Chapter 6
Some Special Problems

Unlike some industries, such as coal mining, some types of chemical manufacturing, cotton spinning and rubber processing, which produce the classic diseases of occupation, there are no specific occupational diseases associated with the offshore industry at present. However there are a number of conditions which seem to be particularly common or are related to particular aspects of the industry, and which therefore qualify for special consideration in any account of this subject.

Hydrogen Sulphide

Hydrogen sulphide occurs in so called ‘sour gas’ in varying concentrations but some, in certain parts of the North Sea, is about 500 parts per million (ppm), for example. It only becomes a problem, of course, if it is allowed to escape, when it can be rapidly fatal. Asphyxia occurs at concentrations above 10 ppm and sudden collapse at 600 ppm. It is detectable by the human nose in concentrations of 0.3 ppm. In normal gas production there is normally no leakage of this gas, though at sour gas processing plants a slight smell of hydrogen sulphide is usually detectable. Continuous monitoring for hydrogen sulphide is necessary, with an automatic warning system which activates when the concentration rises above 5 ppm.

During exploration or development drilling in known natural gas reserves, hydrogen sulphide may be inadvertently encountered and uncontrolled release of this material is more likely to occur. In these circumstances, all the workers on a rig may need to wear respirators and they must be medically fit to do so. The theoretical risk of H₂S entering the respiratory tract through a perforated tympanic membrane (Poda 1966) is no longer considered feasible and potentially exposed workers do not need to be specially examined to ensure that their tympanic membranes are intact.

Hydrogen sulphide is an acute poison which, in concentrations of 600 ppm, may cause sudden asphyxia with collapse, followed by coma and rapidly fatal consequences. At lower concentrations, the eyes become irritated and there is blurring of vision with lachrymation, photophobia and keratitis. As mentioned earlier, the characteristic smell of hydrogen sulphide is detectable in very small concentrations, as low as 0.3 ppm. As the concentration increases, the odour becomes sweeter and more penetrating up to a concentration of 20 - 30 ppm, but over this concentration olfactory fatigue sets in and the gas may be undetectable. There are no known chronic effects from repeated or continuous inhalation of hydrogen sulphide in low concentrations.

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It has recently been pointed out that hydrogen sulphide can be generated in the stagnant water which accumulates in oil storage reservoirs and oil water separators, and also in the legs of offshore platforms and semi-submersibles where there is stagnant sea water. The hydrogen sulphide in these sites is produced by the action of sulphate-reducing bacteria, from the sulphates present in sea water. In stagnant conditions, the aerobic bacteria which are normally present are no longer able to grow, but sulphate-reducing bacteria which metabolise sulphate instead of oxygen can survive, producing hydrogen sulphide and other products. The atmosphere directly above the stagnant water will contain hydrogen sulphide at dangerous levels, and great care must be taken when such areas are entered or opened.

Respirators must be worn in concentrations of 10 ppm.

**Methane**

Methane is the principal constituent of natural gas, in which its concentration is approximately 85%. It is non-toxic, but it will of course produce anoxia if its concentration rises sufficiently high to reduce the partial pressure of oxygen below 150 millimetres of mercury. Treatment of anyone overcome by methane is artificial respiration and the administration of oxygen. Methane can produce an explosive mixture with air, and there is a high risk of fire.

**Methanol**

Methanol is used in gas production to prevent the formation of hydrates in the system, as they could block the pipelines by forming frozen condensates when they mix with water. For practical purposes, methanol is only toxic if ingested. It is known that methanol can be inhaled above its theoretical limit value of 200 ppm without causing illness or discomfort. It cannot be inhaled in sufficiently high quantities to be a toxic hazard via the respiratory route and it is not, in normal usage, absorbed through the skin. Therefore in the offshore situation the toxic effects of methanol are unlikely to be encountered, and those people handling it can be reassured that they are not exposed to any risk in spite of the fact that methanol, when ingested, is highly toxic.

**Ethylene Glycol**

This is used to absorb water during gas production and like methanol is only toxic, in practice, when ingested. Although the mean lethal dose for an adult is in the region of 100 ml, ethylene glycol is never likely to be ingested in the course of its normal use in gas production processes. It has a low vapour pressure and so does not reach high atmospheric levels. There is no significant absorption through the skin.