


MATERIALS IN CONTACT WITH WATER INTENDED FOR DRINKING AND OTHER DOMESTIC PURPOSES	
INFORMATION FOR	MANUFACTURERS WRAS APPROVAL APPLICANTS PLUMBING SYSTEM SPECIFIERS & USERS
	WATER QUALITY EFFECTS OF NON-METALLIC MATERIALS IN FLEXIBLE HOSES AND WATER FITTING COMPONENTS

Some non-metallic materials (including natural and synthetic rubbers and a few plastics) are unsuitable for use with wholesome water, because they support extensive microbial growth, impart a very strong, unpleasant, taste and odour or release toxic substances to the drinking water.

EARLIER ADVICE FROM WRAS ABOUT EPDM HOSES

In January 2006 WRAS issued advice concerning the effects on water quality of flexible rubber hoses made from EPDM (ethylene propylene diene monomer), a common polymer which is the basis of many rubber materials used in contact with drinking water. It was never intended to imply that the concerns about effects on water quality associated with these hoses were directly associated with EPDM itself, nor were they applicable to other EPDM rubber components used within drinking water systems, such as "O" seals, valve diaphragms or tap washers.

THE CAUSE OF CONCERN

Concerns had been raised by hose and tap manufacturers, health authorities, scientists and plumbing installers regarding the effects of the materials used for some flexible hoses on the quality of water intended for drinking or other domestic purposes. The concerns include the possibility that these materials may encourage the growth of bacteria which can be harmful to health, especially the Legionella bacterium which causes Legionnaires' disease.

Legionnaires' disease is an opportunistic infection of the lung caused primarily by inhaling Legionella bacteria contained in fine water droplets or aerosols. It can be fatal, particularly amongst hospitalised patients who are aged or immuno-compromised. Most reported cases of Legionnaires' disease are associated with water systems in large buildings where temperature and flow patterns allow the bacteria to multiply. These conditions may be found in under-used taps and showers.

Conditions which may favour the growth of Legionella are well documented in the Health and Safety Executive's Approved Code of Practice and Guidance L8, (Legionnaires' disease: The control of legionella bacteria in water systems). These conditions include the leaching of chemicals from plumbing materials in contact with water. The chemicals can be used by bacteria as nutrients for their growth. Bacteria can form biofilms (microbial 'slime') on the material surfaces in contact with the water, and the biofilm can harbour Legionella.

FLEXIBLE HOSES

Evidence from scientific investigations of the occurrence of the Legionella bacterium in hospitals had shown that some flexible hoses used to connect washbasin taps to plumbing systems were heavily infected with biofilm which included the Legionella bacteria. Attempts to disinfect the plumbing systems may have been hampered because microscopic examination showed that the inner surface of these hoses were roughened and pitted. This was thought to have occurred during the manufacture of the hoses by extrusion of the raw material. The rough inner surfaces and the pits provide ideal places for bacteria to attach and form biofilm and evade attempts at disinfection.

OTHER COMPONENTS

Following an outbreak of Legionnaires disease in the 1980s associated with the use of non-WRAS approved "O" seals, a whole range of "O" seals were developed, mainly from EPDM but also from nitrile rubber. By testing using British Standard BS 6920 (see below) these were shown not to

encourage general microbiological growth or the growth of *Pseudomonas* bacteria in contact with drinking water and, in other tests, did not support the growth of *Legionella* bacteria. These "O" seals were approved by the water industry approval schemes which were the predecessors to WRAS.

Since the original 1980s outbreak involving a non-approved rubber, there have been no further published incidents associated with "O" seals. All WRAS approved "O" seals have been shown by testing that they do not encourage microbial growth.

EFFECTS OF ADDITIVES AND TREATMENTS

Tests have shown that most types of synthetic rubber formulations can result in some increased biofilm formation due to the leaching of nutrients. However, where adverse effects have been detected with these materials, they are usually associated with particular additives to the basic polymeric material, such as fillers, plasticisers, processing oils or mould release agents. For any specific rubber formulation the effects on water quality will also be influenced by the method of manufacture and post-cure treatment or storage. These may help to remove the traces of organic chemicals which otherwise could encourage bacterial growth when the components are placed in water. For example, heating the components for a period of time could drive out more of the organic chemicals remaining after manufacturer. Differences may also result between components stored at room temperature in open air and in closed containers. These beneficial effects are more readily achieved with smaller components and those which are more open to the air than hoses, because the organic chemicals cannot so easily escape from the inside of a length of hose.

THE REGULATORY STATUS

The Water Supply (Water Fittings) Regulations 1999 (in England and Wales), the Scottish Water Byelaws (2004) and the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009, collectively referred to as "the Regulations", apply to all plumbing systems in the UK which receive or convey water supplied by a public water supplier. The Regulations require that materials in contact with water intended for domestic purposes (which includes drinking, cooking, bathing, washing) shall not contaminate the water. The Government Guidance¹ to the Regulations states that to meet this requirement, all non-metallic materials should comply with BS6920: "Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water".

THE LEGAL REQUIREMENT

It is a legal requirement that flexible hoses are assessed by a competent laboratory for their compliance with BS6920: Parts 1 to 3. These tests assess the likelihood of the material being able to support microbiological growth and leach chemicals into the water with which they are in contact – chemicals which might either act as nutrients for bacteria, cause an adverse effect on the aesthetic qualities of the water (e.g. give it taste, odour, colour or turbidity) or be toxic to humans.

Installers (plumbers) and Users (building managers) of water fittings are liable to prosecution for non-compliance with the Regulations. It is essential that unsuitable hoses are not used in wholesome water systems. Under the Regulations and Health and Safety legislation, the safeguard against prosecution for the use of unsuitable fittings leading to harmful effects on health is to insist on the use of fittings which have been assessed and shown to be satisfactory.

COMPLIANCE & CONTROLS

One widely used assessment system is the WRAS Approval Scheme, in which manufacturers voluntarily submit water fittings and materials for assessment of their compliance with the regulations. The Scheme assesses the results of tests on products and where they are satisfactory, issues a unique approval number for them. Approved products are listed in the WRAS Water Fittings and Materials Directory. This is used widely by fittings specifiers, installers and Water Suppliers' inspectors to verify

¹ Guidance Document relating to Schedules 1 and 2 of the Water Supply (Water Fittings) Regulations 1999, Defra, available on the website <http://www.defra.gov.uk/environment/water/industry/wsregs99/guide>

that the fittings comply with the requirements of the regulations. The Directory is freely available on the internet via the WRAS website (www.wras.co.uk/directory).

Approvals for flexible hoses lined with EPDM rubber are given in Section 1863 of the Directory. The product entry in the Directory includes a description of the nature and location of the marking which the manufacturer has used on the product, which may be useful in identifying that a particular fitting found in service is a WRAS Approved product. However, because of the limited availability of space on the products for marking, identification can be difficult. There are also examples where unscrupulous manufacturers of poor quality hoses have copied the marking of products in attempts at counterfeiting.

As well as choosing approved products from the Water Fittings and Materials Directory, specifiers and installers are therefore advised to ensure that they purchase approved water fittings from a supplier recognised by the manufacturer and, if necessary, to ask the supplier for evidence of orders and invoices showing that the products supplied have come from the approved manufacturer.

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