

Life Cycle of an Oil & Gas Installation

Presented by

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Purpose Decommissioning Cost Estimation

- Part of business case to build & install facility (life cycle cost)
- During installation phase: be cognizant of potential effects of actions on decommissioning costs (i.e. do not remove lifting lugs)
- Production phase: Developing annual decommissioning cost estimates for future decommissioning provision/escrow (FAS 143 ARO)- Asset Retirement Obligations
- Assisting to determining the economic end of the production phase
- Planning decommissioning up to 5 years before decommissioning
- Negotiations with partners
- Sale to other operator
- Concept definition (Bid quality) cost estimate of the decommissioning cost
- Execution phase: Managing decommissioning process



Cost Estimation Applied to Decommissioning



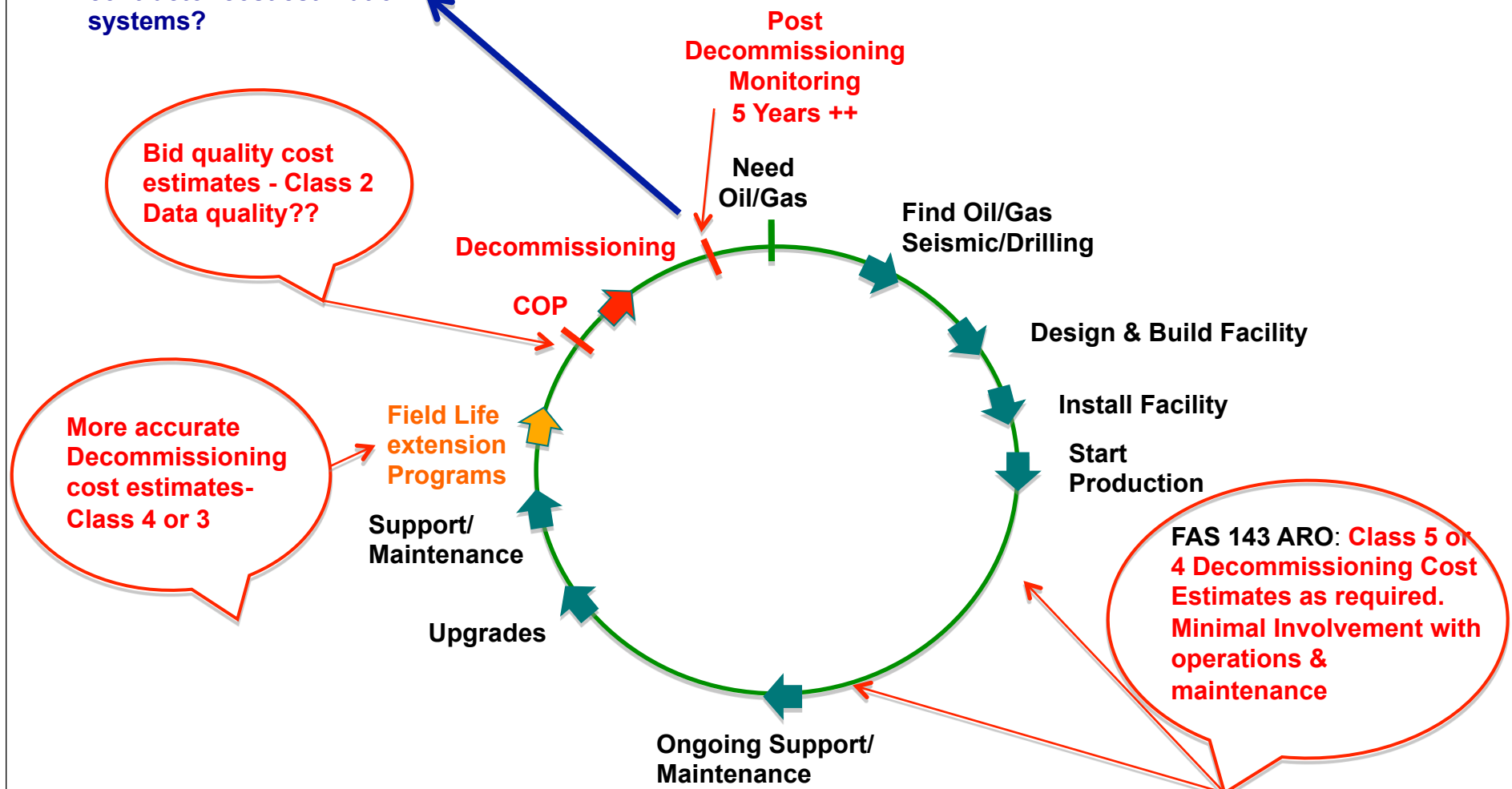
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Typical Current Interaction between Decommissioning & Life Cycle of an Oil/Gas Field

Lessons Learned- How do they feed back into "Decommissioning Industry" & into client & contractor cost estimation systems?

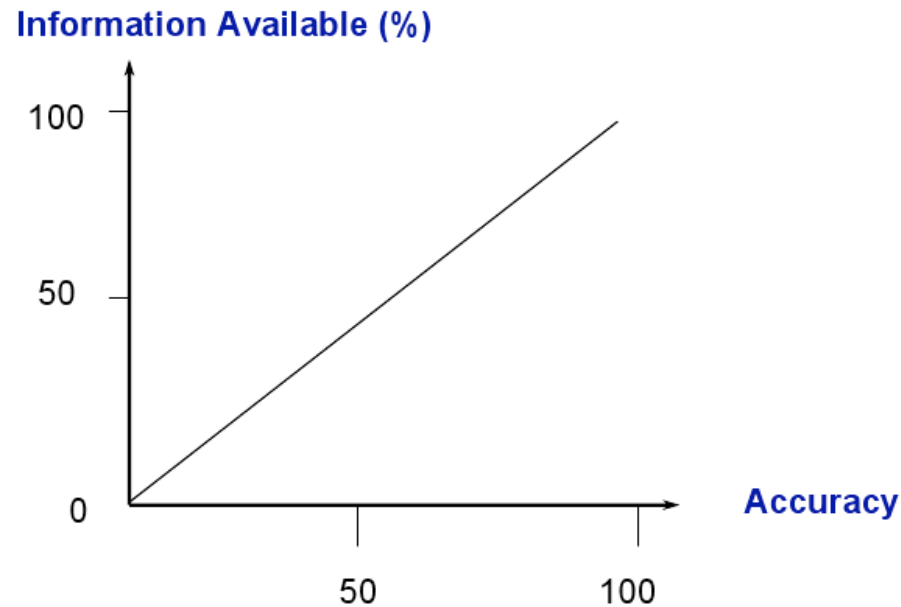


Issues with Current Interaction between Decommissioning & Life Cycle of an Oil/Gas Field

- No linkage between operations, maintenance, life extension and decommissioning
- Not considered at every decision gate in life cycle
- No continuity in building of facility specific data & knowledge for operator or contractor
- Does not address the quality of “data risk” element in cost estimation
- Does not get the contractor involved early enough in the process
- Does not identify “Hot Spots” until too late
 - “unknown unknowns”
 - “Known Unknowns”
- **Poor data results in a poor cost estimate**



Relationship between Data Accuracy versus Cost Estimate Accuracy



Accurate Current Data is one of the Foundation Stones of a Good Cost Estimate



How Consider Decommissioning as Part of the Life Cycle & Improve Decommissioning Cost Estimation Accuracy?



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How to Improve Decommissioning Cost Estimation Accuracy

- Decommissioning should be treated as a ongoing part of the operation of an offshore field.
- During the life of an oil/gas field there should be three parallel tacks: **running operations, maintenance and decommissioning**
- At every CAPEX and OPEX decision gate in the life cycle of the field, the consequences of the decision on future decommissioning costs and ongoing decommissioning accrual costs should be examined and considered
- **This would minimize the impact of a short term gain which may create a major decommission cost in the long term**
- This process would also create an early and continuous awareness of decommissioning as a significant part of the offshore oil & gas business



Ideal Interaction between Decommissioning & Life Cycle of an Oil/Gas Field to Improve Cost Estimation Accuracy

8. Decommissioning planned with full consideration of future decommissioning, disposal & operating pollution.

- Class 2 Decom Cost Estimate required pre bid
- Accurate current data packs available for bidders as a result of this life cycle with decommissioning methodology
- Accurate current records of solids, liquids & gases available as a result of this life cycle with decommissioning methodology etc

7. Field Life extension planned with full consideration of future decommissioning, disposal & operating pollution.

- Class 3 Decom Cost Estimate required pre & post work
- Effect of field extension on decommissioning
- What can be removed during modification
- Detailed modification records maintained
- Weight report revised & undated
- Update records of solids, liquids & gases
- Carry out decommissioning data status audit

6. Upgrades completed with full consideration of future decommissioning, disposal & operating pollution

- Class 3 Decom Cost Estimate required at least 5 years before earliest predicted COP date
- Upgrade design effects on future decom
- What can be removed during upgrade
- Detailed modification records maintained
- Weight report revised & undated
- Update records of solids, liquids & gases
- Carry out decommissioning data status audit

5. Maintenance carried out with full consideration of future decommissioning, disposal & operating pollution

- Balancing, operations, maintenance & decommissioning
- Detailed damage records maintained
- Detailed modification records maintained
- Regular audit of records required for decommissioning
- Weight report annually reviewed & undated
- Records of solids, liquids & gases annual update
- Decommissioning Cost Estimates as required

4. Production started with full consideration of future decommissioning, disposal & operating pollution

- Detailed damage records maintained
- Detailed modification records maintained
- Regular audit of records required for decommissioning
- Weight report annually reviewed & undated
- Records of solids, liquids & gases annual update
- Decommissioning Cost Estimates as required

1. Design & drill wells with full consideration of future decommissioning, disposal & minimization of operating pollution, as stated in ISO 14040 "Life Cycle Management"

- Insure accurate "well files"
- (Industry does a reasonable to good job as this is the "cash cow")
- Detailed as-built well records
- Design Details of each well

2. Design & Build Facility
Design for removal is an IMO Jan 98 legal requirement

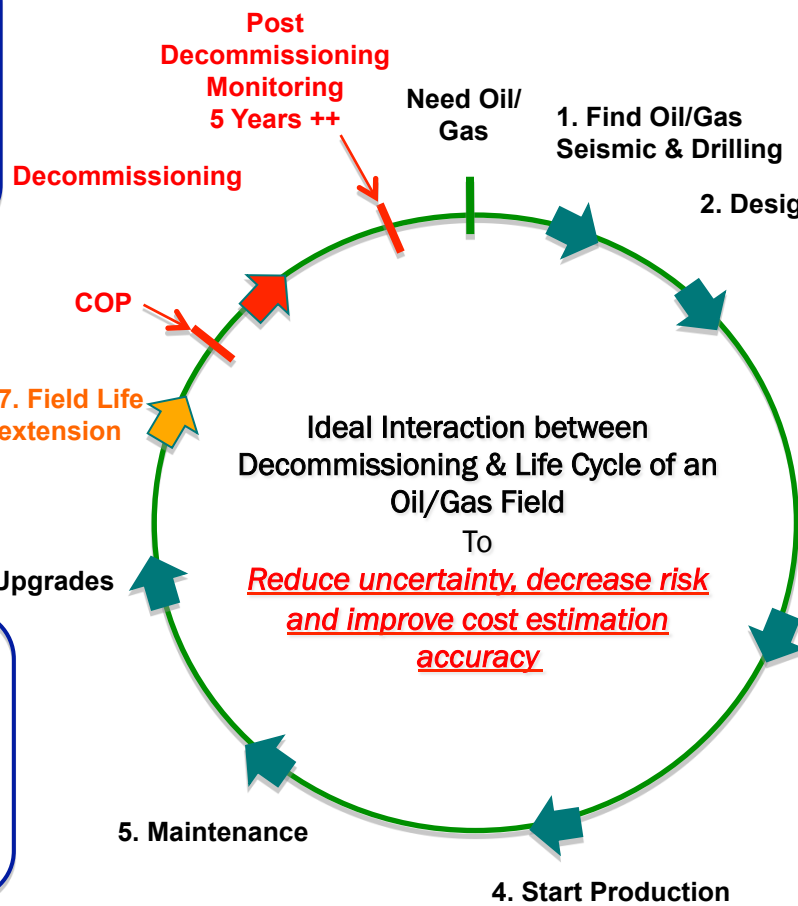
2. Facilities designed with full consideration of future decommissioning, disposal & operating pollution, as stated in ISO 14040 "Life Cycle Management"

- Lifting Lugs/pad-eyes to be usable in 30 years
- Built-in jacket cutting devices (Cold War bridges)
- Design documents to contain mandatory Decom section
- Material content marked on every item to assist disposal
- Reusable topside module shells
- Build in reinforced locations in modules for weighing
- Access panels in modules to ease removal of equipment
- Design conductors & risers to be removed with the jacket
- Gather full photographic & video records
- Data capture & storage system to have Decom front-end
- ...many more decommissioning friendly features possible

3. Install Facility

3. Facilities installed with full consideration of future decommissioning, disposal & operating pollution.

- Lifting Lugs/pad-eyes to be protected in situ
- Detailed as-built documentation prepared
- Detailed records of solids, liquids & gases on board
- Prepare an as-built weight report
- Keep seabed free of all debris
- Record of drill cutting pile location & contents



1. Design & drill wells

- ◆ **Design & drill wells with full consideration of future decommissioning, disposal & minimization of operating pollution, as stated in ISO 14040 “Life Cycle Management”**
- ◆ **Insure accurate “well files”**
(Industry does a reasonable to good job as this is the “cash cow”)
- ◆ **Detailed as-built well records**
- ◆ **Detailed engineering records of each well**



2. Design & Build Facility

2. Facilities designed with full consideration of future decommissioning, disposal & operating pollution, as stated in ISO 14040 “Life Cycle Management”

- **Lifting Lugs/pad-eyes to be usable in 30 years**
- **Built-in jacket cutting devices (Cold War bridges)**
- **Design documents to contain mandatory Decom section**
- **Material content marked on every item to assist disposal**
- **Reusable topside module shells**
- **Build in reinforced locations in modules for weighing**
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3. Installation of Facilities Phase

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4. Production Phase

4. Production started with full consideration of future decommissioning, disposal & operating pollution

- Detailed damage records maintained
- Detailed modification records maintained
- Regular audit of records required for decommissioning
- Weight report annually reviewed & undated
- Records of solids, liquids & gases annual update
- Decommissioning Cost Estimates as required



5. Maintenance During Production Phase

5. Maintenance carried out with full consideration of future decommissioning, disposal & operating pollution

- **Balancing, operations, maintenance & decommissioning**
- **Detailed damage records maintained**
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- **Regular audit of records required for decommissioning**
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6. Upgrades During Production Phase

6. Upgrades completed with full consideration of future decommissioning, disposal & operating pollution

- **Class 3 Decom Cost Estimate required at least 5 years before earliest predicted COP date**
- Upgrade design effects on future decommissioning
- What can be removed during upgrade
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- Carry out decommissioning data status audit



7. Field Life Extension Planning During Production Phase

7. Field Life extension planned with full consideration of future decommissioning, disposal & operating pollution.

- **Class 3 Decom Cost Estimate required pre & post work**
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6. Upgrades During Production Phase

8. Decommissioning planned with full consideration of future decommissioning, disposal & operating pollution.

- **Class 2 Decom Cost Estimate required pre bid**
- **Accurate current data packs available for bidders as a result of this life cycle with decommissioning methodology**
- **Accurate current records of solids, liquids & gases available as a result of this life cycle with decommissioning methodology etc**
- **Class 2 Decom Estimate is used for Bid evaluation and project monitoring during execution**
- **The learning's are captured in a class 1 Decom Estimate**



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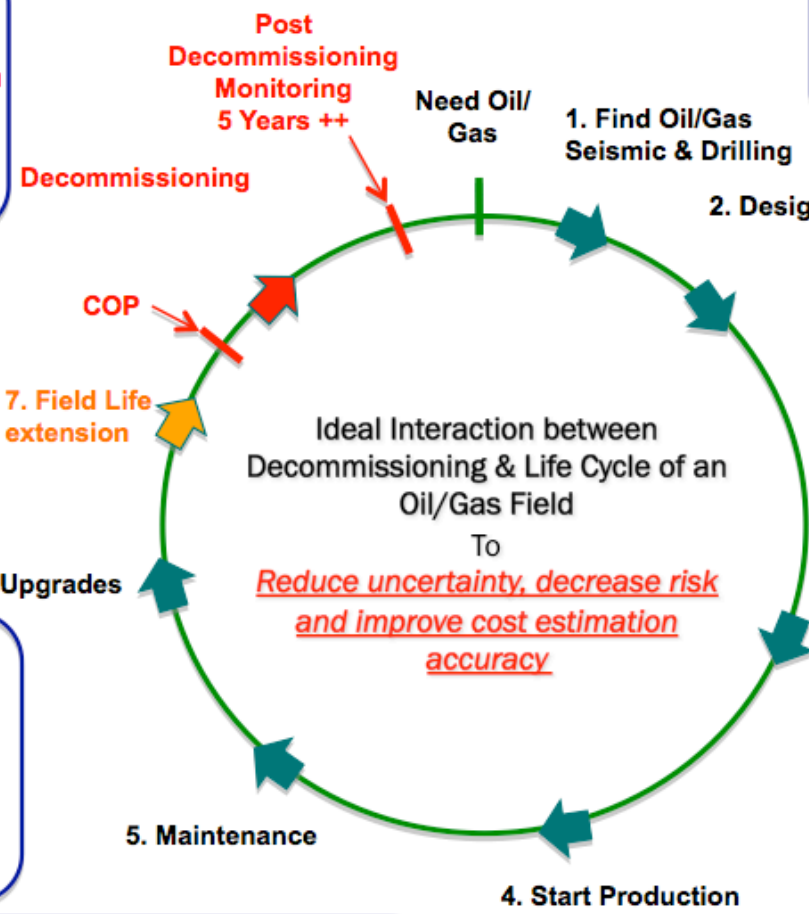
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Decommissioning Goals using Life Cycle Approach

Know your facility with “Trained Decommissioning Eyes”

This will enable you to

- Minimize “unknown unknowns”
- Manage the “Known unknowns”
- Improve Data sets for future bid packages and hence minimize contingency from bidders
- Minimize end of life “surprises” for operators, governmental bodies, the public and shareholders
- Enable more open discussion & Transparency between operators, governmental bodies, the public and shareholder

This will lead to improved accuracy of cost estimates



Future Applications of Decommissioning Cost Estimation

- Part of business case to build & install facility (life cycle cost)
- During design phase to optimize the facility to reduce decommissioning cost
- During installation phase: be cognizant of potential effects of actions on decommissioning costs (i.e. do not remove lifting lugs)
- Production phase: Developing annual decommissioning cost estimates for future decommissioning provision/escrow
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Thank you for your attention

Any Questions ?



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