

## **My CV**

I was an engineer in the chemical industry and in the dairy, food and drink equipment manufacturing and plant construction. For the matter in hand, I commissioned a Reverse Osmosis water treatment plant in Saudi Arabia for a desert dairy.

### **Wastewater treatment**

In the US flowback and produced water is stored in huge, open pits and some is subsequently injected into deep, underground wells - both practices are prohibited in the EU (and the UK).

In the UK fracking wastewater is stored in double-skinned tanks prior to being sent for treatment. The operator has to have a written agreement with a company with a permit to treat and dispose of its waste, but operations must cease if a treatment facility is unavailable.

### **Wastewater analysis**

Every well location will have a different wastewater analysis dependent on the chemicals added to the production water and the mineral content below ground. Until there is flowback, an analysis cannot be performed, but there is a published analysis of Cuadrilla's wastewater from nearby drilling in 2011.

### **Methane and volatile organic compounds (VOCs)**

Gas comes up with the flowback and VOCs to a gas/liquid separation plant which is not 100% efficient, giving explosion risks from residual dissolved methane and health risks from VOCs in the wastewater.

### **High salinity**

There are high levels of total dissolved solids (TDS), which can be around 5 times that of seawater. Clearly it cannot be discharged into rivers unless its concentration is reduced, which requires evaporation and crystallisation. Ultrafiltration and RO are inappropriate.

## **Content**

One well's wastewater of 22,000 cubic metres contains ca. 30 tonnes of suspended solids and 4,000 tonnes of salt needed to be transferred to landfill due to the toxic metal salts and radioactivity content. The solids contain 400 kg barium, 290 kg iron, 46 kg manganese, 20 kg arsenic, 7 kg nickel, 3 kg copper, 2.5 kg cadmium, 1 kg lead, 1 kg chromium, 1 kg cobalt. Traces of silver, vanadium, mercury and zinc and radioactivity (NORM). There are also chlorides, nitrates, sulphates and fluorides.

It will take around 300 well drillings per year to provide 15% of the UK's gas consumption. The figures above when multiplied by 300 lead to over a million tonnes of landfill a year.

## **Discharge standards**

To define the necessary process plant there needs to be a standard to define the wastewater discharge parameters for dissolved as well as suspended solids.

## **Bran Sands, Tees**

Of the four EA nominated plants only Bran Sands is coastal. It has currently no contractual arrangement to take in fracking wastewater. It will need the actual analysis of the input and the required discharge standards to be able to establish a price per cubic metre treated and acceptably discharged.

## **Clarity is needed**

For Cuadrilla and Third Energy to proceed with test fracking they are required to have contracted treatment works able to take in the wastewater and deal with its high salinity. Also the implications of the full production, when 6 million cubic metres of wastewater will arise from 300 production wells per year need consideration.

## **Fracking for gas non-viable**

The imposition of the UK regulations will make fracking for gas in the UK non-viable.