Emissions from offshore drilling operations
Synopsis

Today, offshore drilling is a power intensive industry and as such the large drilling platforms potentially emit in excess of 25,000 tonnes of CO$_2$ /year.

EPA’s threshold for a “major” source of CO$_2$ equivalent emissions.
Operations

Our challenge is in how we operate, and what BACT can be introduced given the conflicting demands of diesel efficiency and safe, black out free operations.

Our drilling operations require power at all times and spinning redundancy. However, the best efficiency comes when running at a steady 85% load.

55% * 2 = 110%, if only one engine was running; BLACKOUT
Max load 1850 kW. (39%)

Min Load 1100 kW. (23%)

However, we’re not always tripping pipe and the engines can be loaded up better. Power management needs examining.
Many emissions reduction technologies are in development; however, these are not commercially available yet for large marine engines.

SCR’s are available but are impractical for an offshore drilling rig.

- Exhaust Gas Recirculation
- Ignition timing retardation
- Derating of engines
- Direct water injection
- Emulsified fuel use
- Humid air motor/water mist
- NO\textsubscript{x} Scrubber/absorber technology
- Replacement of engines
- Selective Catalytic Reduction (SCR)
- Good Combustion Practice
Initial assumptions

Initially, offshore industry was being pushed into the use of SCR’s by governing agencies.

We studied the feasibility of operating an SCR system offshore and identified the pitfalls in the operation and logistics.

For offshore drilling, SCR’s are a non-starter…
First Steps

To be able to reduce emissions, we need to ensure that all quick fixes and simple steps have been taken to reduce emissions before moving on to major overhauls and fixes.

To this end, we have devised a system that we have called DEWT. Diesel Emissions with Turbochargers.
Basic Requirements

- $\text{NO}_x \rho$ – derived from $\text{NO}_x$ ppm concentration
- Load – Generator load in kW.
- Exhaust Flow – Air flow + fuel flow
Air Flow

Flow of any description is the most difficult variable that is needed to measure; for this reason, we look at what is normally measured.

- **Pressure.** (Charge air & E.R. pressure)
- **Temperature.** (Temperatures for the gas through the combustion process)
- **Turbocharger RPM.**
Air Flow

Flow of any description is the most difficult variable that is needed to measure; for this reason, we look at what is normally measured.

- **Pressure.** (Charge air & E.R. pressure)

- **Temperature.** (Temperatures for the gas through the combustion process)

- **Turbocharger RPM.**
**Air Flow**

We are able to calculate the NO\textsubscript{x} reading using temperature and pressure data, measured with a time stamp to generated load.

**Exhaust Gas Flow**

The exhaust flow is the combination of the air flow and fuel flow. For a diesel engine, that’s approximately the ratio of 50:1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge Air Pressure</td>
<td>bar</td>
</tr>
<tr>
<td>Charge Air Temp</td>
<td>°C</td>
</tr>
<tr>
<td>Turbocharger RPM (A &amp; B)</td>
<td>RPM</td>
</tr>
<tr>
<td>Exhaust Temp after blower(s) where exhaust sample's taken.</td>
<td>°C</td>
</tr>
<tr>
<td>Engine air inlet pressure</td>
<td>mbar</td>
</tr>
<tr>
<td>Engine air inlet temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Engine Air inlet relative humidity</td>
<td>%</td>
</tr>
<tr>
<td>Generator Load</td>
<td>kW</td>
</tr>
<tr>
<td>Emissions concentration</td>
<td>ppm</td>
</tr>
<tr>
<td>Test Bed fuel Consumption</td>
<td>g/kW·h</td>
</tr>
</tbody>
</table>
Data Collection & Actions

The DEWT system is designed to be used twice daily, over an average of 60 minutes. This value is logged in our daily machinery report along with the other, normal engine parameters. From this, our maintenance system will raise a flag to inspect the engine if the NO$_x$ level is rising.
Actions

Once the DEWT system indicates a rise in emissions, the maintenance system instigates a job to investigate the engine combustion. The investigation identifies the emissions deviation and fixes it.

Essentially this moves engine maintenance to CBM, the condition being the emissions value.
Today, we have a rig with a permit that’s currently open for public comment. This permit includes fully trialing DEWT whilst drilling east of 87½° Longitude.

***Public Notice Copy***

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
Region 4  
Atlanta, Georgia

Permit to Construct and Operate Under the Outer Continental Shelf Air Regulations  
Permit No.

In accordance with the provisions of Section 328 of the Clean Air Act (CAA), 42 U.S.C. § 7627, and the implementing Outer Continental Shelf (OCS) Air Regulations at Title 40 Code of Federal Regulation (CFR) part 55, which incorporate by reference the Prevention of Significant Deterioration (PSD) of Air Quality Regulations at 40 CFR 52.21,

is hereby authorized to construct and operate air emissions units and to conduct other air pollutant emitting activities at an OCS source at the following location:

Well #1 located on the OCS waters in the Gulf of Mexico east of longitude 87.5. The drill site is located at latitude 27°34’49.1016 and longitude 87°13’29.28 or approximately 160 miles southeast of the mouth of the Mississippi River and 200 miles southwest of Panama City, Florida.

Upon initial start-up, this OCS source and support vessels shall be constructed and operated in accordance with the terms and conditions set forth in this permit.

This permit shall become effective on: [insert effective date: 30 days after the date of the service of notice of the final permit decision under 40 CFR 124.15, unless review of the permit decision is requested in accordance with 40 CFR 124.19; or if no comments requested a change in the draft permit, the permit shall become effective immediately upon issuance].

This permit shall not relieve the owner or operator of the responsibility to comply fully with all applicable provisions of federal and state law.

Date Signed  
Beverly H. Banister  
Director  
Air, Pesticides, and Toxics Management Division

Draft-OCS-EPA-84005-032311
Questions?