



Air Pollution

Pollution: Shipping

Peter Evans

Lloyds drew up a strategic plan deciding at first, to measure what emissions were coming directly from ships at various constant speeds. So called steady state conditions. Monitoring equipment was installed in the engine rooms of ships, connected to a sampling probe, which was fitted directly into the exhaust flue. The results were used to derive general emission factors for ships, allowing the emissions for a given type of ship, travelling at various speeds to be predicted. The Princess Julianna was one of the ships studied. A short crossing ferry, running between the Dutch ports of Vlissingen, and Boreskins. This phase of the study, used the same monitoring equipment, but it was far more complex. To investigate transient emissions, sensors were connected directly to engines, to measure variables such as, engine speed and temperature. and all the data had to be logged onto a computer, to keep track of the way the emissions varied with the changing state of the ship. Because the transient manoeuvres of ships like the Princess Julianna and its sister ferry were close to land, it had been decided from the start, to link the transient study with a land based survey to measure air quality on shore, and determine if it varied with shipping activity.

Dr. Gillian Reynolds, Section Head, Environmental Engineering

We selected Vlissingen for a number of reasons. One of the main ones being that it was a small town surrounded by rural environment. This provided us with a readily definable area to look at. In addition, the Dutch have a long history of meteorological and air quality monitoring, so they were able to provide us with a lot of useful information, such as data on meteorological conditions in Vlissingen, on land based emission sources in the area, and also on shipping movements in the Shelt estuary. We're using a mobile laboratory to make the air quality measurements. This laboratory is monitoring at five primary sites in turn, for approximately ten days at each site.

Peter Evans

The mobile lab arrives at a new primary site, this time, a technical school on the edge of Vlissingen. It will remain here for ten days, automatically logging data onto an on board computer. Before sampling can begin, environmental scientist Steve Danton must prepare the lab for action. Meteorological conditions have a fundamental effect on air quality at any site. So the speed and direction of the wind, as well as ambient temperature and humidity, have to be monitored throughout the survey. Measurements are taken high above the region of influence of the lab, and its immediate surroundings. Air samples are drawn into another mast. The air is divided into five streams, which are connected to separate gas analysers, similar to those used on board the ships. Particulate matter is collected separately. Samples are drawn down a third mast, into the instrument, and through a tape of filter paper on which airborne dust collects. The amount of particulate matter collected on a window of filter, over a short period of time, gives a measure of particulate concentration in the air. The five gas analysers, all apply standard techniques for determining the concentration, of different gaseous pollutants. The instruments might look the same but, inside, very different techniques are applied. Here UV fluorescence is used for measuring sulphur dioxide. This single study will generate a great deal of data on air quality, right across the Vlissingen area. But even the most accurate data, will still be raw. How will the information be used, to determine the impact of shipping on local air quality. Having established how much pollution to expect from a particular kind of ship, as it manoeuvres its way through differing conditions of speed and weather, and through the various complex motions needed to get the vessel in or out of port, they could finally address the question they first started with. How significant are these emissions. Gillian Reynolds worked on the project for five years. We went back to find out.

Gillian Reynolds

When we last spoke in Vlissingen we were undertaking, a local quantification exercise to look at the impact of emissions on Vlissingen. We found that passing ship traffic, didn't really cause a significant pollution problem, that is in Vlissingen, but when one looks at busy harbours, there can be a significant impact from shipping on the local air quality. We then developed that methodology, and looked at the impact of shipping emissions on the whole of the, or from the whole of the North East Atlantic on North West Europe. From that work, it was apparent that, oxides of nitrogen, and sulphur dioxide emissions, were particularly significant from shipping, of the order of magnitude of the annual emissions from the UK or France. Other components such as hydrocarbons and carbon monoxide, really were negligible.