

Confidential

Tireless problem

Location of problem: The defect is at the junction where a narrow pipe from the pressuriser joins the main wider pipe of the primary circuit. This is close to the reactor pressure vessel and there are no isolation valves between the pressure vessel and this junction.

Nature of problem: There are two cracks on either side of the pressuriser pipe where it joins the main pipe. The two cracks are 180 degrees apart on the pressuriser pipe. These cracks extend to the main pipe and may have originated in the main pipe.

Cause: The effect of thermal ageing on the junction. The main pipe expands in all directions but primarily from end to end. The narrower pressuriser pipe expands around its circumference. The tensions caused by the pipes expanding in different ways has probably caused the cracks. Fluctuation of the pressure/temperature in the circuit thus leads to cracking. The development of this problem will vary between submarines, taking account of ageing, the cycles the reactor has been through and the particular way individual submarines have been operated. The problem has appeared first on HMS Tireless because there was a poor quality repair carried out on it earlier.

Initial diagnosis: The fault had been assumed to be a horizontal crack along the weld, because of the way the steam was seen on a video at the time of the incident. In fact the crack is vertical. It is now likely that the crack may not have originated in the weld but in the main pipe.

Submarines affected: The radiological records of this pressuriser junction on other submarines are being assessed. Signs of the problem have been found on four of the six Trafalgar class submarines in addition to HMS Tireless.

Repair work: The lead repair will be carried out on a submarine in Devonport, probably HMS Torbay. The reactor on HMS Tireless will be repaired after this and so there will be a delay of around five months, till May 2001, in the completion of the repair to HMS Tireless.

Original repair plan for Tireless: The plan approved by the Gibraltar and Spanish governments was drawn up to deal with a horizontal crack in a weld. It involved removing part of the pressuriser pipe and the weld, but not part of the main pipe. This will no longer be adequate. The repair will now involve removing and replacing part of the main pipe.

Implications of repair: The original plan involved lowering the level of coolant water so that work could be carried out on the top part of the coolant pipe. This would be the height of the coolant above the fuel core. The full repair will now involve replacing a section of the main pipe and so draining the pipe, either to a low level, or completely. This will further reduce the height of the coolant above the fuel core. This will make any fluctuation in the stability of the submarine