11958 SENATE RESOURCES

Alaska Consolidated Team (ACT)

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

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

Relative Corrosivity of BP North Slope Fields

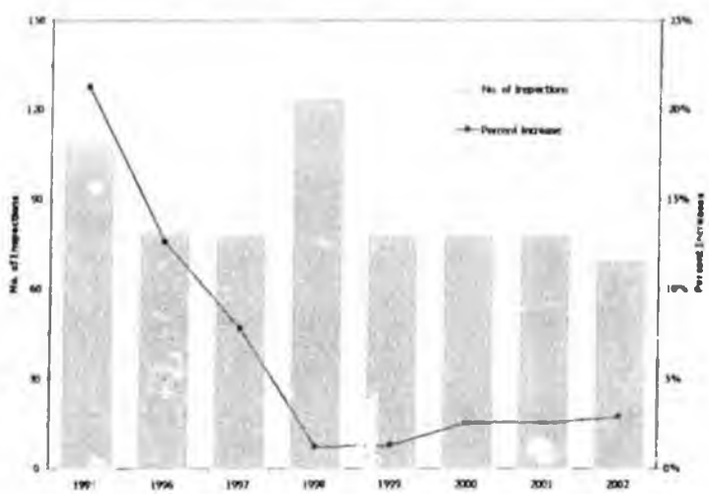
	Prod Fluid Characteristics				Material of Construction[a]			
					Production		Injection	
Field	H_2O, %	T °F	P_{CO_2} %	CR[b]	WL	FL	WL	FL
GPB	70	150	12	H	CS+CI	CS+CI[c]	CS+CI	CS+CI
END	90	150	18	H	DSS	DSS	CS+CI	CS+CI
MPU	47	125	1.5	L/M	CS	CS[d]	CS+CI	CS+CI
Northstar	0.8	160	5	M	CS+CI	N/A	N/A	N/A
Badami	0.3	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
- **PWI, SW Injection System**
  - Inter-Island Water Line (IIWL) main concern
    - Control by:
      - Maintenance pigging
      - Biocide
      - Inhibition (increased in 2003)
- **External Corrosion**
  - Primary 2002 focus on common-carrier oil sales line

Endicott IIWL Quarterly UT Inspections

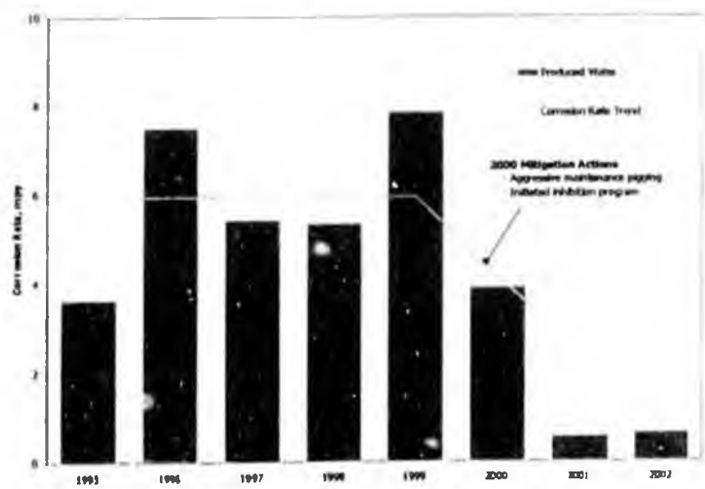


Milne Point Unit Overview

- **Production System**
  - Initiating inhibition program
    - K-Pad flow line initiated in 2001
    - New S-Pad designed for inhibition
    - 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**
  - Primary 2002 focus on common-carrier oil sales line
  - Five excavations on I-Pad
    - 70 inspection items – 8 with corrosion with < 20% wall loss

Continuous treatment

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
- **Northstar**
  - On stream in late 2001
  - Continuous inhibition into well production lines
  - No water injection system
    - Water cut <1%
  - Corrosion monitoring program developing
  - Inspection baseline and historical record being established

ACT – Corrosion/Structural Related Spills

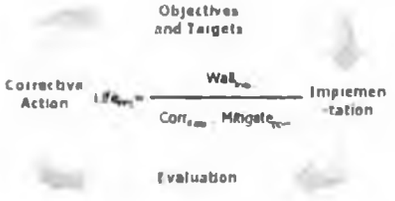
Service	Leaks	Saves	Sleeves	Comments
Oil Flow lines	0	0	0	
Oil Well Lines	0	6	0	Well 2-30 erosion
Water Flow lines	0	1	0	
Water Well Lines	1	0	0	Well 1-31 pin hole
GLT/MI Flow lines	0	0	0	
GLT/MI Well lines	0	0	0	

ACT 2003 Goals and Objectives

- **Endicott**
  - Inter-Island Water Line (IIWL) and PW/SW well lines
    - Slight increase based on inspection data - inhibitor increase Apr-03
- **Northstar**
  - Continue to establish corrosion monitoring and inspection history
  - Inspection and mitigation programs responding as appropriate
- **Badami**
  - Relatively low corrosivity
  - No major changes are anticipated
- **Milne Point Unit**
  - Continuing to build a more comprehensive baseline inspection
  - Inspection and mitigation programs responding as appropriate
  - Developing 3 Phase System Program
    - Continued analysis of production flow lines
    - Initiate corrosion inhibition as applicable
  - Buried flow lines
    - Trial GUT technology that uses fixed monitoring locations

Summary

- **Delivery of Objectives**
  - Long term Fitness For Service
- **Corrosion Management System**
  - Integration of key elements
    - Thickness – Inspection program
    - Rate – Corrosion monitoring
    - Mitigation – Corrosion inhibition
- **GPB Focus for 2003**
  - 3-Phase – Maintain performance
  - SW – DO and MIC control
  - PW – Monitor effects of chemical change
- **ACT Focus for 2003**
  - Badami – monitor fc status
  - Northstar – respond to baseline data
  - Endicott – PW/SW injection system
  - Milne Point – 3 phase production system



Commitment to Corrosion Monitoring

30 October 2003
10:00 am to 3:00 pm

ConocoPhillips Building 700 "G" Street
Conference Room ATO-1167

2nd-Half 2003 Meet and Confer
(Meeting # 6)

Agenda

Introductions/Opening Remarks – (10:00 to 10:30 am)

- ConocoPhillips new staffing
- ADEC update on new staffing for Charter (Dianne, - Mike. Watts)
- BP new staffing

BP Review (10:30 to 11:45 am)

Lunch in ATO-1167 (11:45 pm to 12:45 pm)

ConocoPhillips Review (12:45 to 2:00 pm)

ADEC (2:00 to 2:30pm)

Open discussion, questions, and feedback (2:30 to 3:00 pm)

Mike. Watts - gave notice mid-October - Maybe using Olivier from CC Technologies now

→ Line marking minimum should be contract identified

→ Y-36 Flow Line spill - final report

BP and State of Alaska Charter Agreement

Corrosion Monitoring Review 2003

Meet and Confer VI

October 30th, 2003

Focus on GC Prudhoe Bay

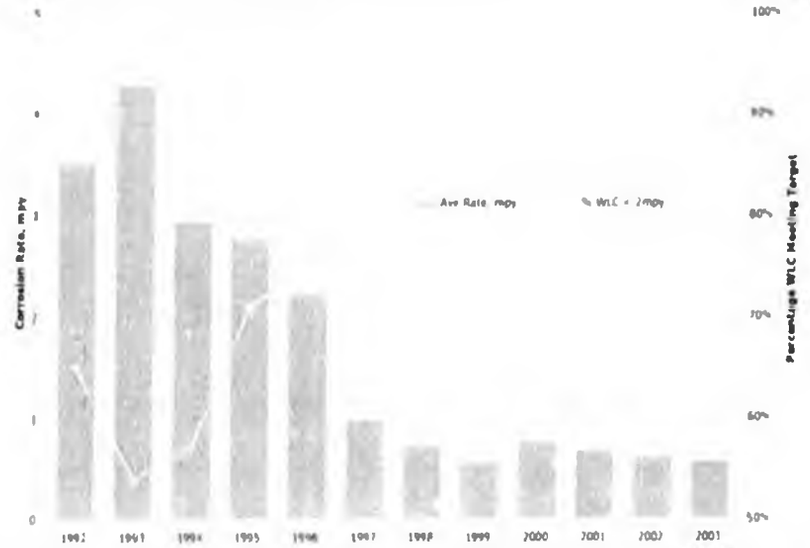
Outline

- **Corrosion Monitoring**
  - 3 Phase Production
    - Flow line and well line coupons
  - Water Injection System
    - Flow line and well line
- **Internal Inspection**
  - 3 Phase
  - Water injection
- **External Corrosion**
- **Cased Piping Inspection**
- **Smart Pigging Activity**
- **2003 Corrosion Related Spills**
  - Y-36 incident and follow-up
- **Summary**

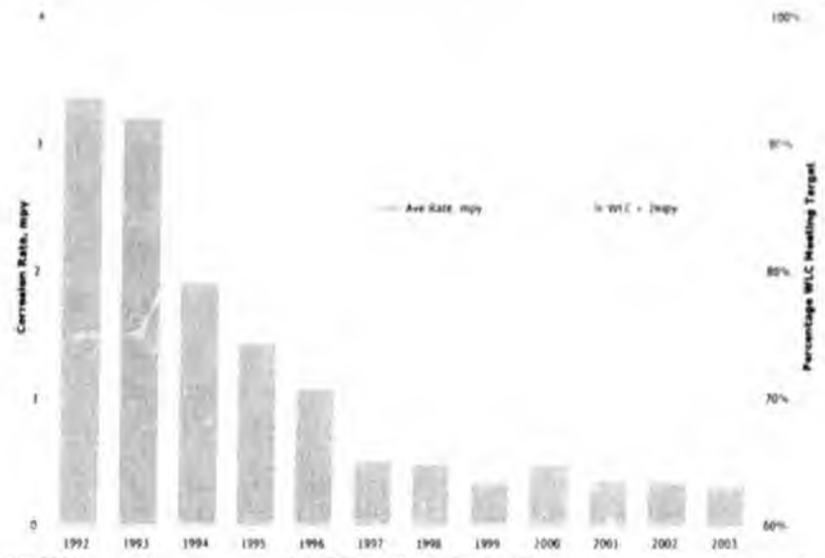
Corrosion Monitoring 3 Phase Production

- **Weight Loss Coupons**
  - Well lines
  - Flow lines
- **Monitoring Corrective Actions**
  - ER probes and coupons
- **ER Probe Example**
- **Corrosion Inhibitor Injection**
  - Concentration
  - Water rates
- **Inspection**
  - Flow and well line summaries
- **Inspection Corrective Actions**
- **3 Phase Inhibition Summary**

3 Phase– Well Line Coupons

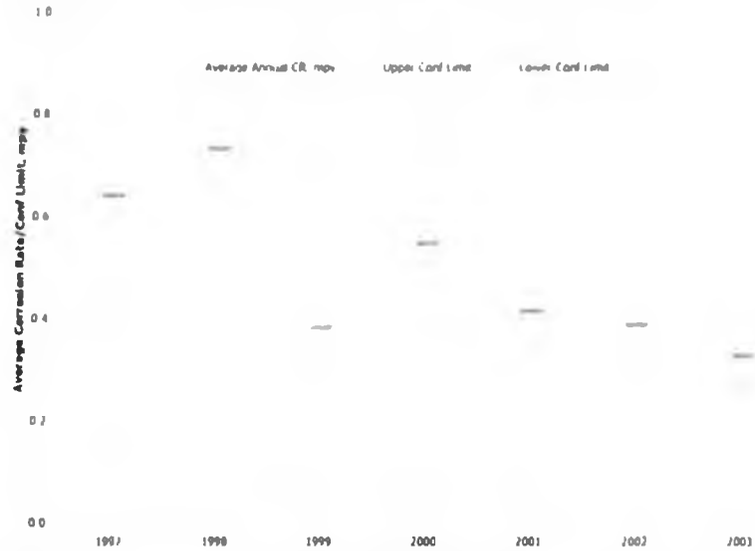


3 Phase– Flow Line Coupons



1997 Onward– Corrosion Rate Focus

Average



Reviewing weekly trends quick response

Flow Line Monitoring Corrective Actions

- **ER Probes**

	No.	Equip ID
Action	6	01D
Action	3	03D Y-36
Action	1	01C 05D 17D F-49 16D

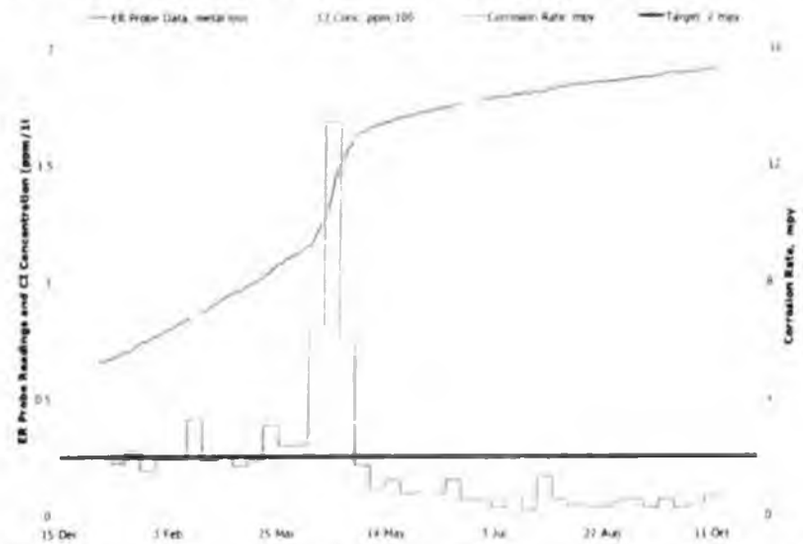
Equip ID	Cause	Action
03D	Increased Corrosivity	Increased Cl by 6 gpd
05D	Increased Corrosivity	Increased Cl by 25 gpd
17D	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl by 5%
03D	Increased Corrosivity	Increased Cl by 10%
01D	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl 18 gpd
01D & 01C	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl by 10%
03D	Increased Corrosivity	Increased Cl by 5%
F-49	Increased Corrosivity	Increased Cl by 5%
16D	Increased Corrosivity	Increased Cl by 5%
Y-36	Increased Corrosivity	Increased Cl by 10%
Y-36	Increased Corrosivity	Increased Cl by 10%
Y-36	Increased Corrosivity	Production routing change

- **Weight Loss Coupons**

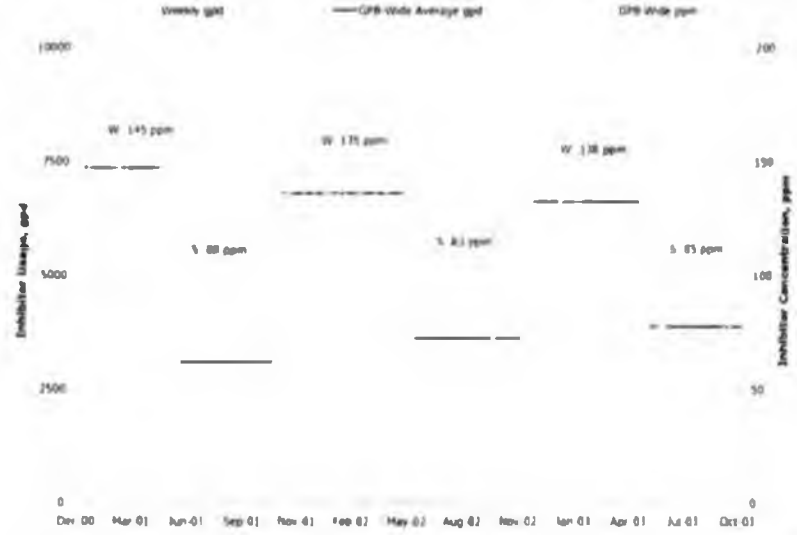
Equip ID	Cause	Action
14D	Increased Corrosivity	Increased Cl by 10%
Q-01	Increased Corrosivity	Increased Cl by ~100%

(1D)

ER Probe Corrective Action Example



GPB Wide Corrosion Inhibitor Concentrations

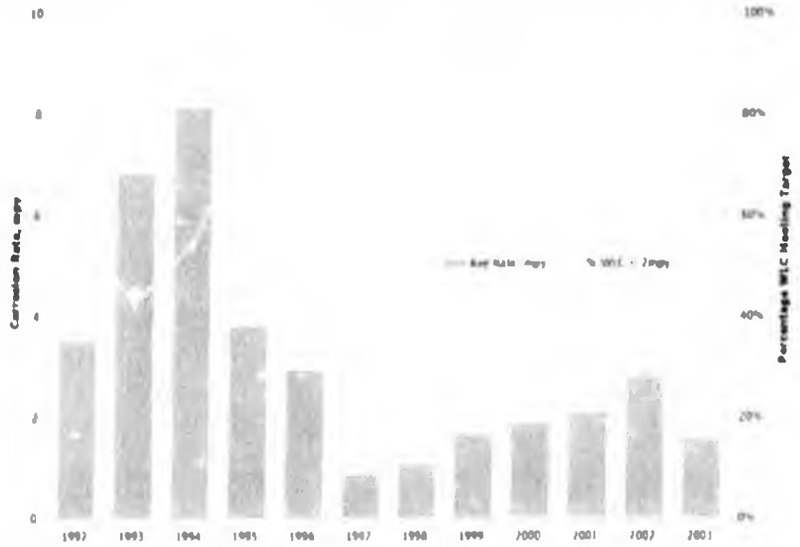


W winter
S summer
use different blends of corrosion inhibitor chemistry

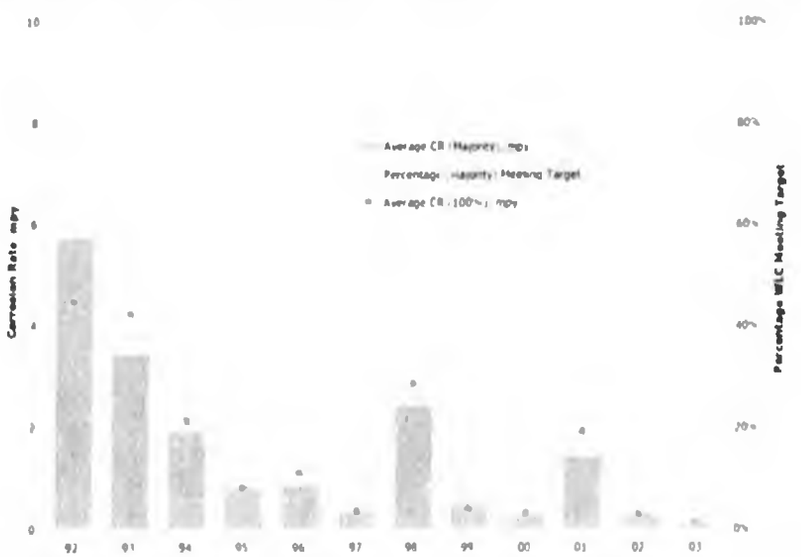
Water Injection Systems

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

Aggregate Water Injection Flow Line Coupons



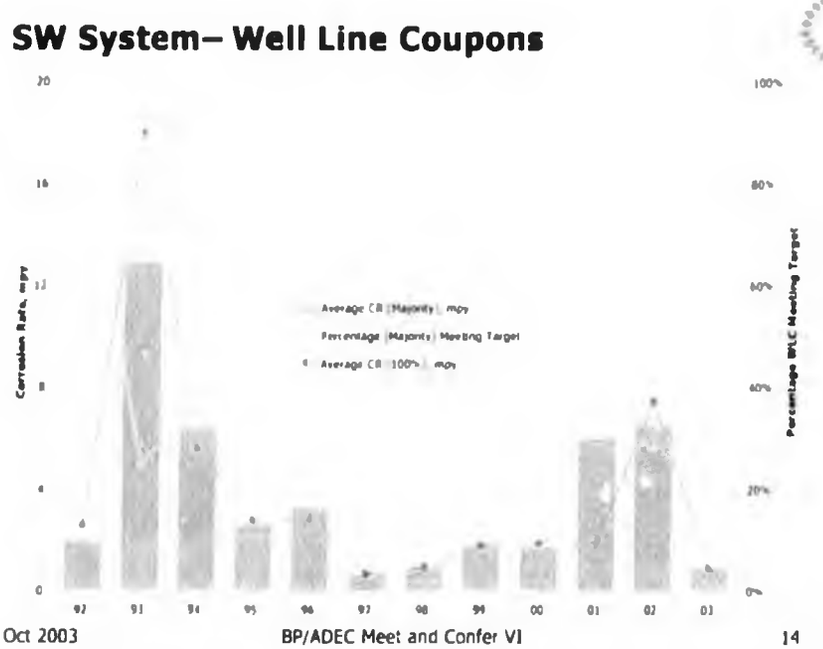
PW System– Well Line Coupons



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



Majority - more than intermediate pitting

100% - all time in service period

Limited data set
Extended shutdown period to be considered

Inspection Program

- **Inspection Activity**
  - Internal
  - External
- **Internal Inspection**
  - 3 phase – flow ar _ well line
    - Flow line corrective action
  - Water jection – flow and well line
- **External Inspection**
  - Activity level
- **Cased Piping Inspection**
  - Activity level
  - Type and method
- **Smart Pigging Activity**
- **Spill Summary**
  - Y-36 Incident

Changed internal inspection contractor

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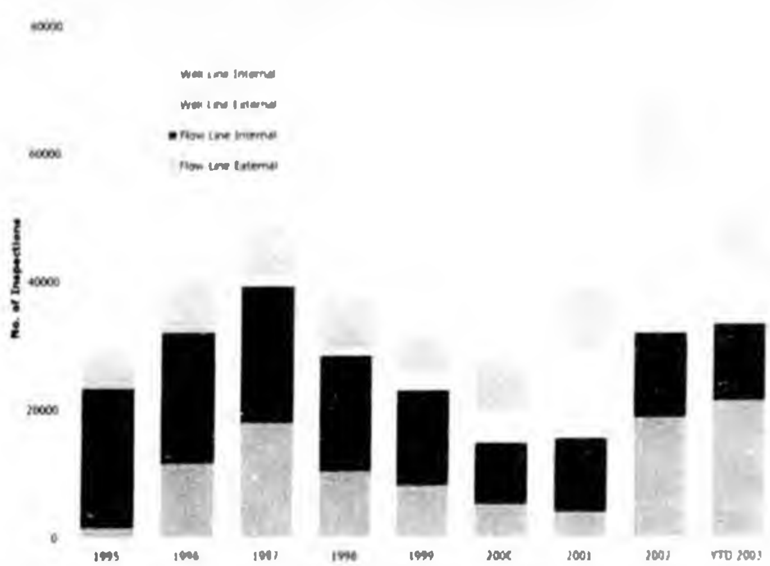
Flow/Well Line Inspection Activity



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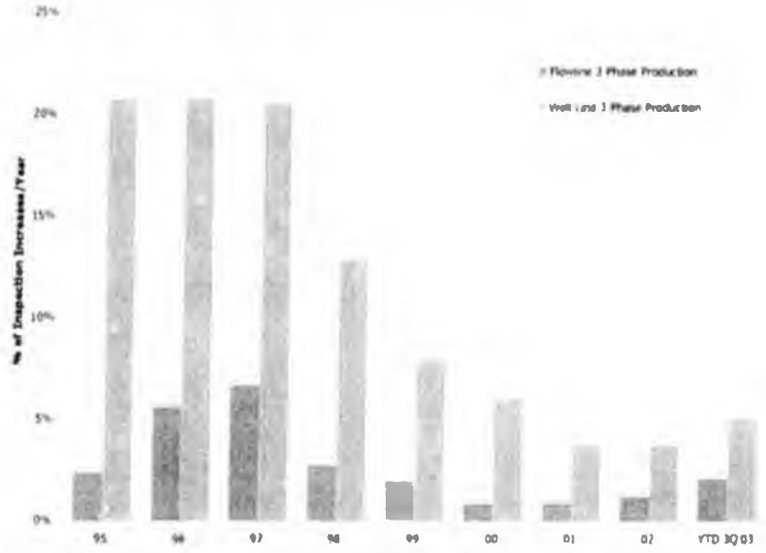
External 30,000 item goal should be met

No change in inspection level activity (internal)

3 Phase Inspection Program

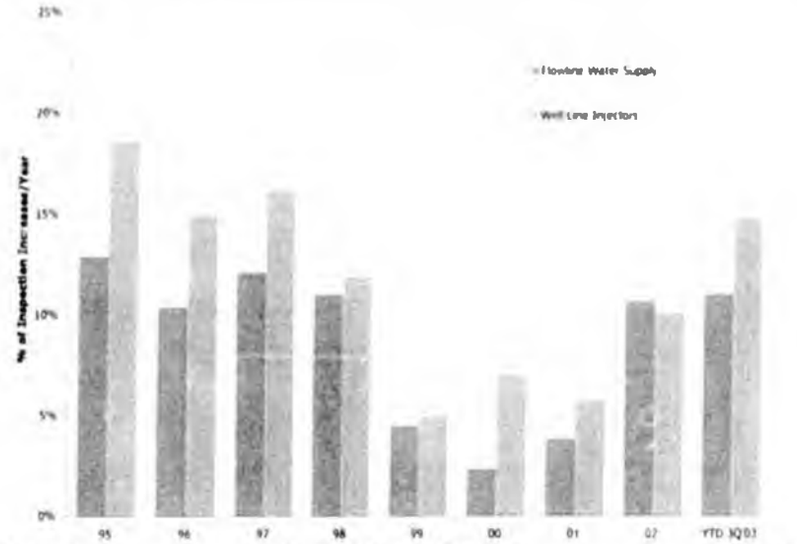


Flow Line Inspection– Corrective Actions

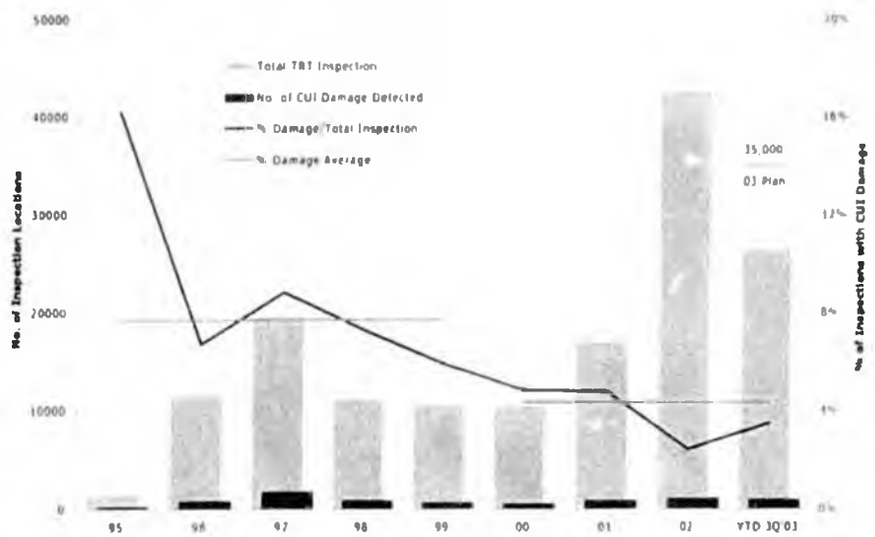
- **Inspection**

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

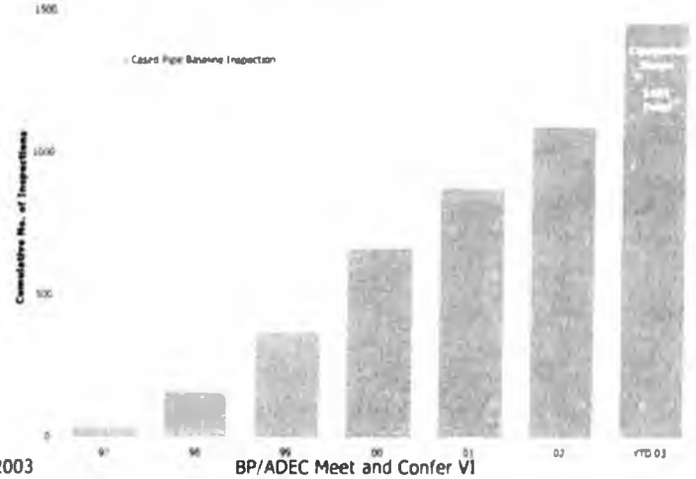


External Corrosion Inspection



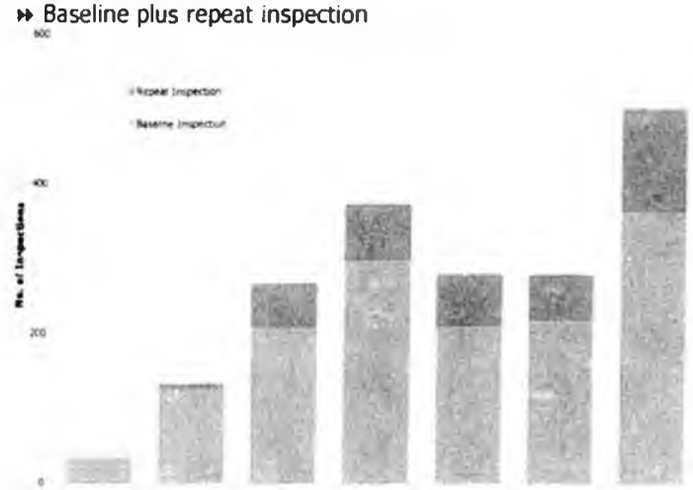
Cased Pipe Inspection I

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



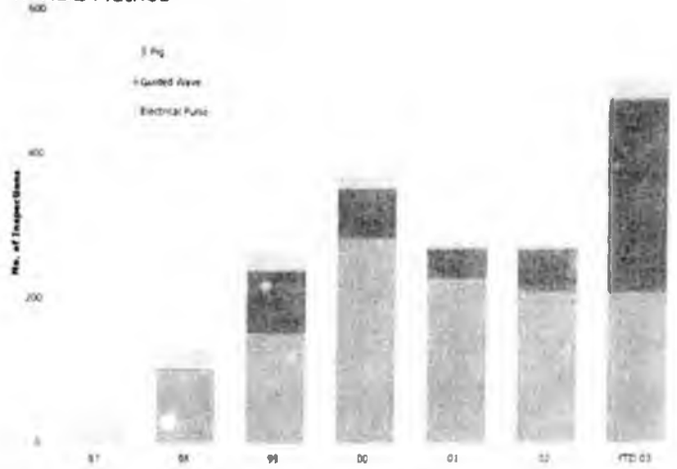
Cased Piping Inspection II

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



Cased Piping Inspection III

- **Inspection Activity**
  - NDE Method



Not many lines can't inspect piggable.

Smart Pig Inspection

- **Completed 3Q'03**

pi line

Equipment ID	Diameter	Material Thickness	From	To	Service	Length (miles)
PTMCLS01/02	24"	0.375"	Drill Site 1	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

Fit for Service

- **Interim Report**
  - 2 locations on PTMCLS01/02 – flagged as potential problems
  - 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 approx. 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

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

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 by end of year
- **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

28 April 20

ConocoPhillips

Commitment To Corrosion Monitoring Overview

presented to the

5th Meet & Confer

April 2003

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Internal Inspection

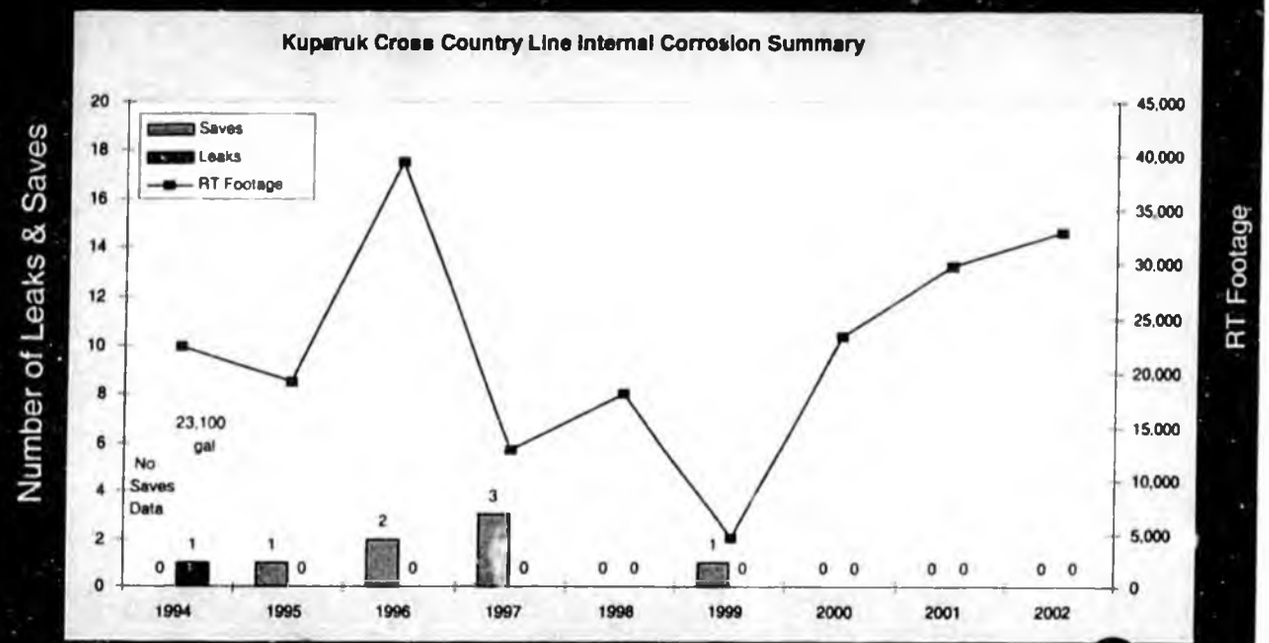
Corrosion is Under Control in Phase Production Lines

- ✓ Over 30,000 ft of over 233 lines inspected (RTR and RT)
- ✓ Integrated Turbulent Area Inspection Program
- ✓ 0 Leaks, 0 Saves
- ✓ Smart Pig of water lines >10" – Cost Prohibitive, evaluating alternatives

2002

Internal Corrosion Spills - Cross Country Lines

1994 Spill 24" 1Y/R Crude CC Line



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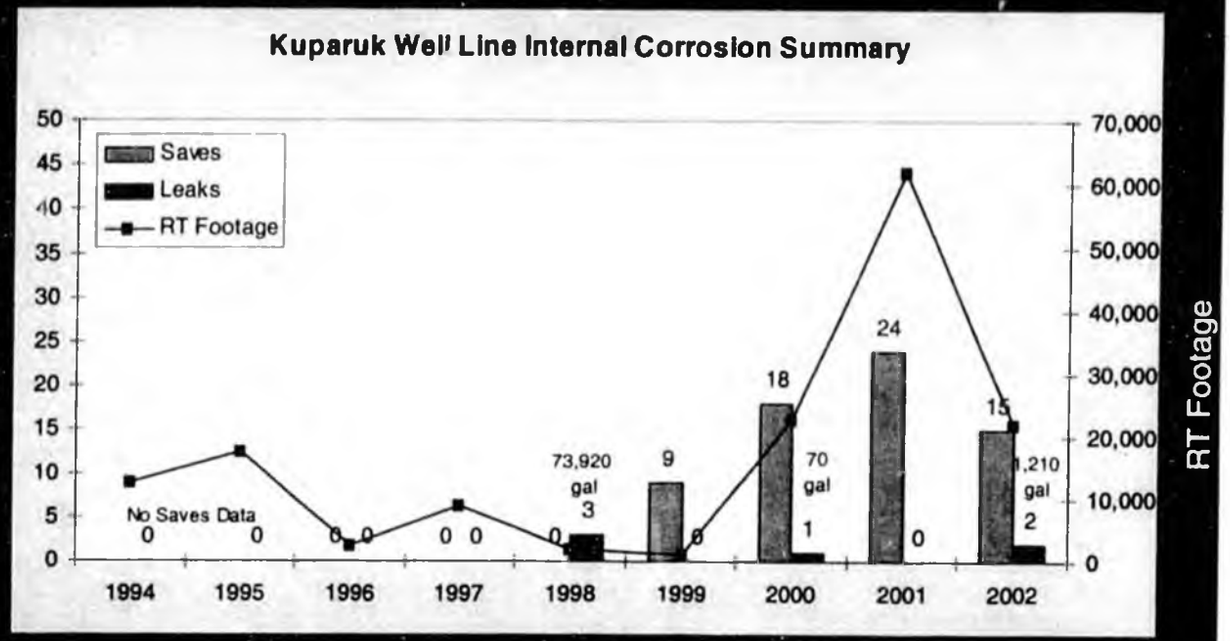
Internal Inspection Focus Area

- ✓ Completed goal of inspecting all .312" lines due for inspection
- ✓ Over 22,000 ft of over 500 lines inspected (RTR and RT)
- ✓ 17 lines required repair (8 injectors, 9 producers)
- ✓ 2 Leaks, 15 Saves
- ✓ Expanded inspection scope @ DS 2T

2002

Internal Corrosion Spills – Well Lines

1998 Spills	1L-16 6" WI
	1L-36 6" WI
	1A-[illegible] 6" WI
2000 Spill	1G-08 6" PC
2002 Spills	2A-18 6" PC
	2T-13 6" PC



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Internal Inspection

- ✓ **Continue to Focus on and Inspect Well Lines**
  - Complete baseline inspection of 6" OD, .312 and .375 lines six years or older
  - Priority based on wall thickness, age of line, and time since previous inspection.
- ✓ **Maintain Inspection of Cross Country Lines**
  - Inspect roughly 15,000+ feet by RTR
  - Complete inspection of elevation change elbows scheduled as part of the "Turbulent Area Program" inspections (formerly called "Elbow Inspection Program")
  - Prioritize & finalize plan to inspect Water Injection CCL's >10"

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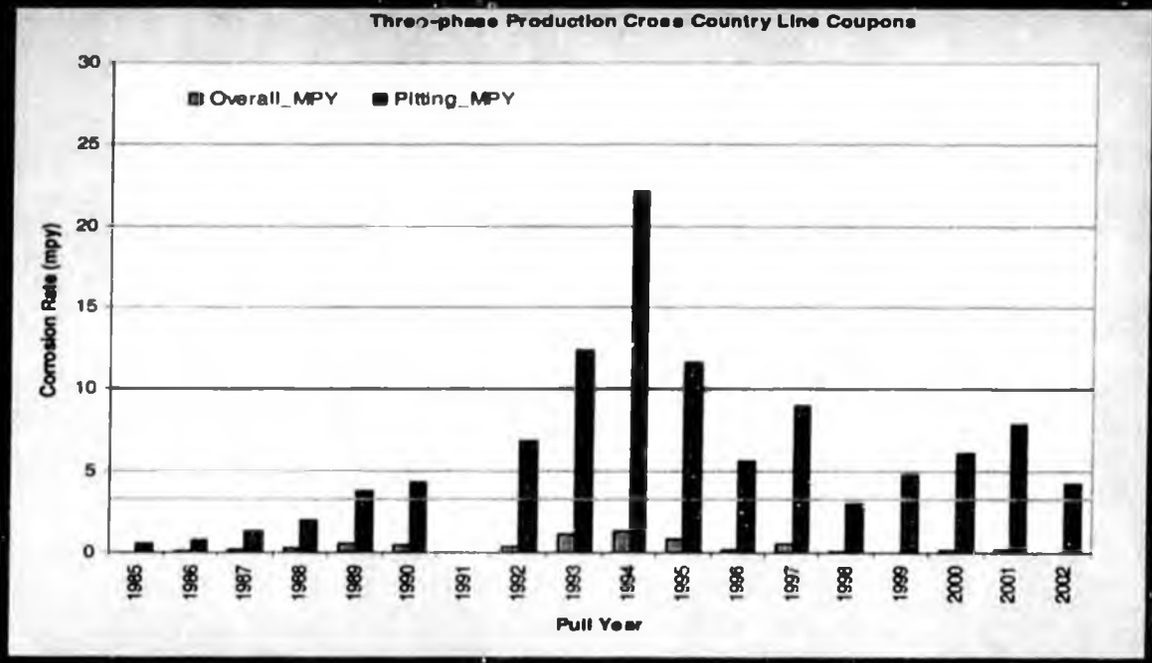
Corrosion Inhibition is effective



2002

- ✓ Coupon average rates remain below thresholds, and are trending down
- ✓ Over 90% of 3-Phase Production CC lines have ER probe rates < 2 mpy
- ✓ Less than 3% of repeat inspection locations showed increases
- ✓ All inhibited 3-Phase Production CC lines with probe, coupon, or inspection rates above thresholds had corrective action taken

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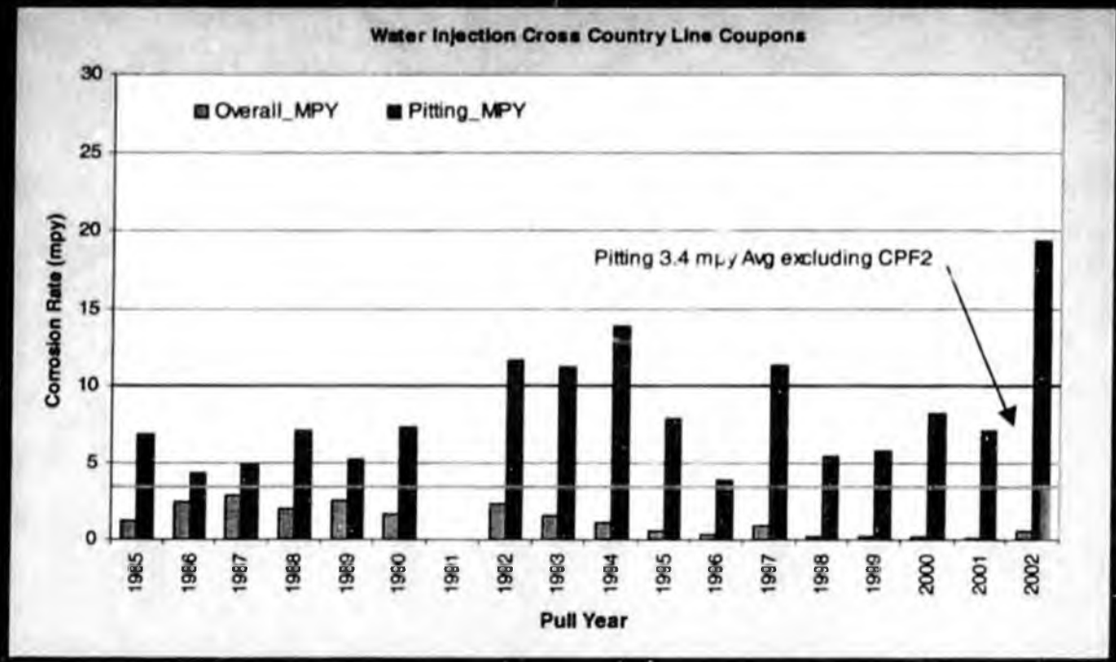
Monitoring/Mitigation

Continuing Focus Area

2002



- ✓ Field average pitting rate excluding "bad actors" falls below threshold (Average affected by lines at CPF2)
- ✓ Recent inspection data from the CPF2 lines show some damage on three lines.
- ✓ Investigation into CPF2 PW System anomalies – some corrective steps already taken (i.e. biocide treatment concentration increased)

batch treatment working of biocide @ CPF2

47 mpy @ CPF2

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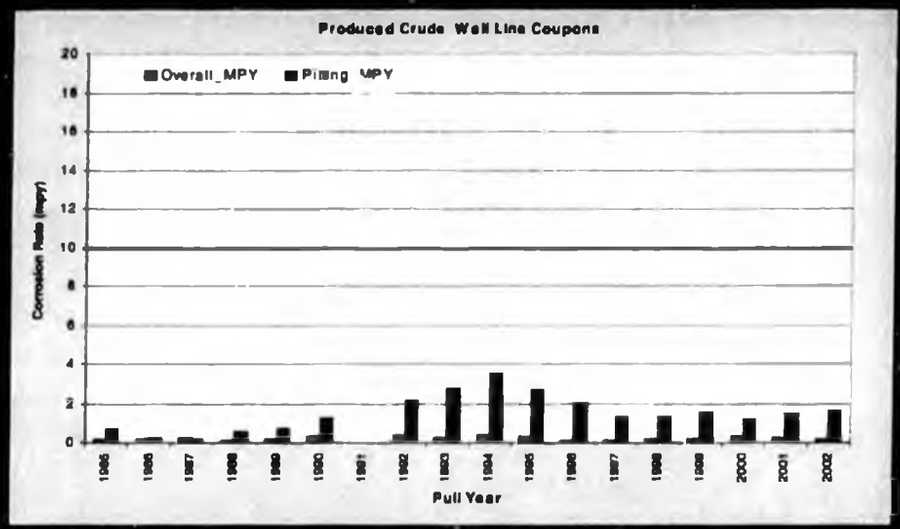
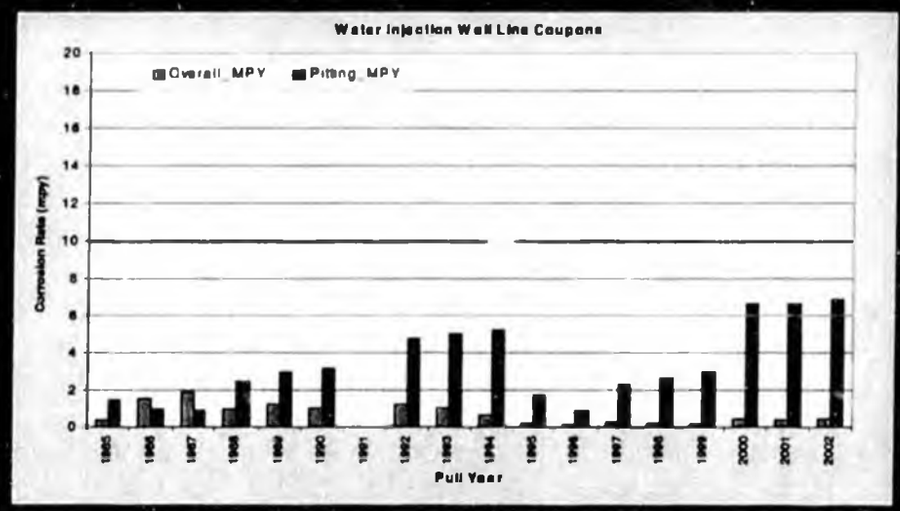
2002 Monitoring/Mitigation

3 Phase Production Well Lines



- ✓ Coupon average corrosion rates remain below threshold levels
- ✓ Well head CI injection design selection finalized
- ✓ Well head CI added at selected Tabasco wells & trunk piping

Water Injection Well Lines



- ✓ Coupon corrosion rates remain below targets
- ✓ Inspection data indicates that higher rates are actually being experienced

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Monitoring/Mitigation

- ✓ Continue testing for more effective corrosion inhibitors
  - Field test of Champion 2002-49A underway at DS1R
  - At least two additional field tests candidates targeted
- ✓ Complete Implementation of wellhead corrosion inhibitor injection at at least 4 more Drill Sites
- ✓ Complete initial investigation of CPF2 PW System anomalies
- ✓ SBG (Surfactant) Produced Water System Pilot Test
  - Design stage and chemical formulation complete, planning on mid year start-up at DS1E

Need to look at where wellhead injection occurs. (H2I Solver)

Kuparuk - replaces insulation w/ tape *Ted - get the photos and show

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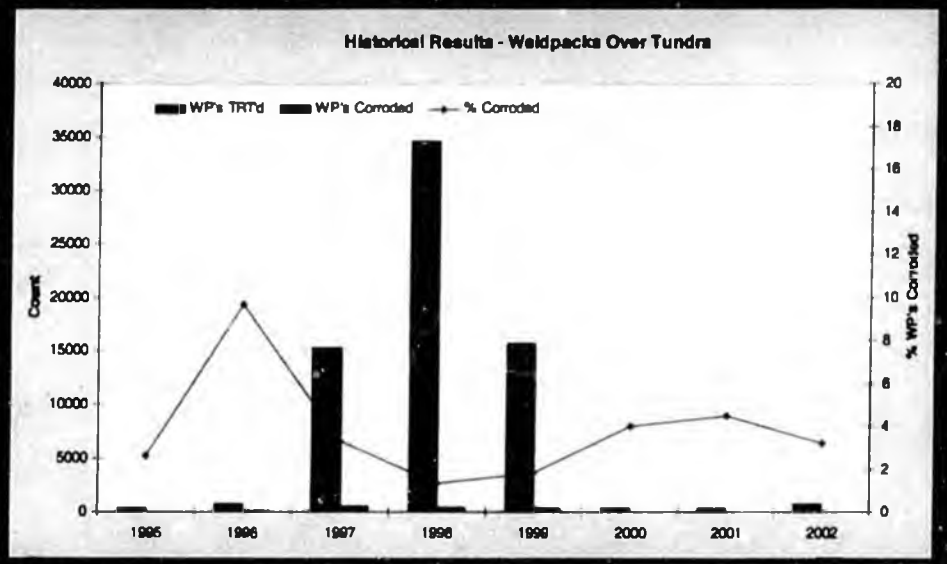
External Inspection

Mature Ongoing Program

2002

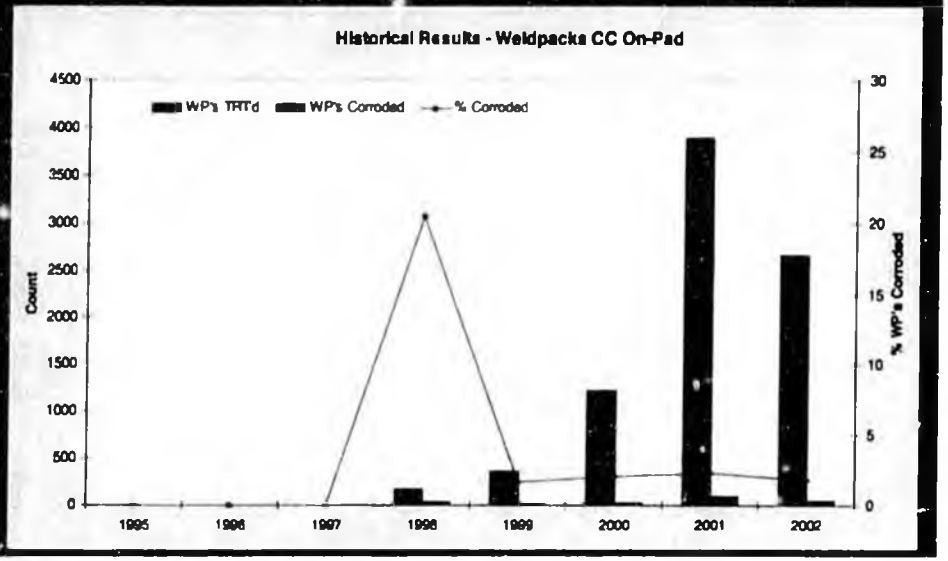


⇐⇐ CC Lines Over Tundra

- ✓ Initiated limited scope recur effort
- ✓ Targeted medium-wet weld packs in saddles identified during initial survey.
- ✓ 12% were found with increased water saturation.

CC Lines On Pad ⇒

- ✓ Overall program completion - 92%
- ✓ TRT'd 2658 weld packs, 150% of annual goal
- ✓ The % corroded weld packs found dropped slightly, ~ 1.8%



↳ no repair

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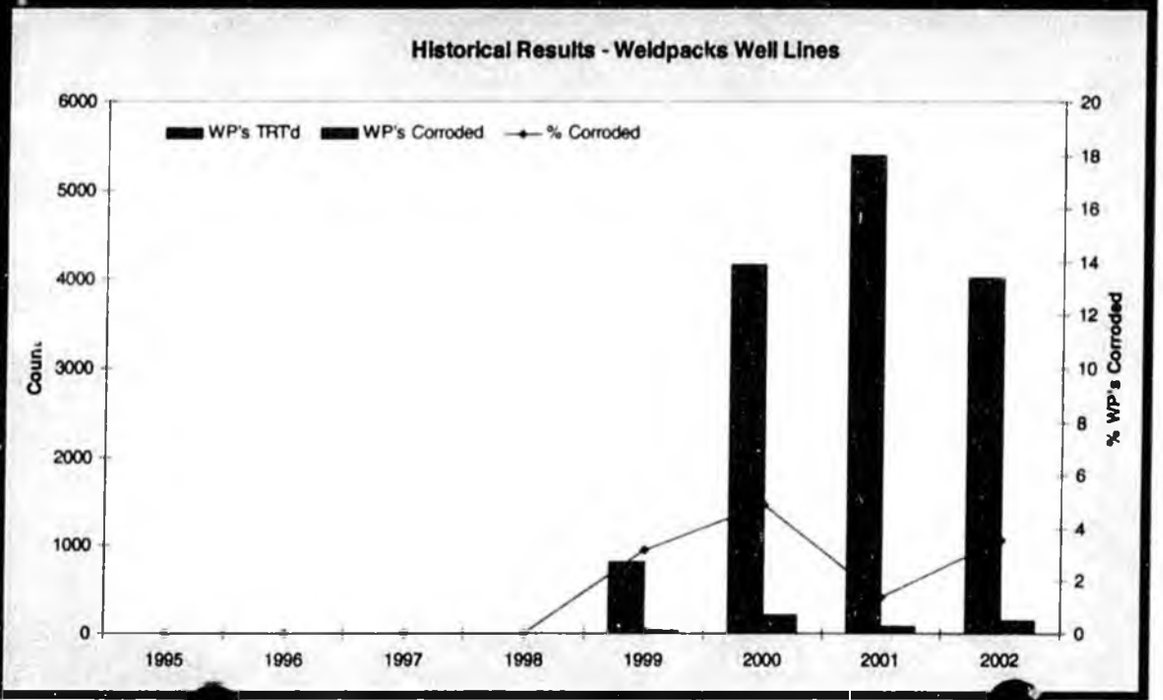
External Inspection

2002

- ✓ Overall program completion - 60%
- ✓ Goal is to complete TRT baseline inspections by YE 2005
- ✓ TRT'd 4116 weld packs by YE, 103% of annual goal
- ✓ % Corroded increased to 3.5%
- ✓ Two locations repaired



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External Inspection

2003 Goals

- ✓ Cross-Country Lines Over Tundra
  - Recur TRT approximately 1500 CUI locations
  - TRT approximately 100 'Tarn Design' weld packs
  - Continue monitoring of 'Denso Tape' protocol
  - Develop prioritized long term recur schedule / program
- ✓ Cross-Country On-Pad
  - Inspect 50% of remaining weld packs, with goal of 2004 YE completion
- ✓ Well-Line Weld Packs
  - Inspect 17% of weld packs, with goal of 2005 YE completion
- ✓ Perform initial evaluation of last summer's CUI Buffer Spike pilot program

$50K/day

ConocoPhillips

Inspection Results

2002

Complete Goal of Inspecting All Priority 1 Pipes

- ✓ Inspected all 130 previously un-inspected priority 1 locations with PTI/TWI
- ✓ 8 cased pipes were excavated (goal was 5 to 9)
  - 2 had severe to moderate damage (1 internal, 1 external)
  - external damage was sleeved, internal damage was replaced & upgraded
  - 6 had minor or no significant corrosion
- ✓ 8 Refurbishments, 2 Saves, No Leaks
- ✓ Completed Annual Visual Casing Inspection - cleared all obstructions

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Inspection Results

Program Snapshot

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

All Lines in GKA/AOA Inventory	Inspected Thru 10/31/02	Un-inspected Lines	Total	Previously Uninspected Lines Inspected in 2002
Priority 1 Oil	331	44	375	38
Priority 1 Non-Oil	226	17	243	92
Priority 2 Oil	1	18	19	0
Priority 2 Non-Oil	0	98	98	0
Priority 3 Oil	1	21	22	0
Priority 3 lines Non-Oil	2	13	15	0
2002 Total Inventory	561	211	772	130

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Inspection Results

- ✓ Re-inspect approximately 60 priority 1 pipes
  - Inspect using PTI and/or TWI technologies
- ✓ Complete initial inspection of all priority 2 lines ~ 115 lines
  - Selectively use PTI and/or TWI technologies where warranted.
- ✓ Prioritize and excavate lines as appropriate ~ 5-9 lines
- ✓ Continue cooperative efforts with equipment vendors, COP R&D, and BP to improve technology, and explore new technologies

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2002

External Corrosion

✓ No incidents to report

Internal Corrosion

✓ 2A-18 Well Line Leak at Cosasco Fitting/Elbow (4/7/02); previously reported

✓ 2T-13 Well Line Leak (7/25/02)

Other Structural

✓No incidents to report

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Spills/Incidents

- Leak occurred shortly after shutting-in well at manifold building
- 10 gallons of product (41% oil and 59% produced water) spilled, contained on-pad
- Leak occurred in 0.375" wall thickness section of line at a weld pack
- Completion of investigation delayed due to lack of access

Background Inspection History:

- Pre-spill inspections on this line consisted of:
  - weld-packs
  - branch connections (part of 2A-18 follow-up inspections)
- Piping was originally installed at DS 3R, then reclaimed for use at 2T-13 in 1996
  - Pipe was new when installed and abandoned at DS 3R
  - Condition of pipe when installed at 2T-13 in 1996 is unknown
- Based on age (6 years) and wall thickness of 0.375", this section was not scheduled for initial internal inspection until 2004.

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Spills/Incidents

Alpine Plant — 6" 2T-13 PO Well Line Leak — 7/25/02

- Evaluate replacement line size for well 2T-13 to minimize under deposit corrosion
  - ✓ **Complete** (4" piping installed)
- Inspect all well lines at DS 2T for internal corrosion, to determine if similar conditions exist
  - ✓ **Complete** - inspected 34 well lines at DS 2T.
    - 28 well lines showed no corrosion damage
    - 6 well lines showed much less severe damage, similar to 2T-13 mechanism .
    - 1 well line (2T-08) met "Best Practice" (not derated) repair criteria.
  - ✓ Additionally, inspected of all DS 3R well lines (origin of pipe used on DS 2T)
    - No significant damage was noted on any of the DS 3R well lines.
- Based on inspection results, determine if inspection criteria across field should be modified
  - ✓ 20 lines, with similar design and operating conditions as 2T-13, were added to the 2003 inspection schedule
  - ✓ Continuing to verify conclusion that severity of 2T-13 corrosion was an isolated incident.
    - – All prior inspection results continue to support current program criteria

Put in Service in 1986

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Spills/Incidents

2003 Update

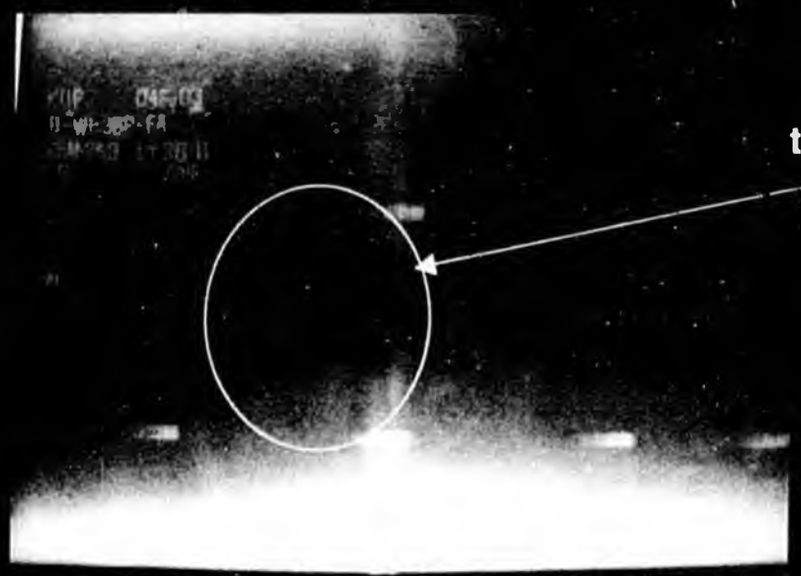
- On 4/14/03 at 7:00 a.m.,a leak from a small ¼ inch hole was discovered on an 8 inch Cross-Country Seawater Injection line located approximately 300 feet off the Kuparuk CPF3 pad.
- The leak was discovered during a normally scheduled visual inspection.
- Estimated 135 BBL. of sea water was spilled,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

Seawater and [illegible] cod-water service

ConocoPhillips

Spills/Incidents

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



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

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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

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Commitment To Corrosion Monitoring
Overview

presented to the

Alaska Department of Environmental Conservation

6th Meet & Confer

October 30, 2003

ConocoPhillips

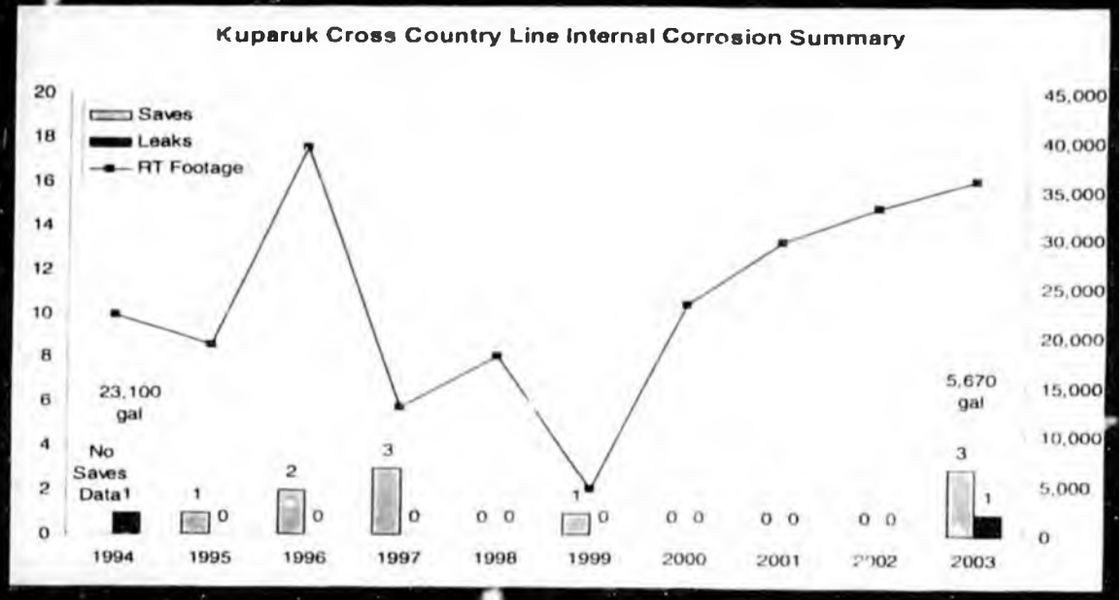
Internal Inspection

- ✓ 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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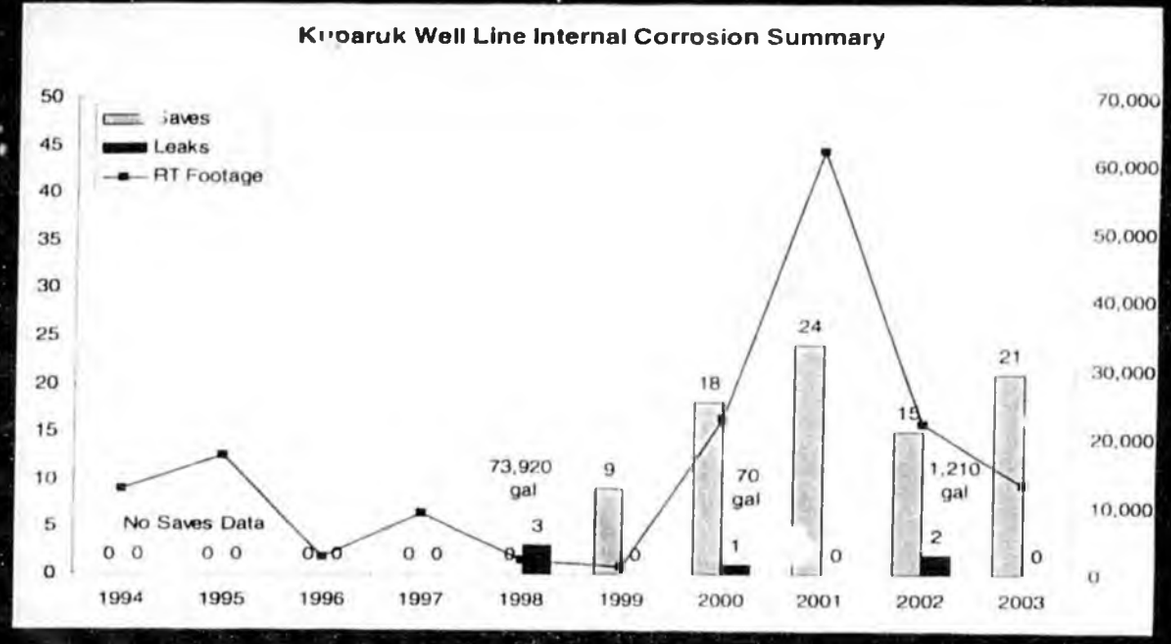
Internal Inspection

- ✓ 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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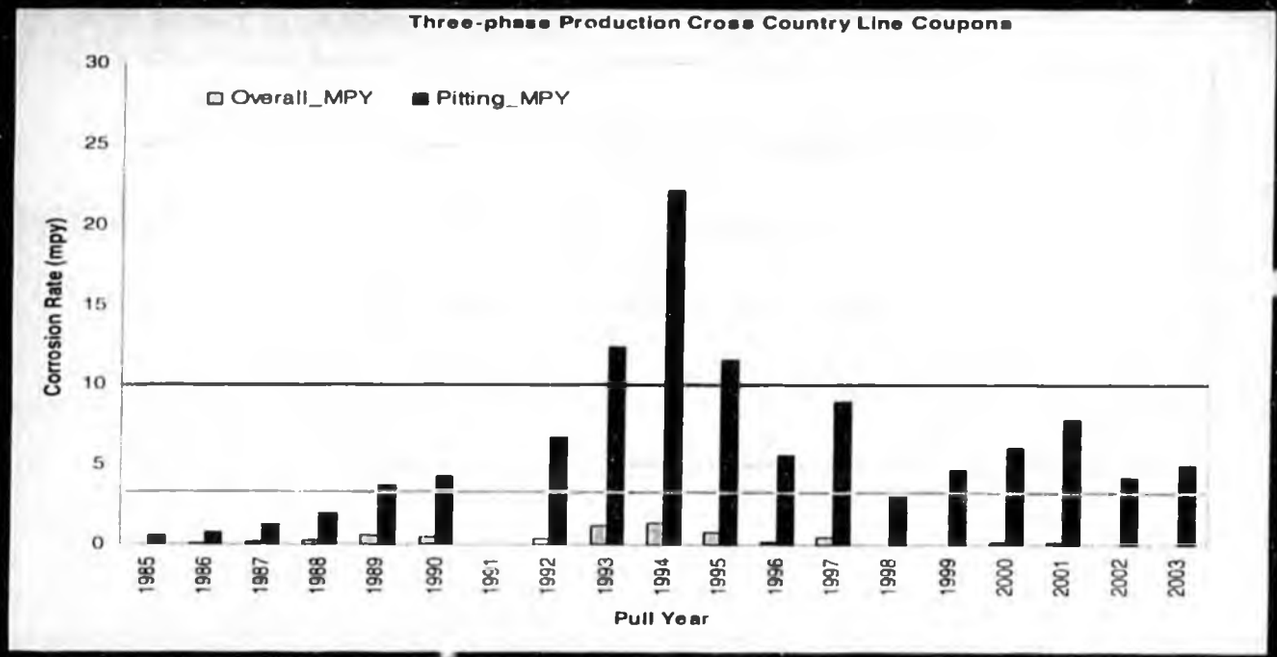
Monitoring/Mitigation



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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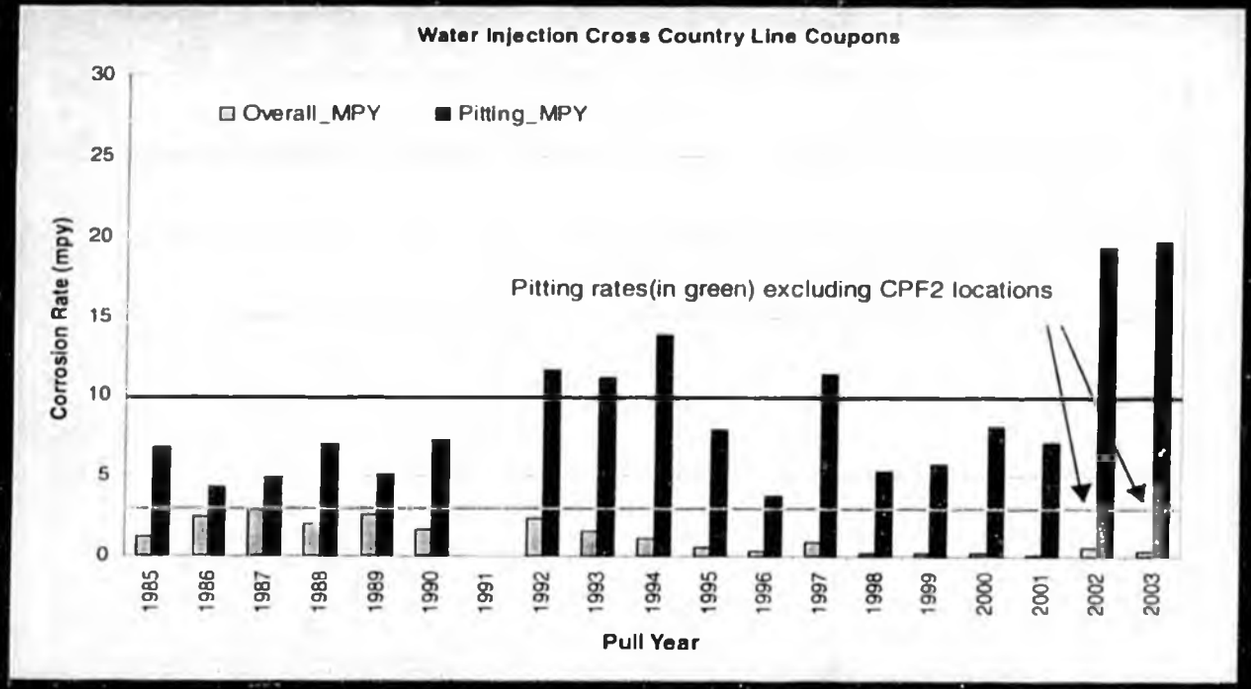
Monitoring/Mitigation

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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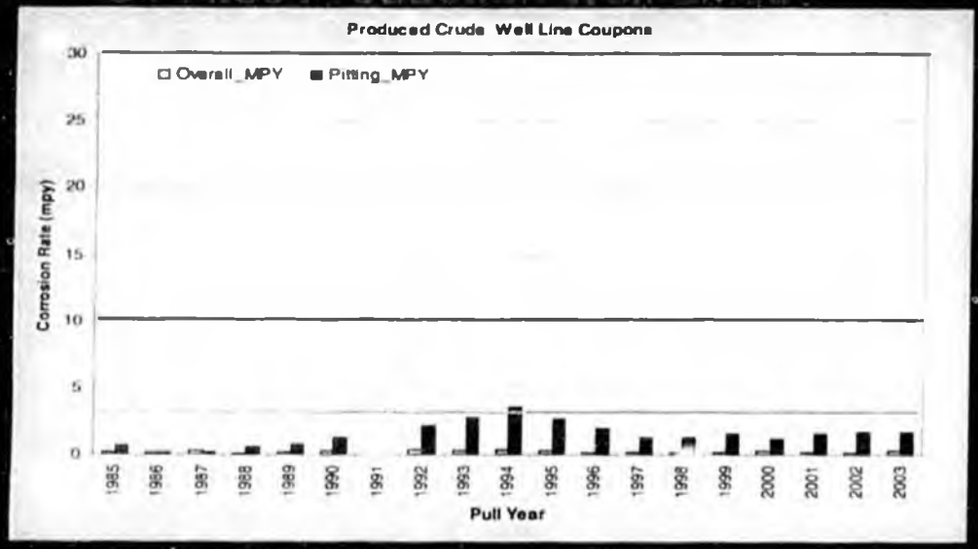
Monitoring/Mitigation

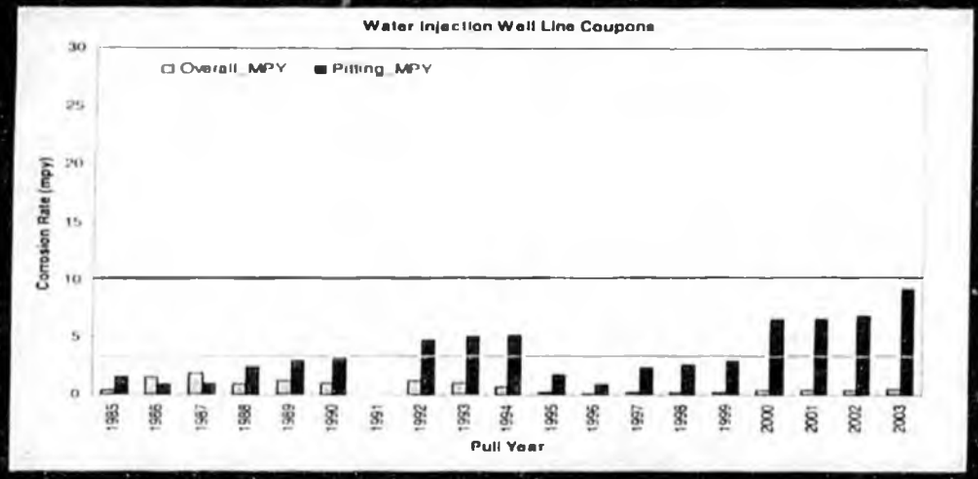
2003

3 Phase Production Well Lines



- ✓ 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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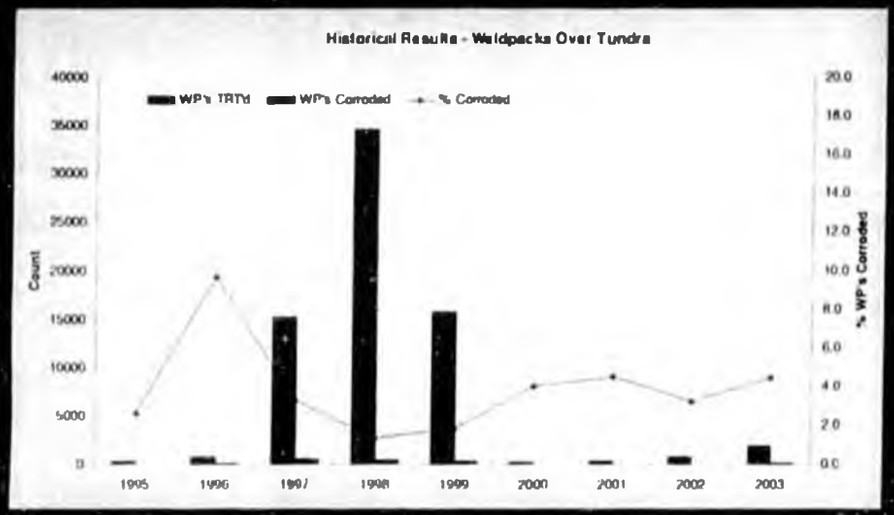
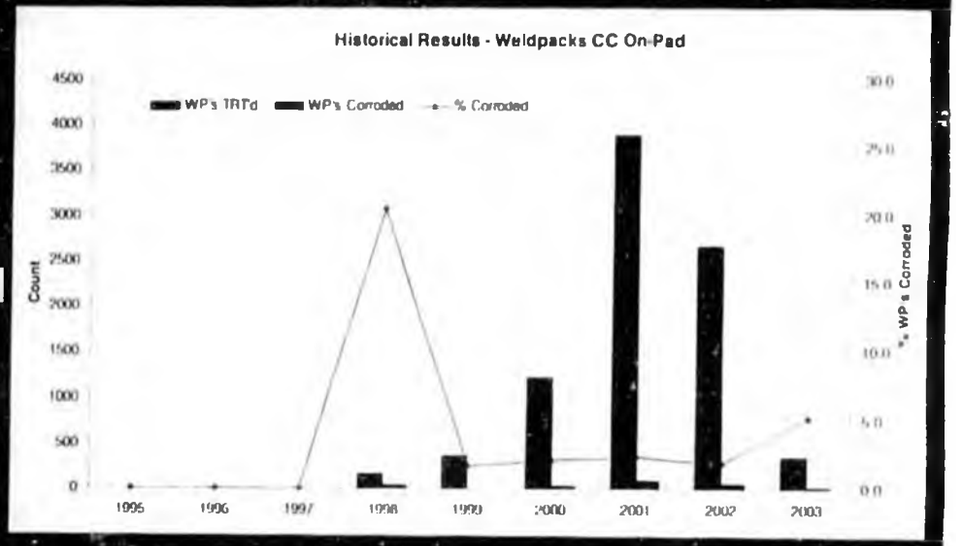
External Inspection

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.

- ✓ 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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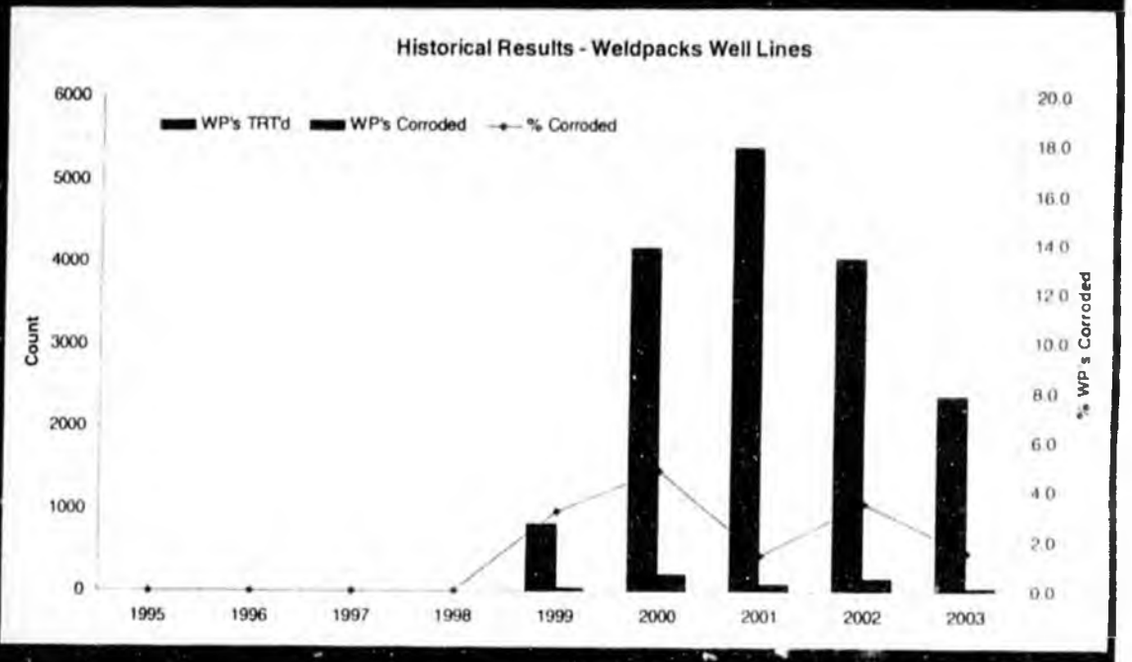
External Inspection

- ✓ 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

Program Snapshot

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

2003 Goals – Status Update

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.

2003 Summary

External Corrosion

- ✓ No incidents to report

Internal Corrosion

- ✓ No new incidents to report since April meeting

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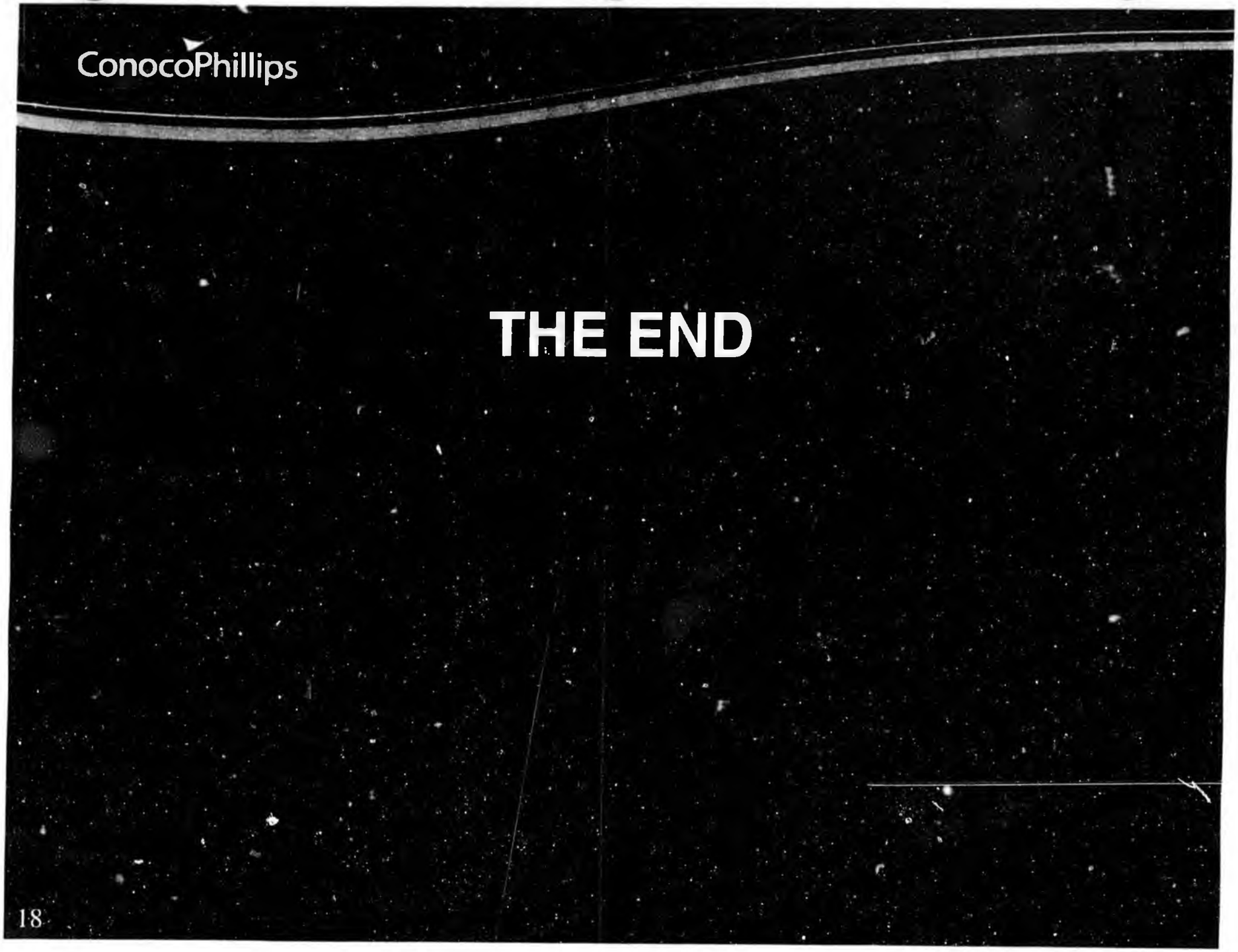
- 13 pipeline supports failed – Attributed to fatigue
- No breach or reduction of pipeline integrity
- Pipeline support reinstated successfully w/o incident
- Best practices captured & implemented
- Field-wide inspections for similar installations complete
- All support installations surveyed confirmed fit-for-service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THE END
18

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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

FALL 2003

30th. 30.50.3

Commitment to Corrosion Monitoring

30 October 2003
10:00 am to 3:00 pm

ConocoPhillips Building 700 "G" Street
Conference Room ATO-1167

2nd-Half 2003 Meet and Confer
(Meeting # 6)

Agenda

Introductions/Opening Remarks – (10:00 to 10:30 am)

- ConocoPhillips new staffing
- ADEC update on new staffing for Charter
- BP new staffing

BP Review (10:30 to 11:45 am)

Lunch in ATO-1167 (11:45 pm to 12:45 pm)

ConocoPhillips Review (12:45 to 2:00 pm)

ADEC (2:00 to 2:30pm)

Open discussion, questions, and feedback (2:30 to 3:00 pm)

BP

BP and State of Alaska Charter Agreement

Corrosion Monitoring Review 2003

Meet and Confer VI

October 30th, 2003

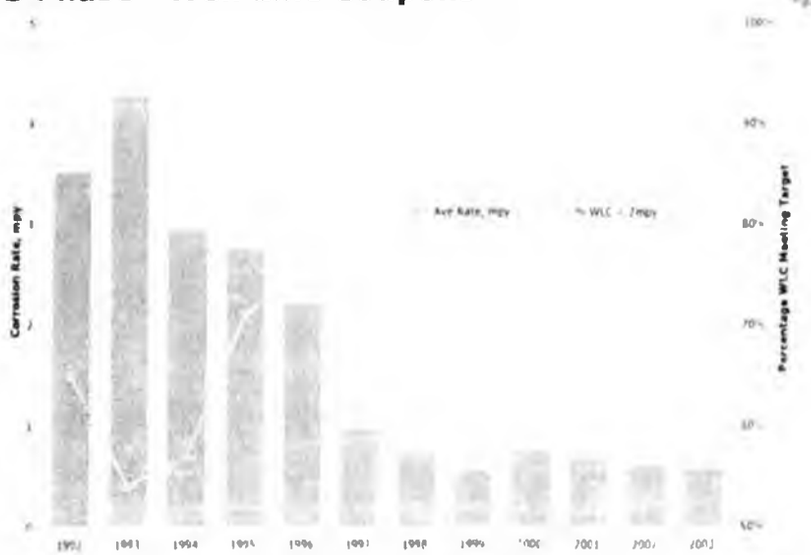
Outline

- **Corrosion Monitoring**
  - 3 Phase Production
    - Flow line and well line coupons
  - Water Injection System
    - Flow line and well line
- **Internal Inspection**
  - 3 Phase
  - Water injection
- **External Corrosion**
- **Cased Piping Inspection**
- **Smart Pigging Activity**
- **2003 Corrosion Related Spills**
  - Y-36 incident and follow-up
- **Summary**

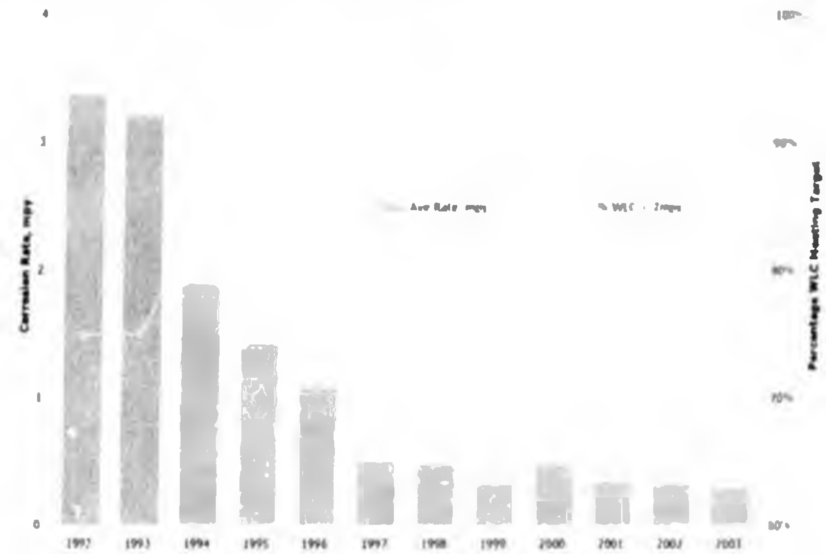
Corrosion Monitoring 3 Phase Production

- **Weight Loss Coupons**
  - Well lines
  - Flow lines
- **Monitoring Corrective Actions**
  - ER probes and coupons
- **ER Probe Example**
- **Corrosion Inhibitor Injection**
  - Concentration
  - Water rates
- **Inspection**
  - Flow and well line summaries
- **Inspection Corrective Actions**
- **3 Phase Inhibition Summary**

3 Phase– Well Line Coupons



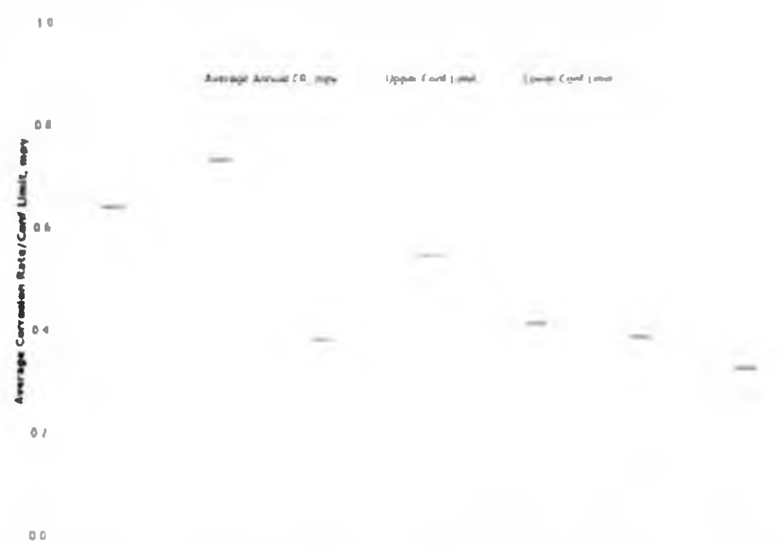
3 Phase– Flow Line Coupons



Oct 2003 BP/ADEC Meet and Confer VI 5

Conf. Confidence intervals/limits

1997 Onward– Corrosion Rate Focus



Oct 2003 BP/ADEC Meet and Confer VI 6

Flow Line Monitoring Corrective Actions

- **ER Probes**

	No.	Equip ID
▸▸ Action	6	01D
▸▸ Action	3	03D
		Y-36
▸▸ Action	1	01C
		05D
		17D
		F-49
		16D

Equip ID	Cause	Action
03D	Increased Corrosivity	Increased Cl by 6 ppd
05D	Increased Corrosivity	Increased Cl by 25 ppd
17D	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl by 5%
03D	Increased Corrosivity	Increased Cl by 10%
01D	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl 18 ppd
01D & 01C	Increased Corrosivity	Increased Cl by 5%
01D	Increased Corrosivity	Increased Cl by 10%
03D	Increased Corrosivity	Increased Cl by 5%
F-49	Increased Corrosivity	Increased Cl by 5%
16D	Increased Corrosivity	Increased Cl by 5%
Y-36	Increased Corrosivity	Increased Cl by 10%
Y-36	Increased Corrosivity	Increased Cl by 10%
Y-36	Increased Corrosivity	Production routing change

- **Weight Loss Coupons**

Equip ID	Cause	Action
14D	Increased Corrosivity	Increased Cl by 10%
Q-01	Increased Corrosivity	Increased Cl by ~100%

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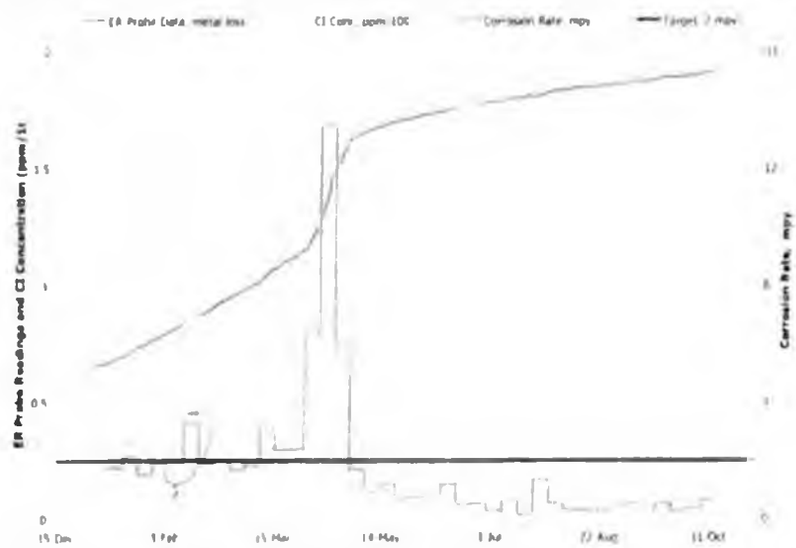
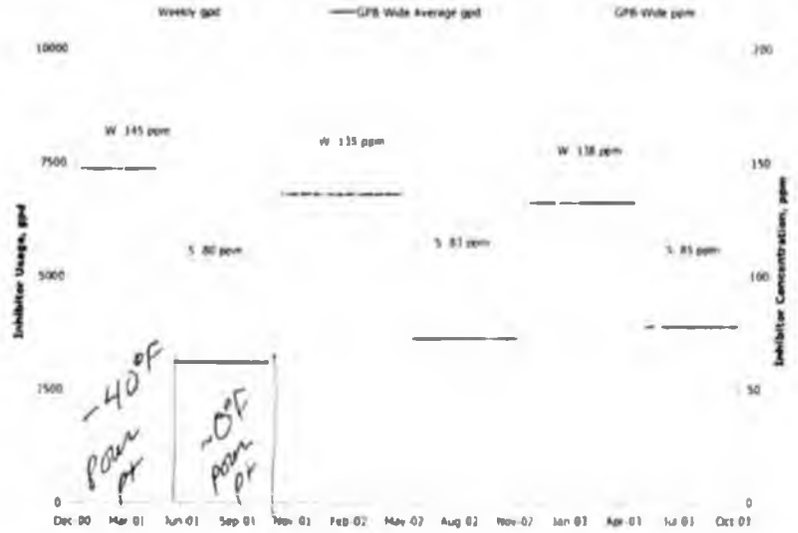
ER Probe Corrective Action Example



Oct 2003 BP/ADEC Meet and Confer VI 8

GPB Wide Corrosion Inhibitor Concentrations



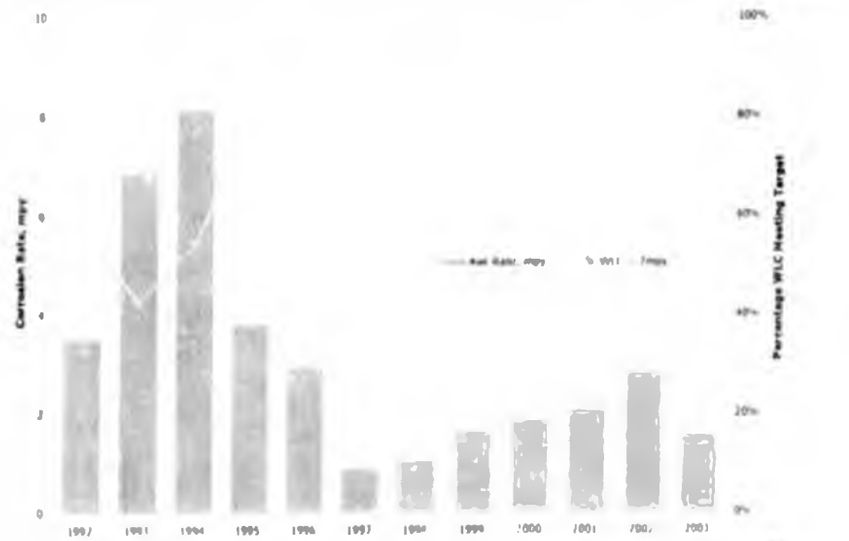
Oct 2003 BP/ADEC Meet and Confer VI 9

Water Injection Systems

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

Oct 2003 BP/ADEC Meet and Confer VI 10

Aggregate Water Injection Flow Line Coupons



Oct 2003 BP/ADEC Meet and Confer VI 11

increase due to seawater system

PW System– Well Line Coupons

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limited data set represents the orange line re: 100% meeting target