

TER Engineering Services

Material Testing, NDT,
Research, Inspection and Training



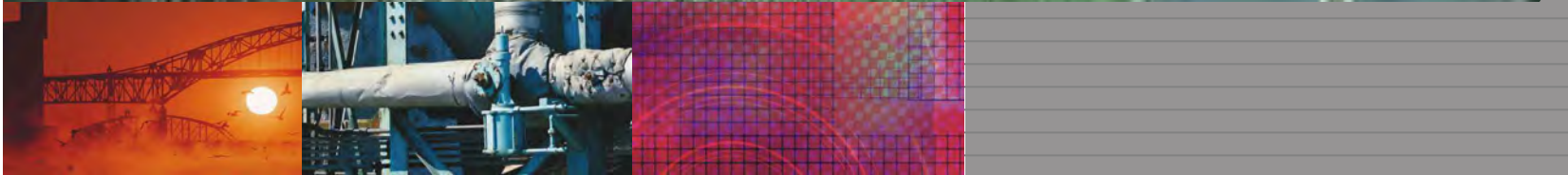
Trust
Competence
Reliability



TCR Engineering
Services

Founded in 1973, TCR Engineering Services is a **global leader** in materials testing failure analysis and NDT Services. Accredited to ISO 17025 and NABL, TCR has a presence in India, Middle East, South Africa and Asia-Pacific. There are three things that have always been, and will always be, more important than anything else for us at TCR Engineering Services: **Trust, Competence and Reliability.** These values are in fact more than a corporate mission. They symbolize a way of life that permeates every aspect of our firm and the way we do business.

Our timely and **accurate results** reporting of material properties, stringent product inspections, in-depth engineering consulting and contract research have ensured quality and enhanced performance; giving our customers a competitive edge in the marketplace. Our strengths lie in the powerful synergy of our people, our solutions, our technology and our commitment to **being the best.**



Outsource your QA needs Global Delivery Model.

TCR Engineering Services believes in establishing long-term, strategic relationships with our customers as opposed to short-term, opportunity-based engagements. We hold ourselves accountable for delivering quality results, all the way from top to bottom to each member of an engagement.

Customers are our most trusted proponents and ambassadors of goodwill. Our key customers in each of the industries we serve are leaders who are known for delivering superior value to their customers and shareholders.

TCR delivers superior value to all customers by leveraging its expertise in material testing services, inspection, consulting, contract research, training and sourcing. TCR has a assurance services to some of the best known organizations in the oil and gas, refining, chemicals, electronics, construction, power generation, automotive, defense, aerospace, mining, pharmaceutical, biotechnology, manufacturing, process industry and public.

The measure of our success lies in the success of our customers. Over 2500 of India's most innovative and successful companies use our 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.

Our rapidly growing global delivery services model allows TCR to be the preferred back- end material testing laboratory for some of the world's largest corporations. To date, TCR has performed laboratory testing and inspection services for numerous customers in the North America, Europe, Africa, Middle-East and Asia-Pacific.



Proving Results. QA Partner for over 2000 companies.

Reliance Industries, India. Failure Analysis, Engineering Consulting

Unilever, India and Bangladesh. Remaining life assessment study of production boilers.

Indian Oil Corporation, India. Conventional and Advanced NDT Services

Godrej and Boyce, India. Welding procedure qualification

Bhabha Atomic Research Centre, India. Material testing, NDT, corrosion and plant assessment services through metallography

Naval Dockyard, India. NDT, Health assessment, import substitution and material testing

Nuclear Power Corporation, India. NDT and material testing

Deepak Fertilizers & Petrochemicals Ltd., India. Risk Based Inspection (RBI) and plant assessment Services

Larsen and Toubro, India and Malaysia. NACE corrosion testing for HIC and SSCC

Saudi Aramco, Saudi Arabia. Advance NDT Services including TOFD, Phase Array, PWHT, Helium Leak Testing.

MBH Analytical, UK. Wet Chemical Analysis of certified reference materials

Xalloy, Thailand and USA. Weight-loss corrosion testing of samples

Johnson Screens, Australia. Chemical and micro examination of samples

SABIC, Saudi Arabia. Microstructure interpretation of in-situ metallurgical replica's and Failure Analysis

PetroRabigh, Saudi Arabia. Training at TCR Institute of Materials Technology

Masaood John Brown, Dubai. SEM and grain size determination of Metallurgy samples

PT Paiton Energy, Indonesia. TPI, consultancy on forging and fabrication in India

SASOL, South Africa : Shut Down assistance with Expert Engineers and NDT Technicians



Failure Analysis

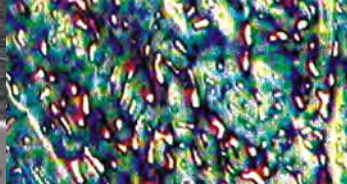
TCR has solved more than 1000 critical problems related to many industries on different components having services like high temperature, high pressure rotating, corrosive environment such as ASME boiler and pressure vessels, gas turbine engine components, oil and gas transmission pipelines, food processing equipments, heat exchangers, medical supplies, refineries, petrochemical plants, aircraft/ aerospace, offshore structures, industrial machinery, weldments and ships.

TCR undertakes Root Cause Failure Investigation for variety of industries including Petrochemicals, Refinery, Oil exploration, Chemical, Fertilizers, Power and Energy, Pharmaceuticals, Transport and Automobile, Fabrication and Engineering Industries.

Approach to failure analysis at TCR is unique and unequivocal. We are meticulous in carrying out first hand examination and gathering background information with regard to the problem. We at TCR are fully aware about the complexity of the analysis and pit falls of taking short cuts. The team of experts from different discipline synergize scenario of failure analysis and assist in arriving at correct

solution to the problem. Professional approach adopted at TCR has developed its own way to report the details of investigations encompassing all the evidences recorded. It explains the background of the problem, visual examination, low magnification examination, NDT results, and Chemical Analysis, Scanning Electron Microscopy and EDS Analysis, Metallography, Corrosion and Mechanical Test results. All the test results are summarized in the discussion part and at the end the failure scenario is elucidated vis-à-vis evidences recorded, with the proper analysis. Based on the analysis done, the most probable cause of the problem is identified. Suitable recommendations are also made to prevent reoccurrence of the problem. Indeed it is a valuable document that can act as a reference guide for the future course.

Prima facie, TCR's approach is synergistic and creative based on proper team work between different specialists. We are down to earth practical in providing a pragmatic solution to the problem that provides complete satisfaction to our customers and we in turn gain their confidence. Thus, we build long term relations with them to meet their future demands of problem solving. It is not exaggerating to say that we provide the most indepth study of a failure investigation.



Metallography

Our qualified metallurgists 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 has the state-of-the-art Inverted Metallurgical Microscope Olympus GX51 and the Leco 500 Microscope with an Image Analysis System.

The team has an in-house developed microstructure characterizer software that assists with the 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.

In-Situ Metallography

Performed as an NDT service, In-Situ Metallography from TCR 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. 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 Inspol 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.



Corrosion Testing

A wide variety of corrosion related tests are undertaken at TCR Engineering Services to determine weight loss corrosion, inter-granular attack as per ASTM A262 (A-F), pitting corrosion as per ASTM G48, Ammonia Vapor Test as per ASTM A761, Salt Spray Test is as per ASTM B117 and Chloride Stress Corrosion Test as per ASTM G36. TCR also conducts tests as per ASTM G35.

Our Sour 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 is 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.

We can also carry out the tests listed above under 3rd party inspection of LRS, TUV, DNV, ABS, BV and other inspection agencies.

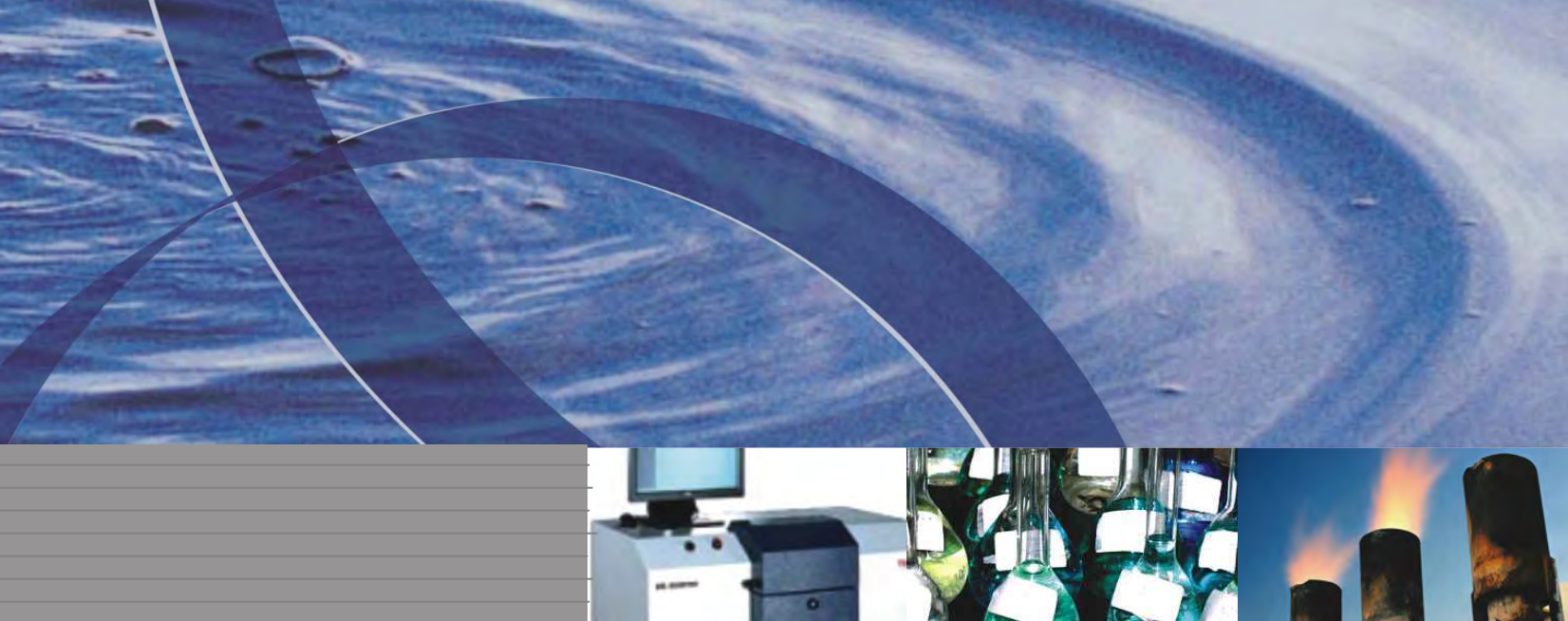
Mechanical Testing

TCR Engineering Services offers an impressive range of mechanical testing services accredited to NABL and ISO 17025 quality standards. The testing is performed as per ASTM, BS, DIN, NACE, IS standards as well as per client-provided specifications.

The Mechanical Testing Facility 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. The following are also available: Welder Qualification, Bend Tests, Compression Tests, Flaring and Flattening Tests, Hardness Testing (Rockwell, Brinell, Superficial Micro Hardness), Nick Break, Drop Weight, Proof Load, Hydraulic / Pneumatic Test, Component Testing, and more. TCR also undertakes Testing of Welding Electrode as per IS 814 and Wire Rope Testing.

Turnaround time is reduced by TCR's in-house machine shop that is experienced in specimen preparation using CNC wire cut machine, milling and lathe machines, stress-free grinding equipment, saws, surface grinders, and other tools.



Chemical Analysis

An inherent strength of TCR Engineering Services is our ability to successfully undertake analytical chemistry assignments. 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 includes Optical Emissions Spectrometer (OES), Inductively Coupled Plasma (ICP) Spectrometer, Glow Discharge spectrometer (GDS), Atomic Absorption Spectrometer and Automatic Carbon Sulphur Determinators.

The Classical Wet Chemistry department uses Gravimetry and Titrimetry procedures to analyze chemical composition of materials, and assists in the identification of unknown materials.

Non Destructive Testing

TCR's qualified and experienced field services team is dedicated to performing the highest level of quality service in the non-destructive testing industry. Our conventional NDT/NDE service offering includes Ultrasonic Testing, Thickness Gauging, Magnetic Particle Testing, Dye Penetrant Testing, Visual Testing, Helium Leak Detection, Ferrite Measurement, Steam Side Oxide Scale Measurements, Positive Material Identification, Inspection and ASNT Level III Consulting Services. Field service Metallography and structural inspection are also offered.

TCR is having extensive experience, technical know-how and creativity of its workforce to provide automated and advanced NDT inspection such as Automated UT using Time of Flight Diffraction (ToFD) and Phased Array, Eddy Current, RFET, IRIS, CIPS/DCVG, Corrosion under Insulation (CUI) Evaluation, Thermography, Boroscopy, ACFM, EMAT, and Remote Crawler based Storage Tank Inspection.

TCR is approved and registered by all major companies including Saudi Aramco, Reliance, IOC, BPCL, SEC, SWCC, Petronas, Chevron, Halliburton, Schlumberger, Weatherford, SABIC, SIPCHEM, APPC, PetroRabigh, Lubref and Tasnee.



Positive Material Identification

TCR's on-site inspection and testing team has over 12 highly sophisticated Portable Alloy Analyzer Spectrometers which can non destructively and accurately measure the chemical composition of materials.

TCR Engineering'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 the Middle-East and Asia-Pacific. Using portable alloy analyzer spectrometers, TCR's engineers can provide elemental identification and quantitative determination without regard to form, size and shape. No samples need to be cut for PMI. TCR has provided PMI services on over 600 projects including major oil and petrochemical installations in India, Malaysia, and the Middle-East.

The TCR Engineering Services 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 & Weld and can provide a comprehensive maintenance assessment.

The PMI Services Team has Portable X-Ray Florescence (XRF) based instruments including Metorex XMet 3000TX and XMet 3000T, Niton Xlt and the Metal Master 2000. The team also has the ARC-MET 8000, a Portable Optical Emission Spectrometer.

Our engineers and PMI team can travel across India, Hong Kong, China, Singapore, Malaysia, Indonesia, Russia, Dubai, and the Middle-East. PMI Services to North America and throughout Europe are also available.



RoHS Compliance Testing

TCR Engineering Services undertakes RoHS and WEEE related compliance testing for electronic products and accessories using both the Non Destructive Screening Method using Xray Fluorescence Spectroscopy (XRF) as well as the Verification Method using Inductively Coupled Plasma (ICP) Spectrometer.

The RoHS Testing Team at TCR analyzes concentrations of lead, mercury, cadmium, chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs) in electrical and electronic components to the required limits to ensure that products meet requirements but more importantly, that products retain their full functionality.



Engineering Consulting

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

Contract Research and Laboratory Outsourcing

We can effectively operate and manage an in-house laboratory for a corporation while retaining our the innovative, professional and superior quality service. We bring to these engagements, our strong process, our management expertise as well as results reporting method based on our integrity.

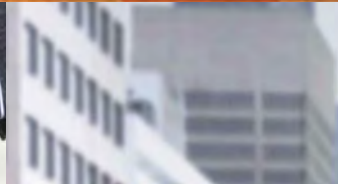
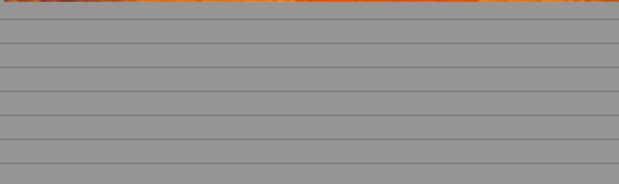
Inspection

Independent, third-party inspection and quality assurance services from TCR Engineering Services include, Factory Audits, OEM Development, Raw Material Inspection, Initial Production Check, In-Production Check, Random Inspection and Loading Supervision directly on-site at your vendor's location in India.

Material and Product Sourcing

TCR covers the entire sourcing process from locating suppliers to transferring design specifications. TCR will setup the supply chain and logistics control to ensure that shipments meet all export guidelines.

From India, TCR can source ferrous and non-ferrous metals, casting & forging, sheet metal, bar, pipe, stainless steel, nuts, bolts, engineering goods, non-metallic materials such as polymer, ceramic, glass, machined parts, and machine tool components. Our Engineers are well versed in interpreting drawings and can assist in the creation of "test" samples. Finally our strengths and multifaceted expertise in material testing and inspection services helps maintain quality control on all shipments.



Manpower Deployment

We have qualified personnel with ASNT Level II and III certifications, AWS/CSWIP Senior Welding Inspectors, and CSWIP Plant Inspectors with experience in design, fabrication, construction, inspection and erection of Pressure Vessels, Heat Exchangers, Towers, Stacks, Tanks, Plant Pressure Piping, Offshore oil wells and many advanced projects. They can be deployed to work on-site at your location.

Our experienced and skilled personnel are respected for their integrity and recognized by relevant inspection authorities. For plant shutdowns, TCR can easily deploy a proficient engineering and NDT team including Metallurgists, API 510 /570 /653 Inspectors, ASNT Level III Experts, Bgas Paint Inspectors, Multi-Skilled NDT Level II Technicians, CSWIP/AWS Certified Welding Inspectors and QA/QC Inspectors and Plant Reliability Engineers.

Training

The training curriculum from TCR Engineering is formalized to provide custom training programs, best practices and leading knowledge quality assurance and plant reliability. TCR Engineering's trainers have a highly effective teaching style with several years of experience in the technical training industry. The trainers are all professionals with years of experience both in the classroom and with applied technology skills. Our courses include:

Metallurgy

- Mechanical Metallurgy Laboratory – Level I and Microstructure Characterization
- Metallurgy for Plant Executives and NDT Inspectors
- Metallurgy for Non Metallurgists
- Sour Gas Corrosion Testing – Level I and II

Asset Integrity Managing Technologies

- Fitness for Service (FFS) Assessment
- Damage Mechanisms (DMs) Knowledge
- Implementing Risk Based Inspection (RBI)

Failure and Root Cause Analysis Guides

Non Destructive Testing

- 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

Welding Courses

Piping Stress Analysis Courses



Value. Anywhere. Anytime.

Growth and downturn. Boom and bust. High and low. Economic and business cycles are in constant flux, driving change and have a lasting impact on industry structures, the role of technology, customer behavior, the creation, and the destruction of markets. It is a tall order for any firm to deal with this paradigm as it strives to maintain its survival. Organizations need a trusted partner who will help them navigate through these ever-changing conditions. TCR Engineering Services has not only survived these cycles in the last three decades but has also remained true to its customers and helped them weather these economic uncertainties.

We leverage our multi-national network of laboratories to enable our customers to convert their materials and product to have lasting value.

Experienced Team. We Listen.

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. Our diverse and experienced professionals work together toward a common goal of excellence in every aspect of our business. We live up to our commitments.



India

TCR Engineering Services
Plot No. EL-182, MIDC-TTC,
Electronic Zone,
Behind Nelco, Mhape
Navi Mumbai-400 710
Maharashtra, India

Tel : 91-22-6738 0900 to 999,
Tel : 91-22-2761 2324,
27610921/22/23,
Fax : +91-22-2761 2044
Cell : +91-93233 97295
E-Mail : sales@tcreng.com
URL : www.tcreng.com

TCR Engineering Services
35 Pragati Industrial Estate,
N. M Joshi Marg, Lower Parel,
Mumbai - 400 011,
Maharashtra, India
Tel : 2307 3390, 2309 2347,
2309 7921, 2309 7923,
2309 1938, 2305 3930
Fax : +91-022-23080197
E-Mail: sales@tcreng.com

TCR Advanced Engineering
36/2/9, First Floor,
Abhishek Complex, G.I.D.C.,
Makarpura, Vadodara - 390 010,
Gujarat, India
Tel : +91-265-2657 233,
+91-2643 024
Fax : +91-265-2634 375
E-Mail: baroda@tcreng.com

International HQ

TCR Engineering Consulting FZC
PO Box 122453, Dubai, UAE
Tel : +971-50-7858901
E-Mail: uae@tcreng.com

Middle-East

TCR Arabia Limited
P.O. Box 3422# 3 & 4,
Next to Al Kifah Construction,
Beside A-Kadi Tent Factory,
Near King Abdulaziz Sea Port,
Dammam,
Kingdom of Saudi Arabia.
Tel : +966-3-8475785
Tel : +966-3-8475784
Fax : +966-3-8475768
E-Mail : sales@tcr-arabia.com
URL : www.tcr-arabia.com

Agents

Approved Group International
No 6 Jalan DBP 3
Dolomite Business Park
68100 Batu Caves
Selangor, Malaysia
24-hour hotline: +603-6188 6311

TCR Engineering Services

www.tcreng.com

Our innovative and educational website assists manufacturers, material producers and engineering professionals stay up-to-date with changing compliance requirements and its related implications on the testing of their material or product.

The website is also the fulcrum of the global material testing outsourcing program. Emails sent through this site are answered by our web support customer service department within 48 hours. We post completed test reports and invoices for each international customer for easy downloading from our website with highest levels of security.

The website offers details on the various laboratory testing and quality assurance services offered by TCR and disseminates information about company's management, joint venture/franchise models, human resources, training, software products and company news.

Printed in India
© 2011-15 TCR Engineering Services Private Limited.

All rights reserved.

TCR and the TCR Engineering Services Logo, are trademarks and services marks of TCR Engineering Services Pvt. Ltd. and are registered in certain countries. All other trademarks and service marks, whether registered or not in specific countries, are the property of their respective owners.