

APTECH Engineering Services, Inc. Petrochemical Group

The Development and Implementation of Process Piping Inspection Programs

Many industrial accidents have been caused by the failure of process piping. These failures are often related to corrosion and materials degradation. Applicable codes and standards state that:

“It is the owner’s responsibility to verify that all required examinations and testing have been completed and to inspect piping to the extent that is necessary to be satisfied that it conforms to all applicable examination requirements of the Code and engineering design.”

Refineries and petrochemical plants typically have thousands of miles of process piping. Many of these piping systems are difficult to reach, are often insulated, and are difficult to inspect. Because of this, piping is usually inspected at only a few locations. The process of defining and naming corrosion circuits, identifying thickness monitoring locations (TML), and measuring and analyzing data is crucial in assisting management to making important economic and safety decisions.

However, many process piping inspection programs are poorly designed and badly implemented. Some plants are overwhelmed by too many TMLs and large amounts of data, while others have little or no data. Inspection points should be selected where experience suggests corrosion is likely to cause significant problems. Often this experience is lacking. Data collection and inspections can produce poor information, and the control and tracking of data is poorly organized. Because of this, piping inspection programs are seen as problematic, complex, time consuming, inefficient, and costly.



Issues

The failure of process piping inspection programs can be attributed to several issues. These include:

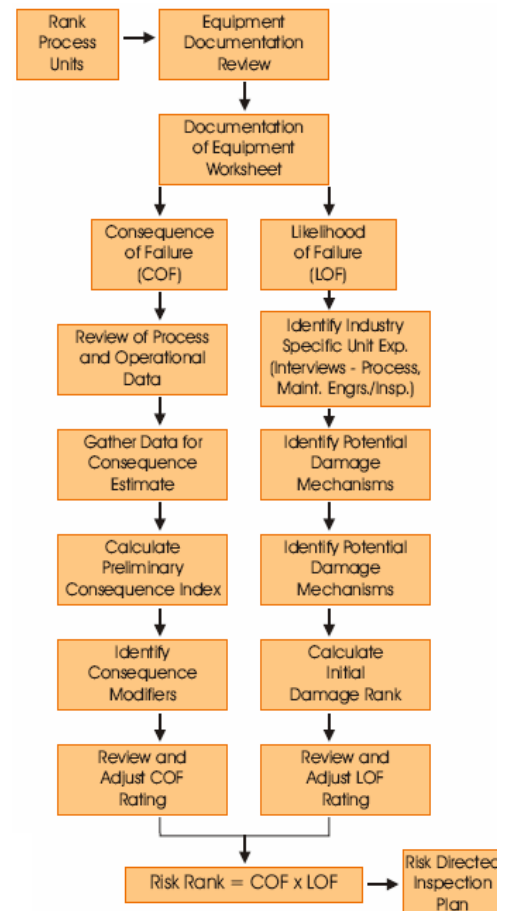


- ◆ Not following applicable codes and standard
- ◆ No clearly defined scope
- ◆ Inadequate inspection practices and procedures
- ◆ Poor ultrasonic (UT) data management
- ◆ Lack of experience and understanding of issues
- ◆ Lack of training

Solutions

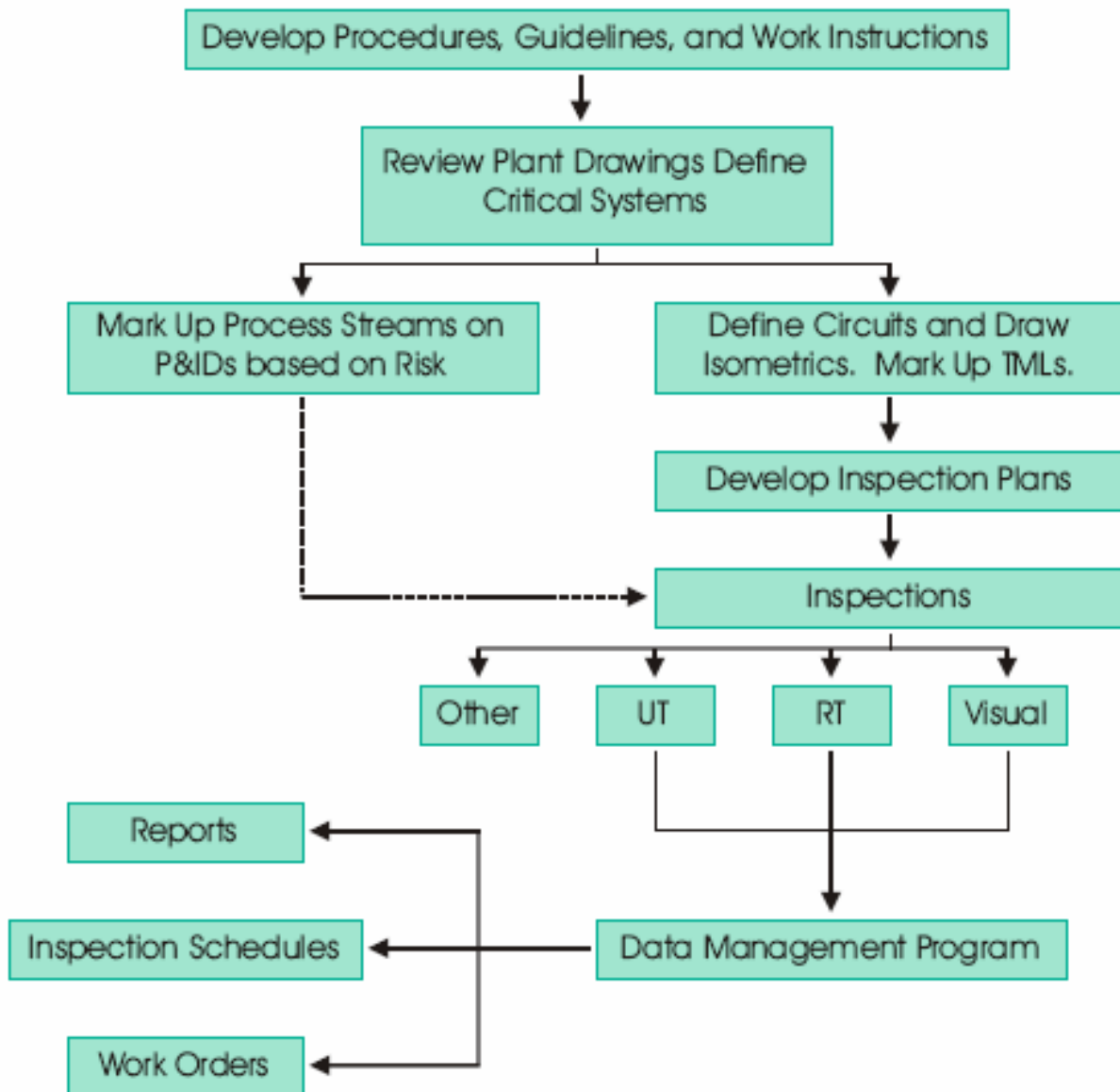
APTECH's experience with risk based technology and the development and implementation of inspection programs can help to solve these plant problems and provide cost-effective solutions to process piping inspection programs. These solutions would include:

- ◆ Following applicable codes and standards
- ◆ Developing a systems approach
- ◆ Integrating of procedures, guidelines, and work instructions
- ◆ Focusing on critical items (as defined by RBI or others)
- ◆ Implementation of correct inspection techniques
- ◆ Using the correct tools and equipment
- ◆ Utilize data management programs effectively
- ◆ Correct analysis, tracking, and reporting of data
- ◆ Setting of inspection scope and frequencies
- ◆ Timely updating of prioritizations
- ◆ Pro-active use of technologies
- ◆ Correct training and procedures



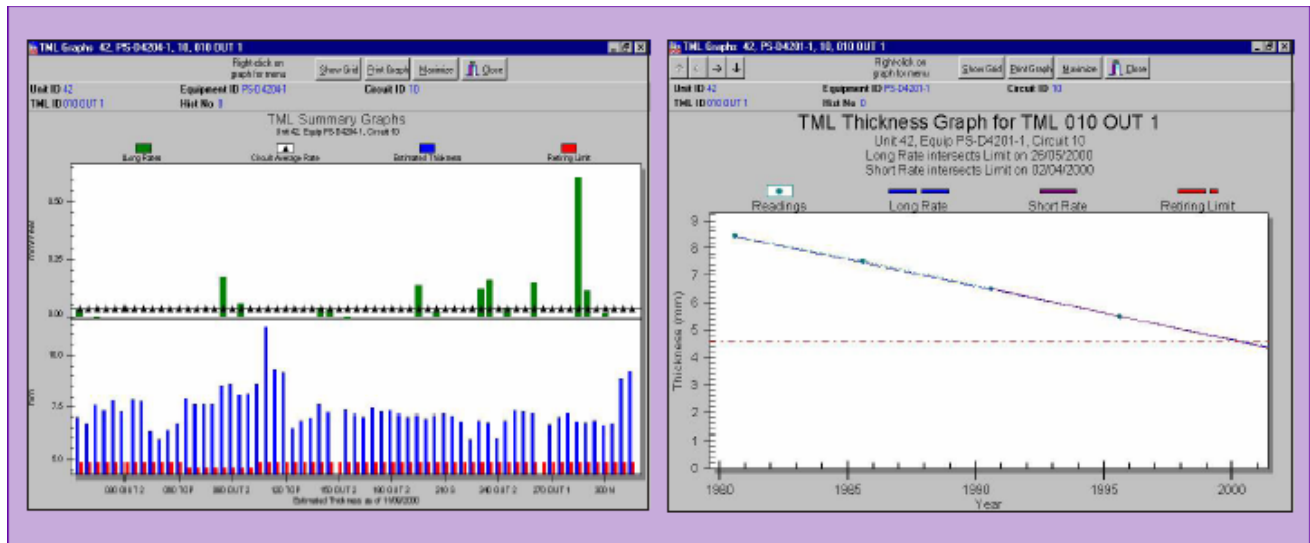
Systems Approach

Piping inspection programs need to be carefully planned, implemented, and maintained in order to ensure safe plant operation. Because of the complexity of issues, a systems approach is generally accepted as the most effective way to develop process piping inspection programs. APTECH has many years experience in developing these systems and in successfully implementing them in a variety of plants. The steps towards successful implementation may include:

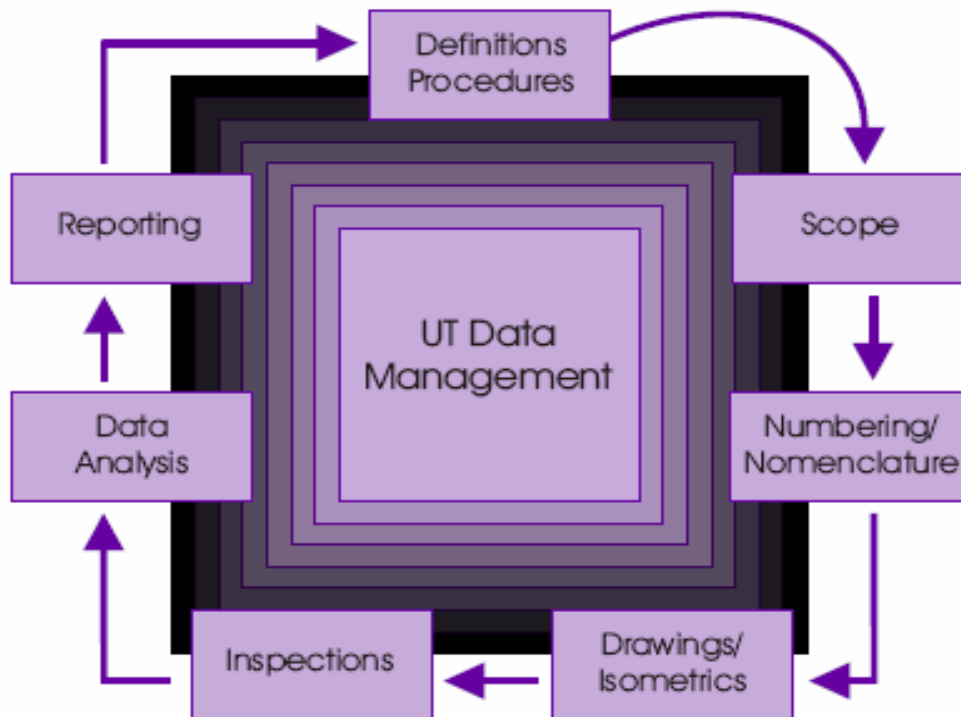


UT Data Management and Reporting

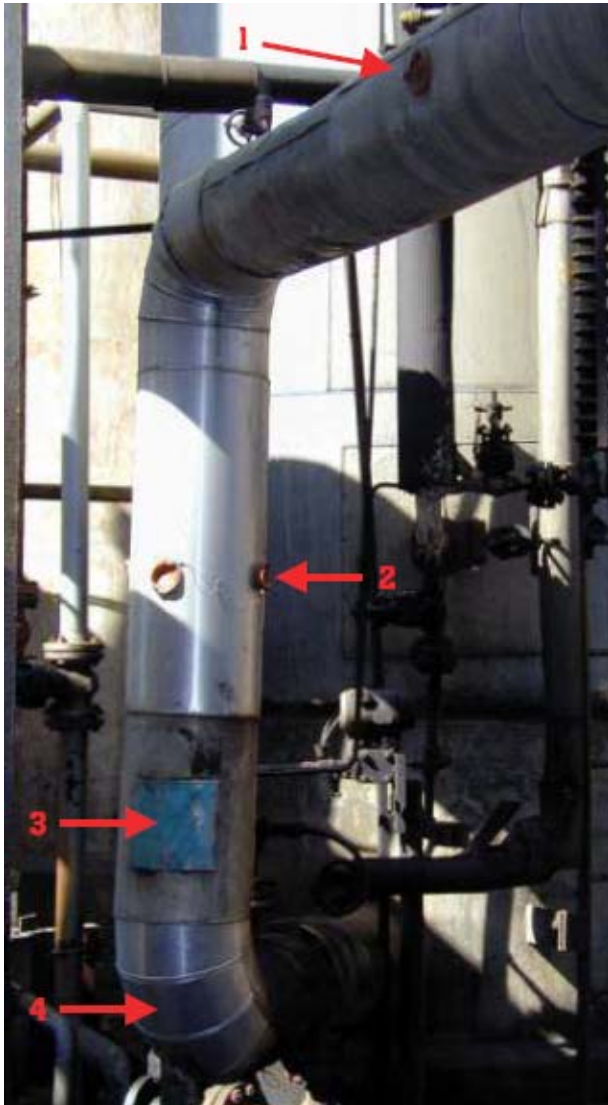
The management of UT testing data is critical for the successful functioning of any piping inspection program. The volume of data is large and cumbersome, so commercial software packages have been developed in order to manage the data, calculate corrosion rates, and determine next the inspection dates. These products include PCMS, DMAPS, and Ultra-Pipe. However, the implementation of these products requires careful planning and foresight. APTECH has experience with many of these packages and understands the many facets that are needed to ensure correct implementation and management.



UT Data Management Facets



Process Piping Problems



1. Incorrect TML position
2. Incorrect TML position
3. Incorrect port and sealing
4. No TMLs
5. Poor sealing due to inferior plugs
6. Poor workmanship



1. Destruction of original coating
2. New coating incompatible with old
3. No new coating
4. Leaking flanges and poor maintenance
5. Poor insulation



Process Piping Solutions



1. Correct TML Locations
2. Clearly marked TML locations
3. Good insulation
4. Superior plugs



Partial Project Listing

Abdel Hadi Abdullah Al-Qahtani & Sons (Representative for SABIC)	Development and Implementation of Piping Inspection Program
Ammonia Plant, USA (completed under client attorney privilege)	Risk Based Inspection (RBI) Program and Assistance with Siting Calculations (20 Fixed Equipment Items and Piping)
ARCO Chemical Company	Mechanical Integrity Documentation Program Plan
Engen - A Division of Engen Petroleum	Development of Piping Inspection Program
Fluor Daniel, Inc.	Stainless Steel Piping Failure Analysis
FMC Corporation	Support for FMC's Mechanical Integrity Program – Piping Systems and Pressure Vessels
Hampshire Chemical Corporation	Assistance to Hampshire Chemical Corporation for Mechanical Integrity Program Development
Lyondell Petrochemicals Company	Metallurgical Analysis of Pipe Components from Sulfolane System
Lyondell-Shell Refining Co.	Failure Analysis of Pump Out-Line Off of 53 Exchangers in HDS Unit Service
Lucite International, Inc.	Risk Based Inspection Study and TML Optimization of Piping Circuits
Occidental Permian LTD, RBI of Pipeline	Qualitative RBI Plan (55 Miles of Critical Piping)
Oman India Gas Pipeline	Construction and Operations Phase Risk Analysis
Premcor Refining Group, Inc.	Classify Piping for West Crude Unit
Sasol North America, Inc.	Evaluation of Pipe Vibration, C9-21 Compressor Discharge Piping, Normal Parafins Unit
Suncor, Inc.	Process Piping Inspection Program Audit
Tesoro Petroleum Hawaii	Piping System Inspection and Testing Program
Texaco, Inc.	Availability Model of the Petronius Offshore Oil/Gas Production Field
Valero Energy Corporation	Classification of Piping Systems for the Sulfur Recovery Unit, Naphtha Hydrotreating Unit, and GAS CON Unit
Williams Refining LLC	Classify Piping in the Sats Gas Recovery Unit

For More Information, Contact One of These Offices.

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