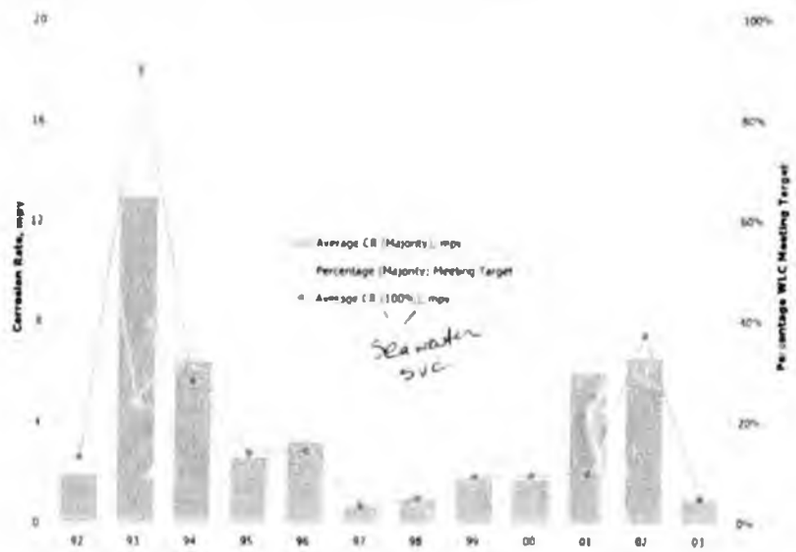
11959 SENATE RESOURCES

SW System– 2002/2003 Corrective Actions

- **Upstream Corrosion Control**
  - Improved dissolved oxygen control
- **Downstream Corrosion Control**
  - Improved microbiological/biocide efficacy
- **Oxygen Control– Corrective Actions**
  - Set O_2 control < 20 ppb
    - Mechanical fixes to tower
    - Continuous O_2 scavenger
- **Microbiological- Corrective Action**
  - Increased biocide frequency
    - 2002 from once every two weeks to once a week
  - Increased effective biocide concentration
    - 2003 from 500 ppm to 750 ppm
    - Increases downstream biocide residual levels

SW System– Well Line Coupons

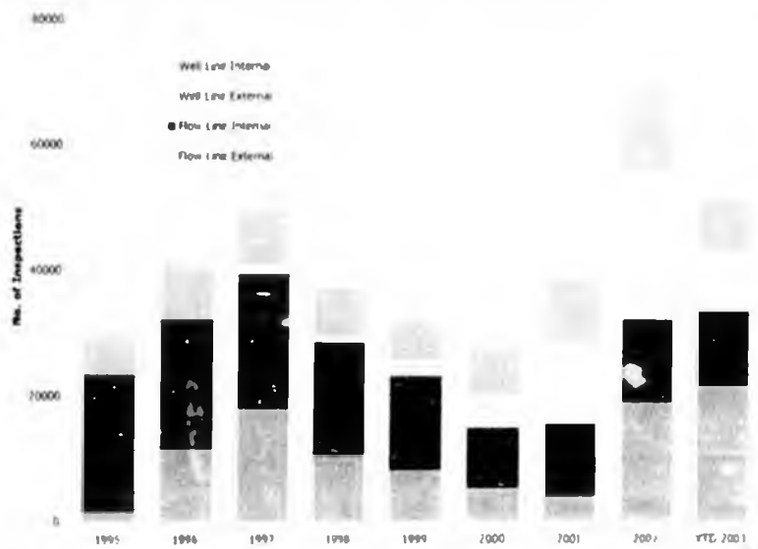


Very limited dataset system just shut down recently

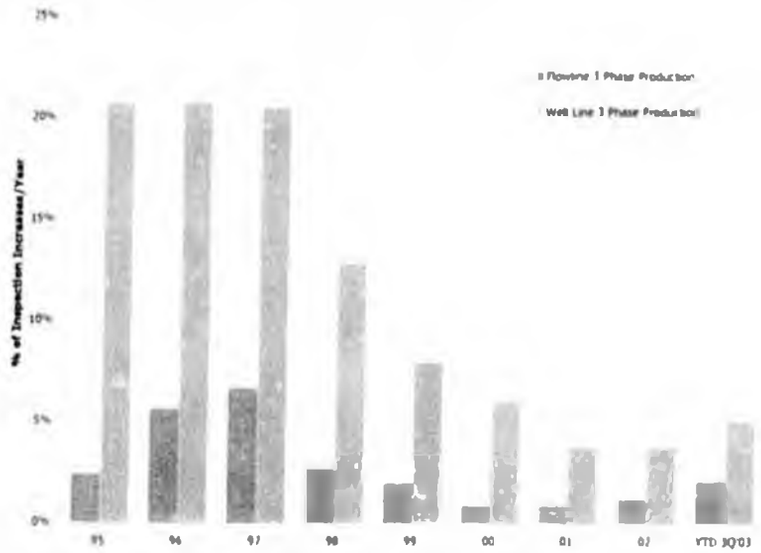
Inspection Program

- **Inspection Activity**
  - Internal
  - External
- **Internal Inspec n**
  - 3 phase – flow and well line
    - F line corrective action
  - Wate injection – flow and well line
- **External Inspection**
  - Activity level
- **Cased Piping Inspection**
  - Activity level
  - Type and method
- **Smart Pigging Activity**
- **Spill Summary**
  - Y-36 Incident

Flow/Well Line Inspection Activity



3 Phase Inspection Program

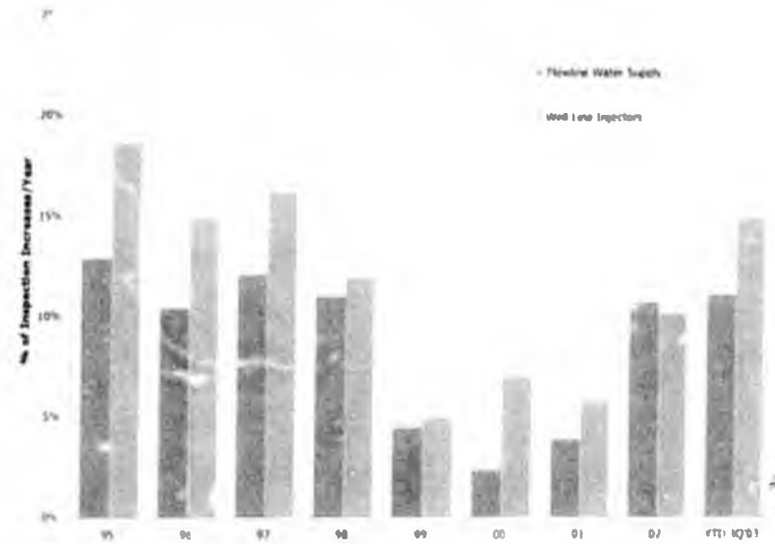


Flow Line Inspection– Corrective Actions

- **Inspection**

Equipment ID	Cause	Action
Y36	Increased Corrosivity	See ER Probe Action Log
16C/17C	Increased Corrosivity	Increased CI by 5%
W-74	Increased Corrosivity	Increased CI by 10%

Water Injection Inspection Program



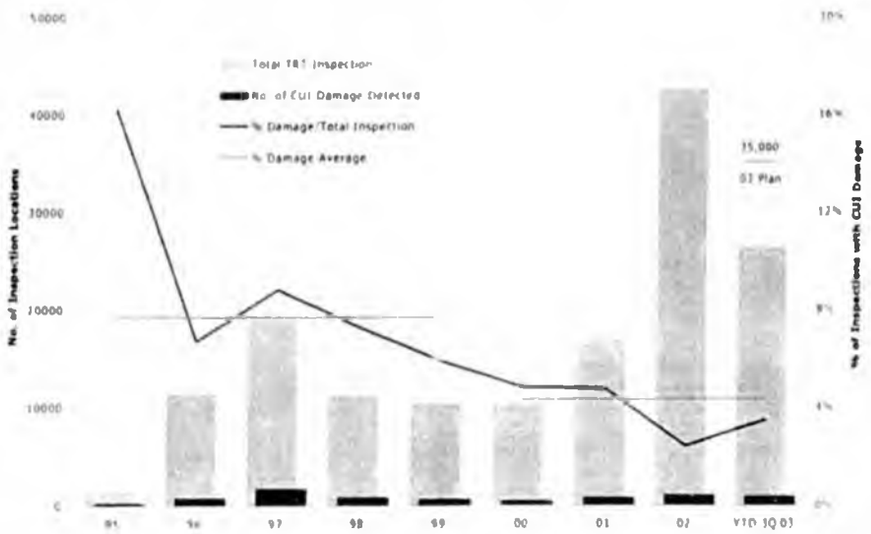
Oct 2003 BP/ADEC Meet and Confer VI 19

2 yr lag time

reports change over 2 yrs

the lag w/ inspection activity

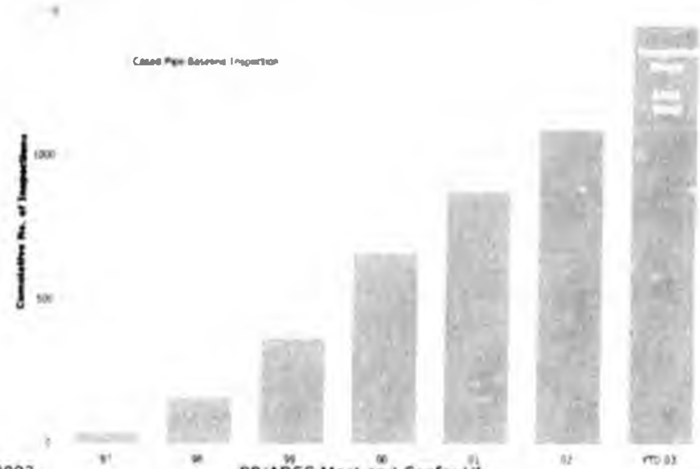
External Corrosion Inspection



Oct 2003 BP/ADEC Meet and Confer VI 20

Cased Pipe Inspection I

- **Completed Initial Baseline Inspection**
  - Awaiting 2003 NDE provider(s) report



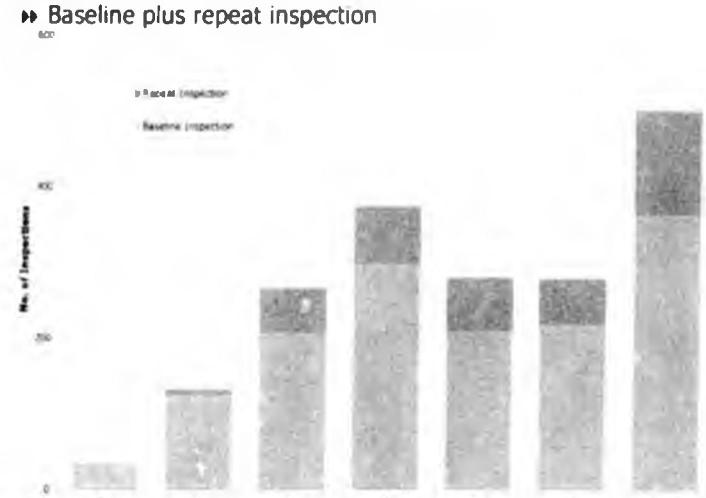
Oct 2003 BP/ADEC Meet and Confer VI 21

reflects add'l equipment installed since tax 2 #s

still installing this type of pipe

Cased Piping Inspection II

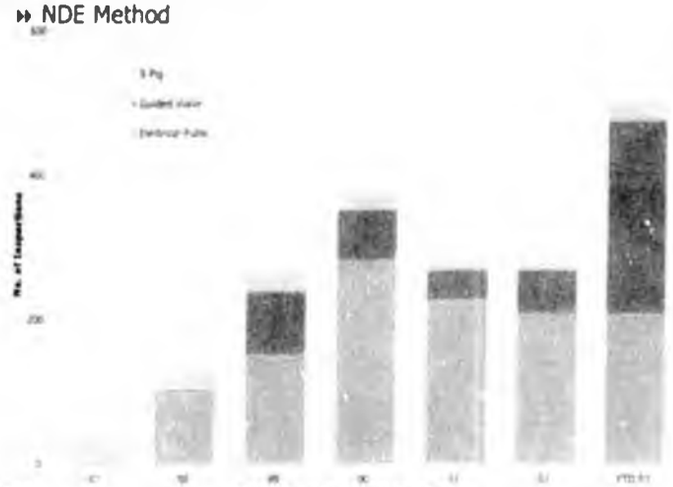
- **Inspection Activity**
  - Baseline plus repeat inspection



Oct 2003 BP/ADEC Meet and Confer VI 22

Cased Piping Inspection III

- **Inspection Activity**
  - NDE Method



Smart Pig Inspection

- **Completed 3Q'03**

Equipment ID	Diameter	Material Thickness	From	To	Service	Length (miles)
PTMCLS01/02	24"	0.375"	Drill Site L1	LPC	3 Phase Production	5
S-36	24"	0.375"	S Pad	GC2	3 Phase Production	6
Y-36	24"	0.375"	Y Pad	GC1	3 Phase Production	6

- **Tentative 4Q'03**

Equipment ID	Diameter	Material Thickness	From	To	Service	Length (miles)
STP-36	36"	0.375"	PM2	GC1	3 Phase Production	~11

Smart Pig Inspection II

- **Interim Report**
  - 2 locations on PTMCLS01/02
  - Field verification of interim report damage assessment
    - FFS assessed by PR-3-805 Modified Criterion as cited in CFR 195
    - 1st location
      - CUI damage – failed B31.4 80% criteria
      - Line immediately shut-in and sectional repair completed
    - 2nd location
      - Coincident internal and external damage
      - Fit-for-service with MOP greater than design
- **Final reports**
  - Not yet received
- **Smart Pig FollowUp**
  - Validation and verification with NDE
  - Results reported under routine NDE

YTD 2003 Spill Summary

- **Spill Location Summary**

	Affected Surface	
	Internal	External
Well Line	-	-
Flow Line	-	1

- **Spill Mechanism Summary**

	Mechanism		
	CO_2	Erosion	CUI
Well Line	-	-	-
Flow Line	-	-	1

- **Spill Fluid Summary**

	Service		
	Prod	SW	PW
Well Line	-	-	-
Flow Line	1	-	-

Y-36 Large Diameter Flowline

- **Incident Summary**
  - May 27th 2003 leak detected
  - Line shut-in and insulation removed
  - Leak occurred at caribou crossing
- **Inspection**
  - Gravel and casing cut back aprnx. 8'
  - Corrosion network present 360°
    - Leak at 06:00 o'clock position
    - Network stopped 12" inside of insulation
- **Cause**
  - Failure caused by external corrosion
    - Water ingress via UT insulation window
- **Corrective Action Plan**
  - Sleeve installed at location
  - Additional visual/NDE inspection
    - Similar configurations across GPB

Line leak and sleeve installation

Oct 2003 BP/ADEC Meet and Confer VI 27

Y-36 Corrective Action Plan Scope

- **Visual Inspection of All Below Grade Piping**
  - Observations recorded at each crossing
    - Insulation missing/damaged
      - Evidence of corrosion/visible by-product
    - Tide/water marks
    - Casing blockage/debris
    - Casing overburden
    - Non-bearing/unsupported pipe
  - Review inspection history
  - Audit cased pipe inventory records
- **Additional 2003 Cased Pipe Inspection Over Plan**
  - All segments with missing insulation at or near crossing
  - All segments with water/tide marks not examined in prior 3 years
  - Any segments resulting from audit not inspected

Oct 2003 BP/ADEC Meet and Confer VI 28

Y-36 Corrective Action Plan- YTD Progress I

- **Visual Survey and Audit Completed**
  - Observed 31 segments with external corrosion at missing insulation
  - All locations with missing insulation identified
- **NDE Follow-up**
  - 31 locations examined and prioritized by TRT
    - 3 locations for immediate excavation/mitigation
    - 28 locations added to expanded 2003 NDE program
  - 3 Segments - Excavation/Mitigation
    - Sleeve repair upstream/downstream - 1 crossing (24" X-74)
    - Replaced complete pipe segment - 1 crossing (14" NGI/CCP)
    - Location fit-for-service - 1 crossing (24" F-74)
- **Additional 2003 Inspection Program**
  - Increased cased pipe NDE scope by ~200 segments
  - Total 2003 program scope ~500 locations

Y-36 Corrective Action Plan- YTD Progress II

- **2003 Cased Pipe Scope Breakdown**

	No.	%	Notes
Electrical Pulse	207	41%	
Guided Wave	268	54%	28 with corrosion All with missing insulation Electrical pulse validation
Smart Pigging	25	5%	Includes Y-36 post spill

- **Thermal Insulation**
  - Replacement of missing insulation at cased crossing
    - On-going ~75% complete
- **Outstanding Actions**
  - Awaiting final analysis of cased pipe inspection results
  - Develop recommendation/prioritization of reported damage
  - Develop long term cased pipe program
    - On-going activity versus baseline
    - Monitoring versus discovery

Summary

- **Internal Corrosion**
  - 3 Phase Systems
    - Lines showing sustained performance
    - Proactive process of corrective action
  - Water Injection Systems
    - Well line PW and SW systems improving
      - Caution – SW system limited/preliminary data
    - Flow line water injection
      - Coupon program showing improvement
      - Discrepancy between coupon and inspection trends
- **External Corrosion**
  - On track to deliver 35,000 locations in 2003
  - Cased pipe baseline inspection on-track for completion by end 2003
- **Y-36 Spill and Followup Actions**
  - Significant increase in cased pipe effort

CPA

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Commitment To Corrosion Monitoring Overview

presented to the

Alaska Department of Environmental Conservation

6th Meet.& Confer

October 30, 2003

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Internal Inspection

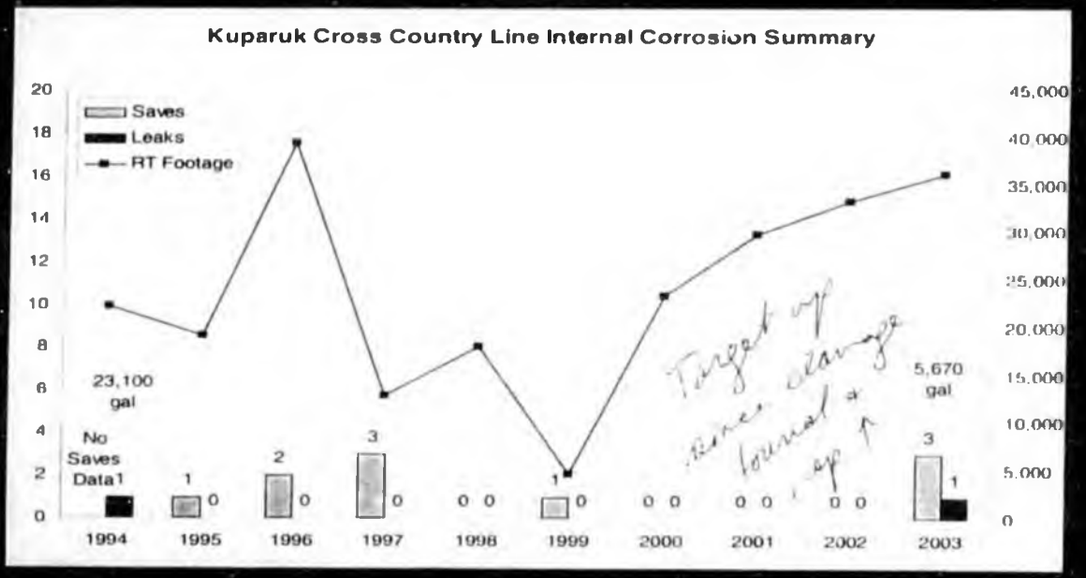
Corros[illegible] Under [illegible] Lines

- ✓ Over 38,000 ft of over 198 lines inspected (RTR and RT)
- ✓ On schedule to complete baseline inspection on elbows due for inspection under our Turbulent Flow Area Inspection Program
- ✓ 1 Leak (injector), 3 Saves (1 injector, 2 producers)
- ✓ Linear Array appears to work on 16" and smaller water packed lines.

2003

Internal Corrosion Spills
- Cross Country Lines

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



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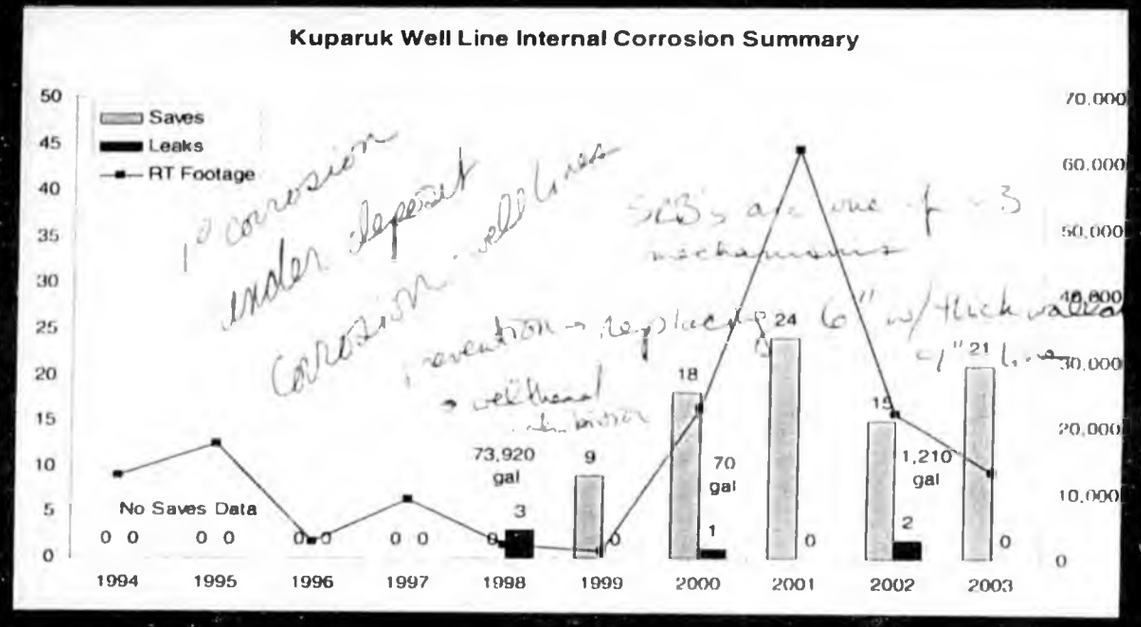
Internal Inspection

- ✓ On schedule to complete baseline inspection of all well lines due for inspection
- ✓ Over 13,000 ft of over 469 lines inspected (RTR and RT) so far.
- ✓ 21 lines required repair (17 injectors, 4 producers)
- ✓ 0 Leaks, 21 Saves

2003

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



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Internal Inspection

Cross-Country Lines	
Goal	***Status***
Inspect ~ 15,000 feet by RTR	Inspected 38,000 feet
Complete elevation change elbow inspections	On schedule to complete
Prioritize and finalize plan to inspect WI lines >10" OD.	List compiled, Finalizing '04 plan.
Well Lines	
Complete baseline inspection of all 6" OD, 0.312 and 0.375" six years old or older or since previous inspection.	On schedule to complete

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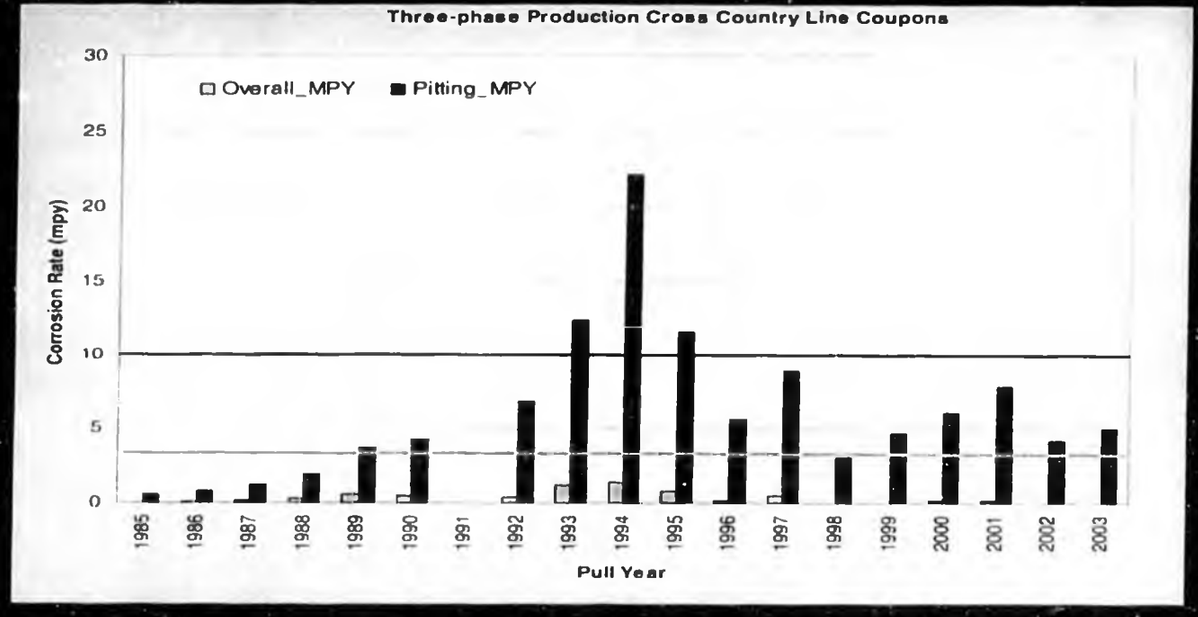
Monitoring/Mitigation



2003

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

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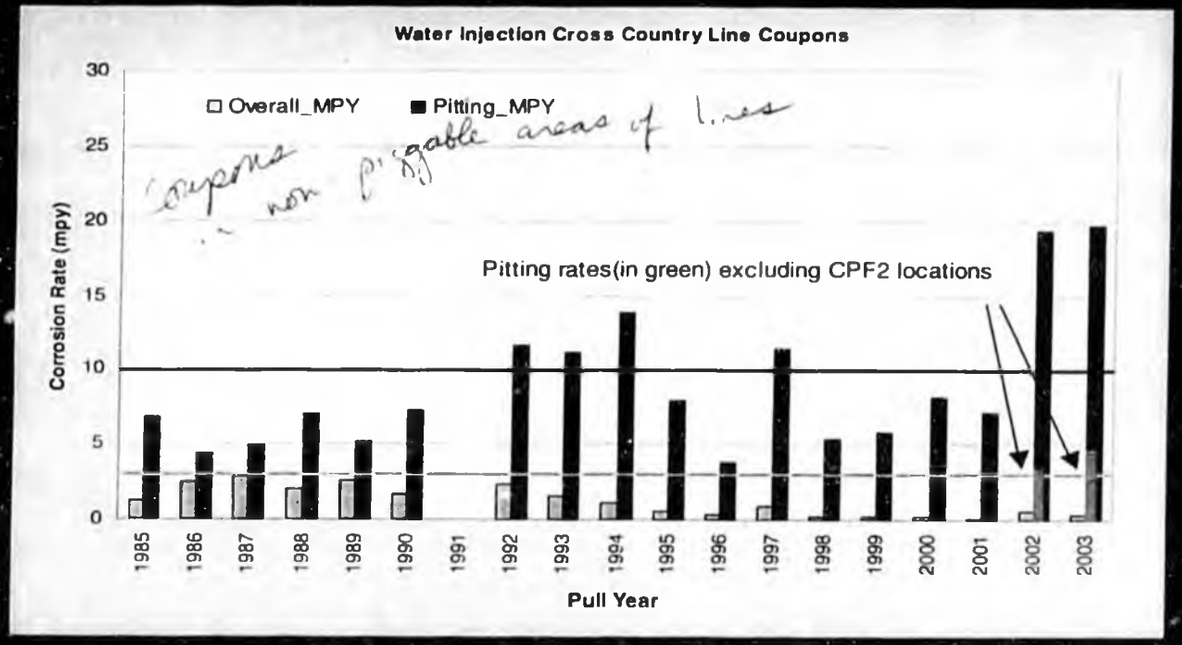
Monitoring/Mitigation



2003

- ✓ Average corrosion rates affected by lines at CPF2.
- ✓ Since 2001, all 16 CPF2 CC WI lines under 12" dia. inspected with RTR. Two lines showed damage greater than 30% wall loss using UT.
- ✓ Biocide study completed and formal recommendations implemented at CPF2 and in progress at other two CPF's.

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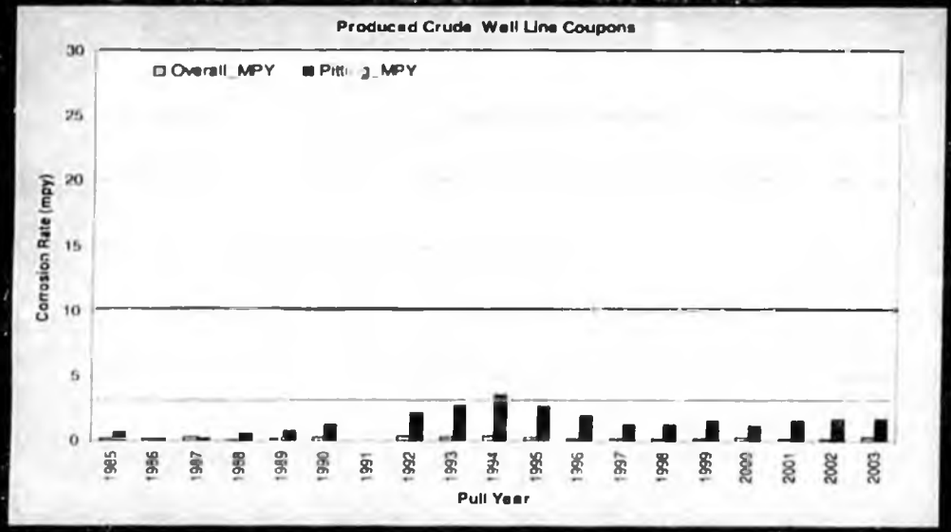
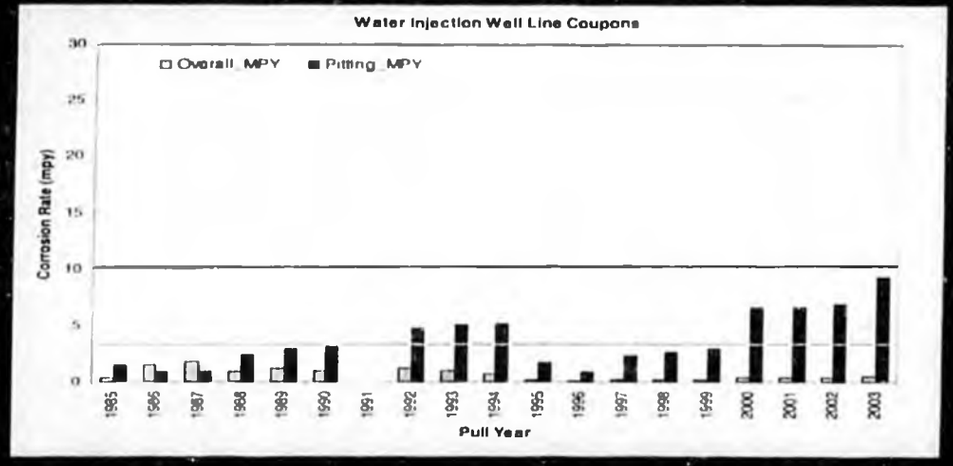
Monitoring/Mitigation 2003



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

Water Injection Well Lines



- ✓ Coupon average corrosion rates remain below targets
- ✓ Inspection data indicates higher corrosion rates in some lines
- ✓ KDR locations are identified

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Monitoring & Mitigation

Monitoring & Mitigation	
Goal	***Status***
Continue testing for more effective corrosion inhibitors	• Field test of Champion 2002-049A completed at DS1R. Next test planned for 2UVW system in November • Field test of Champion 2002-050B pending at DS1R. Evaluation of another field test candidate in progress
Complete Implementation of wellhead corrosion inhibitor injection at 4 more Drill Sites	• DS's 1A, 1H, 1Y, 2T engineering and construction in progress • Added chemical tech position to perform system maintenance
Complete initial investigation of CPF2 PW System anomalies.	• Biocide study completed • Recommendations are being implemented
SBG (Surfactant) Produced Water System Pilot Test	• Hardware installed, remaining work in progress

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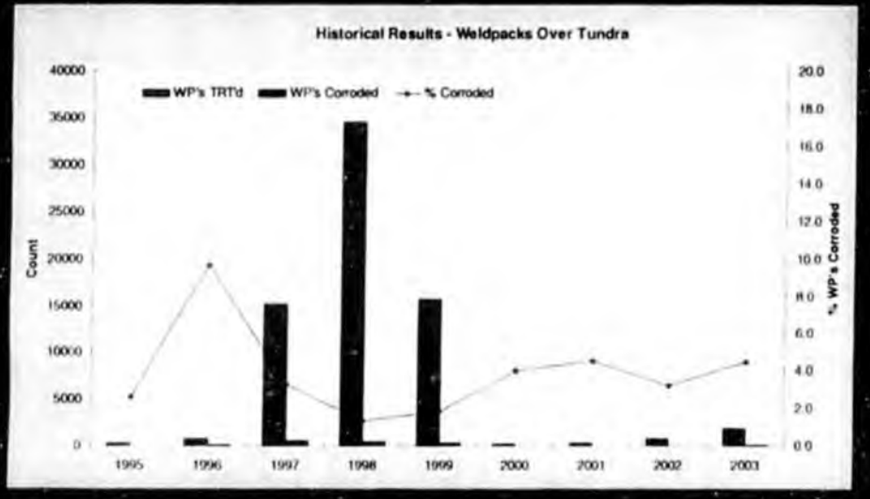
External Inspection 2003

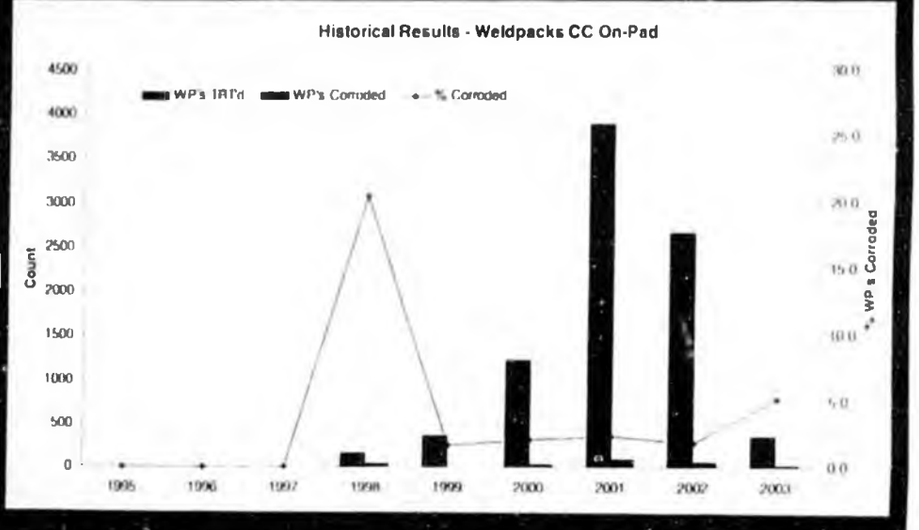


⇐⇐

- ✓ 1864 weld packs TRT inspected. 83 had corrosion or ~5%. No repairs.
- ✓ Walkdown verification underway
- ✓ Approx. 1,000 weld packs identified so far that need baseline inspection.

CC Lines On Pad

- ✓ Overall program completion - 96%
- ✓ 352 weld packs TRT'd YTD (long weld packs, high)
- ✓ The % corroded weld packs found increased to 5.1%. No Repairs



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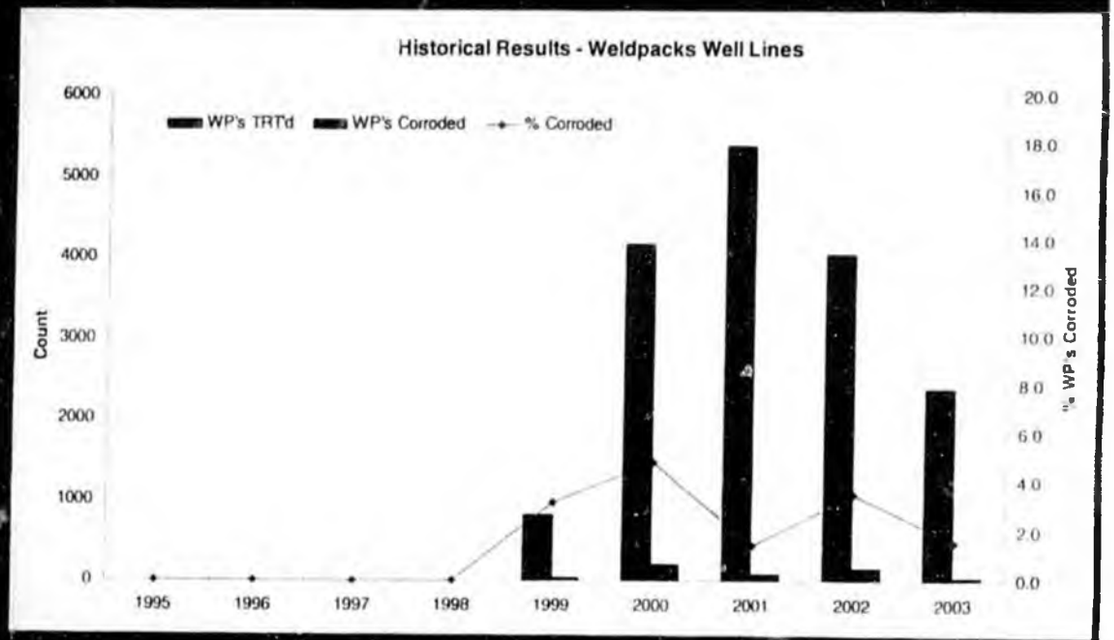
External Inspection

- ✓ Overall program completion - 77%
- ✓ Annual goals for 2003, 2004, and 2005 revised to 2,500.
- ✓ 2358 weld packs TRT'd YTD
- ✓ % Corroded decreased to 1.5%
- ✓ Two locations repaired

2003



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Buffer Spike Summary

- pH data was obtained on all test locations.
- Field review of this data indicates that the pH increased substantially in the wet insulation.
- The 2003 progress report has not yet been completed.
- TRT of the test locations planned for 2004

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External Inspection

Cross-Country Lines Over Tundra	
Goal	***Status***
Complete walk down verification of 172 high priority lines.	Have completed 140 lines YTD, 81%
TRT approx. 100 'Tarn Design' WPs	**Complete:** 100 WPs were inspected using C-arm. No water was found.
Continue monitoring of 'Denso Tape' refurb. technique	Continued spot checks of locations. No failures found
Develop long term recur.schedule/program	In progress. Gathering inspection data.
Cross-Country On-Pad	
Inspect 50% of remaining WPs (343) with goal of 2004 YE completion of baseline inspections	**Complete:** 352 WPs TRT'd YTD
Well Line Weld Packs	
Inspect 17% of weld packs, 2005 completion	Goal revised to 2500. 2358 WPs TRT'd YTD; on track for 2005 completion
Misc.	
Evaluate last summer's CUI Buffer Spike pilot program	Pending final report from B'ville

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Inspection Results 2003

- ✓ Re-inspected 82 priority 1 locations with PTI/TWI
- ✓ Inspected all priority 2 locations
- ✓ 6 cased pipes excavated so far (goal was 5 to 9)
  - One had severe internal damage - pipe was replaced
  - One had moderate internal damage - scheduled for replacement in 2004
  - Four had only minor or no significant corrosion
  - Tally so far: 6 Refurbishments, 2 Saves, No Leaks
- ✓ Completed Annual Visual Casing Inspection - cleared all obstructions

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Inspection Results

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

All Lines in GKA/AOA Inventory	Inspected Thru 10/31/03	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
2002 Total Inventory	665	110	775	1

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Inspection Results

Goal	Status
Reinspect ~ 60 priority 1 pipes using PTI/TWI.	Inspected 82.
Complete baseline inspection of all ~ 115 priority 2 pipes using PTI/TWI selectively where warranted	Completed visual and casing gas analysis on all pipes, no PTI/TWI inspections warranted.
Prioritize and excavate 5-9 pipes.	Completed 6 excavations so far.
Continue cooperative effort with equipment vendors, COP R&D and BP to improve current technology and explore new technologies.	B&E tested in '03. Found no reason to switch to this technology at this time.

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2003

External Corrosion

- ✓ No incidents to report

Internal Corrosion

- ✓ No new incidents to report since April meeting

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- 13 pipeline supports failed – Attributed to fatigue
- No breach or reduction of pipeline integrity
- Pipeline support reinstated successfully w/o incident
- Best practices captured & implemented
- Field-wide inspections for similar installations complete
- All support installations surveyed confirmed fit-for-service

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THE END

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Glossary of Terms

Equipment Classification:

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

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

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

Service Definitions:

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

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

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

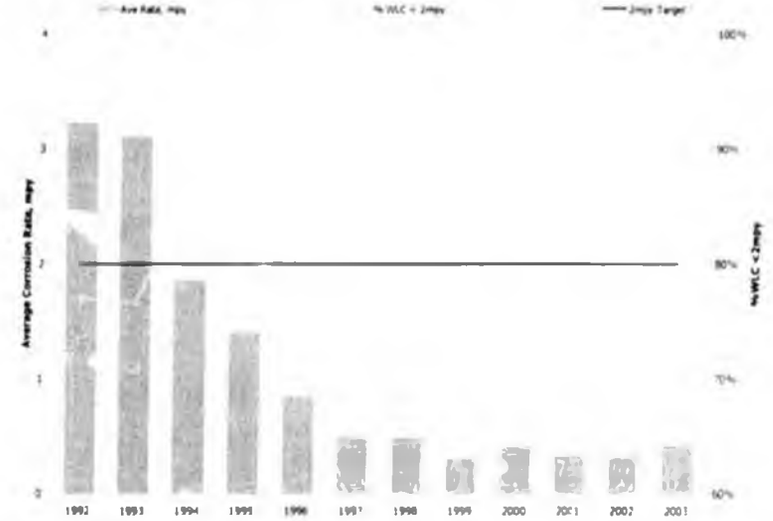
- **Strategic Objectives**
  - Minimize HSE Impacts
    - Corrosion loss of containment
  - Fit-for-service Infrastructure
    - Remaining field life
    - With gas sales 50+ years
  - Infrastructure Integrity
    - Satellite fields
    - Use of existing infrastructure
  - Future Major Gas Development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

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

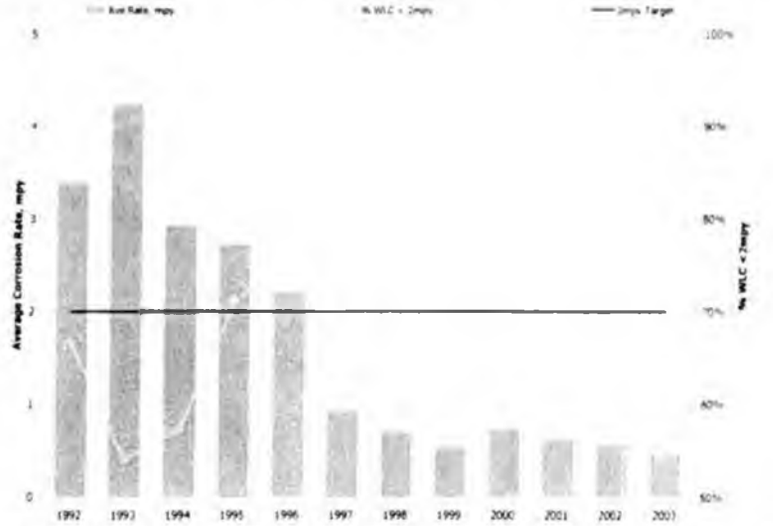
GPB Corrosion Mitigation Activity

	2001	2002	2003
Internal Inspections			
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

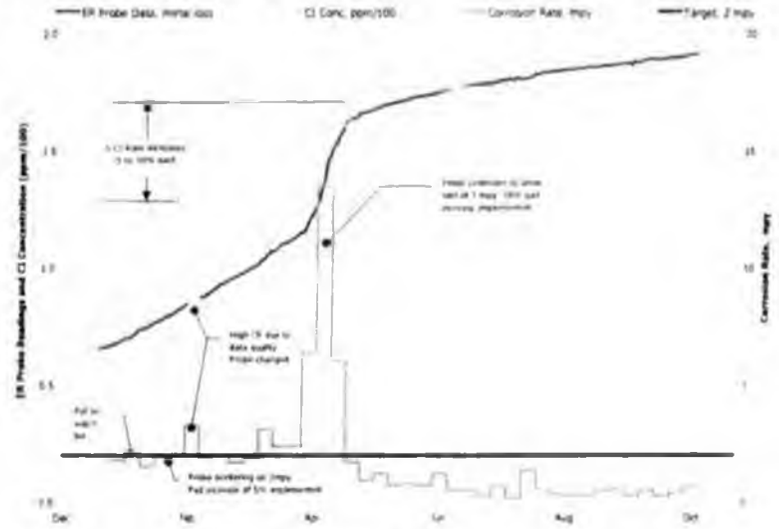
3 Phase – Flow Line Coupons



3 Phase – Well Line Coupons



ER Probe Example



Monitoring Corrective Actions

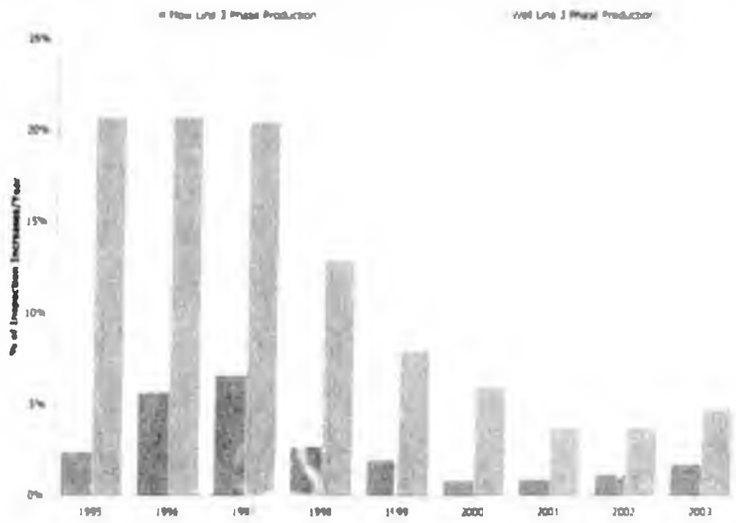
- **ER Probe Corrective Actions**

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%
Y-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

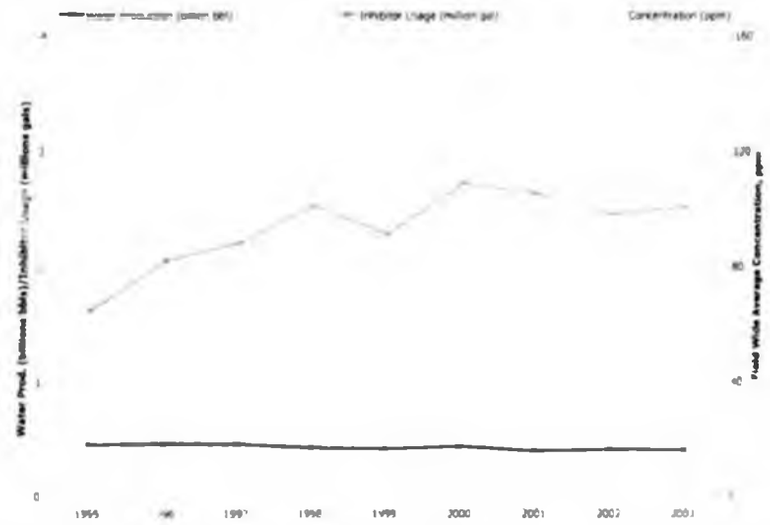
Flow and Well Line Inspection - Production



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%

Corrosion Inhibition Summary I

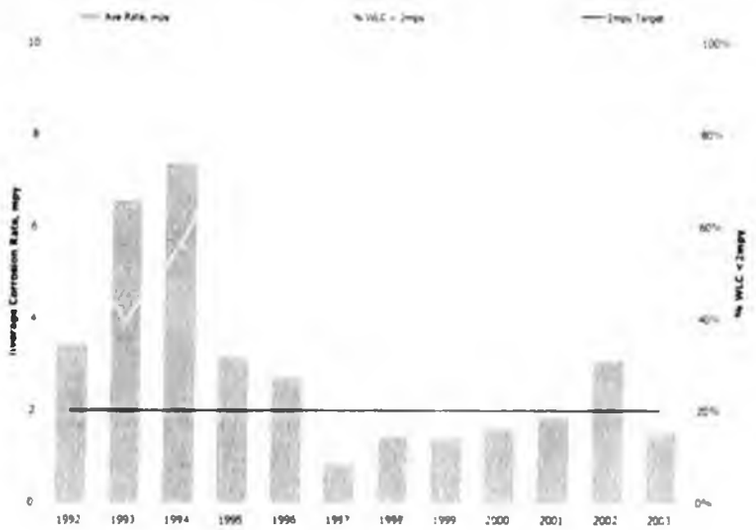


Corrosion Inhibition Summary II

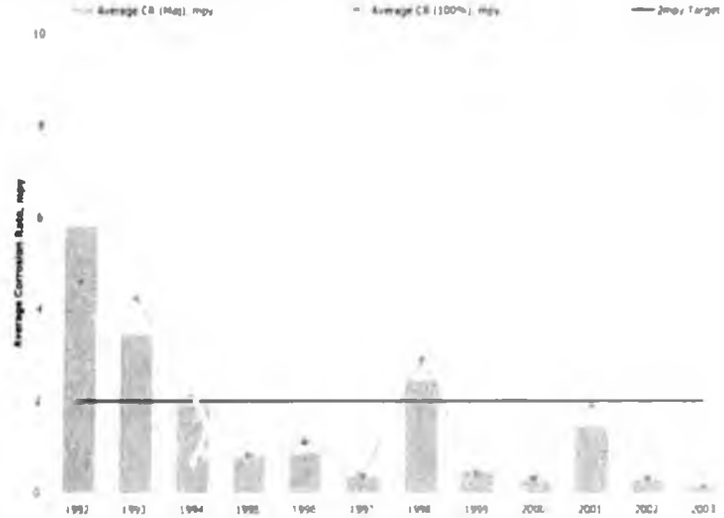
Water Injection Systems

- **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

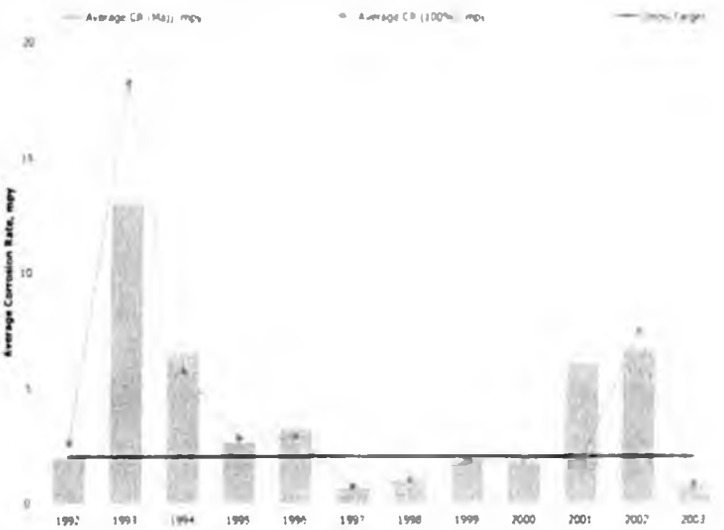
Water Injection Flow Line



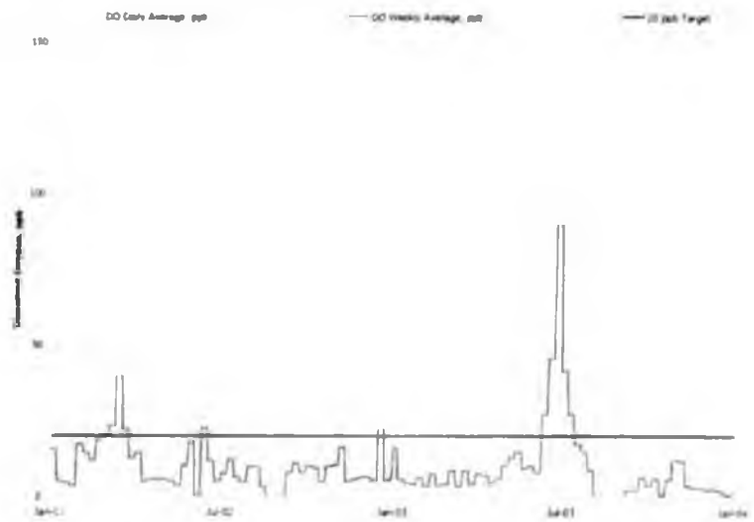
PW System – Well Line



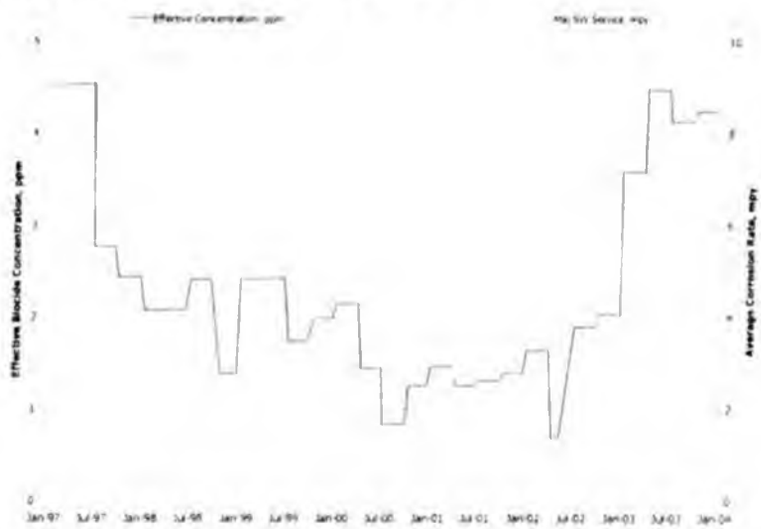
SW System – Well Line



2002 - 2003 Oxygen Control

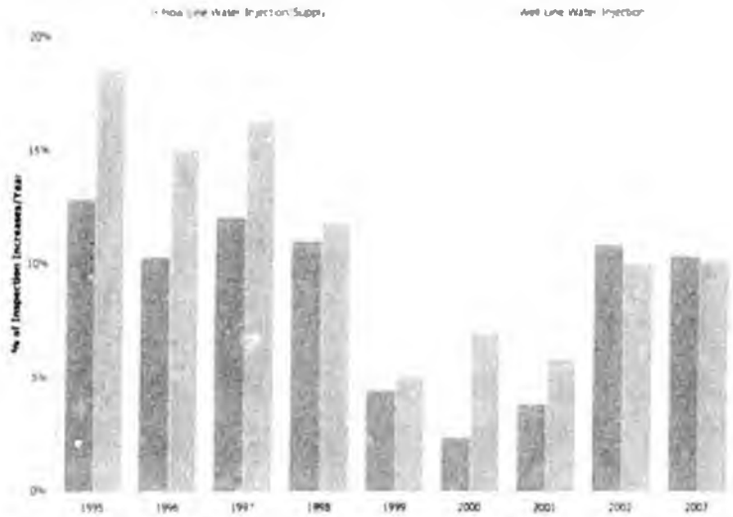


Biocide and Corrosion Rate I

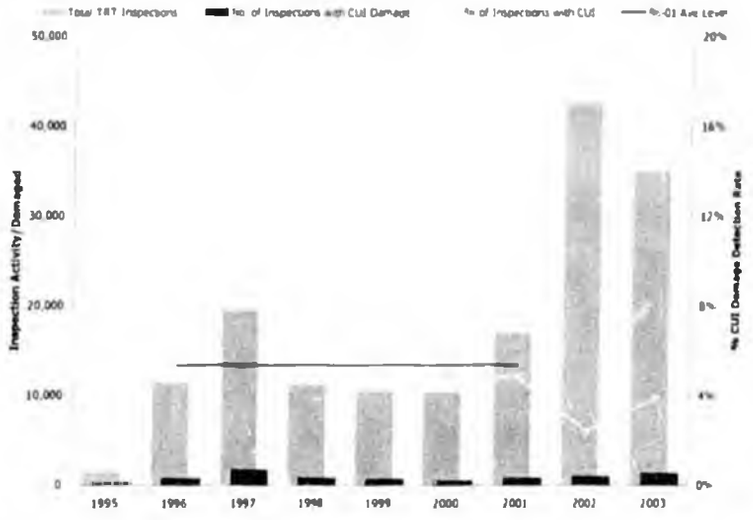


Biocide and Corrosion Rate II

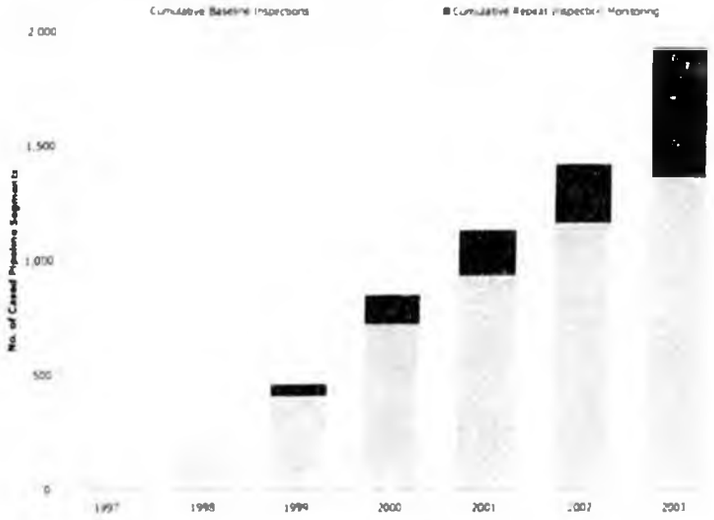
Flow and Well Line Inspection - Injection



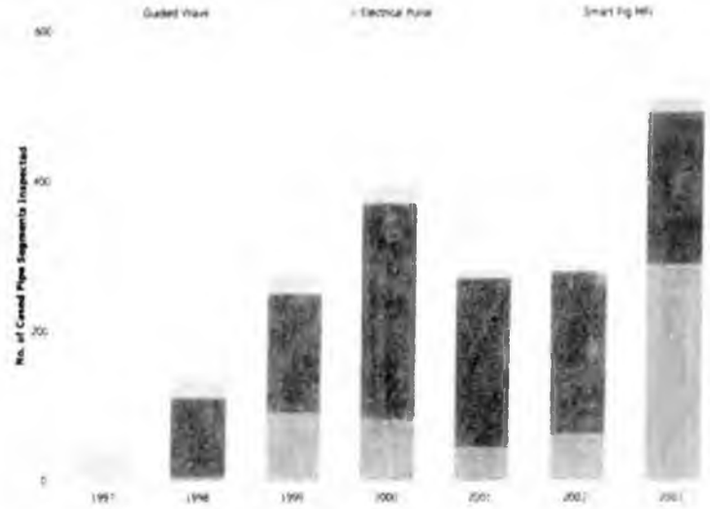
External Corrosion Inspection



Cased Piping Inspection I



Cased Piping Inspection II



2003 Program Performance

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

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

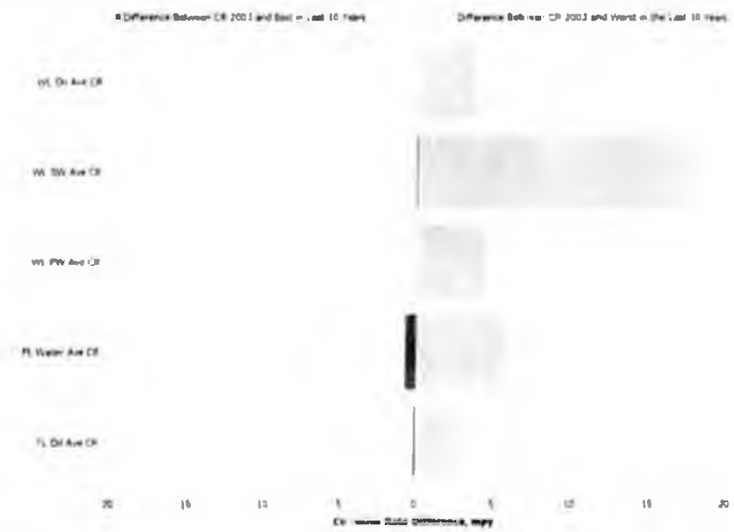
	Surface		Service				Mechanism			
	Int	Ext	OIL	SW	PW	Gas	CO_2	Erosion	CUI	Mech
WL										
FL		2	1			1			1	1

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

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

2003 Corrosion Rate Status Against History



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	×	No change

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%

ACT Corrosion Mitigation Activity

	2001	2002	2003
Internal Inspections			
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

Relative Corrosivity of BP North Slope Fields

	Prod Fluid Characteristics				Material of Construction [a]			
					Production		Injection	
Field	H_2O (%)	T (°F)	P_{CO_2} (%)	CR [b]	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

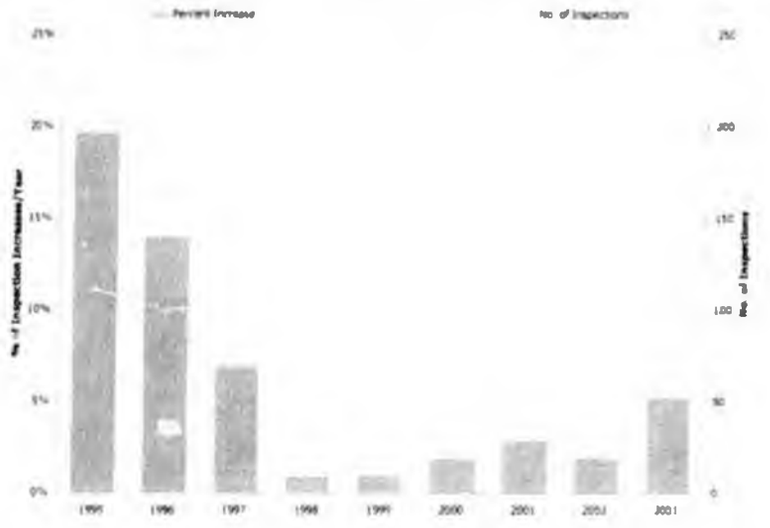
Notes
(a) CS is carbon steel, CI is corrosion inhibitor, DSS is duplex stainless steel
(b) Unmitigated relative corrosion rate, H - high, M - medium, and L - low
(c) There are a limited number of Duplex Stainless Steel flow lines in GPB
(d) Two production flow lines are inhibited at MPU

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

Endicott Corrosion Monitoring

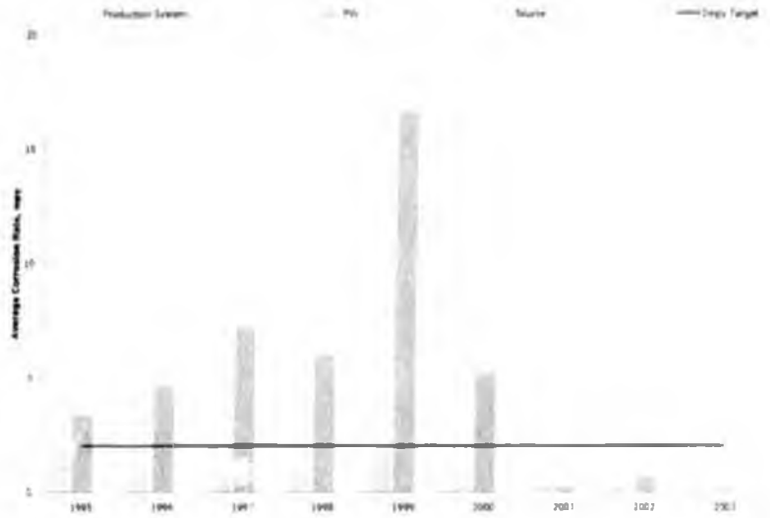
Endicott IIWL Quarterly UT Inspections



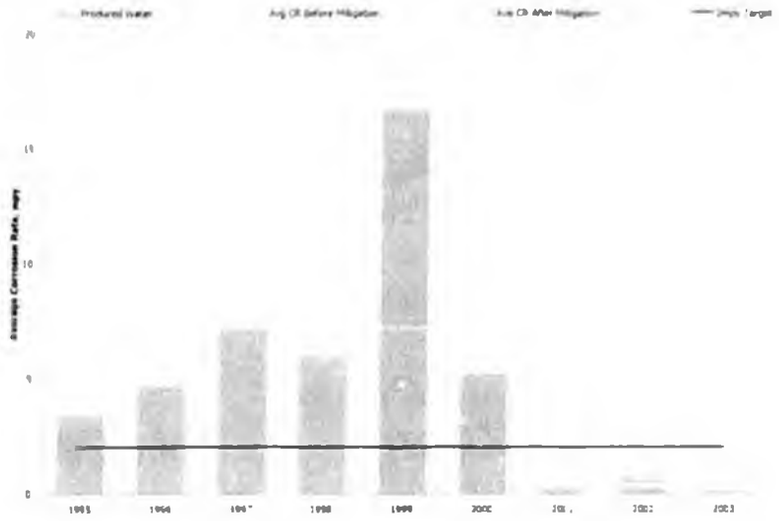
Milne Point Unit Overview

- **Production System**
  - Initiating inhibition program
    - K-Pad flow line initiated in 2001
    - S-Pad inhibited in power fluid
    - F L-C production flow line inhibition initiated in 2003
    - Remaining facilities under review for inhibition
      - Flow characteristics
      - Inspection a[illegible] 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

MPU Corrosion Monitoring



MPU Produced Water Corrosion Rate Trend



Badami and Northstar

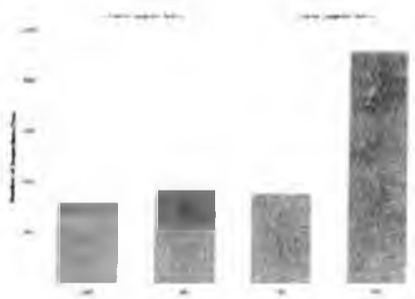
- **Badami**
  - On production since 1998
  - Production well below expectations
  - No water injection system
    - Water cut <1%
  - No significant corrosion experienced
  - Warm shut-in in August of 2003
- **Northstar**
  - On stream in late 2001
  - Continuous inhibition into well production lines
    - 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

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%

ACT - Overall Inspection Activity

	Surface	2000	2001	2002	2003
Endicott	Int	1,346	1,480	1,686	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**



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**

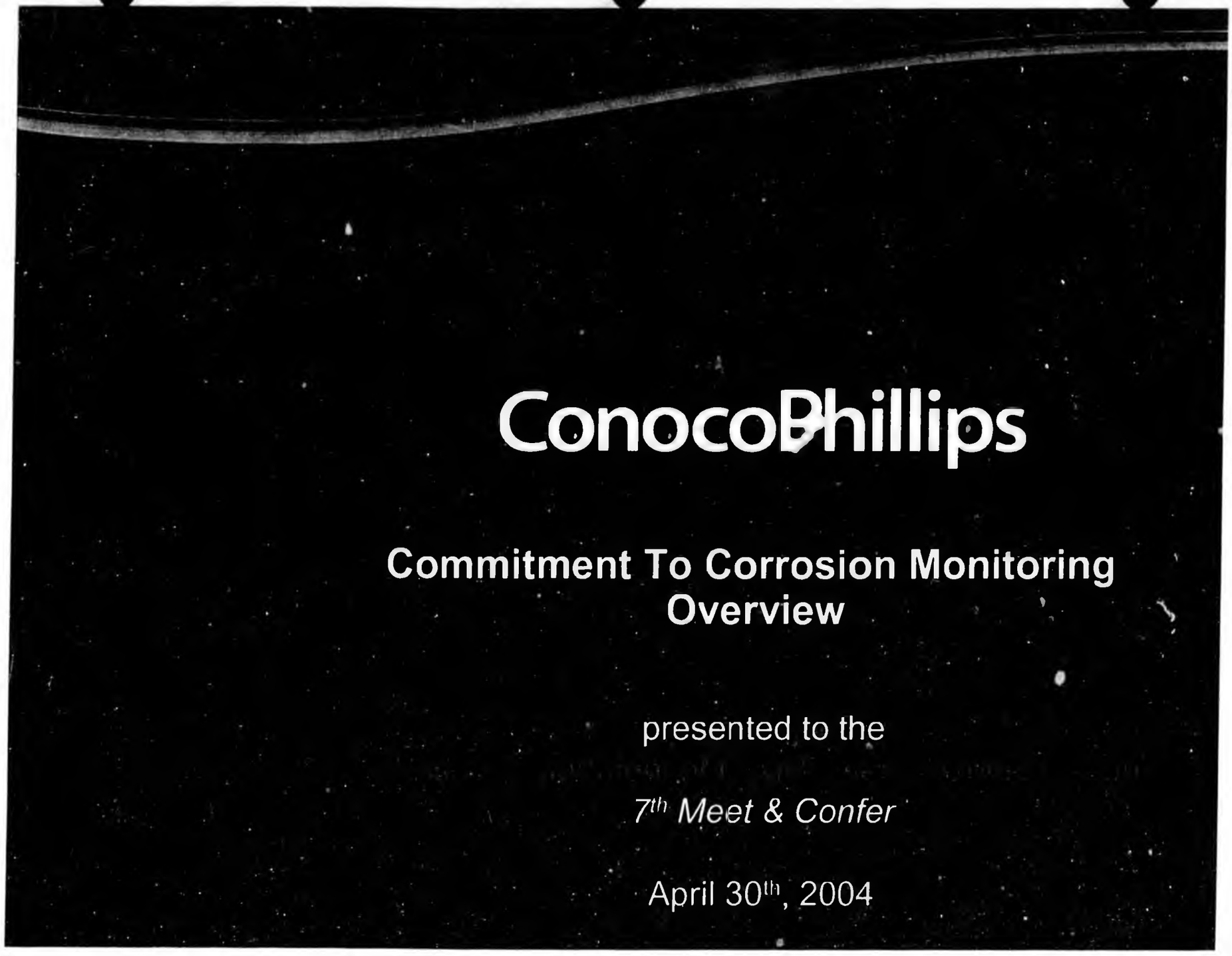
ACT 2003 Goals and Objectives

	03 Act	04 Plan
Endicott		
Inter-Island Water Line and PW/SW well lines		
Slight increase based on inspection data - inhibitor increase Apr-03	✓	Monitor
Emphasis on consistent/reliable maintenance pigging	✓	Continue
Northstar		
Continue to establish monitoring and inspection history	✓	Continue
Inspection and mitigation programs responding as appropriate	✓	
Badami		
Field put in warm shut-in/mothball	✓	
Baseline and follow-up inspection as part of 'mothball' program		Plan
Milne Point Unit		
Continuing to expand on the inspection program	✓	Continue
Inspection and mitigation programs responding as appropriate		
Developing 3 Phase System Program		Continue
Continued analysis of production flow lines	✓	Continue
Initiate corrosion inhibition as applicable	✓	Continue
Buried flow lines		
Trial GUT technology that uses fixed monitoring locations	✓	Trial

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

CPA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Commitment To Corrosion Monitoring
Overview
presented to the
7th Meet & Confer
April 30th, 2004

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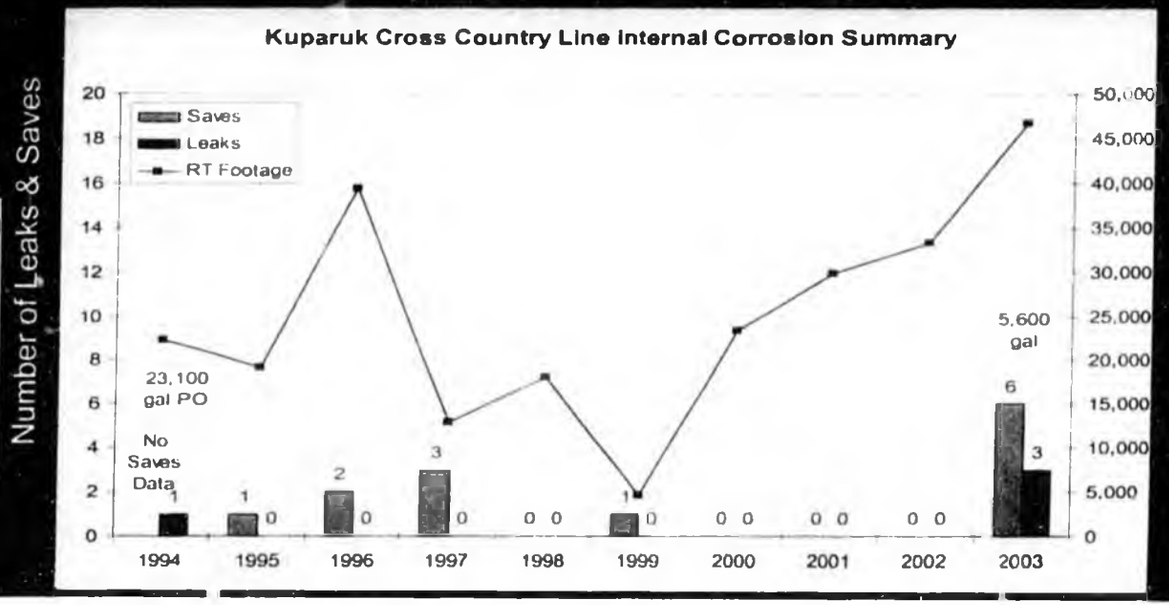
Internal Inspection

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



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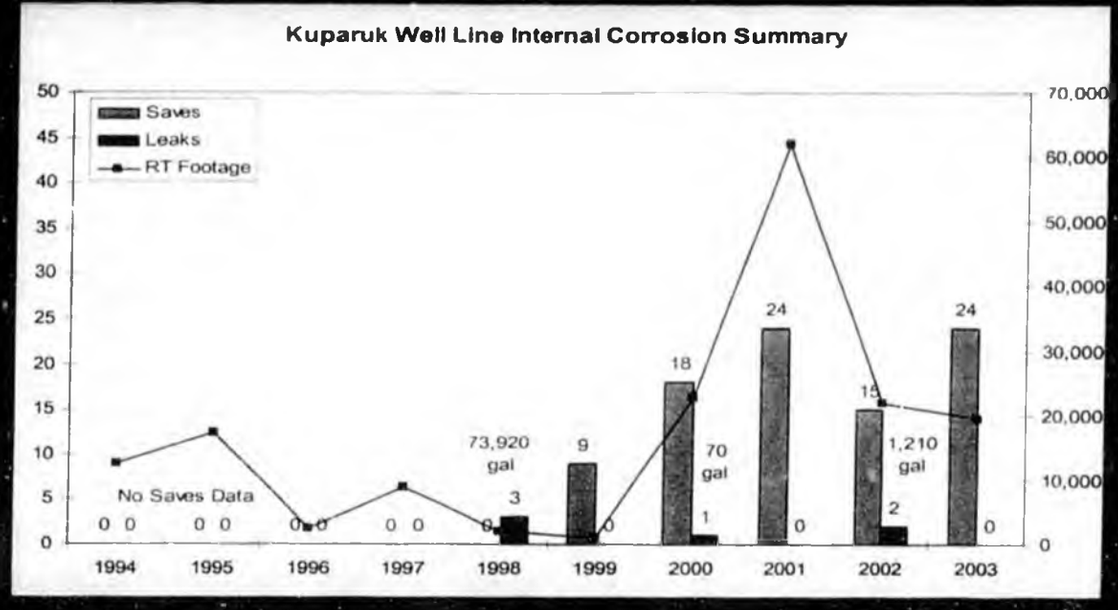
Internal Inspection Focus Area

- ✓ 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



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Internal Inspection

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

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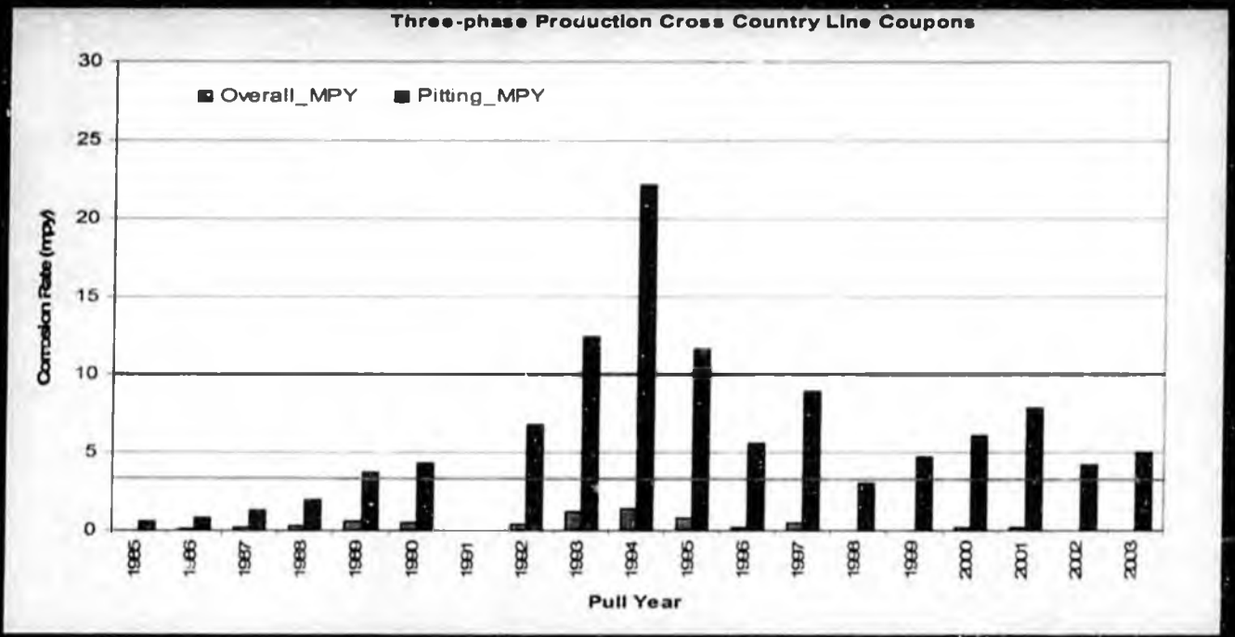
Monitoring/Mitigation

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

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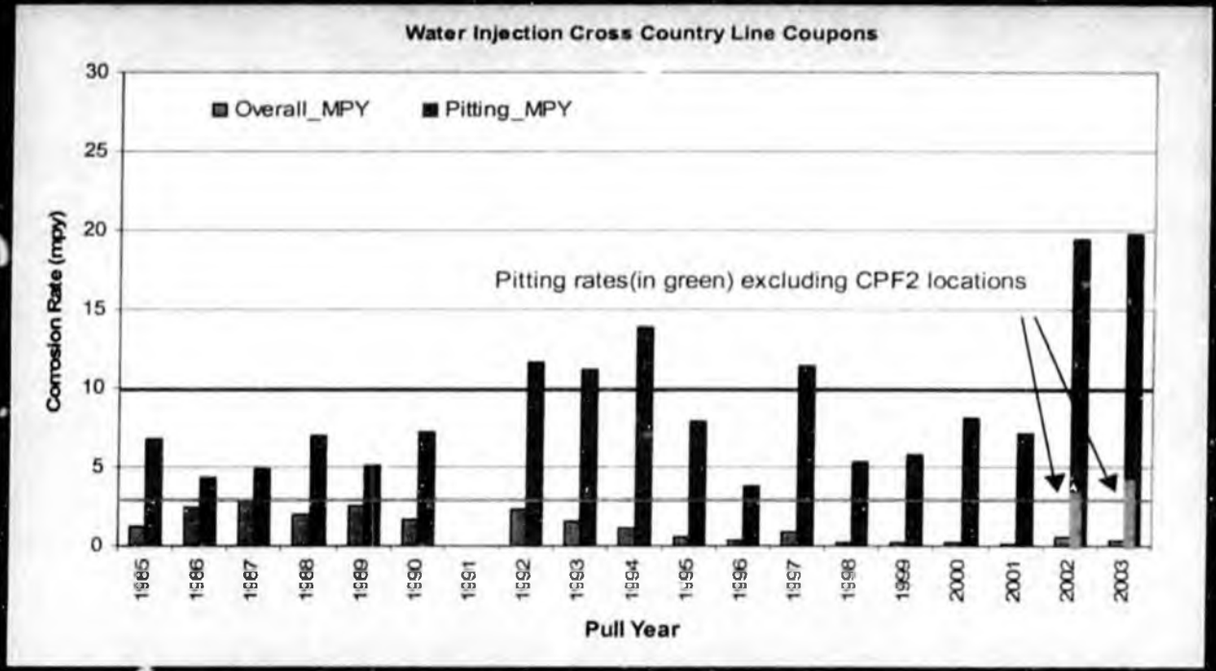
Monitoring/Mitigation

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.

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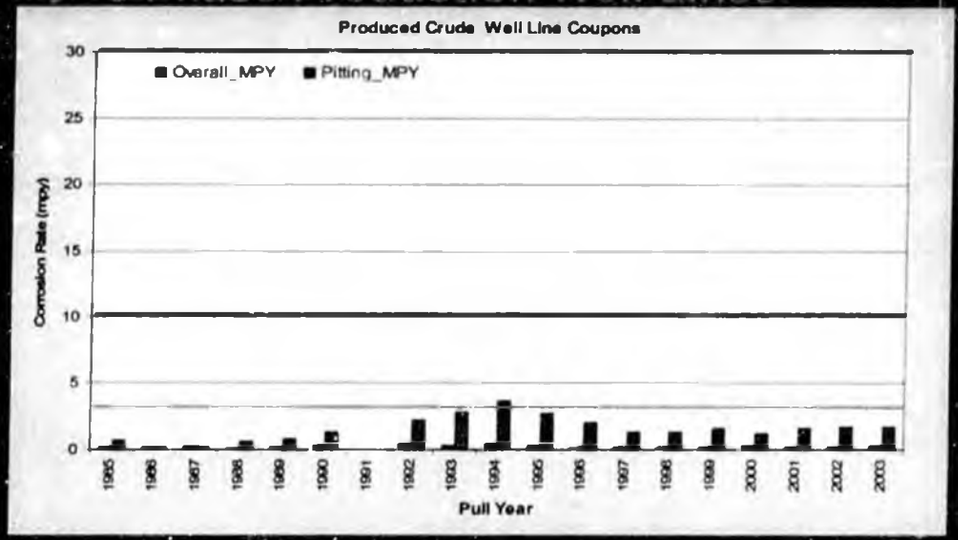
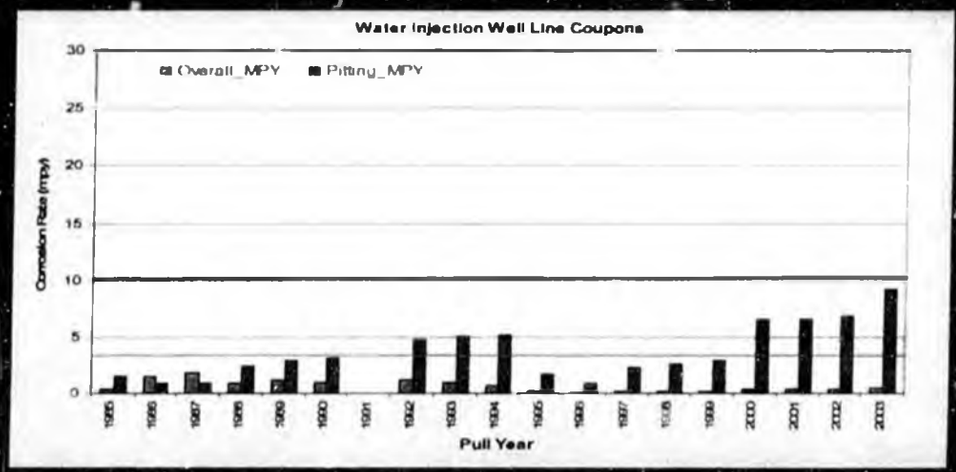
Monitoring/Mitigation 2003

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

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Monitoring & Mitigation

Monitoring & Mitigation	
Goal	***Status***
Continue testing for more effective corrosion inhibitors	• 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	• DS's.1A, 1Y, 2T construction in progress • Added chemical tech position to perform system maintenance
Audit all 3 CPF PW System treatment programs	•Recommendations are being implemented •Follow-up residuals study forth coming
SBG (Surfactant) Produced Water System Pilot Test	• Product components ordered •Complete phase 1, start phase 2 of test this summer

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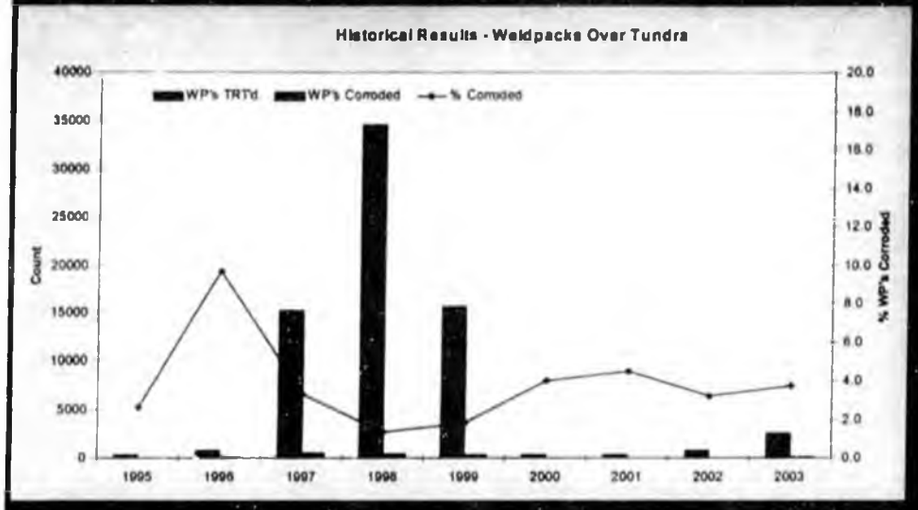
External Inspection

2003

Mature Ongoing Program

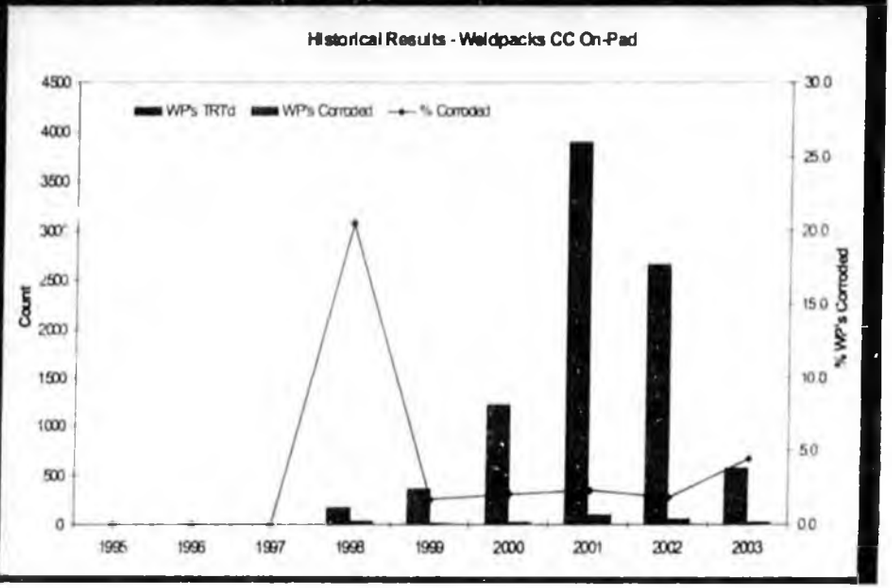


⇐⇐ [illegible] Lines On Tundra

- ✓ 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.



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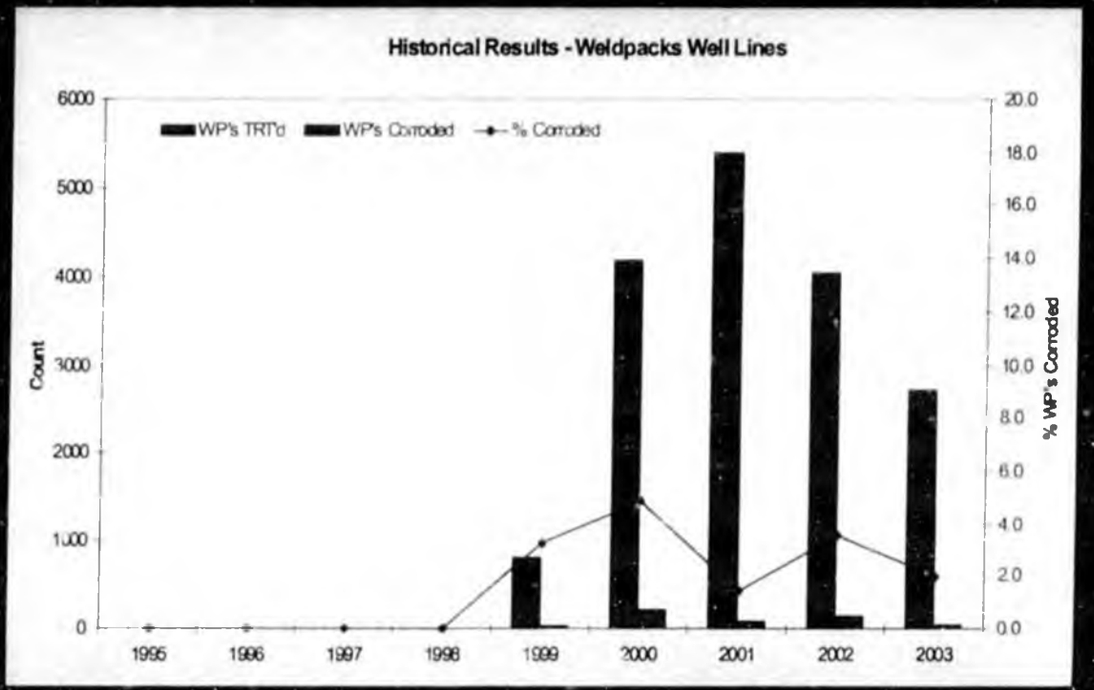
External Inspection

- Baseline Effort for Weldpacks

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

2003



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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

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External Inspection

Cross-Country Lines Over Tundra	
Goal	***Status***
Complete Baseline TRT inspections on CUI locations identified during 2003 corrosion survey	On schedule
TRT approx. 100 Turn 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 PO/WI well lines >10 years old	On schedule
Misc.	
Evaluate CUI Buffer Spike pilot program	Pending 2004 TRT results.

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Inspection 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

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Inspection Results

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

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Inspection Results

Goal	Status
Reinspect [illegible] priority 1 pipe's using UT	On schedule
Complete second round of inspection on all priority 2 pipe's using UT selectively where warranted	On schedule
Prioritize and excavate 5 "P" 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

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Spills/Incidents

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.