



# APTECH Engineering Services, Inc. Petrochemical Group

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## Pipeline Experience

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Since its inception, Aptech Engineering Services, Inc. (APTECH) has been involved in the design, installation, operation, and maintenance of oil and gas transmission and distribution facilities. Our projects have spanned international borders, onshore and offshore lines, and have involved a range of our technologies. These include:

- ◆ Design Controls for Avoiding Catastrophic Fracture
- ◆ Failure Analysis and Incident Investigation
- ◆ Inspection of Internal and External Condition
- ◆ Corrosion Control and Assessment
- ◆ Inspection
- ◆ Interpretation of Pigging Results
- ◆ Mechanical Integrity Assessments for Welds and Line Pipe
- ◆ Probabilistic Modeling of Fracture and Fracture Control Programs
- ◆ Process Safety Assessments and Risk Analysis
- ◆ Risk Management for Existing Infrastructure and New Builds



## APTECH's Services

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The services we offer to pipeline companies include the following:

- ◆ Pipeline Integrity Management
- ◆ Risk Assessment and Risk Management
- ◆ Risk Based Maintenance and Inspection Programs for Pipelines
- ◆ Maintenance, Inspection, and Repair Procedure Development
- ◆ NDE and Records Management
- ◆ Corrosion Control, Coatings, and Materials Management
- ◆ Root Cause Failure Analysis and Incident Investigation
- ◆ Operational Support, Training, and Procedures
- ◆ Operational Integrity Management Systems



## APTECH's Experience

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The projects that are summarized here will provide an introduction to APTECH's experience and capabilities.

### Liquid Line — Third Party Damage

APTECH analyzed a liquids line failure that resulted in significant river water pollution. We performed the failure analysis and confirmed that a prior mechanical damage incident was the root cause of the failure. We performed finite element analysis to define local stresses at a dented location in the pipe and, using a probabilistic fracture mechanics-based fatigue analysis, we were able to define the most likely time the damage occurred.

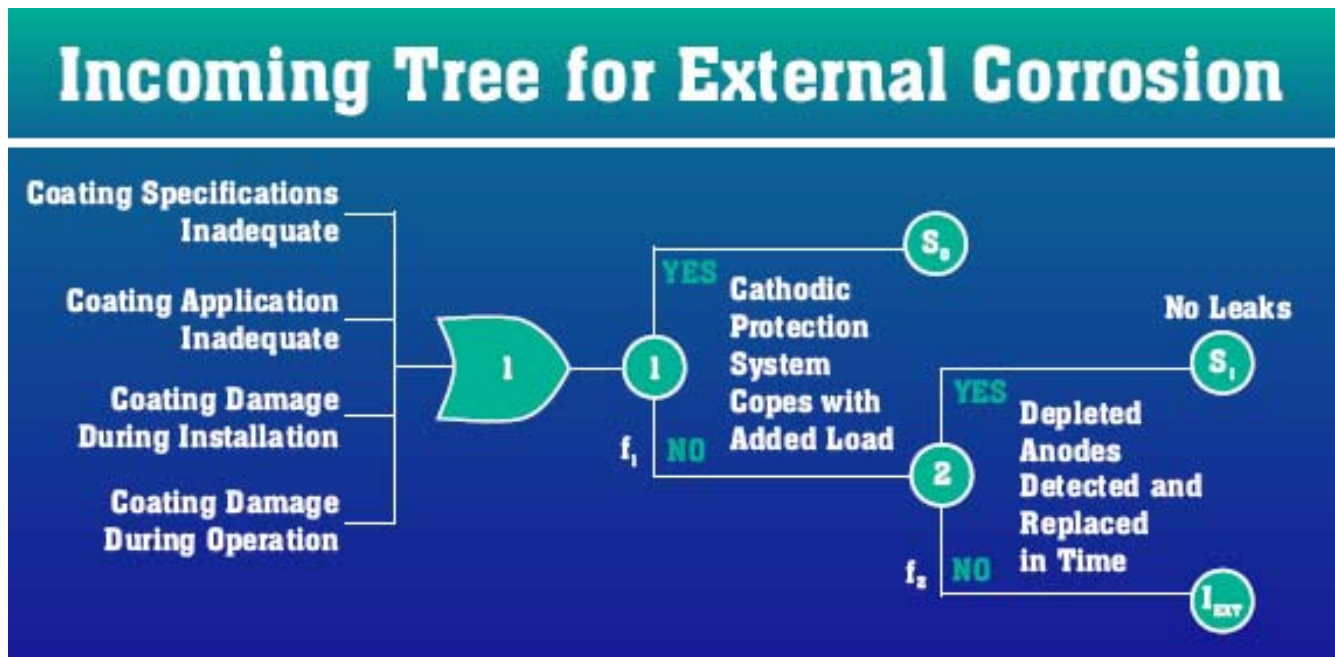
### Natural Gas Line Collapse

In this project, APTECH analyzed the collapse of a buried natural gas line that was subjected to a shock wave from an explosion due to a fire at an ammonium perchlorate production plant. We calculated the force imposed on the pipeline by the shock wave and also performed a condition assessment of the remaining section of line. We also performed mechanical integrity calculations to determine if the gas line had leaked prior to the fire and explosion, which was a hypothesis proposed by others for the failure scenario. We were able to demonstrate convincingly (to a jury) that the gas line did not contribute to the fire and explosion, but rather the line damage was a result of the above ground explosion.



### Offshore Pipeline Fracture Mechanics Analysis

In this project, APTECH analyzed the significance of pre-existing weld imperfections in an offshore line that was laid in the South China Sea. On subsequent review of the circumferential weld radiographs by the owner, it was concluded that linear indications were present in the welds. Using fracture mechanics procedures based on API 1104, we were able to conclude that the imperfections did not constitute a fracture risk. We also concluded that fatigue was not a life limiting condition.



## **Design Support — Offshore Pipeline Risk Analysis**

APTECH was part of the Technology Development team for the proposed Oman-to-India natural gas pipeline. We were responsible for hazard scenario identification for all phases of the project (design, installation, and operation) and developed probabilistic risk assessments for the major hazard scenarios. The analyses resulted in a risk ranking of the key hazards based on realistic cost assessments of the consequences and evidence-based predictions of the likelihood. APTECH also contributed to issues related to fracture control, weld quality, pipeline collapse, and overall quality assurance programs.

## **Design Support - Alaskan Natural Gas Transmission System (ANGTS)**

In this project, APTECH provided design support for materials selection for the line pipe and compressor stations for the proposed transport of chilled natural gas. We developed the fracture control plan for the line pipe and welds and also used the result to tailor the inspection program and quality assurance program. The reports on APTECH's work were part of the submittal to a Federal Energy Regulatory Commission on the project.

## **Onshore Pipeline Risk Analysis**

APTECH developed risk analyses for onshore lines as a means of ranking alternate operating scenarios and for lines for which the local environment has changed from swamp to flooded conditions. We used DOT Office of Pipeline Safety data to estimate the expected failure rate per mile for the various operating scenarios. The data were modified, based on specific line conditions to be relevant to the situation analyzed. This project also involved the evaluation of the corrosion control program based on cathodic protection and coatings.

For an onshore oil pipeline and tank farm, APTECH performed a risk and reliability analysis to compare data from the USA with data from East Europe. These data indicated much higher incident rates and hence a higher risk when the East European failure rates were used.



## **Operational Integrity Assessment**

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APTECH Project Risk Consultants assisted a client with an operational integrity assessment of a world-scale oil and gas pipeline gathering and distribution system. The purpose of the assessment was to identify any issues that could lead to a major environmental or safety incident. The work included an evaluation of all the elements of process safety, with a focus on the following:

- ◆ Mechanical Integrity (external corrosion, internal corrosion, erosion, preventive maintenance)
- ◆ Fire and Gas Detection Systems (instrumentation, alarm sequence, halon usage)
- ◆ Operating Procedures
- ◆ Management of Change
- ◆ Safe Work Practices, particularly LockOut/TagOut
- ◆ Regulatory Compliance, particularly with regard to OSHA 29 CFR 1910.119
- ◆ The Impact of Production Creep

Issues considered during the evaluation included the integrity of the fire detection and control systems, the resources required to minimize corrosion failures, value maintenance, and safe work practices.



## **APTECH Petrochemical Group**

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The APTECH Petrochemical Group is a division of Aptech Engineering Services, Inc. We are located in Houston, Texas to provide a direct focus on Mechanical Integrity services to the process industries. We have provided services to these industries throughout the world.

APTECH is an internationally known consulting engineering services firm. We have provided services for over 20 years to numerous businesses throughout the world. Our corporate offices are located in Sunnyvale, California.

We provide specialists in the fields of corrosion/metallurgy, thermal-hydraulic analysis, stress analysis, fracture mechanics, vibration analysis, statistical analysis and process plant management systems. Our specialists provide technical solutions to meet our clients needs.

Our clients include petroleum and chemical/petrochemical companies, fossil and nuclear utilities, manufacturing and equipment vendors in the aerospace, automotive, electronics and semiconductor industries. Support to legal firms and insurance companies is a substantial part of our business.

### **Primary Services Provided by the Petrochemical Group Include:**

#### **RBI Services**

We apply RBI techniques to develop Risk Ranking of plant pressure equipment and piping. Improved inspection planning leads to lower inspection costs and safer plant operation.

#### **RBI Software**

APTECH provides software tools for RBI evaluation. We are a leader in RBI software development.

#### **Metallurgy and Failure Analysis Studies**

#### **Inspection Program Development**

We provide services to develop inspection management systems using RBI results.

#### **PSM/MI Consulting & Training**

We provide consulting, training and audits on PSM system to assist our clients in providing a world class management system. Training is also provided on RBI technology and software utilization.

#### **Litigation Support**

We provide consulting to legal firms and insurance companies to assist them in incident investigations.

#### **Abbreviations:**

RBI - Risk Based Inspection

PSM - Process Safety Management

MI - Mechanical Integrity

## **For More Information, Contact One of These Offices.**

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