PLATE 12
OIL FROM SLUDGE (OFS)

1. Most suitable for the following sludge types:
- untreated primary
- lagoon stabilised
- anaerobically digested
- aerobically digested
- ATAD
- Dual digested

2. Dewatering requirements:
- minimum 30% dry solids content
- higher dry solids content is preferred

3. Stabilisation requirements:
- none required
- anaerobic or aerobic stabilisation preferred

4. Process description
OFS technology is a patented thermochemical or pyrolytic process in which the organic content of sludge is converted into end products with energy content and to an oil with properties similar to diesel fuel. The process operates at relatively low temperatures (650°-700°C) and at atmospheric pressure. Among the gas products of a pyrolytic reaction are methane (CH_4) and carbon monoxide (CO). Dewatered sludge to about 35% dry solids is used as feed for the OFS process.

In the first stage, at about 450°C, pre-dried sludge with approximately 5% moisture content, is heated in a reactor vessel in the absence of oxygen (pyrolysis). At this temperature approximately 40-50% (w/w) of the sludge is vaporised. These vapours are contacted with the residue from the sludge (char) in the second stage of the reactor where the organic molecules are converted to aliphatic hydrocarbons, which are the principal components of crude oil.

The process produces oil, along with char, non-condensable gas and reaction water. These latter products are burnt in a hot gas generator (similar to a fluidised bed incinerator) which produces most if not all the energy for sludge drying and reactor heating.

The final products are oil and ash. The oil is suitable for combustion in engines while the char from the reactor has similar properties to high value commercial activated carbons used for the adsorption of heavy metals. The ash is suitable as aggregate for use in concrete products.

The process is designed to operate in a number of modes depending on the market trend for sludge products.

Only one such plant is in existence; at Subiaco in Western Australia. Only the sludge dewatering and drying phases of the process have been commissioned so far.

5 Biosolids Classification **(EPA Victoria Draft (2002) Guidelines for Environmental Management)**
The biosolids classification for the incineration thereof is not specified in the EPA Victoria Draft (2002) Guidelines. The only solid product from the process is, however, a sterile ash. It is highly likely that it would have a 1A classification. When the process produces fertiliser it is expected to have a solids content in excess of 90%. In all likelihood it will also be classified as 1A.

6. Market for final product
A range of products are produced each with its own market including oil, ash, pelletised fertiliser and activated carbon.

7. Benefits
- dramatic reduction in sludge volume
- a range of potentially valuable marketable product
- containment of odours and dust
- compact process requiring small footprint

8. Limitations
- high capital cost
- high O&M cost
- not a proven established technology yet
- no established market for products yet
- only suitable for large scale operations

9. Costs (Oil from Sludge)
Typical capital costs and/or operating costs are not available and are expected to be site specific.

The Subiaco OFS plant in Western Australia which has a 25 dry tonne per day capacity had a capital cost of $23 million. The cost includes the following elements: sludge blending, dewatering, drying, energy recovery, air pollution control, conversion reactors and stand by lime stabilisation. O&M costs are in excess of $1.3 million per year. (*Source: Western Australia Water Corporation, personal communication*)

10. Product sale
The price of the product produced is difficult to estimate at this stage because it has not been produced and sold here. Since the product is essentially a fuel oil and its sale price should be higher than the compost. Based on the current fuel price in Australia, the price of the oil produced is likely to be around $500/$m^3$.