11960 SENATE RESOURCES

ConocoPhillips

- DS2D-09 Flowline Failure (3/17/04) – Attributed to excessive snowloading
- Tarn Pipeline Support Structure (5/24/03) - 13 pipeline supports failed – Attributed to fatigue
- 2X 8" MI Line Failure (12/31/01) – Attributed to fatigue caused by WIV .
- DS2X-13 PO Line S-Riser Failure (11/22/99) – Attributed to a large pressure surge
- DS2U-6 PO Line S-Riser Failure – Attributed to a large pressure surge

2004 Update

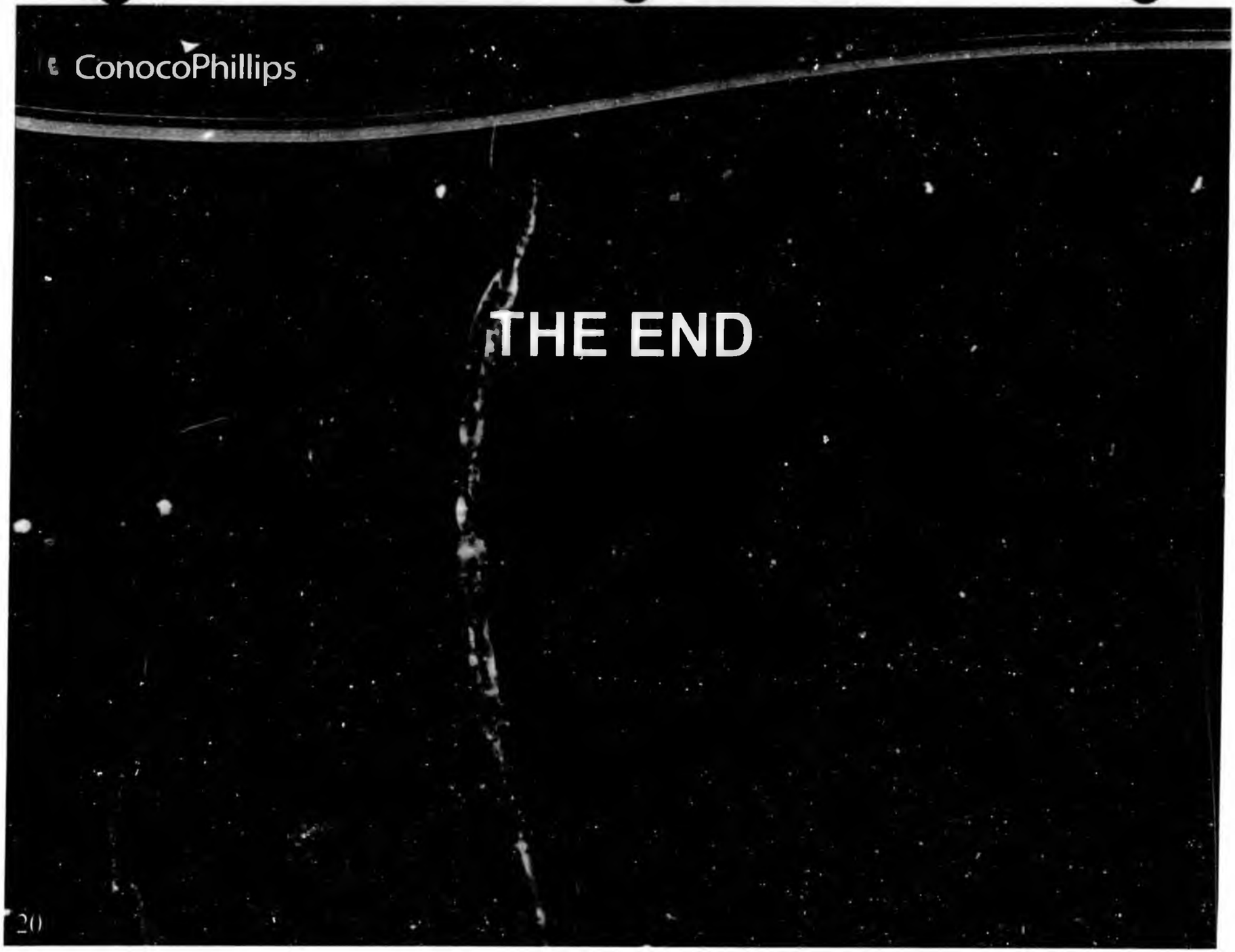
- On 4/14/03 at 7:00 a.m.,a leak from a small ¼ inch hole was discovered on an 8 inch Cross-Country Seawater Injection line located approximately 300 feet off the Kuparuk CPF3 pad.
- The leak was discovered during a normally scheduled visual inspection.
- Estimated 135 BBL. of sea water was spilled, contacting an area of tundra approximated by a circle 75 feet in diameter.

ConocoPhillips

Spills/Incidents

- In 1999. 274 weld packs were inspected for Corrosion Under Insulation
  3 weld packs were stripped and refurbished. no repairs required
- In 1999. two internal corrosion areas identified. 30% and 25% wall loss.
- In 12/2001. recurring internal inspection at 30% location showed no increase.
- On 7/28/2002. recurring internal inspection showed minor area increase. and 31% wall loss.
- In 1st Qtr 2003. scheduled RTR internal corrosion crawler showed "F" rated damage at several internal locations near welds.
  Worst damage was 73% wall loss.
  Recommendation to shutdown and depressure the line was issued.

typical Internal corrosion found near welds on 8 in. Line - not a film of actual leak site.


ConocoPhillips
THE END

ConocoPhillips

Glossary of Terms

Equipment Classification:

Well Line Pipe from the wellhead to the Drill Site manifold. For production wells, a well line handles the flow from a single well prior to commingling with fluids from other wells and transportation to the Central Processing Facility. For water injection wells, a well line handles the water flow going from a common manifold to a single wellhead.

Cross-Country Line Pipe from the Drill Site manifold to the Central Processing Facility (CPF).

Below-Grade Location That portion of a single pipeline which crosses underneath a road or other earthen feature at a single location. The linear extent of the location consists of the length of pipeline between casing ends.

Service Definitions:

Three-phase Production Basic reservoir fluids (oil, water, and gas) produced from down hole through to the CPF. Typically sees changes in temperature and pressure only from reservoir changes and are essentially un-separated.

Seawater (SW) Water from the Beaufort Sea that has been treated at the Seawater Treatment Plant (STP). Note that seawater treatment at the Kuparuk STP consists of filtration, oxygen stripping using produced gas, and biocide.

Produced Water (PW) The water separated at the CPF from three-phase production.

Mixed Water (MW) Produced water and seawater that have been commingled.

Gas Generic term for the different gas systems that transport dry (no liquids) gas between facilities. Includes fuel gas, artificial lift gas, and miscible Injectant.

Produced Oil The liquid hydrocarbon separated at the CPF from three-phase production.

Inspection Terminology:

CRM – Corrosion rate monitoring.
UT- Ultrasonic testing
RT – Radiographic testing
RTR Real time radiographic testing
TRT Tangential radiographic testing
PTI Profile Technologies Inc. (Electro magnetic inspection)
TWI – The Welding Institute (Long range UT)\
KDR – Known damage recur inspection
TFS Turbulent Flow Survey
WOL – Weld-O-Let

FALL 2004

BP

ADEC GPB Agenda
August 18 - 20

BPX

ADEC Team Members:

• Lydia Miner	Section Manager, Exploration, Production & Refineries, ADEC
• Sam Saengsudham	Section Manager, Pipeline and Tank Integrity, ADEC
• Gary Evans	EPR C-plan Reviewer, ADEC
• E. Wade Gilpin	EPR C-plan Reviewer, ADEC
• Dan Stears	Manager, Coffman Engineering
• Rodney Evans	Corrosion Engr., Coffman Engineering
• Oliver Moghissi	Consultant, CC Technologies

Day	Time	Location	Subject
Wed	8 – 9:30a	PBOC	Meet with GPB Operations Manager and Area Managers - Communication, coordination, interface of CIC programs and information with Operations
	9:45 – 11:15a	PBOC	Safety Orientation - CIC HSE Advisor
	11:30 - 12:30p	PBOC	Lunch
	12:30 – 12:50	PBOC	Check into rooms
	1 – 2:45p	PBOC	Attend CIC Chemical meeting
	3 – 5:30p	GPB West	Visit site of Y-36 spill Visit typical well head Visit Well Pad Manifold building Look at typical well pad Chemical Injection System Look at non-common carrier pipeline system (LDF/CL)
	6 – 6:30	PBOC	Q & A session
	6:45p	PBOC	Dinner
Thurs	6a – 7a	PBOC	Breakfast **(Note: ADEC individuals leaving today must check bags)**
	7:15 – 9:45	GPB	Observe coupon pulls/ER Monitoring
	10:15 – 11:15	CIC Office	Explanation of data input
	11:30 – 12:30p	PBOC	Lunch
	12:45 – 2	CIC Office	Discussion of External Corrosion & Below Grade Piping Programs (Kip, Randy/Jim, George/Terry)
	2:15 – 5:30	GPB	Field Observation of CUI detection and mitigation, BGP technology/CRM locations **(Note: ADEC team members leaving today must be back at BOC or PBOC nlt 4:15p to catch bus to airport)**
	6 – 6:30	PBOC	Q & A Session
	6:45	PBOC	Dinner
Fri	6 – 7a	PBOC	Breakfast **(Note: ADEC individuals leaving today must check bags)**
	7:15 – 8:15	CIC Office	Overview of Inspection Program
	8:30 – 10:15	GPB	Field Observation of NDE crews (DRT, UT)
	10:45 – 11:15	PBOC	Q & A Session
	11:40	PBOC	Board bus for airport (arrive – Anchorage 2:20p)

CPA

ADEC Corrosion Charter
Meet & Confer - Field Visit
August 16 – 17, 2004

Day	Time	Location	Subject
Mon	10:30 – 11.00a	KOC	Check in
	11.00 – 12:30a	KOC	Lunch (Lynn and Chairs) Safety Orientation / Camp Video – HSE Supervisor Organizational Chart Review
	12:30 – 6:15p	KRU	Tour of field corrosion inspection activities. Start at DS1A with well house, manifold (survey marks & drawings), coupon, probe, chemical injection, known damage recur points, corrosion rate monitoring. Visit radiographic test, manual tangential radiographic test, below grade piping program dig & refurbished weld pack location
	6:15 – 6:30p	KOC	Kakivik Safety Tool Box Meeting
	6:30 – 7:30p	KOC	Dinner**
	7:30 – 8:30p	KRU	Field Visit: Automated tangential radiographic test & Linear Array
Tue	6:30a – 7:30a	KOC	Breakfast **
	7:30 – 8:30	Corr.Conf.	Corrosion morning meeting
	8:30 – 11:00	Eng. Conf.	Inspection/Corrosion Program Overview, Q & A
	11.00 – 1:00p	Eng. Conf.	Lunch & Meet with Operations Leadership
	1:00 – 3:00p	Corr.Conf.	Corrosion Planning Meeting Review. Discussion with coordinators for facilities, drill sites & cross-country, Travis Stelly, Spencer Morningstar & Buddy Van Dam respectively.
	3:00 – 5:00	CPF 1	CPF 1 Facility Tour
	5:15 – 7:00	KOC	Dinner & wrap up
	7:00	KOC	Bus to Prudhoe

** Opportunity to visit with select Operations Leadership personnel as available

ADEC & Coffman Team Members

- Lydia Miner — Section Manager, Exploration, Production & Refineries, ADEC
- Sam Saengsudham — Section Manager, Pipeline and Tank Integrity, ADEC
- Gary Evans — EPR C-plan Reviewer, ADEC
- E. Wade Gilpin — EPR C-plan Reviewer, ADEC
- Dan Stears — Manager, Coffman Engineering
- Rodney Evans — Corrosion Engr., Coffman Engineering
- Oliver Moghissi — Consultant, CC Technologies

SPRING 2005

May 3, 2005 Corrosion M&C
Attendees @ A.D.E.C.

Name	Company	E-Mail
Wade Gilpin	ADEC	wade_gilpin@dec.state
Brad Frates	CPAI	brad.j.frates@conocophillips.com
John Kuzma	BPXA	[illegible]
Lydia Miner	ADEC	lydia_miner@dec.state.ak.us
Laurie Silfven	ADEC	Laurie_Silfven@dec.state.ak.us
Al Dinhardt	CPAI	n1195@conocophillips.com
Matt Collins	CPAI	n1412@conocophillips.com
Gary R Crawford	BPXA	crawfogr@bp.com
Don Stears	Coffman	stears@coffman.com
Oliver Moghissi	CCTechnologies	omoghissi@cctechnologies.com
Kip Sprague	BPXA	[illegible]
Bill Hedges	BP Trinidad	hedgesb@bp.com.
Brett Leach	BPXA	Brett Leach@bp.com
Jay Murali	CPAI	n1085@conocophillips.com
Lynn Tyler	CPAI	"
[illegible]	CPAI	[illegible]@conocophillips.com
Sam Saengsudham	ADEC	[illegible]
Kristen Ballard	ADEC	kristen_ballard@dec.state.ak.us
Dianne Munson	ADEC	dianne_munson@dec.state.ak.us
Gary Evans	ADEC	gary_evans@dec.state.ak.us
Michele Sherwood	E&E for EPA	msherwood@ene.com

BP

5/3/05
meet & confer

Commitment to Corrosion Monitoring Year 2004

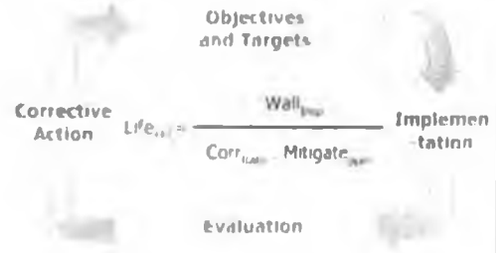
Meet and Confer IX
May 03, 2005

Outline

- **GPB**
  - Corrosion Management Program Overview
  - Overall Activity
  - Corrosion Monitoring
  - Internal Inspection
  - External Corrosion
  - Cased Piping Inspection
  - In-line Inspection
  - Corrective Actions
  - 2004 Leaks & Repairs
  - Summary & Look Forward
- **ACT**
  - ACT Description
  - Endicott
  - Milne Point
  - Northstar
  - Badami
  - ACT Overall
  - 2004 Leaks & Repairs
  - Summary and Look Forward

Corrosion Management Program

- **Strategic Objectives**
  1. Minimize HSE Impacts
     - Corrosion loss containment
  2. Fit-for-service Infrastructure
     - Remaining field life
- Future Major Gas Development
  - Utilize existing facilities
  - Gas sales demands longevity (50+ years)



Step	Program Elements
Plan	**Objective** Program objective and purpose
	Target Performance metric
Do	**Implementation** Plan to achieve objective
Check	**Evaluation** Method to evaluate performance
Act & Learn	**Corrective Action** Correct deviation from target

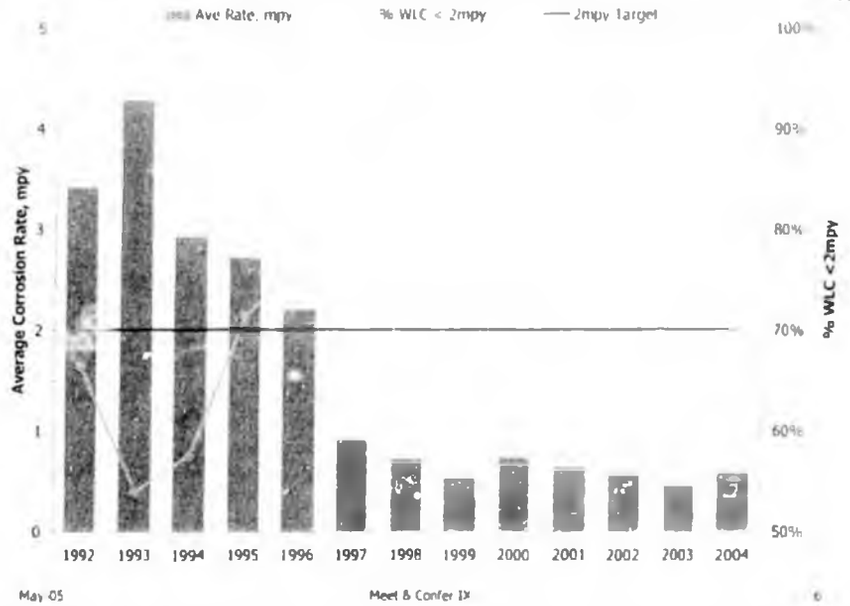
GPB Corrosion Mitigation Activity

	2001	2002	2003	2004
Internal Inspections				
Well lines	10,311	13,176	11,251	12,969
Flow lines	11,618	12,234	14,131	14,284
External Inspections				
Well lines	13,071	23,949	10,821	14,231
Flow lines	3,966	18,727	24,258	21,153
Total	**38,966**	**69,086**	**60,461**	**62,637**
Coupon Activity	7,686	7,596	7,362	7,185 pulls
ER Probe Activity	83	82	85	87 sites
Chemical Volume	2,630,000	2,450,000	2,520,000	2,670,000 gal
Concentration	157	143	147	151 ppm
Water Cut %	70	71	72	74 %

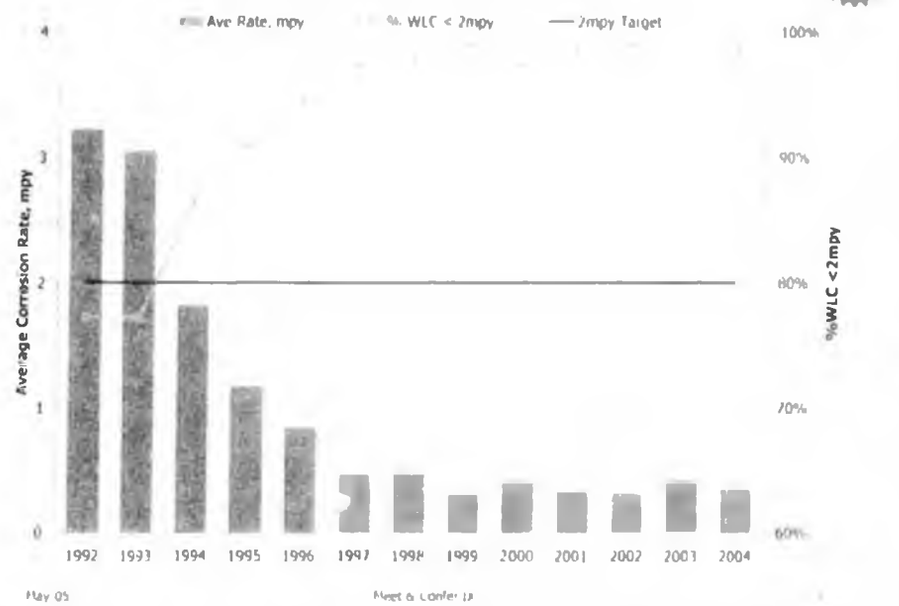
3-Phase Monitoring and Mitigation

- **Weight Loss Coupons**
  - Well lines
  - Flow lines
- **Corrosion Inhibitor Injection**
  - Concentration
  - Unplanned Events

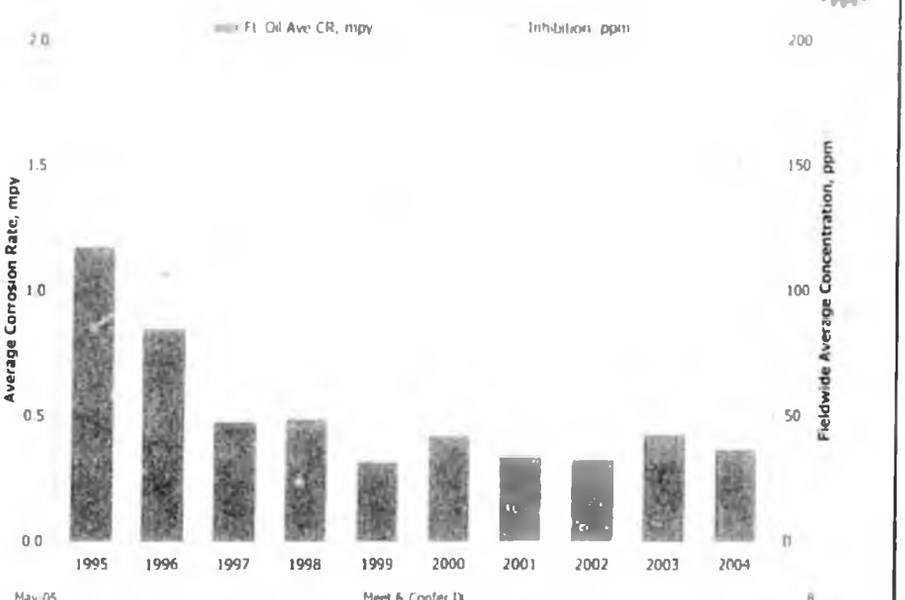
3 Phase – Well Line Coupons



3 Phase – Flow Line Coupons



Corrosion Inhibitor Concentration



Unplanned Chemical Event - I

- **Chemical instability at winter temperatures**
  - Precipitates formed at colder temperatures
    - Plugged trunk and lateral CI injection system
  - Cause
    - Several changes in manufacturing process to incumbent chemistry
  - Interim Corrosion Control
    - Add 10% Xylene to inhibitor which prevent precipitation
    - Continuous inhibition for LDFs with dedicated pumps
    - Well line batch program based on fluid corrosivity and risk at plugged locations
    - Cut out and replaced plugged tubing
  - Current Status
    - All plugged locations are back online
    - Chemical manufacturing changes were "rolled back"
    - Extensive changes to manufacturer's process and procedures

Unplanned Chemical Event - II

- **Trial chemical material incompatibility**
  - **Large scale trial using DS01 and DS12**
    - Trial chemical identified through screening program
    - 5 pinhole leaks at DS12 in SS316L tubing
    - CI delivery system shut-in at both drillsites
  - **Interim Corrosion Control**
    - Continuous inhibition for LDFs with dedicated pumps
    - Well line batch program based on fluid corrosivity and risk
  - **Failure Analysis**
    - Trial chemical is not compatible with SS316L
    - Random isolated pitting, most frequent in "heat loops"
    - Gaps identified in materials compatibility testing for new chemicals
    - Lab testing indicates material will re-passivate
  - **Path Forward**
    - Replaced the "heat loops" tubing
    - Pressure test the systems
    - Return to service in May-05
    - Extensive changes to manufacturer's process and procedures

2005 Forecasted Impact (Well lines)

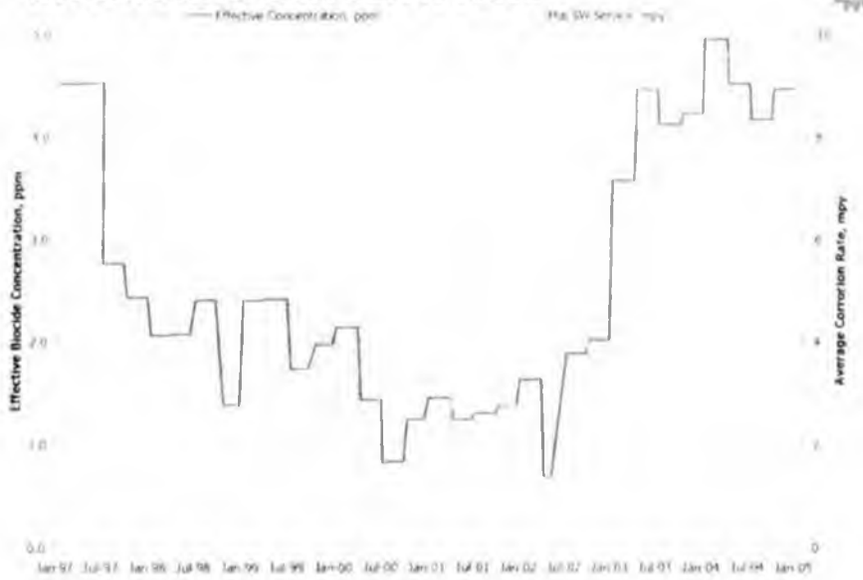
Water Injection Systems

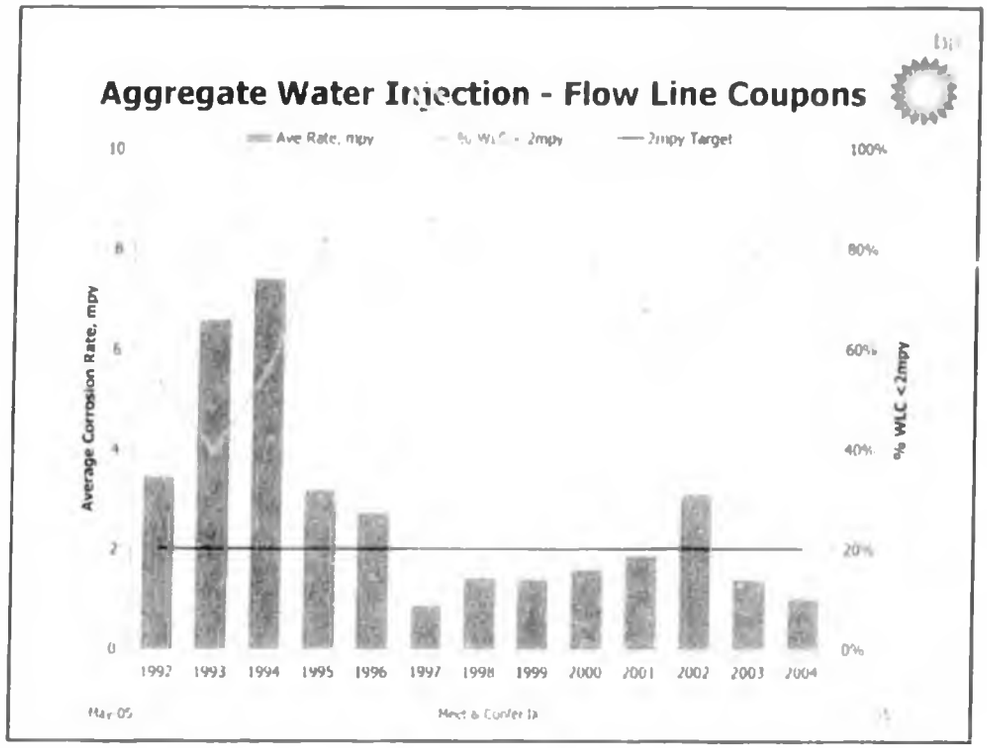
- **Overall Improvements**
  - Seawater System
  - Produced Water System
- **Weight Loss Coupons**
  - Flow lines
  - Produced Water system
  - Seawater system

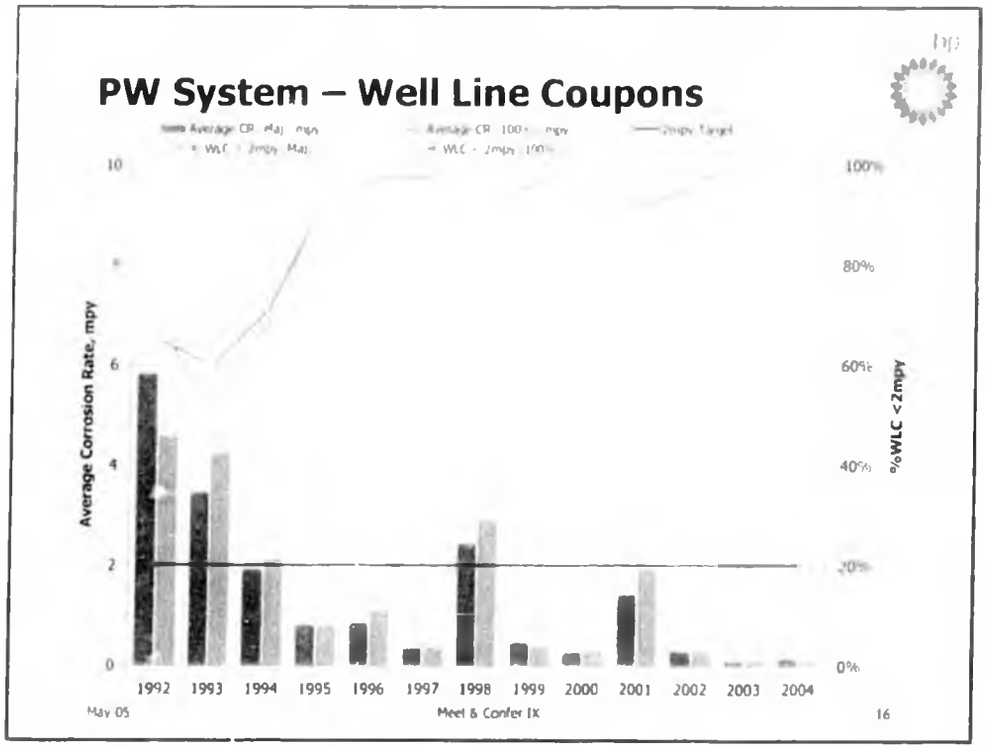
Water Injection Performance Improvement

- **Seawater System**
  - Improved dissolved oxygen control
    - Set O_2 control < 20 ppb
      - Spring Excursions
  - Increased biocide frequency to 1/week
    - Increased effective biocide concentration by 50%
      - 500 ppm to 750 ppm
- **Produced Water System**
  - 3-phase corrosion inhibitor
    - More carryover into PW system
  - PW mitigation programs
    - Continuous injection
      - FS1 and 3
      - GC1, 2, and 3

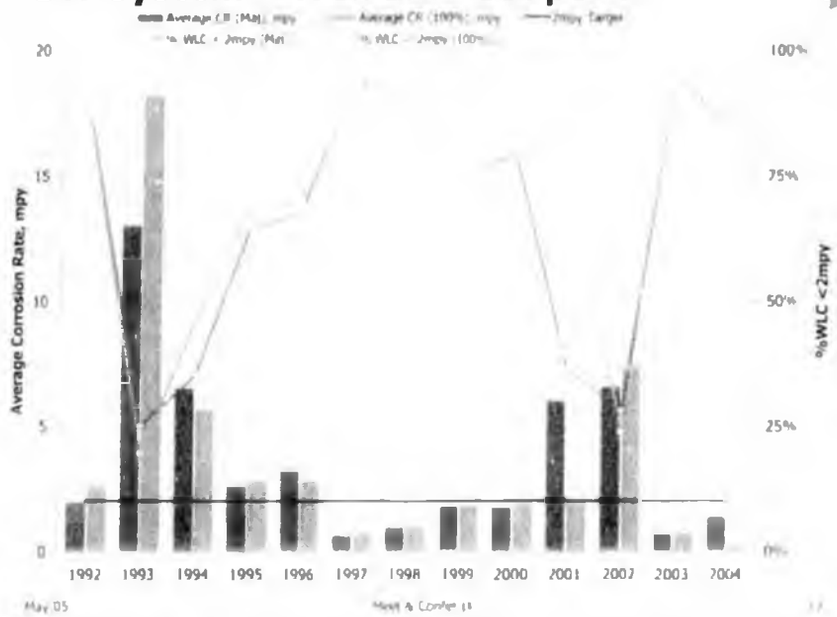
Biocide and Corrosion Rate




Aggregate Water Injection - Flow Line Coupons
Ave Rate, mpy
2mpy Target
Average Corrosion Rate, mpy
% WLC <2mpy
10
8
6
4
2
0
100%
80%
60%
40%
20%
0%
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
May 05
Meet & Confer IX


PW System – Well Line Coupons
Average Corrosion Rate, mpy
%WLC <2mpy
10
6
4
2
0
100%
80%
60%
40%
20%
0%
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
May 05
Meet & Confer IX
16

SW System – Well Line Coupons



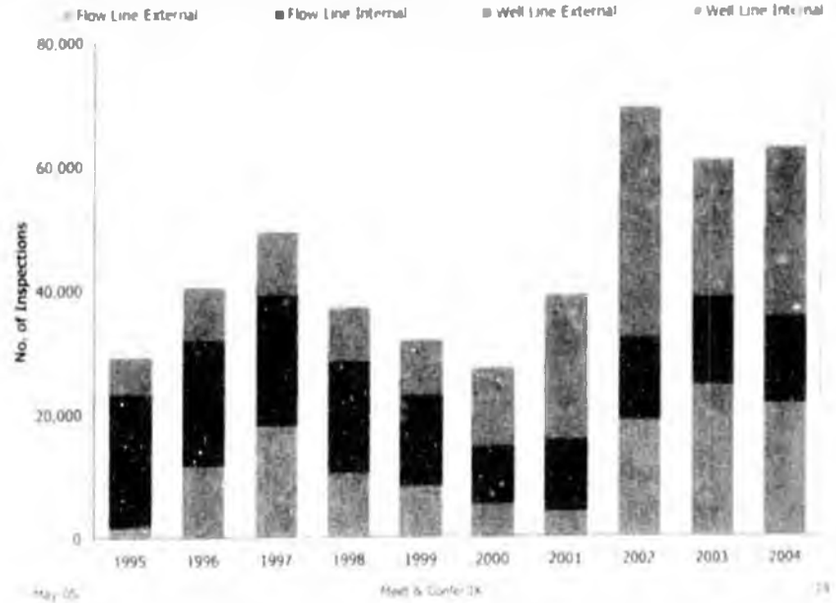
May 05

Inspection Program

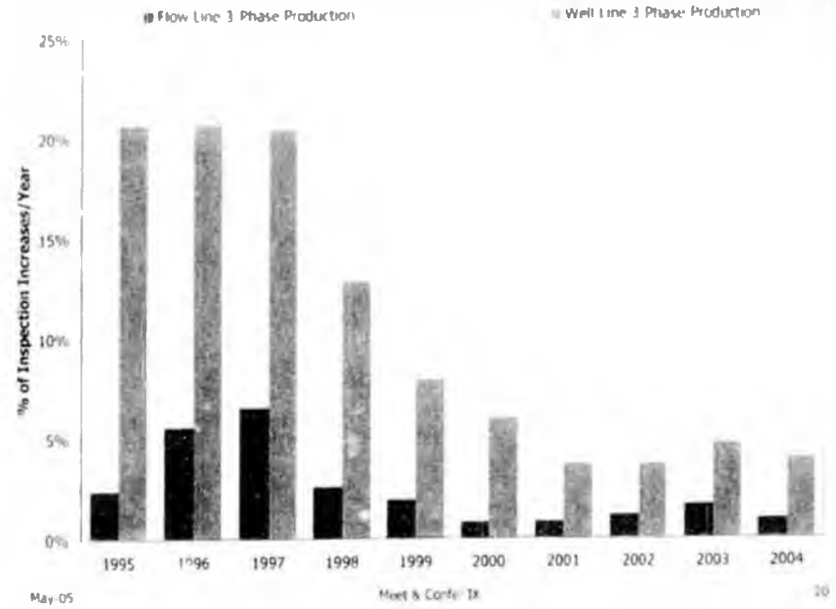
- **Internal Inspection**
  - 3 phase – flow and well line
  - Water injection – flow and well line
- **External Inspection**
- **Cased Piping Inspection**
- **In-line Inspection**

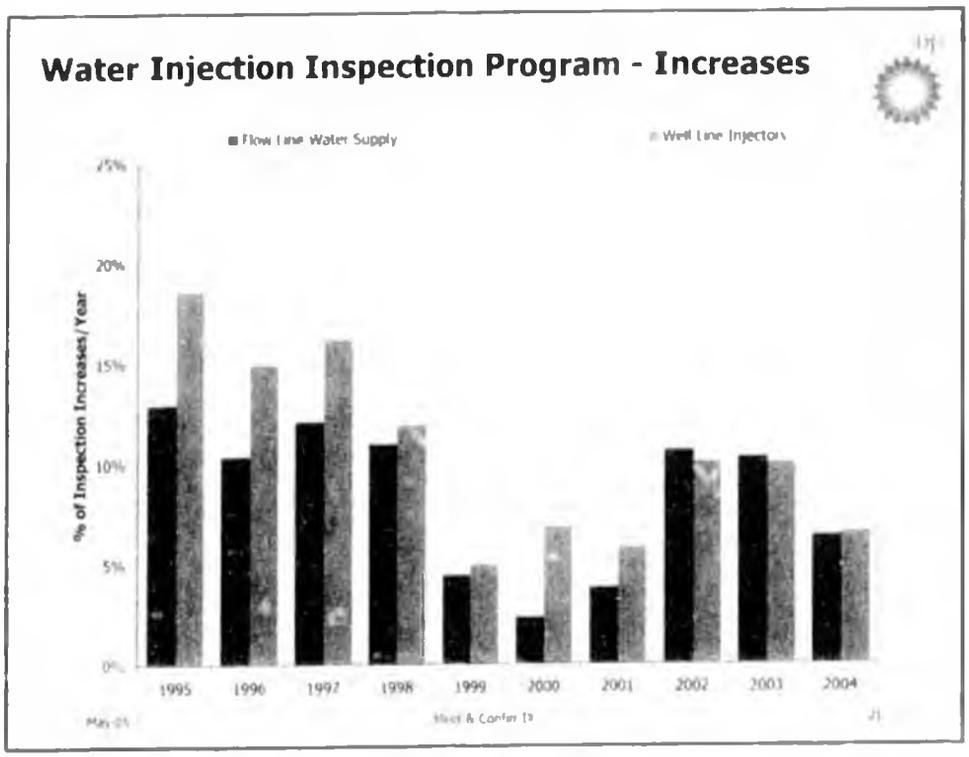
May 05

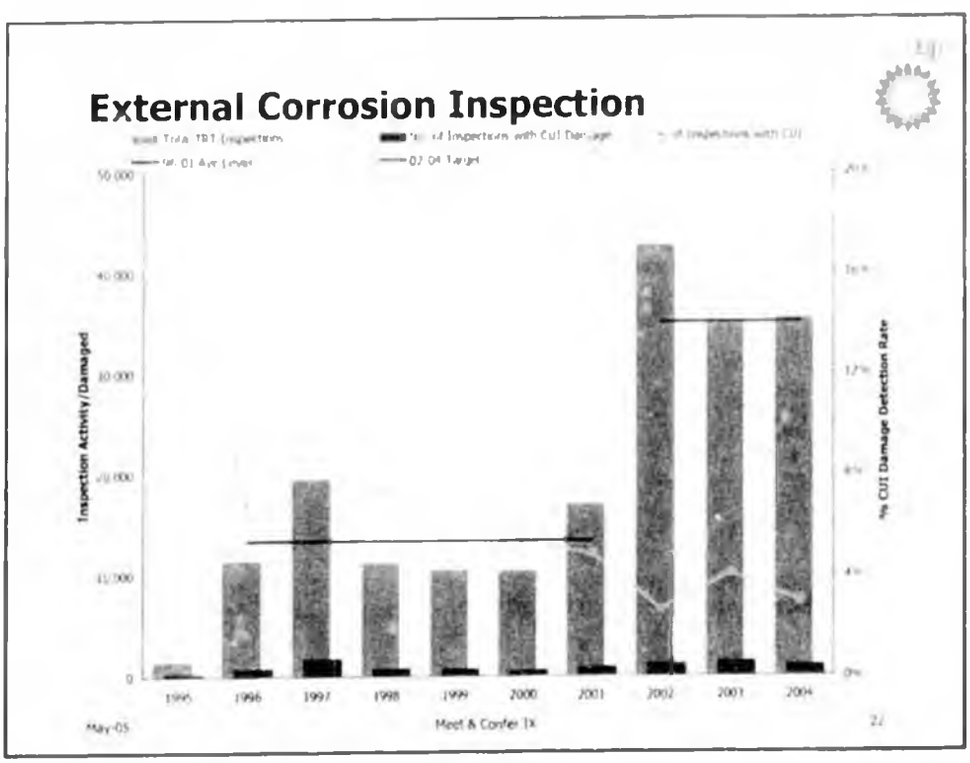
Flow/Well Line Inspection Activity



3-Phase Inspection Program - Increases




Water Injection Inspection Program - Increases
Flow Line Water Supply
Well Line Injectors
% of Inspection Increases/Year
25%
20%
15%
10%
5%
0%
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
May-05
Meet & Confer IX


External Corrosion Inspection
02 04 Target
Inspection Activity/Damaged
% CUI Damage Detection Rate
50,000
40,000
30,000
20,000
10,000
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
May-05
Meet & Confer IX

Cased Pipe Program Activity

- **Baseline inspections completed in 2003**
  - All cased piping segments
- **Long-term management program defined and implemented in 2004**
  - Each anomaly has been prioritized for re-inspection
  - Use guided-wave and/or in-line inspection
  - 108 segments were re-inspected
  - 19 partial excavations and 2 complete excavations
    - No mechanical repairs required

In-line Inspection

- **4 pipelines had ILI runs**
- **No repairs identified**

Equipment	Service	Diameter	Previous ILI	From	To	Length (miles)
D-36	3 Phase	24	2001	D-Pad	GC-1	1.5
F-74	3 Phase	24	1999	F-Pad	GC-1	2.5
STP-36	3 Phase	36	1990[1]	PM-02	GC-1	9.7
X-74	3 Phase	24	1997	X-Pad	GC-3	5.5

[1]Pipeline was idle with nitrogen gas from 1996 to 2004. It was re-commissioned for 3-phase production in 2004

2004 Leaks and Repairs

- Corrective Actions
- 2004 Leak Details & Updates
- 2004 Repairs

Flow Line Corrective Actions

- **Weight Loss Coupons**
  - 2-Chemical Increase

Equipment ID	WLC CR, mpy	Cause	Action
[illegible]	[illegible]	[illegible]	[illegible]

- **ER Probe**
  - 59-Chemical Increases

Equipment ID	No. of Action	Cause	Action
[illegible]	[illegible]	[illegible]	[illegible]

- **Inspection Program**
  - 1-Chemical increase

Equipment ID	No. of Action	Cause	Action
[illegible]	[illegible]	[illegible]	[illegible]

2004 Leaks and Repairs

- **Leak Summary**
  - Total of 4 Leaks

	Surface	
	Int	Ext
WL	2	1
FL		1

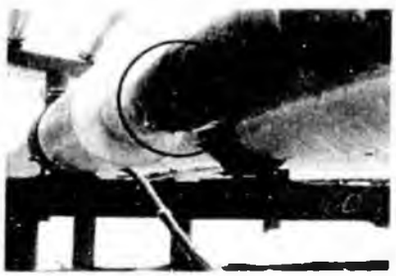
	Service			
	OIL	SW	PW	Gas
WL	1		2	
FL	1			

	Mechanism			
	CO_2	Int	CUI	Mech
WL		1	1	1
FL			1	

2004 Leak Detail

- **Well line 17-14**
  - Apr-04 leak detected
  - 3-phase production
  - External corrosion (CUI)
  - 5 gallon spill
  - Section Replaced

- **Well Line M-13**
  - May-04 leak detected
  - Produced Water
  - Freeze rupture
  - 20 gallon spill
  - Currently not in service



2004 Leak Detail

- **DS04 PW Divert**
  - Jun-04 leak detected
  - Internal corrosion (D/L)
  - 30 gallon spill
  - Section Replaced

- **Flow line 06C/13B**
  - Sep-04 leak detected
  - 3-phase production
  - External Corrosion (CUI)
  - 153 gallon spill
  - Sleeve Repair

2004 Leaks and Repairs

- **Repair Summary**
  - Increased focus on Water Injection System
  - Uniform Application of FFS Criterion

Service	Type	Internal	External	Mechanical	Total
Oil	FL	5	13	-	18
	WL	5	13	-	18
Water	FL	23	9	1	33
	WL	13	1	-	14
Gas	FL	-	12	-	12
	WL	-	37	-	37
Total		**46**	**85**	**1**	**132**

GPB Summary

- **Internal Corrosion**
  - 3 Phase Systems
    - Lines showing sustained performance
      - 2 chemical events
      - Proactive process of corrective action
  - Water Injection Systems
    - Significant improvement
- **External Corrosion**
  - >35,000 locations in 2004 (above plan)
- **Cased Pipe**
  - Executing long-term management strategy

GPB 2005 Goals and Objectives

	2004 Actual	2005 Plan
Corrosion Monitoring		
Coupon – no significant changes	✓	No change
ER probes – no significant changes	✓	No change
Inspection Program	✓	No change
External Corrosion Inspection		
Weld pack inspections ~35,000	✓	No change
Cased Piping Inspection		
Long-term management	✓	No Change
Chemical Mitigation		
Rapid Screen testing (40)	✓	No Change
Large scale facility trial (1)	✓	No Change
Technology		
ER-probe remote monitoring pilot	-	Planned
Remote tank strap reading demo	x	In Progress
Fixed Monitoring for Cased Piping	✓	No Change

Outline

- **ACT**
  - ACT Description
  - Endicott
  - Milne Point
  - Northstar
  - Badami
  - ACT Overall
  - 2004 Leaks & Repairs
  - Summary and Look Forward

Alaska Consolidated Team (ACT)

- **Producing Fields**
  - Endicott
  - Milne Point
  - Badami
  - Northstar
- **Relative Comparison**
  - ACT smaller than GPB
  - Differences in age
  - Non-common carrier FL
    - None at Northstar
    - None at Badami
  - Materials of construction

Metric	ACT	GPB	ACT (ACT + GPB)
Production Trains	4	21	16%
Prod and Inj Wells	230	1475	13%
Non common carrier FL	105	1350	7%
Acreage	75000	203000	27%

Relative Corrosivity of BP North Slope Fields

Field	Prod Fluid Characteristics H_2O (%)	T (°F)	P_{CO_2}(%)	CR [b]	Material of Construction [a] Production WL	Production FL	Injection WL	Injection FL
GPB	74	150	12	H	CS+CI	CS+CI	CS+CI	CS+CI
ENI	89	150	18	H	DSS	DSS	CS+CI	CS+CI
MPU	49	125	1.5	L/M	CS	CS	CS+CI	CS+CI
Northsta	4	160	5	M	CS+CI	N/A	N/A	N/A
Badami	~0	65	~0	L	CS	N/A	N/A	N/A

Notes:

(a) CS = carbon steel, CI = corrosion inhibitor, DSS = duplex stainless steel

(b) Unmitigated relative corrosion rate, H = high, M = medium, and L = low

(c) There are a limited number of Duplex Stainless Steel flow lines in GPB

(d) Two production flow lines are inhibited at MPU

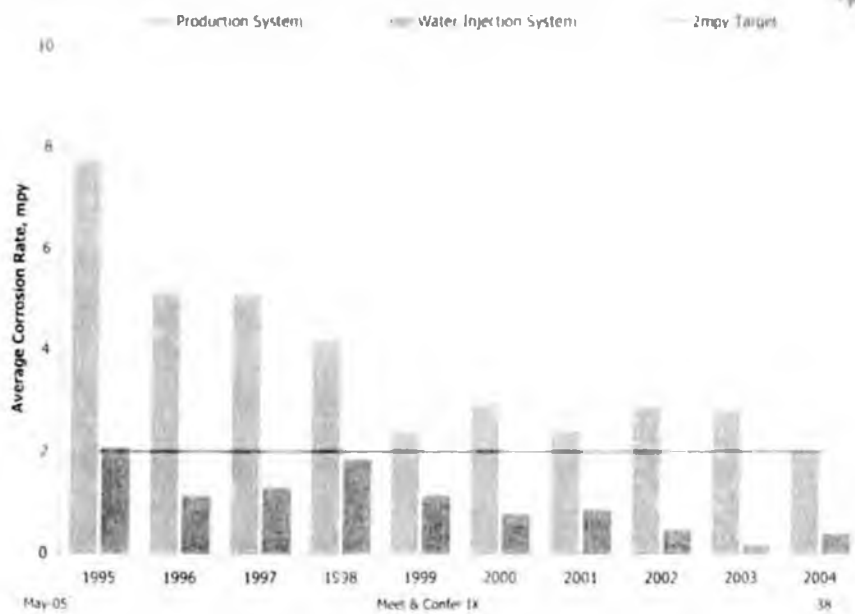
ACT Corrosion Mitigation Activity

	2001	2002	2003	2004
Internal Inspections				
Endicott	1,480	1,686	2,072	2,216
Milne Point	629	1,601	4,388	4,048
Northstar	16	149	204	327
Badami		5	29	26
External Inspections				
Endicott	16	40	856	731
Milne Point	1,570	70	1,583	1,738
Total	**3,718**	**3,551**	**9,132**	**9,086**
Coupon Activity	378	348	511	464
Chemical Volume				
Produced Water	NA	NA	101,835	86,951
Three Phase	NA	NA	37,595	31,239
Total			**139,430**	**118,190 gal**

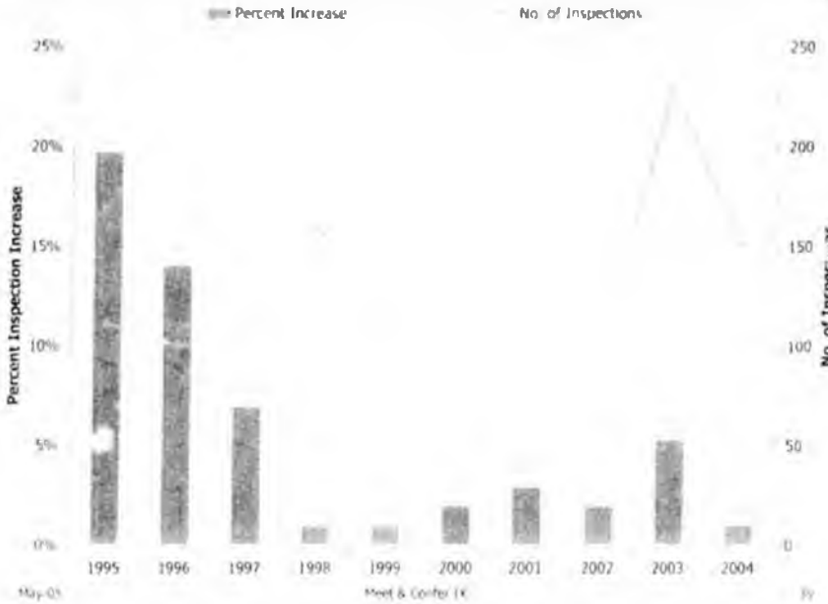
Endicott Overview

- **Production System**
  - Primarily Duplex Stainless Steel
  - Exception are the carbon steel C-spools
    - Velocity monitoring
    - Inspection program
    - Manage to repair/replace
- **PW/SW Injection System**
  - Inter-Island Water Line (IIWL) main concern
    - Control by:
      - Maintenance pigging
      - Inhibition (increased by 50% in 2004)
      - Biocide – eliminated in 2004 as a trial
- **External Corrosion**
  - Primary 2004 focus IIWL
    - No increases observed in repeat examinations
    - Slight corrosion found at 3 of 719 new locations
      - No Repairs required

Endicott Corrosion Monitoring



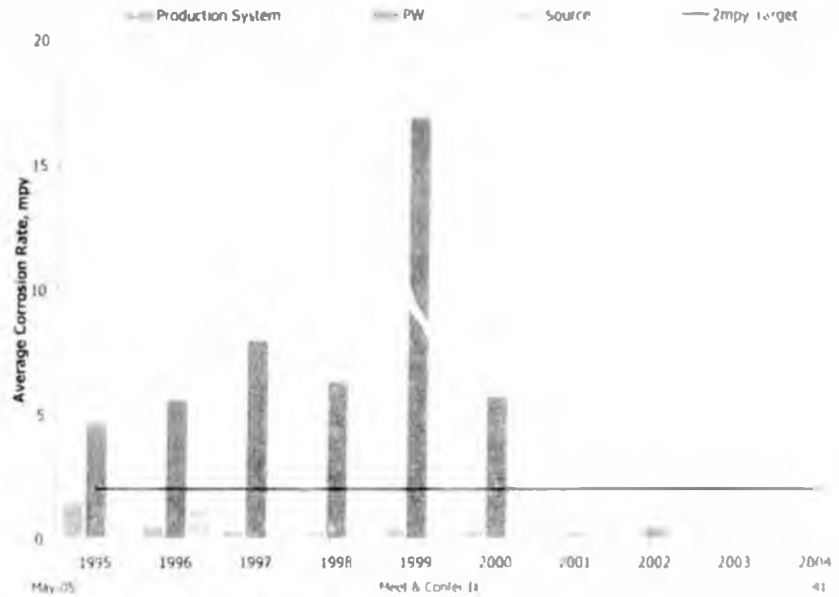
Endicott IIWL Quarterly UT Inspections



Milne Point Unit Overview

- **Production System**
  - Initiating inhibition program
    - K-Pad flow line initiated in 2001
    - S-Pad inhibited in power fluid
    - F-L-C production flow line inhibition initiated in 2003
    - Remaining facilities under review for inhibition
      - Flow characteristics
      - Inspection and corrosion monitoring data
- **Water Injection system**
  - Inhibition initiated in 2000
  - Along with more aggressive maintenance pigging program
  - Significant decrease in corrosion activity
- **External Corrosion**
  - Significant focus on external corrosion detection activities
    - 1,738 TRT inspections
    - No increases in 251 repeat locations
  - 45 Excavations
    - Tract 14 (maj), B, C and D pads
    - 13% inspection increases at 227 repeat locations (internal)

MPU Corrosion Monitoring



Badami and Northstar

- **Badami**
  - Began production in 1998
  - Production below expectations
  - No water injection system
    - Water cut <1%
  - No significant corrosion experienced
  - Warm shut-in in Aug-2003
  - Performed baseline and follow-up inspections of equipment
    - No damage
- **Northstar**
  - Began production in late 2001
  - Continuous inhibition into well production lines
    - Working plan to relocate CI injection further upstream
  - No water injection system
    - Water cut ~4%
    - Concern over dissolved oxygen from mud-plant operation
  - Corrosion monitoring program development in progress
  - Inspection baseline and historical record being established

Northstar Corrosion Monitoring

System	Location	Access Fittings	%WLC <2 mpy
Oil Production			
	Upstream of CI Injection	13	23%
	Downstream of CI Injection	1	100%
Water Disposal			
	Upstream of Mud Addition	9	100%
	Downstream of Mud Addition	2	50%

ACT – Leaks and Repairs

- **Zero-Corrosion related spills**
- **1-Mechanical related spills**
  - Freeze burst at MPU
- **17 Repairs/replacement activity**
  - Endicott - 3 erosion and 1 mechanical damage repairs
  - Milne Point – 7 internal, 5 external and 1 mechanical repair

Service	Type	Internal	External	Mechanical
Oil	FL	6	1	-
	WL	3	-	1
Gas	FL	-	-	-
	WL	-	-	-
PW	FL	-	4	-
	WL	1	-	1
	Total	**10**	**5**	**2**

ACT 2005 Goals and Objectives

	04 Act	05 Plan
Endicott		
Inter-Island Water Line and PW/SW well lines		
Reduced corrosion based on inspection data		
Trial no biocide and 50% decrease in CI		Monitor
Emphasis on consistent reliable maintenance pigging		Continue
Northstar		
Continue to build monitoring and inspection history		Continue
Inspection and mitigation programs responding as appropriate		Continue
Re-locate 3-phase CI to wellheads		Continue
Monitor effects of mud plant dissolved oxygen on PW disposal system		Monitor
Improve CI tracking and reporting		Plan
Badami		
Baseline and follow-up inspection as part of 'mothball' program		Continue
Milne Point Unit		
Continuing with ongoing expanded inspection program		Continue
Inspection and mitigation programs responding as appropriate		Continue
Developing 3 Phase System Program		Continue
Continued analysis of production flow lines		Continue
Initiate corrosion inhibition as applicable		Continue
Improve CI tracking and reporting		Plan
Review of corrosion monitoring locations		Plan

Overall Summary

- **Delivery of Objectives**
  - Long term Fitness-for-Service
- **Corrosion Management System**
  - Integration of key elements
    - Remaining wall – Inspection program
    - Rate – Corrosion monitoring
    - Mitigation – Corrosion inhibition
- **GPB Focus for 2005**
  - 3-Phase – Recover performance
  - SW – DO and MIC control
  - PW – Increased Focus
- **ACT Focus for 2005**
  - Badami – Monitor for shut-in status
  - Northstar – Move CI Upstream, Reporting
  - Endicott – Continue
  - Milne Point – Coupon Locations, Reporting

CPA

5/3/05
meet & confer

Greater Kuparuk Area

Commitment To Corrosion Monitoring Overview

presented to the
Alaska Department of Environmental Conservation
8th Meet & Confer

May 3rd, 2005

*R&D = linear array for water lines.

*RAC = Remote Access something = less scaffolding

*And a different way to screen inhibitor.

Spills/Incidents
2005 Update

6" *2KWI Injection water Line Leak* **3/26/2005**

Scenario:

- On 3/26/05 At ~10:45 AM, a leak from a ⅛ inch X ¼ hole was discovered on the below-grade section of a six-inch Cross-Country Water Injection line located at the DS2H pad.
- The leak was discovered during a routine corrosion survey.
- Estimated 1,219 Bbl of a mixture of produced water and sea water was spilled, contacting an area of tundra approximately two acres in size.

Spills/Incidents

2005 Update

6" *2KWI Injection water Line Leak* **3/26/2005**

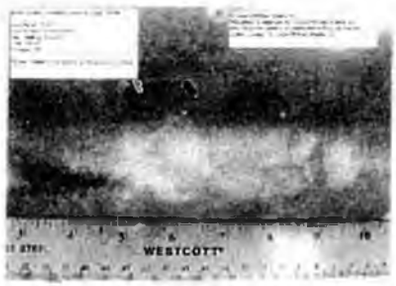
Background/Inspection History:

- After commencing operation of this line in 1989, the initial inspection of this line took place in 2001 when a 5% RTR inspection (463') was completed. Nine of the twelve segments inspected had no damage. Widely scattered internal pitting was noted in three segments. Worst case damage was 17% wall loss. A below grade piping long range inspection for external corrosion on this line was completed by Profile Technology Inc. (PTI) in July of 2001. No indications were reported.
- In the period between 2001 and the time of the leak, seven recurring manual inspections (at three locations) were performed on this line with minor increases and worst case damage of 35% wall loss by RT.
- In 2005, another 5% RTR inspection (614') was conducted. Widely scattered internal pitting was discovered in all 16 segments inspected with a worst case damage of 29% wall loss.

3

Current Status: **6" *2KWI Injection water Line Leak*** **3/26/2005**

- All below grade pipe at 2H pad has been recovered and replaced.
- Spill clean up is complete.
- 100% inspection of the line between 2H and 2K is in progress. Estimated completion date is May 5th, 2005. To date, four areas have been identified for sleeve repairs.
- A Root Cause Failure Analysis (RCFA) commenced April 27th and is expected to take 8-10 weeks to complete.



4

Deadleg Corrosion was Focus Area

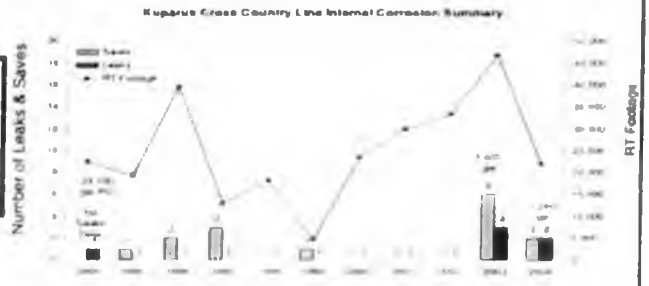
Internal Inspection
Cross Country Lines

- ✓ Completed all 2004 goals.
- ✓ Over 21,000 ft of over 329 lines inspected (RTR and RT)
- ✓ With help of new technology (Linear Array), all WI lines with OD < 24" have now been inspected.
- ✓ Completed baseline survey on over-tundra deadlegs
- ✓ 2 Leaks (1 SW injection, 1 production), 2 Saves (production). SW leak caused by MIC. Production line leak and saves were in deadlegs.

2004

Internal Corrosion Spills - Cross Country Lines

1994 Spill	24" 1Y/R Crude Oil
2003 Spill	8" 3B Sea Water
2004 Leak	6" 3R Sea Water



5

Mature Program

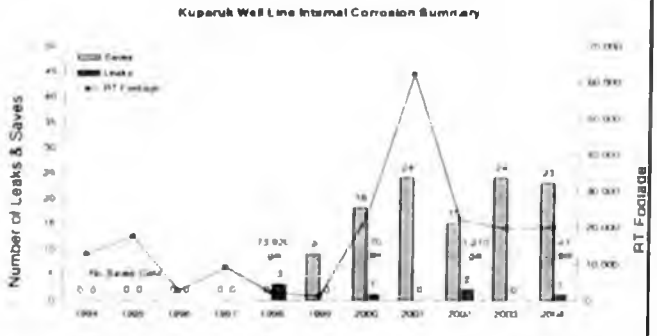
Internal Inspection
Well Lines

- ✓ Completed all 2004 goals.
- ✓ Roughly 20,000 ft of over 207 lines inspected (RTR and RT).
- ✓ 24 lines required repair (16 injection, 8 production).
- ✓ 1 Leak, 23 Saves. Leak due to erosion around obstructed flow straightening vane bundle.

2004

Internal Corrosion Spills – Well Lines

1998 Spills	1L-1 6" WI
	1L-3 6" WI
	1A-9 6" WI
2000 Spill	1G-8 6" PC
2002 Spills	2A-18 6" PC
	2T-13 6" PC
2004 Spills	1Y-02 3" WI



6

Internal Inspection

2005 Goals

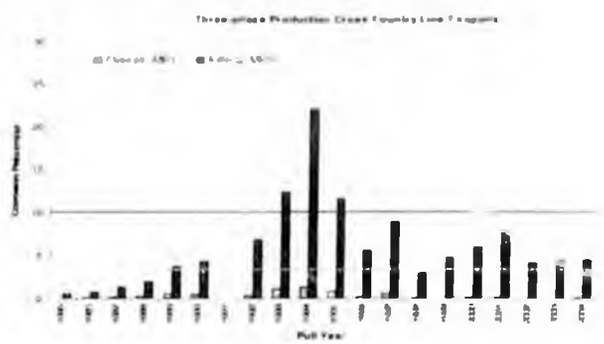
Cross-Country Lines	
Goal	***Status***
Inspect all on-pad deadlegs and WOLs	On schedule
Continue Recurring Interval Inspection Program, KDR Program and TFS Program	On schedule
Smart pig 30" SWI line in '05	On schedule
Well Lines	
Continue Recurring Interval Inspection Program, KDR Program and Erosion Program	On schedule

7

Monitoring/Mitigation

Three-Phase Cross Country Lines

Corrosion Inhibition is Effective



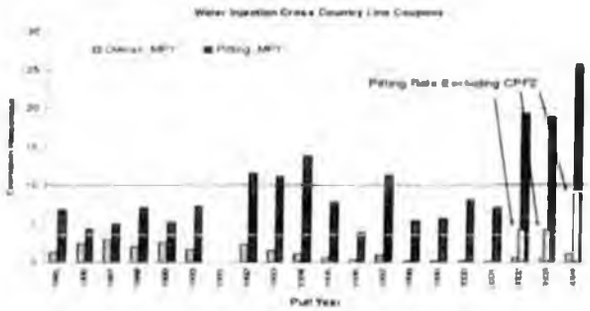
2004

- ✓ Coupon average rates remain below thresholds.
- ✓ 94% of 3-Phase Production CC lines have ER probe rates < 2 mpy.
- ✓ 3% of repeat inspection (CRM) locations showed increases.
- ✓ All 3-Phase Production CC lines with probe, coupon, or inspection corrosion rates above thresholds had corrective action taken.

8

Monitoring/Mitigation
WI Cross Country Lines

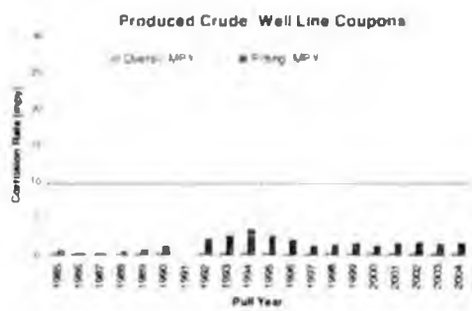
Continuing Focus Area

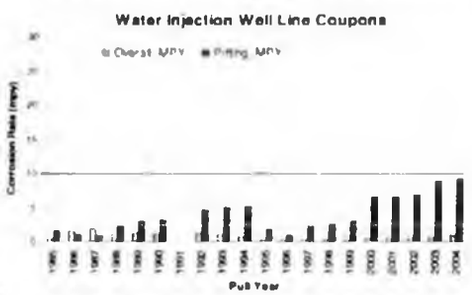


2004

- ✓ Average coupon pitting rates at CPF1 and CPF3 increased, but are still below threshold However, contribution of average coupon pitting rates at CPF2 continue to push field average above 10 MPY action-required limit
- ✓ Inspection corroborates coupon results but with lower corrosion rates than shown by coupons
- ✓ Implemented a better biocide treatment of the CPF2 system in 2nd half 2004. Early 2005 coupons show lower corrosion rates on the worst previous coupon locations Improvements to the new seawater injection system at CPF2 (TWIX) being evaluated

Monitoring/Mitigation
Well Lines





2004

- ✓ Coupon average corrosion rates remain below threshold levels
- ✓ Well head CI injection installed at DS's 2T, 1H, 1A, 1Y

- ✓ Coupon average corrosion rates remain below targets
- ✓ Additional KDR locations have been added, increasing surveillance

2005 Goals

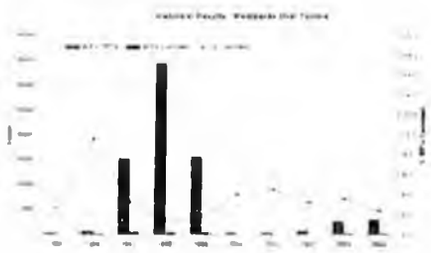
Monitoring & Mitigation	
Goal	***Status***
Continue testing for more effective corrosion inhibitors	• Field test of Champion 2002-50B completed at DS's 2U, 2V, 2W • Field test of Baker RE5273 started at DS 1R • Bartlesville lab screening protocol enhanced to include longer RCA tests and additional JIP runs for top performing field-test candidate chemicals. Investigating alternative techniques to evaluate corrosion inhibitors for pitting resistance • Nine new candidates selected for extensive lab screening and potential field testing
Continue improvements to all three CPF PW System treatment programs	• Biocide injection system improvements implemented at CPF2 • RCFA and Field-wide water system study underway to evaluate treatment effectiveness
SBG (Surfactant) Produced Water System Pilot Test	• Testing phase has been completed and data are being evaluated

Mature Ongoing Program

2004

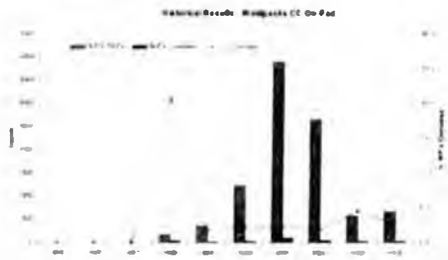
⇐⇐ CC Lines Over Tundra

- ✓ 3094 weld packs TRT inspected, exceeded goal of 3020
- ✓ Seventy-one (~2.3%) had corrosion. Two repairs were performed.
- ✓ Walkdown inspection has been completed. Overall program baseline completed - 100%



CC Lines On Pad ⇒⇒

- ✓ 672 weld packs TRT inspected, exceeded goal of 406.
- ✓ Eighteen (~2.7%) had corrosion. No repairs required.
- ✓ Overall program baseline completed - 100%

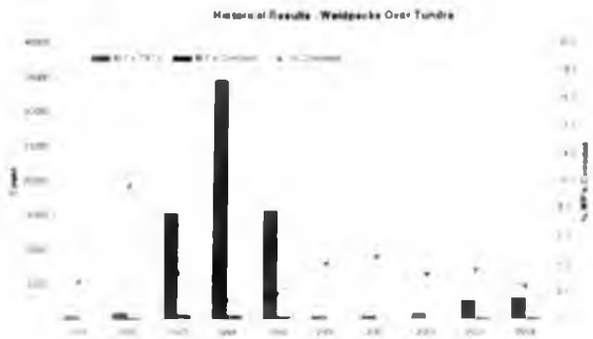


External Inspection
Well Lines

Baseline Effort for Well Lines

- ✓ Overall program baseline completion - 100%
- ✓ 885 weld packs TRT'd. Stated goal was to complete the baseline inspections by YE2005 but was completed in 2004, one year early.
- ✓ Seventeen (~1.9%) were corroded. No repairs were required.

2004



13

External Inspection

2005 Goals

Cross-Country Lines Over Tundra	
Goal	***Status***
Continue TRT to Evaluate the Tarn WP Design	On schedule
Continue TRT monitoring of Denso Tape refurbishment technique	On schedule
Complete recur TRT inspections due	On schedule
Cross-Country On-Pad	
Complete recur inspections due	On schedule
Well Line Weld Packs	
Complete recur inspections due	On schedule
Misc.	
Complete TRT inspections and pH measurements to continue to evaluate buffer spike mitigation option	On schedule

14

Inspection Results
Below Grade Piping

2004

Completed Second Recurring Inspection Cycle

- ✓ Completed all 2004 goals.
- ✓ Re-inspected 63 priority 1 locations with TWI.
- ✓ Inspected all priority 2 locations.
- ✓ 9 cased pipes excavated (goal was 5 to 9)
  - One had severe CUI damage – location was sleeved
  - Eight had only minor or no significant corrosion
  - Final Tally: 9 Refurbishments, 1 Saves, No Leaks
- ✓ Completed Annual Visual Casing Inspection - cleared all obstructions.
- ✓ Tested "Focused UT Method" with TWI.

15

Inspection Results
Below Grade Piping

Program Snapshot (GKA Only)

Note: The only uninspected priority 1 lines are those that are newer than 10 years old

All Lines in GKA Inventory	Inspected Through 2004	Un-inspected Lines	Total	Previously Uninspected Lines Inspected in 2004
Priority 1	560	55	615	0
Priority 2	100	0	100	2
Priority 3	10	39	49	0
2004 Total Inventory	670	94	764	0

16

Inspection Results
Below Grade Piping

2005 Goals

Goal	*Status*
Reinspect ~ 60 priority 1 pipes using TWI.	On schedule
Inspect all priority 2 pipes	On schedule
Prioritize and excavate 5-9 pipes if warranted	On schedule
Continue cooperative effort with equipment vendors, COP R&D and BP to improve current technology and explore new technologies	On schedule

17

Spills/Incidents
2004 Update

Summary 2004

External Corrosion

- ✓ No incidents to report

Internal Corrosion

- ✓ One CC line water injection leak (3RWI) in 2004
- ✓ One CC line produced oil leak (3R Test Return Line deadleg) in 2004
- ✓ One well line leak (1Y-02 erosion around straightening vane bundle)

Other Structural Concerns

- ✓ 3I GL Line Secondary Mode WIV Failure @ Girth Weld – 12/04

18

DS3I Secondary Mode Wind-Induced Vibration (WIV) Failure Sum...ary

- December 17, 2004
- Severe Blizzard Conditions
  - Sustained Winds 35-45 mph
  - ↪Emergency Travel Only
- Complete Parting of 8" GL Pipe - ≈ 79 mmscf Dry Gas Released
- Secondary Mode WIV Clearly A Causal Factor
- Fit-For-Service Plan Developed & Executed
  - DS3I 8" GL & DS3I to DS3M 6" GL
  - Inspected Welds Subject to WIV
  - One Other Crack Discovered
- Pipeline Returned to Service 2/3/05
- Secondary Mode TVA's Installed Late March 2005

19

WIV Background

- Basic WIV Concepts
  - Equal Length Straight Run Pipeline Spans
  - System Natural Frequencies & Damping Ratios
  - Aerodynamics (wind speed, air density, lift, vortex shedding)
  - Mode Shapes (Primary vs. Secondary)
  - Can Cause Cyclical Stresses Of Concern
- ➨WIV Is Effectively Mitigated Through Damping
  - Pipeline Vibration Dampers (PVD's)
  - Tuned Vibration Absorbers (TVA's)

20

Primary Modes

Secondary Modes

21

WIV Program History

- **NO** Primary Mode WIV Failures On Pipelines Employing PVD/TVA Devices Since Program Inception
- Secondary Mode Not Considered Likely
  - @ Time Of Original Construction
  - Subsequent WIV Program Evaluations
- Secondary Mode WIV Not Mitigated by Primary Mode PVD's

22

Way Forward

- Expand Current WIV Model ("EXTRA")
  - Refine Model @ Higher Wind Velocities
  - Enhance Predictive Capability for Secondary Mode WIV
- Re-Evaluate Other Pipeline Segments
  - Using Enhanced Model
  - Address Areas Of Concern As Appropriate
- Revise Pipeline Specifications
  - Ensures Secondary Mode WIV Is Addressed For Future Pipelines
- Evaluate Overall WIV Program From a Life-Cycle Perspective

WNS 2004

Alpine: 1st production in November of 2000

Two Drill sites on production

Internal Corrosion

- ✓ Production lines: Coupon rates all less than 1 mpy
- ✓ Water Injection lines: 4 mpy pitting on a single coupon, remainder: < 1mpy
- ✓ 18 Production well lines inspected: no damage

External Corrosion

- ✓ Improved design standards incorporated into 'new construction'
- ✓ All below-grade process piping is externally coated

No corrosion related leaks since start-up.

2005 Goals

Goal	*Status*
Inspect over 2000 ft of the CD2 Produced Crude line for internal corrosion	On schedule
Perform interval inspection on 15 well lines	On schedule
Inspect 200 locations for CUI	On schedule
Layout and API-570 visual for lines 5 yrs old	On schedule

THE END

FALL 2005

BP

Date/Time	Activity	Resources
9/12/2005 14:35	CIC Flight to SCC	Tim, Bill, Kip
9/13/2005 13:30	ADEC Arrives	
	Meet at Airport (security driver and bus)	Bus, driver
	Drive and Checkin at PBOC	9 rooms for ADEC + 4 CIC
3:00 PM	PBOC Conference Room	Conference Room (PBOC CR 2)
	HSE Orientation	Safety Gear (FRC, Hats, Glasses, jackets)?
	Operations Welcome	Ops Representative
	CIC Presentation	
	Address ADEC specific issues	
	Strategy and set up field trip	
5:30 PM	Dinner	
9/14/2005 8:00	CIC building	Bus, Driver
	Coupon process	Jack/Bnan
	Inspection process	Acuren
	CIC Personnel (Planners, Inspectors, Production Chemist)	NS TL/Kip
11:00 AM	Lunch	
12:00 PM	Field Trip	Bus, Driver
	Guided wave demo	TBD
	C-Arm	TBD
	Scan-trak	TBD
	RAT	TBD
	Leak location	TBD
	Pig shop or arrival	TBD
	External corrosion/insulation	TBD
	Casing excavation location	TBD
	A-Pad structural	TBD
	ER-probe remote (Xpad, Epad, Cpad, FS1, L2)	TBD
	CI rapid screen	TBD
6:00 PM	Dinner	
	PBOC depending on location	
9/15/2005 8:00	PBOC Conference Room	Conference Room (PBOC CR 2)
	CIC M&C Presentation	
	Standard Metrics update	
10:30 AM	ADEC Closeout	Ops Representation
11:00 AM	Lunch	
12:00 PM	Transporation to Airport	Bus, Driver
	Alaska Airlines Depart 13:55	

Sept 15 2005 Field M&C

Charter Corrosion II.A.6
9105

Commitment to Corrosion Monitoring Year 2005

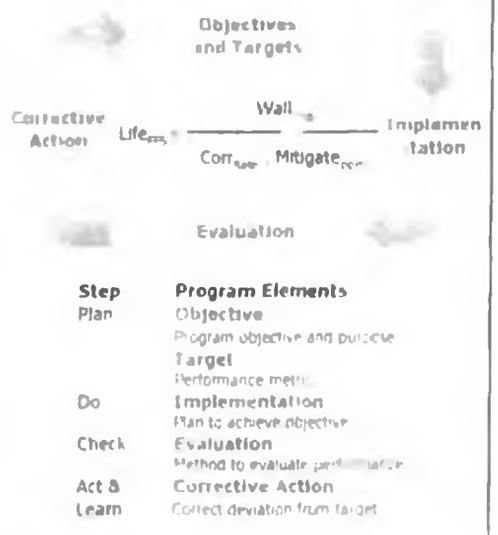
Meet and Confer X
September 15th, 2005

Outline

- **GPB**
  - Corrosion Management Program Overview
  - Overall Activity
  - Goals & Objectives
  - Corrosion Monitoring
  - Int/Ext Inspection
  - Cased Piping Inspection
  - In-line Inspection
  - Corrective Actions
  - 2005 Leaks & Repairs
  - Summary

Corrosion Management Program

- **Strategic Objectives**
  1. Minimize HSE Impacts
     - Corrosion loss of containment
  2. Fit-for-service Infrastructure
     - Remaining field life
- Future Major Gas Development
  - Utilize existing facilities
  - Gas sales demands longevity (50+ years)



Step	Program Elements
Plan	**Objective** Program objective and purpose
	Target Performance metric
Do	**Implementation** Plan to achieve objective
Check	**Evaluation** Method to evaluate performance
Act & Learn	**Corrective Action** Correct deviation from target

GPB Corrosion Mitigation Activity

	2002	2003	2004	Aug'05	
Internal Inspections					
Well lines	13,176	11,251	12,969	5,138	RT UT
Flow lines	13,234	14,131	14,284	8,925	RT UT
External Inspections					
Well lines	23,949	10,821	14,231	12,098	TRT
Flow lines	18,727	24,258	21,153	8,047	TRT
Total	**69,086**	**60,461**	**62,637**	**34,208**	
Coupon Activity	7,596	7,362	7,185	5,324	pulls
ER Probe Activity	82	85	87	89	sites
Chemical Volume	2,450,000	2,520,000	2,670,000	1,630,000	gal
Concentration	143	147	151	149	ppm
Water Cut %	71	72	74	76	%

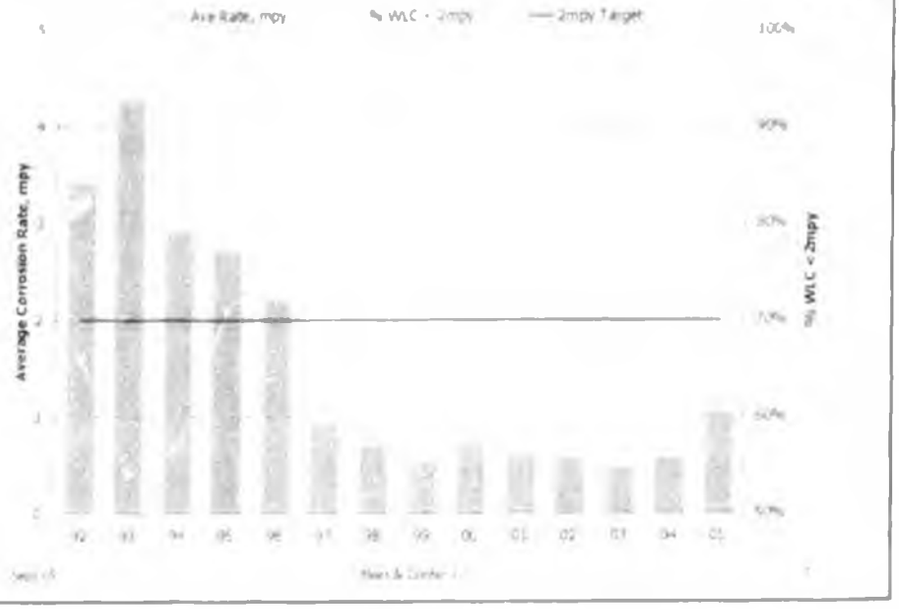
GPB 2005 Goals and Objectives

	2005 Plan	'05 Update
Corrosion Monitoring		
Coupon – no significant changes	No change	
ER probes – no significant changes	No change	
Inspection Program		
External Corrosion Inspection		
Weld pack inspections ~35,000	No change	~ 32,000
Cased Piping Inspection		
Long-term management	No Change	
Chemical Mitigation		
Rapid Screen testing (40)	No Change	
Large scale facility trial (1)	No Change	~ Compat
Technology		
ER-probe remote monitoring pilot	Planned	
Remote tank strap reading demo	Planned	
Fixed Monitoring for Cased Piping	No Change	

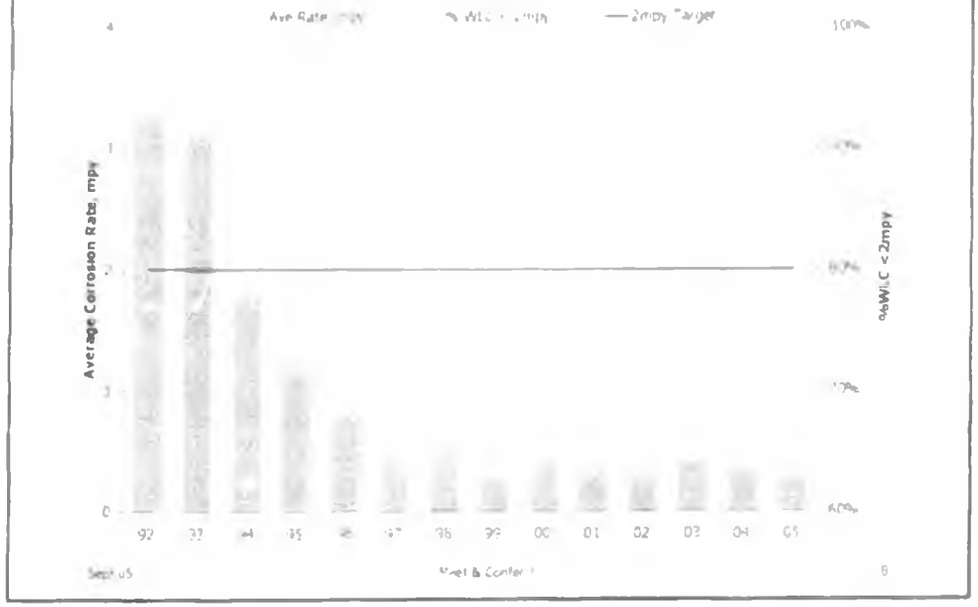
3-Phase Monitoring and Mitigation

- **Weight Loss Coupons**
  - Well lines
  - Flow lines
- **Corrosion Inhibitor Injection**
  - Concentration
  - Unplanned Events

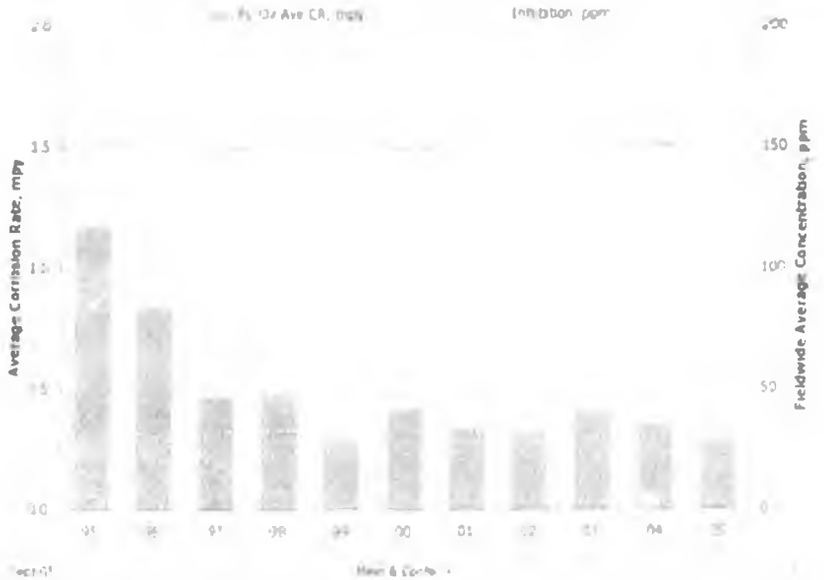
3 Phase – Well Line Coupons



3 Phase – Flow Line Coupons



Corrosion Inhibitor Concentration



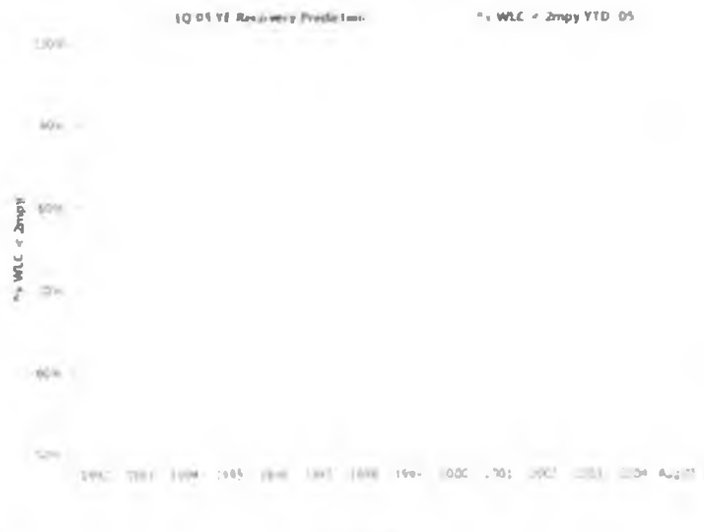
Unplanned Chemical Event - I

- **Chemical instability at winter temperatures**
  - Precipitates formed at colder temperatures
    - Plugged trunk and lateral CI injection system
  - Cause
    - Several changes in manufacturing process to incumbent chemistry
  - Current Status
    - All plugged locations are back online – normal summer
    - Extensive changes to manufacturer's process and procedures
      - Process changes follow an internal MOC process
      - Standardized on a stress test
  - 05-06 Winter Plan
    - Using chemistry that has been through the revised processes and testing

Unplanned Chemical Event - II

- **Trial chemical material incompatibility**
  - Large scale trial using DS01 and DS12
    - Trial chemical identified through screening program
    - 5 pinhole leaks at DS12 in SS316L tubing
    - Failure Analysis
      - Trial chemical is not compatible with SS316L
  - Pressure tested the systems
    - DS01 passed and returned to service in May-05
    - DS12 failed
      - Wells are being batch treated
      - Common lines are treated with continuous injection
      - Injection system is being re-designed as gas lift injection
      - In-service target mid-2006

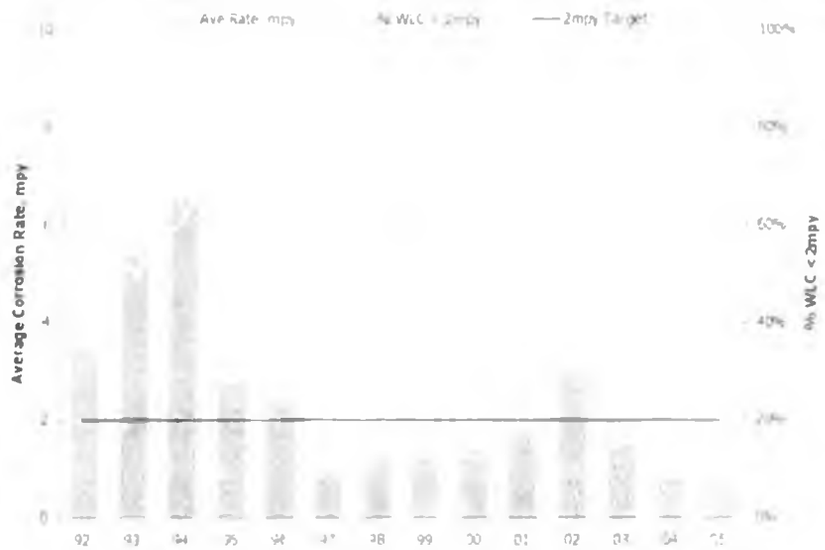
2005 Forecasted Impact (Well lines)



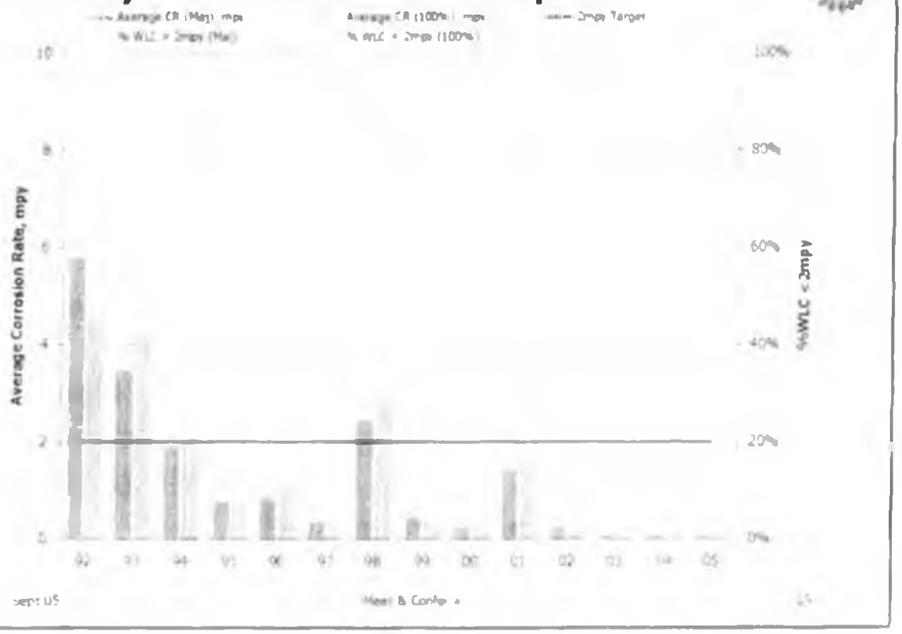
Water Injection Systems

- **Weight Loss Coupons**
  - Flow lines
  - Produced Water system
  - Seawater system

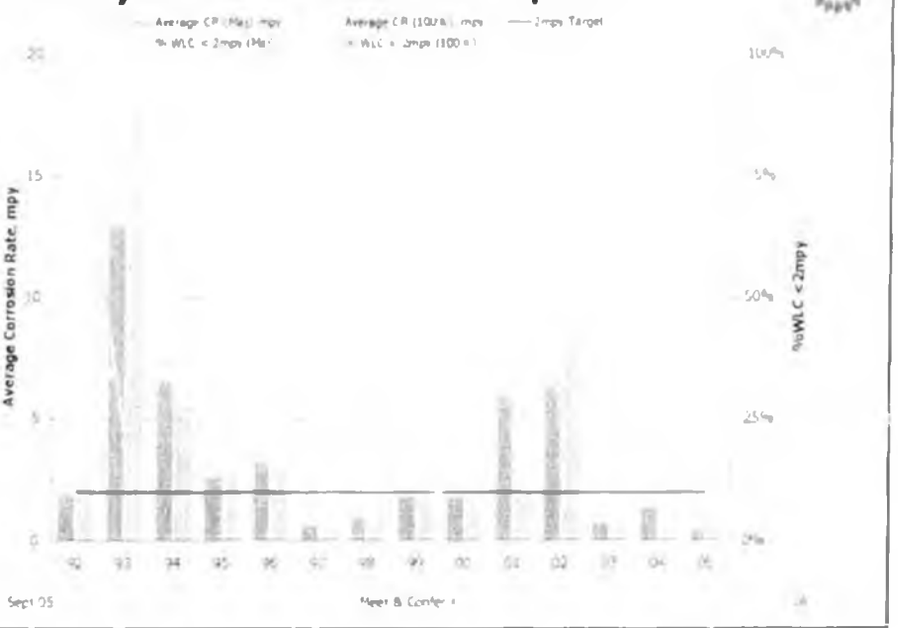
Aggregate Water Injection - Flow Line Coupons



PW System – Well Line Coupons



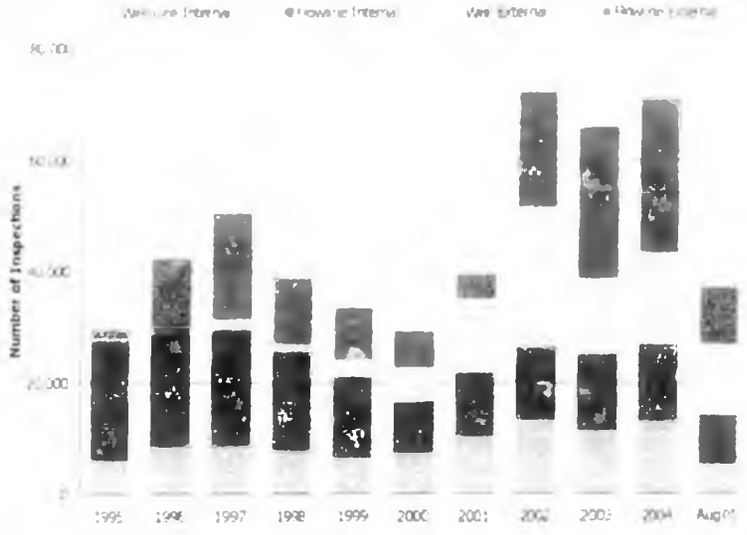
SW System – Well Line Coupons



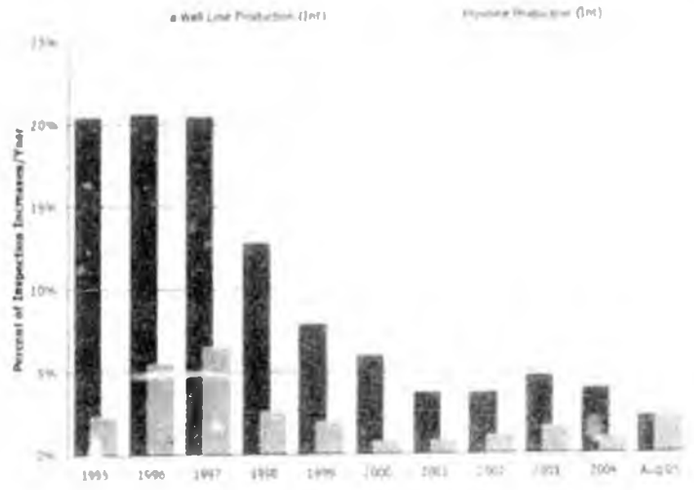
Inspection Program

- **Activity Level YTD**
- **Internal Inspection**
  - 3 phase – flow and well line
  - Water injection – flow and well line
- **External Inspection**
- **Cased Piping Inspection**
- **In-line Inspection**

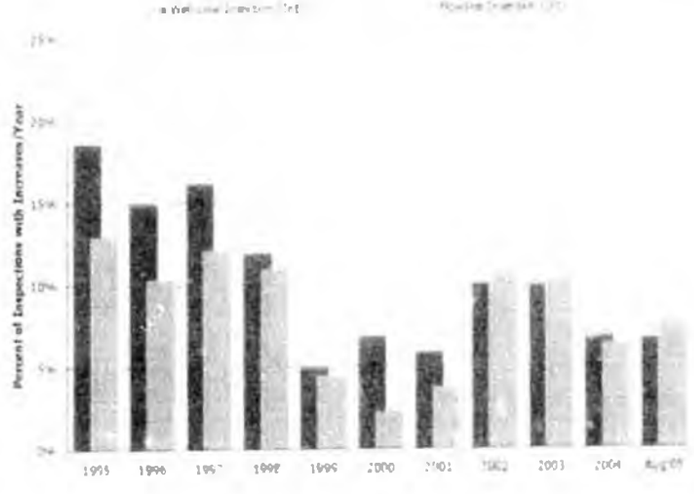
Flow/Well Line Inspection Activity



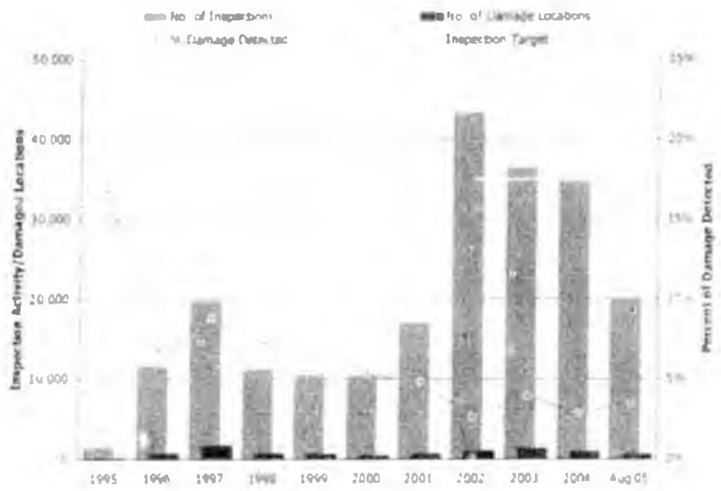
3-Phase Inspection Program - Increases



Injection Inspection Program - Increases



External Corrosion Inspection



Cased Pipe Program Activity Aug '05

- **Cased Pipe Inspection**
  - ~100 planned segments
    - Guided Wave MsS
    - Smart Pig MFL (3 runs)
      - Completed August
- **Cased Pipe Excavations**
  - Full excavation: F, X and Z
    - F & X from previous inspection
      - Moderate CUI anticipated
    - Z Pad proactive replacement
      - CS to Duplex
        - 4 segments (O/W/E)
  - Planned excavation
    - S Pad & Spine Rd/GC1
      - Tentative/No activity yet

In-line Inspection

- **3 Smart Pig Inspections**
  - Runs completed end of August
  - Reports due ~Oct/Nov

Equipment	Service	Diameter	Previous ILI	From	To	Length (miles)
E-36	3 Phase	24	1999	E-Pad	GC-1	2.9
W-74	3 Phase	24	1997	W-Pad	EWE Junction	0.9
Z-74	3 Phase	24	1997	Z-Pad	EWE Junction	3.3

2005 YTD Corrective Action/Leaks

- **Corrective Actions**
  - Inhibition
  - Repairs
- **Leak Details**
  - Loss of containment
- **Structural Repairs**
  - Subsidence

Flow Line Corrective Action

- **Weight Loss Coupons**
  - 3 chemical increases

Equip ID	MPY	Cause	Action
[illegible]	2.18	CI Plugging	Batch treat, re-establish continuous injection
[illegible]	4.54	Increase corrosivity	CI increased via ER probe
[illegible]	[illegible]	CI incompatibility	Re-establish inhibition with common line pump
[illegible]	2.25	CI Plugging	Batch treat to establish continuous injection
147	2.67	Increased corrosivity	10% CI increase
046	2.41	Pump down	Repaired common line pump
345	2.48	Increased corrosivity	10% CI increase
347	2.48	Increased corrosivity	10% CI increase

- **ER Probes**
  - 7 chemical increases

Equip ID	No. of Actions	Cause	Action
248/345	1	Increased corrosivity	10%
PTMCS0103	1	Increased corrosivity	10%
M-34	1	Increased corrosivity	5%
W2ED	1	Increased corrosivity	5%
345	1	Increased corrosivity	10%

- **Inspection Program**
  - 1 chemical increase

Equip ID	No. of Actions	Cause	Action
PTMCLS0109	1	Increased corrosivity	10%

Piping Repairs Jan - Aug '05

- **Repair Summary**
  1. **External corrosion**

Service	Type	Internal	External	Mechanical	Total
Oil	RL	1	12	1	14
	WL	-	6	-	6
Water	RL	2	-	-	2
	WL	4	5	-	9
Gas	RL	-	2	2	4
	WL	-	1	-	1
Total		**7**	**26**	**3**	**36**

2005 YTD Leaks

- **Leak Summary**
  - Total of 4 Leaks

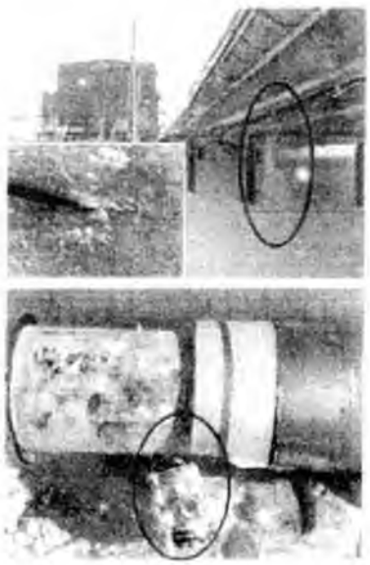
	Surface	
	INT	EXT
WL	1	2
FL	-	1

	Service			
	OIL	SW	PW	GAS
WL	-	1	-	2
FL	1	-	-	-

	Mechanism			
	CO_2	MIC	CUI	Mech
WL	-	1	1	1
FL	-	-	-	1

2005 Spill Detail

- **DS11 8" SW Injector**
  - Leak detected - Feb
  - SW Injector
  - Internal corrosion
  - 270 gallon spill
  - Section replacement
    - ~40 ft new pipe
- **M-74 24" LDF**
  - Leak detected - April
  - 3-phase production
  - Mechanical
  - 4 gallon spill
  - Section replacement
    - ~50 ft new pipe



2005 Spill Detail

- **DS14 – 6" Warm-up gas**
  - Leak detected - April
  - SW Injector
  - Low cycle fatigue @ weld
  - 500 – 1,000 gallon spill
  - Segment isolated
    - Cut-out and blinded

- **DS16 – 3" 16/17AL**
  - Leak detected - July
  - Gas lift
  - External corrosion @ weld pack
  - Small gas release
    - Isolated – No repair to date

A Pad Well Line Pipe Supports

- **Subsidence**
  - Structural instability
    - Exacerbated by rapid thaw
  - 37 well Lines
    - 16 Production
    - 7 Injection (4 PW 3 MI)
    - 14 Gas Lift
- **Corrective Action**
  - Production shut-in
  - Area drained/dammed
  - Top lines cut-out
  - Pipe supported/secured
  - Lower lines/supports inspected
- **In progress**
  - Return to Service plans
    - Remove/demolish equip not needed
    - Restore value-added equipment

PW Injection – '05 Improvement Plan

- **Produced Water performance improvement**
  - Supplemental injection increase
    - 20 to 80ppm
  - Maintenance Pigging
    - Increase focus on maintenance pigging
      - Trap repair/maintenance
      - KPI Tracking/Reporting
- **Repair/Replace**
  - FEL near-term repairs and replacements
    - Proactive –vs. reactive
- **Benefits**
  - Short term high cost – Long term lower cost
    - HSE risks are reduced/mitigated
    - Water injection capabilities available to EOFL

GPB Summary

- **Internal Corrosion**
  - 3 Phase Systems
    - Flow lines showing sustained performance
    - Well lines show decreased performance
      - Result of 2 chemical events
  - Water Injection Systems
    - Significant improvement area
      - Increased supplemental inhibition
      - Increase focus on maintenance pigging
- **External Corrosion**
  - Still an area for improvement
    - Appropriate activity level is being assessed
- **Cased Pipe**
  - Executing long-term management strategy
    - Continue to drive improvement

Outline

- **ACT**
  - ACT Description
  - Endicott
  - Milne Point
  - Northstar
  - Badami
  - ACT Overall
  - 2005 Leaks & Repairs
  - Summary

Alaska Consolidated Team (ACT)

- **Producing Fields**
  - Endicott
  - Milne Point
  - Badami
  - Northstar
- **Relative Comparison**
  - ACT smaller than GPB
  - Differences in age
  - Non-common carrier FL
    - None at Northstar
    - None at Badami
  - Materials of construction

Metric	ACT	GPB	[illegible]
Production Trains	4	[illegible]	[illegible]
Prod and Inj Wells	[illegible]	1475	[illegible]
Non-common carrier FL	[illegible]	[illegible]	[illegible]
Acreage	[illegible]	[illegible]	[illegible]

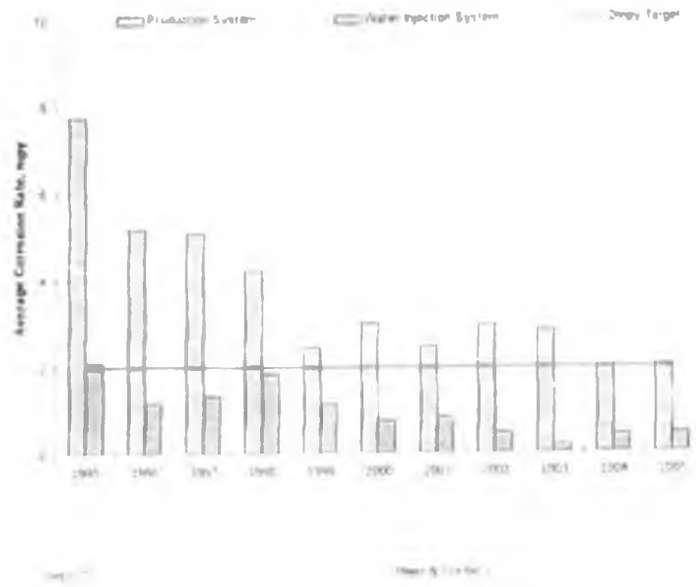
ACT Corrosion Mitigation Activity

		2002	2003	2004	August, 2005
Internal Inspections					
Endicott		1686	2072	2216	2302
Milne Point		1601	4388	4048	2301
Northstar		149	204	327	271
Badami		5	29	26	9
External Inspections					
Endicott		40	856	731	30
Milne Point		70	1,583	1738	15
	Total	**3551**	**9132**	**9086**	**4928**
Coupon Activity		348	511	464	175
Chemical Volume					
Produced Water		NA	101835	86951	92962
Three Phase		NA	37595	31239	23558
	Total		**139430**	**118190**	**116521**

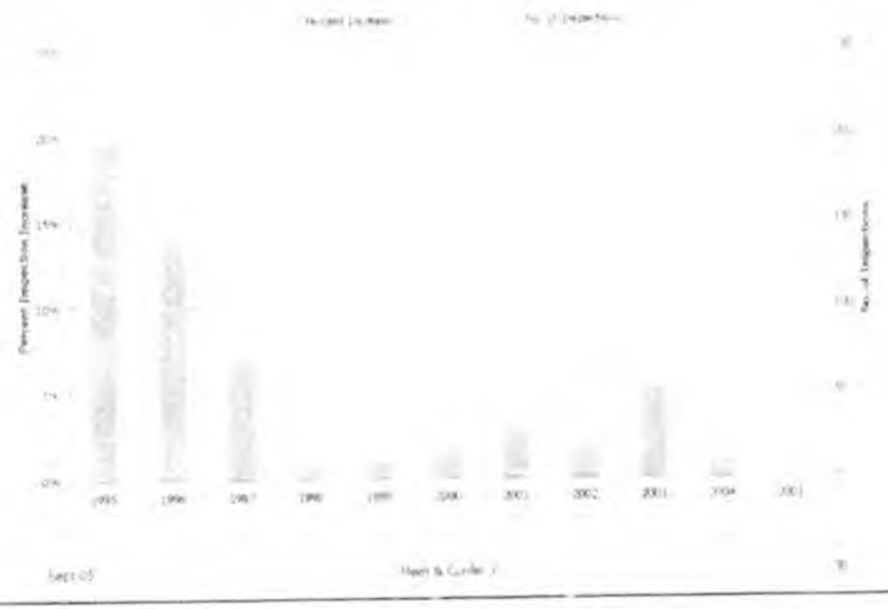
Endicott Overview

- **Production System**
  - Primarily Duplex Stainless Steel
  - Exception are the carbon steel C-spools
    - Velocity monitoring
    - Inspection program
    - Manage to repair/replace
- **PW/SW Injection System**
  - Inter Island Water Line (IIWL) main concern
    - Trial of increasing inhibition and eliminating biocide appears successful
    - No increases in inspection damage to date in 2005 in IIWL
- **External Corrosion**
  - In progress
    - Significant damage in high pressure gas injection well line 5-01
      - 360 degree external damage found in cased portion upon dig
      - Repair options in progress

Endicott Corrosion Monitoring



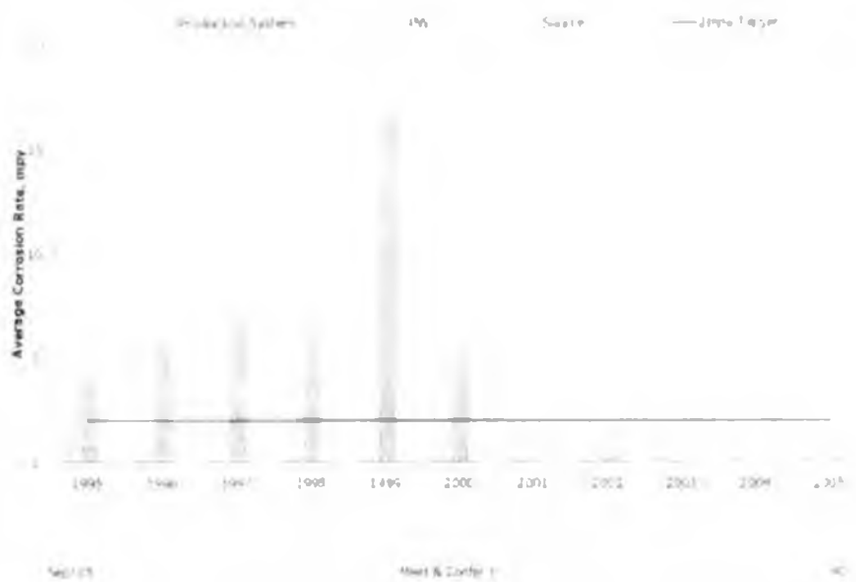
Endicott IIWL Quarterly UT Inspections



Milne Point Unit Overview

- **Production System**
  - Initiating inhibition program
    - K-Pad flow line initiated in 2001
    - S-Pad inhibited in power fluid
    - F-L-C production flow line inhibition initiated in 2003
    - Remaining facilities under review for inhibition
      - Flow characteristics
      - Inspection and corrosion monitoring data
- **Water Injection system**
  - Inhibition initiated in 2000
  - Along with more aggressive maintenance pigging program
  - Significant decrease in corrosion activity
- **External Corrosion**
  - External and dig programs in progress
  - Too early for determinations

MPU Corrosion Monitoring



Badami and Northstar

- **Badami**
  - Began production in 1998
  - Production below expectations
  - No water injection system
    - Water cut <1%
  - No significant corrosion experienced
  - Warm shut-in in Aug-2003
  - Performed baseline and follow-up inspections of equipment
  - Restart of field likely in 2005
- **Northstar**
  - Began production in late 2001
  - Continuous inhibition into well production lines
    - Plan to relocate CI injection further upstream in progress
  - No water injection system
    - Water cut ~4%
    - Concern over dissolved oxygen from mud-plant operation and effluent system
  - Corrosion monitoring program development continues
  - Inspection baseline and historical record establishment continues
  - Corrosion inhibitor usage tracking in place as of May, 2005

Northstar Corrosion Monitoring

System	Location	Access Fittings	%WLC <2mpy
Oil Production			
	Upstream of CI Injection	12	17%
	Downstream of CI Injection	2	50%
Water Disposal			
	Water Disposal	2	50%
	Upstream of Mud and Effluent Addition	8	100%

ACT – Leaks and Repairs

- **One- Corrosion related spill**
- **One – Erosion related spill**
  - Endicott
- **Zero - Mechanical related spills**
- **14 - Repairs/replacement activity**
  - Endicott - 8 internal and 1 mechanical (fatigue) repair
  - Milne Point – 1 internal, 4 external repairs

Endicott Corrosion Related Spills

- **Well 1-49 leaked at C-Spool US of choke**
  - No liquids, small gas leak only
  - Corrosion in HAZ of elbow weld
- **Corrective Action**
  - Inspection procedure modified from 1 to 2 exposures per elbow to ensure 100% coverage of elbow and both girth welds.
- **Well 1-02 leaked at elbow downstream of choke**
  - Release contained quickly as the well tender was on site
  - Spill was all within well house
  - Well was long term shut-in well. Root cause of failure was erosion in elbow.
- **Corrective Action**
  - POP procedure and ERM program reviewed
    - Process/communication improvement
  - Elbow replaced with target tee.

ACT Repair Tables

Endicott Repair Table

Service	Type	Internal	External	Mechanical
Oil	R			
	W	7		1
Gas	R			
	W			
PW	R	1		
	W			
	Total	8	0	1

Milne Point Repair Table

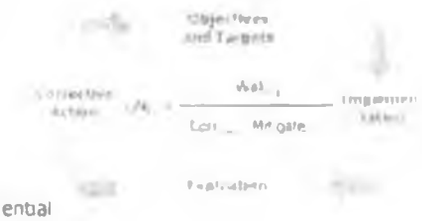
Service	Type	Internal	External	Mechanical
Oil	R	1	1	
	W			
Gas	R			
	W			
PW	R		3	
	W			
	Total	1	4	0

ACT 2005 Goals and Objectives

	05 Plan	05YTD
Endicott		
Inter-Island Water Line and PW/SW well lines		
Reduced corrosion based on inspection data		
[illegible] biocide and SRB [illegible]	Monitor	In progress
Emphasis on consistent reliable maintenance practices	Continue	In progress
Northstar		
Continue to build monitoring and inspection history	Continue	In progress
Re-locate 3-phase CI to wellheads	Continue	In progress
Monitor effects of mud plant DO on PW disposal system	Monitor	In progress
Improve CI tracking and reporting	Plan	
Badami		
Baseline and follow-up inspection as part of mothball program	Continue	
Milne Point Unit		
Improve CI tracking and reporting	Plan	Plan
Review of corrosion monitoring locations	Plan	

Overall Summary

- **Delivery of Objectives**
  - Long term Fitness-for-Service
- **Corrosion Management System**
  - Integration of key elements
    - Remaining wall – Inspection program
    - Rate – Corrosion monitoring
    - Mitigation – Corrosion inhibition
- **GPB Focus for 2005**
  - 3-Phase – Recover performance
  - SW – DO and MIC control
  - PW – Increased Focus
- **ACT Focus for 2005**
  - Badami – Monitor for shut-in status, potential restart
  - Northstar – Move CI Upstream, Reporting
  - Endicott – Continue
  - Milne Point – Coupon Locations, Reporting



CPA

ADEC Corrosion Charter
Meet & Confer - Field Visit 2005
September 27 – 29, 2004

Day	Time	Location	Subject
Tue	17 40 – 18 00	KOC	Arrival by Flight 431 & Check in
	18 00 – 18 30	KOC 223	Safety Orientation / Camp Video – HSE Supervisor (as required)
	18 30 – 19 30	Dining	Dinner with Lynn Tyler & Corrosion Chairs GKA Management Team, HSE personnel as available
	19 30 – 20 30	KOC 223	Review of Field Visit Agenda, Builds
			Adjourn
Wed	06 30 – 07 30	KOC	Breakfast *
	07 30 – 08 30	KOC 223	Corrosion Morning Meeting / Meet with Coordinators
	08 30 – 11 00	KOC 223	ADEC Issues Discussion (RBI, coupon locations, TWI, maint, Pigging)
	11 00 – 13 00	KOC 223	Lunch & Meet with Operations Leadership
	13 00 – 15 00	KOC 223	Inspection/Corrosion Program Overview, Q & A
	15 00 – 17 00	KOC	Free Time
	17 15 – 18 30	KOC	Dinner* with Lynn Tyler & Corrosion Chairs
	18 30 – 19 30	KOC	Day's Review
			Adjourn
Thur	06 30 – 07 30	KOC	Breakfast Check-out of Room
	7 30 – 11 00		Field Visits** 2H Spill Site Select Coupon & Probe Locations 1H Dig Site
	11 00 – 13 00	Dining	Lunch & Meet with Operations Leadership
	13 00 – 15 00p	D-Wing	Exit Issues Meeting (ADEC concerns)
	15.00 –	KOC	Depart KRU, Flight 352

*Opportunity to visit with select Operations Leadership personnel as available

** Subject to change depending on field activities and priorities