

**PRUDHOE
BAY
CORROSION
CRISIS,
8/18/06
(FILE 5)**

SPRING 2004

BP



BP and State of Alaska Charter Agreement
Corrosion Monitoring Review 2003
Meet and Confer VII

April 30th, 2004



Outline

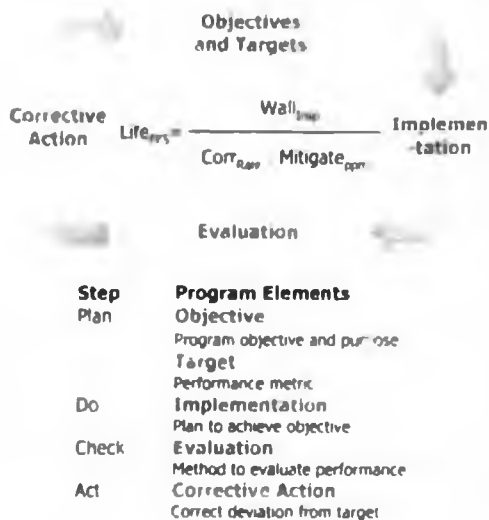
- ▶ **Corrosion Management Program/Objectives**
- ▶ **Greater Prudhoe Bay (GPB)**
 - » **Corrosion Mitigation Activity**
 - » **Internal Corrosion Review**
 - Corrosion Monitoring
 - Inspection
 - Mitigation
 - Corrective Actions
 - » **External Corrosion Review**
 - Inspection
 - Cased Piping Segments
- ▶ **Alaska Consolidated Team (ACT)**
 - » **GPB and ACT Comparison**
 - Size and corrosivity
 - » **ACT Corrosion Review**
 - Activity and System Summary
- ▶ **Summary**

Corrosion Management Program



► Strategic Objectives

- Minimize HSE Impacts
 - Corrosion loss of containment
- Fit-for-service Infrastructure
 - Remaining field life
 - With gas sales 50+ years
- Infrastructure Integrity
 - Satellite fields
 - Use of existing infrastructure
- Future Major Gas Development
 - Utilize existing facilities
 - Gas sales demands longevity



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GPB Corrosion Mitigation Activity



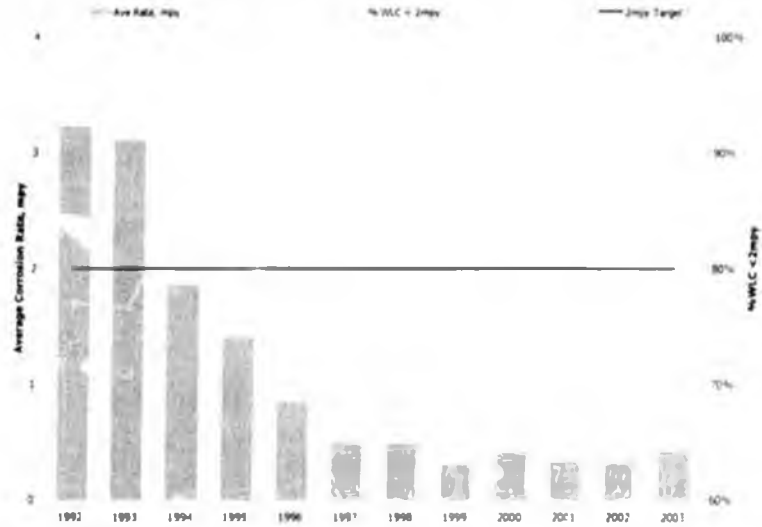
► Internal Inspections	2001	2002	2003
► Well lines	10,311	13,176	11,251
► Flow lines	11,618	13,234	14,131
► External Inspections			
► Well lines	13,071	23,949	10,821
► Flow lines	3,966	18,727	24,258
Total	38,966	69,086	60,461
► Coupon Activity	7,686	7,596	7,362 pulls
► ER Probe Activity	83	82	85 sites
► Chemical Volume	2,630,000	2,450,000	2,520,000 gal
	157	143	147 ppm

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3 Phase – Flow Line Coupons

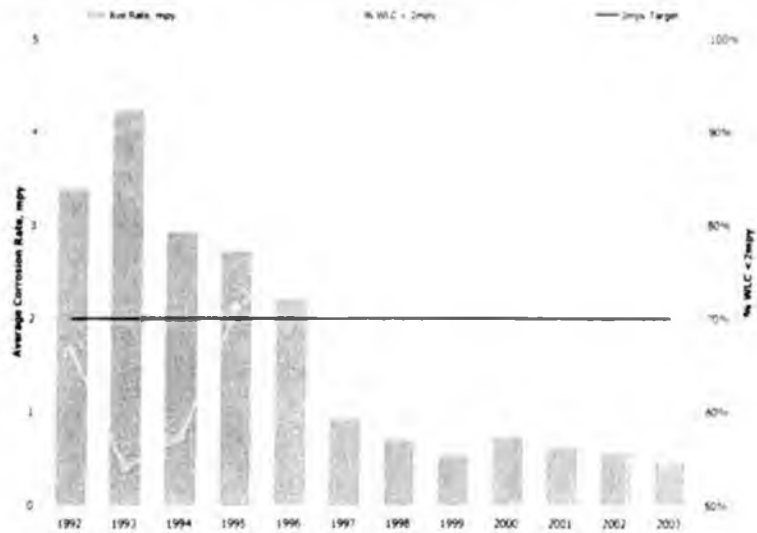


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3 Phase – Well Line Coupons

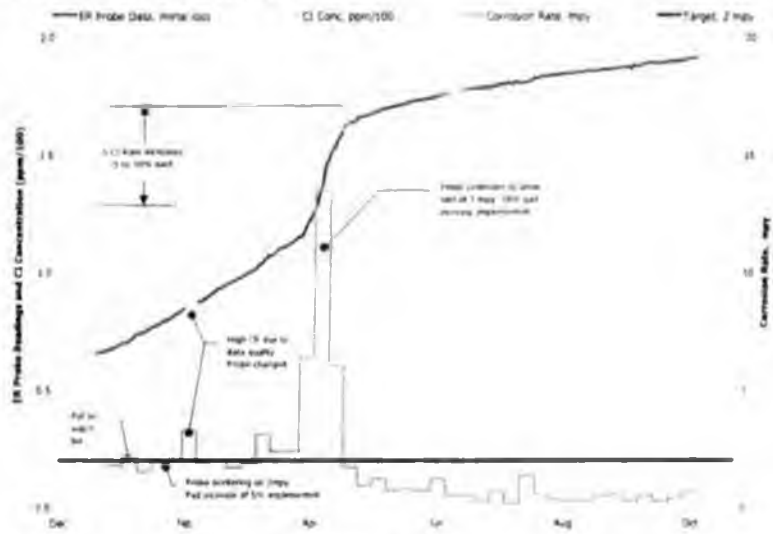


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ER Probe Example



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Monitoring Corrective Actions

ER Probe Corrective Actions

Equip ID	No of Action	Cause	Action
01D	5	Increased Corrosivity	Increased Cl by 30%
01D & 01C	1	Increased Corrosivity	Increased Cl by 5%
03D	3	Increased Corrosivity	Increased Cl by 25%
05D	1	Increased Corrosivity	Batch Pad Increased Cl 25 gal
16D	2	Increased Corrosivity	Increased Cl by 10%
17D	1	Increased Corrosivity	Increased Cl by 5%
F-49	1	Increased Corrosivity	Increased Cl by 5%
U-384	1	Increased Corrosivity	Increased Cl by 5%
V-36	6	Increased Corrosivity	Increased Cl by 57%

Coupon Corrective Actions

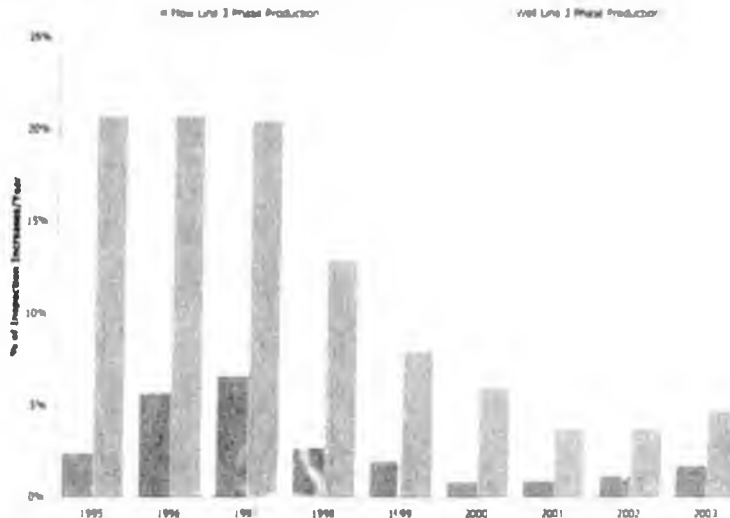
Equip ID	No of Action	Cause	Action
14D	1	Increased Corrosivity	Increased Cl by 10%
Q-01	1	Increased Corrosivity	Increased Cl, Dilute Pad
Q-01	1	Line Shut-In	No Action
Q-06	1	Line Shut-In	No Action
13B	1	Increased Corrosivity	10% Pad increase

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Flow and Well Line Inspection - Production



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Inspection Corrective Actions



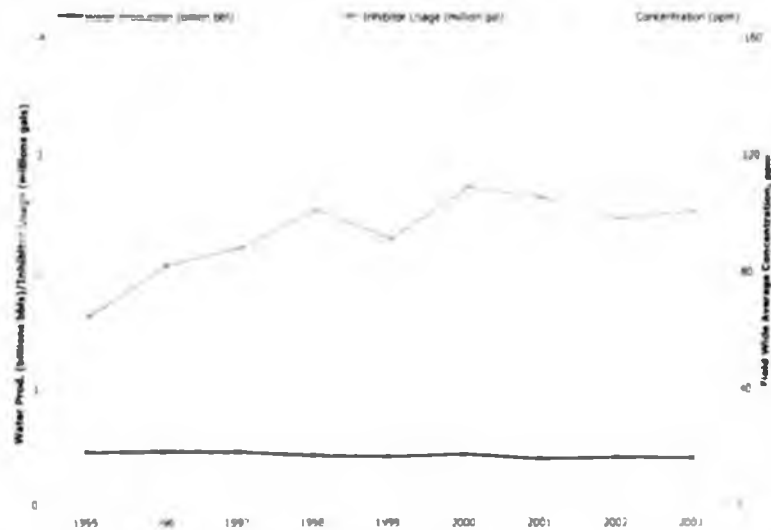
Equip ID	No. of Action	Cause	Action
Y-36	2	Increased Corrosivity	Increased CI by 20%
W-74	1	Increased Corrosivity	Increased CI by 10%
PMTCL	1	Increased Corrosivity	Increased CI by 20%
CL16C/17C	1	Increased Corrosivity	Increased CI by 5%

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Corrosion Inhibition Summary I



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Corrosion Inhibition Summary II



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Water Injection Systems



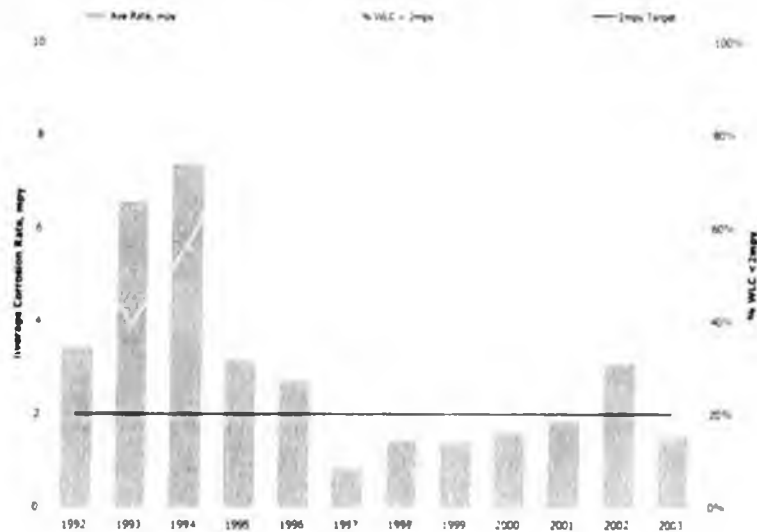
- ▶ **Flow Line Water Injection**
 - ▶ Mixed service
- ▶ **Reporting Format**
 - ▶ Single service
 - ▶ Service plurality
- ▶ **Weight Loss Coupons**
 - ▶ Produced Water system
 - ▶ Seawater system
- ▶ **SW Mitigation**
 - ▶ Oxygen control
 - ▶ Biocide and corrosion rate
- ▶ **Inspection**
 - ▶ Flow and well line

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Water Injection Flow Line

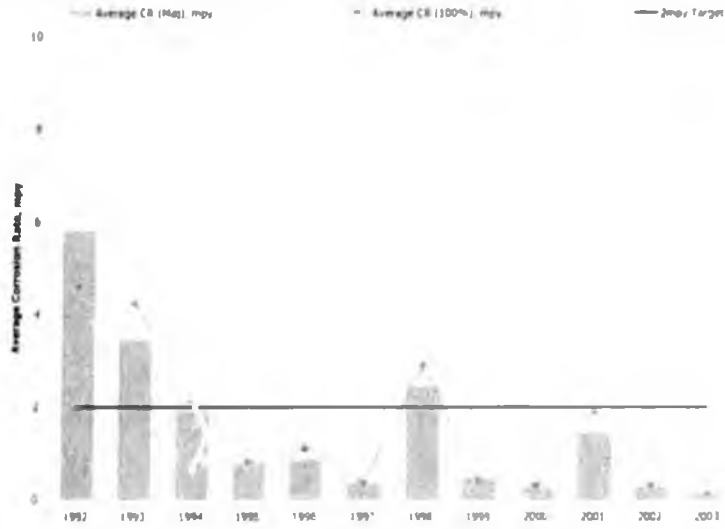


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PW System – Well Line

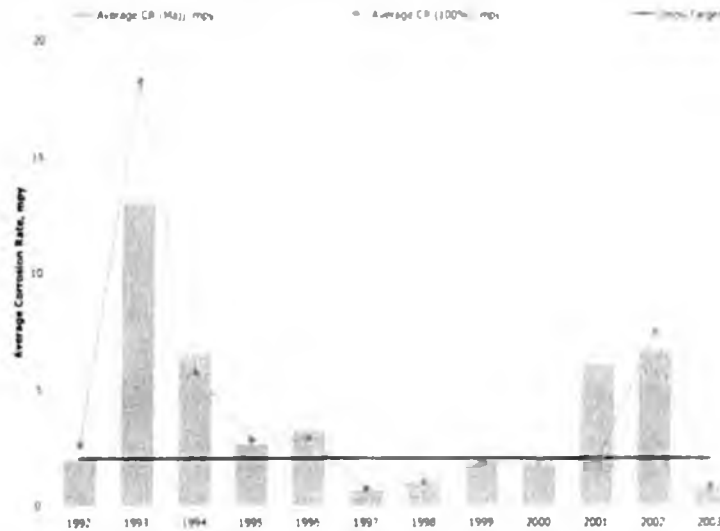


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SW System – Well Line

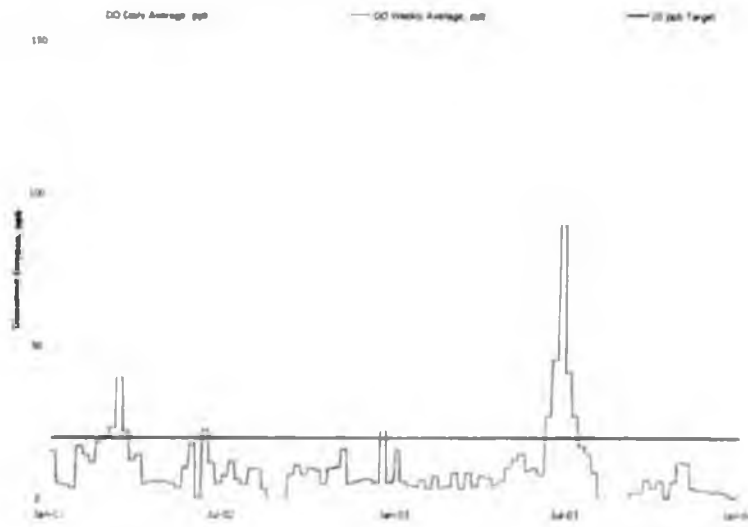


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2002 - 2003 Oxygen Control

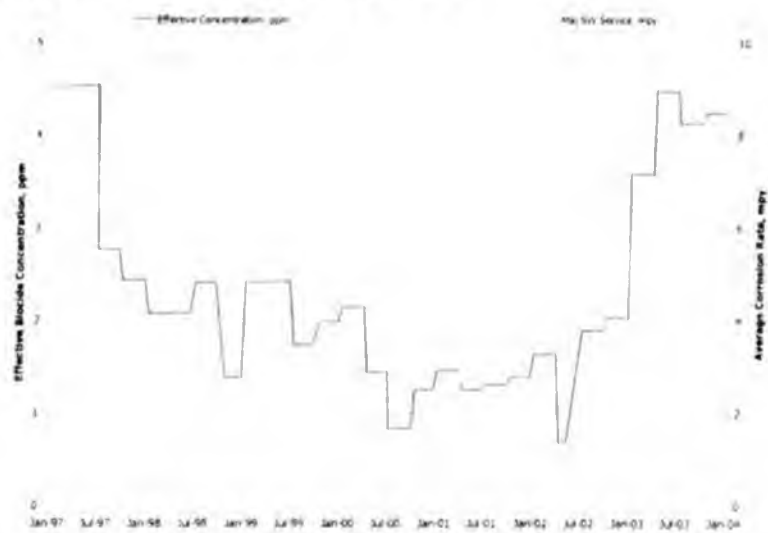


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Biocide and Corrosion Rate I



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Biocide and Corrosion Rate II

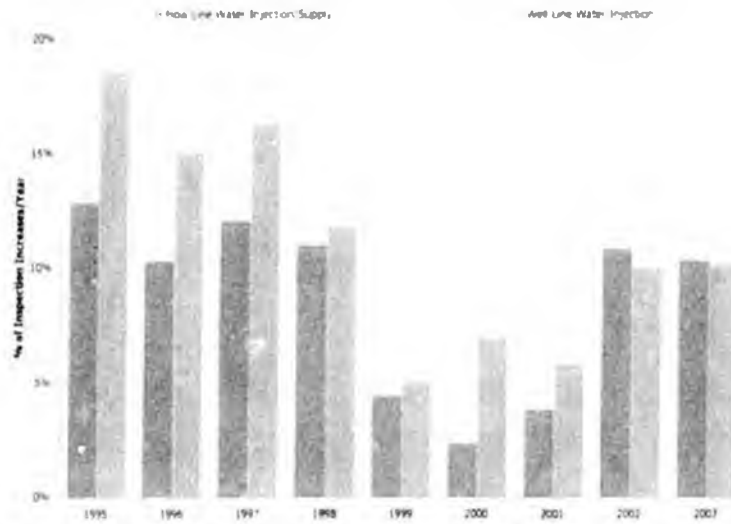


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Flow and Well Line Inspection - Injection

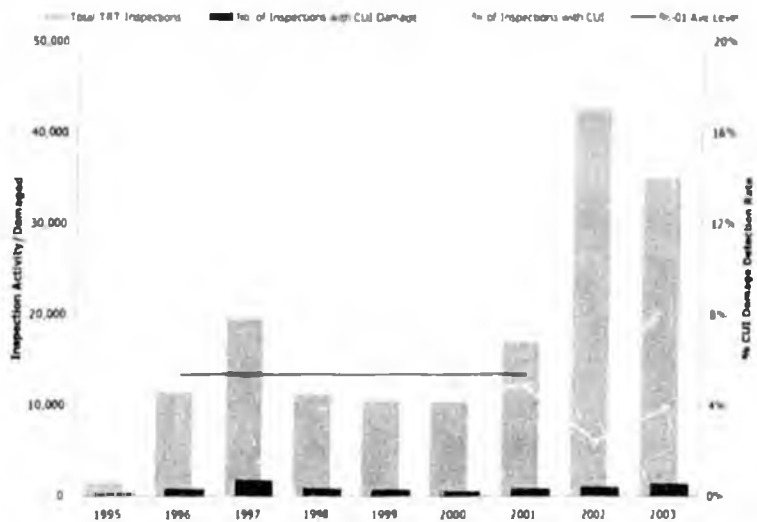


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External Corrosion Inspection

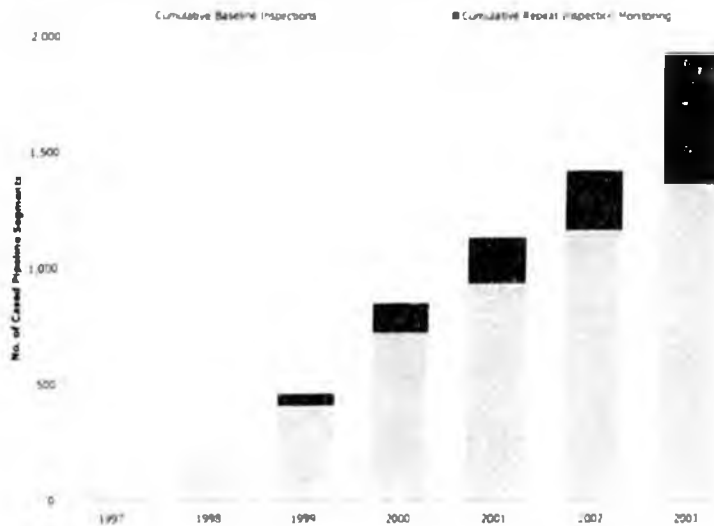


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Cased Piping Inspection I

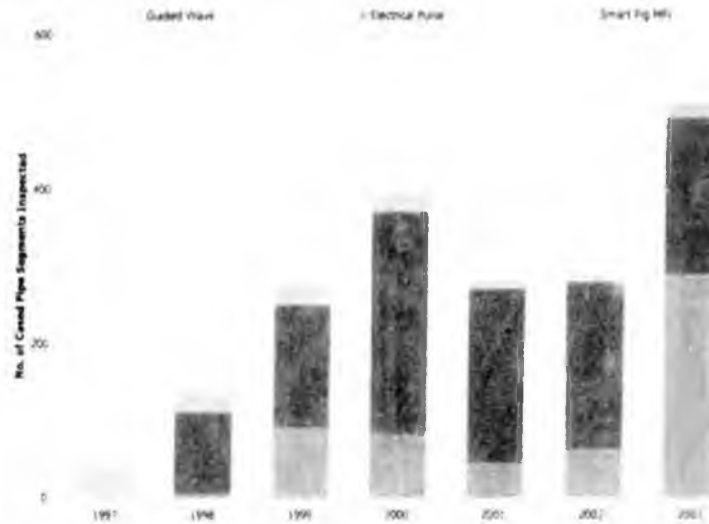


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Cased Piping Inspection II



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2003 Program Performance

- ▶ 1 Corrosion Related Leak
- ▶ 1 Mechanical Failure (WIV)

Service	Location	Type	Date	Mechanism	Volume
3-phase production	Y-36	FL Canbou X-ring	26-May-03	CUI	Oil - 1,325 gal PW - 4,986 gal
Gas	W/2-804	FL	08-Dec-03	Mech	NGL 0.5 gal

	Surface		Service				Mechanism			
	Int	Ext	OIL	SW	PW	Gas	CO ₂	Erosion	CUI	Mech
WL										
FL		2	1			1			1	1

▶ Repairs

- ▶▶ 86 repairs
 - 80 external corrosion
 - 3 internal/erosion
 - 3 mechanical damage

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2003 Overview

- ▶ **Maintained Three-Phase System**
 - ▶ Average corrosion rate and number of conformant lines improved
- ▶ **SW/PW Program Improvement**
 - ▶ Seawater
 - Performance improvement from implemented corrective actions
 - On-going effort to assure trend is confirmed and continued
 - ▶ Produced water
 - Supplemental corrosion inhibitor
 - Improved compatibility of upstream inhibition
- ▶ **Inspection Program**
 - ▶ Implementation of expanded External Corrosion Program
 - ~35,000 items versus historical ~13,000
 - ▶ Baseline inspection of cased piping segments
 - Completed baseline in 2003
 - Evolve the process to monitoring and corrective action

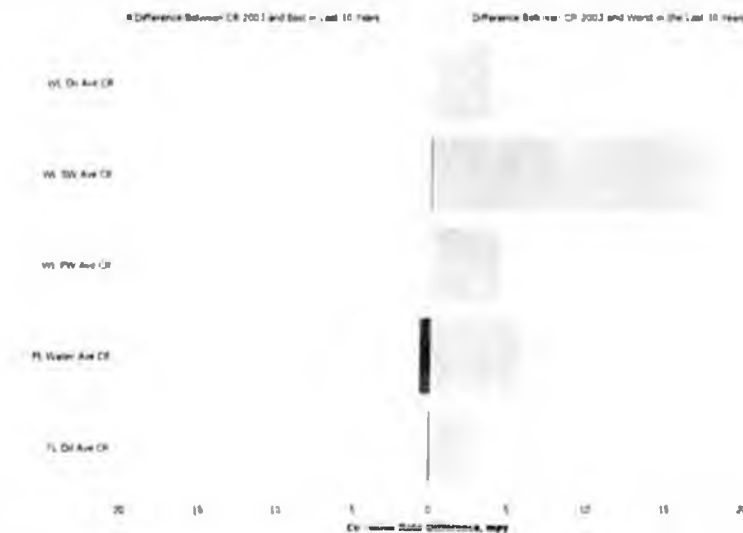
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2003 Corrosion Rate Status Against History



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GPB Goals and Objectives

	2003 Act	2004 Plan
▶ Corrosion Monitoring		
▶ Coupon – no significant changes	✓	No change
▶ ER probes – no significant changes	✓	No change
▶ Inspection Program		
▶ No significant changes planned for 2003	✓	No change
▶ External Corrosion Inspection		
▶ Weld pack inspections ~35,000	35,079	35,000
▶ Cased Piping Inspection		
▶ Complete baseline assessments	✓	Monitor
▶ Chemical Mitigation		
▶ Large scale changes – none planned	✓	Planned 05
▶ Testing/field trials – significant activity	>40	>40
▶ Technology		
▶ High speed/sensitivity ER probes	✓	No change
▶ Remote tank strap reading	x	No change

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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%

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ACT Corrosion Mitigation Activity

▶ Internal Inspections	2001	2002	2003
▶▶ Endicott	1,480	1,686	2,072
▶▶ Milne Point	629	1,601	4,388
▶▶ Northstar	16	149	204
▶▶ Badami	-	5	29
▶ External Inspections			
▶▶ Endicott	16	40	856
▶▶ Milne Point	1,570	70	1,583
Total	3,718	3,551	9,132
▶ Coupon Activity	378	348	511 pulls
▶ Chemical Volume			
▶▶ Produced Water	NA	NA	101,835 gal
▶▶ Three Phase	NA	NA	37,595 gal
Total			139,430 gal

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Relative Corrosivity of BP North Slope Fields

Field	Prod Fluid Characteristics				Material of Construction ^(a)			
	H ₂ O (%)	T (°F)	P _{CO₂} (%)	CR ^(b)	Production		Injection	
					WL	FL	WL	FL
GPB	72	150	12	H	CS+CI	CS+CI ^(c)	CS+CI	CS+CI
END	89	150	18	H	DSS	DSS	CS+CI	CS+CI
MPU	49	125	1.5	L/M	CS	CS ^(d)	CS+CI	CS+CI
Northstar	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

- CS is carbon steel, CI is corrosion inhibitor, DSS is duplex stainless steel
- Unmitigated relative corrosion rate, H - high, M - medium, and L - low
- There are a limited number of Duplex Stainless Steel flow lines @ GPB
- Two production flow lines are inhibited at MPU

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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
 - Biocide
 - Inhibition (increased in 2003)
- ▶ **External Corrosion**
 - ▶ Primary 2003 focus on high pressure gas system
 - No increases observed in repeat examinations

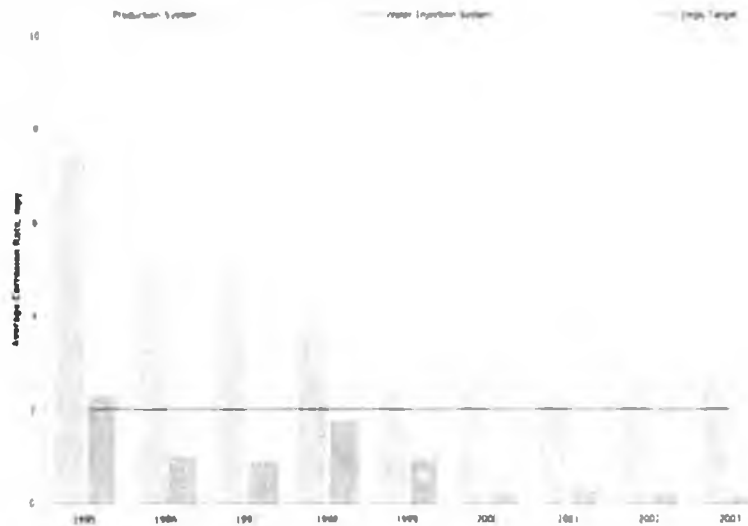
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Endicott Corrosion Monitoring

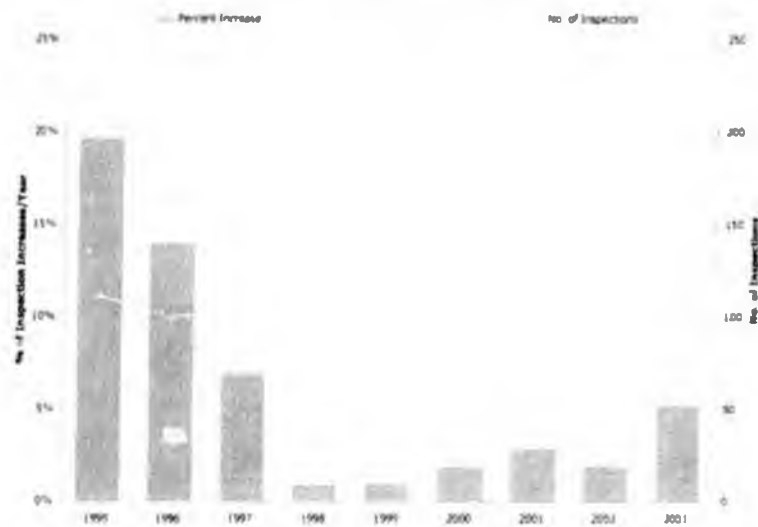


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Endicott IIWL Quarterly UT Inspections



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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

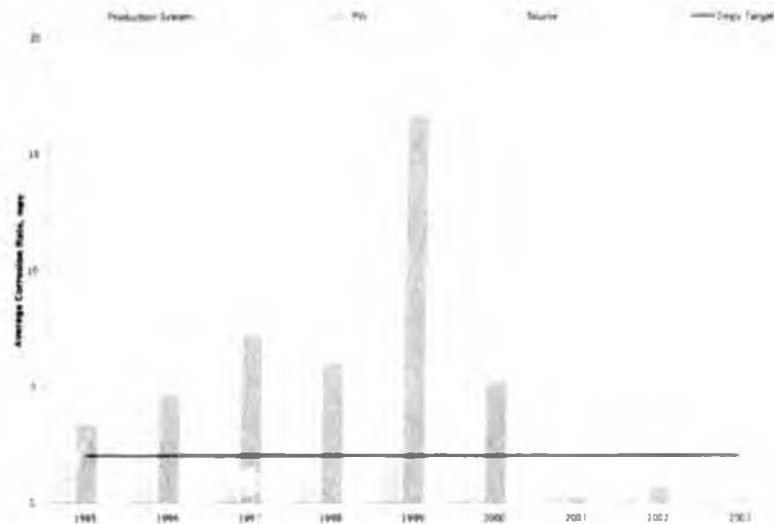
- Significant focus on external corrosion detection activities
 - 1,583 TRT inspections
- Excavations completed 66
 - Tract 14
 - L Pad

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MPU Corrosion Monitoring

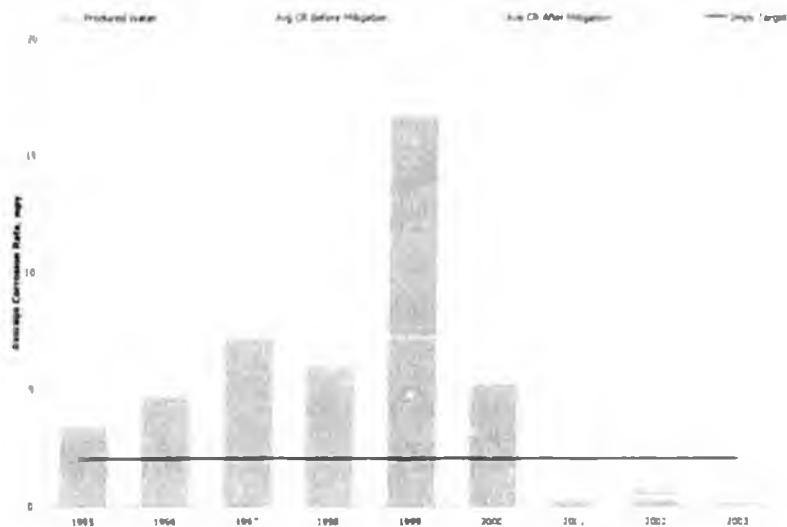


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MPU Produced Water Corrosion Rate Trend



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Badami and Northstar

▶ Badami

- ▶ On production since 1998
- ▶ Production well below expectations
- ▶ No water injection system
 - Water cut <1%
- ▶ No significant corrosion experienced
- ▶ Warm shut-in in August of 2003

▶ Northstar

- ▶ On stream in late 2001
- ▶ Continuous inhibition into well production lines
 - Working plan to relocate CI injection further upstream
- ▶ No water injection system
 - Water cut <1%
 - Concern over mud-plant operation
 - Planned for decommission in 2004
- ▶ Corrosion monitoring program development in progress
- ▶ Inspection baseline and historical record being established

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Northstar Corrosion Monitoring

System	Location	Access Fittings (Pad)	No. WLC >2 mpy	% WLC <2 mpy
Oil Production				
	Upstream of CI Injection	8	7	13%
	Downstream of CI Injection	4		100%
Water Disposal				
	Upstream of Mud Addition	6	-	100%
	Downstream of Mud Addition	1	1	0%

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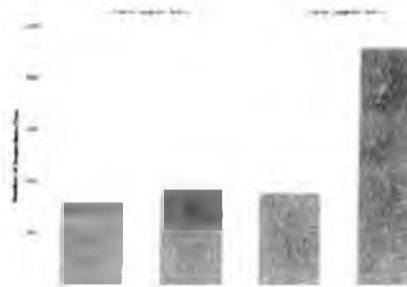
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ACT - Overall Inspection Activity



Surface		2000	2001	2002	2003
Endicott	Int	1,346	1,480	1,606	2,072
	Ext	16	16	40	856
	Total	1,362	1,496	1,726	2,928
Milne Point	Int	1,419	629	1,601	4,388
	Ext	378	1,577	70	1,583
	Total	1,797	2,206	1,671	5,971
Northstar	Int		16	149	204
	Ext				
	Total	-	16	149	204
Badami	Int	27		5	29
	Ext				
	Total	27	-	5	29
Grand Total		3,186	3,718	3,551	9,132



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ACT - Program Performance



- ▶ No corrosion or structural related spills
- ▶ Repair/replacement activity
 - ▶ Endicott - 1 sleeve, 6 spool replacements
 - ▶ Milne Point - 7 sleeve repairs

Service	Type	Int	Ext	Mechanical
Oil	FL	5	1	0
	WL	6	0	0
Gas	FL	0	0	0
	WL	0	1	0
PW	FL	0	0	0
	WL	1	0	0
Total		12	2	0

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ACT 2003 Goals and Objectives



	03 Act	04 Plan
▶ Endicott <ul style="list-style-type: none"> ▶ Inter-Island Water Line and PW/SW well lines <ul style="list-style-type: none"> • Slight increase based on inspection data - inhibitor increase Apr-03 • Emphasis on consistent/reliable maintenance pigging 	✓	Monitor Continue
▶ Northstar <ul style="list-style-type: none"> ▶ Continue to establish monitoring and inspection history ▶ Inspection and mitigation programs responding as appropriate 	✓	Continue
▶ Badami <ul style="list-style-type: none"> ▶ Field put in warm shut-in/mothball ▶ Baseline and follow-up inspection as part of 'mothball' program 	✓	Plan
▶ Milne Point Unit <ul style="list-style-type: none"> ▶ Continuing to expand on the inspection program ▶ Inspection and mitigation programs responding as appropriate ▶ Developing 3 Phase System Program <ul style="list-style-type: none"> • Continued analysis of production flow lines • Initiate corrosion inhibition as applicable ▶ Buried flow lines <ul style="list-style-type: none"> • Trial GUT technology that uses fixed monitoring locations 	✓	Continue Continue Continue Trial

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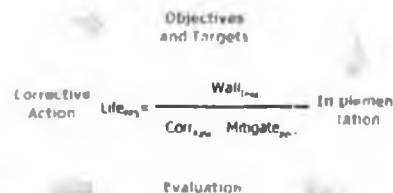
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Summary



- ▶ **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 2004**
 - ▶ 3-Phase – Maintain performance
 - ▶ SW – DO and MIC control
 - ▶ PW – Monitor effects of chemical change
- ▶ **ACT Focus for 2004**
 - ▶ Badami – monitor for shut-in status
 - ▶ Northstar – respond to baseline data
 - ▶ Endicott – PW/SW injection system
 - ▶ Milne Point – 3 phase production system



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CPA

ConocoPhillips

Commitment To Corrosion Monitoring Overview

presented to the

7th Meet & Confer

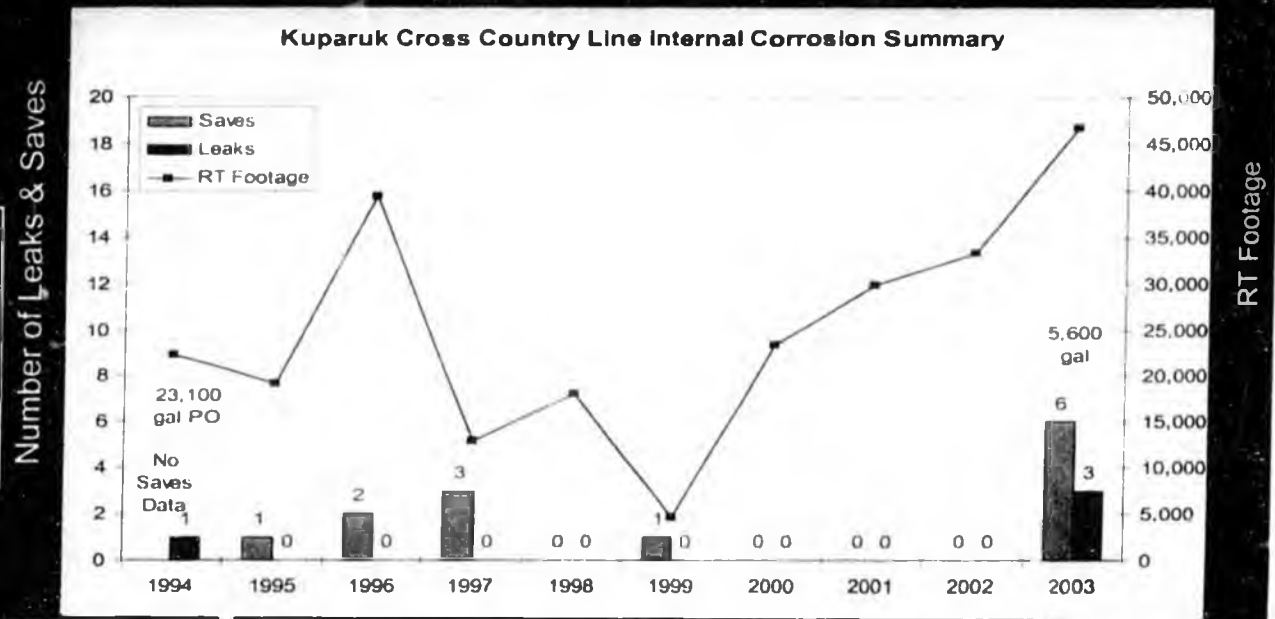
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Deadleg Corrosion is Focus Area

- ✓ Over 46,000 ft of over 234 lines inspected (RTR and RT)
- ✓ Completed baseline surveys on Interval Survey and TFS Programs
- ✓ 3 Leaks (1 INJ, 2 PROD), 6 Saves (1 INJ, 5 PROD)
- ✓ 5 of the 9 repairs on deadlegs, identified 60 for inspection in '04
- ✓ Linear Array appears to work on 16" and smaller water packed lines

2003

Internal Corrosion Spills
- Cross Country Lines



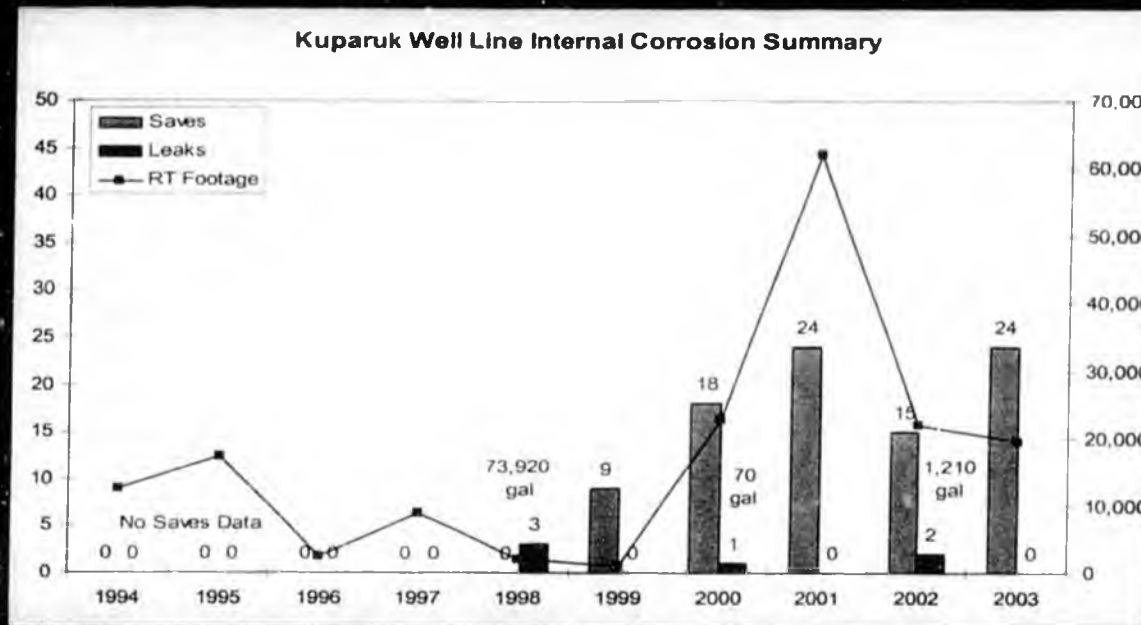
Internal Inspection Focus Area

- ✓ Completed baseline Interval Survey on all well lines due for inspection
- ✓ Roughly 20,000 ft of over 552 lines inspected (RTR and RT).
- ✓ 24 lines required repair (22 INJ, 2 PROD)
- ✓ 0 Leaks, 24 Saves

2003

Internal Corrosion Spills
- Well Lines

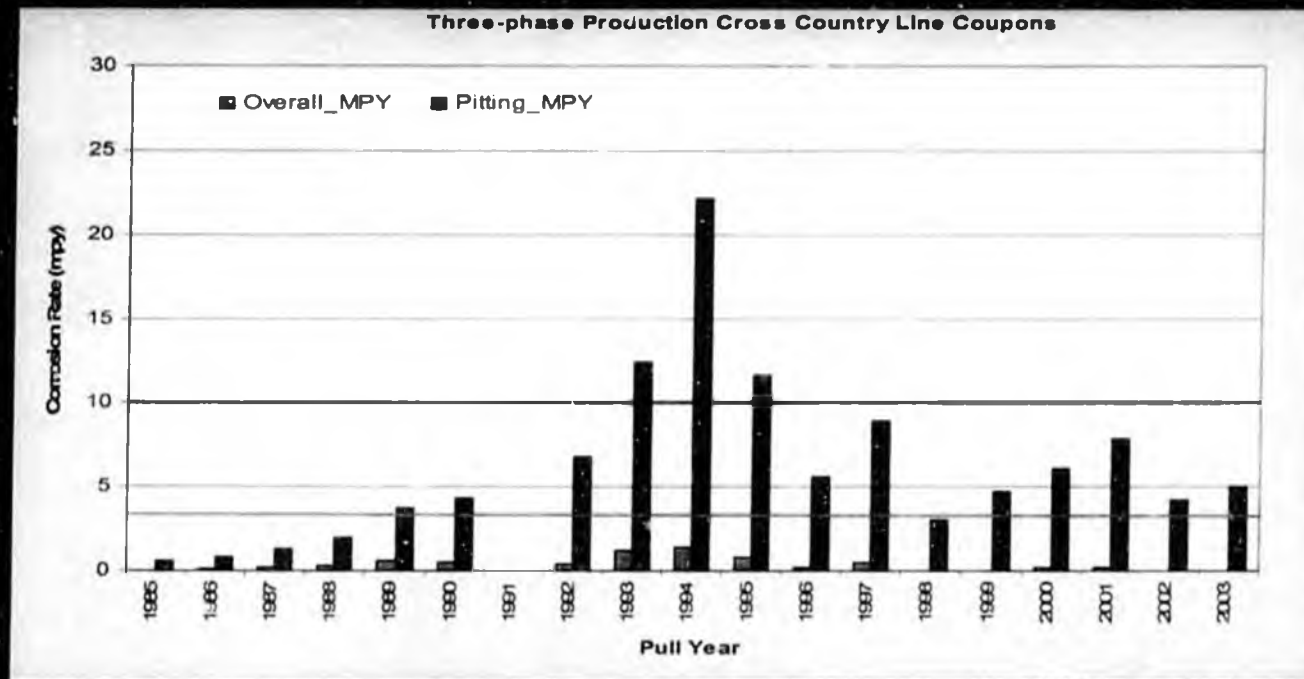
Number of Leaks & Saves



RT Footage

Cross-Country Lines	
Goal	Status
Inspect all over tundra deadlegs and WOLs	On schedule
Initiate Recurring Interval Inspection Program	On schedule
Inspect all 12" and 16" water packed lines that cannot be inspected by conventional RTR with Linear Array	On schedule
Schedule smart pig run on 30" SWI line in '05	On schedule
Continue with KDR and TFS programs	On schedule
Well Lines	
Initiate Recurring Interval Inspection Survey Program	On schedule
Continue with KDR and Erosion programs	On schedule

Corrosion Inhibition is effective

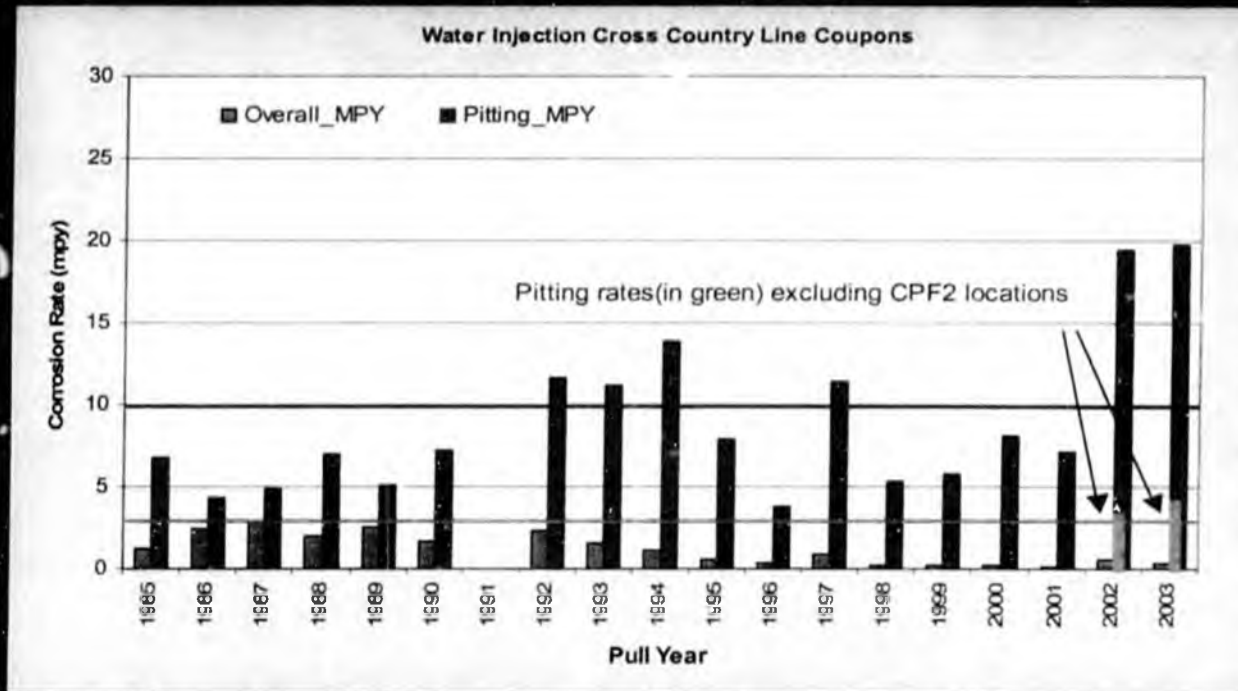


2003

- ✓ Coupon average rates remain below thresholds
- ✓ 95% of 3-Phase Production CC lines have ER probe rates < 2 mpy
- ✓ <1% of repeat inspection locations showed increases
- ✓ All 3-Phase Production CC lines with probe, coupon, or inspection corrosion rates above thresholds had corrective action taken

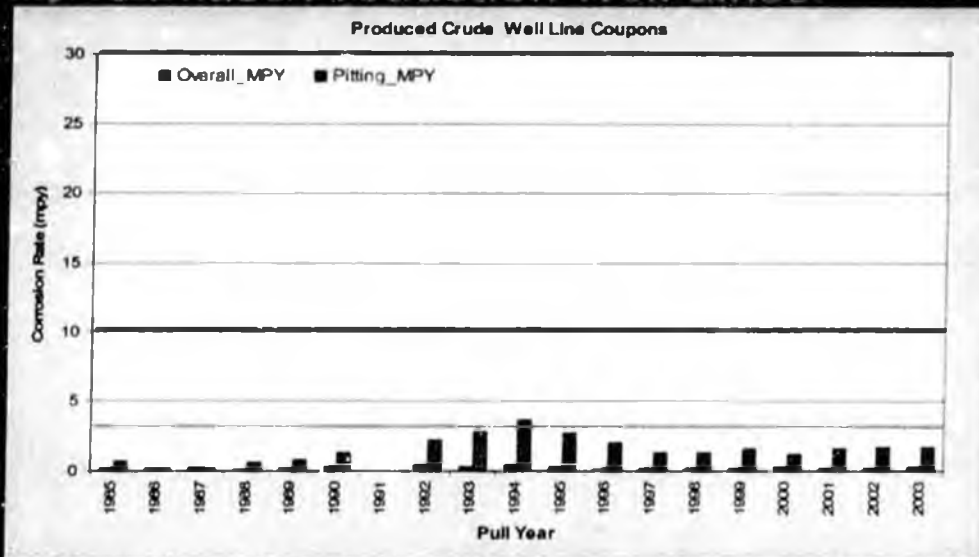
Continuing Focus Area

2003



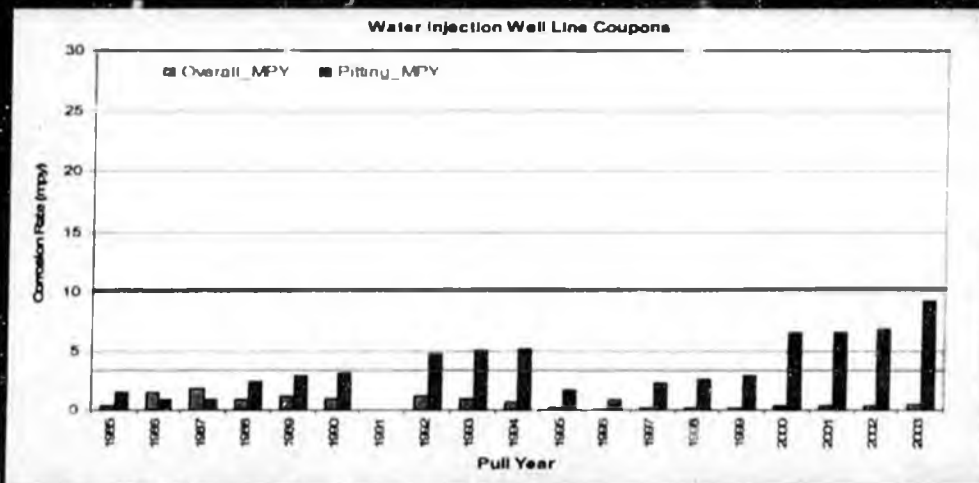
- ✓ Average coupon corrosion rates affected by lines at CPF2.
- ✓ Initial Biocide study completed for all 3 CPF's & CPF2 recommendations have been fully implemented. A follow-up study of impact on procedure changes is underway.
- ✓ Coupon results were used to prioritize 2003 RTR on 28 cross-country water injection lines.

3 Phase Production Well Lines



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

Water Injection Well Lines



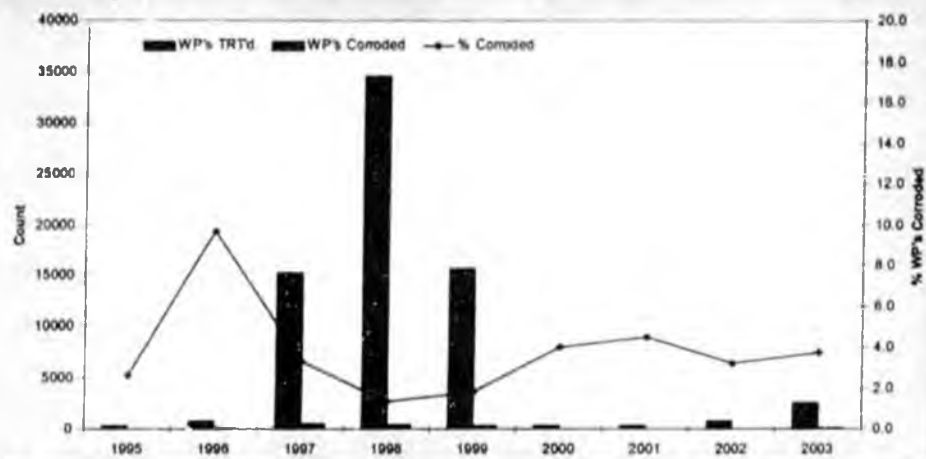
- ✓ Coupon average corrosion rates remain below targets
- ✓ Additional KDR locations identified

Monitoring & Mitigation	
Goal	Status
Continue testing for more effective corrosion inhibitors	<ul style="list-style-type: none"> • Field test of Champion 2002-050B completed at DS1R. Expansion test planned for 2UVW system in May. • Test of Champion 2003-82 underway at DS1R. • Test of Baker RE-5273 underway at DS3R. • Field test of Champion 2002-49A completed at DS's 2UVW
Complete Implementation of wellhead corrosion inhibitor injection at 3 more Drill Sites	<ul style="list-style-type: none"> • DS's.1A, 1Y, 2T construction in progress • Added chemical tech position to perform system maintenance
Audit all 3 CPF PW System treatment programs	<ul style="list-style-type: none"> • Recommendations are being implemented • Follow-up residuals study forthcoming
SBG (Surfactant) Produced Water System Pilot Test	<ul style="list-style-type: none"> • Product components ordered • Complete phase 1, start phase 2 of test this summer

2003

Mature Ongoing Program

Historical Results - Weldpacks Over Tundra

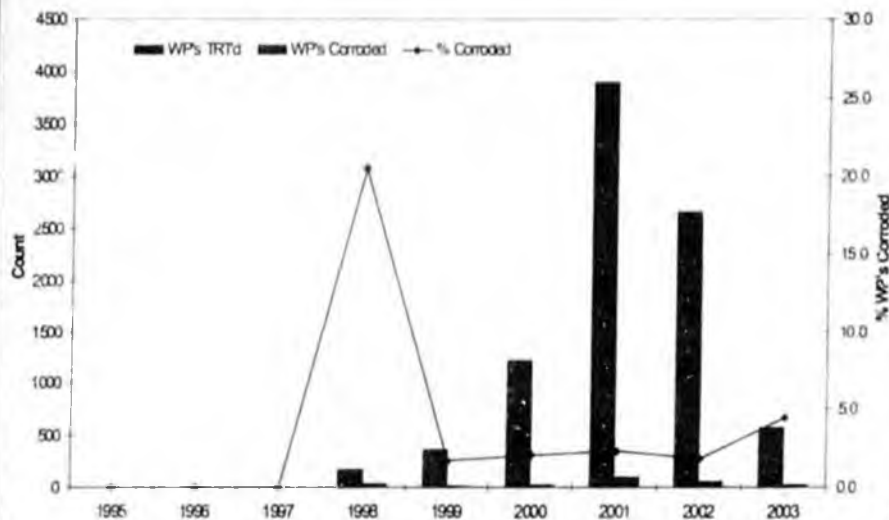


- ✓ 2712 weld packs TRT inspected, 97 had corrosion or ~4%. No repairs.
- ✓ Walkdown verification completed: Approx. still needing baseline inspection (in progress)

CC Lines On Pad

- ✓ Overall program completion - 96%
- ✓ 580 weld packs TRT inspected (long weld packs, high elevation)
- ✓ The % corroded weld packs found increased to 4.5%. No repairs.

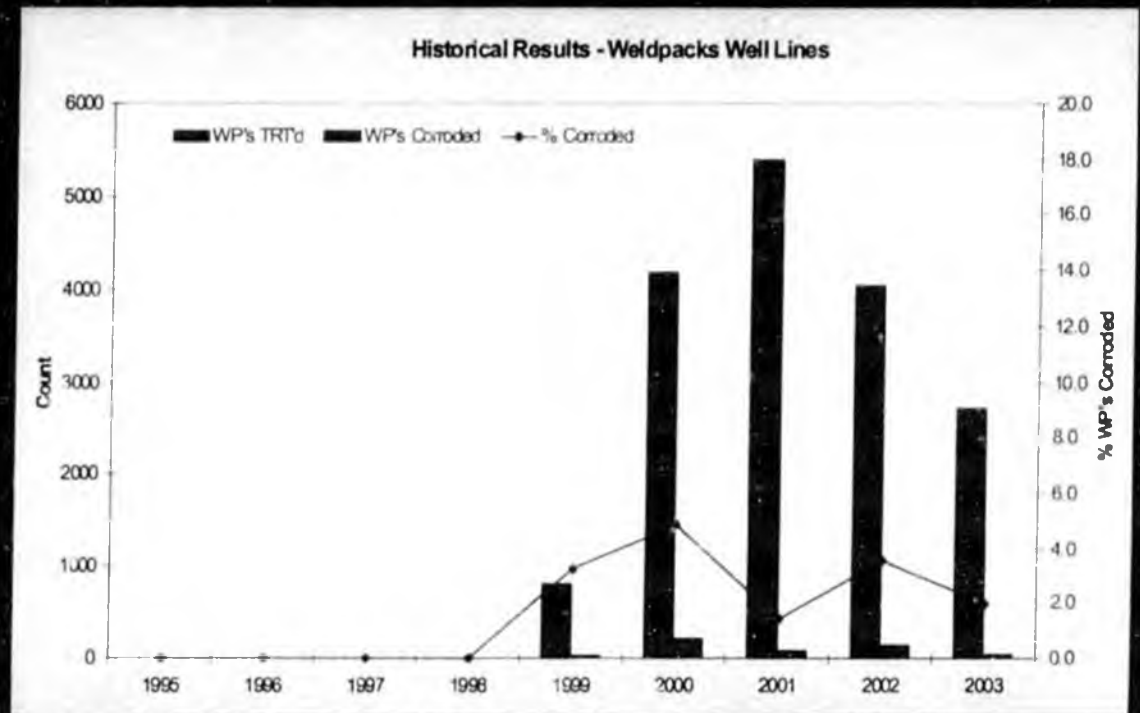
Historical Results - Weldpacks CC On-Pad



Baseline Effort for Well Lines

- ✓ Overall program completion - 91%
- ✓ 2728 weld packs TRT'd.
- ✓ % Corroded decreased to 2%

2003



Buffer Spike Summary

- pH data was obtained on all test locations in 2003.
- The average pH increase at the location of the spikes was 3 pH units. The average pH increase between the spikes was 1.6 pH units, bringing the average pH of the weld pack to a pH of 8.1
- This increase in pH decreases corrosion rates significantly.
- TRT of the test locations is planned for 2004

Cross-Country Lines Over Tundra	
Goal	Status
Complete baseline IRI inspections on CUI locations identified during 2003 identification survey	On schedule
IRI approx. 100 Tank Design WPs	Complete
Continue monitoring of Denso Tape refurbishment technique	On schedule
Develop Recur CUI Program for CC over tundra lines	The plan is complete. Will implement in 2005.
Complete recur TRT inspections on 2210 CUI locations	On schedule
Cross-Country On-Pad	
Complete remaining baseline inspections	On schedule
Well Line Weld Packs	
Complete baseline inspections of all POWI well lines >10 years old	On schedule
Misc.	
Evaluate CUI Buffer Spike pilot program	Pending 2004 TRT results.

2003

- ✓ Re-inspected 82 priority 1 locations with PTI/TWI
- ✓ Inspected all priority 2 locations
- ✓ 8 cased pipes excavated (goal was 5 to 9)
 - One had severe internal damage - pipe was replaced
 - One had moderate internal damage - scheduled for replacement in 2004
 - Six had only minor or no significant corrosion
 - Final Tally: 8 Refurbishments, 2 Saves, No Leaks
- ✓ Completed Annual Visual Casing Inspection - cleared all obstructions

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

All Lines in GKA/AOA Inventory	Inspected in 2003	Un-inspected Lines	Total	Previously Uninspected Lines Inspected in 2003
Priority 1 Oil	327	40	367	0
Priority 1 Non-Oil	236	21	257	1
Priority 2 Oil	14	1	15	0
Priority 2 Non-Oil	84	0	84	0
Priority 3 Oil	3	26	29	0
Priority 3 lines Non-Oil	1	22	23	0
2003 Total Inventory	665	110	775	1

Goal	Status
Reinspect 100 priority 1 pipes using IWI	On schedule
Complete second round of inspection on all priority 2 pipe using IWI selectively where warranted	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	No vendor tests currently scheduled for 2004

2003

External Corrosion

- ✓ No incidents to report

Internal Corrosion

- ✓ One water injection spill (3BWI) in 2003.

Other Structural Concerns

- ✓ Tarn/Meltwater VSM failure, repair/remediation completed in 2004.
- ✓ DS2D-09 Flowline Failure on 3/17/04, failure at a flange-to-reducer girth weld.

- 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 $\frac{1}{4}$ 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.

- 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

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 earth 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 biociding.

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**

BIPX

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

<u>Day</u>	<u>Time</u>	<u>Location</u>	<u>Subject</u>
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, Larry)
	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

C PA

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

<u>Day</u>	<u>Time</u>	<u>Location</u>	<u>Subject</u>
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.I.F.C.

<u>Name</u>	<u>Company</u>	<u>E-Mail</u>
Wade Gilpin	ADEC	wade.gilpin@dec.state.ak.us
Brad Frates	CPAI	brad.j.frates@conocophillips.com
John Keema	BP	John.Keema@bp.com
Lydia Miner	ADEC	lydia_miner@dec.state.ak.us
Laurie Silfrun	ADEC	Laurie_Silfrun@dec.state.ak.us
Al Dink	CPAI	al1195@conocophillips.com
MATT COLLINS	CPAI	m1412@conocophillips.com
Gary R Crawford	BPXA	crawfogr@bp.com
Don Stears	Coffman	stears@coffman.com
Oliver Moghissi	CCTechnologies	omoghissi@cctechnologies.com
KIT STRANGLE	BPXA	kitstrangle@bp.com
Bill Hedges	BP Trinidad	hedgesb@bp.com
BRETT LEACH	BPXA	Brett.Leach@bp.com
JAY MURAKI	CPAI	m1085@conocophillips.com
LYNN TYLER	CPAI	lynn.tyler@conocophillips.com
Chris Daco	CPAI	chris.daco@conocophillips.com
JAMIE MESSING	ADEC	james.messing@dec.state.ak.us
Kristen Bullard	ADEC	kristen_bullard@dec.state.ak.us
Dianne Munson	ADEC	dianne-munson@dec.state.ak.us
Gary Evans	ADEC	gary.evans@dec.state.ak.us
Michelle Stenwood	E&E for EPA	msternwood@epa.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

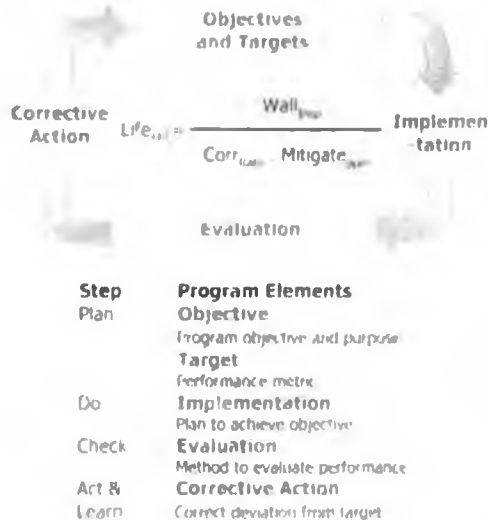
▶ ACT

- ▶▶ 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)



MA 55

Meet & Confer 14

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 %

MA 05

Meet & Confer 14

3-Phase Monitoring and Mitigation



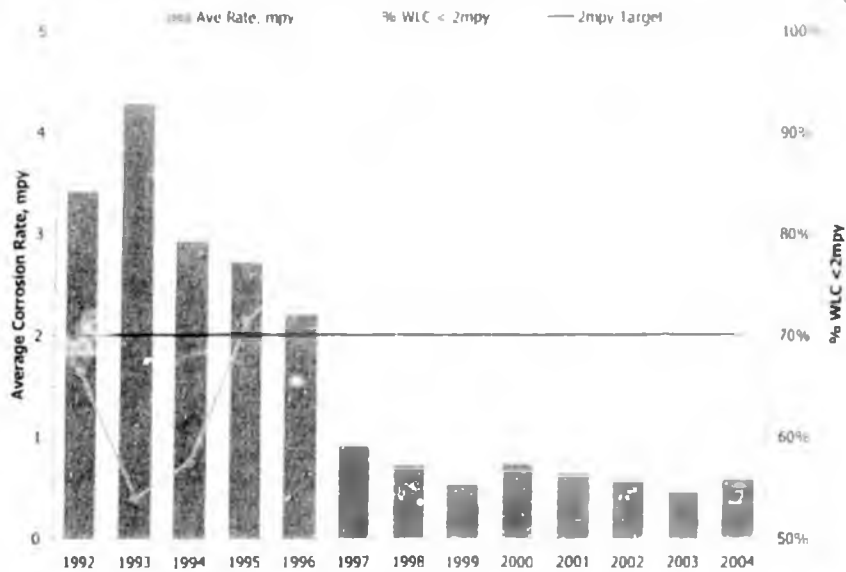
- ▶ **Weight Loss Coupons**
 - ▶▶ Well lines
 - ▶▶ Flow lines
- ▶ **Corrosion Inhibitor Injection**
 - ▶▶ Concentration
 - ▶▶ Unplanned Events

May 05

Meet & Confer 17

5

3 Phase – Well Line Coupons

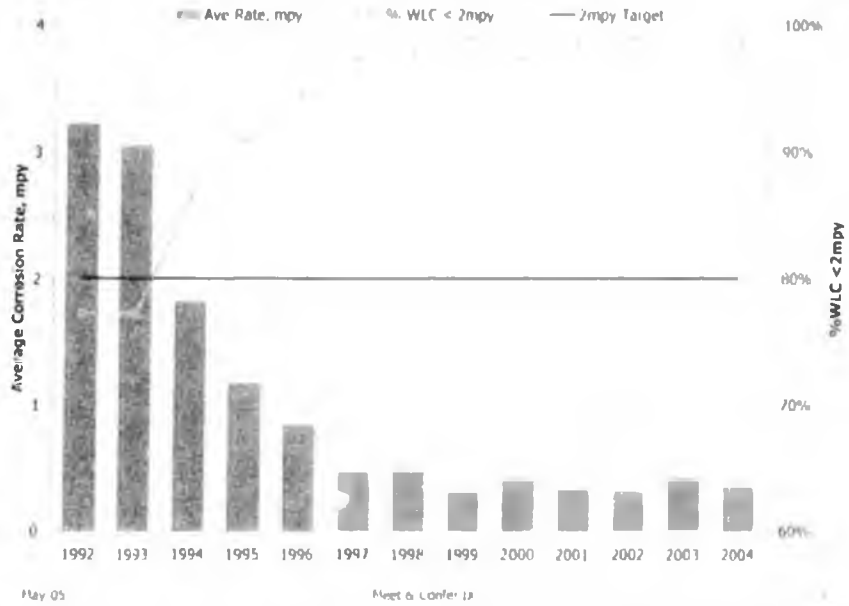


May 05

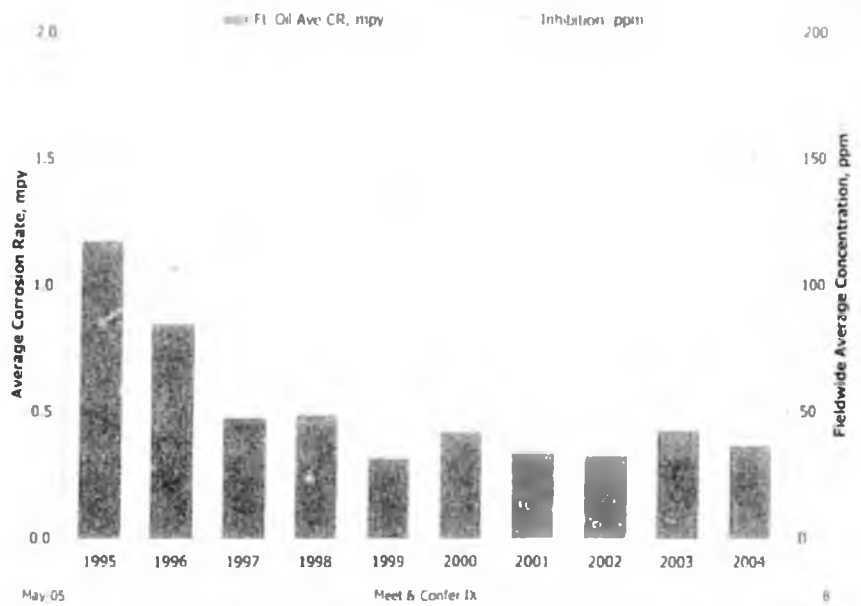
Meet & Confer 17

6

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

May-05

Meet & Confer 1a

40

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

May-05

Meet & Confer 1a

40

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 O₂ 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

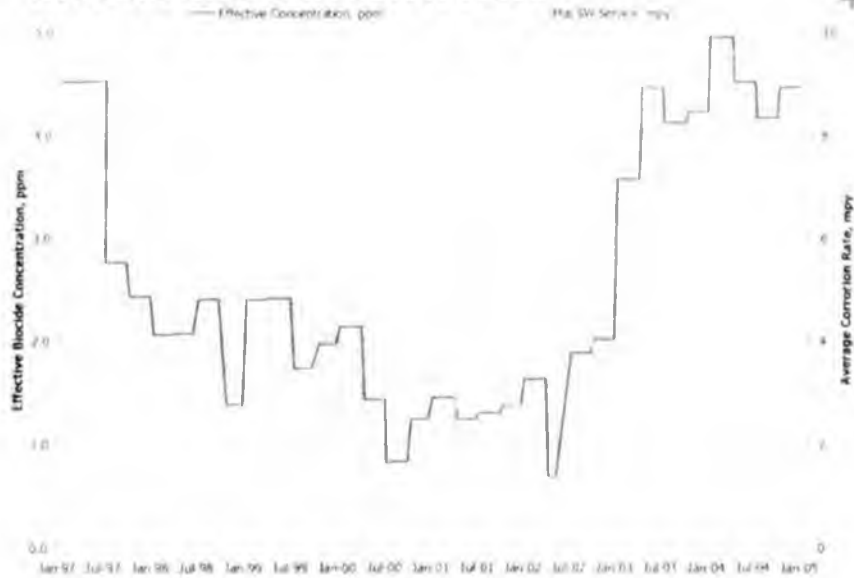
- » 3-phase corrosion inhibitor
 - More carryover into PW system
- » PW mitigation programs
 - Continuous injection
 - FS1 and 3
 - GC1, 2, and 3

May 05

Fleet & Confer [X]

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Biocide and Corrosion Rate

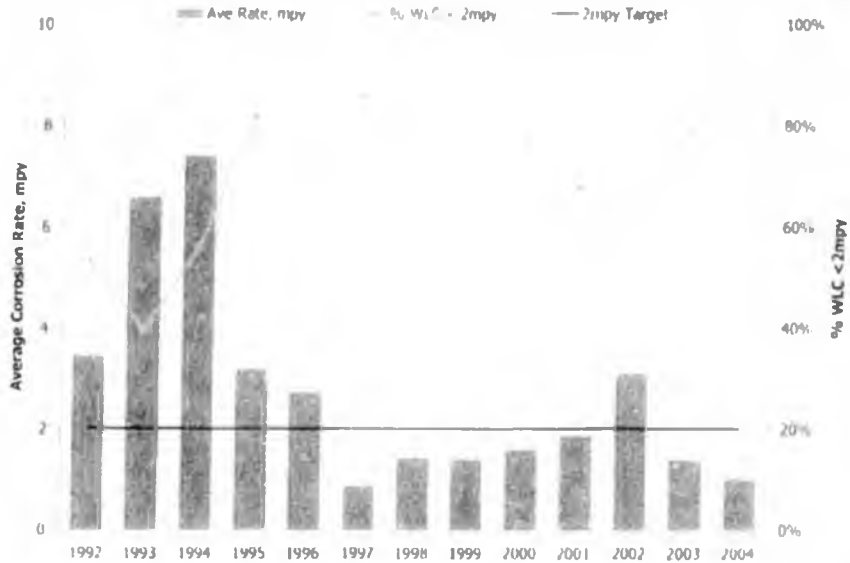


May 05

Fleet & Confer [X]

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Aggregate Water Injection - Flow Line Coupons

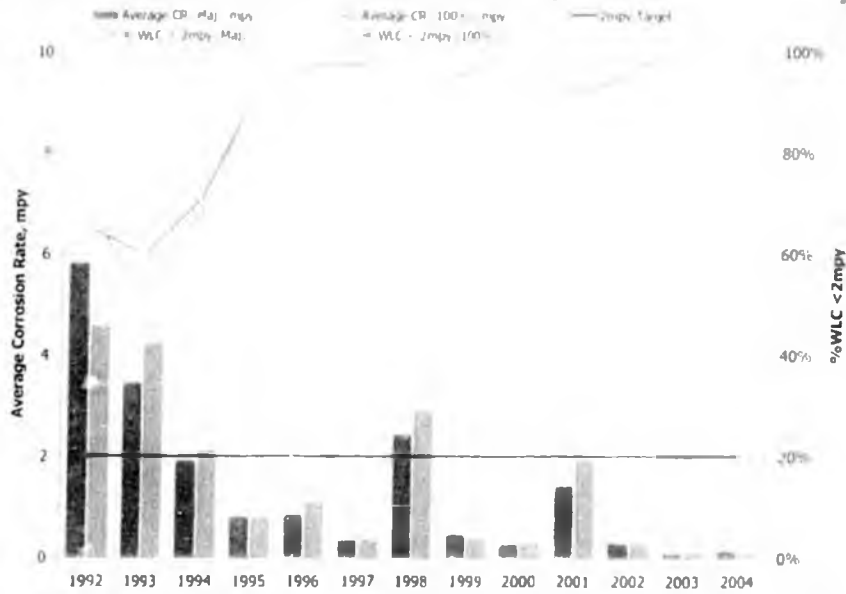


May 05

Meet & Confer 1a

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PW System - Well Line Coupons

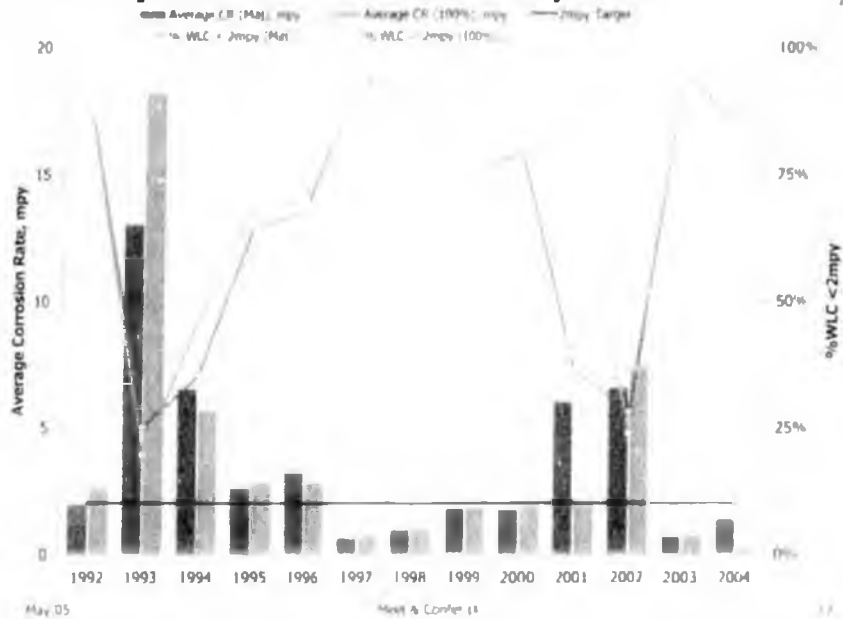


May 05

Meet & Confer 1a

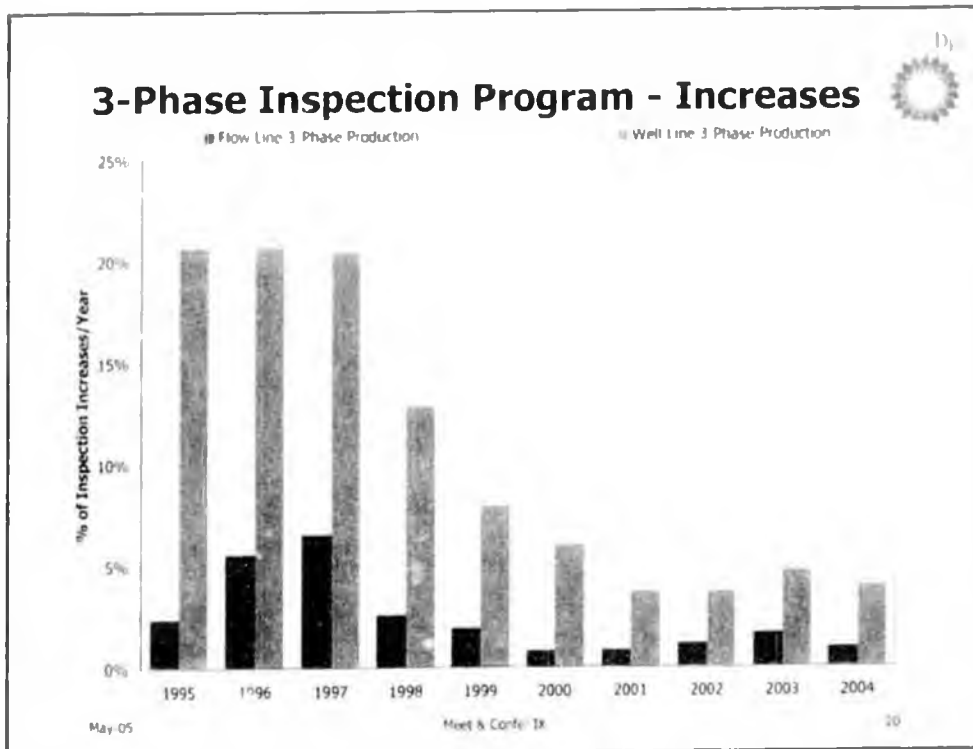
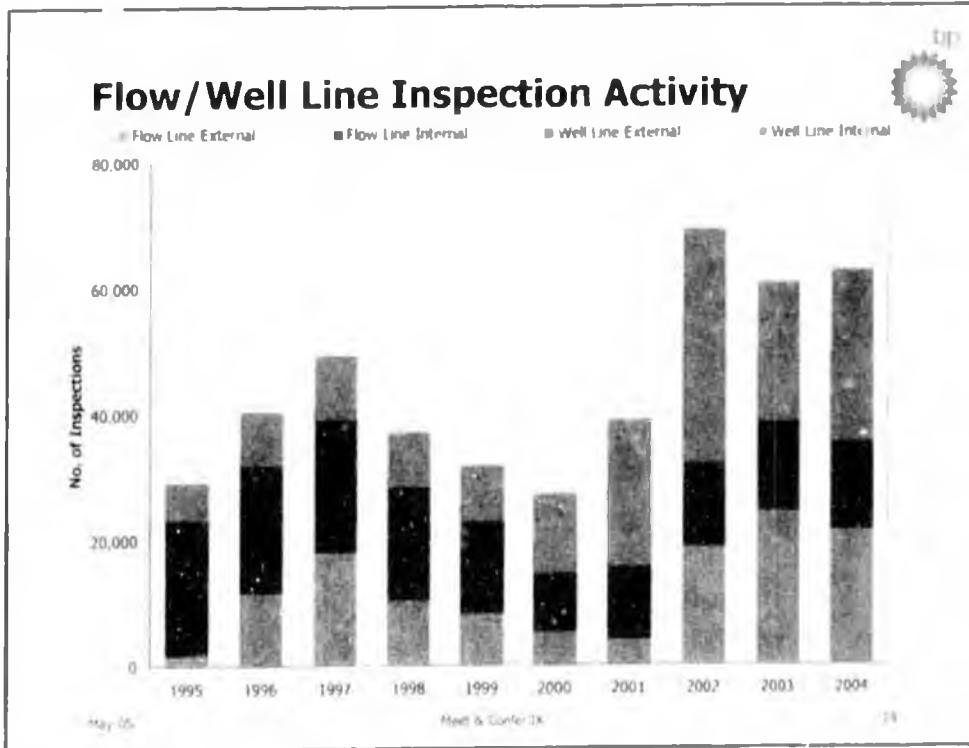
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SW System – Well Line Coupons

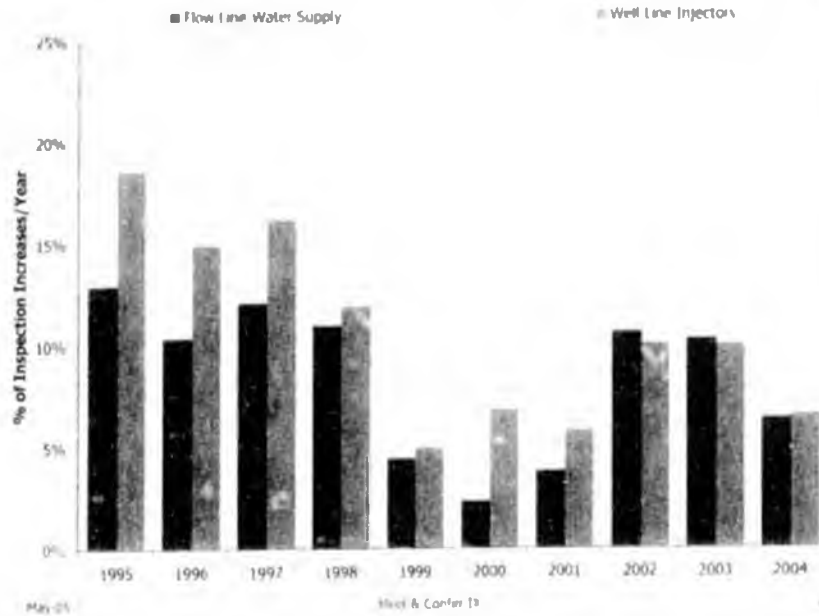


Inspection Program

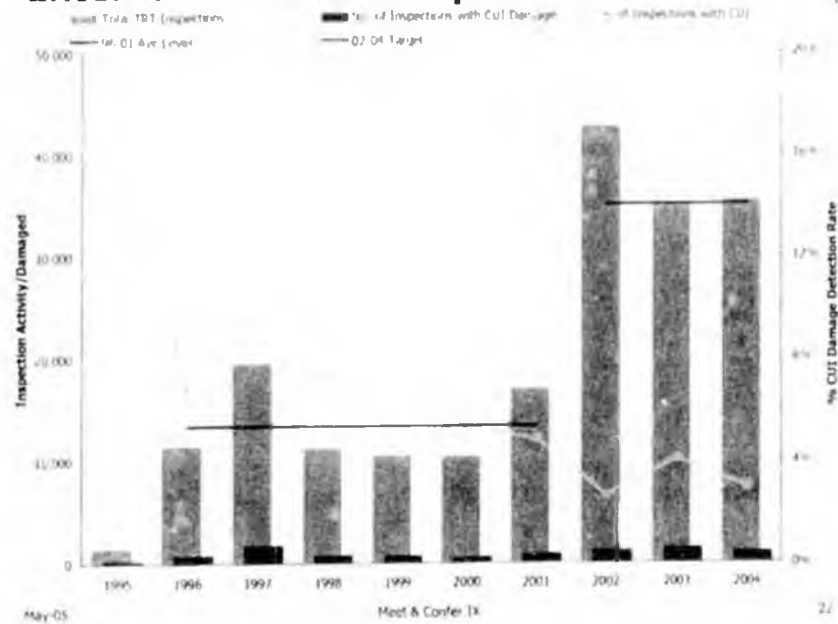
- ▶ **Internal Inspection**
 - ▶ 3 phase – flow and well line
 - ▶ Water injection – flow and well line
- ▶ **External Inspection**
- ▶ **Cased Piping Inspection**
- ▶ **In-line Inspection**



Water Injection Inspection Program - Increases



External Corrosion Inspection



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

0141

May 4, 2005

11

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

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

May 05

Meet & Confer 13

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2004 Leaks and Repairs



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

May 05

Meet A Confer 13

25

Flow Line Corrective Actions



▶ Weight Loss Coupons

- ▶▶ 2-Chemical Increase

▶ ER Probe

- ▶▶ 59-Chemical Increases

Equipment ID	WLC CR. copy	Cause	Action
101	1.11	11 Discharge	Re-attached inhibitor with 1/2 inch line jump
108	1.41	11 Control Discharge	1/2 inch line jump to ER Probe
140	1.41	11 Flaring	Sub-Process to INERTED Discharge
14-01	1.41	Increased Capacity	Controlled by 20%
14-02	1.41	Increased Capacity	Controlled by 20%
14-03	1.41	11 Flaring	Revised with Discharge
14-04	1.75	11 Flaring	Sub-Process to INERTED Discharge
14-05	1.75	11 Flaring	Sub-Process to INERTED Discharge

Equipment ID	No. of Action	Cause	Action
101	1	Increased Capacity	Controlled by 20%
108	1	Increased Capacity	Controlled by 20%
140	1	Increased Capacity	Controlled by 20%
14-01	1	Increased Capacity	Controlled by 20%
14-02	1	Increased Capacity	Controlled by 20%
14-03	1	Increased Capacity	Controlled by 20%
14-04	1	Increased Capacity	Controlled by 20%
14-05	1	Increased Capacity	Controlled by 20%
14-06	1	Increased Capacity	Controlled by 20%
14-07	1	Increased Capacity	Controlled by 20%
14-08	1	Increased Capacity	Controlled by 20%
14-09	1	Increased Capacity	Controlled by 20%
14-10	1	Increased Capacity	Controlled by 20%
14-11	1	Increased Capacity	Controlled by 20%
14-12	1	Increased Capacity	Controlled by 20%
14-13	1	Increased Capacity	Controlled by 20%
14-14	1	Increased Capacity	Controlled by 20%
14-15	1	Increased Capacity	Controlled by 20%
14-16	1	Increased Capacity	Controlled by 20%
14-17	1	Increased Capacity	Controlled by 20%
14-18	1	Increased Capacity	Controlled by 20%
14-19	1	Increased Capacity	Controlled by 20%
14-20	1	Increased Capacity	Controlled by 20%
14-21	1	Increased Capacity	Controlled by 20%
14-22	1	Increased Capacity	Controlled by 20%
14-23	1	Increased Capacity	Controlled by 20%
14-24	1	Increased Capacity	Controlled by 20%
14-25	1	Increased Capacity	Controlled by 20%
14-26	1	Increased Capacity	Controlled by 20%
14-27	1	Increased Capacity	Controlled by 20%
14-28	1	Increased Capacity	Controlled by 20%
14-29	1	Increased Capacity	Controlled by 20%
14-30	1	Increased Capacity	Controlled by 20%
14-31	1	Increased Capacity	Controlled by 20%
14-32	1	Increased Capacity	Controlled by 20%
14-33	1	Increased Capacity	Controlled by 20%
14-34	1	Increased Capacity	Controlled by 20%
14-35	1	Increased Capacity	Controlled by 20%
14-36	1	Increased Capacity	Controlled by 20%
14-37	1	Increased Capacity	Controlled by 20%
14-38	1	Increased Capacity	Controlled by 20%
14-39	1	Increased Capacity	Controlled by 20%
14-40	1	Increased Capacity	Controlled by 20%
14-41	1	Increased Capacity	Controlled by 20%
14-42	1	Increased Capacity	Controlled by 20%
14-43	1	Increased Capacity	Controlled by 20%
14-44	1	Increased Capacity	Controlled by 20%
14-45	1	Increased Capacity	Controlled by 20%
14-46	1	Increased Capacity	Controlled by 20%
14-47	1	Increased Capacity	Controlled by 20%
14-48	1	Increased Capacity	Controlled by 20%
14-49	1	Increased Capacity	Controlled by 20%
14-50	1	Increased Capacity	Controlled by 20%
14-51	1	Increased Capacity	Controlled by 20%
14-52	1	Increased Capacity	Controlled by 20%
14-53	1	Increased Capacity	Controlled by 20%
14-54	1	Increased Capacity	Controlled by 20%
14-55	1	Increased Capacity	Controlled by 20%
14-56	1	Increased Capacity	Controlled by 20%
14-57	1	Increased Capacity	Controlled by 20%
14-58	1	Increased Capacity	Controlled by 20%
14-59	1	Increased Capacity	Controlled by 20%

▶ Inspection Program

- ▶▶ 1-Chemical increase

Equipment ID	No. of Action	Cause	Action
14-01	1	Increased Capacity	Controlled by 20%

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2004 Leaks and Repairs



▶ Leak Summary

▶▶ Total of 4 Leaks

	Surface			Service			
	Int	Ext		OIL	SW	PW	Gas
WL	2	1	WL	1		2	
FL		1	FL	1			

	Mechanism			
	CO ₂	Int	CUI	Mech
WL		1	1	1
FL			1	

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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



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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



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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

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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

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GPB 2005 Goals and Objectives



	<u>2004 Actual</u>	<u>2005 Plan</u>
▶ 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

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Outline



▶ ACT

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

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

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Relative Corrosivity of BP North Slope Fields



Field	Prod Fluid Characteristics				Material of Construction ^(a)			
	H ₂ O (%)	T (°F)	P _{CO₂} (%)	CR ^(b)	Production		Injection	
					WL	FL	WL	FL
GPB	74	150	12	H	CS+CI	CS+CI	CS+CI	CS+CI
ENT	89	150	18	H	DSS	DSS	CS+CI	CS+CI
MPI	49	125	1.5	L/M	CS	CS	CS+CI	CS+CI
Northstar	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 is carbon steel, CI is corrosion inhibitor, DSS is duplex stainless steel.
 (b) Unmitigated relative corrosion rate: H - high, M - medium, L/M - low.
 (c) There are a limited number of Duplex Stainless Steel flow lines in GPB.
 (d) Two production flow lines are inhibited at MPI.

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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

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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

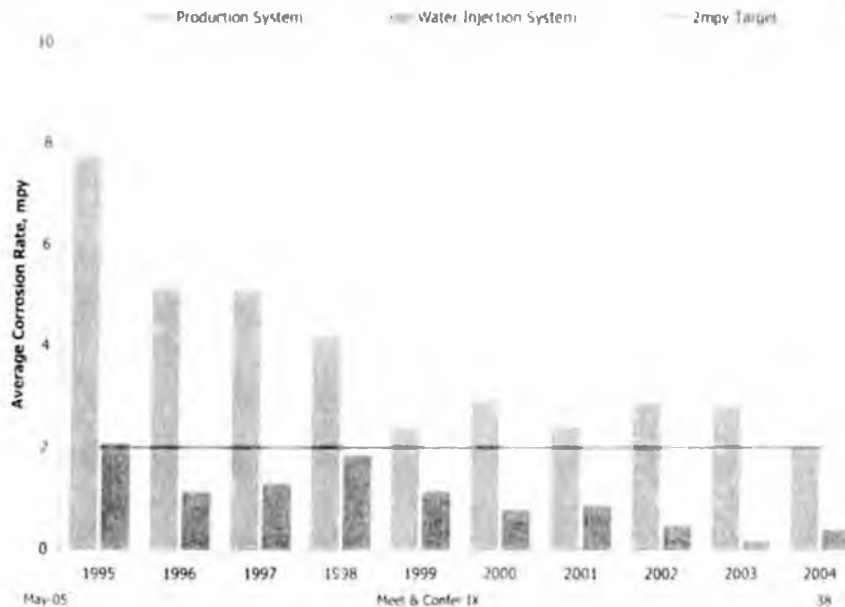
- ▶▶ Primary 2004 focus IIWL
 - No increases observed in repeat examinations
 - Slight corrosion found at 3 of 719 new locations
 - No Repairs required

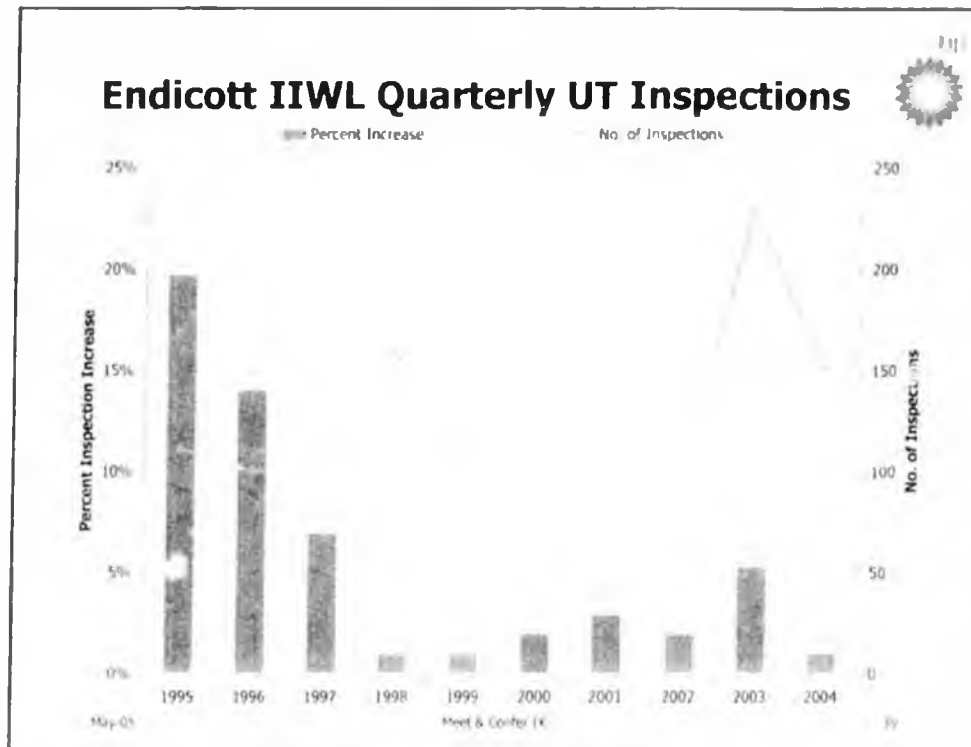
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Endicott Corrosion Monitoring





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

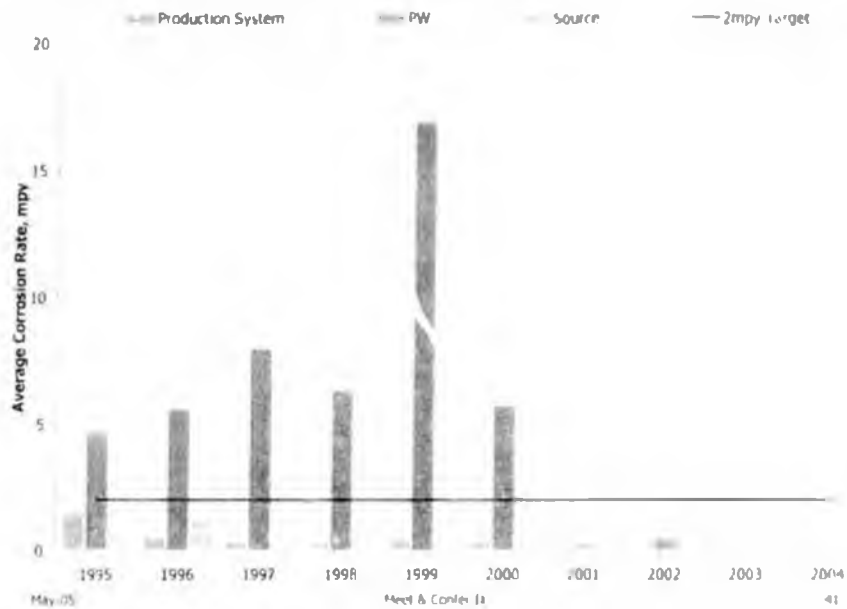
- ▶▶ Significant focus on external corrosion detection activities
 - 1,738 TRT inspections
 - No increases in 251 repeat locations
- ▶▶ 45 Excavations
 - Tract 14 (maj), B, C and D pads
 - 13% inspection increases at 227 repeat locations (internal)

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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

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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%

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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	0
	WL	3	0	1
Gas	FL	0	0	0
	WL	0	0	0
PW	FL	0	4	0
	WL	1	0	1
Total		10	5	2

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ACT 2005 Goals and Objectives



	04 Act	05 Plan
Endicott <ul style="list-style-type: none"> » Inter-Island Water Line and PW/SW well lines <ul style="list-style-type: none"> • Reduced corrosion based on inspection data • Trial no barite and 50% increase in CI • Emphasis on consistent/reliable maintenance pigging 	<ul style="list-style-type: none"> • • 	<ul style="list-style-type: none"> Aligner Continue
Northstar <ul style="list-style-type: none"> » Continue to build monitoring and inspection history » Inspection and mitigation programs responding as appropriate » Re-locate 3-phase CI to wellheads » Monitor effects of mud plant dissolved oxygen on PW disposal system » Improve CI tracking and reporting 	<ul style="list-style-type: none"> • • • • • 	<ul style="list-style-type: none"> Continue Continue Continue Monitor Plan
Badami <ul style="list-style-type: none"> » Baseline and follow-up inspection as part of 'mothball' program 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> Continue
Milne Point Unit <ul style="list-style-type: none"> » Continuing with ongoing expanded inspection program » Inspection and mitigation programs responding as appropriate » Developing 3 Phase System Program <ul style="list-style-type: none"> • Continued analysis of production flow lines • Initiate corrosion inhibition as applicable » Improve CI tracking and reporting » Review of corrosion monitoring locations 	<ul style="list-style-type: none"> • • • • • 	<ul style="list-style-type: none"> Continue Continue Continue Continue Plan Plan

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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



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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 $\frac{1}{8}$ inch X $\frac{1}{4}$ 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.

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.



Deadleg Corrosion was Focus Area

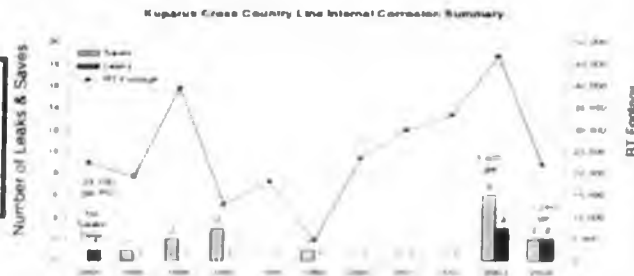
Internal Inspection Cross Country Lines

- ✓ 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



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Mature Program

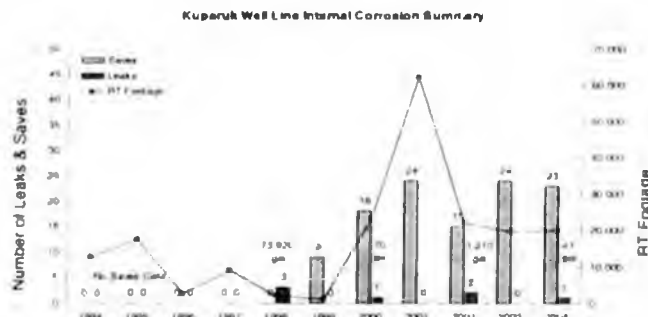
Internal Inspection Well Lines

- ✓ 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

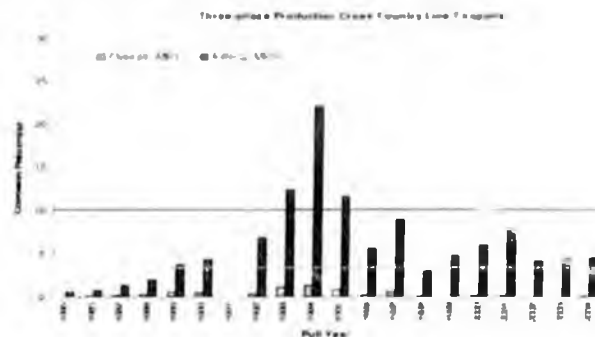
2005 Goals

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

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Monitoring/Mitigation Three-Phase Cross Country Lines

Corrosion Inhibition is Effective



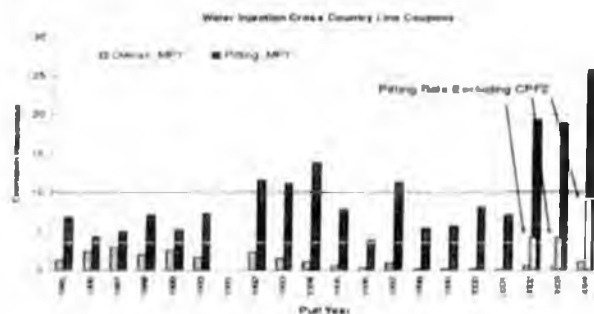
2004

- ✓ 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.

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Continuing Focus Area

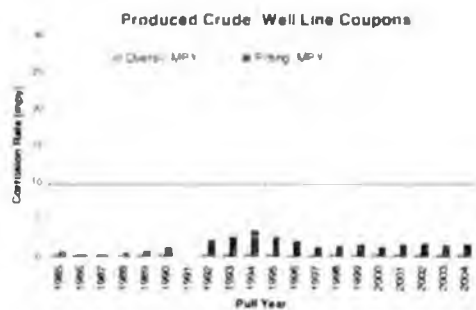
Monitoring/Mitigation WI Cross Country Lines



2004

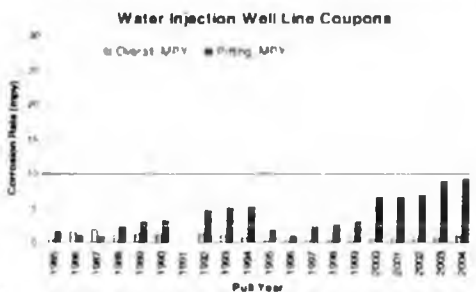
- ✓ Average coupon pitting rates at CPF1 and CPF3 increased, but are still below threshold. However, contribution of average coupon pitting rates at CPF2 continue to push field average above 10 MPY action-required limit.
- ✓ Inspection corroborates coupon results but with lower corrosion rates than shown 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.

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Monitoring & Mitigation

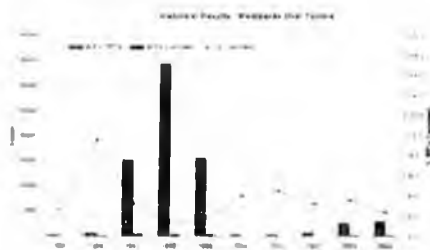
2005 Goals

Monitoring & Mitigation	
Goal	Status
Continue testing for more effective corrosion inhibitors	<ul style="list-style-type: none"> Field test of Champion 2002-50B completed at DS# 2U, 2V, 2W Field test of Baker RES273 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Testing phase has been completed and data are being evaluated

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External Inspection Cross Country Lines

Mature Ongoing Program



CC Lines On Pad ⇨⇨

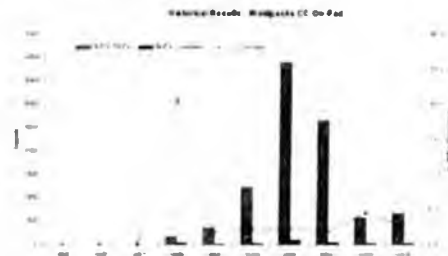
- ✓ 672 weld packs TRT inspected, exceeded goal of 406.
- ✓ Eighteen (~2.7%) had corrosion. No repairs required.
- ✓ Overall program baseline completed - 100%

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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%

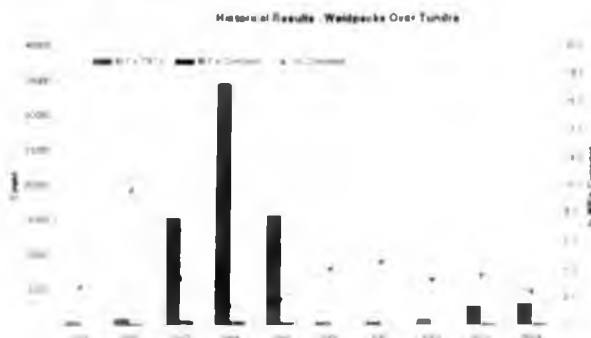


External Inspection
Well Lines

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



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

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.

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

Inspection Results
Below Grade Piping

2005 Goals

<i>Goal</i>	<i>Status</i>
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

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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

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DS3I Secondary Mode Wind-Induced Vibration (WIV) Failure Summary

- 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

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WIV Background

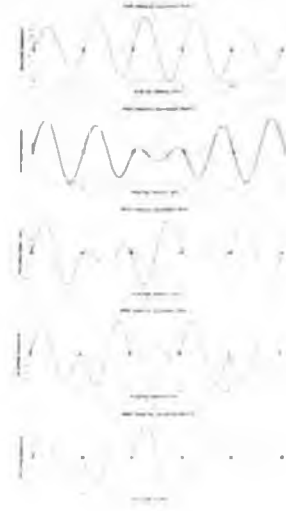
- Basic WIV Concepts
 - Equal Length Straight Run Pipeline Spans
 - System Natural Frequencies & Damping Ratios
 - Aerodynamics (wind speed, air density, lift, vortex shedding)
 - Mode Shapes (Primary vs. Secondary)
 - Can Cause Cyclical Stresses Of Concern
- WIV Is Effectively Mitigated Through Damping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

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Primary Modes



Secondary Modes



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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

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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

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Alpine Overview

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: < 1 mpy
- ✓ 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.

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2005 Goals

<i>Goal</i>	<i>Status</i>
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	Transportation to Airport	Bus, Driver
	Alaska Airlines Depart 13:55	

Sept 15 2005 Field m/c

Charter Corrosion I.I.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

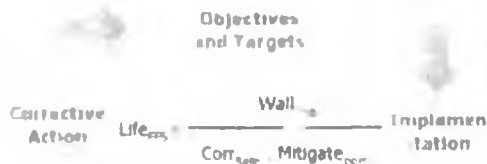
- Corrosion loss of containment

2. Fit-for-service Infrastructure

- Remaining field life

► Future Major Gas Development

- Utilize existing facilities
- Gas sales demands longevity (50+ years)



Evaluation

Step Plan

Program Elements

Objective

Program objective and purpose

Target

Performance metric

Implementation

Plan to achieve objective

Evaluation

Method to evaluate performance

Corrective Action

Correct deviation from target

Act & Learn

Page 10

Heat & Corrosion

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	%

Page 10

Heat & Corrosion

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	← 30,000
▶ Large scale facility trial (1)	No Change	* Compat
▶ Technology		
▶ ER-probe remote monitoring pilot	Planned	← 10,000
▶ Remote tank strap reading demo	Planned	← 10,000
▶ Fixed Monitoring for Cased Piping	No Change	← 10,000

See 1.05

Meet & Confer

3-Phase Monitoring and Mitigation

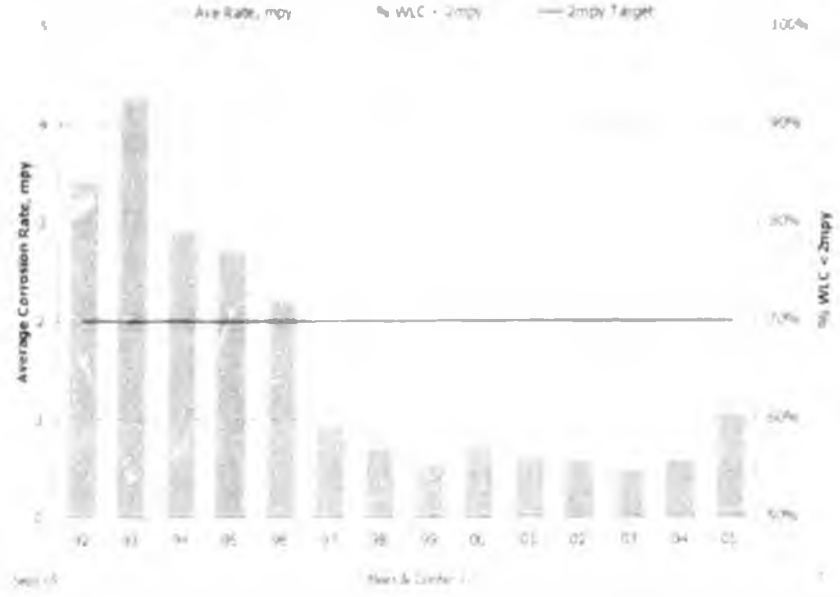


- ▶ **Weight Loss Coupons**
 - ▶ Well lines
 - ▶ Flow lines
- ▶ **Corrosion Inhibitor Injection**
 - ▶ Concentration
 - ▶ Unplanned Events

See 1.05

Meet & Confer

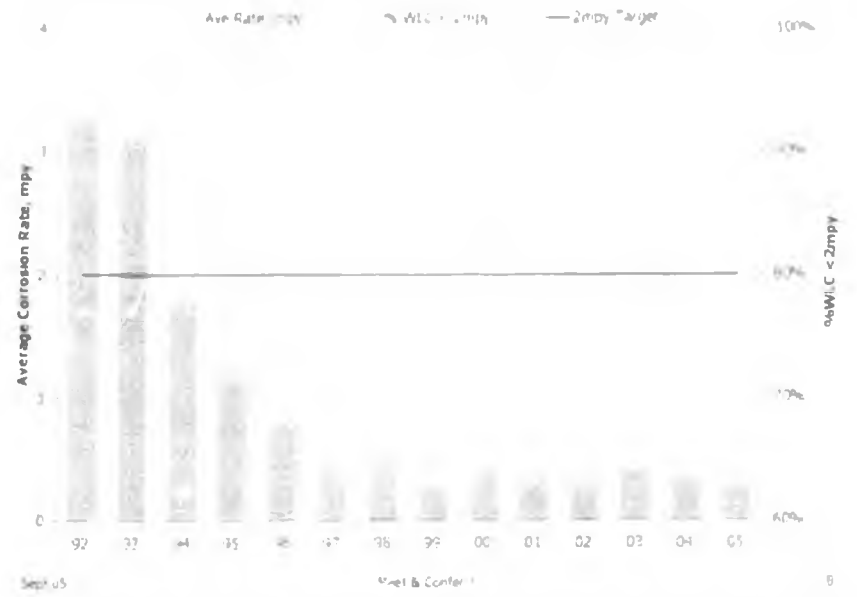
3 Phase – Well Line Coupons



Sept 05

Met & Confer 1

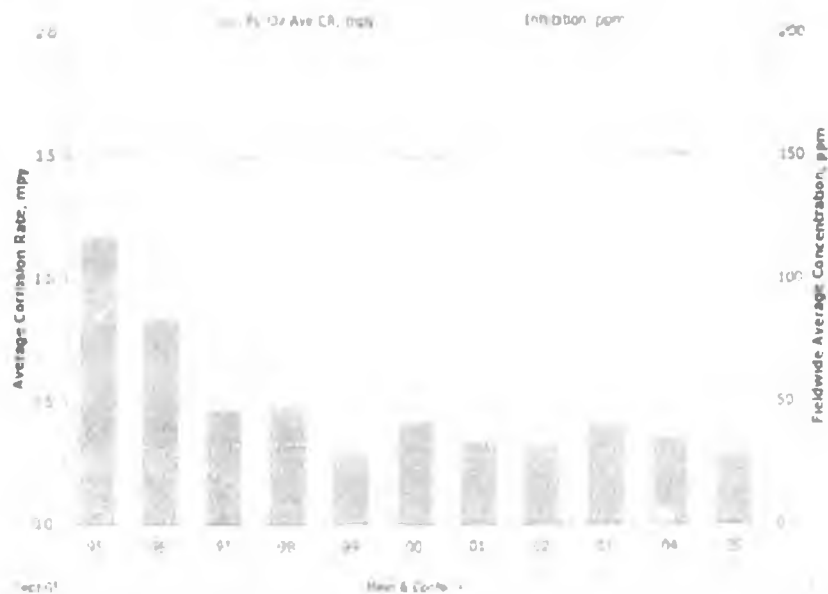
3 Phase – Flow Line Coupons



Sept 05

Met & Confer 1

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

Sept 05

Panel B, Slide 3

11



2005 Forecasted Impact (Well lines)



Sept 05

Panel B, Slide 4

12

Water Injection Systems



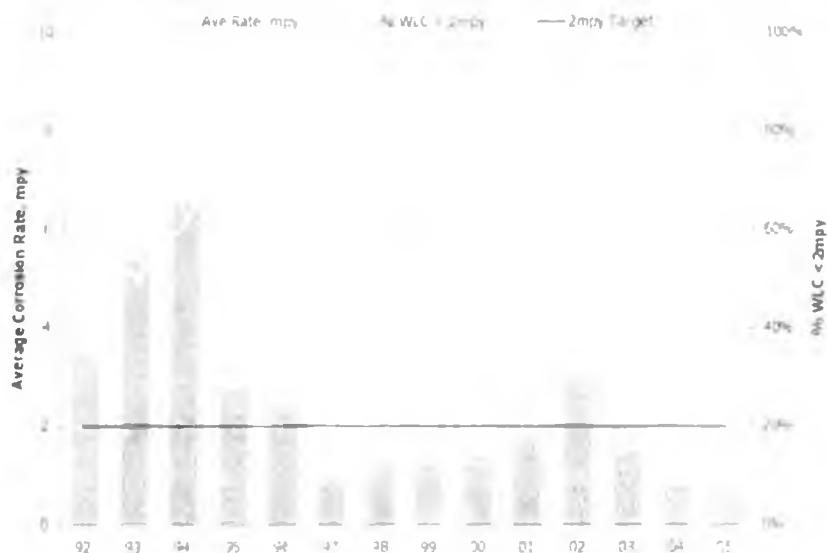
▶ Weight Loss Coupons

- ▶ Flow lines
- ▶ Produced Water system
- ▶ Seawater system

Sect 05

Sheet 6 Control 1

Aggregate Water Injection - Flow Line Coupons

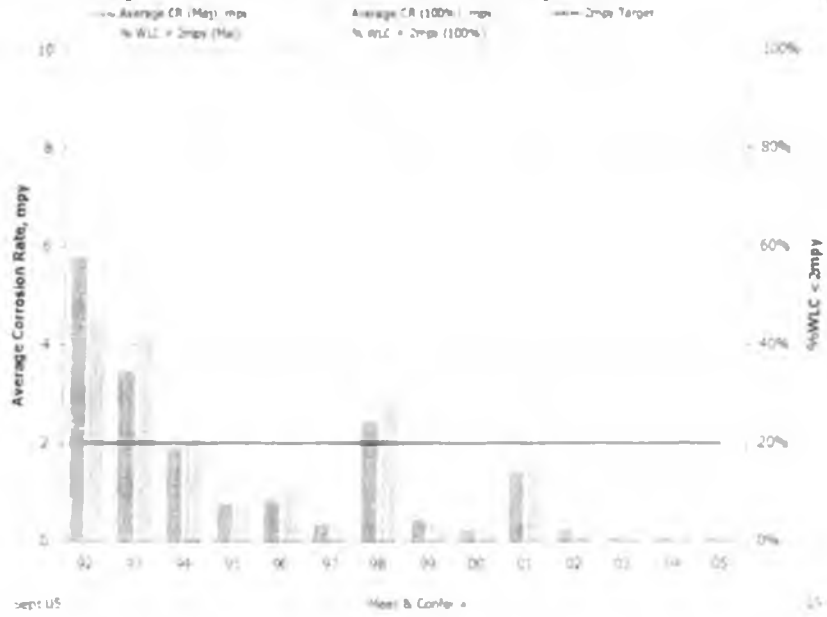


Sect 05

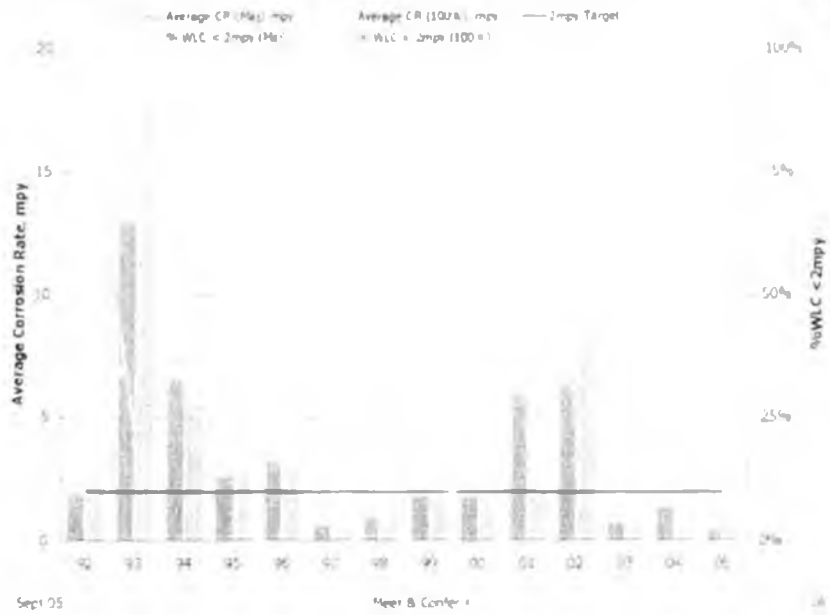
Sheet 6 Control 1

14

PW System – Well Line Coupons



SW System – Well Line Coupons



Inspection Program

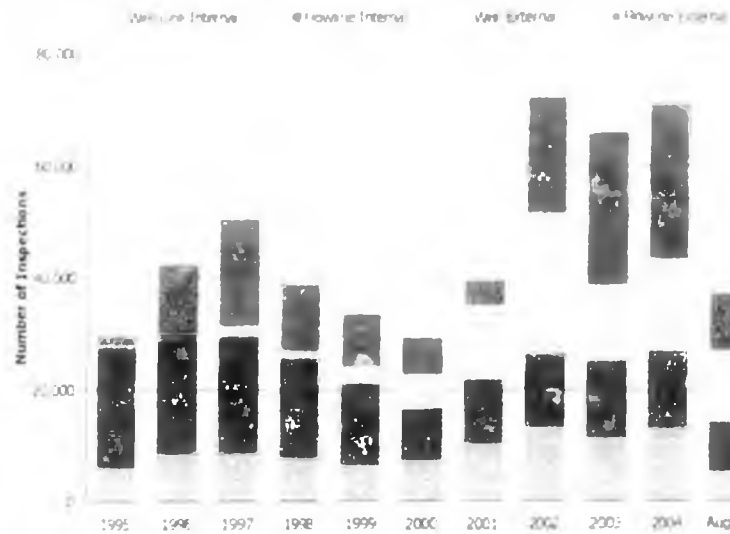


- ▶ Activity Level YTD
- ▶ Internal Inspection
 - ▶ 3 phase – flow and well line
 - ▶ Water injection – flow and well line
- ▶ External Inspection
- ▶ Cased Piping Inspection
- ▶ In-line Inspection

Sept 01

Maat & Carter 1

Flow/Well Line Inspection Activity

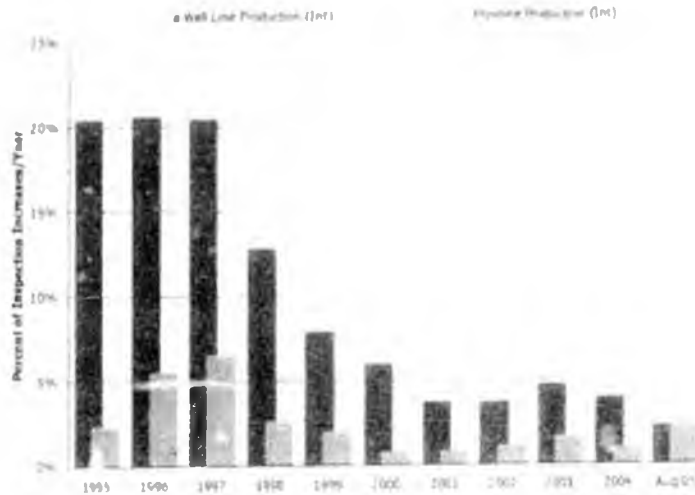


Sept 01

Maat & Carter 1

25

3-Phase Inspection Program - Increases

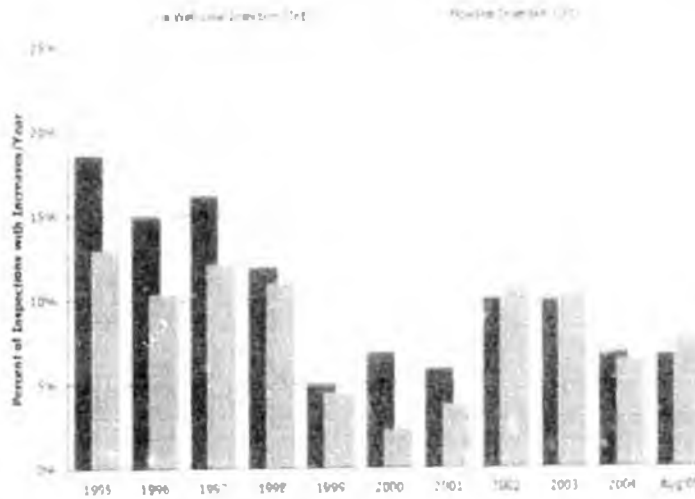


Sec: 02

Next & Cont'd >

19

Injection Inspection Program - Increases

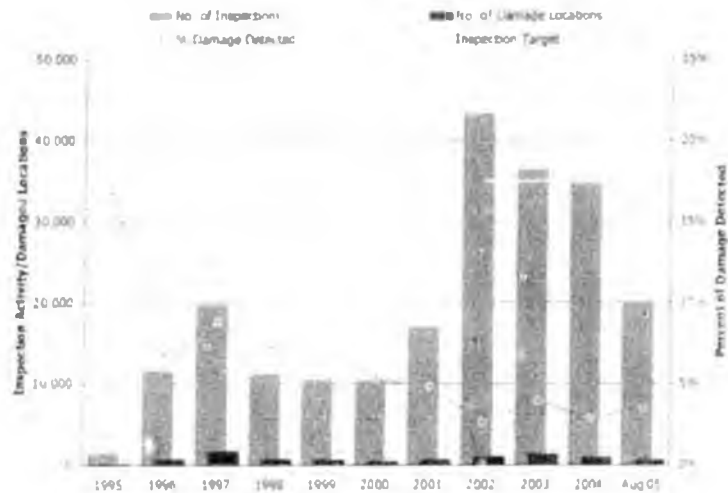


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20

External Corrosion Inspection



Sept 05

Meet 5 Confer 1

21

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/B)

▶ Planned excavation

- S Pad & Spine Rd/GC1
 - Tentative/No activity yet

MsS Guided Wave Inspection Report



Sept 05

Meet 5 Confer 1

22



In-line Inspection

▶ 3 Smart Pig Inspections

- ▶▶ Runs completed end of August
- ▶▶ Reports due ~Oct/Nov

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



Sept 05

Meet & Confer

23



2005 YTD Corrective Action/Leaks

▶ Corrective Actions

- ▶▶ Inhibition
- ▶▶ Repairs

▶ Leak Details

- ▶▶ Loss of containment

▶ Structural Repairs

- ▶▶ Subsidence

Sept 05

Meet & Confer

24

Flow Line Corrective Action



► Weight Loss Coupons

►► 3 chemical increases

Equip ID	MPY	Cause	Action
345	2.18	Cl Pugging	Batch treat, re-establish continuous injection
345	4.54	Increased conductivity	Cl increase via ER probe
346	0.11	Cl incompatibility	Re-establish inhibition with common line pump
341	2.25	Cl Pugging	Batch treat, re-establish continuous injection
345	2.67	Increased conductivity	10% Cl increase
346	2.41	Pump down	Repaired common line pump
345	2.49	Increased conductivity	10% Cl increase
347	2.45	Increased conductivity	10% Cl increase

► ER Probes

►► 7 chemical increases

Equip ID	No. of Actions	Cause	Action
348/349	3	Increased conductivity	10%
PTMCS010	1	Increased conductivity	10%
M-74	1	Increased conductivity	5%
W200	1	Decreased conductivity	5%
345	1	Increased conductivity	20%

► Inspection Program

►► 1 chemical increase

Equip ID	No. of Actions	Cause	Action
PTMCS0102	1	Increased conductivity	10%

Sept 05

Meet & Confer 3

25

Piping Repairs Jan - Aug '05



► Repair Summary

1. External corrosion



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

Sept 05

Meet & Confer 3

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2005 YTD Leaks

- ▶ Leak Summary
 - ▶▶ Total of 4 Leaks

		Surface				Service			
		INT	EXT			OIL	SW	PW	GAS
WL		1	2	WL		-	1	-	2
FL		-	1	FL		1	-	-	-

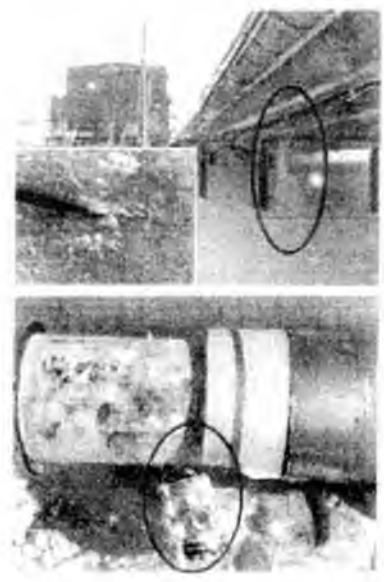
		Mechanism			
		CO ₂	MIC	CUI	Mech
	WL	-	1	1	1
	FL	-	-	-	1



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

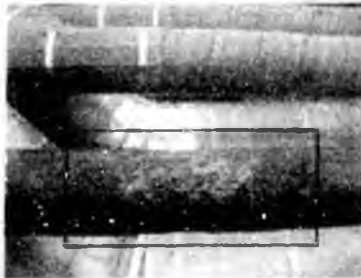
▶ DS14 – 6" Warm-up gas

- ▶▶ 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



Section 15

Meets & Corrosion



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



Section 15

Meets & Corrosion

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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

Page 11

Meet & Confer



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

Page 12

Meet & Confer

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
 - None at Northstar
 - None at Badami
- ▶▶ Materials of construction

Metric	ACT	GPB	ACT / GPB %
Production Trains	4	28	14%
Prod. stat. (in. well)	230	1475	16%
Non-common carrier FL	100	1350	7%
Age (age)	15000	207000	7%

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

Sept 05

Heat & Corrosion

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

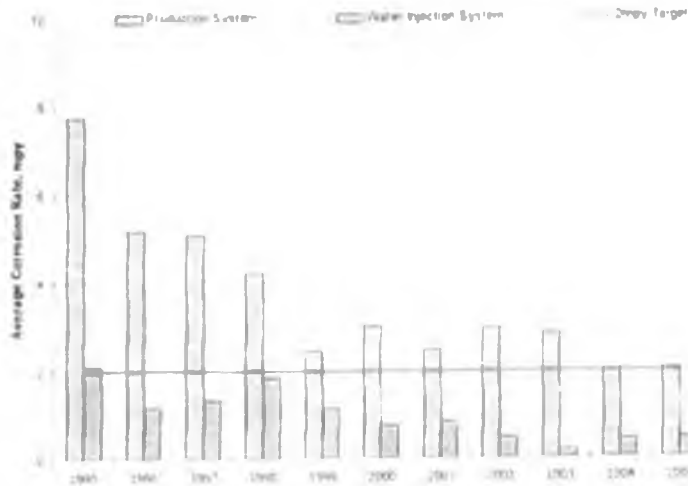
▶ External Corrosion

- ▶▶ 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

Sept 05

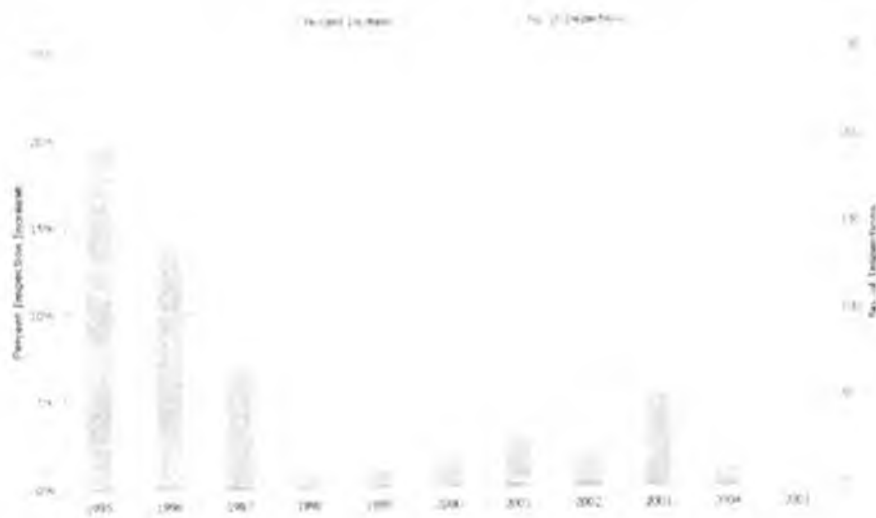
Heat & Corrosion

Endicott Corrosion Monitoring



Sept 05 Hess & Carter

Endicott IIWL Quarterly I/T Inspections



Sept 05 Hess & Carter



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

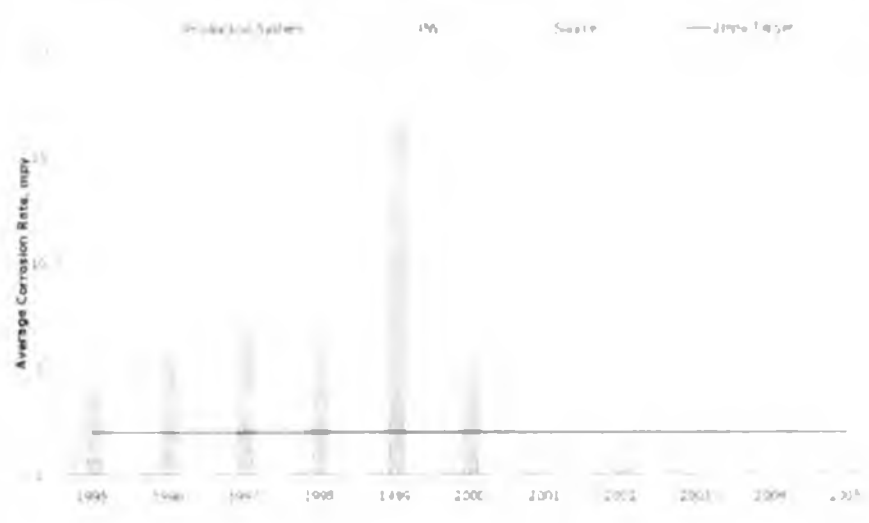
Page 27

Milne & Corbett

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MPU Corrosion Monitoring



Page 28

Milne & Corbett

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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

Meet & Confer 1



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%

Sec 01

Meet & Confer 1

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	7		1
	W			
Gas	R			
	W			
PW	FL	1		
	W			
Total		8	0	1

Milne Point Repair Table

Service	Type	Internal	External	Mechanical
Oil	R	1	2	
	W			
Gas	FL			
	W			
PW	FL		1	
	W			
Total		1	4	0

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Health & Safety

10

ACT 2005 Goals and Objectives



Endicott

05 Plan '05YTD

- » Inter-Island Water Line and PW/SW well lines
 - » Reduced corrosion based on inspection data

Training on chloride and SO₂ increase in CI
Emphasis on consistent/reliable maintenance pigging

Monitor In progress
Continue In progress

Northstar

- » Continue to build monitoring and inspection history
- » Re-locate 3-phase CI to wellheads
- » Monitor effects of mud plant DO on PW disposal system
- » Improve CI tracking and reporting

Continue In progress
Continue In progress
Monitor In progress
Plan

Badami

- » Baseline and follow-up inspection as part of mothball program

Continue

Milne Point Unit

- » Improve CI tracking and reporting
- » Review of corrosion monitoring locations

Plan Plan
Plan

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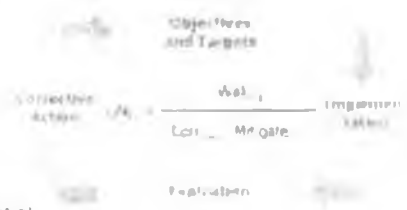
Health & Safety

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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

APEC Corrosion Charter
Meet & Confer - Field Visit 2005
September 27 - 29, 2004 5

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			

*Opportunity to visit with select Operations Leadership personnel as available

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

** Subject to change depending on field activities and priorities

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

Overall Meeting Objectives

- Present an overview of the corrosion program to enhance understanding on the part of ADEC/Coffman regarding strategy, guidelines, risk-based approach.
- Understand the rationale behind coupon location selection & monitoring of accelerated corrosion rate coupons.
- Visit selected 2004/2005 leak sites and locations where CPA is likely experiencing greater than average corrosion rates to understand location-specific parameters and prevention/mitigation measures.
- Review of below grade inspection program and how the long-range inspection technologies correlate with excavations or direct assessment results.
- Discuss the maintenance pigging program status

ADEC & Coffman Team Members

- Dianne Munson North Slope Charter Agreement Manager, ADEC
- Sam Saengsudham Section Manager, Pipeline and Tank Integrity, ADEC
- Gary Evans EPR C-plan Reviewer, ADEC
- Wade Gilpin EPR C-plan Reviewer, ADEC
- Kirsten Ballard Environmental Specialist, ADEC
- Laurie Silfven Environmental Specialist, ADEC
- Dan Stears Manager, Coffman Engineering
- Rodney Evans Corrosion Engr., Coffman Engineering
- Oliver Moghissi Consultant, CC Technologies

SPRING 2006

Charter 11.A.6

Meeting calendar agenda
per calendar

May 13, 2006

BP / CPAI - ADEC Meeting

Location: CPAI Conference Room ANO-259

Date: 3 May 2006

Time: 8:30 am - 4:45 pm

Session I - 2005 Report Meet & Confer

8:30 - 8:45am	Opening remarks
	• ADEC
	• BP
	• ConocoPhillips
8:45 - 10:15 am	BP Annual Report presentation
10:15 - 10:45 am	Break
10:45 am - 12:15 pm	ConocoPhillips Annual Report presentation
12:15 - 1:15 pm	Lunch

Session II - Extraordinary Events Discussion

1:15 - 1:30 pm	Opening Remarks
1:30 - 2:45 pm	BP Incidents
2:45 - 4:00 pm	ConocoPhillips Incidents
4:00 - 4:45 pm	Q&A, Comments, Adjournment

Meeting Attendees

Name	Affiliation	Job Title	Phone	email
Larry Dietrick	ADEC	Director Spill response	465-5255	Larry_dietrick@dec.state.ak.us
Bill Hutmacher	ADEC	Program Manager	269-3054	bill_hutmacher@dec.state.ak.us
Leslie Pearson	ADEC	Program Manager		
Lydia Miner	ADEC	Expl.Prod. Sect. Manager	269-7680	Lydia_miner@dec.state.ak.us
Dianne Munson	ADEC	Charter Agmt. Manager	269-3080	Dianne_munson@dec.state.ak.us
Sam Saengsudham	ADEC	Engineer, P/L Tank Integrity	269-3078	Sam_saengsudham@dec.state.ak.us
Laurie Silfven	ADEC	Expl Prod. Sect. Support	269-7540	Laurie_silfven@dec.state.ak.us
Bob Tisserand	ADEC	Expl. Prod. C-Plans	269-3060	Robert_tisserand@dec.state.ak.us
Gary Evans	ADEC	Expl. Prod. C-Plans	269-7536	Gary_evans@dec.state.ak.us
Craig Wilson	ADEC	Industry Preparedness	465-5204	Wilson_wilson@dec.state.ak.us
Tom DeRuyter	ADEC	Prevention Emer. Response	451-2145	Tom_DeRuyter@dec.state.ak.us
Dan Stears	Coffman Engineers	Principal	276-6664	stears@coffman.com
Oliver M. Ghissi	Coffman Engineers	Sr. VP, CC Technology	614-761-1214	omoghi@coffman.com
Rodney Evans	Coffman Engineers	Corrosion Engineer	276-6664	Evans@coffman.com
Carl Lautenberger	EPA	On-scene Coordinator, Reg 10	257-1342	Lautenberger.carl@epa.gov
Mike Jones	EPA	Ecology & Environment	257 5000	
Cathy Foerster	AOGCC	Commissioner	793-1221	Cathy_foerster@admin.state.ak.gov
Tom Maunder	AOGCC	Sr. Petroleum Engineer	793-1250	Tom_maunder@admin.state.ak.gov
Bruce Novinska	ADNR	JPO, Specialist	257-1309	bnovinsk@jpo.doi.gov
Leslie Kozisek	ADNR	JPC Representative	257-1357	lkozisek@jpo.doi.gov
Robert Guisinger	US DOT, OPS	Engineer, Inspector	271-6520	Robert.guisinger@dot.gov
Bruce Hansen	US DOT, OPS	Sr. Engineer	405 954-1138	Bruce.hansen@dot.gov
Steve Gout	US DOT, OPS			

Meeting Attendees (contd.)

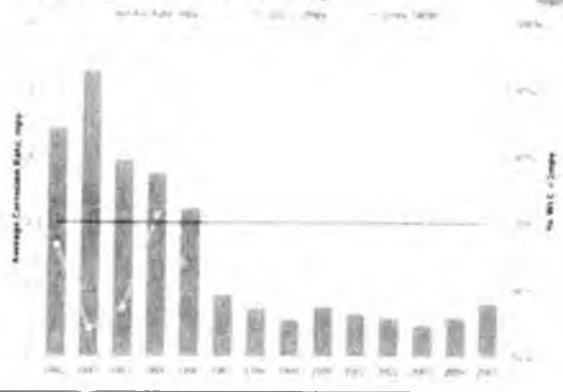
Name	Affiliation	Job Title	Phone	email
Brett Leach	BP	Integrity & Assurance Mgr.	564-4437	brett.leach@bp.com
Bill Hedges	BP	CIC Anch. Team Lead	564-4466	Bill.hedges@bp.com
Tim Bieri	BP	CIC Corrosion Engineer	564-4425	Timothy.bieri@bp.com
Kip Sprague	BP	CIC Integrity Analyst	564-4462	spragukp@bp.com
Terry Costlow	BP	Mgr. NAG Integrity Mgmt.	281 366-5903	costlo@bp.com
John Kuzma	BP	CIC Corrosion Engineer	564-4439	kuzmajh@bp.com
Paul Dubuisson	ConocoPhillips	NSOD Field Mgr.	263-4822	Paul.dubuisson@ConocoPhillips.com
Bob Bray	ConocoPhillips	NSOD Ops Support Mgr.	659-7289	Robert.d.bray@ConocoPhillips.com
Ken Donajkowski	ConocoPhillips	V.P., HSE	263-4682	
Jay Murali	ConocoPhillips	Engineering & Corrosion Supv	659-7384	Jay.J.Murali@ConocoPhillips.com
Mark Jerling	ConocoPhillips	Engineering & Corrosion Supv	659-7384	N1085@ConocoPhillips.com
Scott Fahrney	ConocoPhillips	Engineering & Corrosion Supv	265-6041	Scott.Fahrney@ConocoPhillips.com
Chris Dash	ConocoPhillips	Corrosion Engineer	263-4828	Chris.dash@ConocoPhillips.com
Al Dahlquist	ConocoPhillips	Corrosion Engineer	659-7773	N1195@ConocoPhillips.com
Randy Barnes	ConocoPhillips	Corrosion Engineer	659-7869	N1297@ConocoPhillips.com
Dave Newman	ConocoPhillips	Corrosion Engineer	659-7869	N1297@ConocoPhillips.com
Brad Frates	ConocoPhillips	Corrosion Engineer	659-7149	N1462@ConocoPhillips.com
Tom Austin	ConocoPhillips	Corrosion Engineer	659-7149	N1462@ConocoPhillips.com
Ed Goldmann	ConocoPhillips	Corrosion Engineer	670-4444	Alp1349@ConocoPhillips.com
Toby Erickson	ConocoPhillips	Engineer (DOT-IMP)	263-4729	Toby.h.erickson@ConocoPhillips.com
Ryan Stramp	ConocoPhillips	Engineer (GPB)	265-6806	Ryan.stramp@ConocoPhillips.com
Dan Kruse	ConocoPhillips	GPA Mgr.	265-1315	Dan.p.kruse@ConocoPhillips.com

BP

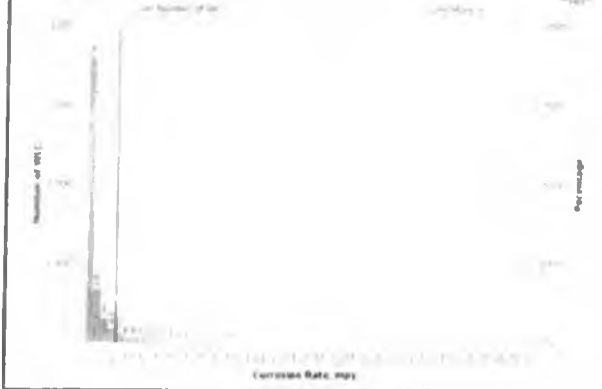
3-Phase Monitoring and Mitigation

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

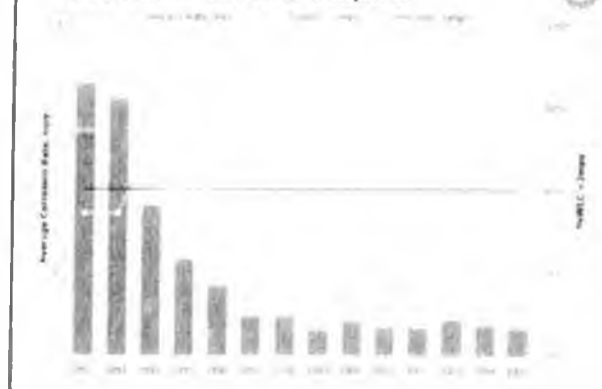
3 Phase – Well Line Coupons



3 Phase – Well Line Coupons



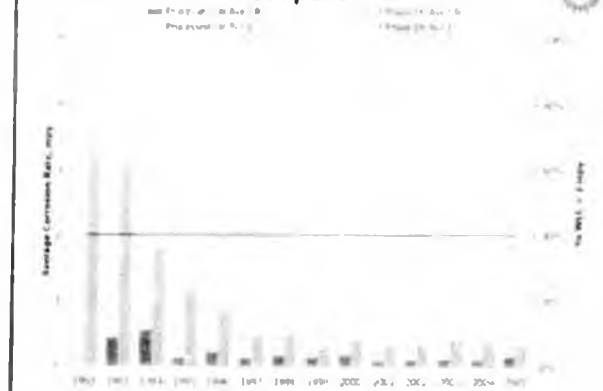
3 Phase – Flow Line Coupons



3 Phase – Flow Line Coupons



Oil – Flow Line Coupons



Recent History

- 4Q 2004 **Water Infrastructure Study**
- 1Q 2005 **Multi Disciplinary Team Formed**
 - » Engineering, Reserve, CIC, Projects, WIO, CP
- 1Q 2005 **Strategy Developed**
 - » Inhibition (3 phase carry over & direct)
 - » Clean Pipelines
 - Chemical
 - Pigging
- 2Q 2005 **Partner Endorsement**
 - » \$2.9 MM in 2005
- 3Q 2005 **Implementation**

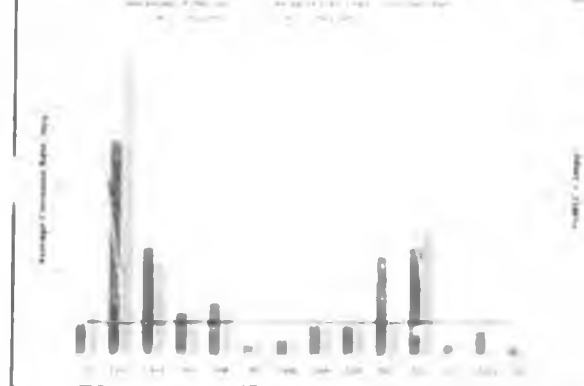
Inhibition Increase Work completed

- **All sites now converted to EC1081A (proven)**
 - » EC9041A (incumbent) has been depleted
- **Most sites now at target 60ppm**
 - » Down from initial 80ppm
 - » FS2 Target 2Q 06 (Large water producer)
- **Significant Logistic Work Completed**
 - » 90 day supply of EC1081A on hand
 - » 15 new trailers

Produced Water Summary

- 2005.....
- **Strategy Developed**
 - **Partner approval**
 - **Implementation**
 - » EC1081A increased to 80% of 40ppm
 - » Improved pigging performance
- 2006.....
- **Gaps identified:**
 - » Monitoring
 - » 3 Phase carry over
 - » Feed system upgrades
 - » Pigging performance
 - » Strategy coordination

SW System – Well Line Coupons



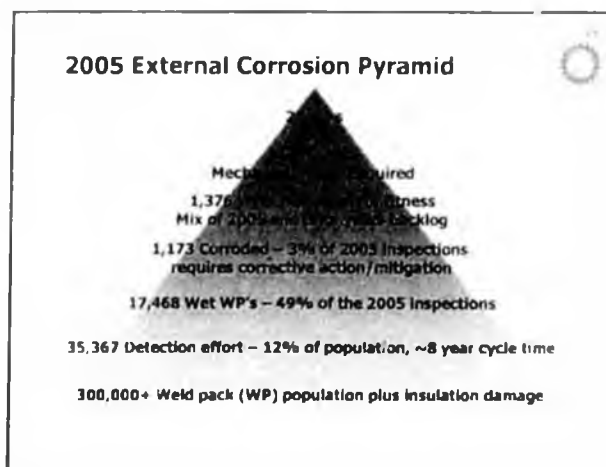
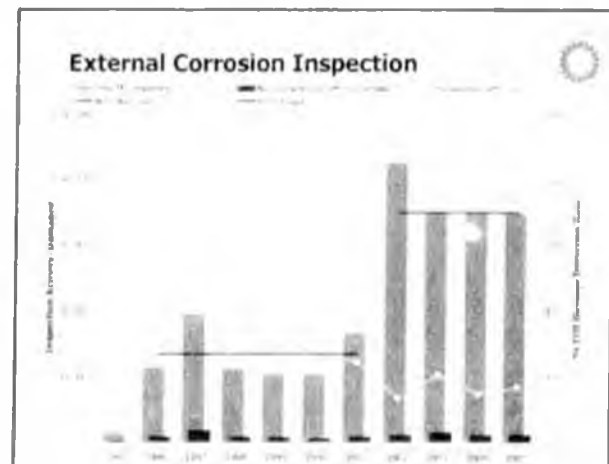
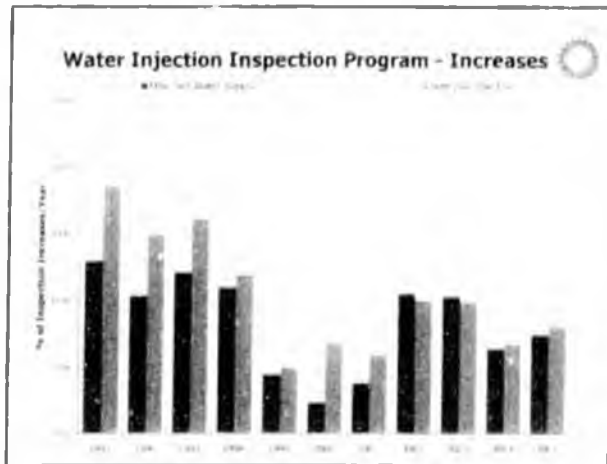
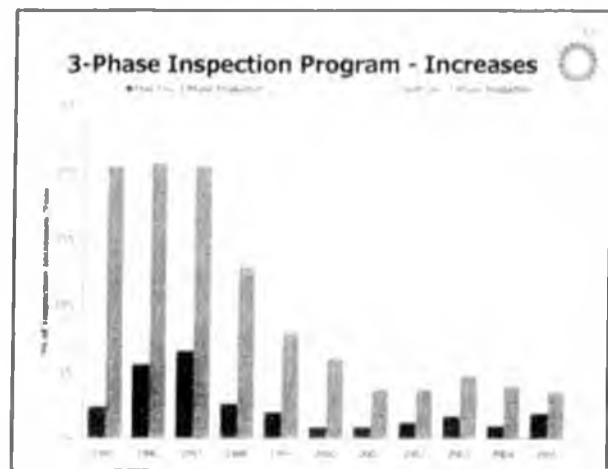
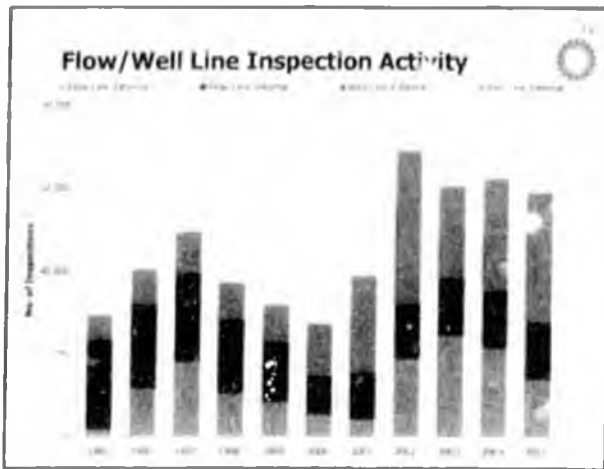
2005 REVIEW

8 Opportunities: Reverse "Creeping Changes"

1. Investigate different water intake (cleaner)
 2. Re-instate filters
 3. Resume biociding of STP
 - Plant modification options already scoped
 4. Better DO control (especially summer)
 5. Orbisphere – restore confidence in data
 6. Pigging (weekly, 6 weeks, quarterly?)
 7. Supplemental biocide at IMF2
 - Trial – for low-velocity, "special problem" circuit
 8. PW/SW swaps – line cleaning
 - "schmoo be gone," hot diesel, etc.
- Implement 2006

Inspection Program

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



- ### Cased Pipe Management Program
- ▶ Use guided-wave/ILI/visual inspection
 - ▶ Baseline inspections completed in 2003
 - ▶ GUT resource brought "in-house"
 - ▶ Used to identify and prioritize excavations
 - ▶ 79/100 segments were re-inspected
 - ▶ 5 with ILI
 - ▶ 74 with GUT permanently installed
 - Cobalt probe shortage
 - ▶ 6 segments were excavated
 - ▶ 4 – no corrosion damage
 - ▶ 1 – external corrosion
 - ▶ 1 – mechanical repair

2005 Leak/Spill Detail

DS16 - 3" 16/17AL

- » Leak detected - July
- » Gas lift
- » External corrosion @ weld pack
- » Small gas release
 - Shut in - awaiting repair



DS11-02

- » Leak detected - October
- » Seawater
- » Internal corrosion
- » ~10 gallon spill
 - Shut in - field repairs



2005 Repairs

Repair Summary

Service	Type	Internal	External	Mechanical	Total
3 Phase Oil		0	23	1	24
Water		0	1	0	1
Gas		0	1	0	1
Flowline		0	0	0	0
Flowline		0	0	0	0
TOTAL		12	49	10	71

GPB Summary

Internal Corrosion

- » 3 Phase Systems
 - Lines showing sustained performance
 - Chemical events
 - Proactive process of corrective action
- » Water Injection Systems
 - Produced water Strategy Implementation
 - Sea Water Plan Developer

External Corrosion

- » > 35,000 locations as planned

Cased Pipe

- » Executing long term management strategy

6 Leaks

GPB 2006 Goals and Objectives

	2005 Actual	2006 Plan
<ul style="list-style-type: none"> • Review ALL Strategies • Corrosion Monitoring <ul style="list-style-type: none"> » Coupons - no significant changes » ER probes - no significant changes 		No change No change No change
<ul style="list-style-type: none"> • Internal Inspection Program • External Inspection Program <ul style="list-style-type: none"> » Weld pack inspections - 15,000 		40,000
<ul style="list-style-type: none"> • Cased Piping Inspection <ul style="list-style-type: none"> » Long term management 	79,100	175
<ul style="list-style-type: none"> • Chemical Mitigation <ul style="list-style-type: none"> » Rapid Screen testing » Large scale facility trial » PW Mitigation at facilities » SW Implementation 		No Change No Change Plan Plan
<ul style="list-style-type: none"> • Technology <ul style="list-style-type: none"> » ER probe remote monitoring pilot » Remote tank strip reading demo » Field monitoring for cased piping » Remote monitoring of CI flow » Linear array real time corrosion 		Continue Continue Continue Plan Plan

Outline

ACT

- » ACT Description
- » ACT Overall Activity
- » Endicott
- » Milne Point
- » Northstar
- » Badami
- » 2005 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	WT
Producing Fields	4	11	18
Flowlines	12	115	21
Flowline Miles	100	200	100
Flowline Miles per Well	7.5	1.75	1.75

Relative Corrosivity of BP North Slope Fields

Field	Prod Fluid Characteristics				Material of Construction (1)			
	H ₂ O (%)	T (°F)	Flow (%)	CR (2)	Production		Injection	
	WL	FL	WL	FL	WL	FL	WL	FL
GPS	75	150	12	II	CS+CI	CS+CI	CS+CI	CS+CI
TRD	92	155	18	II	SS	SS	CS+CI	CS+CI
BPV	52	125	1.5	III	CS	CS	CS+CI	CS+CI
Northstar	10	180	8	II	CS+CI	CS	N/A	N/A
Badami	10	185	10	I	CS	CS	N/A	N/A

(1) CS = Carbon Steel, CI = Corrosion Inhibitor, SS = Super Alloy Steel
 (2) CR = Corrosion Rate (mm/yr) (3) CR = Corrosion Rate (mm/yr)
 (4) II = High Corrosivity, III = Medium Corrosivity, I = Low Corrosivity
 (5) Flow = 2000-3000 gpm (6) Flow = 1000-2000 gpm
 (7) Flow = 1000-2000 gpm (8) Flow = 1000-2000 gpm
 (9) Flow = 1000-2000 gpm (10) Flow = 1000-2000 gpm

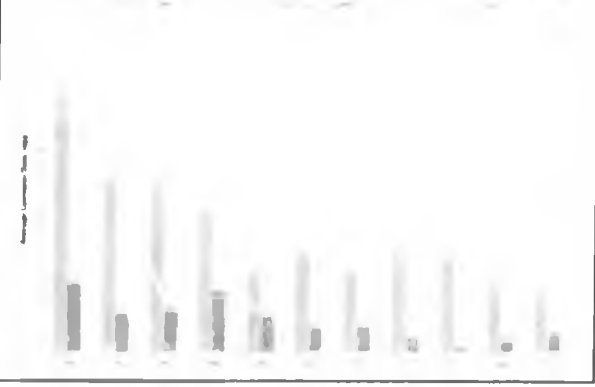
ACT Corrosion Mitigation Activity

	2001	2002	2003	2004	2005
Internal Inspections					
Endicott	1,086	1,684	2,672	2,710	1,152
Milne Point	670	1,651	4,188	1,140	1,487
Northstar	25	144	204	127	985
Badami		5	29	28	60
External Inspections					
Endicott	11	40	856	711	104
Milne Point	1,570	707	1,581	1,710	177
Total	3,718	3,551	9,132	9,086	7,355
Coupon Activity					
Produced Water, gal	NA	NA	101,815	64,551	111,744
Three Phase, gal	NA	NA	17,595	31,279	33,100
Total			119,410	95,830	144,844

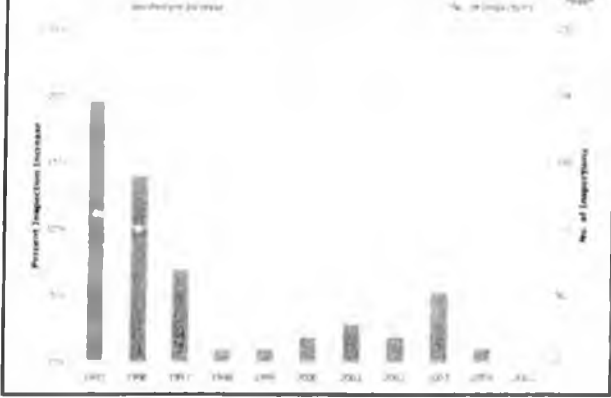
Endicott Overview

- Production System**
 - Primarily Duplex Stainless Steel
 - Exception are the carbon steel C spools
 - velocity monitoring
 - inspection program
 - Manage IG repair/replace
- PW/SW Injection System**
 - Inter-Island Water Line (IIWL) - main concern
 - Control by
 - Maintenance pigging
 - Inspection
 - Block hydrolysis
- External Corrosion**
 - 104 Inspections
 - 1 Sleeve repair (IIWL)
 - 1 Identified replacement in 2004 (19" API 5L pipe)

Endicott Corrosion Monitoring



Endicott IIWL Quarterly UT Inspections



Milne Point Unit Overview

- Production System**
 - Progressing inhibition program
 - K-Pad flow line initiated in 2001
 - S-Pad inhibited in power fluid in 2002
 - F-L-C production flow line inhibition initiated in 2003
 - B-pad flow line inhibition recommended (started 7Q06)
 - Tract 14 inhibition recommended
- Water Injection system improvements**
 - Inhibition initiated & increased maintenance pigging program in 2000
 - Significant decrease in corrosion activity

MPU - Inspection Summary

External Corrosion

- 177 inspections
 - 131 at above grade locations
 - 46 in 9 below grade excavations

Internal Corrosion

- 3,487 inspections
 - 100 in 9 below grade excavations

No repairs identified

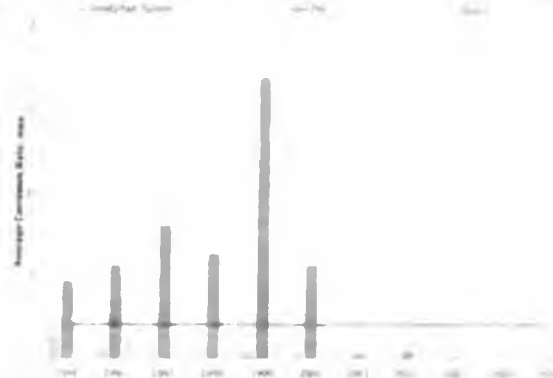
Flow line internal



Well line internal



MPU Corrosion Monitoring



Badami and Northstar Overview

Badami

- Began production in 1998
 - Production below expectations
 - No water injection system
 - Asset shut-in
 - No significant corrosion experienced
- Warm shut-in in Aug 2001
 - formed baseline and follow up inspections of equipment
 - etc. see app.
- Restart in Oct 2005

Northstar

- Began production in late 2001
- Continuous inhibition into well production lines
 - Reinforcing CI injection further upstream in progress
- No water injection system
- Corrosion monitoring program: WLC and ER probe
- Inspection baseline and historical record establishment ongoing

ACT - Leaks and Repairs

10 - Repairs/replacement activity

- 8 - SAVMS
- 2 - Corrosion related leaks
 - 1 emission on S spool at Endicott during well PDP
 - Minorly soluble crude well flow
 - 1 corrosion on C spool at Endicott (HAZ)
 - Small gas release, no liquid

Equipment Type	Service	Badami		Endicott		118w Point		Northstar	
		Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.
Production	Flare	1		6					
Flowline	Produced Water				1				

ACT 2006 Goals and Objectives

- Review ALL Strategies
- Dedicated ACT Integrity Team
- Indicott

05 Act 06 Plan

<ul style="list-style-type: none"> Identify all equipment and the O&M team Identify all equipment and the O&M team Identify all equipment and the O&M team 	<ul style="list-style-type: none"> Identify all equipment and the O&M team Identify all equipment and the O&M team Identify all equipment and the O&M team
<ul style="list-style-type: none"> Northstar Identify all equipment and the O&M team Identify all equipment and the O&M team Identify all equipment and the O&M team 	<ul style="list-style-type: none"> Identify all equipment and the O&M team Identify all equipment and the O&M team Identify all equipment and the O&M team
<ul style="list-style-type: none"> Badami Identify all equipment and the O&M team 	<ul style="list-style-type: none"> Identify all equipment and the O&M team
<ul style="list-style-type: none"> Mine Point Unit Identify all equipment and the O&M team Identify all equipment and the O&M team Identify all equipment and the O&M team 	<ul style="list-style-type: none"> Identify all equipment and the O&M team Identify all equipment and the O&M team Identify all equipment and the O&M team

Overall Summary

- Delivery of Objectives
 - Long term Fitness-for Service
- Corrosion Management System
 - Integration of key elements
 - Remaining well - Inspection program
 - Rate - Corrosion monitoring
 - Mitigation - Corrosion inhibitor
- 2006
 - Review ALL Strategies
 - Increase Staff
 - Dedicated ACT Team



BP Leaks 2006

ADEC Meet & Confer XI
3rd May 2006

2006 Leak/Spill Detail

11-10

- Leak detected - January
- Seawater
- Internal corrosion
- No Volume Estimate
 - Shut in - No repair to date

OT21

- Leak detected - March
- Processed Oil
- Internal corrosion
- ~5,000 bbls
 - Shut in



2006 Leak/Spill Detail

04-13

- Leak detected - April
- Produced water leak
- Under Investigation

R-Pad - 3" R-19 GLT

- Leak detected - April
- Gas lift
- External corrosion
- Small gas release
 - Shut in - No repair to date



GC21 - Oil Transit Line Leak



GC2 to GC1 pipeline spill site

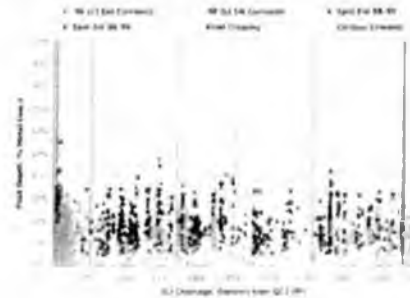


WOA OTL Internal Inspection History

- ▶ Pipeline actively inspected throughout service life
 - 1988 identified 1st internal corrosion
 - 1990 In-Line Inspection
 - 70-100% internal corrosion
 - 1991-1998 continued annual monitoring
 - 1998 2nd In-Line Inspection
 - Corrosion moderate - CI program in place - 1995
 - External (CUI) more of a concern than internal
 - 1999-2004 continued annual monitoring
 - No significant increases
 - 2004 detected increased corrosion activity in GC2 PO Plant Piping
 - 2005 added scope & frequency to inspection
 - 37 to 108 inspections
 - Included bi-annual inspection monitoring
 - Planned in-line inspection for 2006 based on 2005 IIF inspection
 - 2006 Pipeline Leaked

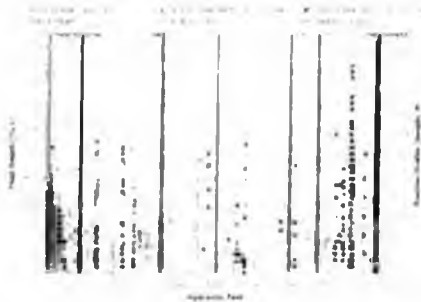
OT-21, 1998 ILI & Verification

- ▶ Corrosion degradation after ~21 years
 - Moderate internal and external corrosion damage. Pipe FFS



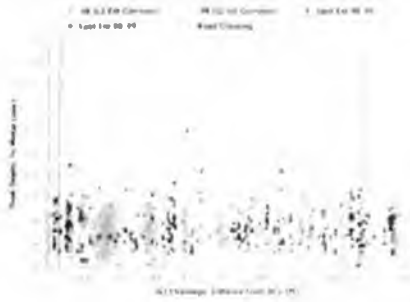
OT-21, 1998 ILI & Post Leak Data

- ▶ Significant internal corrosion increases
 - Largely associated with elevation changes and low points



OT-13, 1998 ILI & Verification

- ▶ Corrosion degradation after ~21 years
 - Moderate internal and external, slightly better than 2.1 segment



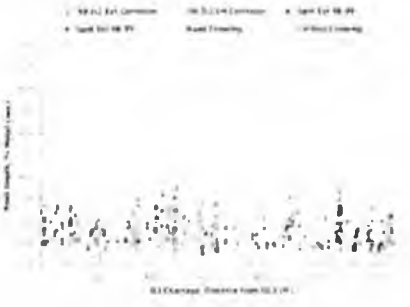
OT-13, 1998 ILI & Post Leak Data

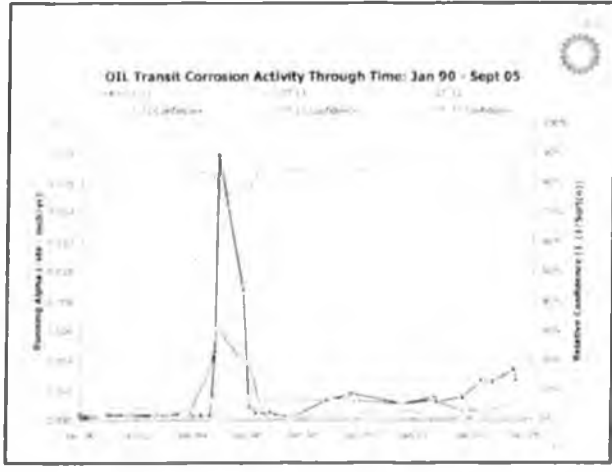
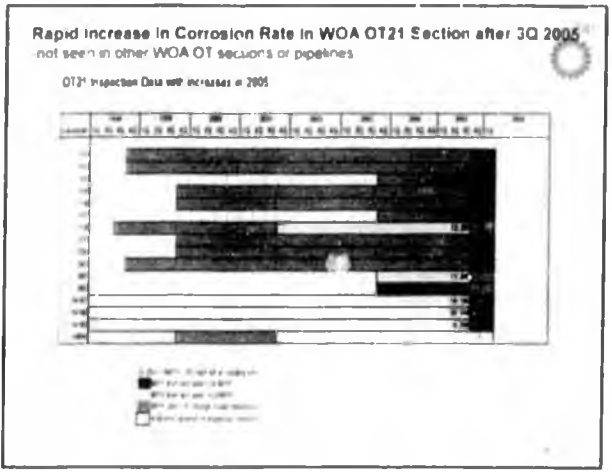
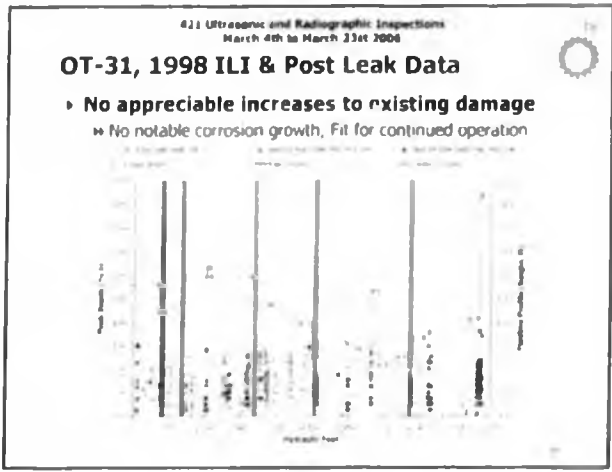
- ▶ No appreciable increases to existing damage
 - No notable corrosion growth, Fit for continued operation



OT-31, 1998 ILI & Verification

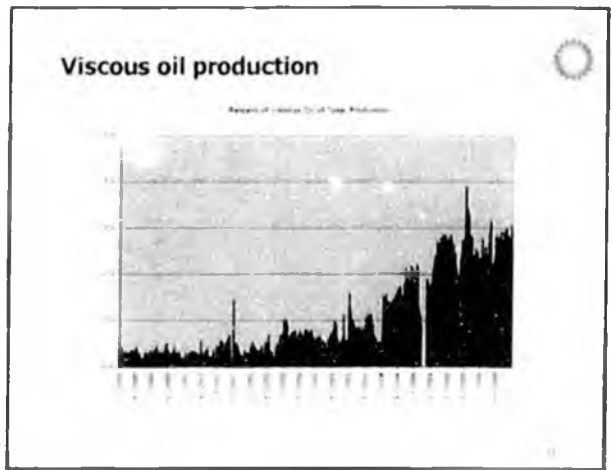
- ▶ Corrosion degradation after ~21 years
 - Moderate corrosion, progressively less than upstream



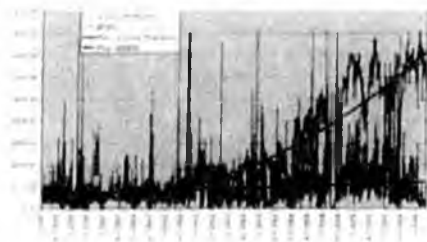


Investigation

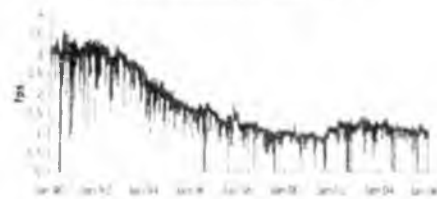
Preliminary Findings



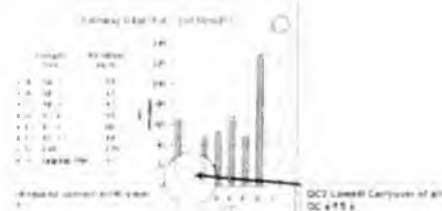
Viscous oil production & BS&W



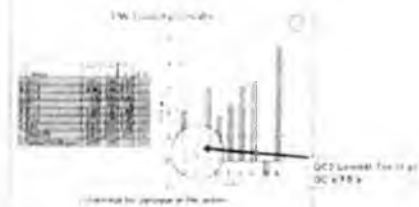
OT-21 Historical Velocities - fps



Inhibitor carry over test Feb 2005



Produced water toxicity to bacteria



Increased presence of H2S, July 2005

GC-1 H2S Sample Log Sheet

Location	PPH Result	H ₂ S Result	1 - 10 Result	Date	Sample Method
Gas Off 2 Slug Catcher	30	70	30	7/1/05	Direct gas
Gas Off 2 Slug Catcher	20	25	70	7/1/05	Direct gas
Water Off 2 Slug Catcher	140	140	100	7/1/05	gas off the water - slugs & grass
Water Off of B Dery	180	180	100	7/1/05	gas off the water - slugs & grass
Water Off of C Dery	50	30	30	7/1/05	gas off the water - slugs & grass
Water Off of D Dery	25	30	30	7/1/05	gas off the water - slugs & grass
Water Off of E Dery	25	30	30	7/1/05	gas off the water - slugs & grass
Water Off of F Dery	50	40	40	7/1/05	gas off the water - slugs & grass
Water Off of G Dery	60	60	80	7/1/05	gas off the water - slugs & grass
Water Gas Compressor	175	300	300	7/1/05	Direct gas
Discharge of Booster Pump #401	40	50	80	7/1/05	gas off the water - slugs & grass
Discharge of Booster Pump #402	275	350	300	7/1/05	gas off the water - slugs & grass
Dry Well - Tank Gas Phase	170	225	200	7/1/05	Direct gas

Possible Factors

- ▶ Low Velocity
- ▶ BS&W Excursions
- ▶ Reduced Corrosion Inhibitor
- ▶ Reduced Water Toxicity
- ▶ Increased Viscous Oil (~15%) at GC2
 - » Fine Sand
- ▶ Increased H₂S in GC2 Vessels

CPA



ConocoPhillips

Commitment To Corrosion Monitoring Overview

presented to the

Alaska Department of Environmental Conservation

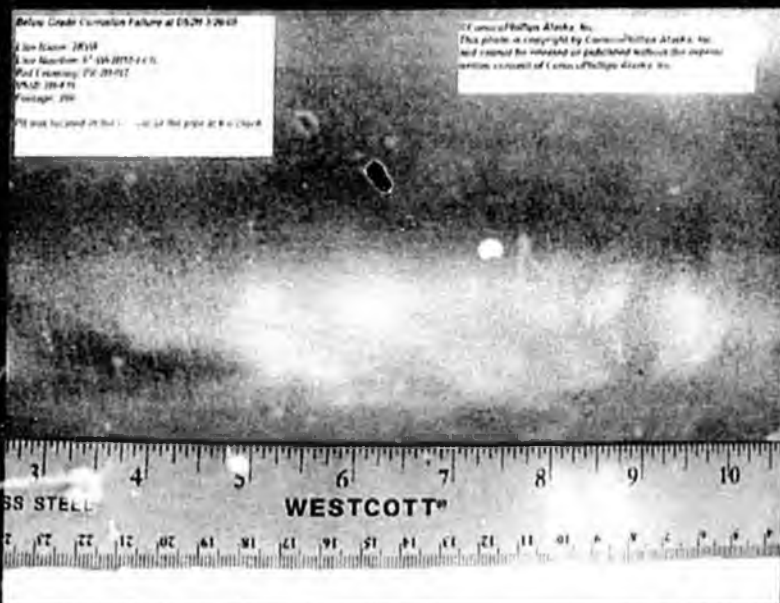
9th Meet & Confer

May 3, 2006

Program Enhancements

- Linear array very valuable for evaluation of 12-16" diameter water-packed Cross Country (CC) lines.
- Pigging program for CC WI lines standardized with disk/brush/disk pigs & monitoring of pigging returns.
- Monitoring of biocide application with residual measurements initiated.
- The number of below-grade piping circuits excavated tripled from 2004 to 2005.
- Rope Access Technology (RAT) added to inspection capabilities.
- The extent of tangential radiographic (TRT) inspection expanded to include 12 O'clock position; a 360-degree inspection is performed where possible.

- On 3/26/05 At ~10:45 AM, a leak from a 1/4 inch X 1/4 hole was discovered on the below-grade section of a 6" CC WI line at DS2H pad.
- The leak was discovered during a routine corrosion survey.
- Original estimate of **113,000 gallons**, eventually revised to 51,198 gallons. The approx. 2-acre spill was a mixture of PW and SW.



- Line put in WI service in 1989
- Initial inspection in 2001 w/ 5% RTR (463') showed 9 of 12 segments had no damage. Scattered internal pitting in 3 segments - 17% wall loss max.
- Below grade long range inspection for external corrosion on this line by Profile Technology Inc. (PTI) in July of 2001; no indications.
- Between 2001 and the time of the leak, 7 recurs by manual inspections at 3 locations showed minor increases and 35% max. wall loss by RT.
- In 2005, another 5% RTR inspection (614') showed widely scattered internal pitting in all 16 segments inspected with 29% max. wall loss.

- Commingling of PW & SW caused additional solids deposition and rendered corrosion inhibition less effective
- Coupon mpy rates increased post 2000 due to the above
- Under-deposit/MIC corrosion accelerated due to nutrients from SW/PW
- Maintenance pigging ineffective in removing solids
- The line was subject to low flow velocities

ADEC & BP were represented in the Physical Cause Analysis Team

Lessons Learned - Part Four

- Fourteen Near, Medium and Long-term recommendations from Physical Cause Analysis under various stages of implementation
- Commingling of PW & SW at CPF2 is suspended; plans to commingle at CPF3 is now on HOLD
- More aggressive maintenance pigging with disk-brush-disk combo in operation; pigging returns (TSS) monitored
- Risk-based inspection protocols further strengthened with more frequent interval inspections
- TWI technique for internal & external long range inspection prioritized field-wide
- Recent data indicate lines are 'cleaning up' and corrosion rates have receded

- 3JPO 12" CC line leaked on 10/26/2005 at saddle weld-pack - external corrosion
- Leaks at 10 O'clock position on line – corrosion was 360 degrees around
- Weld-pack previously inspected 12/2001 - no corrosion or water detected
- This weld-pack was not scheduled for re-inspection under the existing CC line interval inspection program.
- TRT Program Guidelines changed – Require Top and Bottom inspection over entire CUI length when medium wet or damaged insulation – An increased CUI inspection frequency has been proposed



Internal Inspection

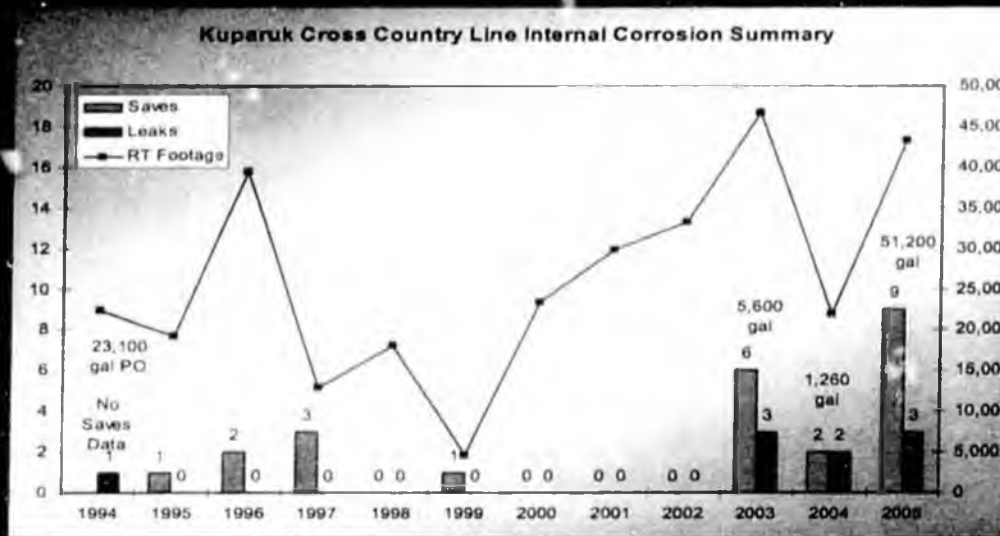
2005

- ✓ Completed all 2005 goals except for 30" SWI Line Smart Pig.
- ✓ Over 43,000 ft over 160 lines inspected (RTR and RT)
- ✓ Completed baseline survey of on-pad deadlegs.
- ✓ 3 Leaks (1 water injection, 2 production), 9 Saves (5 WI, 4 PO). WI leak caused by MIC.

Internal Corrosion Spills - Cross Country Lines

2004 Spill 24" 1YK Crude Oil
 2003 Spill 6" 3R Sea Water
 2004 Leak 6" 3R Sea Water
 2005 Spill 6" 2K Mixed Water

Number of Leaks & Saves



RT Footage

Internal Inspection

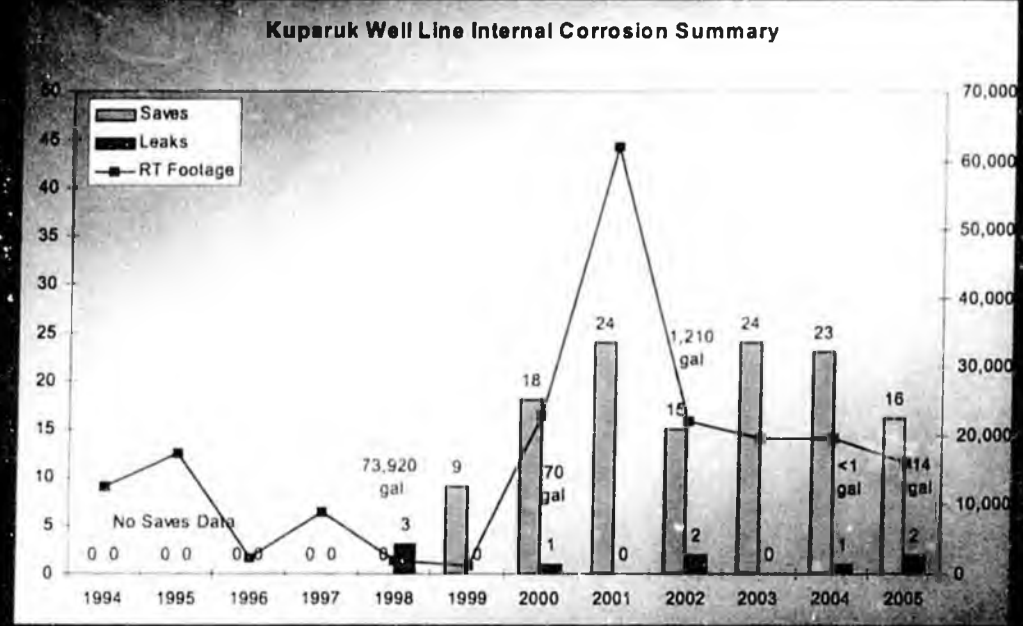
2005

- ✓ Completed all 2005 goals.
- ✓ Roughly 16,000 ft of over 300 lines inspected (RTR and RT).
- ✓ 18 lines required repair (11 injection, 7 production).
- ✓ 2 Leaks, 16 Saves. Leaks due to under-deposit corrosion and erosion.

Internal Corrosion Spills - Well Lines

1995 Spills	1L-16 WI 1L-36 WI 1A-96 WI
2000 Spill	1G-86 PC
2002 Spills	2A-16 FC 2T-136 PC
2004 Spill	1Y-023 WI
2005 Spill	1G-096 WI

Number of Leaks & Saves

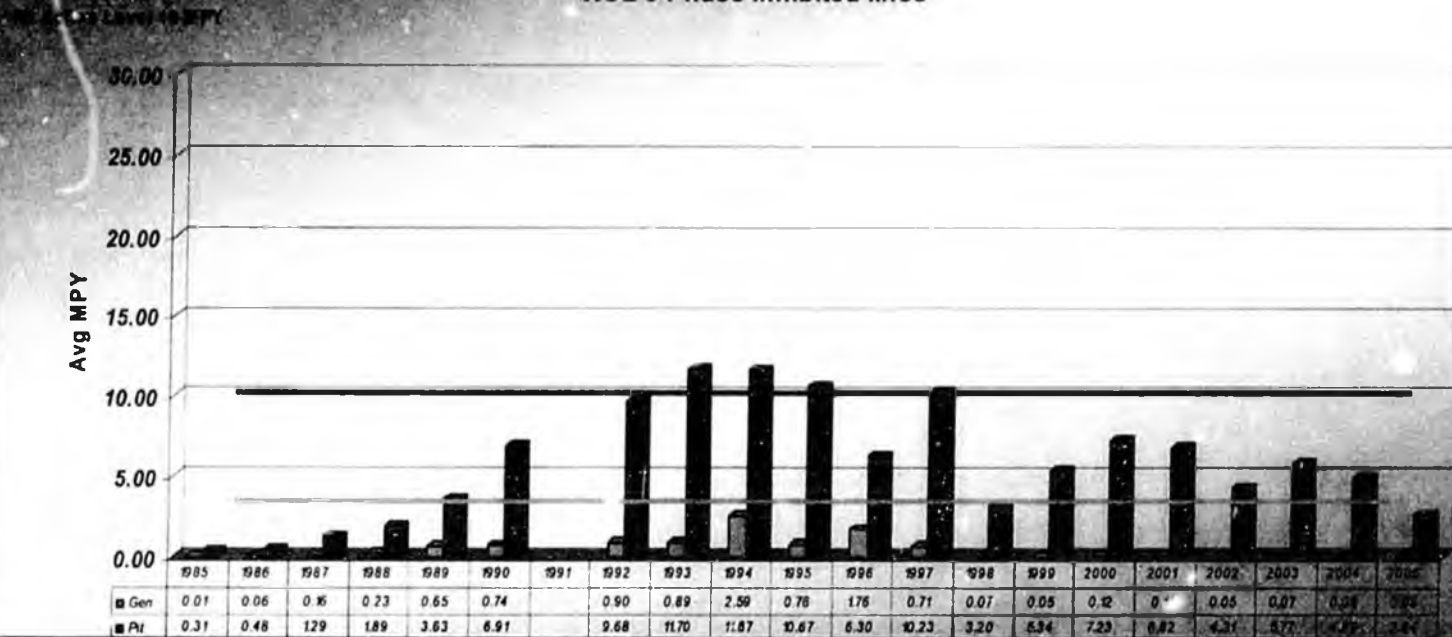


RT Footage

Cross-Country Lines	
<i>Goal</i>	<i>Status</i>
Continue Recurring Interval Inspection Program, KDR Program and TFS Program	On Schedule
Smart pig 30" SWI line in '06.	Deferred from 2005. Evaluating feasibility of smart pigging 12-inch WI lines.
Well Lines	
Continue Recurring Interval Inspection Program, KDR Program and Erosion Program	On Schedule

Corrosion Inhibition is Effective

XCL 3 Phase Inhibited lines

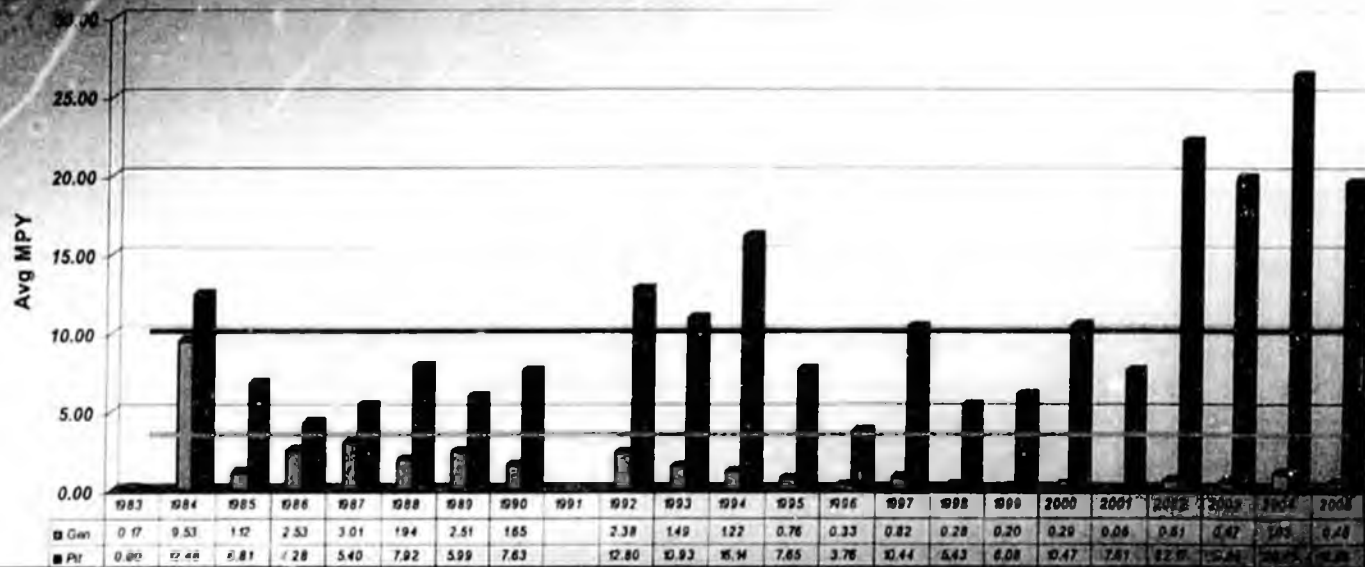


2005

- ✓ Coupon average rates remain below thresholds.
- ✓ 96% of 3-Phase Production CC lines have ER probe rates < 2 mpy.
- ✓ Inspection continues to support monitoring with 419 corrosion rate monitoring (CRM) inspections conducted, with one minor increase found
- ✓ All 3-Phase Production CC lines with probe, coupon, or inspection corrosion rates above thresholds had corrective action taken.

2005

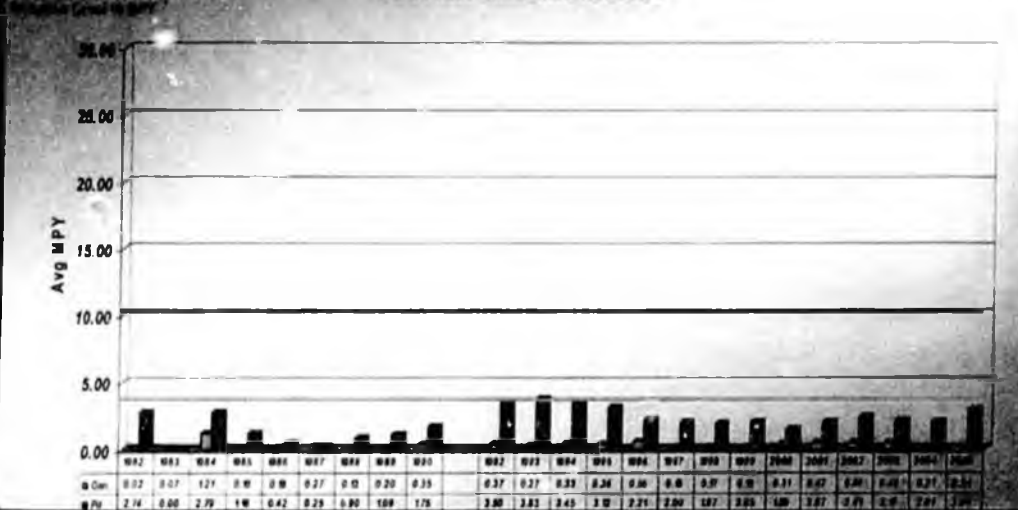
Cross County Wtr Inj Lines



- ✓ Coupons changed after CPF₂ split the SW & PW, were pulled 3 months later with pitting rates dropping on all header coupon locations from a high of 185 mpy to a high of 18 mpy.
- ✓ Inspection continues to corroborate monitoring data
- ✓ Continuing to adjust and analyze mitigation program with adjustments to pigging at all facilities and additional adjustment to STP biocide treatment.

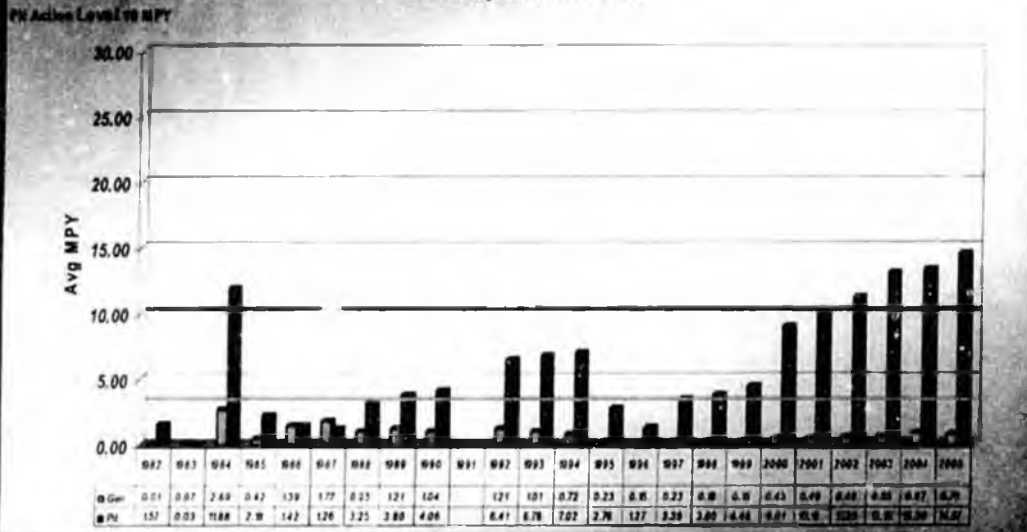
2005

DS 3 Phase Uninhibited Well Lines



- ✓ Coupon average corrosion rates remain below threshold levels
- ✓ Inspection supports lower 3 phase system corrosion rate with lower number of repairs identified in this system

DS Wtr Injection Well Lines



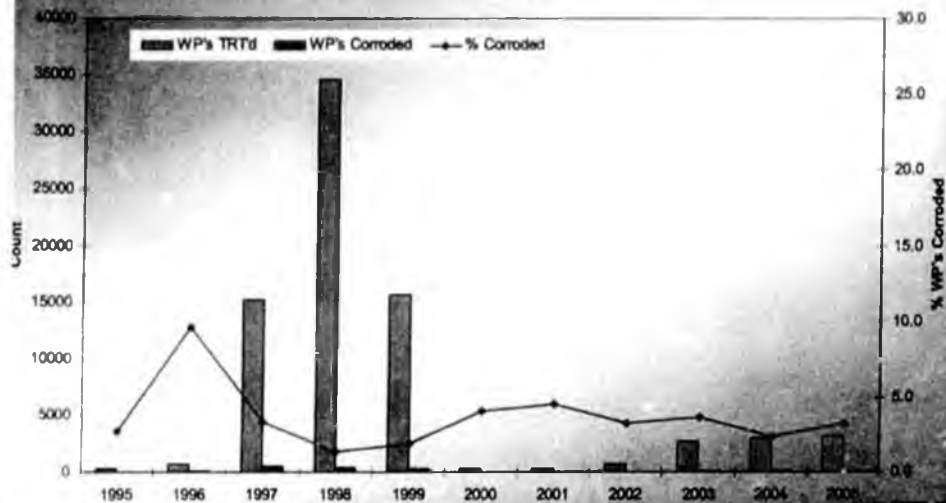
- ✓ Inspection continues to identify lines requiring repair / replacement.

Monitoring & Mitigation	
Goal	Status
Continue testing for more effective corrosion inhibitors	<ul style="list-style-type: none"> • Field test of Baker RE5273 started moved from DS1R to next phase large scale testing at CPF2 Drillsites 2U, V and W • Next test at DS1R should begin mid summer
Continue improvements to all three CPF Water injection System treatment programs	<ul style="list-style-type: none"> • Biocide injection residuals along with Total Suspended Solids and serial dilution are being monitored to verify mitigation system performance • New pig sampling position created
Improve Field wide Maintenance Pigging Program	<ul style="list-style-type: none"> • New field wide maintenance pigging recommendation issued and currently being implemented
Install additional monitoring locations in water injection system.	<ul style="list-style-type: none"> • Both additional coupon locations and inspection corrosion rate monitoring (CRM) locations are being established and installed.

2005

Mature Ongoing Program

Historical Results - Weldpacks Over Landra

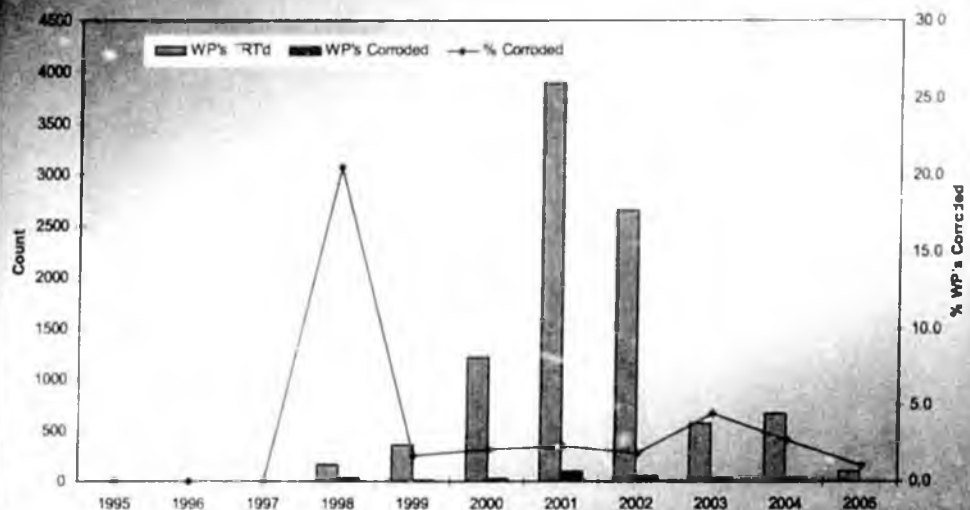


- ✓ 3205 weld packs TRT inspected.
- ✓ 102 (~3.2%) had corrosion. One location required a temporary sleeve (DS3KPO).

CC Lines On Pad ⇒⇒

- ✓ 94 weld packs TRT inspected.
- ✓ Only one location was found to have corrosion (~1.0%). No repairs required.

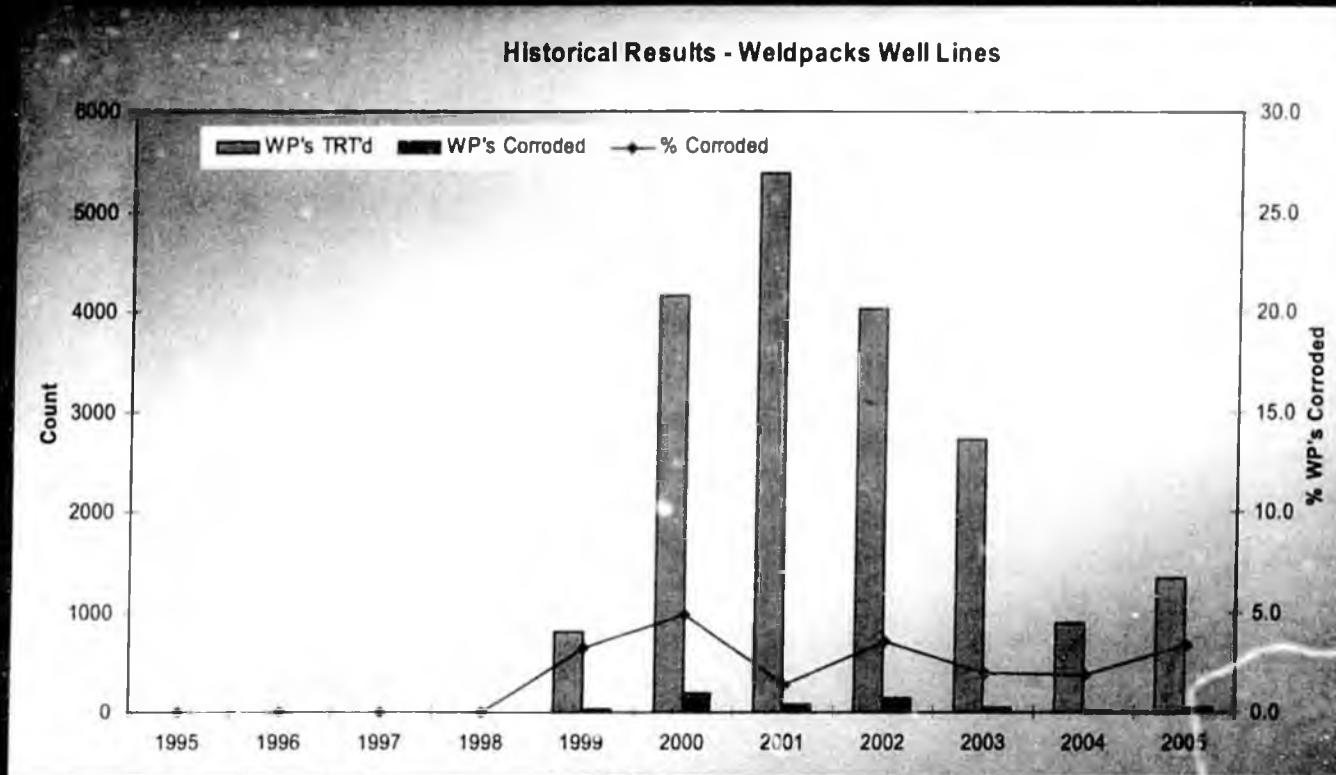
Historical Results - Weldpacks CC On-Pad



External Inspection

2005

- ✓ 1347 weld packs TRT'd. Baseline inspections were completed in 2004. 2005 was the first year of our recur inspection program.
- ✓ 46 (~3.4%) were corroded. No repairs were required. The corroded weld packs were refurbished.



Cross-Country Line Corrosion Under Insulation Inspections

<i>Goal</i>	<i>Status</i>
Cross-Country On/Off - Pad	
TRT 100 Weld Packs to Evaluate the Tarn WP Design	On Schedule
TRT 100 Weld Packs refurbished with Denso Tape to monitor performance	On Schedule
TRT approximately 3950 Weld Packs (based on seven lines)	On Schedule
Well Line Weld Packs	
TRT approximately 1500 Weld Packs (based on 130 lines)	On Schedule
Misc.	
Complete Buffer Spike Report and Issue Recommendations.	On Schedule

2005

- ✓ Completed all 2005 goals.
- ✓ Inspected 127 priority 1 locations with TWI (double that of 2004).
- ✓ Inspected all priority 2 locations.
- ✓ 24 cased pipes excavated (goal was 5 to 9)
 - Four repairs, 2 replacements (1 CUI, 1 int), 2 sleeves (1 CUI, 1 combo).
 - Twenty had only minor or no corrosion.
 - Final Tally: 24 Refurbishments, 3 Saves, 1 Leak
- ✓ Completed Annual Visual Casing Inspection - cleared all obstructions.

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

All Lines in GKA Inventory	Inspected Through 2005	Un-inspected Lines	Total	Previously Uninspected Lines Inspected in 2005
Priority 1	529	58	587	2
Priority 2	118	0	118	0
Priority 3	67	0	67	0
2005 Total Inventory	714	58	772	0

<i>Goal</i>	<i>Status</i>
Inspect ~ 130 priority 1 pipes using TWI.	On Schedule
Inspect all priority 2 circuits (visual & gas sniff)	On Schedule
Prioritize and excavate ~24 circuits	On Schedule
Continue cooperative effort with equipment vendors, COP R&D and BP to improve current technology and explore new technologies.	On Schedule

2005

External Corrosion

- ✓ 3JPO

Internal Corrosion

- ✓ 2KWI CC line spill
- ✓ 1G-09 WI well line spill due to under-deposit corrosion

Other Structural Concerns

- ✓ 3I GL Wind Induced Vibration

2005

Alpine: 1st production in November of 2000

Two Drill sites on production

Internal Corrosion

- ✓ Production lines: Coupon rates all less than 2 mpy
- ✓ 2600 ft of a X-C production line inspected – no damage.
- ✓ Water Injection lines: 18 mpy pitting on a single coupon, remainder: < 10mpy threshold. All general corrosion rates below 1 mpy
- ✓ 32 Well lines inspected: no damage
- ✓ 330 ft of the CD2 WI line inspected, but resolution was poor

2005

External Corrosion

- ✓ Improved design standards incorporated into 'new construction'.
- ✓ Two direct buried lines identified; no CP or external coating. Excavations and inspections were performed to assess the integrity of the lines and placed on a very conservative inspection schedule.
- ✓ Spot TRT on 10 well lines. No damage.

No corrosion related leaks since start-up.

2016 Goals

<i>Goal</i>	<i>Status</i>
Inspect 20 lines for CUI	None yet – pending the end of the winter construction
Perform interval inspection on 20 well lines	None yet – pending the end of the winter construction season
Layout and API-570 visual for lines 5 yrs old	On schedule

Cono  Phillips

THE END

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 biociding.

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