Each one of the below listed jobs were part of a unique and interesting challenge to our teams at TCR Engineering Services. TCR’s clients saw a measurable value and hence, companies were able to bring the right products/services to the market, at the right time and at the right cost. TCR’s noteworthy projects include:

**FAILURES ANALYSIS PROJECTS**

- Schlumberger Oilfield Services
  - Failure Investigation (FI) of Mandrel Bypass of Equalizer Sub.
- Wartsila, Finland
  - Failure Investigation of Crank Shaft
- Thermax
  - Failure Analysis of Cupro Nickel Tubing of Chiller Unit
- Sterlite Industries India Ltd.
  - Volute Casing, Crane Hook / Pump Failure Investigation
- Weir Mineral India
  - Root Cause Analysis of Shaft Failures in Vertical Pumps (Cantilever Design)
- Welspun Gujarat Sthal Rohen Ltd.
  - Failure Investigation of Apis 5 Ps 2 X60, (Pipe No: 3612) Line Pipe Failed During Hydro Test at site
- Torrent Power Ltd.
  - Failure Investigation Of Blade of Lp Rotor Stage 4A Of ESM 110MW Unit
- Caparo Engg P Ltd.
  - FI of Axel A Rear Suspension Of Car
- Godrej Industries Ltd.
  - Failure Investigation of Refromer Tubes
- Hindustan Petroleum Corporation
  - Failure Investigation Of Radiant Heater Outlet Header Cap
- Bombardier Transportation India
  - Failure Investigation Of Notching Spring Of Tap Changer
- Ratnamani Metals & Tubes Ltd.
  - Failure Investigation Duplex R 2205 (50.8 X 2.13 Mm) Tube Failed During Hydro-Forming Expansion
- GAIL India
  - Root Cause Analysis at a Lpg Recovery Plant
- Man Industries India
  - FI of Mechanical Expander Pulb Rod
- Siemens Ltd.
  - Failure Investigation of ESV Sleeve DN 200
- Hydrl Jindal
  - Failure Investigation of Die Cracking In Swaging Process (Cold Forming Process)
- Reliance Industries
  - Detection of Carbon using portable Optical Emission Spectroscopy
- Petronas, Malaysia
  - PMI crew on assignment on behalf of L&T, India

**MAJOR PROJECTS**

Kuwait Oil Company
- 2 crews of PMI using portable XRF and portable Optical Emission spectroscopy

Hyundai Heavy Industries
- Portable XRF on Pipe Joints

Cochin Refinery
- PMI for Stock sorting purposes

Reliance Industries
- Portable XRF using portable Optical Emission Spectroscopy

Petronas, Malaysia
- PMI crew on assignment on behalf of L&T, India

**METALLOGRAPHY ASSIGNMENTS**

Constar, USA
- SEM Analysis of Plastic samples taken on 3-4 KA, 20 KV voltage magnification

NDT-CCS
- Evaluation of Metallographic Replicas

Reliance
- Over 1200 metallographic replicas created and analyzed to evaluate post fire damage

Zamir Group
- Micro Hardness Testing

Alsum
- SEM and EDAX Analysis

Massed John Brown, Dubai
- SEM analysis to characterize the carbide morphology types in cuballs based alloys such as FKS 414

**TCR COMPANY PROFILE**

- Indian Oil Corporation
  - 4 PMI crews deployed for a period of 2 years using portable XRF spectrometers

Bharat Petroleum
- One PMI crew for identifying incoming materials at site

Larsen & Toubro, Mumbai | Godrej & Boyce Mfg., Mumbai | Oswal Petro Chemicals | Syco Sanmor, Tamil Nadu | Virgo valves, Pune | Hawai valves | Endress+Hauser india pvt ltd.
- Mumbai Bombay Fluid / Swagelok
  - Ongoing on-call PMI services provided using portable XRF spectrometers

- Biosync Scientific Pvt. Ltd.
  - Measurement of drug Coating layer on Drug coated stent used in Angioplasty

Godrej Industries Ltd.
- Remaining life assessment was carried out through In situ Metallography route

Lupin Ltd.
- Remaining life assessment of fermentor vessel was carried out by Evaluating microstructure at critical locations

Gujarat Power Generation Co. Ltd.
- Bharuch
  - Microstructure evaluation at critical locations of HRSG Unit

National Thermal Power Corporation
- In situ Metallography conducted on critical components of turbine.
Metallography Assignments (Cont.)

**IFFCO**
Instutu Metallography for evaluation
degradation of microstructure of
ammonia plant for remaining life
assessment.

**IPCL**
Institute metallography at critical
locations of naphtha plant

**L & T**
Institute Metallography for microstructure
evaluation after various manufacturing
stages of critical components

**Bharat Petroleum Corporation Ltd.**
Damage assessment of Scrubber
column and condenser tubes.

**Zuari Industries Ltd.**
Metallography Work Conducted On Various
Critical Locations Of Process Steam Supply,
Heater Outlet Piping

**Hindustan Petroleum Corporation Ltd.**
Institu Metallography of reommer tubes

**Suzlon Windfarm Services Ltd.**
Damage assessment of windmill caused in
accidential fire through institu Metallography
route

**Tata Power Company**
Institute Metallography work conducted on
critical locations of Gas Turbine Unit -7
during outage.

**Elecon Enginering Ltd.**
Institu Metallography at various locations
of large size Gear

**Gulbrandsen Limited**
Damage assessment through Institu
Metallography route on ammonium
chloride anhydrous vessel

**Nagarjuna Fertilisers & Chemical Ltd.**
Institu Metallography of ammonia plant

**United Phosphorous Ltd.**
Institu Metallography of evaporator
support to assess the stress corrosion
cracking

**Indian Oil Corporation Ltd.**
Institu Metallography of FCC plant

**Gujarat State Fertilizer Company**
Institute metallography work on Reducer
of Outlet Bottom Header of Reformer
at Ammonia – IV Plant

**Tata Chemicals Ltd.**
Various critical locations of Urea Plant

**Essar Steel Ltd.**
Institu Metallography on cooling coil of
furnace.

**Fatigue & Fracture Toughness**

**Naval Materials Research
Laboratory, India**
Crack tip opening displacement testing
as per client Requirement

**Jindal Steel & Power Ltd., India**
Fatigue crack growth rate test as per
ISO 17108

**AnnSafe Bridport, Sri Lanka**
Fatigue testing of Bulk hold baggie
nuts (Belts) as per client Requirement

**REMAINING LIFE ASSESSMENTS**

**Torrent Power**
Remaining Life Assessment and
Investigation of Blade failed from root
for LP Rotor stage 4A of E Station
110MW Unit

**Zuari Industries**
Remaining life assessment of steam pipe
line and surface cracks.

**Alstom Power**
RLA study through Institu-metallography
work of critical components of 120MW
Turbine at MSGB-KTPS, Kozak

**Asha Cellulose**
Health assessment work on R-1 Reactor
at Mech Engineering, Vallad

**Vanakbori Thermal Power station**
RLA Study of various components of
Boiler No: 2

**Hindustan Unilever**
- RLA study of critical components of MP
  Boiler No: 1 (G-122) at Kundain Ind., Goa
  - RLA study of critical components of Boiler
    No: 1 at V.D.L. at Khed, Chiplun Location
    Institu metallography work on various
    components of Boiler No: 1 (UP – 3702) at
    Vetal Location
  - RLA study of various pressure components
    of Stain Mullar Boiler No.: MR 6/95 at Sewri

**Gujarat Fluoro-Chemicals Ltd.**
- Metallurgical Assessment of CFC Reactor R-
  501 and Column C-513 at Formosa Plastics
  company Taiwan R.O.C.
  - Condition Assessment work (VE,
    metallography, U.T, MPI, Hardness &
    Thickness Survey) on AHF Boiler, V-31B
  - Health assessment work on R-201 Main
    Reactor CFC plant (Metallography &
    hardnass) at Ali-alav, Pune

**Unilever Bangladesh**
RLA Visual, MPI, DIF, Metallograph,
Hardness & Thickness Survey on critical
locations of Package Boiler at
Unilever Bangladesh Ltd, Chittagong,
Bangladesh

**Atul Industries Vapi, Gujarat**
- RLA of Chlorine storage tank
- RLA Study (Institu-metallography, MPI
  & Hardness) on Old Autoclave – G
  2101

**Alembic Limited, Vadodara**
RLA of fermentor

**Godrej, Valla, Gujarat**
- Remaining Life Assessment of Used
  N9 Pipe for Alcohol Synthesis Plant
- Remaining Life Assessment Of
  Alcohol Synthesis Plant

**IQCL**
Health Assessment Study of C-0.9Mo
Piping in Hydrogen Unit I Plant

**Siemens Ltd**
Remaining life assessment of turbine.

**Jaghadia Copper**
Condition assessment of ladle furnac

**Aarti Industries**
RLA of turbine
**Corrosion Detection**

- Caterpillar, USA: Weight loss corrosion test for over 35 samples.
- KPIOS, Kuwait: Hydrogen Induced Cracking Test as per NACE standard for over 15 plate samples.
- Enerflex Canada: HIC and SSC corrosion tests as per NACE TM 0177 and TM 0284 for over 20 samples.
- EloLab Canada: Salt Spray test at a Coca Cola plant.
- GMMS, UAE: HIC and SSC testing on over 15 samples.
- Larsen and Toubro (L&T): HIC testing as per NACE TM 0284 on an ongoing basis and Intergranular Corrosion of Aluminum Alloys by Mass Loss After Exposure to Nitric Acid at per ASTM G67.

**Non-Destructive Testing (NDT)**

- ONGC, Iran: 40 team member crew deployed for shutdown activity including conventional NDT, scaffolding, and shutdown project management.
- NPCIL, Kota: Shutdown Crew deployed for NDT including 20 NDT Level II and a NDT Level III person.
- Indian Naval Shipping: NDT and RLA Study of LPG Tanker.
- Several projects for EIL and L&T: Ongoing daily callouts for UT, DP, MP, PT, Ferrite Measurement, Portable Hardness.

**JUTA**, China: SSG test based on Sinopex approved standard (closely adopted to NACE guidelines).

**Xalloy, Thailand**: Chloride Stress Corrosion Cracking, Intergranular Corrosion as per AGTM A202.

**Walchandnagar Industries**: HIC and SSC Testing.

**Godrej, Mumbai**: Stress Oriented Hydrogen Induced Corrosion as per NACE 0177 method D.

**Bay-Forge Pvt. Ltd., India**: Visual Assessment of Fatigue Corrosion Susceptibility of Aluminum Alloys as per ASTM G66.

**KOC, Kuwait**: Automated UT using ToFD for Storage Tanks based on API 650 Appendix U. Project undertaken with HHI as FPC contractor.

**Tekfen, KSA**: Automated UT using ToFD based on Code Case 181 undertaken at Aramco’s PetroRabigh site.

**Mass Construction, India**: Conventional Radiography by using X-ray source based on ASME SEC VIII Div. 1 Conventional Radiography by using Gamma ray source by API 1104.

**NMRL, Mumbai**: NDT for WPS as per ASME SEC IX.

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**Third Party Inspection Services**

- **Saudi Chemanal**: Third party inspection at various locations (Kolkata, Tirupur & Pan) as per Client provided ITP/QAP.
- **Kamila Sanderson, USA**: AWS Welding Inspector as well as QA/ QC Personnel deployed at a vendor site in India.
- **EMC Sp. Z. o. o., Poland**: QA/QC inspection and Pre-shipment loading audit of electric light bulbs at a vendor site in Mysore, India.
- **Permapipe, UAE**: 6-Month duration project for QA/QC inspection including dimensional verification and specification compliance of insulation material used in refinery piping.
- **Aventech, Canada**: Factory Audit and Sourcing Assistance of Casting Suppliers.
- **Flowserve, UK**: QA/QC inspection at Audi in Chennai on an ongoing basis.
- **Elliott Company, USA**: Factory Audit and QA/QC inspection on behalf of the USA based company at their supplier site in western India for a 3-year duration project.
- **Aliflex, UK**: QA/QC inspection with daily photographs and status reports advising client of vendor’s progress and quality status.
- **Metpost, UK**: Inspection of fabrication and Factory Audit of casting and forging companies in India.
- **American Industrial Supply, USA**: Third party Inspection, Stamp Transfer and Shipment Audit.

**RoHS Compliance Services**

- **Sys Concept, Canada**: Detection of RoHS restricted elements using the screening and verification methods.
- **Birla Copper**: Test of Lead content in samples.
- **Emerson Climate Technologies**: RoHS testing on an ongoing basis for over 500 samples.
- **Parveen Industries**: RoHS compliance for 28 plastic samples.
- **Godrej Lawkim Group**: RoHS testing on an ongoing basis for over 600 samples.