



## Operating Plant and Systems Professionals

Inc.

'Your Increased Profitability is Our Bottom Line'

### DR. JOHN S. SMART, III SENIOR CORROSION, PIPELINE AND METALLURGY CONSULTANT

#### SUMMARY

John S. "Jack" Smart is a specialist in the areas of corrosion, pipelines, metallurgy and training, and partner in DYNAMIC MONITORING SYSTEMS, INC. He has 38 years experience as a corrosion engineer, metallurgist and operations engineer with The International Nickel Company, Amoco Corporation and as a corrosion consultant. He has extensive practical field experience in all phases of oilfield corrosion control, including refineries and petrochemical plants, gas plants, drilling, oil and gas production, internal and external corrosion of pipelines, intelligent pig interpretation including B31G/RSTREN analysis, cathodic protection, materials selection, offshore platform corrosion design and inspection programs, coatings, chemical treating of oil and gas, and water treating for waterflooding and disposal. He is known for his practical and cost effective solutions to corrosion problems.

#### WORK HISTORY

FIT, Inc. 2007 – present

John assists FIT clients in all areas of pipeline maintenance.

John Smart Consulting Engineers, Principal, 1991- present

- Corrosion consulting to the oil and gas production, pipeline and marine transportation industries
- Packer Engineering, Naperville, IL, adjunct consultant

Amoco Chemical Co. Welchem Division, Houston, TX 1987-1991

Manager, International Sales

Consulting Engineer, pipelines

Amoco Production Company, Houston, TX 1983-1987

Consulting Engineer - Corrosion in Oil and Gas Production and Pipelines, Water Treating for Water Flooding. Directly responsible for all Amoco Production corrosion control programs in Argentina, Trinidad, UK, Norway, Netherlands, Egypt, UAE, including training of nationals.

Amoco Trinidad Oil Company, Galeota Point, Trinidad, West Indies. Engineering Group

Supervisor-Production Facilities, 1980-1982; 1 yr. Assignment in Petroleum Engineering (1982-1983)

Amoco International Oil Company, Chicago Illinois 1973-1980 Sr. Staff Engineer, Corrosion. Had responsibility for all corrosion control programs in Amoco International Oil Co. operations in Argentina, Venezuela, Trinidad, UK, Netherlands, Norway, Egypt, Iran

Amoco Oil Company, Whiting, Indiana Research Laboratories, Research Project Engineer - Metallurgy and Corrosion, 1970-1973; Refineries and Petrochemical Plants

Assistant to President, Martin Oil Service, 1968-1970

Research Metallurgist, The International Nickel Company Research Laboratories, Suffern N.Y. (1967-1968)

### **CONSULTANCY PROJECTS**

1. Materials specifications for sour gas production wells, process and plant equipment, and pipelines.
2. Corrosion monitoring systems for sour gas production system, salt dome brine mining system
3. Corrosion design for several offshore oil and gas fields with high carbon dioxide content.
4. Corrosion control in high rate high H<sub>2</sub>S well test with carbon steel tubulars.
5. Materials and corrosion specifications for Floating Production System and pipeline.
6. Coiled tubing inhibitor distribution system for unmanned offshore platforms.
7. Inspection of oil and gas production system with corroded welds, surface process equipment and underwater pipeline system, including development of UT inspection specifications of welds based upon fracture mechanics.
8. Downhole chemical injection for corrosion, paraffins and emulsions in gas lift oil wells.
9. Storage tank bottoms chemical treating program (Corrosion Inhibitors and Biocides).
10. Course in "Oil Field Metallurgy" for field operators and engineers of major oil company.
11. Corrosion design of four Tension Leg Platforms in Gulf of Mexico
12. Total Corrosion Design of 4 platform Dong Fang Gas Field, China National Offshore Oil Co
13. Corrosion Control in Salt Dome brine mining system and brine pipeline
14. Corrosion design for three offshore gas fields in Asia, including in-field pipelines
15. Corrosion control design for over 15 gas compression systems
16. Evaluation of Pipelines by ASME B31G and RSTRENG for Mechanical Integrity
17. Interpretation of Intelligent Pig results for offshore and onshore pipelines
18. Cathodic Protection design of 7 pipelines, including chemical lines
19. Analysis of HVAC Interference of over 10 Pipelines
20. Drying of Pipelines after hydrotest for sour service
21. Evaluation of 36" offshore pipeline from intelligent pig inspection results for prospective purchaser
22. Course in Internal Corrosion of Pipelines to two major oil companies
23. Risk analysis for corrosion for Oman India Pipeline
24. Evaluation of trans-Andean oil pipeline for mechanical integrity, corrosion
25. Analysis of MIC in oil production equipment
26. Specification of properties and testing protocols for chemicals used in deep water production

systems

27. Pipeline Risk Management Course for overseas National Oil Company in Asia.
28. Corrosion inhibitors for Cement
29. Pipeline Coating Performance and Cathodic Protection potential attenuation.
30. Hydraulic Fluid Corrosion problems in heavy construction equipment and tractors
31. Failed 10,000 psi lower master valve on gas well
32. Gel Pigging Dispute for pipeline

## **EDUCATION**

B.E. Chemical Engineering, Yale University, 1963

Ph. D. Materials Science, Northwestern University 1968.

University of Chicago Business School evening program, completed course requirements for majors in Accounting, Finance and International Business, did not graduate due to travel requirements for job.

Continuing Education: Corrosion and Water Treating, Internal Corrosion in Pipelines, Economics for Engineers, Gas Well Operations, Sour Gas Handling, Multi-Phase Flow, Pressure Transient Analysis, Fracture Mechanics, Design Elements of Offshore Structures, Quality Process, Managing Negotiations, Strategic Planning, Microbiology

## **PROFESSIONAL AFFILIATIONS AND OFFICES HELD**

1. Member, NACE (34 yrs), AIChE (15 yrs), SPE (35 yrs)
2. Past Chairman, NACE Houston Section, 1989-1990, Program Chairman 1991-1994, 2000-2003
3. Active member of NACE Technical Committees in T-1 (Oil and Gas Production), T-3 (Corrosion Science and Technology), T-6 (Coatings), T-7 Cathodic Protection, and T-10 (Underground Corrosion Control).
  - Past Chairman: NACE T-10E-4 "Internal Corrosion in Pipelines"
  - Past Chairman: NACE T-1-4 committee on "Erosion Corrosion in Oil and Gas Production".
  - Past Chairman: T-1C-17 "Predicting Environmental Aggressiveness of Oilfield Systems from System Conditions"
5. Member: API RP-14E re-write Committee on "Design and Installation of Surface Production Equipment on Offshore Platforms." 1994-1995
6. Board of Directors, The Offshore Technology Conference, 1989-1995 representing AIChE
7. Program Committee of Offshore Technology Conference, 12 times symposium chairman.
8. Technical Paper Reviewer for SPE, NACE
9. Gas Research Institute Microbiological Corrosion Users Group
10. Technical Activities Committee Chairman, Pigging Products and Services Association
11. Member, NACE Materials Performance magazine, Editorial Advisory Board, 1999-2006
12. Pipeline Integrity Management Magazine (UK) Editorial Board, 2001-2006

## **WORK EXPERIENCES**

3 years as Research Project Engineer in Refineries and Petrochemical Plants, plus 14 years as Sr

Staff Engineer/Engineering Associate, Corrosion, for Amoco International Oil Company, supervising programs in 10 countries involving extensive travel, field work, and training. 3 years as Engineering Supervisor, Amoco Trinidad Oil Company, 11 years consulting engineer in corrosion of O&G Production, pipelines, marine transportation. The following list is of projects by Dr. Smart:

### **CORROSION CONTROL IN OIL AND GAS PRODUCTION**

Annual corrosion surveys for Amoco's International Oil and Gas Production Facilities for the periods 1973-1980 and 1984-1987. Chemical treating, water treating for water flooding, platform Cathodic Protection and inspection, well casing CP, Atmospheric and Pipeline Coatings, corrosion monitoring and life prediction, economic evaluation for corrosion control investments. Extensive International travel and supervision of local corrosion control efforts.

### **EXTERNAL CORROSION AND CATHODIC PROTECTION OF PIPELINES**

1. Cathodic Protection Surveys of 12 pipelines, over 100 production system gathering lines
2. Cathodic Protection design of 7 pipelines including offshore, onshore, HVAC interference, deep anode bed design, potential attenuation modelling
3. Offshore Pipeline Riser Splash Zone Coating Repairs
4. Design of an offshore pipeline coating and CP system, 24" Gas Line
5. Retrofit of CP to a Leaking 54 Inch Offshore Tanker Loading Line
6. Analysis in Corroded Pipelines per ASME B31G.
7. Corrosion of pipeline and AC Mitigation in HVAC Transmission Line Right of Way (6)
8. CP Interference analysis on oil pipeline
9. Tank Farm Cathodic Protection Systems - analysis and retrofit
10. External MIC on Pipeline Inside Partially Shorted Casing.
11. CP design on Coiled Tubing Flowlines
12. CP Design on Deepwater Field Development for TLP, including piles and tendons, hull
13. NACE Talk: "MIC and Pipelines"
14. Corrosion under disbanded coatings on pipelines
15. Cathodic Protection Design on new Pipelines including provision for CP in remote areas
16. External MIC under disbanded pipeline coatings, including expert witness lawsuit experience
17. Deepwater pipeline cathodic protection
18. Developed Finite Element computer program for CP attenuation in pipelines and rectifier spacing

### **INTERNAL CORROSION IN PIPELINES**

1. Pipeline On-Line Internal Corrosion and Bacteria Monitoring System
2. 42" Offshore Crude Oil Pipeline System Internal Corrosion Program, including inhibitor program, MFL, and UT intelligent pig evaluation
3. Failure Analysis in Multi-Products Pipeline due to MIC
4. Chairman: Gulf Coast Corrosion Control Seminar: Internal Corrosion of Pipelines '89-94
5. Internal Sour Gas/Condensate Production Pipeline corrosion program.
6. Carbon Dioxide Gas Gathering System Treatment Program and Analysis
7. Bacteria Corrosion in Pipelines

8. Water, Hydrate and Paraffin Inhibition and Removal from Offshore Pipelines
9. Pigging and Chemical Treating in Pipelines
10. Internal Corrosion Control in a Supercritical Gas Pipeline
11. Internal Corrosion Inspection Program for Offshore Oil Gathering System.
12. PL Company Operating Manual, Sections on Corrosion and Bacteria.
13. Hydrotest Procedures and Regulatory Approvals (Federal and State).
14. Internal Corrosion of PL's Training Program for Major Oil Company.
15. Internal corrosion control and corrosion risk evaluation of Oman-India Pipeline.
16. "MIC of Ships" Talk at SSPC Nat'l Mtg, 1994, to ABS Meeting on Tanker Corrosion, 1995
17. Development of "Pit Cleaning Pig" for bacteria contaminated pipelines.
18. Internal corrosion failure analysis in products pipeline in South America.
19. Internal corrosion analysis for crude oil pipeline with high leak rate.
20. Monitoring and corrosion analysis of salt dome hydrocarbon storage facility, Louisiana

#### **INTERNAL CORROSION MONITORING IN PIPELINES AND OIL AND GAS PRODUCTION**

1. Evaluation of Corrosion Inhibitor Programs in high rate gas wells.
2. Evaluation of Chemical Treating in Oil Pipelines for Corrosion and MIC.
3. Inventor - Dynamic Monitoring System - An on-line corrosion and bacteria monitoring system for oil and gas pipelines
4. "The Galvanic Probe" talk to NACE SC Regional Meeting, 1976
5. "On-Line System Developed for Monitoring Internal Corrosion" Pipe Line and Gas Industry March 1995
6. Evaluation of MIC for External Corrosion of several oil and gas pipelines
7. Designed Corrosion Monitoring System for several major sub-sea pipeline systems
8. Corrosion Monitoring System for Waste Gas Compression System
9. Pipeline condition analysis for pipelines with corrosion, scale and/or paraffins.
10. Computerized analysis of flow hydraulics for corrosion control
11. Salt dome hydrocarbon storage facility brine corrosion monitoring system

#### **OFFSHORE PLATFORM CATHODIC PROTECTION**

1. Corrosion Failure of Offshore Platforms Inspection Programs, North Sea, Trinidad
2. Cathodic Protection and Regulatory Inspection of Offshore Platforms
3. Annual CP surveys for over 125 platforms in Middle East, North Sea, Atlantic Ocean
4. Optimized Anode Retrofit Design for Offshore Platforms.
5. Implementation of anode retrofit, saving over \$7 million
6. Visual platform surveys using divers and ROVs, damage assessment.
7. Cathodic Protection design of 4 tension leg platforms in Gulf of Mexico in 1600 to 3350 ft water depths.
8. Cathodic protection design of numerous conventional offshore platforms all over the world, including use of magnesium anodes for high initial polarization designs
9. Cathodic Protection and Anode Specifications for China National Offshore Oil Company Dong Fang Field, 4 platform CP design and inspection program based on high initial polarization design procedure

## **WATER TREATING FOR WATER FLOODING**

1. Water Treating Specifications for seawater water floods and produced water injection.
2. Water Flooding State of the Art Manual for major International Oil Company
3. Determination of well plugging and fracturing in water injection wells.
4. Treating for Bacteria in water floods.
5. Monitoring for bacteria and corrosion in seawater water floods.
6. Chlorination specifications and equipment for seawater water floods
7. Deaeration process design in seawater water floods.
8. Scaling of mixed sea-water and formation water in waterfloods.
9. Development of best practices for offshore waterflooding for major international oil company
10. Chemical Treating specifications and quality control for major international oil company

## **COATINGS**

1. Coating Specifications for Maintenance of Offshore Platforms
2. Splash Zone Coating Systems
3. Marine Terminal/Tank Farm Painting Programs
4. Painting of Continuously Wet Piping Systems
5. Roof Painting of Marine Terminal Floating Roof Storage Tanks
6. Fiberglass Storage Tank Bottoms Linings
7. Internal Lining of Lease Tanks
8. Coatings Specifications for over 20 offshore platforms including TLP's, tension legs, drilling semi-submersibles, and conventional platforms
9. Pipeline coatings specifications including FBE, CTE, syntactic polyurethane foam insulation, hot lines
10. Shielding of pipelines from CP due to disbanded pipeline coatings

## **REFINERIES AND PETROCHEMICAL PLANTS**

1. Hydrogen cracking of welded pressure vessels in a sour gas plant.
2. Materials Specifications for high temperature hydrogen attack of refinery vessel steels using Nelson Curves.
3. Ultraformer explosion failure analysis using fracture mechanics of weld defects
4. Reactor vessel insulation and insulation failure, temperature indicating paints
5. Corrosion of refinery process vessels by organic sulfides and hydrogen sulfide
6. Napthenic acid corrosion of Vacuum Gas Oil vessels by Trinidad crude
7. Corrosion inspection of pipe stills and other refinery process vessels during turn-arounds, including pipe stills.
8. Direct fired furnace tube failures and tube hangers
9. Two stage Desalter operation for corrosion mitigation in pipe stills, demulsifier use and correlation of salt content to pipe still overhead corrosion problems
10. Pipe still overhead corrosion inhibitor treatments and condenser tube metallurgy
11. Heat exchanger failure analysis and specifications, including titanium tubes in polluted sea water service
12. Numerous refinery failure analysis investigations, including pumps, heater tubes, furnace burner operations

13. Refinery storage tank bottoms corrosion and use of chopped sprayed glass liners
14. Use of stainless steel liner materials in refinery pressure vessels
15. Stress corrosion cracking of stainless steel petrochemical plant piping
16. Hot spot (High Temp) stress analysis in ammonia reactor vessel wall and nozzles
17. HDPE plant debottlenecking assignment, catalyst recovery and product purification
18. Terephthalic acid manufacture vessel corrosion control using titanium and 317L explosion bonded clad steels
19. Refinery and Petrochemical Plants paint testing program
20. Mechanical Integrity and Risk Analysis Program for Refinery in Hawaii

### **OIL TREATING, GAS PLANT CORROSION, ENVIRONMENTAL**

1. Oil Process Train Corrosion Analysis, materials specifications for over 10 oil field process plants and gathering systems
2. Symposium Chairman, "Oily Water Clean-Up" AIChE Nat'l Mtg 1986
3. Project Supervisor - Treatment of Oily Produced Water
4. Sour Gas Plant Corrosion Surveys, 9 plants, US, Middle East, and Canada
5. Corrugated Plate Interceptor analysis for oily water, West Africa offshore platform
6. Landfill Gas Compression with 50% CO<sub>2</sub>
7. Materials Performance Study for CO<sub>2</sub>, H<sub>2</sub>S rejection and recovery by proprietary semi-permeable membrane process