Gulf of Mexico Rule Changes on Decommissioning and P&A

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Lillehammer Energy Claims Conference
March 2-4, 2011

PART 1 – REGULATORY CHANGES

PART 2 – DECOMMISSIONING CHARACTERISTICS

PART 3 – ECONOMIC AND ACTIVITY DATA

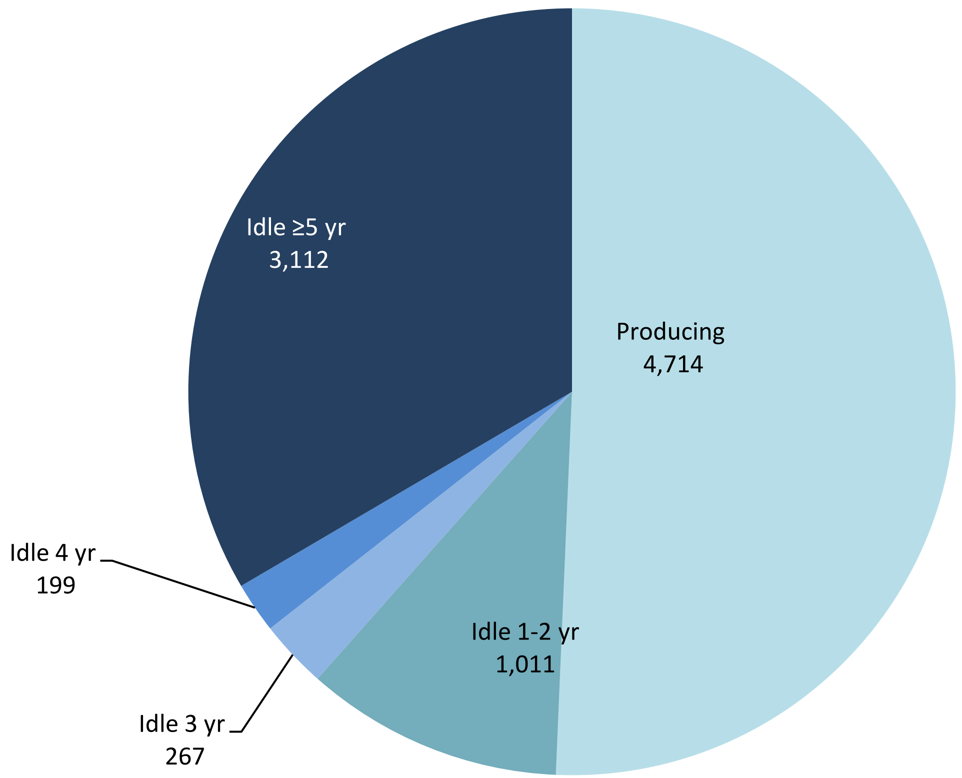
PART 4 – EMPIRICAL MODELS

PART 5 – RESEARCH NEEDS

PART 1
Regulatory Changes

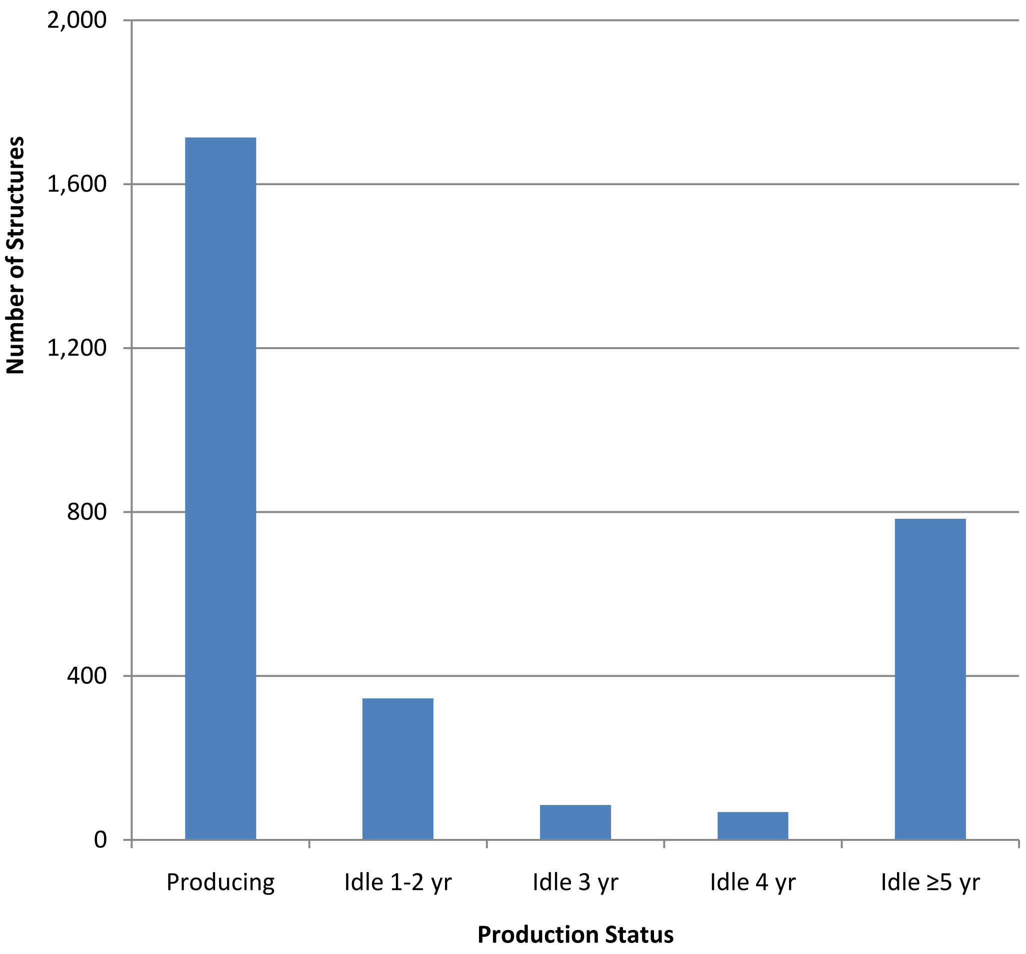
GOM Well Inventory (2011)

36,210	**SPUD**
23,104	PA
3,530	TA
9,576	**INVENTORY**



GOM Structure Inventory (2011)

6,954	**INSTALLED**
3,447	REMOVED
3,507	**INVENTORY**
3,112	**Producing & Formerly Producing INVENTORY**



NTL No. 2010-G05

Wells Idle >=5 yr: 3 years to PA, TA, or ZI

Structures Idle >= 5 yr: 5 years to remove

Starting from OCT 15, 2010

Ending OCT 14, 2013

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY, MANAGEMENT AND REGULATION
GULF OF MEXICO OCS REGION

NTL No. 2010-G05

Issue Date: September 15, 2010
Effective Date: October 15, 2010
Expiration Date: October 14, 2013

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES AND PIPELINE RIGHT-OF-WAY HOLDERS IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO OCS REGION

Decommissioning Guidance for Wells and Platforms

This Notice to Lessees and Operators and Pipeline Right-of-way Holders (NTL) supersedes NTL No. 2004-G06, Structure Removal Operations, effective April 5, 2004. In addition to updating the guidance on this topic, the NTL provides definitions of *capable of production in paying quantities*, *downhole zonal isolation*, *no longer useful for operations*, and *toppled platform*; establishes an approach to ensure that idle infrastructure on active leases is decommissioned in a timely manner; and provides clarification, description, and interpretation of many other issues regarding decommissioning that have arisen since publication of 30 CFR 250, Subpart Q in 2002.

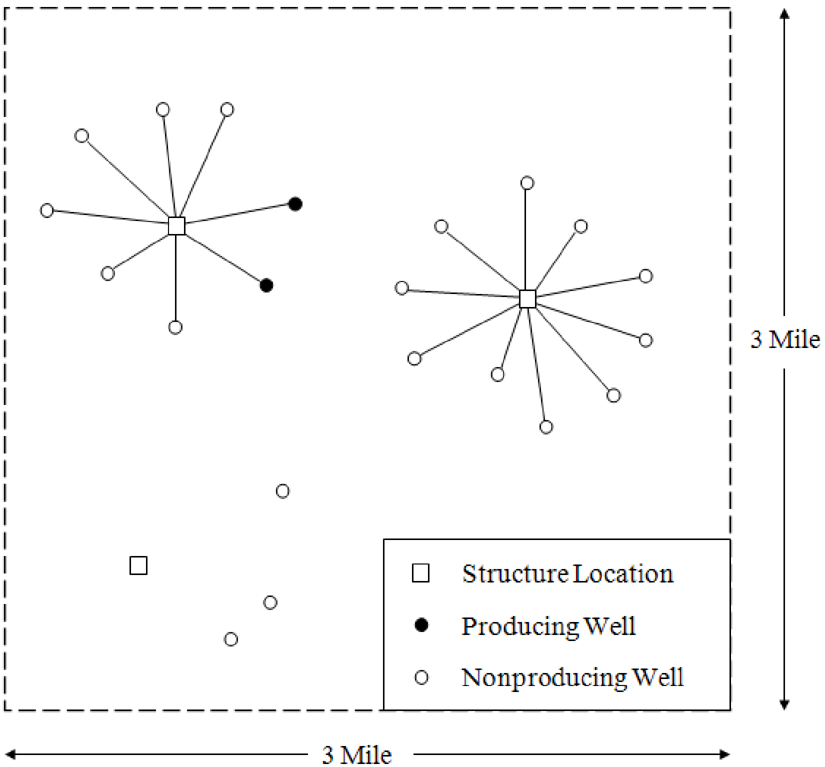
NTL No. 2010-G05

"… establish guidelines that provide ***a consistent and systematic approach to determine the future utility of idle infrastructure on active leases*** *and to ensure that all wells, structures, and pipelines on terminated leases and pipelines on terminated pipeline rights-of-way are decommissioned within the timeframes established by regulations, conditions of approval, and lease instruments."*

System Boundary Changes

HISTORICALLY,

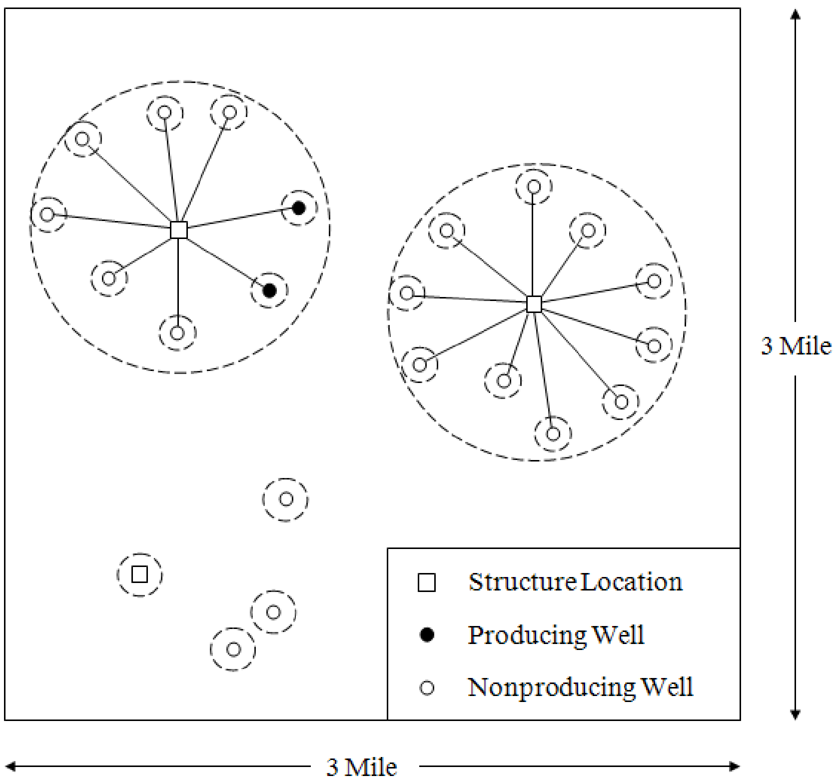
before OCT 14, 2010:



Within 1 year after the lease terminates:
- Permanently plug and abandon all wells
- Remove all structures
- Site clear and verify around each site

PRESENT,

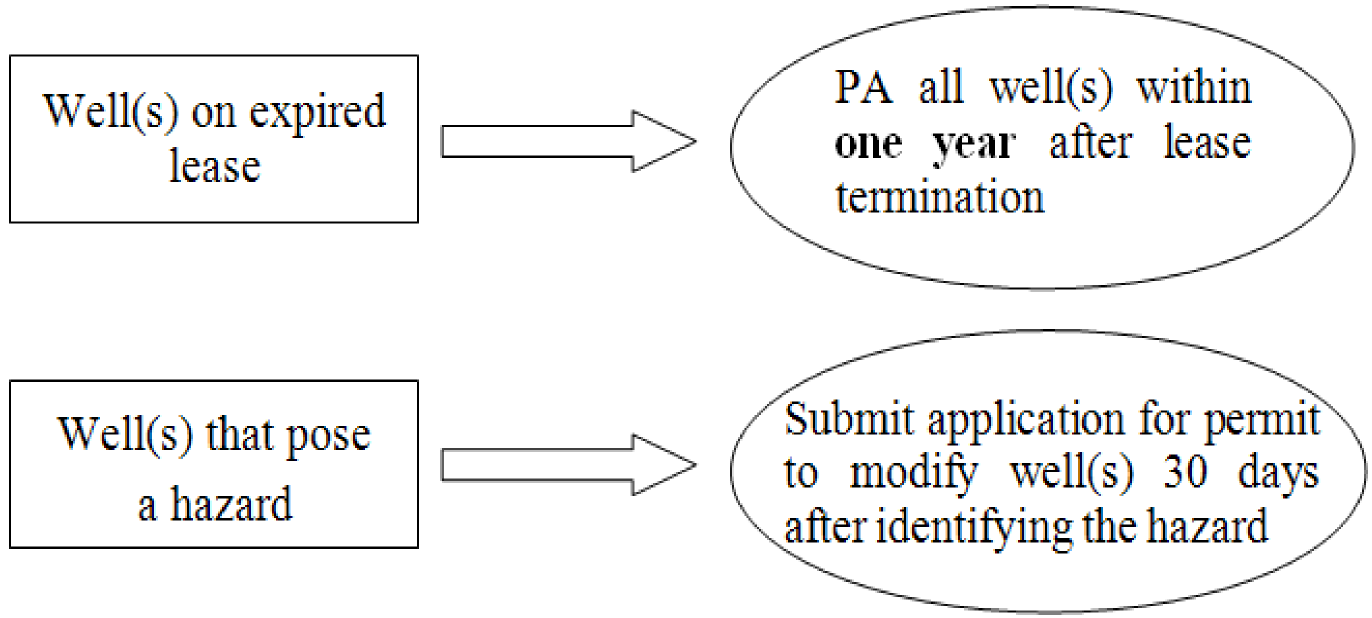
after OCT 14,2010:



After a well or structure stops production for 5 years or more:
- Permanently or temporarily abandon all wells
- Remove structures
- Site clear and verify around each site

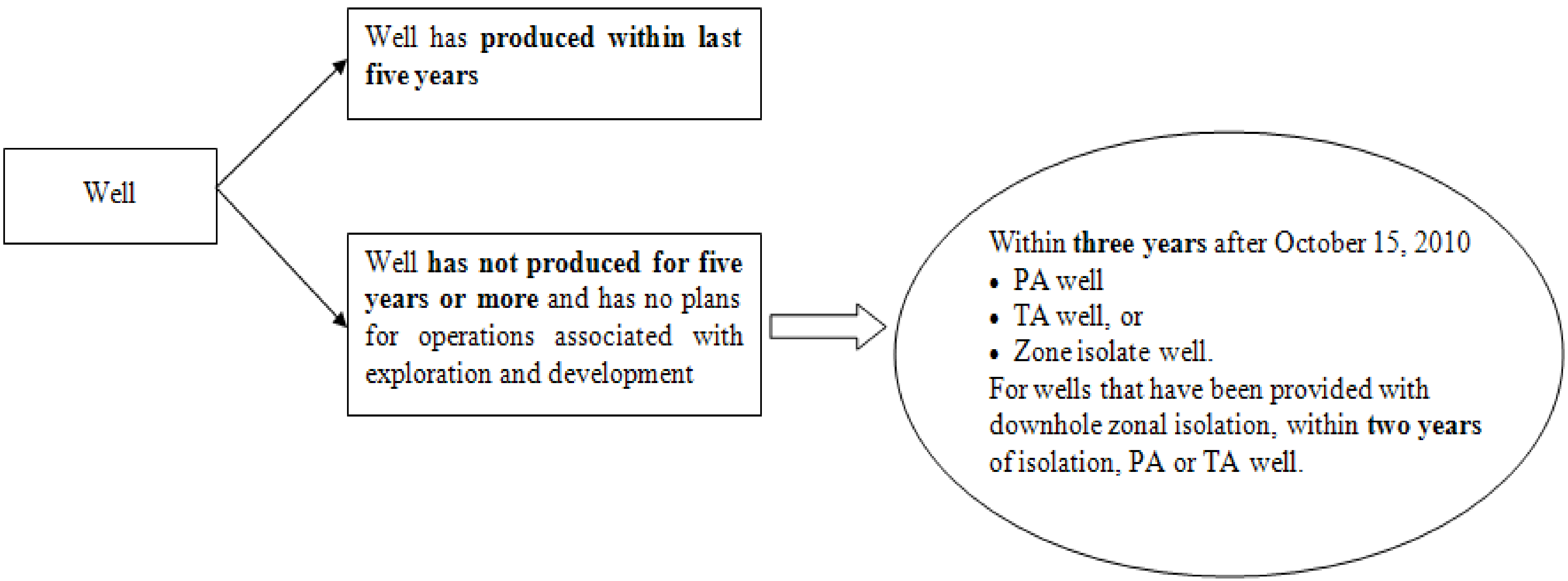
Expired Leases, Hazardous Wells

30 CFR 250.1710, 1711(a)



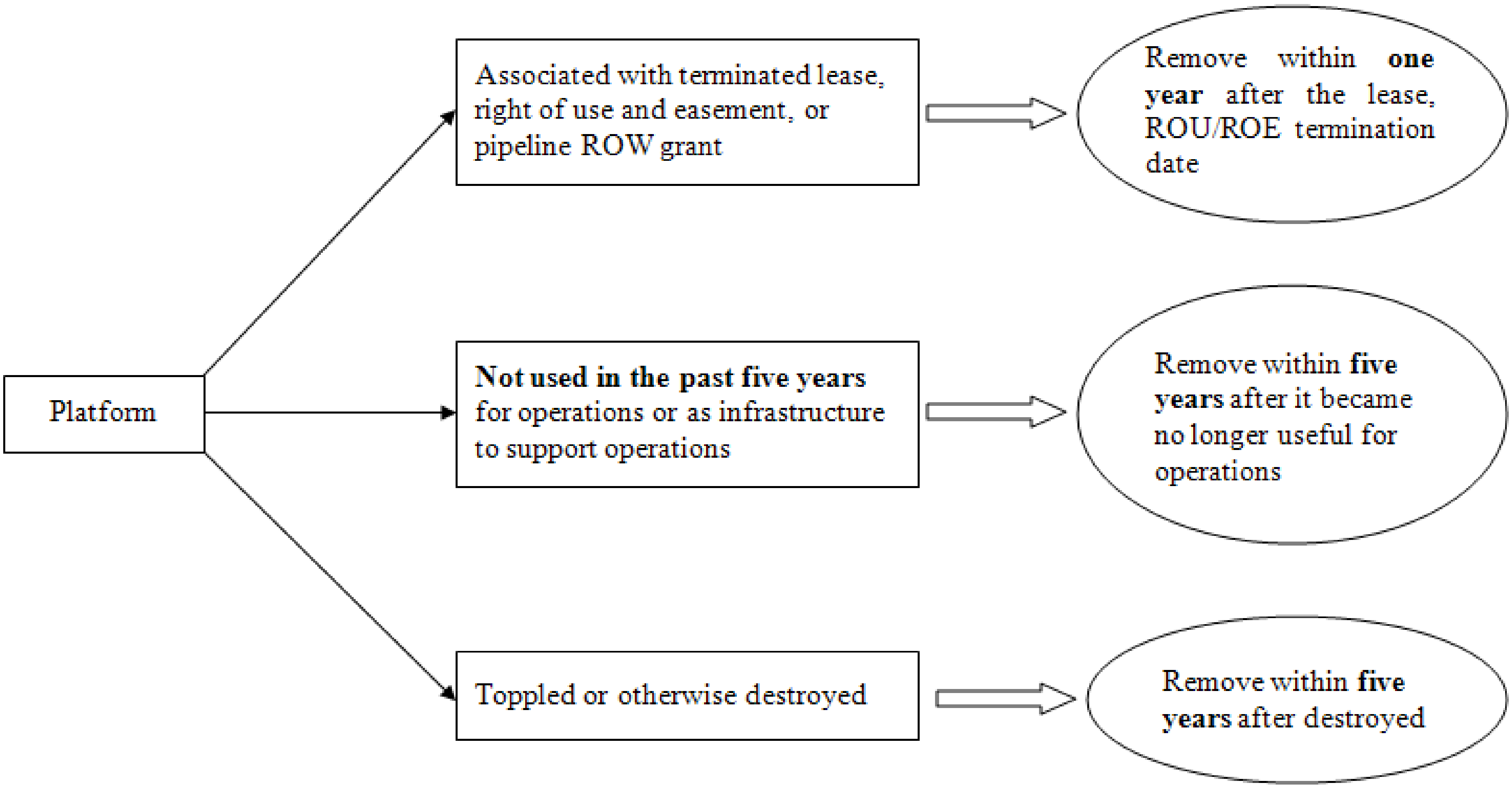
Idle Wells (5 / 3)

30 CFR 250.1712(b)



Idle Structures (5 / 5)

30 CFR 250.1703(c)



Impact of NTL

Benefits vs. Cost

Benefits:

(1) Clean-up the GOM
(2) Reduce hurricane exposure and destruction
(3) Improve the balance sheets of operators by reducing liability
(4) Reduce insurance premiums in the future
(5) Increase work-force utilization in aftermath of BP oil spill, deepwater moratorium
(6) Planned decommissioning operations are cheaper than unplanned operations (i.e., hurricane destroyed structures)

Costs:

(1) Compliance cost
(2) Potential lost production
(3) Information and utility cost
(4) Potential reduction for future E&P development options

Compliance Cost

Idle >= 5 Wells:

3,112 @ $200-350K/well + TA wells

Idle >= 5 Structures:

783 @ $1.2-2.8 MM/structure

Well Abandonment:

$857 million - $1.3 billion

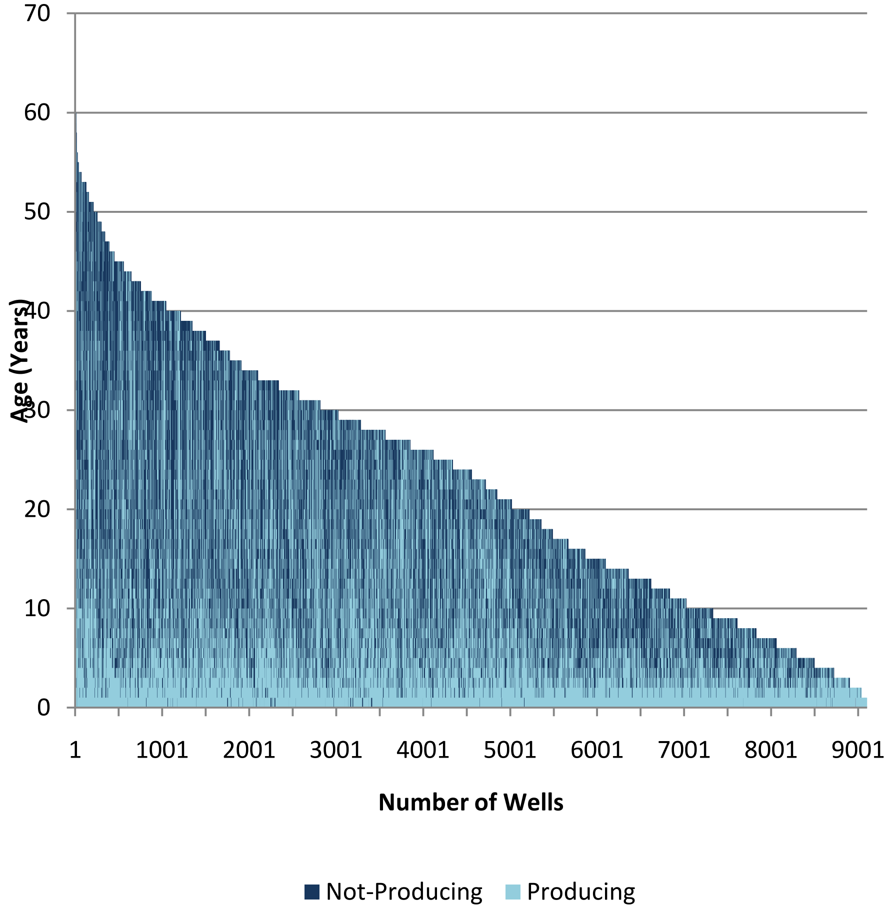
Structure Removal:

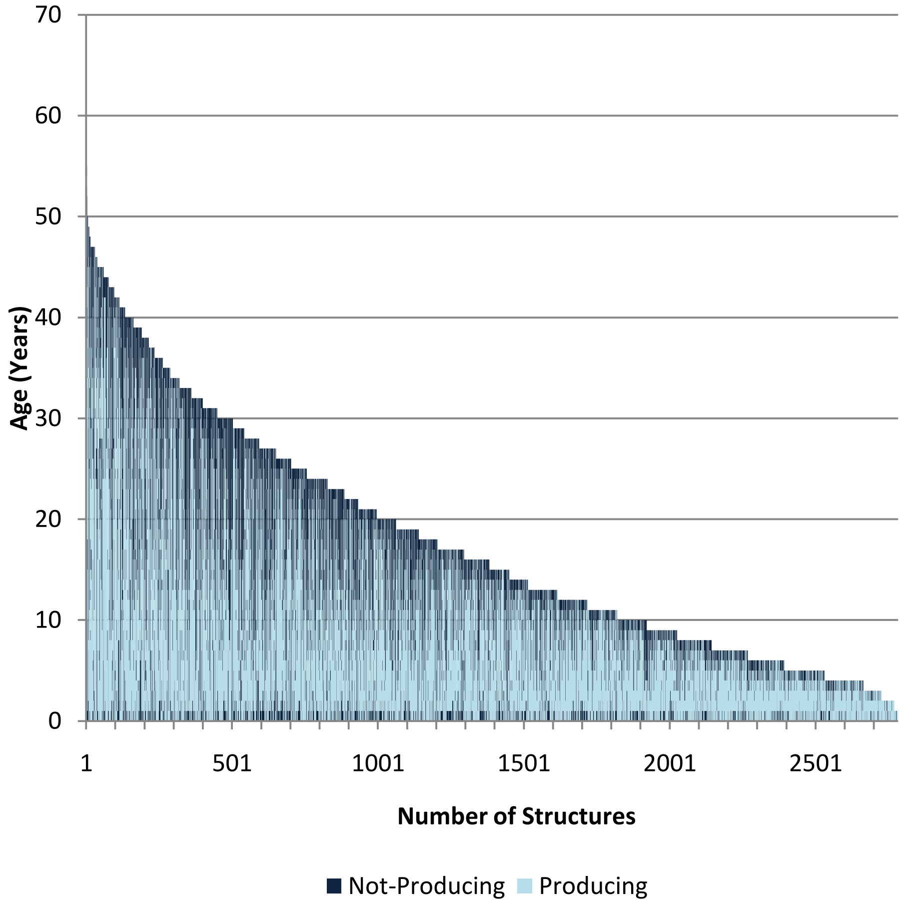
$940 million - $2.2 billion

TOTAL:

$1.8 – $3.5 billion

Wells & Structures Go In & Out of Production All the Time…

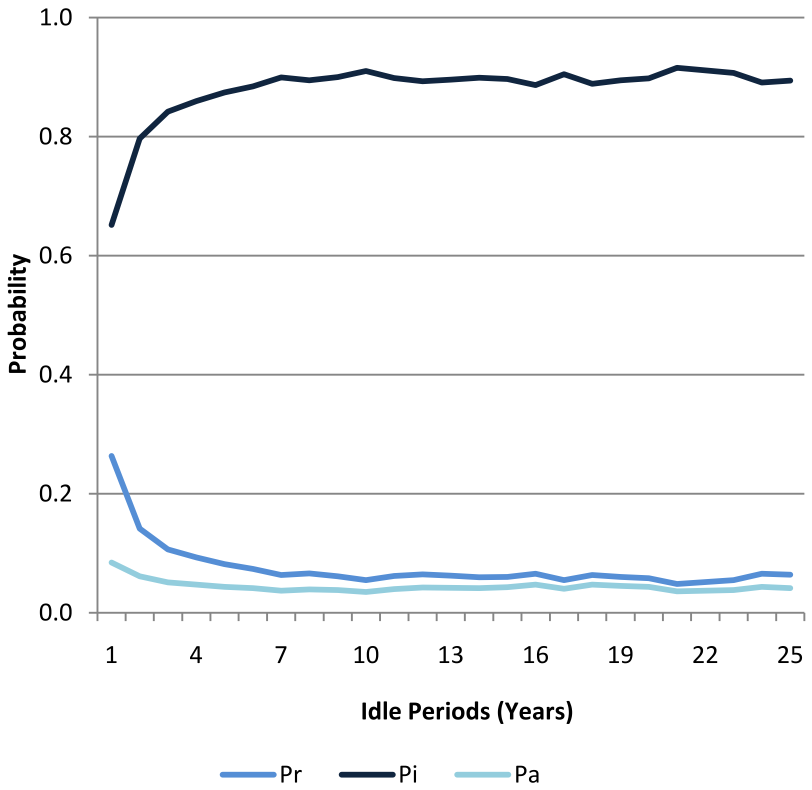




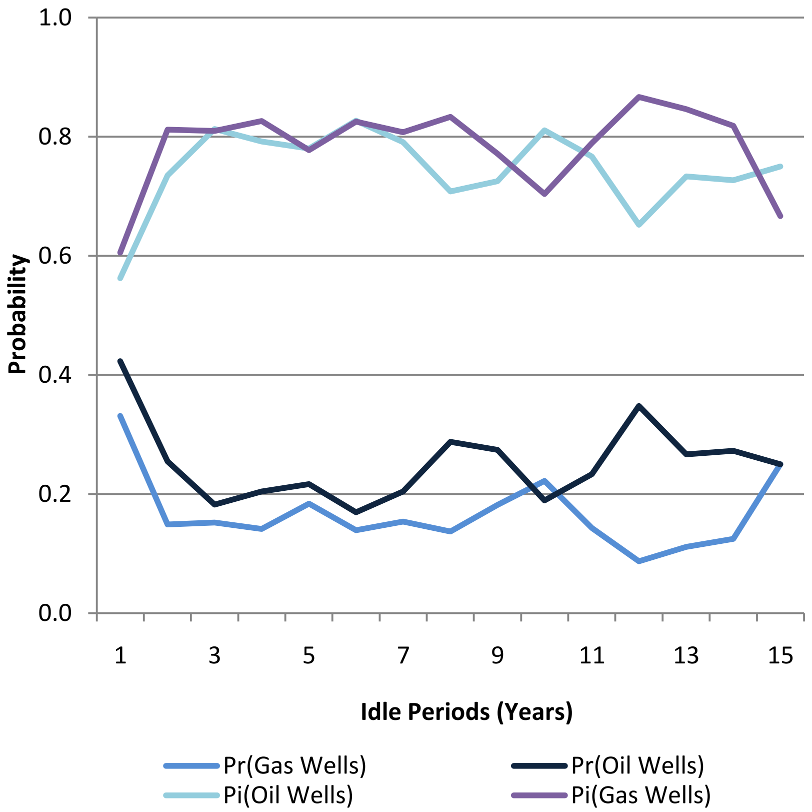
Shallow Water < 500 ft

…And Idle Wells Can Return to Production If Available

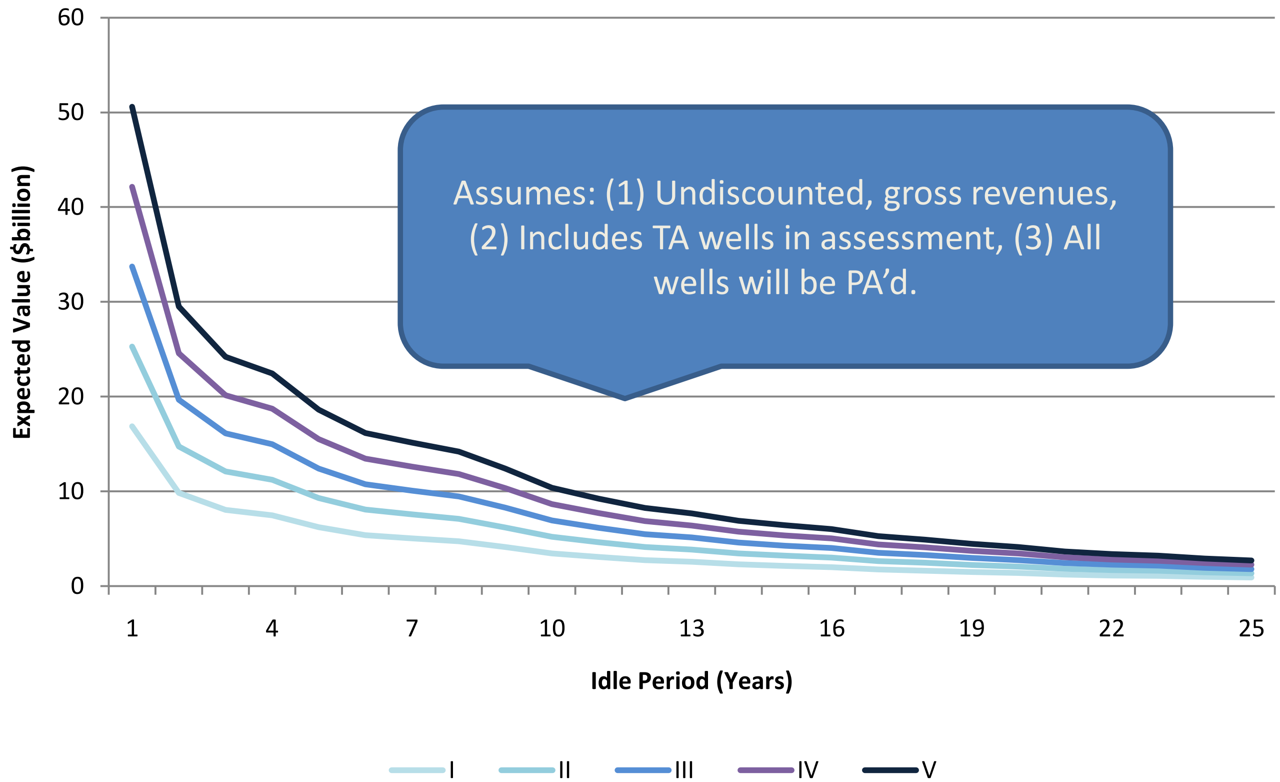
Shallow Water, Oil:



Deepwater, Oil and Gas:



Potential Lost Production – Upper Bound



TOTAL: $6.3 – $18.6 billion

New decommissioning requirements will lower Gulf of Mexico production

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The US Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE), formerly known as the Minerals Management Service, issued new guidelines and measures in the form of Notice to Lessees 2010-G05 on Sept. 15 for decommissioning idle wells and structures on active leases on the Gulf of Mexico Outer Continental Shelf (OCS).

NTL 2010-G05 dissolves the lease boundary in determining decommissioning time lines and redefines the regulatory requirements at the individual wellbore and structure level by specifying the maximum number of years wells and structures are allowed to remain idle before they have to be abandoned. NTL 2010-G05 is a significant departure from historic requirements and, as far as we are aware, is the first regulation across any offshore basin to require infrastructure to be decommissioned after production ceases for a fixed period of time.

GULF OF MEXICO WELL INVENTORY—2010 (Table 1)

Status	Shallow water (<500 ft)	Deep water (≥500 ft)
Producing	3,858	668
Idle <5 years	1,586	170
Idle ≥5 years	3,273	113
Never producing	833	216
TA—never producing	485	274
TA—previously producing	2,649	179
Total	**12,692**	**1,620**

The purpose of this article is to quantify the costs of NTL 2010-G05 and the economic consequences of prematurely abandoning idle infrastructure. The value of an idle well is the potential that it may produce again in the future, but because of uncertain and imperfect information operators do not and cannot know the future utility of their idle inventory. If idle wells are prematurely abandoned and idle structures are removed, the opportunity for future production will be lost or greatly diminished.

In the short term, operators will clean up and cut their idle inventory, and within a few years all wells and structures that have not produced for 5 years or more will be plugged and removed. Longer-term, the new regulations impose uncertain consequences for production operations and will impact cost outlays, efficiency, and development opportunities in the region.

We estimate that the gross revenue lost as a result of NTL 2010-G05 will range between $6.2 billion to $18.6 billion. Foregone government royalties are expected to fall between $775 million and $2.3 billion. If the decommissioning time lines for idle wells were reset using a 10-year criteria, lost production is estimated to decrease to $3.5-11.4 billion.

Production intermittency

No well or structure produces continuously throughout its lifetime. Maintenance, workovers, production problems, downstream disruptions, low commodity prices, and hurricane damage impact operations and stop production for various periods of time. In every field development, and on every offshore structure, wells begin and end production at different times; therefore, some wells become idle as other wells continue to produce. Wells that stop producing may be used at a later time to further explore the formation and seek future development opportunities.

When production on a lease ceases, the lease terminates. Historically, federal regulations required that companies permanently abandon all wells and remove all structures on a terminated lease within 1 year. Because a lease often has many wells and one or more structures, wells and structures sit idle on a lease until the lease stops producing. As long as a lease is producing in paying quantities, inactive (idle) wells and structures can be held on the lease and remain in compliance with the lease instrument.

Activity spectrum: wells

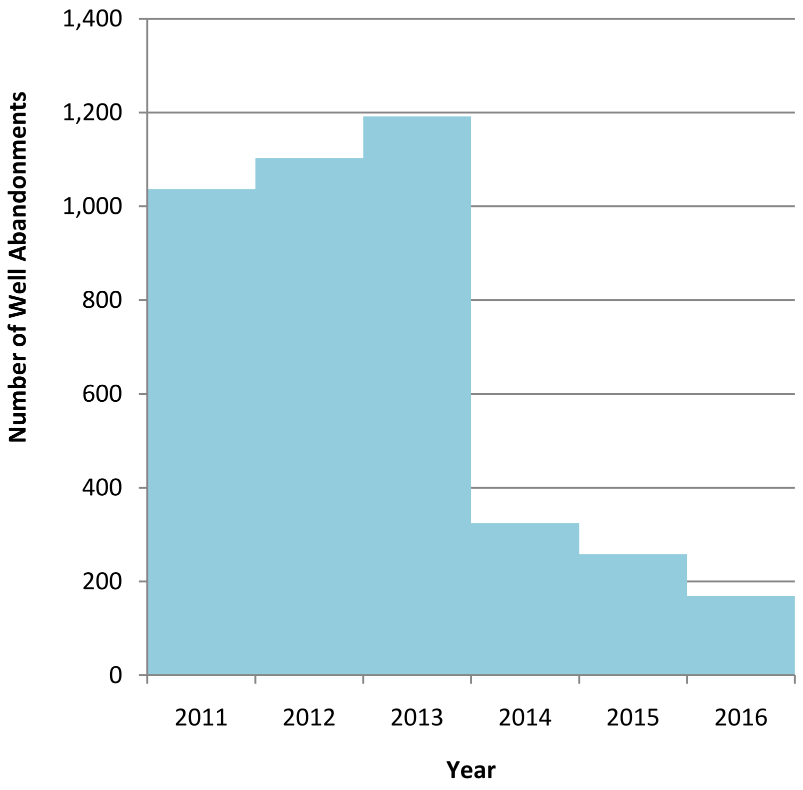
Fig. 1a is a snapshot of the producing status of all original wellbores currently in the shallow-water (<500 ft) Gulf of Mexico, with shading indicating production status. A light shade indicates production, and a dark color indicates no production; age is represented along the vertical axis. The production activity of each well is initialized from its time of completion, represented at the bottom of the chart, to the current production status, at the top of the chart. Sampling is on annual basis, and the length of each vertical segment represents the age of the well.

The plot demonstrates that production intermittency is a part of normal field operations. We refer to charts that represent production activity as the "activity spectrum."

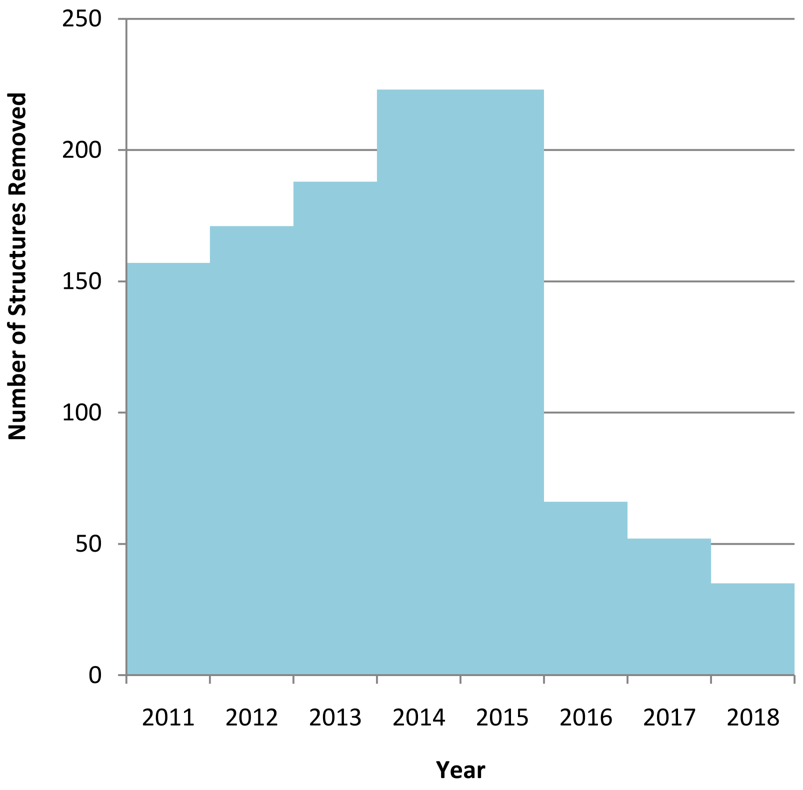
O&GJ; Nov 10, 2010

NTL 2010-G05 Activity Forecast

Wells:



Structures:



Operator Liability

GOM Inventory & Liability Classes

Production Status	Number of Structures	Producing	Number of Idle Wells: 1-2	3	4	≥5	Never producing
Producing	1,714	4,714	680	191	149	2,108	153
Idle 1-2 yr	345		331	30	12	227	23
Idle 3 yr	85			46	4	14	4
Idle 4 yr	68				34	51	1
Idle ≥5 yr	783					712	29
Total	2,995	4,714	1,011	267	199	3,112	210

NTL Liability: < 5 yr
Transition Liability: 5 to 8 yr
Producing Liability: 3+ yr

= 3 Liability Classes

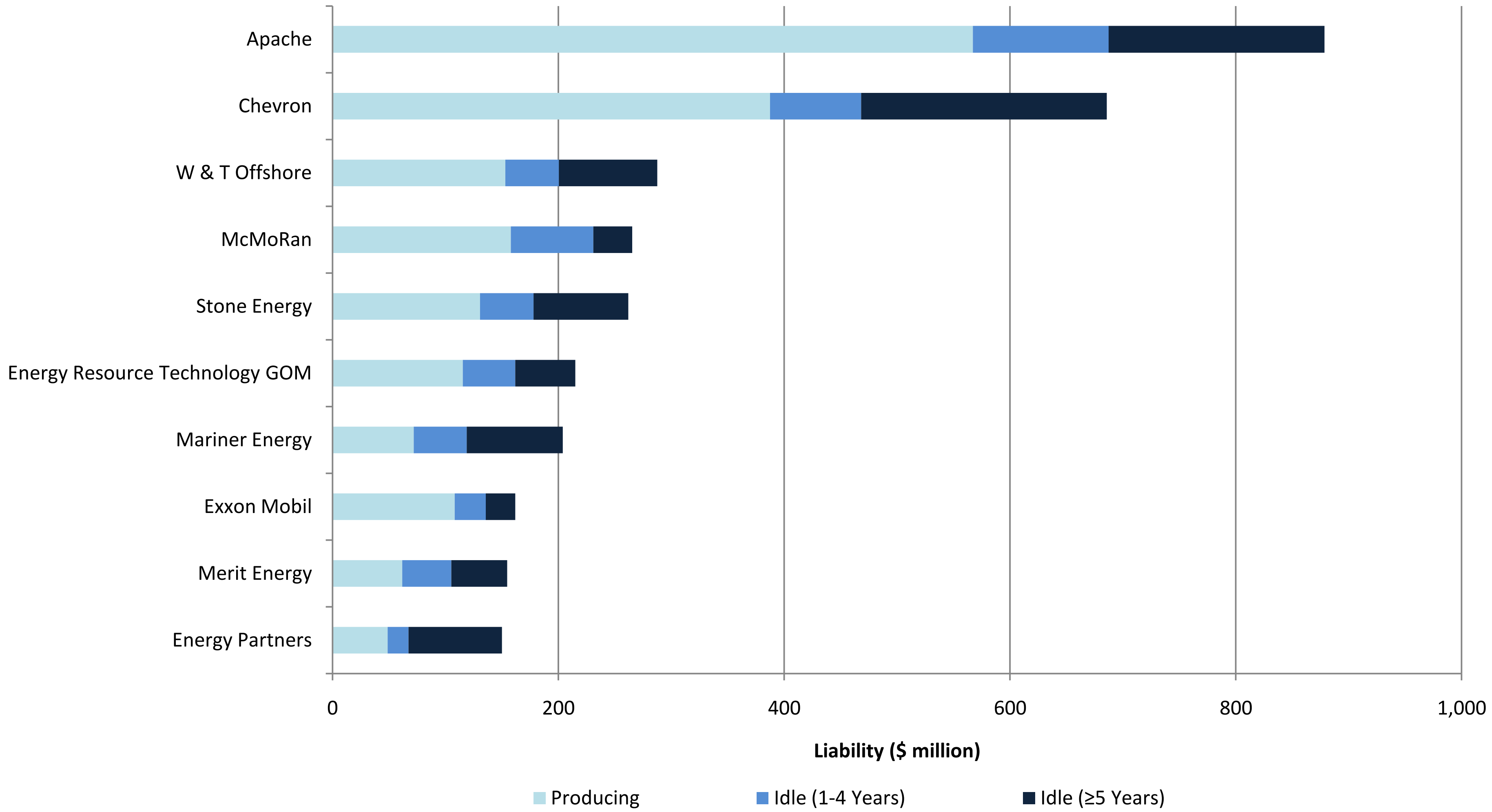
3 Liability Classes

Liability Class:	**Characteristics:**
1. NTL Liability	• Definite, short-term, < 5 yrs
2. Transition Liability	• Uncertain, short-long term, 5-8 yrs
3. Producing Liability	• Uncertain, long term, 3+ yrs

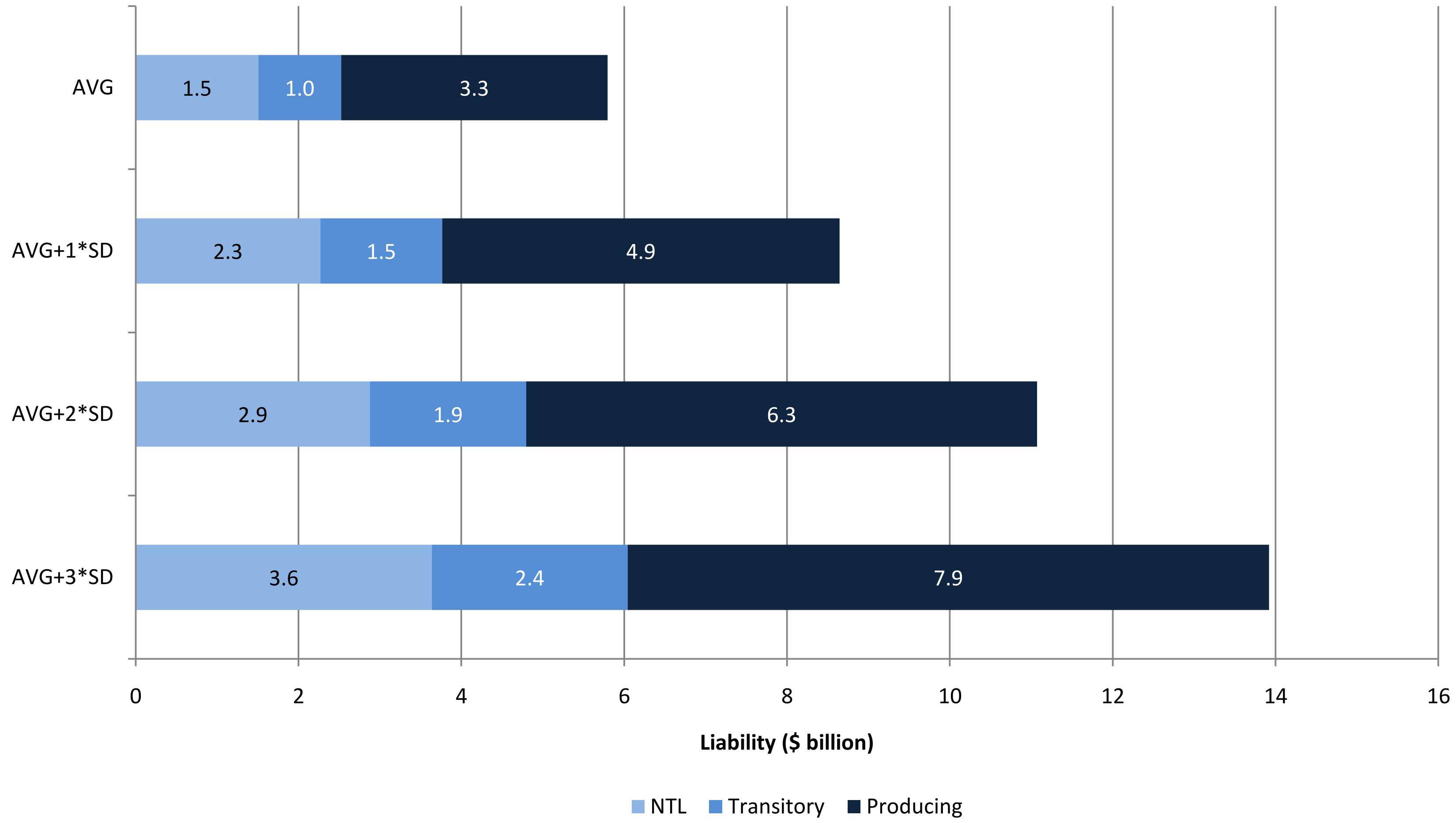
NTL Liability (Short-Term)

	NTL Liability ($ million)
Chevron	$267 - 603
Apache	$235 - 468
Stone Energy	$101 - 271
Mariner Energy	$94 - 231
Energy Partners	$81 - 170
Subtotal	$778 – 1.74 billion
TOTAL	$1.5 – 2.9 billion

Operator Exposure – Expected



GOM Decommissioning Liability



PART 2
Decommissioning Characteristics

BOEMRE Regulations

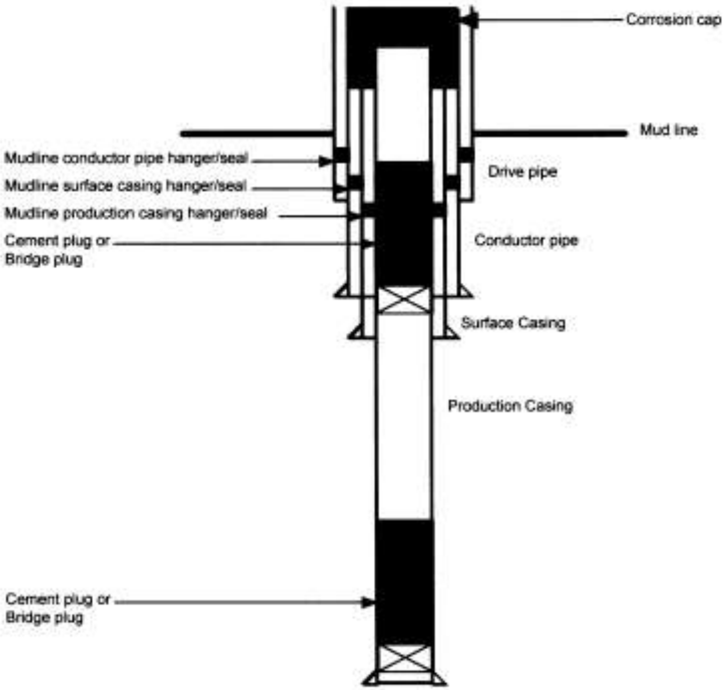
30 CFR 250 Subpart Q - WELLS

30 CFR 250.1717-1717

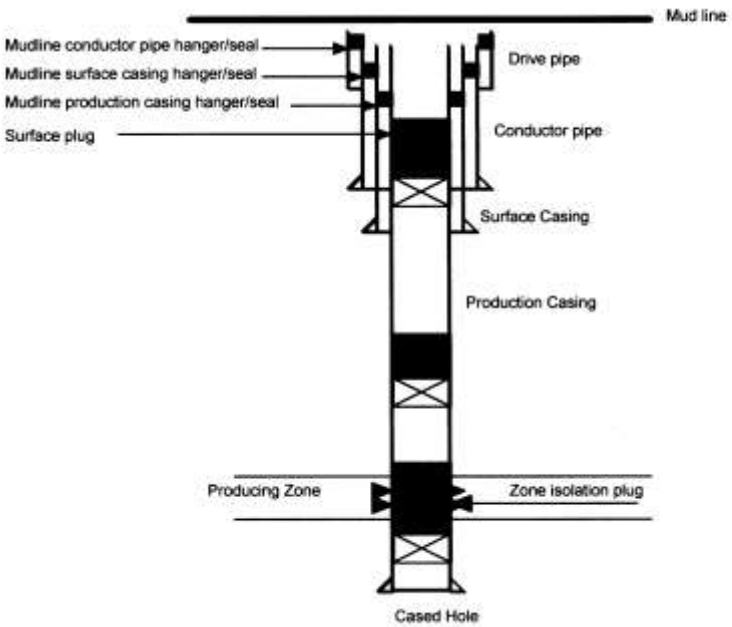
- Application to abandon
- Downhole plug to squeeze cement to all perforations
- Surface cement plug to at least 200 ft in length
- All cement plugs must prevent fluid migration to the seafloor
- Casings cut at least 15 BML
- District Manager may approve alternate depth if water depth is greater than 800 m (2,624 ft)

Temporary vs. Permanent Abandonment

TEMPORARY ABANDONMENT



PERMANENT ABANDONMENT



30 CFR 250 Subpart Q - PLATFORMS

30 CFR 250.1725-1730

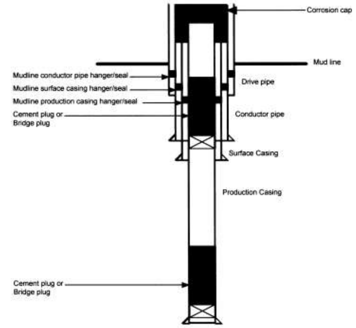
- Application to remove with cost recovery fee to RSFO
- Must remove all platforms and other facilities to at least 15 ft BML
- Within 30 days after removal submit final report to RSFO
- RSFO may grant a departure to remove a platform by approving partial structural removal or toppling in place for conversion to an artificial reef

30 CFR 250 Subpart Q – SITE CLEARANCE

30 CFR 250.1740-1743

- Application for site clearance
- 300 ft trawl radius for well site
- 600 ft trawl radius for single well caisson, well protector jacket, template, manifold, or subsea well site
- 1,320 ft trawl radius for platform site
- If site is not trawled, may use sonar, divers, or an ROV

Stages of Decommissioning


Corrosion cap
Mud line
Mudline conductor pipe hanger/seal
Mudline surface casing hanger/seal
Mudline production casing hanger/seal
Cement plug or
Bridge plug
Drive pipe
Conductor pipe
Surface Casing
Production Casing
Cement plug or
Bridge plug


06/05/2005


06/04/2005

General Characteristics

Grouped into 5 categories:

Regulatory

Operational

Cost

Market

Exposure/Liability

Regulatory

1. Highly prescribed process with well-defined timelines and activity requirements
2. System boundaries for performance have changed from the leasehold to well/structure for idle inventory
3. For non-producing wells and structures, timelines are based on the amount of time a well/structure has not produced
4. Changes have been made over the years in environmental requirements (use of explosives, mammal surveys) and financial requirements (supplemental bonding, threshold levels)

Operational

1. Each decommissioning project is unique and is impacted by project-specific factors
2. Operations are usually low-tech and routine and occur over short time scales
3. A large number of operations occur annually
4. Seasonal patterns of activity

Cost

1. All offshore fields have end-of-life decommissioning cost
2. Many factors impact the cost of operations, uncertain and unpredictable
3. Cannot identify a “primary” set of factors
4. Reasonably stable under “normal” market conditions
5. Market conditions play a main role in cost via vessel dayrates
6. Execution standards are important (i.e., company type influences cost structure)
7. Catastrophic failures lead to higher decommissioning cost

Market

1. Specialized and relatively small business segment
2. No significant barriers to entry, so new firms can form relatively quickly and easily
3. Dayrate and turnkey contracts popular
4. Highly competitive sector
5. Transparent with well-established players
6. Dynamic and evolving, with various business models

Exposure/Liability

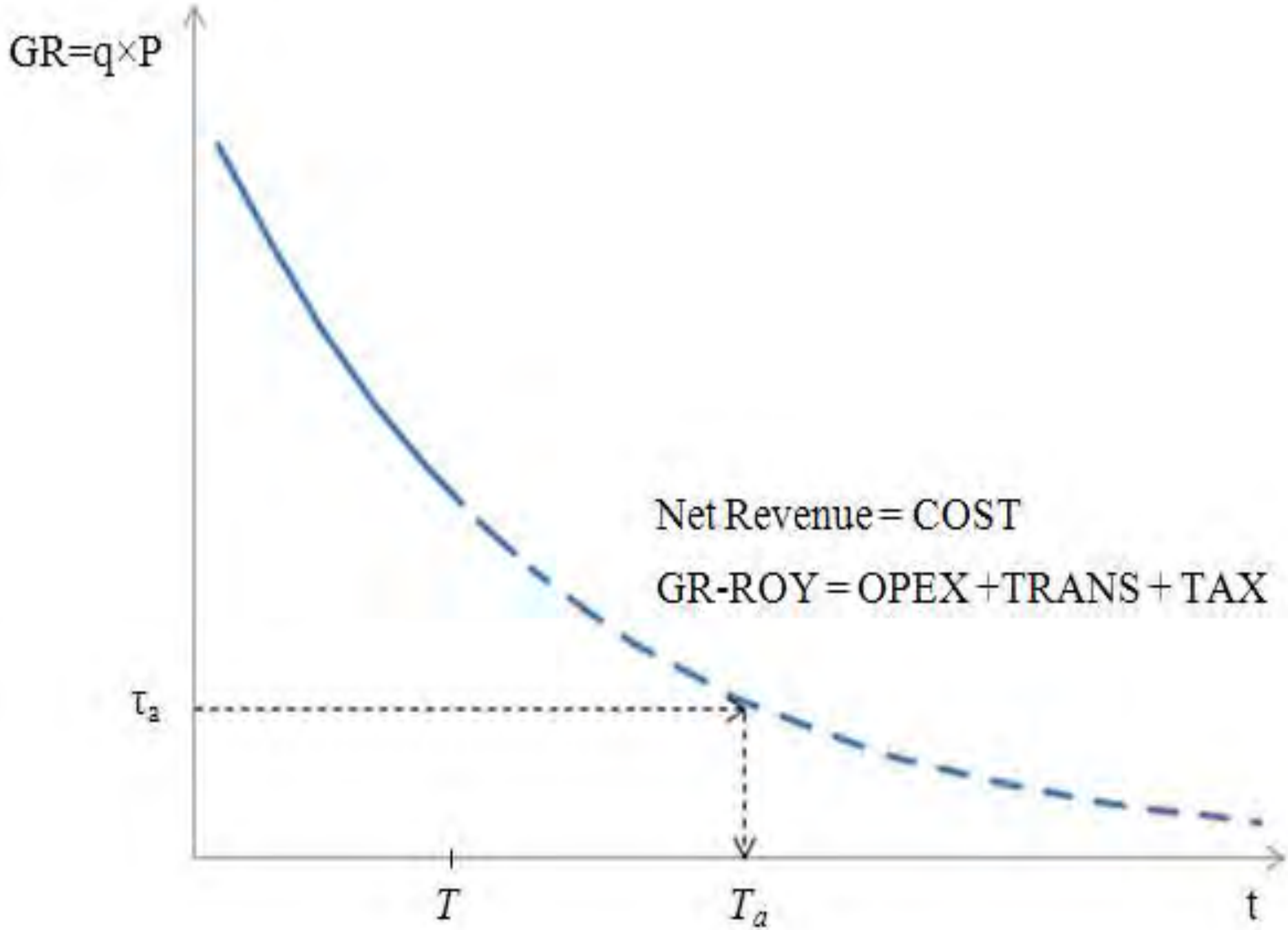
1. Each producing lease represents a different level of decommissioning risk
2. Three classes of liability
3. All previous owners or record title holders are jointly and severally liable
4. U.S. government is the party of last resort
5. Government requires supplemental bonding on leases for operators that do not meet financial "strength" qualifications to protect against possible default

PART 3
Economic &
Activity Data

Economic Limit

For Producing Structures, When Does Decommissioning Occur?

Economic Limit: Net Revenue = Cost


GR=q×P
Net Revenue = COST
GR-ROY = OPEX +TRANS + TAX
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Economic Limits GOM (1986-2009)

Primary Product	Count	Revenue ($1000)	Oil (BPD)	Gas (MCFPD)	BOEPD	MCFEPD
Oil	338	**539**	30(64)	122(336)	**50**	**-**
Gas	1,466	**924**	6(20)	614(1,190)	**-**	**647**
Dry Gas	158	**1,061**	-	788(1,724)	**-**	**788**

Primary Product	Structure	Count	Revenue ($1000)	Oil (BPD)	Gas (MCFPD)	BOEPD	MCFEPD
Oil	CAIS+WP	205	**298**	19	54	**28**	-
	FIXED	133	**911**	47	228	**85**	-
Gas	CAIS+WP	759	**884**	5	585	-	**616**
	FIXED	707	**968**	6	645	-	**681**
Dry Gas	CAIS+WP	80	**725**	-	629	-	**629**
	FIXED	78	**1,405**	-	952	-	**952**


EXPLORATION & DEVELOPMENT

GULF COAST ECONOMIC LIMITS—1

Economic limits estimated for US gulf coastal fields

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When the revenue generated from an oil and gas field is less than the cost of operation, the field is no longer considered an asset and production ceases. Capital investment may be made in an attempt to increase production or the field may be divested or abandoned.

Economic limits are a common industry metric but are often considered from a conceptual perspective rather than as an object for empirical computation.

The purpose of this four-part series is to compute the economic limits in Texas, Louisiana, and the Gulf of Mexico federal Outer Continental Shelf. This region contributed over half the oil and gas production in the US in 2009 and is the nation's largest oil and gas producing region.

We begin Part 1 by describing the resources and production of Texas, Louisiana, and the federal OCS. Information on paying quantity rules, reservoir and field classifications, and operating cost is also provided. Development of the methodological framework concludes the discussion.

Economic limit as a proxy

Economic limits provide useful operational information because they indicate the value (and hence the state) when production is no longer commercial. Economic limits also serve as key input in production forecasts and revenue models.

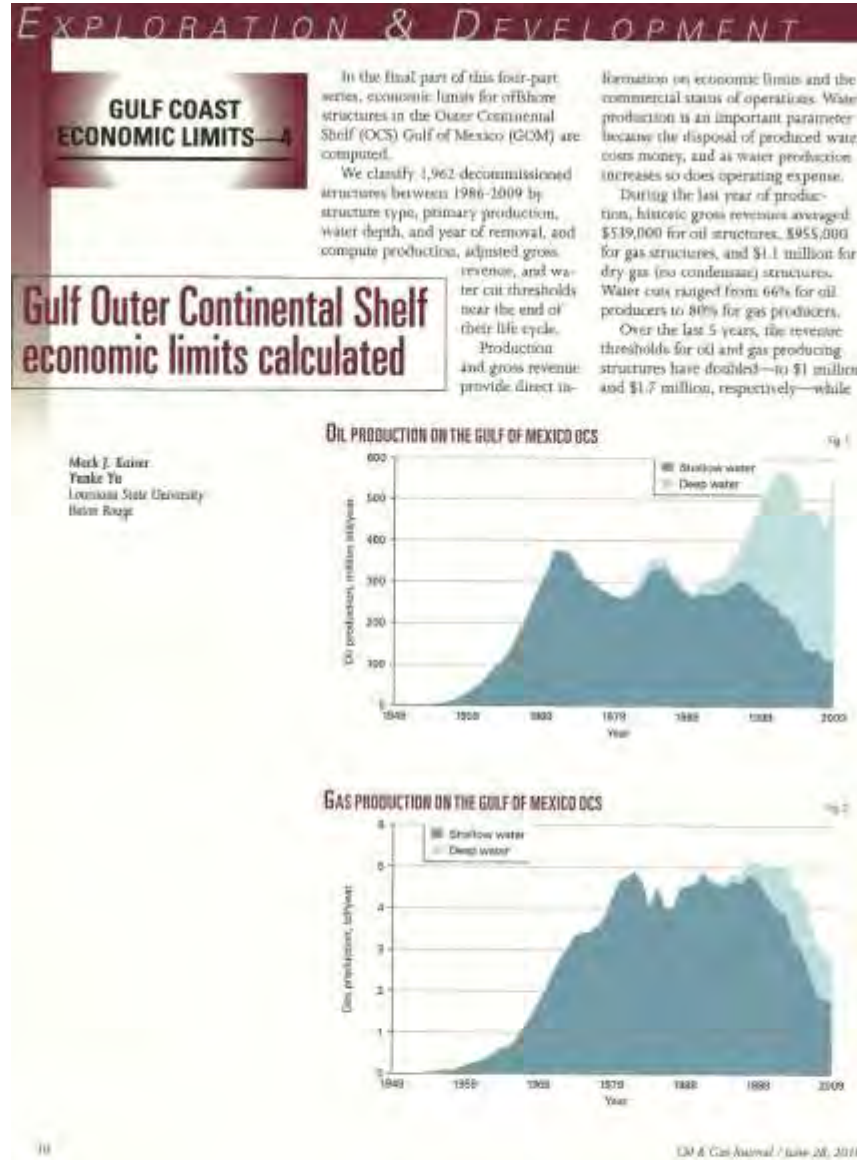
Oil and gas fields have unique geologic characteristics and development strategies; are located in areas of diverse terrain, accessibility, and environmental conditions; produce different quality streams; and have different labor, equipment and material cost. Economic limits are therefore expected to vary with these and other factors.

The economic limit serves as a proxy for rational decision-making, and as with all proxy

TOP 5 OIL PRODUCING STATES AND FEDERAL OFFSHORE PRODUCTION

TOP 5 GAS PRODUCING STATES AND FEDERAL OFFSHORE PRODUCTION

TOP 5 GAS LIQUIDS PRODUCING STATES AND FEDERAL OFFSHORE PRODUCTION


EXPLORATION & DEVELOPMENT

GULF COAST ECONOMIC LIMITS—4

Gulf Outer Continental Shelf economic limits calculated

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In the final part of this four-part series, economic limits for offshore structures in the Outer Continental Shelf (OCS) Gulf of Mexico (GOM) are computed.

We classify 1,962 decommissioned structures between 1986-2009 by structure type, primary production, water depth, and year of removal, and compute production, adjusted gross revenue, and water cut thresholds near the end of their life cycle.

Production and gross revenue provide direct information on economic limits and the commercial status of operations. Water production is an important parameter because the disposal of produced water costs money, and as water production increases so does operating expense.

During the last year of production, historic gross revenues averaged $539,000 for oil structures, $955,000 for gas structures, and $1.1 million for dry gas (no condensate) structures. Water cuts ranged from 66% for oil producers to 80% for gas producers.

Over the last 5 years, the revenue thresholds for oil and gas producing structures have doubled—to $1 million and $1.7 million, respectively—while

OIL PRODUCTION ON THE GULF OF MEXICO OCS

GAS PRODUCTION ON THE GULF OF MEXICO OCS

O&GJ; June 7 – 24, 2010

Decommissioning Cost

DAYRATE: Cost = Dayrate * Duration

TURNKEY: Cost = Lump Sum Payment

Many Factors Impact Cost

- Project (Site-Specific)
- Market
- Exogenous (e.g., weather, problems)

Many Factors Impact Cost

P&A:

- Well complexity (single vs dual completion; well depth)
- Number of wells (economies)
- Water depth
- Contract type
- Well status (normal vs. hurricane-destroyed)
- Method (rig vs. rigless)
- Weather
- Execution standards
- Problems

Structure Removal:

- Structure type
- Max lift weight
- Water depth
- Structure condition (normal vs. hurricane-destroyed)
- Contract type
- Disposition (reef vs. onshore)
- Company type
- Structure configuration
- Weather
- Scale economies
- Location (mob/demob)

Conventional Operations (2003-2007)

PA Cost:
$200,000 – $350,000 per wellbore

Structure Removal:

TOTAL COST — Table 12

Water depth, ft	Caisson and well protector	Fixed platform
	$1,000	
0-100	888 (560)	1,131 (970)
101-200	1,525 (881)	2,023 (1,278)
201-300	—	3,468 (2,590)

Note: Includes caisson and well protector costs based on pipeline abandonment and removal operations, and fixed platform costs based on preparation, pipeline abandonment, and removal operations. In parentheses is the standard deviation of the category average.

Gulf of Mexico structure removal costs examined

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Matthew Foster
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A study examined structure removal costs in the Gulf of Mexico for operations performed by TETRA Applied Technologies Inc. from 2003 through June 2008. The data set included 120 projects representing $178 million in expenditures and is one of the largest samples of decommissioning costs analyzed in the gulf.

The study used standard statistical analysis, and we believe the statistical measures are representative of the removal cost of independent operators in the shallow-water gulf during 2003-08.

The study reports costs for preparation, pipeline abandonment, and removal operations across several categories.

Decommissioning represents the end of the production life cycle of offshore structures and involves plugging and abandoning wells, removing infrastructure, and clearing debris from the site. Removal of the topsides equipment, deck, conductors, piles, and jacket is the core of all decommissioning projects and typically is the most expensive.

Cost categories

Decommissioning in general and removal operations in particular involve several activities that may overlap one or more categories.

Removal operations involve mobilization-demobilization of a derrick barge and other service vessels, preparation activity, diving services, explosive services, conductor and pile removal, pipeline abandonment, and structure removal. How a company allocates costs across activity and categories depends on the requirement of the job and a company's accounting system.

We grouped costs into three main categories (structure preparation, pipeline abandonment, and structure removal) and allocated in proportion to effort the activities that overlapped categories.

TOTAL PROJECT COST, 2003-08 — Table 1

Water depth, ft	Caisson	Well protector	Fixed platform	All
		million $		
0-100	16.0	6.2	28.8	51.0
101-200	11.4	—	60.7	72.1
201-300	—	—	54.8	54.8
All	27.4	6.2	144.1	177.7

Note: Includes preparation, pipeline abandonment, and structure removal operations.

Structure preparation

After completion of well plugging and abandonment activities, normally a crew paid on a day rate prepares a structure for removal. Caissons and well protectors typically require little or no preparation, but fixed platform removal usually requires the dispatching of crews for inspections, cleanup, and cutting operations.

An inspection above and sometimes below water determines the condition of the structure and identifies potential problems with the salvage. Depending on the water depth, divers or remotely operated vehicles perform the inspection. Divers can operate effectively down to 300 ft of water.

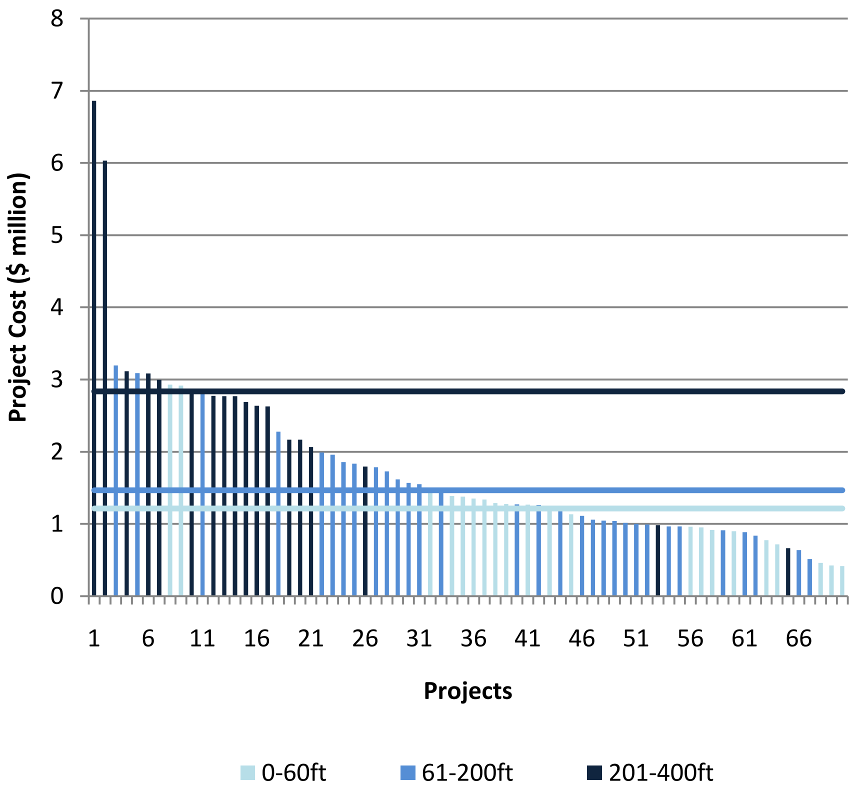
On the deck, the crew flushes and cleans all piping and equipment that contained hydrocarbons. They cut loose separately all modules scheduled for removal from the deck and cut the piping, electrical, and instrumentation interconnections between modules. The crew also prepares the modules for the work needed to lift the modules off the deck.

US Minerals Management Service regulations require disposal of fluids and agents used for purging and cleaning the vessels by either pumping them into an injection well or placing them in storage tanks for disposal onshore.

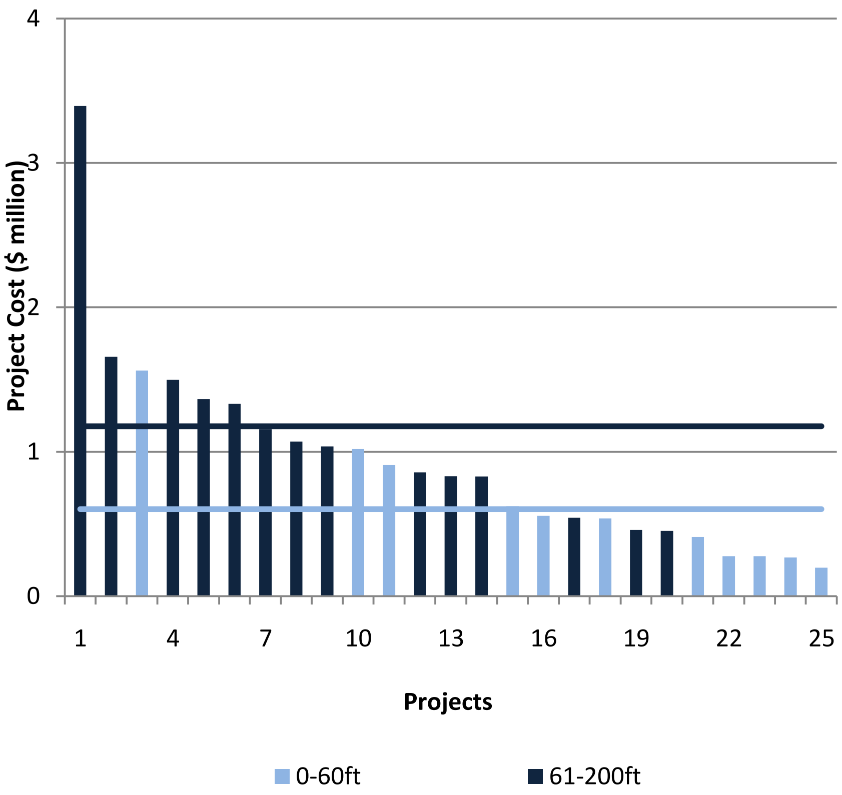
O&GJ; June 15, 2009

Conventional Operations (2007-2010)

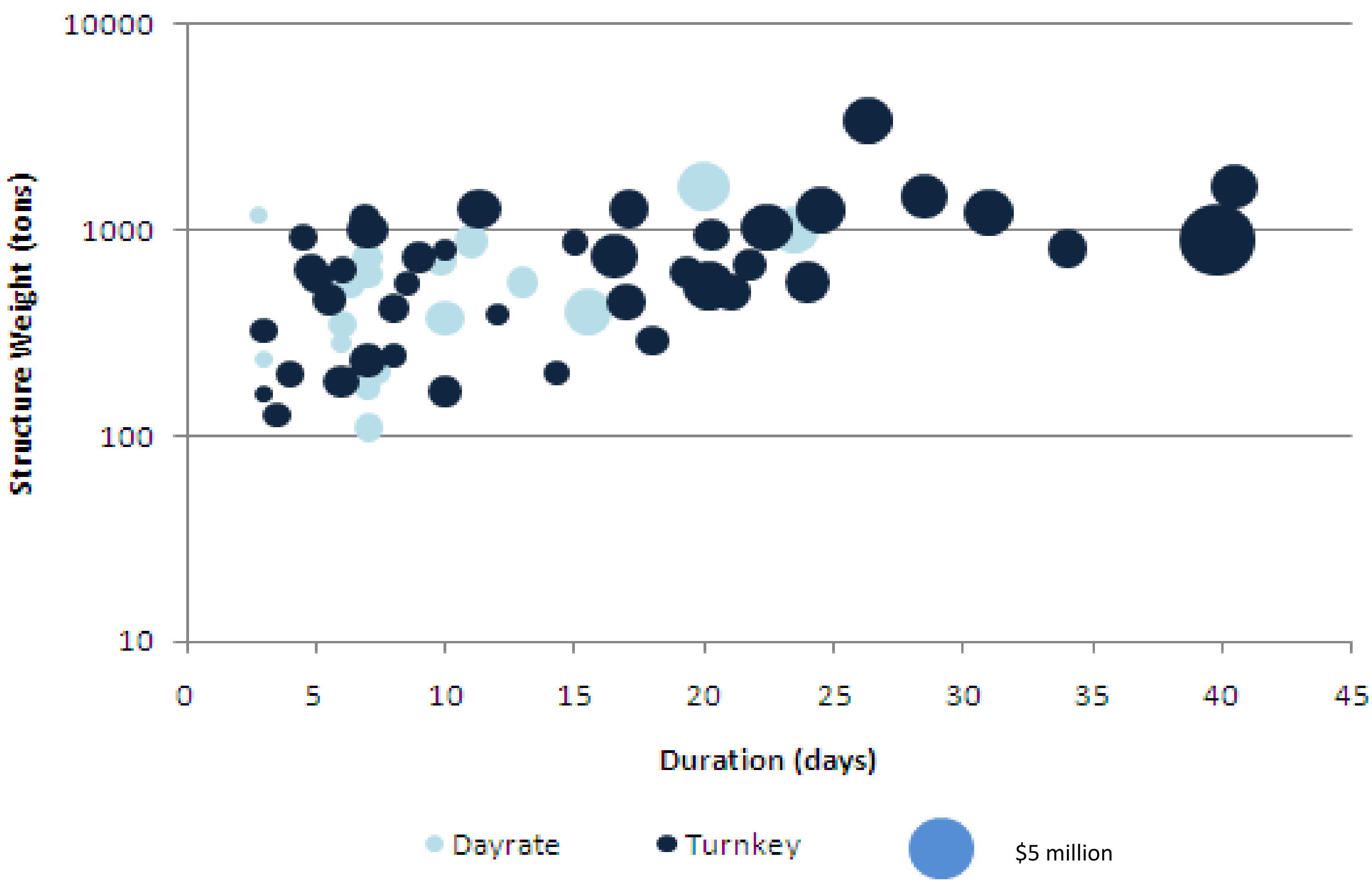
Fixed Platforms:



Caissons:

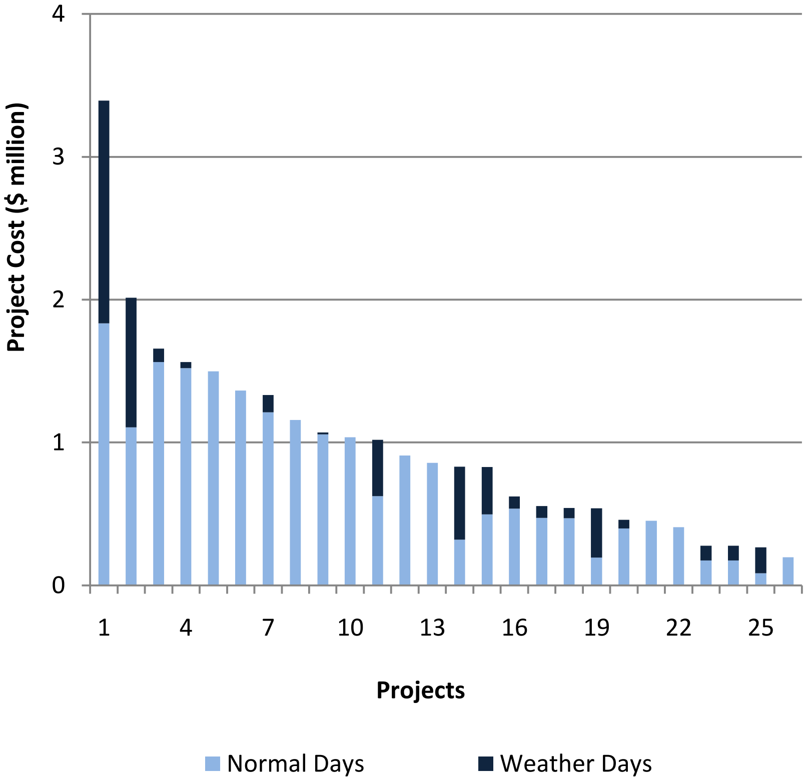


Conventional Operations (2007-2010)

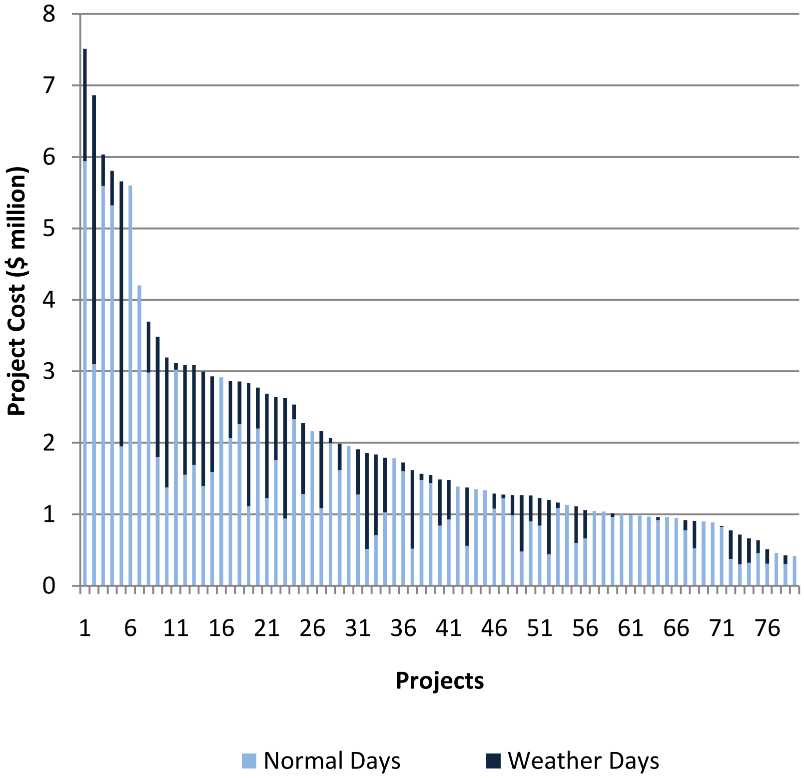


Impact of Weather

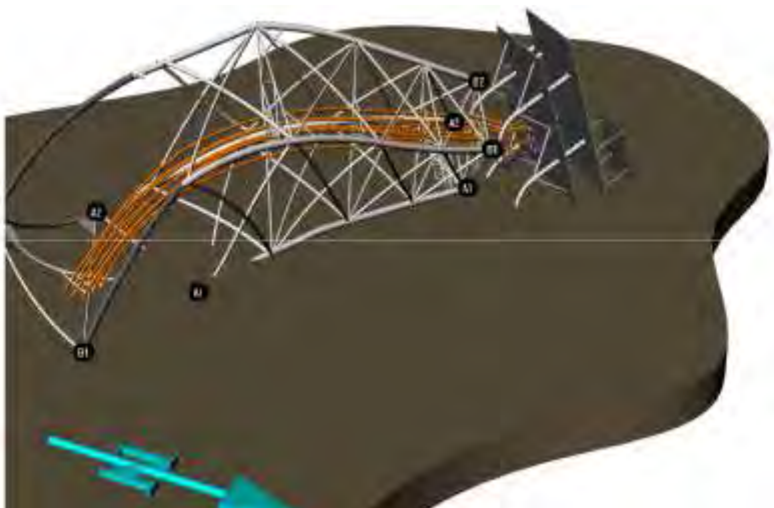
Caissons:



Fixed Platforms:







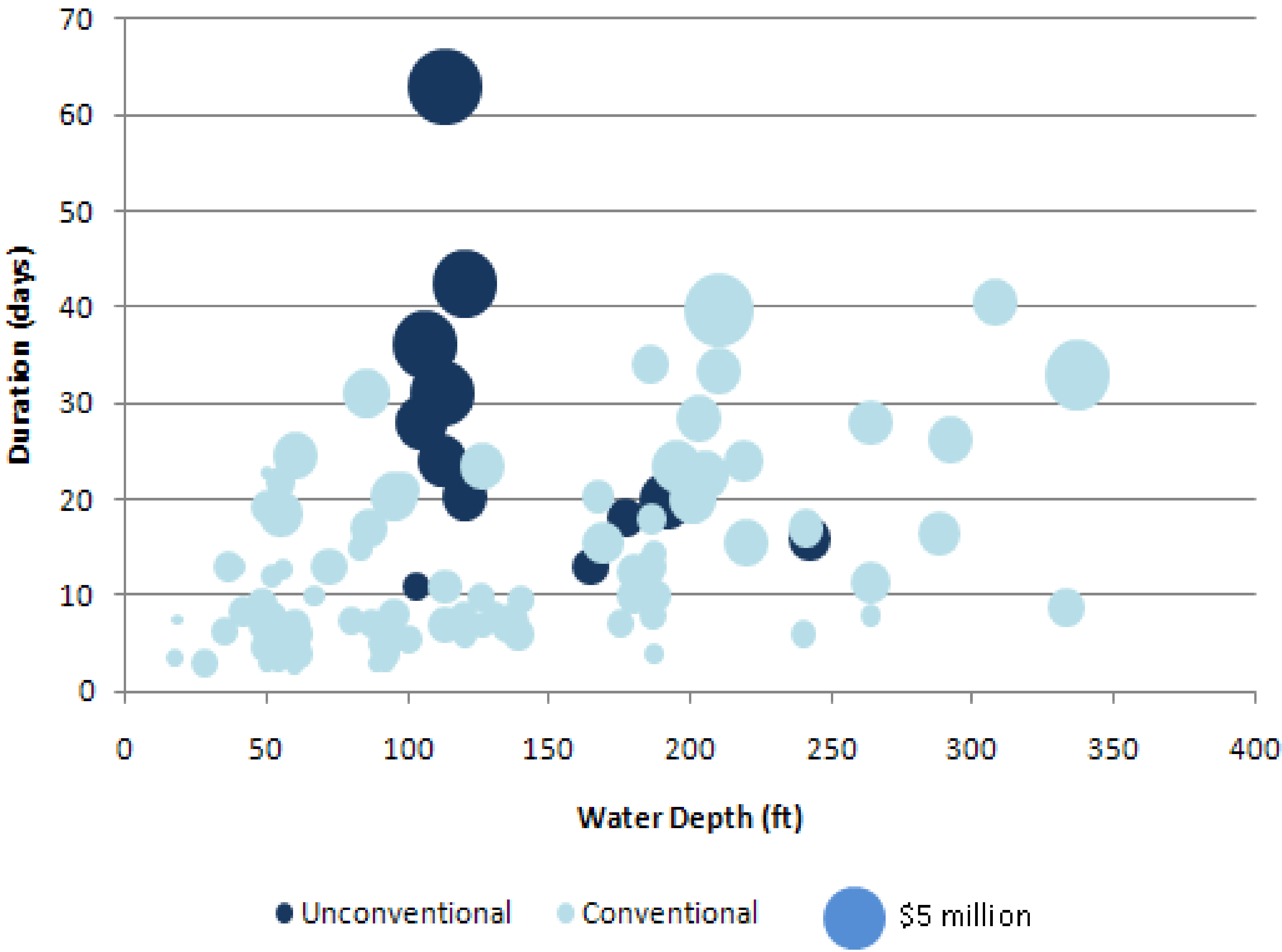

Unconventional Operations

P&A

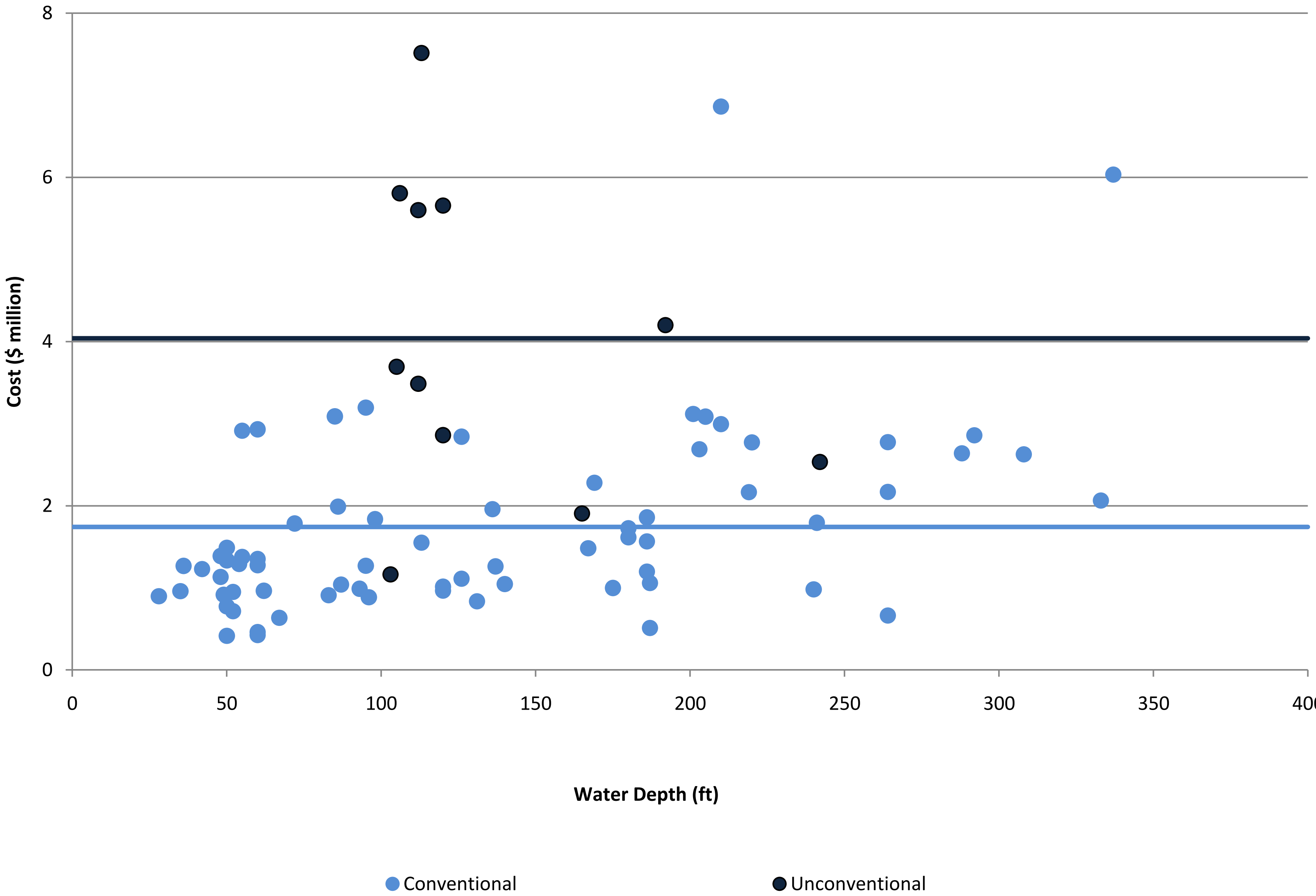
Cost = 10-20X Conventional Cost (???)

Structure Removal

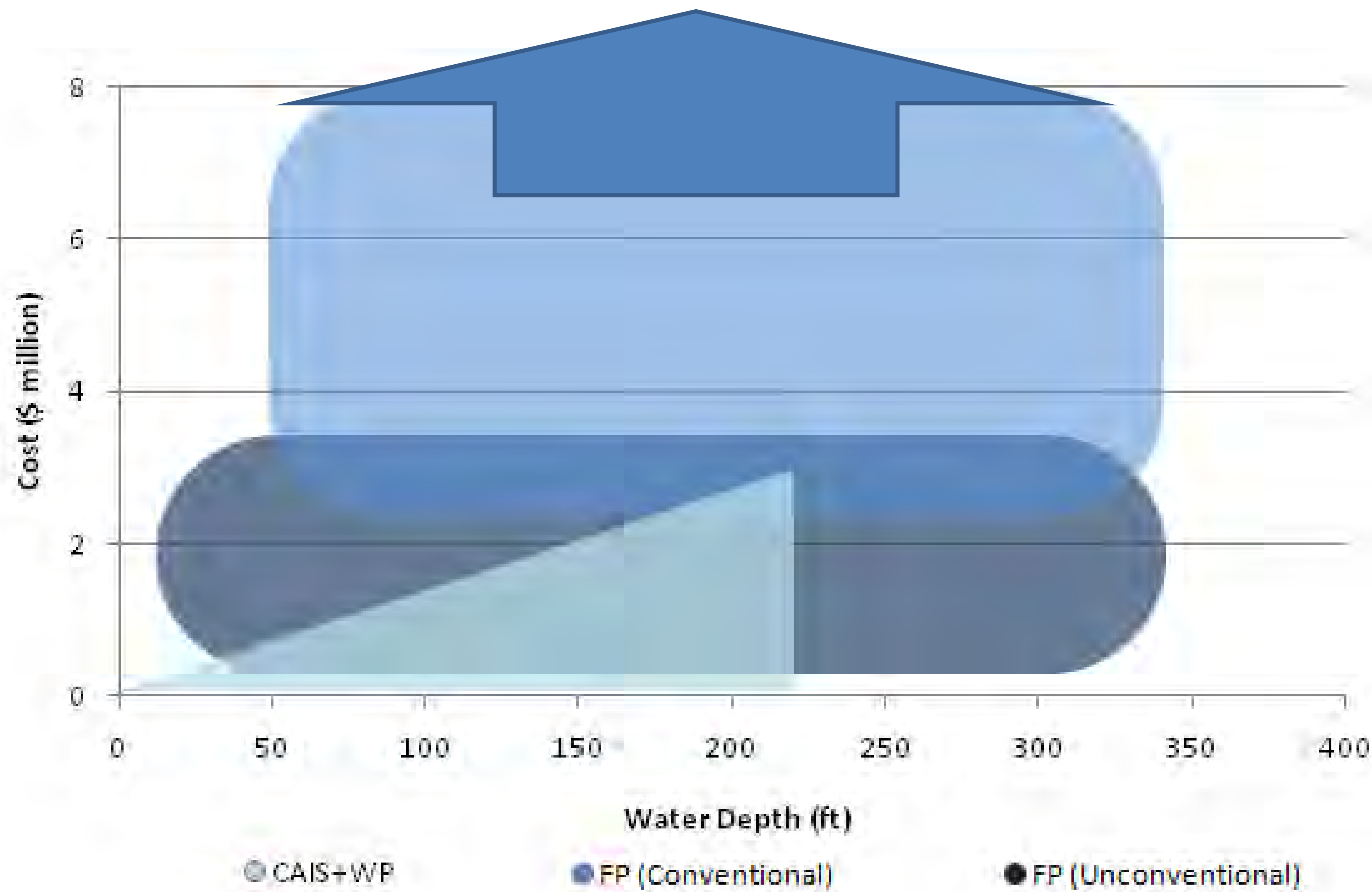
Cost = 2-5X Conventional Cost (??)



70
60
50
40
30
20
10
0
Duration (days)
0
50
100
150
200
250
300
350
400
Water Depth (ft)
Unconventional
Conventional
$5 million



8
6
4
2
0
Cost ($ million)
0
50
100
150
200
250
300
350
400
Water Depth (ft)
Conventional
Unconventional



8
6
4
2
0
Cost ($ million)
0
50
100
150
200
250
300
350
400
Water Depth (ft)
CAIS+WP
FP (Conventional)
FP (Unconventional)

Post-Hurricane Clean-Up Activity (2004-2010)

Hurricane –Destroyed Infrastructure

		—— Structures ——		— Destroyed Wells —	
	Year	Damaged	Destroyed	Total[a]	Impacted[b]
Ivan	2004	5	7	87	83
Katrina	2005	20	45	345	307
Rita	2005	23	69	370	352
Gustav/Ike	2008	28	59	410	328
Total		76	180	1,212	1,070

(a) Original wellbores on destroyed structures, excluding sidetracks.
(b) Original wellbores on destroyed structures not permanently abandoned or temporarily abandoned at the time of destruction.

	— Destroyed Producers —		— Destroyed Auxiliary —	
	Removed	Remaining	Removed	Remaining
Ivan	5	1	1	0
Katrina	22	20	3	0
Rita	20	41	2	6
Gustav/Ike	12	36	2	9
Total	59	98	8	15

	Original Wellbores	Abandoned Wells	Wells Remaining to be Abandoned	Percent (%)
Ivan	83	62	21	25
Katrina	307	273	34	11
Rita	352	311	41	12
Gustav/Ike	328	279	49	15
Total	1,070	925	145	14

Unconventional Decommissioning Cost

$500 to $800+ million

(Highly Uncertain Estimate)

Year in Review

2009-2010 Activity

2009

- **658** PA
- **459** TA
- **219** Removals
- E(CAPEX, **2009**) ~ $518 -981 million

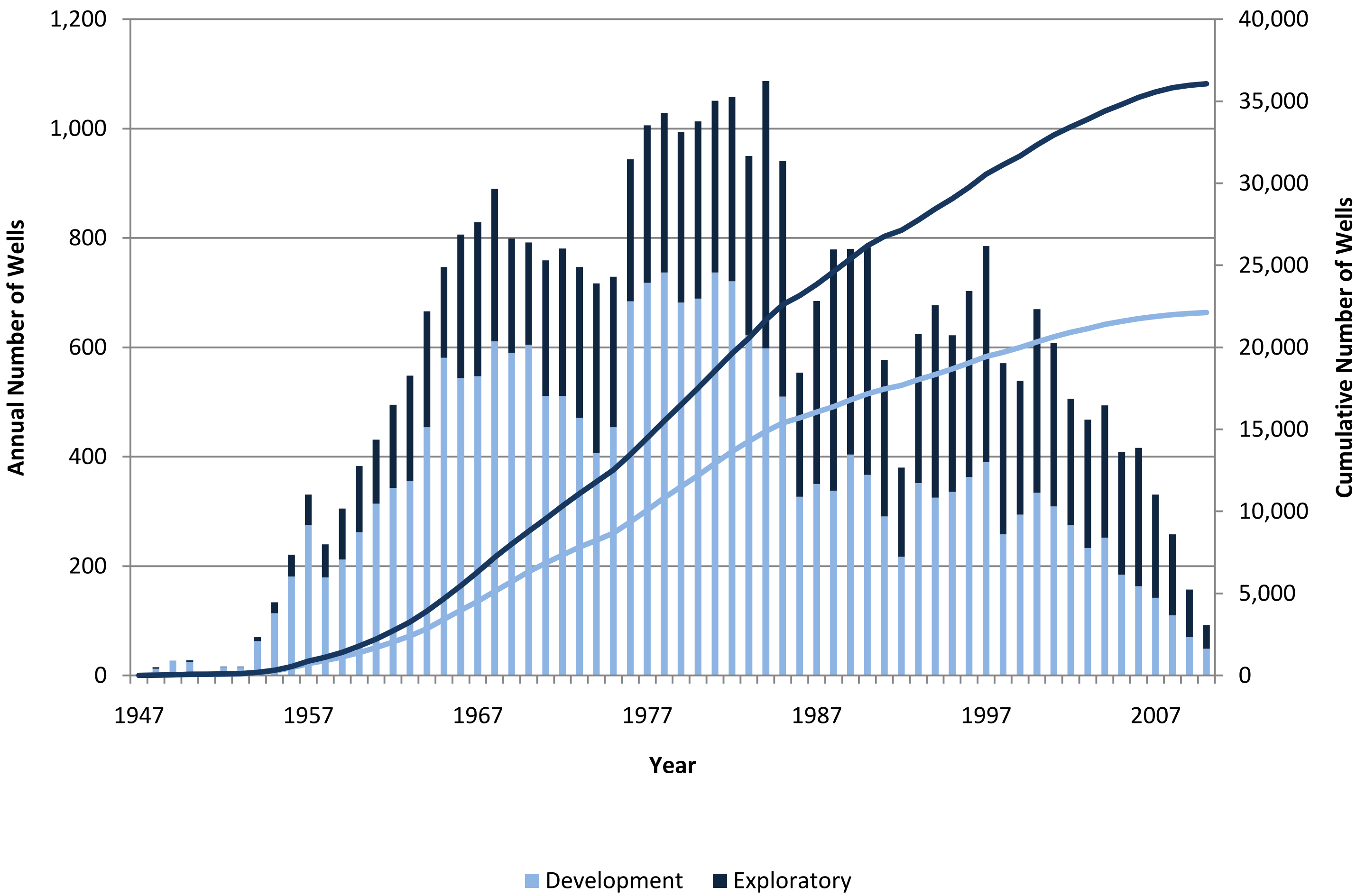
2010

- **615** PA
- **444** TA
- **66** Removals
- E(CAPEX, **2010**) ~ $302-551 million

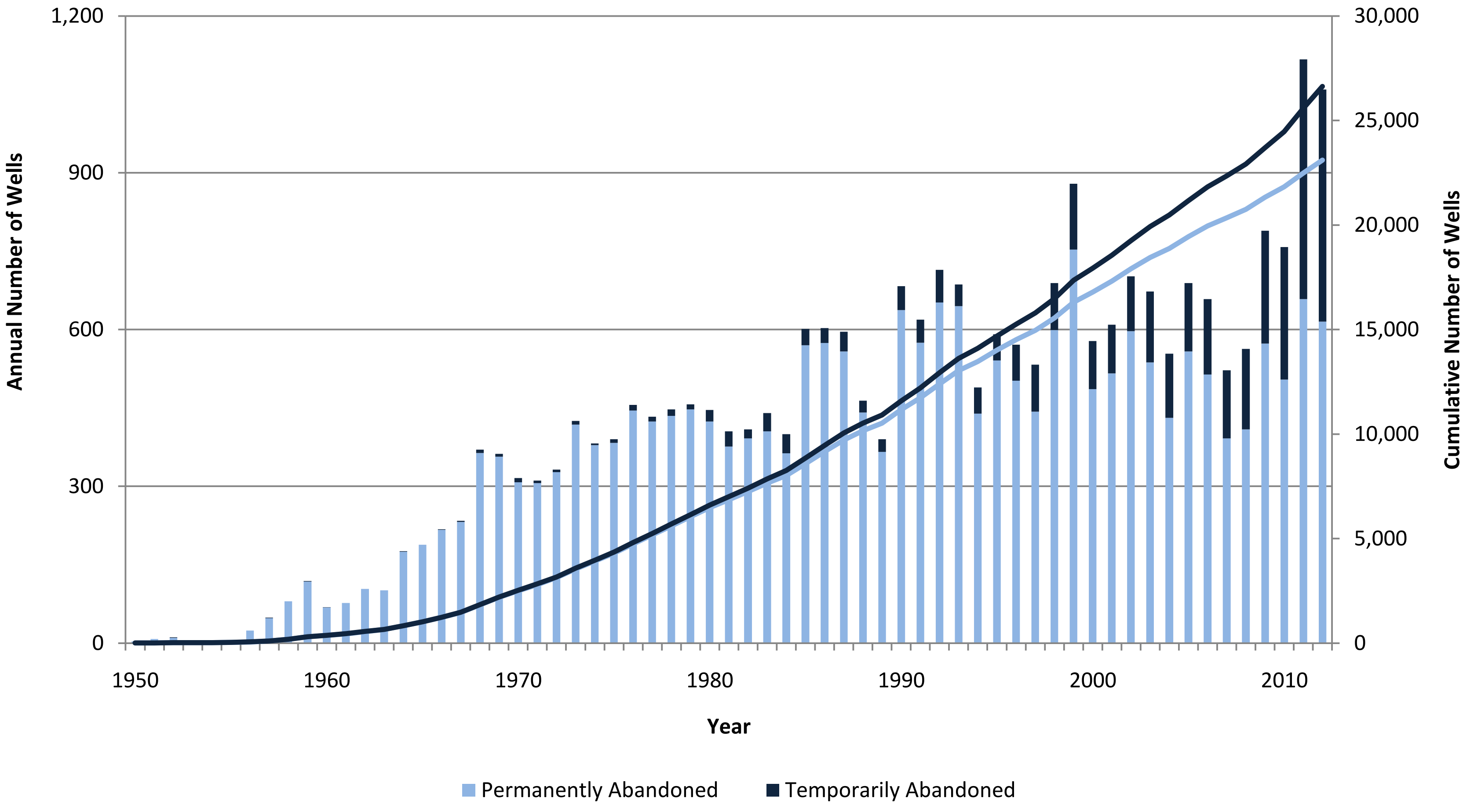
Removal Activity - 2010

WATER DEPTH	CAISSON	WELL PROTECTOR	FIXED PLATFORM
0-60 ft	**11**	**2**	**5**
61-200 ft	**7**	**3**	**32**
201-400 ft	**0**	**1**	**5**
TOTAL	**18**	**6**	**42**

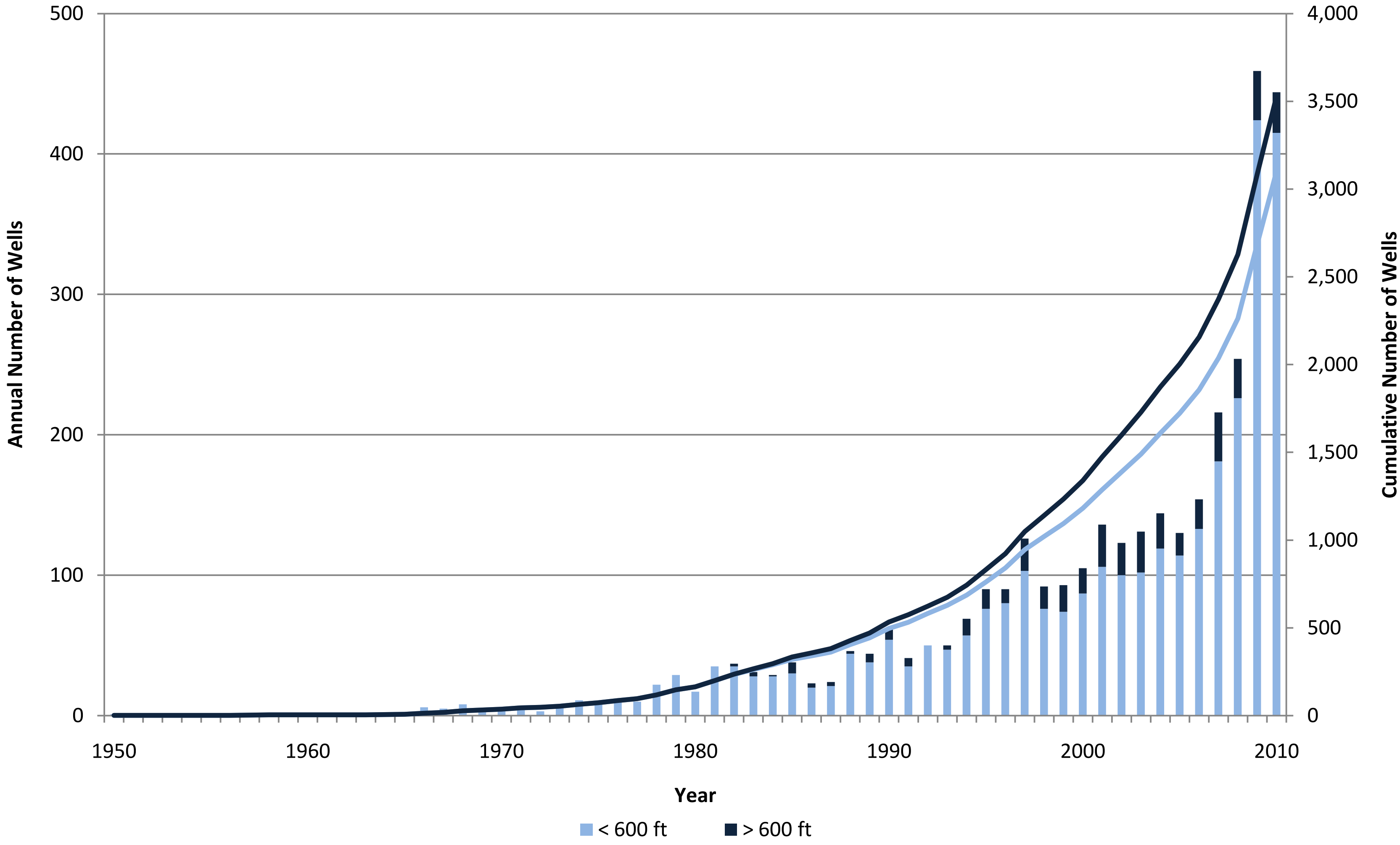
Wells Drilled



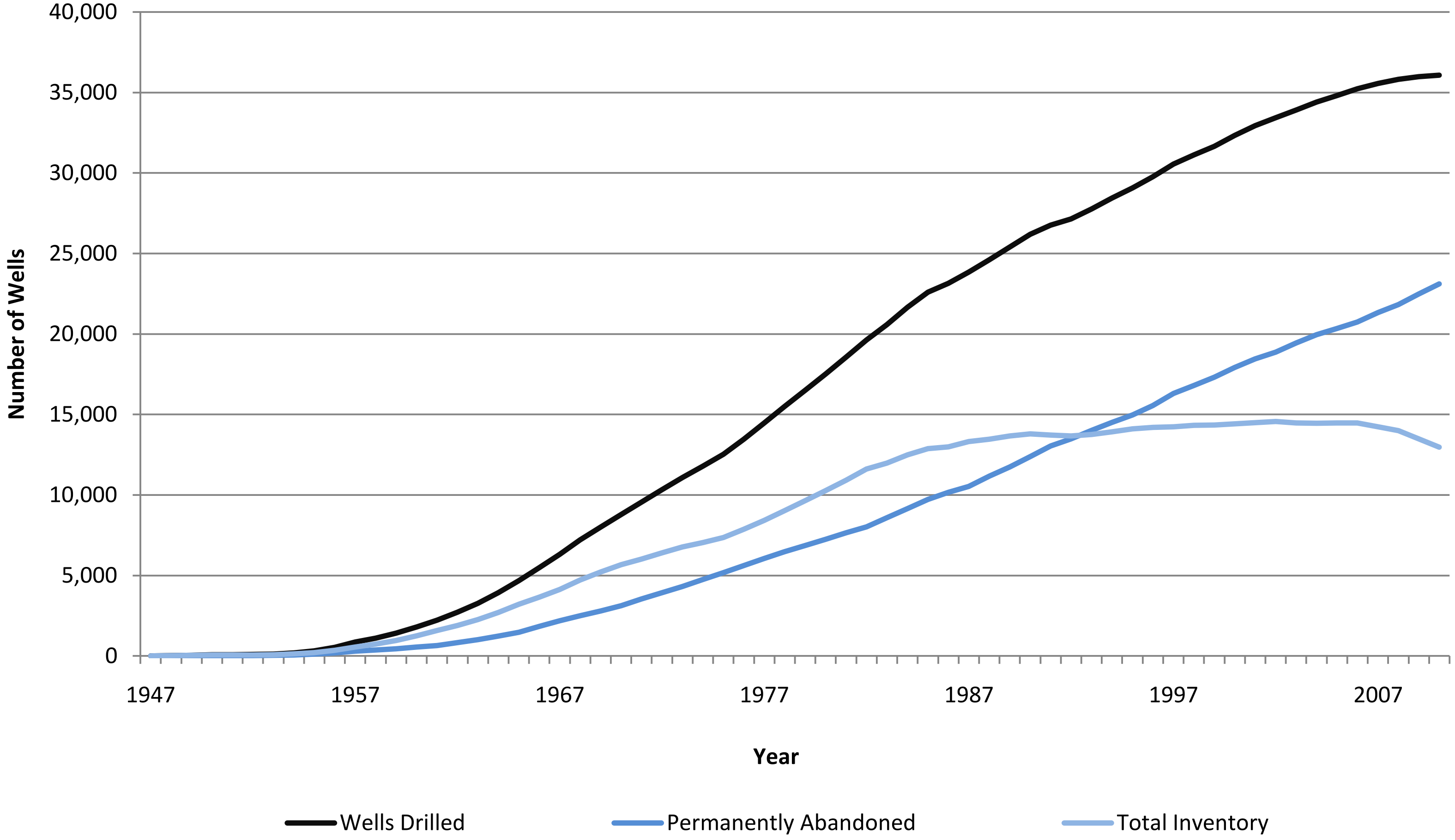
Wells Abandoned



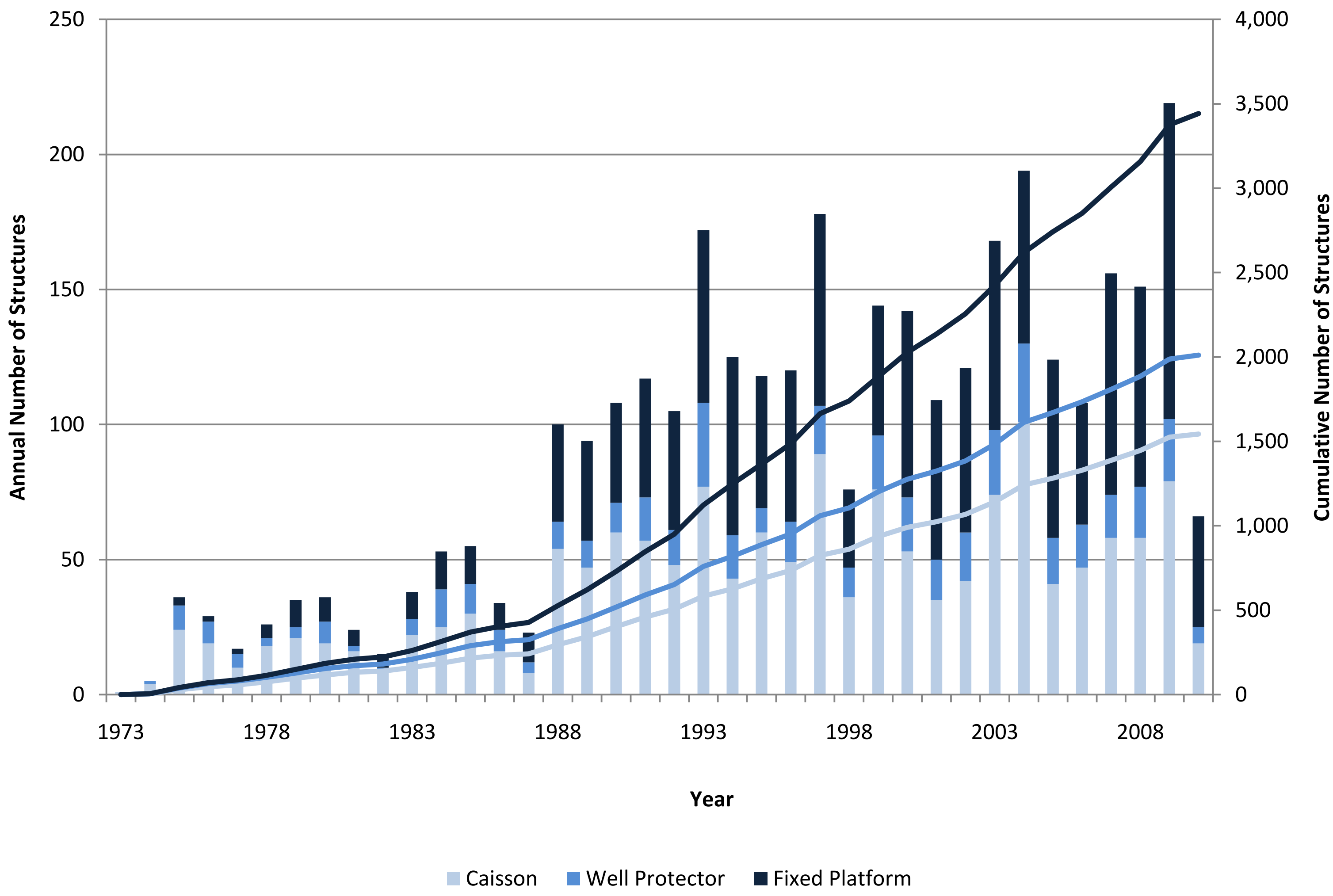
Temporarily Abandoned Wells



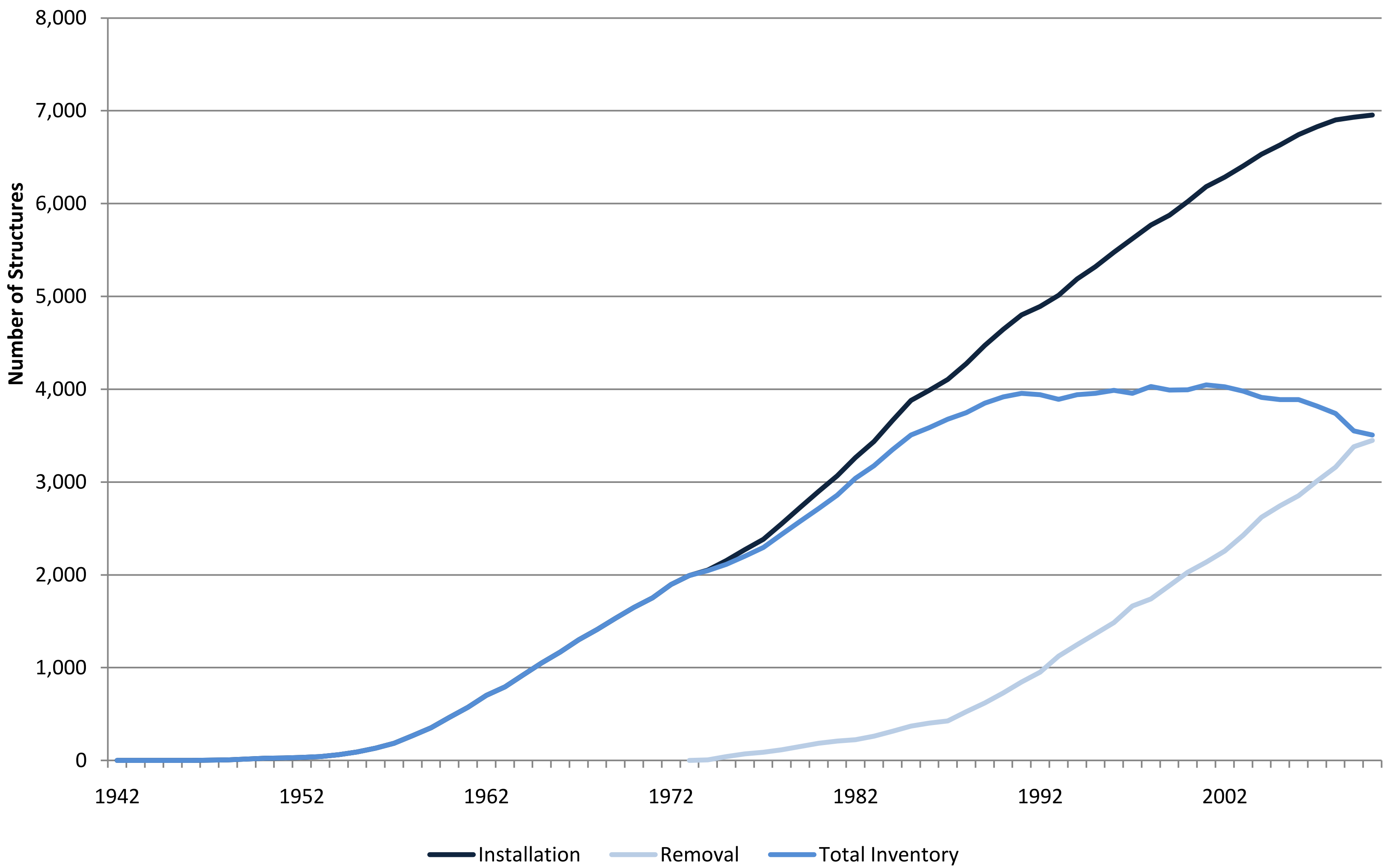
Total Original Wellbore Inventory (includes never-producing wells)



Structures Removed

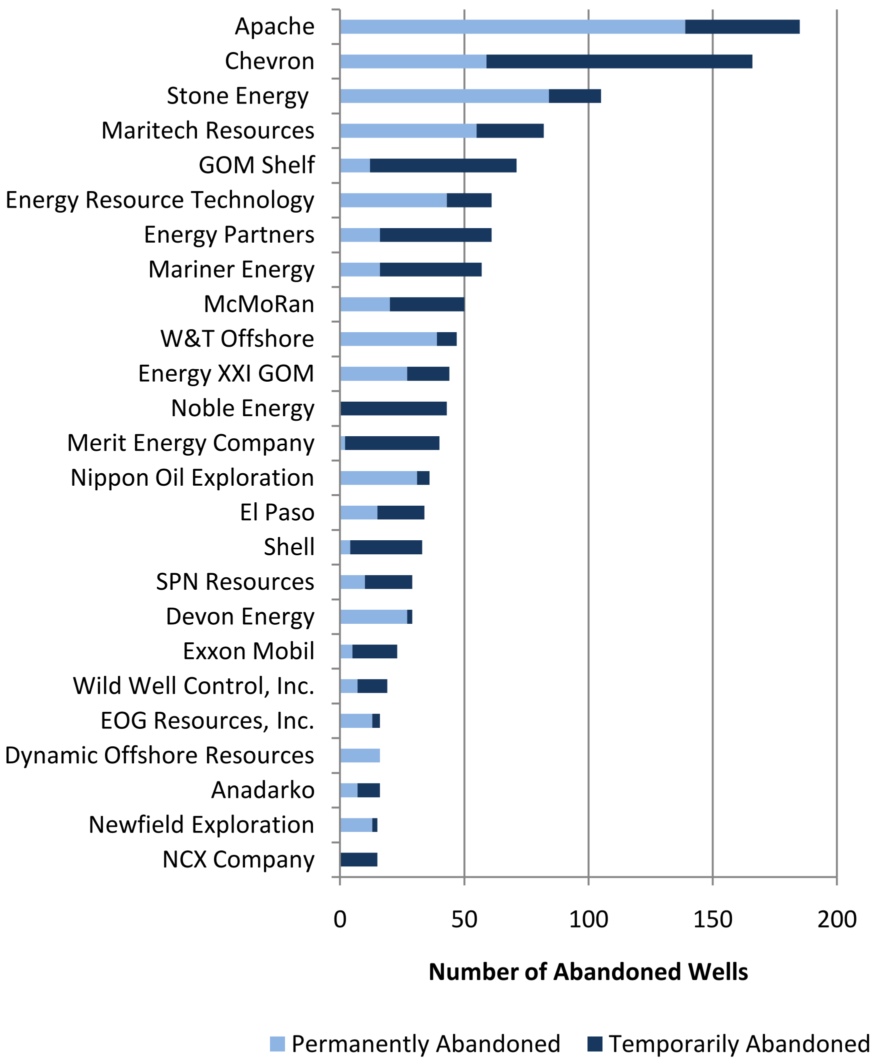


Total Structure Inventory (includes auxiliary structures)

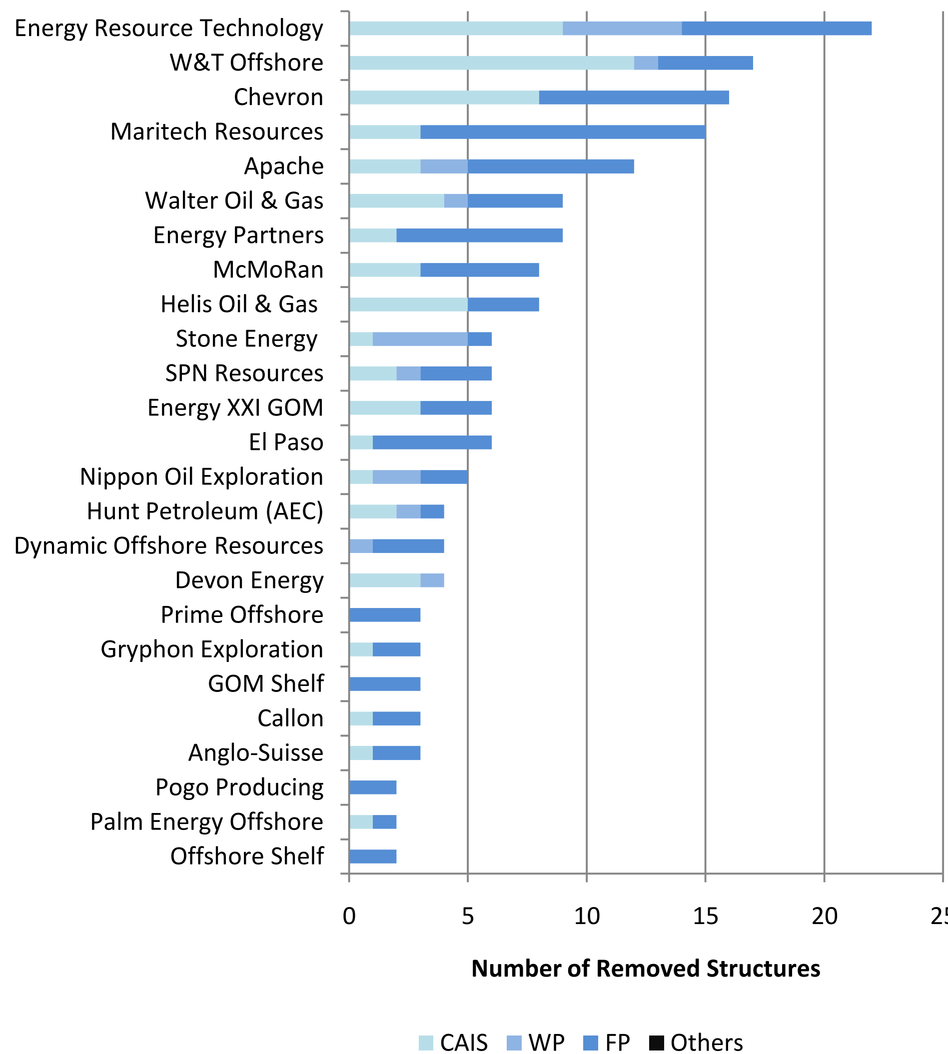


Operator Activity, 2009

Well Abandonments:

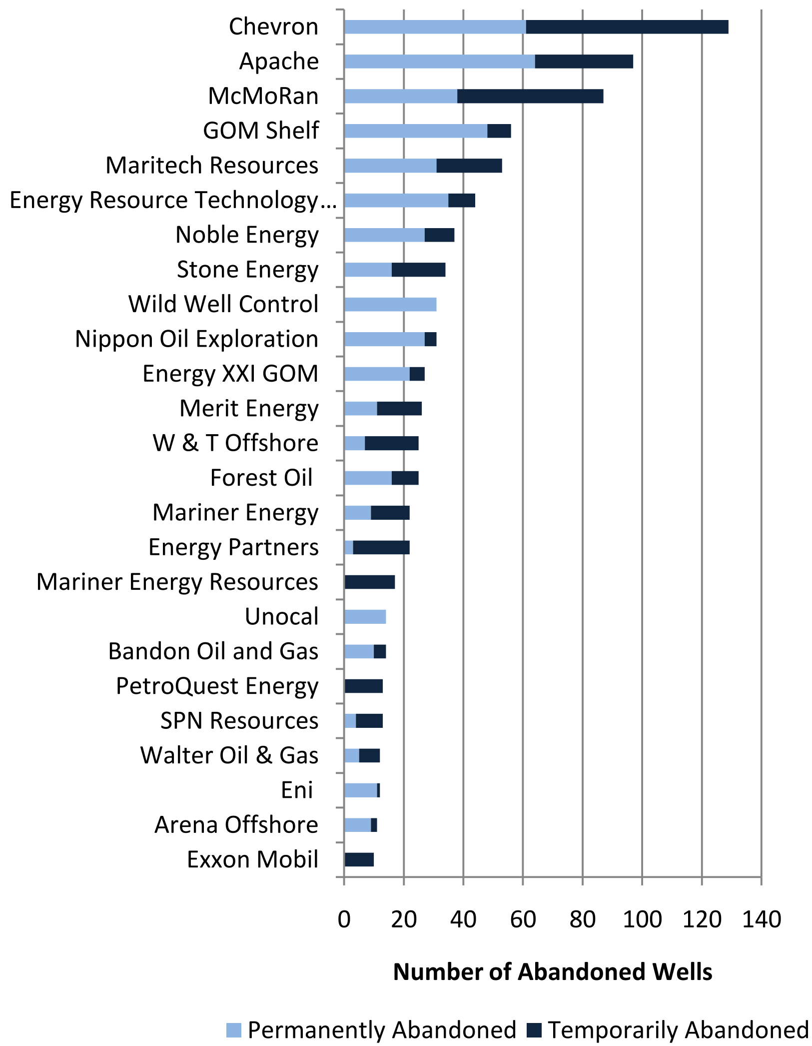


Structure Removals:

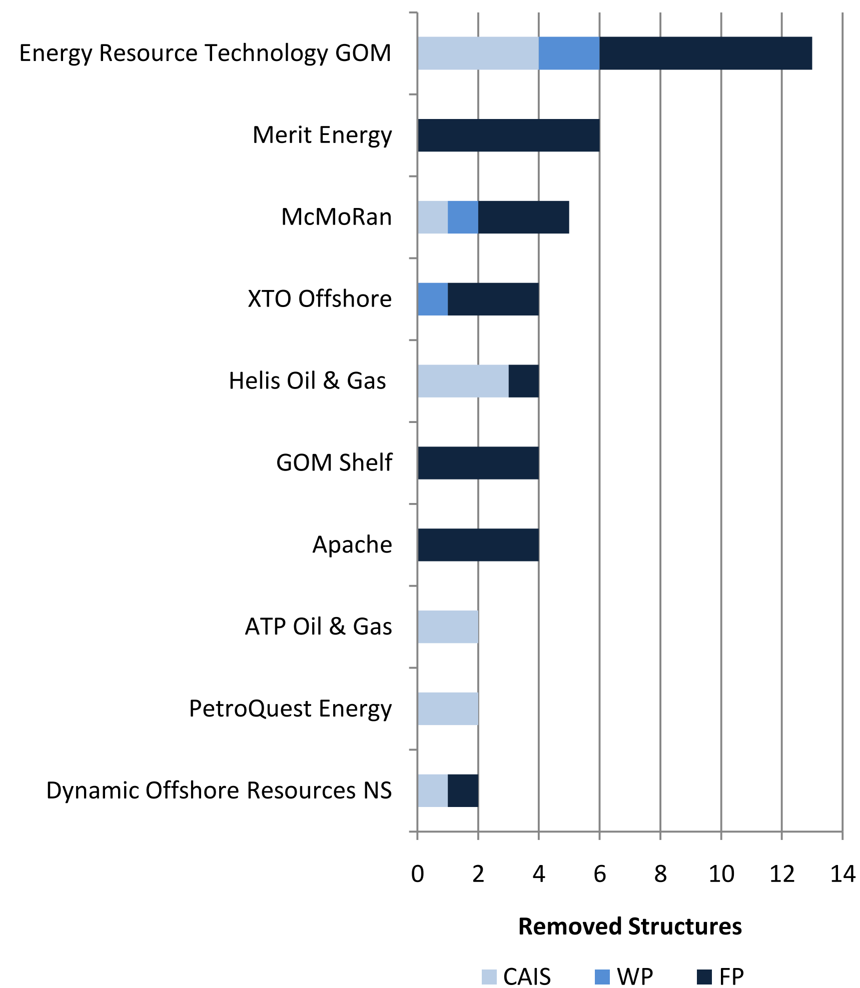


Operator Activity, 2010

Well Abandonments:



Structure Removals:



PART 4
Risk Metrics

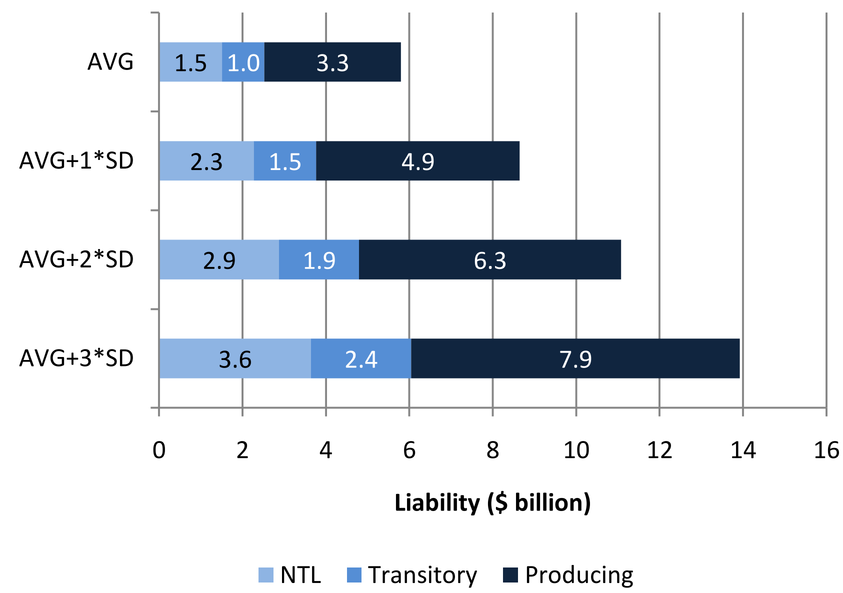
Shallow Water (WD < 500 ft)

Proved Reserves:

$32 - $103 billion
[$40 - 120/bbl]

Decommissioning Liability:

$6 – $14 billion
[AVG – (AVG + 3*SD)]



Decommissioning Risk Metrics

$$R_1(X) = R_1 = \frac{E(\text{Revenue Proved Reserves})}{E(\mathit{DecommissioningLiability})}$$

$$R_2(X) = R_2 = \frac{\text{Production Revenue Year } T}{E(\mathit{DecommissioningLiability})}$$

GOM Decommissioning Risk Matrix
R_1(GOM)= R_1[P,S], WD < 500 ft

Oil Price ($/bbl)	AVG	AVG + 1*SD	AVG + 2*SD
60	**8.6**	**5.8**	**4.5**
80	**11.7**	**7.8**	**6.1**
100	**14.8**	**9.9**	**7.7**

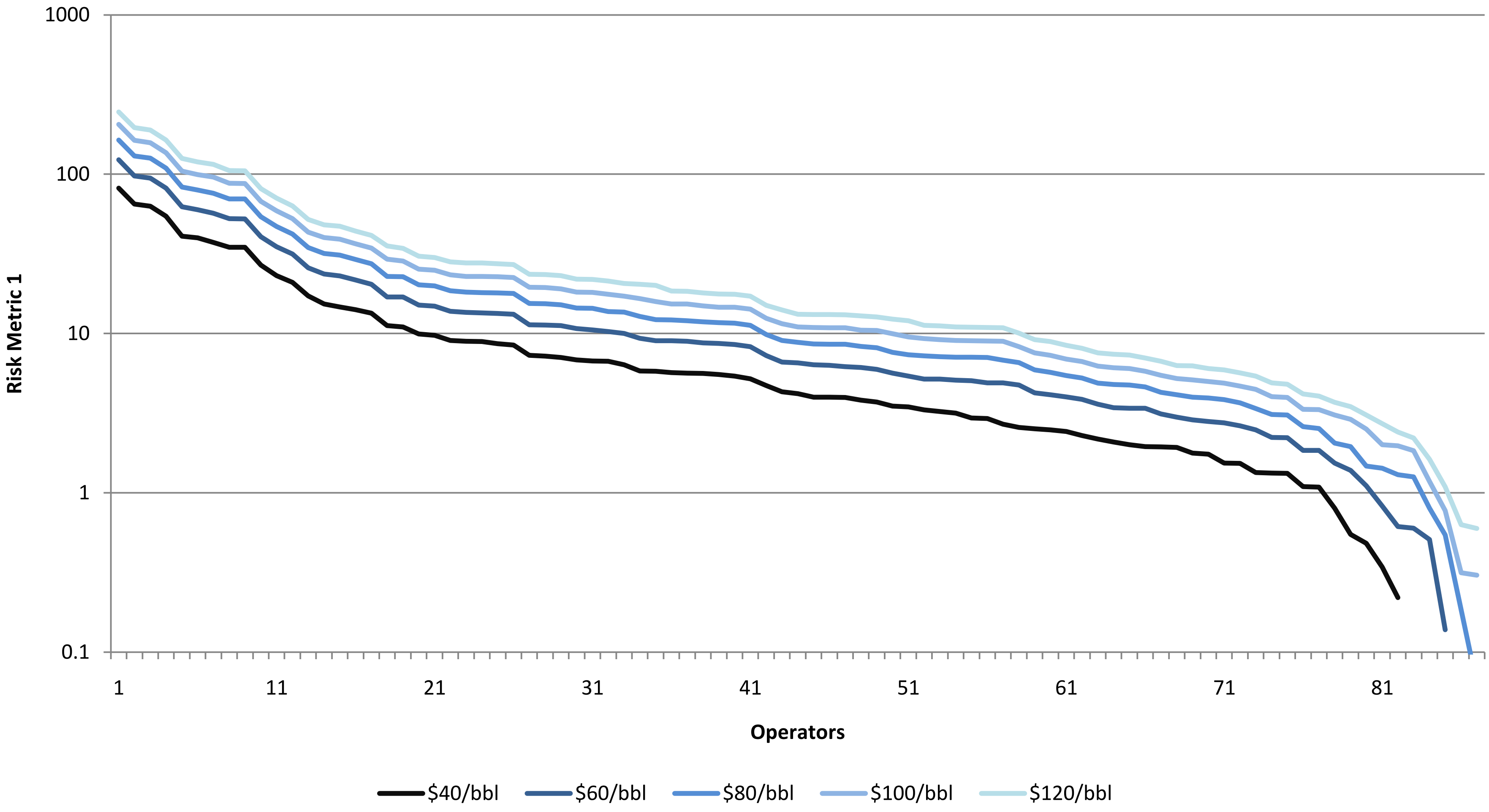
Chevron Decommissioning Risk Matrix
R_1(Chevron)= R_1[P,S], WD < 500 ft

Oil Price ($/bbl)	AVG	AVG + 1*SD	AVG + 2*SD
40	**8.6**	**5.8**	**4.5**
60	**13.2**	**8.8**	**7.0**
80	**17.9**	**11.9**	**9.4**
100	**22.4**	**15.0**	**11.8**
120	**27.0**	**18.1**	**14.2**

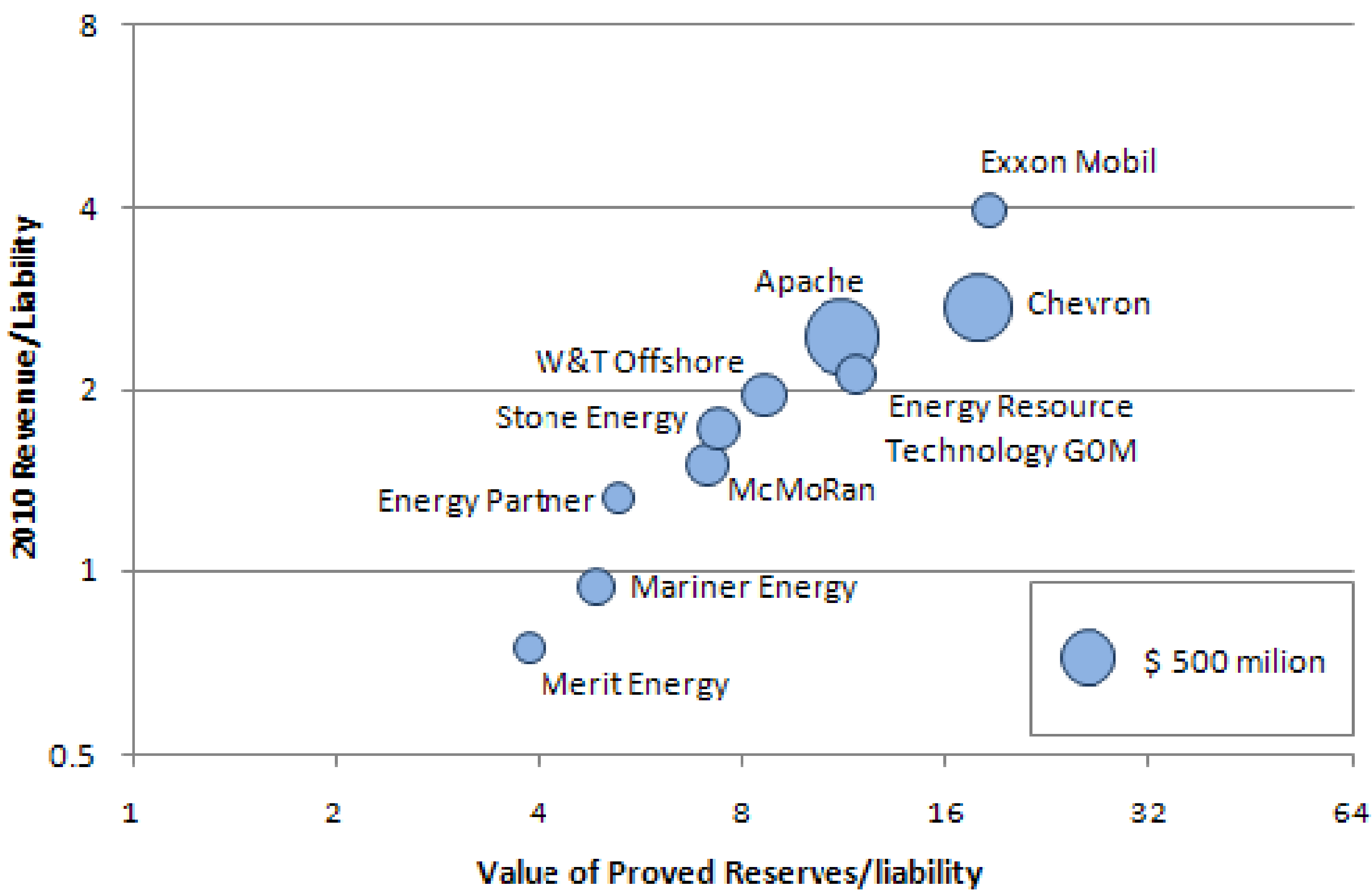
Nexen Decommissioning Risk Matrix
R_1(Nexen)= R_1[P,S], WD < 500 ft

Oil Price ($/bbl)	AVG	AVG + 1*SD	AVG + 2*SD
40	**2.6**	**1.7**	**1.3**
60	**4.1**	**2.7**	**2.2**
80	**5.7**	**3.8**	**3.0**
100	**7.3**	**4.8**	**3.8**
120	**8.9**	**5.9**	**4.7**

GOM Decommissioning Risk Profile $R_1(P)$, S = AVG Decommissioning Cost



$\{R_1 \times R_2\}$ Risk Map



PART 5
Research Needs

Research Needs

- P&A Cost Statistics
- P&A Cost Function
- Detailed Hurricane-Destroyed Cost Analysis
- Operational Activity Description
- Claims Review

Thanks for your attention

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