



Produced Water Society - Observations & Changes in the North Sea

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17th January 2007 - Houston

Historical



UK Legislation prior to 1st Jan 2006:

The Prevention of Pollution Act 1971 {POPA}

→ Discharge of Oil Prohibited unless Specifically Exempted = PW discharges controlled via a system of exemptions

→ 40ppm average monthly discharge limit

→ limitation on PW discharge volume

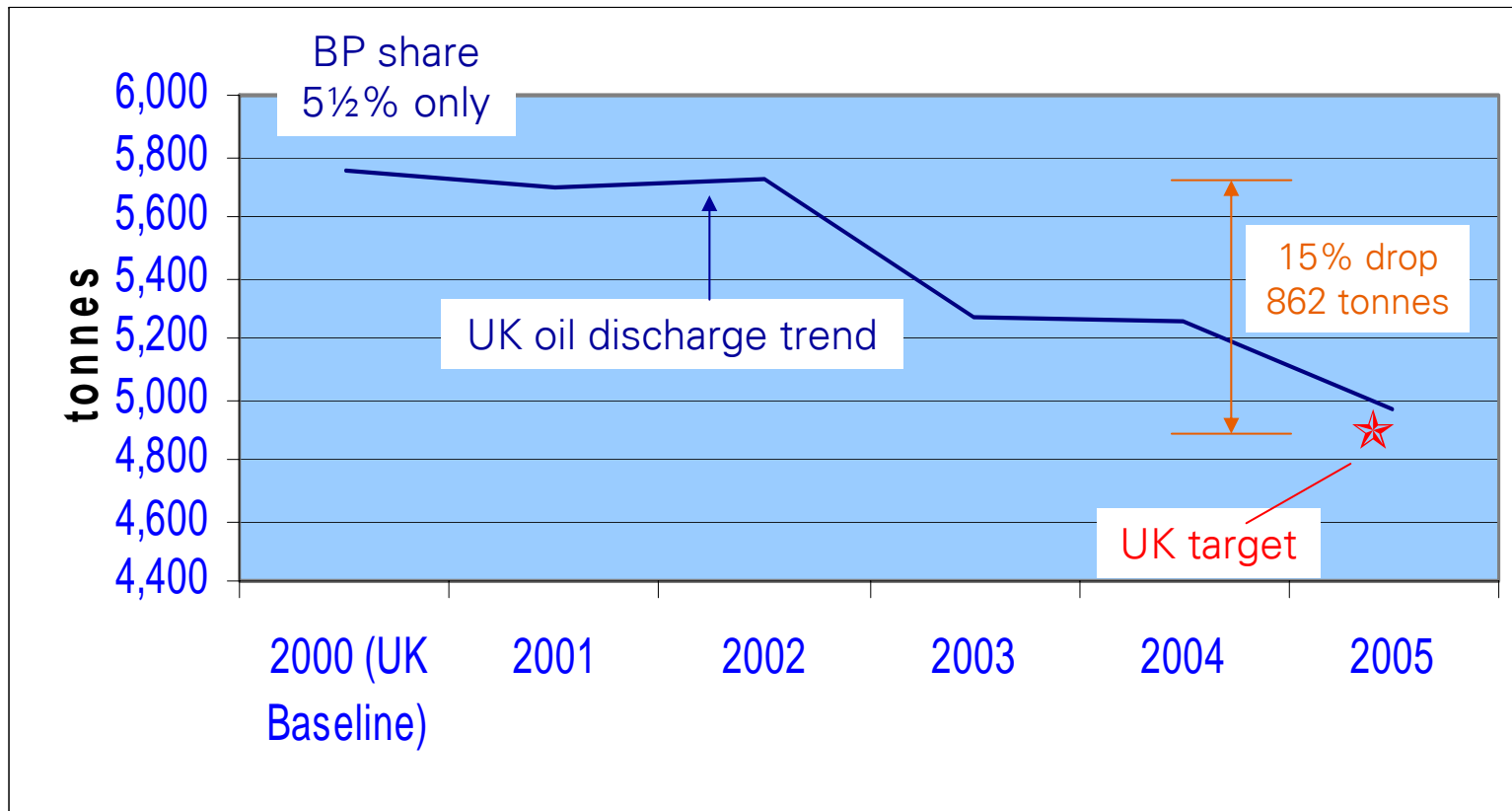
OSPAR Recommendation - 2001

Reduce the input of oil and other substances into the sea from produced water with the ultimate aim of eliminating harmful discharge from this source (includes dissolved components).

{REF: European Union Marine Strategy to eliminate 'Harmful discharge' from Produced water by 2020 }



OSPAR / OPPC – UK Discharge Trend



◆ 2005 actuals only 93 tonnes short of target but does not account for growing water production rates and significant shutdowns incurred in 2005

→ further discharge reduction measures required

BP preference is for PWRI

OSPAR → OPPC



OSPAR – each member state to :

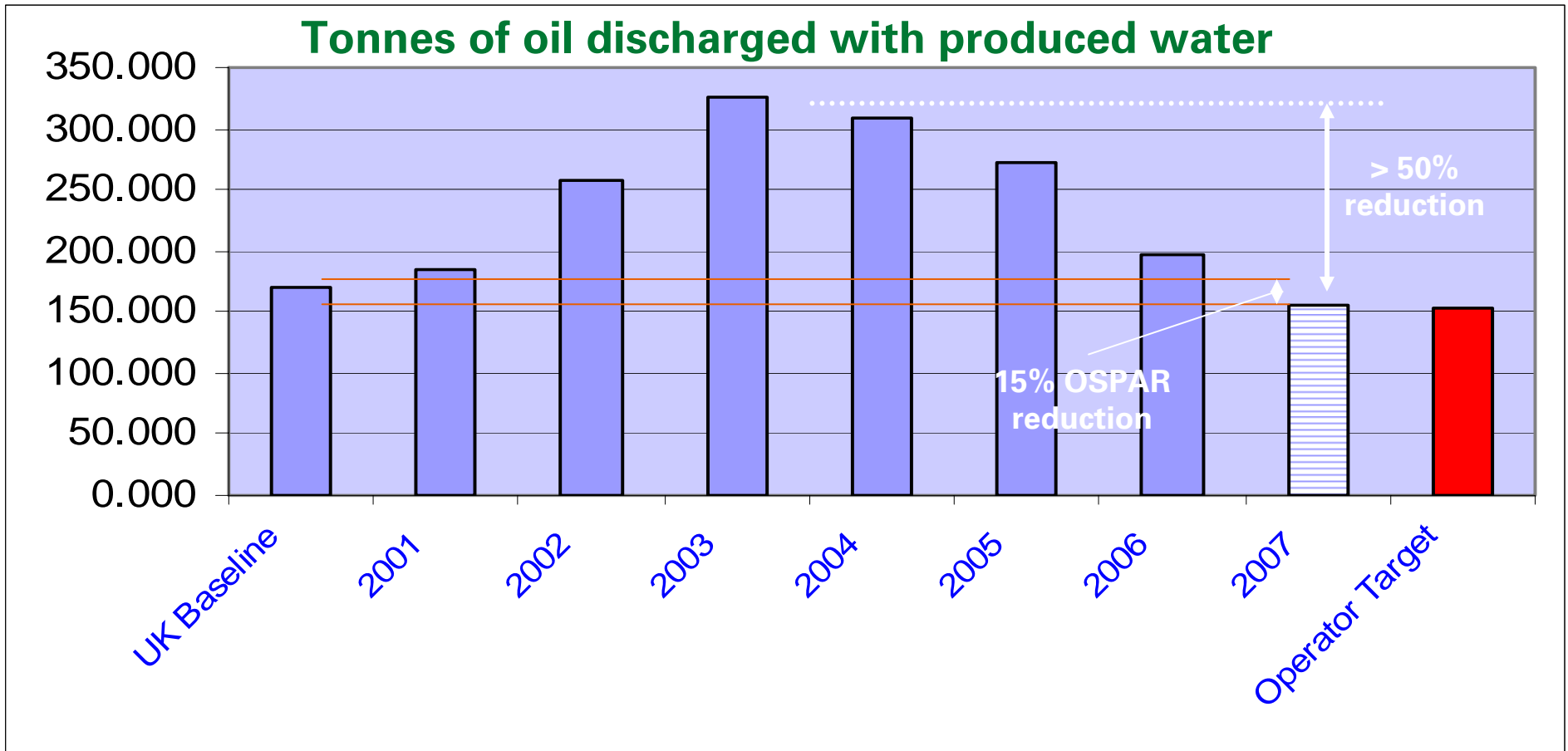
- cut oil discharged to sea from offshore O&G installations by 15%
- cut average discharge oil concentration to 30mg/l
- implement a new integrated analysis method (GC-FID)

UK Regulator implemented these recommendations in '*The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations*' (OPPC) ...came into effect 1st Jan 2006

- OSPAR refers to total oil but OPPC limits only Dispersed oil
- Average monthly discharge limit reduced to 30mg/l
- Oil discharge allowance reduced by 17% from year 2000 baseline
- New chargeable Permit system for PWRI & Discharge streams
- Biannual testing of dissolved components required
- Discharges to be measured to within +/- 10%
- Establishment of PW oil discharge trading scheme
- Reference analysis method changed to GC-FID



BP UK Discharge Performance – IR analysis



Reductions made by implementation of PWRI, improved separation & solids control → reduced oil discharge concentration

~\$20million spent specifically to meet the OPPC discharge limits.

OPPC Trading Scheme



Designed to fund reduction projects by ensuring a cost value -

- ◆ Cap & Trade scheme came into effect on 1st Jan 2007
- ◆ Only covers dispersed oil discharged to sea with produced water
- ◆ Each asset is given an annual discharge allowance based on year 2000 actuals and can sell / buy discharge allocation via the trading scheme
- ◆ Failure to surrender discharge credits equivalent to that actually discharged attracts a penalty of £108,000 / tonne of dispersed oil
 - figure arrived at based on average implementation cost of abatement
- ◆ Discharges to be measured to +/- 10% accuracy
 - meter maintenance /installation issues
- ◆ Trading of allocations is permissible until end of March of subsequent year to allow verification of discharge numbers

However there are issues..

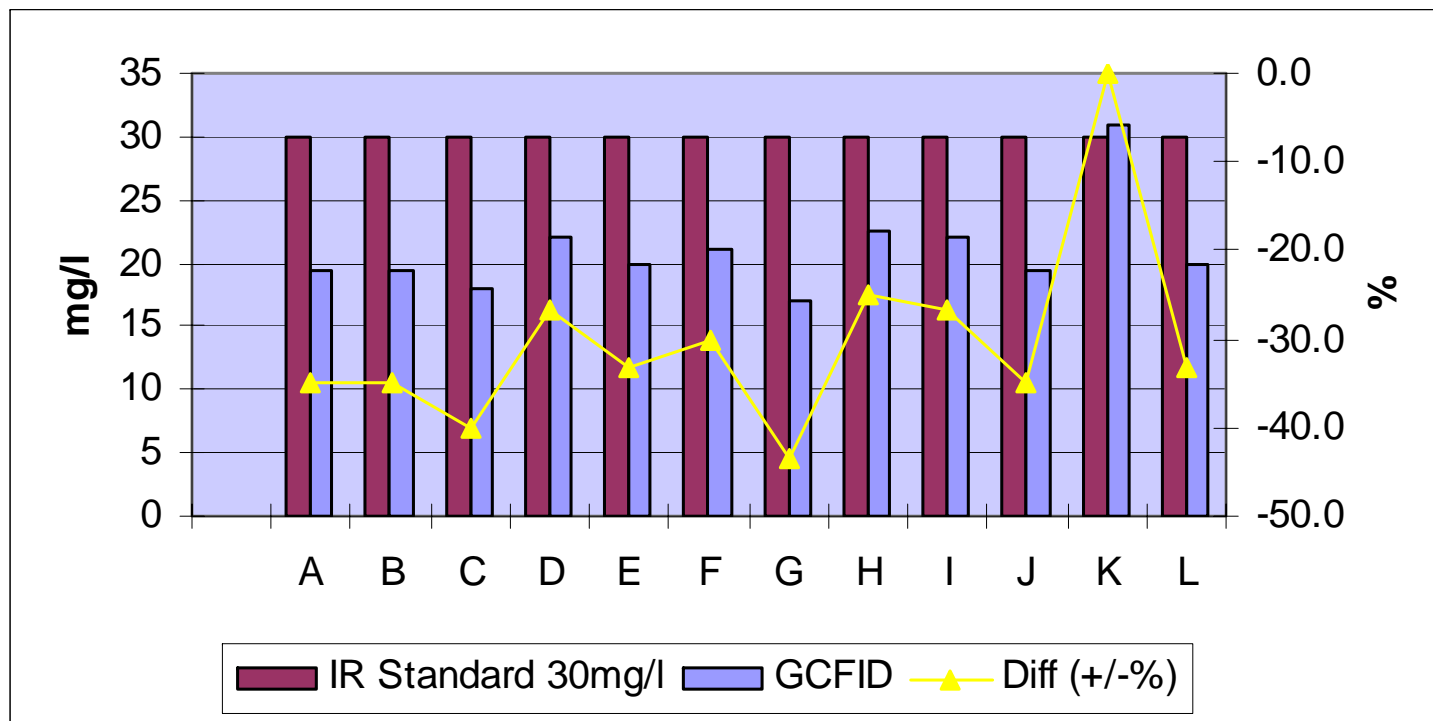
GC-FID Analysis



- GC-FID method proposed by OSPAR known to have difficulties detecting small chain hydrocarbons therefore correction factor adopted in UK OPPC requirement

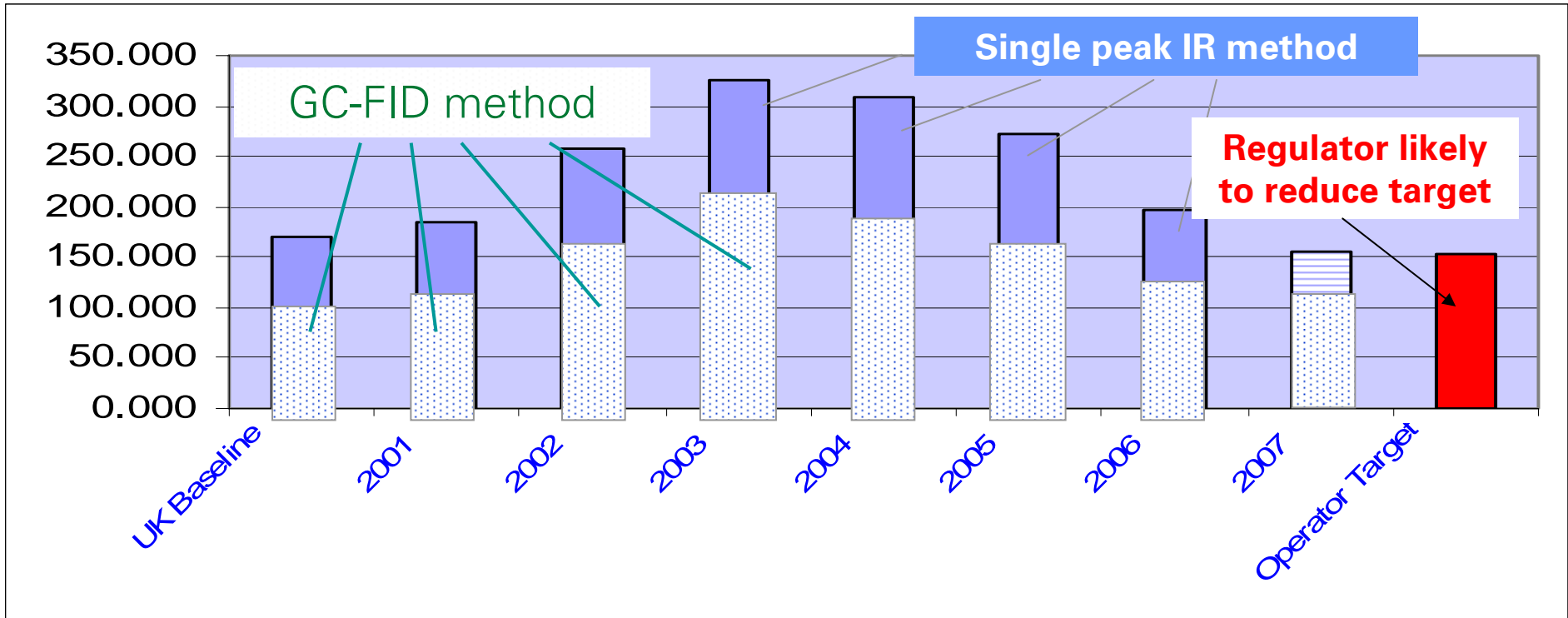
BUT

- **unexpected issues also reported by operators analysing heavy crude samples**



- BP average asset reportable discharge reduction of ~35%

BP UK Discharge based on GC-FID analysis



For BP implementing the new GC-FID analysis method results in a 35% reduction in reportable oil discharged..!!

Other operators have reported reductions ranging from 15 → 60% !!

→ Potential reputational issues for regulator with NGO's & environmental pressure groups

Dissolved/Suspended Components



- New requirement to bi-annually sample & test PW for dissolved components (PAH, BTEX, Heavy metals etc)

- dissolved components can be removed by filtration or oxidation however this can be costly. BP's preferred option is disposal via PWRI.

- Scale formation – many different types however increasing focus by operators on disposal costs associated with radioactive scales as assets near decommissioning.

→ currently in the UK there are only 2 oversubscribed onshore decontamination/disposal facilities !

→ importance of scale inhibition programmes

- Solids management increasingly important to maintain compliance with oil discharge limits and assure avoidance of penalties e.g. blockage of coalescers & separator internals, erosion of pumps/valves and minimize oil associated with solid particles



Other PW Issues



- Alignment across OSPAR member states slow → Denmark & Germany have indicated that they will not be able to fully comply with OSPAR → difficulties establishing international trading & performance comparison
- New separation and treatment technologies available however coordination and communication between companies, installations and operational areas limited → repeat lessons learned & inefficient use of resource
- Significant number of experienced staff either due to retire or relocating to 'new production areas' to train national personnel → reliance on contractors but capability to suitably resource often stretched
- Increasing sampling & metering requirements + focus on analysis procedures → drive to develop reliable, easy to install on line oil in water analyzers