texture
- Type

13. Environmental and Physiological Factors :-

- Atmosphere
- Cleanliness
- Comfort
- Distance
- Elevation
- Fatigue
- Health
- Humidity
- Mental attitude
- Position
- Safety
- Temperature

14. Visual Perception

- What your eyes see
- What your mind sees
- What others perceive
- What the designer, engineer, etc. wants you to see

15. Equipments

- Automated systems
- Borescopes
- Close-circuit television
- Computer based systems
- Fiberscopes
- Gages, micrometers, calipers, templates, scales, etc.
- Imaging systems
- Light sources and special lighting.
- Magnifiers
- Mirrors
- Special optical systems
- Standard lighting

16. Employee-Defined Application

- Mineral-based material
- Metallic materials(including welds)
- Organic-based materials
- Other materials and products(employer defined)

17. Acceptance/Rejection Criteria

- Subjective basis (qualitative)
- Objective basis (quantitative)
- Evaluation of results per acceptance criteria.

18. Recording and Reports

- Subjective methods
- Objective methods
- Recording methods

SPECIFIC TRAINING

Visual Inspection Codes

- AWS D1.1 (steel), D1.2 (Aluminum)
- ASME Section I, V, VIII, 31.1, 31.3

PRACTICAL TRAINING

Evaluate defects in Weld Samples

EXAMINATIONS

- General
- Specific

• Practical

Candidates must score a minimum of 70 % in each test and a minimum of 80% average for all the three tests.

The duration of this course is for 3 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level II certificate at the end of this course.

IX. Radiography Testing – Level II

COURSE OUTLINE

1. Review of Basic Radiographic Principles

- Interaction of radiation with matter.
- Math review
- Exposure calculations
- Geometric exposure principles
- Radiographic-image quality parameters

2. Darkroom Facilities, Techniques, and processing

- Facilities and equipments
  1) Automatic film processor vs manual processing
  2) Safe lights
  3) Viewer lights
  4) Loading lights
  5) Miscellaneous equipments
- Film loading
  1) General rule for handling unprocessed film.
  2) Types of film packaging
  3) Cassette-loading techniques for sheet and roll
- Protection of radiographic film in storage.
- Processing of film – manual
  1) Developer and replenishment
  2) Stop Bath
  3) Fixer and replenishment
  4) Washing
  5) Prevention of water spots
  6) Drying
- Automatic film processing
- Film filing and storage
  1) Retentio0n-life measurements
  2) Long term storage
  3) Filing and separation techniques
- Unsatisfactory Radiographs :-causes and cures
  1) High film density
  2) Insufficient film density
  3) High contrast
  4) Low contrast
  5) Poor identification
  6) Fog
  7) Light leaks
  8) Artifacts
- Film density
  1) Step-wedge comparison film
  2) Densitometers

3. Indications, discontinuities, and defects

- Indications
- Discontinuities

1) Inherent
2) Processing
3) Service

- Defects

4. **Manufacturing Processes and Associated Discontinuities**
   - Casting processes and associated discontinuities
     1) Ingots, blooms, and billets
     2) Sand casting
     3) Centrifugal casting
     4) Investment casting
   - Wrought processes and associated discontinuities
     1) Forgings
     2) Rolled products
     3) Extruded products
   - Welding processes and associated discontinuities
     1) Submerge arc welding (SAW)
     2) Shielded metal arc welding (SMAW)
     3) Gas metal arc welding (GMAW)
     4) Flux corded arc welding(FCAW)
     5) Gas tungsten arc welding(GTAW)
     6) Resistance welding
     7) Special welding processes-electron beam, electro slag, electro gas, etc.
5. **Radiological safety principles Review**
   - Controlling personal exposure
   - Time, distance, shielding concepts
   - ALARA (as low as reasonably achievable) concepts
   - Radiation-detection equipments.
   - Exposure device operating characteristics
6. **Radiographic Viewing**
   - Film illuminator requirements
   - Background Lighting
   - Multiple-Composite viewing
   - Penetrameter placement
   - Film identification
   - Location markers
   - Film density measurements
   - Film artifacts
7. **Application Techniques**
   - Multiple film techniques
     1) Thickness-variation parameters
     2) Film speed
     3) Film latitude
   - Enlargement and projection
   - Geometrical relationships
     1) Geometrical unsharpness
     2) Penetrameter sensitivity
     3) Source -to -film distance
     4) Focal-spot size
   - Triangular methods for discontinuity location
   - Localized magnification
   - Film handling techniques
8. **Evaluation of castings**
   - Casting-methods review
   - Casting discontinuities
   - Origin and typical orientation of discontinuities
   - Radiographic appearance
   - Welding codes/standards- applicable acceptance criteria

- Reference radiographs or pictograms

9. Evaluation of weldments

- Welding-method review
- Welding discontinuities
- Origin and typical orientation of discontinuities
- Radiographic appearance
- Welding codes/standards-applicable acceptance criteria
- Reference radiographs or pictograms

10. Standards, codes and Procedures for Radiography

- ASTM E94/E142
- Acceptable radiographic techniques and setups
- Applicable employer procedures
- Procedure for radiograph parameter verification
- Radiographic reports.

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level II certificate at the end of this course.

X. Eddy Current Testing – Level I

SCOPE

This course prepares a candidate to Perform Surface Eddy Current Inspection and

- Perform Specific Calibrations
- Specific NDT
- Specific Evaluations for Accept or Reject Determinations according to written Instructions
- Record Results

TRAINING

GENERAL TRAINING

Electrical Parameters

- Resistance
- Inductance
- Impedance

Electromagnetism

- Faraday's Law
- Lenz's Law

Eddy Current Theory

- Generation of Eddy Currents
- Impedance changes by Eddy Currents
- Effect of change of impedance on instrumentation

Impedance Curves

- Conductivity Curve
- Lift Off Curve
- Permeability

Types of Eddy Current Sensing Elements

- Probes
  - Absolute
  - Differential
- Lift-off
- Theory of operation

Materials

- Inspection of Non-Ferromagnetic Materials
- Inspection of Ferromagnetic Materials

Special Probes

- Lift Off Insensitive
- Fastener Probes- Ring Probe

Calibration Standards

- Conductivity Standards
- EDM notch Surface Standards

Applications

- Surface Inspection
- Inspection of Airframes
- Airframe Fastener Inspection
- Turbine Blade Inspection
- Inspection of Petrochemical Piping
- Surface Weld Inspection

SPECIFIC TRAINING

Surface ECT Procedure
ASME Section V

PRACTICAL TRAINING

Setting up the Instrument
Selection of Frequency
Calibrations
Test on Various Samples
Prepare test Report

EXAMINATIONS

- General
- Specific
- Practical Tests

Candidates must score a minimum of 70% in each test and a minimum of 80% average for all the three tests.

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level I certificate at the end of this course.

XI. Eddy Current Testing – Level II

SCOPE

This course covers ECT probes, ECT Instrumentation and prepares an inspector to perform Tubing Inspections

This course prepares a candidate to

- Setup and calibrate equipment
- Interpret and Evaluate Results with respect to Applicable Codes, Standards and Specifications
- Familiar with the scope and limitations of the Methods
- Write test reports

TRAINING
GENERAL TRAINING

Electromagnetic Theory

- Eddy Current Theory
- Types of Eddy Current sensing probes

Factors that affect Coil Impedance

- Test part
- Conductivity
- Permeability
- Thickness

Test system

- Frequency
- Coupling
- Field strength
- Test coil and shape

Probes Design

- Surface Inspection Probes

- Tube Inspection Probes

Non Ferromagnetic Tubing Inspection- Conventional ECT

- ASME Calibration Standard
- Bobbin Probe
- Differential and Absolute Inspection
- Selection of Probe Size
- Selection of ECT frequency
- Depth Curves
- Sizing if defects

Ferromagnetic Tubing Inspection- Remote Field ECT

- RFECT Theory
- Probes
- Selection of Probe Size
- Selection of Probe Frequency
- Impedance Plane Analysis

ECT Instruments

- Minimum requirements for Surface Inspection
- Portable Instrumentation
- Minimum requirements for Tubing Inspection
- Computer Controlled Instrumentation
- Sampling Rate and Pull Speed

SPECIFIC TRAINING

Codes and Standards

- ASME Section V
- ASTM Standards

PRACTICAL TRAINING

Setting up the Instrument
Selection of Frequencies for Tube Inspection
Selection of Probe Size
Calibrations
Depth Curve
Data Acquisition
Test on Various Samples
Prepare test Report

EXAMINATIONS

- General
- Specific
- Practical Tests

Candidates must score a minimum of 70% in each test and a minimum of 80% average for all the three tests.

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level II certificate at the end of this course.

XII. Thermography – Level I

The Level I Infrared Thermography Training Course, taught by internationally known Level III in Thermography is geared to the new infrared camera user and focuses on its use for a variety of condition monitoring/predictive maintenance applications.

- Introduction to thermal imaging and measurement systems for predictive maintenance applications.
- Collect quality data, accurate temperature readings, and account for measurement effects such as distance and emissivity using infrared cameras.
- Interpret thermograms and make informed decisions using heat transfer concepts to analyze thermal images, and see the latest in infrared inspection report generation and database software.
- Avoid costly mistakes - learn to distinguish between hot spots and reflections, direct vs. indirect readings and qualitative vs. quantitative thermography.

- Field applications that simulate real-world infrared applications.

Successful Level I Thermography Training course completion provides Level I Thermographer Certification. TCR's Level I Infrared Course meets all Level I ASNT-SNT-TC-1A recommendations for thermal/infrared testing, as established by the American Society for Non-Destructive Testing (ASNT).

Recommended Training for Level I Thermal/Infrared Testing: Basic Thermal/Infrared Physics Course

1.0 The nature of heat-what is it and how is it measured/expressed?
1.1 Instrumentation
1.2 Scales and conversions

2.0 Temperature –what is it and how is it measured/expressed?
2.1 Instrumentation
2.2 Scales and conversions

3.0 Heat Transfer Modes Familiarization
3.1 Heat conduction fundamentals
3.1.1 Fourier's law of heat conduction (concept)
3.1.2 Conductivity/resistance basis
3.2 Heat convection fundamentals
3.2.1 Newton's law of cooling (concept)
3.2.2 Film coefficient/film resistance basics
3.3 Heat radiation fundamentals
3.3.1 Stefan-Boltzmann law (concept)
3.3.2 Emissivity/obsorptivity/reflectivity/transmissivity basis (Kirchhoff's ;aw)

4.0 Radiosity Concepts Familiarization
4.1 Reflectivity
4.2 Transmissivity
4.3 Absorptivity
4.4 Emissivity
4.5 Infrared radiometry and imaging
4.6 Spatial resolution concepts
4.6.1 Field of view (FOV)
4.6.2 Instantaneous field of view (IFOV) – ref. ASTM E-1149
4.6.3 Spatial resolution for temperature measurement – the Split Resonance Function (SRF)
4.6.4 Measurement Instantaneous Field of View (MIFOV)
4.7 Error potential in radiant measurements (an overview)

Basic Thermal/Infrared Operating Course

1.0 Introduction
1.1 Thermography defined
1.2 How infrared imagers work
1.3 Differences among imagers and alternative equipment
1.4 Operation of infrared thermal imager
1.4.1 Selecting the best perceptive
1.4.2 Image area and lens selection for required details
1.4.3 Optimizing the image
1.4.4 Basic temperature measurement
1.4.5 Basic emissivity measurement
1.5 Operation of support equipment for infrared surveys

2.0 Checking Equipment Calibration with Blackbody References

3.0 Infrared Image and Documentation Quality
3.1 Elements of a good infrared image
3.1.1 Clarity (focus)
3.1.2 Dynamic range of the image
3.1.3 Recognizing and dealing with reflections
3.1.4 Recognizing and dealing with spurious convection
3.2 Recording
3.2.1 Video tape

3.2.2 Photographic images
3.2.3 Video photo cameras
3.2.4 Digital recording
3.2.5 Videoprinters

4.0 Support Data Collection
4.1 Environmental data
4.2 Emissivity
4.2.1 Measurement
4.2.2 Estimation
4.2.3 Surface modification
4.3 Surface reference temperature
4.4 Identification and other

Basic Thermal/Infrared Applications Course

1.0 Detecting Thermal Anomalies Resulting from Differences in Thermal Resistance (Quasi-steady-state Heat Flow)
1.1 Large surface-to-ambient temperature difference
1.2 Small surface-to-ambient temperature difference

2.0 Detecting Thermal/Anomalies Resulting from Differences in Thermal Capacitance, Using System of Environmental Heat Cycles

3.0 Detecting Thermal Anomalies Resulting from Differences in Physical State

4.0 Detecting Thermal Anomalies Resulting from Fluid Flow Problems

5.0 Detecting Thermal Anomalies Resulting from Friction

6.0 Detecting Thermal Anomalies Resulting from Nonhomogeneous Exothermic or Endothermic Conditions

7.0 Field Quantification of Point Temperatures
7.1 Simple techniques for emissivity
7.2 Typical (high emissivity) applications
7.3 Special problem of low emissivity applications

The duration of this course is for 5 days and it is conducted by NDT experts from TCR Arabia. Students will be given an ASNT Level I certificate at the end of this course.

XIII. Thermal/Infrared Testing Level I Topical

Basic Thermal/Infrared Physics Course

1.0 The Nature of Heat – What is it and How Is It Measured/Expressed?
- 1.1 Instrumentation
- 1.2 Scales and conversion

2.0 Temperature – What Is It and How Is It Measured/Expressed?
- 2.1 Instrumentation
- 2.2 Scales and conversion

3.0 Heat Transfer Modes Familiarization
- 3.1 Heat conduction fundamentals
  - 3.1.1 Fourier's law of heat conduction (concept)
  - 3.1.2 Conductivity/resistance basics
- 3.2 Heat convection fundamentals
  - 3.2.1 Newston's law of cooling (concept)
  - 3.2.2 Film coefficient/film resistance basics
- 3.3 Heat radiation fundamentals
  - 3.3.1 Stefan-Boltzmann law (concept)
  - 3.3.2 Emissivity/absorptivity//reflectivity/transmissivity basics (Kirchhoff's law)

4.0 Radiosity Concepts Familiarization
- 4.1 Reflectivity
- 4.2 Transmissivity
- 4.3 Absorptivity
- 4.4 Emissivity
- 4.5 Infrared radiometry and imaging

4.6 Spatial resolution concepts
- 4.6.1 Field of view (FOP)
- 4.6.2 Instanteneous field of view (IFOV) – ref. ASTM E 1149
- 4.6.3 Spatial resolution for temperature measurement the split response functions (SRF)
- 4.6.4 Measurement instantaneous field of view (MIFOV)

4.7 Error potential in radiant measurements (an overview)

XIV. Thermal/Infrared Testing Level II Topical Outline

Intermediate Thermal/Infrared Physics Course

1.0 Basic Calculations in the Three Modes of Heat Transfer
- 1.1 Conduction – principles and elementary calculation
  - 1.1.1 Thermal resistance – principles and elementary calculations
  - 1.1.2 Heat capacitance – principles and elementary calculations
- 1.2 Convection - principles and elementary calculation
- 1.3 Radiation - principles and elementary calculation

2.0 The infrared Spectrum
- 2.1 Planck's law/curves
  - 2.1.1 Typical detected bands
  - 2.1.2 Spectral emissivitics of real surfaces
  - 2.1.3 Effects due to semitransparent windows and/or gases
  - 2.1.4 Filters

3.0 Radiosity Problems
- 3.1 Blackbodies – theory and concepts
- 3.2 Emissivity problems
  - 3.2.1 Blackbody emissivity
  - 3.2.2 The greybody and the non-graybody
  - 3.2.3 Broadband and narrow-band emitter targets
  - 3.2.4 Specular and diffuse emitters
  - 3.2.5 Lambertian and non-Lambertian emitters (the amgular sensitivity of emissivity)
  - 3.2.6 Effects of emissivity errors
- 3.3 Calculation of emissivity, reflectivity, and transmissivity (practical use of Kirchoff's law)
- 3.4 Reflexivity problem
  - 3.4.1 Quantifying effects of unavoidable reflections
  - 3.4.2 Theoretical corrections
- 3.5 Transmissivity problems
  - 3.5.1 Quantified effects of partial transmittance
  - 3.5.2 Theoretical corrections

4.0 Resolution Test and Calculatiions
- 4.1 IFOV, FOV, and MIFOV meaurements and calculations
- 4.2 MRTD measurements and calculations
- 4.3 Slit response function – measurement, calculations, interpretations, and comparisons
- 4.4 Resolution versus lens distance
- 4.5 Dynamic range
- 4.6 Data acquisition rate/data density
- 4.7 Frame rate and field rate
- 4.8 Image data density
  - 4.8.1 Lines of resolution
  - 4.8.2 IFOVs/line
  - 4.8.3 Computer pixels/line

XV. Magnetic Flux Leakage Testing Level I Topical Outline

1.0 Magnetic Flux Leakage Testing
- 1.1 Brief history of testing
- 1.2 Basic principles of testing

2.0 Principles of Magnetic Fields
- 2.1 Magnetic fields characteristics
- 2.2 Flux line chracteristics

3.0 Magnetism by Means of Electric Current

- 3.1 Field around a conductor
- 3.2 Right-hand rule
- 3.3 Field in ferromagnetic conductors

4.0 Indirect Magnetization
- 4.1 Circular fields
- 4.2 Longitudinal fields
- 4.3 Transverse fields

5.0 Magnetization Variables
- 5.1 Type of magnetizing current
- 5.2 Alloy magnetic properties
  - 5.2.1 Hysteresis curve
  - 5.2.2 Permeability
  - 5.2.3 Factors affecting permeability

6.0 Flux Leakage
- 6.1 Flux leakage theory
- 6.2 Normal component or flux leakage

7.0 Search Coils
- 7.1 Rate of change in the normal component of flux leakage
- 7.2 Faraday's law (rate of change versus induced voltage)
- 7.3 Factors that affect the voltage induced in a search coil

8.0 Hall effects Search units
- 8.1 Hall effects principles
- 8.2 Factors that affect the output voltage of Hall effect element

9.0 Signal Processing
- 9.1 Rectification
- 9.2 Filtering

10.0 Readout Mechanism
- 10.1 Displays
- 10.2 Strip-chart recorder
- 10.3 Computerrized data acquisition

XVI. Magnetic Flux Leakage Testing Level II Topical Outline

Magnetic Flux Leakage Evaluation Course

1.0 Review of Magnetic Theory
- 1.1 Flux leakage theory
- 1.2 Types of flux leakage sensing probes

2.0 Factors that affect Flux Leakage Fields
- 2.1 Degree of magnetization
- 2.2 Defect geometry
- 2.3 Defect location
- 2.4 Defect orientation
- 2.5 Distance between adjacent defects

3.0 Signal-to-Noise Ratio
- 3.1 Defenition
- 3.2 Relationship to flux leakage testing
- 3.3 Methods of improving signal-to-noise ratio

4.0 Selection of Method of Magnetization for Flux Leakage Testing
- 4.1 Magnetization characteristics for various magnetic materials
- 4.2 Magnetization by means of electric fields
  - 4.2.1 Circular fields
  - 4.2.2 Longitudinal field
  - 4.2.3 Value of flux density
- 4.3 Magnetization by means of permanent magnets
  - 4.3.1 Permanent magnet relationship and theory
  - 4.3.2 Permanent magnet materials
- 4.4 Selection of proper magnetization method

5.0 Coupling
- 5.1 in flux leakage testing

6.0 Signal Processing Considerations
- 6.1 Amplification

6.2 Filtering
7.0 Applications
7.1 General
7.1.1 Flaw detection
7.1.2 Sorting for properties related to permeability
7.1.3 Measurement of magnetic-characteristic value
7.2 Specific
7.2.1 Tank floor and side inspection
7.2.2 Wire rope inspection
7.2.3 Tube inspection
7.2.4 "Intelligent" pigs
7.2.5 Bar inspection
8.0 user Standards and Operating Procedures
8.1 Explanation of standards and specifications used in magnetic flux leakage testing
8.2 Explanation of operating procedures used in magnetic flux leakage testing

Welding Courses

I. Gas Tungsten Arc Welding for Qualified Welder (TIG, 6G)

The GTAW course will include;

- GTAW process operation and safety
- Auxilliary equipment and systems
- Filler materials
- Weld joints and weld types
- Manual welding techniques
- Welding procedures for manual welding steel and steel alloys
- Welding procedures for manual welding pipe
- Checking your welds
- Quality control inspection
- Weld repair
- Qualification and certification

II. Shield Metal Arc Welding (SMAW) for Qualified Welder

The SMAW course will include:

- SMAW process operation and safety
- Auxilliary equipment and systems
- Electrode materials
- Weld joints and weld types
- Manual welding techniques
- Welding procedure for manual welding steel and steel alloys
- Welding procedure for manual welding pipe
- Checking your welds
- Quality control inspection
- Weld repair
- Qualification and certification

F. Plant Operational, Inspection and Reliability Trainings

The following additional classes can also be taught by TCR

1. Piping and Valves, ASME Piping codes:

- Process Piping Fundamentals-Pipe sizing, layout, Design and Engineering
- Piping Design, Construction and Mechanical Integrity
- Understanding of ASME B 31.3 - Process Piping Code
- Understanding of ASME B 31.4 (Liquid Petroleum Transport Piping Code).
- Understanding and Application of Gas Piping Code: (ASME B 31.8).
- Pipe Stress Analysis, Flexibility and Pipe Supports

- Piping Code (ASME B 31.3) and Fitness For Service Assessment (API 579) for Plant Piping.
- Piping and Valves: Design, Construction, Operation ,Protection and Integrity.
- Selection, Operation & Maintenance of Valves, Best Practices
- Control & Safety Relief Valves: Operation, Selection and Troubleshooting
- Piping layout Engineering and Piping Isometrics
- CEASER-II. Pipe Stress Analysis, Expansion Joints and Supports selection
- Application of Piping Codes, Standards and Recommended practices
- Inspection of Pipelines and process piping systems

2. Chemical Engineering, Refineries and Petrochemical Courses :.

- Distillation and Unit Operations, Control and Troubleshooting.
- Principles of Process Engineering
- Fluid Catalytic Cracking Units (FCCU) in Refineries
- Additives for Polyolefins: Their Importance and Functions.
- Chemical Engineering Basics (Unit Operations, process equipments: boiler, chiller, heat exchanger, distillation column; process plants and automation.
- Petroleum Refinery Engineering.
- Introduction to Refinery Processes.
- Plastics: Materials and Testing
- Process Equipment Sizing and Selection.
- Pilot Plant and Scale-up Studies.
- Distillation and Unit Operations, Control and Troubleshooting.
- Chemical Engineering Calculations
- Chemical Engineering and Technology for Non-Chemical Engineers .

3. Pressure Vessels Design, ASME Pressure Vessel Codes:

- Awareness of ASME Codes.(Guided Tour of all ASME codes)
- Coded Pressure Vessel Design. (ASME Section VIII Division-1).
- Coded Design of Boilers and Heaters-ASME Sec.I
- Understanding Codes and Standards.
- Understanding ASME Pressure Vessel codes: ASME Sec.I. Sec.II, Sec V, Sec.VIII and sec. IX
- Shell and Tube Heat Exchangers Design, Operation, Control and Troubleshooting
- Design and Engineering of Shell and Tube Heat Exchangers
- Understanding and Application of ASME Section IX, (Welding Qualifications).

4. Plant Inspection and API courses

- Preparatory Course for API 510 Pressure Vessel Inspector Certification Examination
- Preparatory Course for API 570 Piping Inspector Certification Examination
- Preparatory Course for API 653 Storage Tank Inspector Certification Examination
- Preparatory Course for API 571 (Damage Mechanisms) Supplementary Certification
- API 579-Fitness For Service Assessments
- API 580/81 Risk Based Inspection.
- API 650 - Coded Design of Welded Steel Tanks for Bulk Storage.
- In-service and Shut-down Inspection of Petroleum Refinery.

5. Metallurgy and corrosion Engineering Courses

- Corrosion for Non-Corrosion Engineers.
- Corrosion, Metallurgy and Prevention of Failure
- Selection of Metallic Materials, Metallurgical Principles and Applications.
- Metallurgy for Non-Metallurgists.
- Fundamentals of Materials science for Engineers.
- Metallurgy of Steel (Basic).
- Metallurgy of Steel (Advanced).
- Metallurgy and Failure Analysis of Process Equipment and Piping.
- Root Cause Failure Analysis & Reliability.
- Selection of materials for Refinery and Petrochemical industries.
- Corrosion Awareness Monitoring and Control.

- Root Cause Failure Analysis & Reliability.
- Corrosion and Cathodic Protection

6. Instrumentation ,Control and Communications Courses
   - HART Based Instrumentation and Control Field Devices.
   - Industrial Process Control and Instrumentation
   - Automation Project Engineering (Instrumentation Symbols, P&ID, instrumentation documents, panel docs, project management, installation & commissioning, standards and practices).
   - PLC Commissioning, Programming & Troubleshooting.
   - SCADA and Communication Standards (communication standards and protocols, SCADA concepts and features, alarms, trends, graphs, database connectivity).
   - Advanced SCADA and communications for Water, Electricity and Process Industries.
   - Microcontroller based system design for Embedded applications.
   - Distributed Control System - DCS Design & Operation.
   - Measurement and Automatic Process Control
   - Process dynamics and control.
   - UPS systems & battery chargers. (maint. & troubleshooting).
   - Instrumentation and Controls for Boilers and Auxiliaries.
   - Instrumentation and Controls for Water and Waste-water treatment Plants
7. Welding Technology Courses:
   - Applied Welding Metallurgy.
   - Applied Welding Technology.
   - Welding in Pressure Vessels and Piping, Weld Inspection
   - Understanding and Application of structural welding Code (AWS D 1.1)
   - Understanding and Application of ASME Section IX, (Welding Qualifications).
   - Process Equipments: Fabrication and Heat Treatment
   - Training and Qualifying Welders and Procedures
   - Welding Technology and Welding practices in Fabrication Industry
   - Welding Qualifications Code for Transportation Piping.(API 1104).
   - Certified Welding Inspector: CWI, CSWIP
8. Water Treatment, Pollution Control Courses:
   - Water Treatment Plant Design, Theory and Practices (Ion Exchange and Reverse Osmosis)
   - Boiler Feed Water Treatment Operations & Practices.
   - The Troubleshooting and Preventive Maintenance of Ion Exchange and Reverse Osmosis Demineralization Plants
   - Waste-water treatment in Process plants
9. Pumps , Compressors , and other Rotating equipments:
   - Pumps and Compressors, Performance Curves, Testing Standards and Codes.
   - Centrifugal and Reciprocating Compressors: Operation, Performance & Troubleshooting.
   - Pumps: Operation, Maintenance and Troubleshooting..
   - Pumps : Principles, Selection, Operation, Troubleshooting and Maintenance
   - Selection and Sizing of Rotary Equipments (Pumps, Compressors, Motors and Gear Boxes)
10. Electrical Engineering Courses:
    - Testing of Electrical Power Equipment According to Standard Specifications.
    - Design and operation of Electrical Substation.
    - Selection, laying and fault finding of Electrical Cables
    - Motors, Variable Speed Drives and Generators
    - Selection, installation and Testing of Electric Transformers
11. Training Course in following topics are also arranged.
    - Safety Related Courses and Safety audits
    - Construction and Project Management
    - Site Management, Contract administration & Contract Closeout.
    - Oil well Engineering, Drilling Technology
    - Autocad and Design/Drafting
    - Behavioral sciences, Banking skills, and related Courses
    - Industrial Biotechnology & fermentation.
    - Practical Mechanical Engineering for Industry

Safety, Health and Environment Policy

TCR Arabia is very proud to have an exemplary track record in health, safety and environmental compliance, with no major lost time due to accidentssince inception of the company in KSA.

TCR Arabia has a 'Zero Tolerance' Approach with regards to Safety compliance of its employees. TCR Arabia is committed to good Health and Safety practices based on sound risk assessments and appropriate training.

Throughout TCR Group including TCR Arabia a 'zero tolerance' approach to SHE has been adopted and together with our proactive approach on these issues, we will ensure we remain the safest chain of commercial laboratories in the region.

A. Safety Training

Each new member of staff is thoroughly briefed on the safety hazards associated with a laboratory environment.

The training will, as a minimum, cover the safety aspects of laboratory work including the following:

- Handling of substances hazardous to health.
- Safe operation of cutting, milling, grinding and turning equipment.
- Safe operation of lifting equipment.
- Eye protection.
- Ear protection.
- Respiratory safety.
- Fire Alarm System.

Each member of staff is asked to sign a document to confirm that he has read and understood the safety hazards and precautions. The company supplies safety wear necessary to provide the required protection against laboratory hazards.

B. Safety Control

Procedures, records and maintenance contracts are in place to control safety. These include:

- Fire Alarm and extinguishers maintenance contract.
- H2S Procedures.
- Training Records.
- Injury Records.
- Control of flammable substances and acids.

C. On-Site Safety

Each member of the site team working on a particular project will be briefed prior to his or her first visit to site on the safety hazards associated with site work. Should an organized safety-training program be in existence, staff will attend it. A site visit can be organized by the company responsible person to discuss the safety aspects with the site safety officer.

The company responsible person can carry out periodic site visits and regular safety reviews with site staff.

TCR Arabia will supply all the required safety wear necessary to provide the required protection on site, if the same is not provided by the client.

D. TCR Arabia Safety Policy Statement

TCR Arabia sets high standards and expects all managers to be actively involved with respect to Health and Safety and the protection of our environment.

This means:

- Each TCR Arabia location will comply with all applicable Safety, Health and Environment Regulations within the territory in which it operates.
- While the Directors and Management accept their responsibilities for Health and Safety at work, they expect all employees to play their part and to fulfill their legal obligations under Health and Safety Legislation by taking reasonable care to avoid accidents to themselves and others and following company procedures. Only by full co-operation can the common objectives TCR be achieved.
- Every employee has the responsibility to maintain a safe working environment in which risks arising from the TCR's working practices are identified and controlled. Any willful violation of safety policy will result in disciplinary action.

The definition of a serious breach of Safety Policy is very difficult to categorize objectively in a prescriptive sense and therefore circumstance will dictate the appropriate disciplinary action. There are of course specific instances where summary dismissal will be applicable, i.e.

1. Recklessness in the use of chemicals and radiation sources or any other hazardous materials.
2. Willfully removing or disabling any safety device.
3. Operating equipment or driving whilst clearly incapacitated through alcohol or drug abuse.

4. Falsification of safety records or incident reports.
5. Disposing illegally of any hazardous substance.
6. Willful negligence to carry out proper maintenance of buildings, equipment, etc.

TCR is committed to conducting its activities in such a way as to protect the safety of clients, the public at large, visitors and contractors on company premises.

E. Environmental Protection

Environmental matters are of great importance to the Company.

To Avoid Damaging the Environment, all TCR Arabia employees are encouraged to strictly comply the following:

- Do not pour chemicals or other substances down internal drains. Check with your supervisor for the correct disposal procedure.
- Proper waste management system must be used to ensure that all classes of waste are disposed of in accordance with current legal requirements and local rules
- Store all oils and chemicals including solvents and paints in designated bounded areas.
- Refueling site transport, compressors etc. must be carried out in designate areas.
- If you handle substances hazardous to the environment, make sure you are aware of the site emergency procedure for spillage or leakage.
- Make sure that you are authorized and familiar with the local procedures before filling or draining process tanks or bulk storage tanks.
- Report all spillages/leakages and other incidents, the breakdown or malfunction of any plant and equipment controlling discharge into the environment and any poor housekeeping.

Location and Contact

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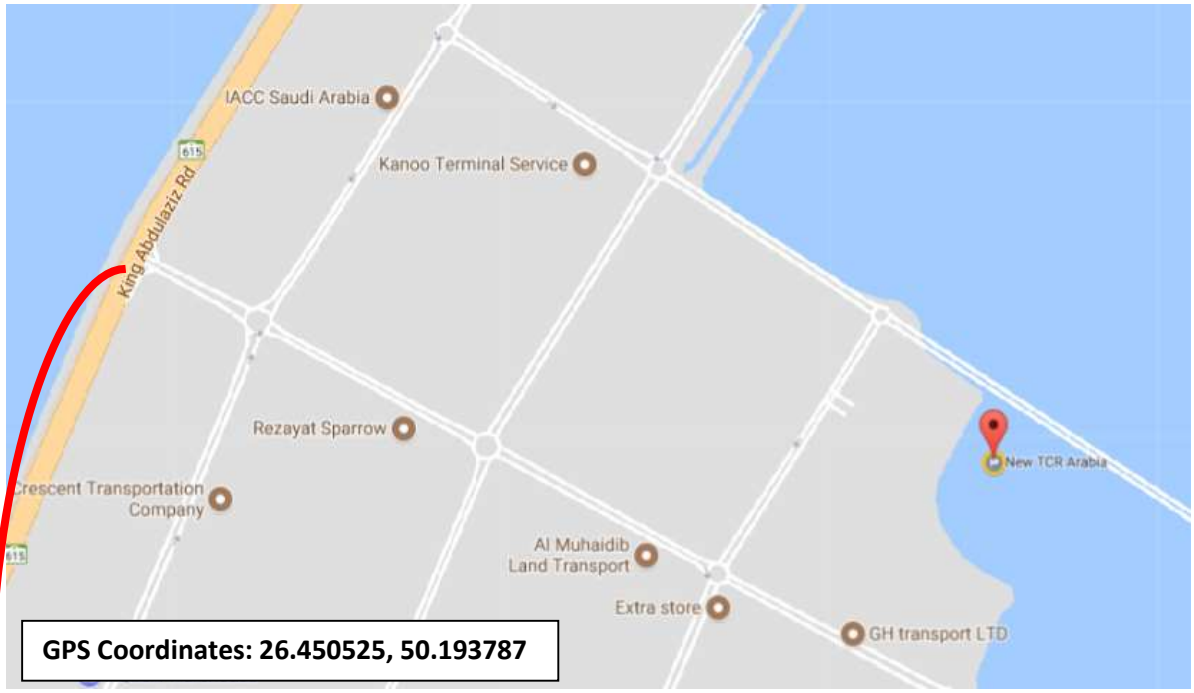

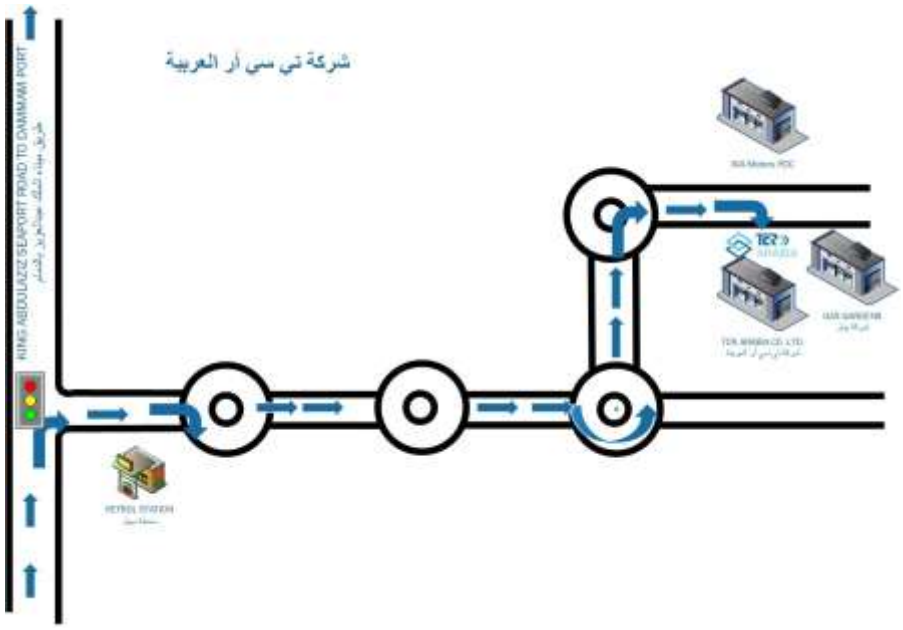

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A. International Locations

We welcome service and technical inquiry, from simple questions to more involved interpretations of codes and specifications. We are located at:

TCR Engineering Services Pvt. Ltd.
35 Pragati Industrial Estate,
N. M Joshi Marg, Lower Parel,
Mumbai - 400 011, India
Tel : 23073390, 23092347, 23097921
Tel : 23097923, 23091938, 23053930
Fax :+ 91-22-23080197
Website: www.tcreng.com

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