PLATE 9
SOIL INJECTION

1. Suitable for the following sludge types:
- lagoon stabilised
- anaerobically digested
- aerobically digested
- ATAD
- Dual digested
- tertiary DAF+F

2. Dewatering requirements:
- none required
- thickening is required to at least 3% - 5% dry solids
- desired dry solids content determined by mechanical equipment

3. Stabilisation requirements:
- none required
- anaerobic or aerobic stabilisation preferred
- aerobic stabilisation for WAS from IDEA, CAS, BNR or EA preferred

4. Process description

Soil injection of biosolids has been practiced widely in Europe and the United States for many years but it is a relatively new technology in Australia. The main reason for this has been the biosolids reuse guidelines in Australia.

While liquid biosolids has little saleable value, it is sought after for its soil conditioner and low quality fertiliser value. Relatively low nutrient values in liquid biosolids make the handling, storage and application thereof higher than for chemical fertilisers. The purchase price of liquid biosolids, however, is very low in comparison.

Application of liquid biosolids to land is enticing because of its simplicity. The biosolids can either be pumped (and stored) or transported to the application site. Thickening of the sludge is desirable in order to reduce the volume and transport costs. Typical solids content of liquid biosolids applied to land range from 1% to 10%.

Liquid injection equipment may be self propelled (tank trucks) or tractor drawn (tank wagons). Sub-surface injection is accomplished by these vehicles equipped with rear mounted high capacity injection shanks.

It is likely that most soil injection applications will be done by contractors due to the cost of equipment and sustained availability of suitable land.
Important advantages of sub-surface injection include:
- minimisation of nuisance effects such as flies and odours
- minimisation of ammonia loss through volatilisation
- elimination of surface run-off containing biosolids
- minimising visibility which leads to better public acceptance.

Storage of liquid biosolids at origin or at the injection site is important when the access to the injection site is prohibited by wet weather.

The suitability of biosolids soil injection will be depend upon factors which include:
- origin and composition of biosolids
- transport distances to injection sites
- soil types and characteristics
- vegetation nutritional requirements which will largely determine the application rate
- rainfall

***5. Biosolids Classification* (EPA Victoria Draft (2002) Guidelines for Environmental Management)**

The biosolids classification is dependent on the stabilisation process used independent of the origin of the sludge. The higher degree of stabilisation and pathogen reduction is likely to be the preferred pre-treatment.

Method	Class	EPA Victoria Draft (2002) Requirements
Soil Injection ATAD Digested	T1	None specified
Soil Injection Anaerobically Digested	T3	None specified
Soil Injection Aerobically Digested	T3	None specified

6. Market for final product

Land application in mainly agriculture, and land rehabilitation. The application and application rate will depend on biosolids classification and soil structure and plant requirements.

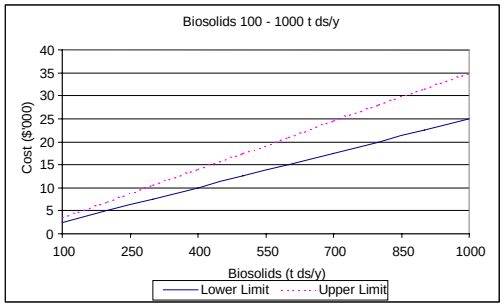
7. Benefits
- no dewatering of biosolids required
- suitable for all types of sludges
- valuable soil conditioner and low grade fertiliser
- Simplifies upstream processes
- Avoids using energy to dewater the sludge
- Immediate mixing of sludge and soil to eliminate odour and vector problems

8. Limitations
- moderate capital cost
- high O&M cost
- large storage facilities for liquid biosolids and resultant potential odours
- Not suitable for wet seasons

9. Costs (Soil Injection)

Soil injection is likely to be contracted out. A typical contract cost, excluding transport cost to the application site (that is the cost of application or disposal only), would vary between $25 and $35 per tonne of liquid sludge. The basis for the cost curves is liquid biosolids with a 10% dry solids content.

Contract cost per annum. Costs ($'000)
[100 – 1 000 t ds/y]



10. Product sale

The price of the biosolids produced is expected to be relatively low compared to compost because the solid content is low which is a small fraction of that of compost. Hence the price is estimated at approximately $5/m^3. The sale of the biosolids can be used to off set part of the processing cost for the sludge.

Contract cost per annum. Costs ($'000)
[1 000 - 3 000 t ds/y]