

**Incident involving British nuclear powered submarine HMS Tireless
February 2013
Summary of information available as at 31 July 2013**

Identification of the leak and return to Devonport

On 17 February 2013 the Sunday Express newspaper reported that HMS Tireless, one of the Royal Navy's nuclear powered 'Trafalgar' class submarines, had experienced a leak from its reactor cooling system during an exercise off the west coast of Scotland earlier in the month (<http://bit.ly/ZC9J1N>). The leak was discovered on 4 February when an alarm was triggered indicating a higher than background level of radiation in the reactor compartment. The submarine then proceeded to its home port at HM Naval Base Devonport in the south west of England, arriving on 6 February. The submarine almost certainly returned to Devonport by travelling through the Irish Sea – the most direct route between the two bases. Neither Devon and Cornwall Police nor Plymouth City Council were informed of the submarine's arrival at Devonport for emergency planning purposes, although Plymouth City Council's Civil Protection Unit was informed by telephone that the submarine would be berthing under a protocol under which the Council is informed of any Naval activity that may result in public or media interest, and informed that the submarine posed no risk to public safety.

The Royal Navy and Ministry of Defence have kept their statements about the incident to a minimum, although it has given short answers to a number of Parliamentary Questions which have been tabled by Members of Parliament on the matter (see annex). Philip Dunne, Minister for Defence Equipment, Support, and Technology, stated: “The recent coolant leak onboard HMS Tireless was a very small quantity and was caused by a very small defect in a system within the sealed reactor compartment of the submarine. There was no risk to the public, environment or the crew” (<http://bit.ly/VBOdrG>). The Minister did not comment on whether the submarine travelled through the Irish Sea to Devonport, saying only that: “The submarine was in international or UK territorial waters throughout her journey to Devonport, where there is a specialist submarine maintenance facility. There was no requirement to engage with or to inform the Government of the Republic of Ireland” (<http://bit.ly/12s3ZcE>).

At Devonport

After the submarine arrived at Devonport on 6 February the reactor was shut down to allow a reactor compartment entry and during a reactor compartment inspection on 7 February a leak was visually identified. According to a Parliamentary written answer, the duration from the initial report of the problem to the cessation of the leak was approximately 192 hours, suggesting that the leak finally stopped on 12 February, several days after the submarine berthed at Devonport. According to local sources, repair work on the submarine was undertaken by workers from Rosyth naval dockyard, rather than Devonport itself.

Permission was given by the Defence Nuclear Safety Regulator (DNSR) for a radioactive discharge to be made from the submarine, and it appears that this discharge may have occurred to the atmosphere when the reactor compartment was ventilated. The Ministry of Defence has refused to say which radioisotopes were released as a result of the leak, but the reactor cooling circuit is likely to have been dominated by a few radiologically significant nuclides, including H-3, N-13, N-16, F-18, Na-24 and Cl-38. The most significant radionuclide vented would probably have been tritium (H-3) with its 12.3 year half life. It is not clear where exactly the discharge took place, but the

timing of regulatory permissions suggests that it occurred when the submarine was berthed at Devonport. No information is available as to whether the discharge took place at a time or under weather conditions that would have minimised risks to residents living near the dockyard.

According to Ministers, no liquids associated with the leak were offloaded at Devonport or discharged at sea. On return to Devonport the reactor compartment was surveyed and a small amount of dry surface radioactive contamination was detected in the vicinity of the leak. The area was cleaned following standard nuclear procedures and solid wastes arising from the cleaning and subsequent repair work were removed in accordance with normal waste disposal procedures. No members of the crew were exposed to additional or unexpected doses of radiation during the incident.

DNSR has stated that it was “involved in all stages following the initial discovery of the leak in line with its role as regulator of nuclear and radiological safety of the UK's Naval Nuclear Propulsion Programme”. Ministers have said that an investigation into the incident by DNSR is considered unnecessary as the Naval Reactor Plant Authorisee (NRPA) is required to thoroughly investigate such matters, but have stopped short of undertaking to release the NRPA report when it has been completed.

Repair work and return to service

On the basis of the very limited information available about the incident, it appears that pipework in the submarine's reactor cooling system – most likely a subsidiary section of pipework, such as the residual heat transfer line, rather than the main cooling circuit - experienced a leak. If the leak was in the main circuit the incident would potentially have been more serious, possibly representing a 'leak before breakage'. A leak before breakage is a small creeping leak in pipework which, if left unchecked, will gradually expand and eventually break, resulting in a catastrophic failure of the cooling system. Operating the submarine under such circumstances obviously poses a risk that such a failure will occur, leading to a reactor accident.

In response to questions about repair work to the submarine, the Ministry of Defence has to date stated that it is too early to confirm the cost of repairs. The work has now been completed and the costs are likely to amount to work with the value of several million pounds. *Tireless* set sail from Devonport at the beginning of July on a three-month overseas deployment, berthing in Gibraltar on 15 July.

HMS *Tireless* was launched in 1984 and, as the oldest of the Navy's submarines currently in service, is close to the end of its life. In May 2000 the submarine was stranded in Gibraltar for 12 months while work was undertaken to repair cracks in pipework of the reactor cooling system. It is not known whether the current problem is similar to or related to the pipework cracking which occurred in 2000, nor whether it is likely to be a generic problem affecting the Royal Navy's other 'Trafalgar' class submarines. Ministers have stated: “The impact of this defect on other submarines has been fully considered and, accordingly, it is not deemed necessary to carry out additional maintenance or inspections as a result”. Immediately after the leak was detected, Navy Command Headquarters briefed Ministers that “there is nothing to indicate at this stage that the current issue is related” to the Gibraltar problems.

On 17 January, in answer to a Parliamentary question, Philip Dunne revealed that the net book value of HMS *Tireless* was only £10 million, significantly lower than the value of other Trafalgar class vessels, because the submarine has a limited remaining service life (<http://tinyurl.com/q65df2t>). The Ministry of Defence has recently announced that the submarine will retire from service in 2014

(<http://tinyurl.com/pdz31f9>). Because of delays in introducing 'Astute' class submarines into service, the Navy intends to retain 'Trafalgar' class vessels in service for longer than originally planned in order to be able to meet its operational requirements. The Ministry has evidently judged that the operational imperative warrants repairing Tireless and that the age of the reactor fuel and the condition and integrity of the hull are sufficiently adequate for the submarine to continue in service for a limited period.

Timeline

- 18 June 2012: Permission given for HMS Tireless to enter dock at Devonport for Long Assistance Maintenance Period (Docking) (LAMP(D))
- 14 January ? Tireless sets sail from Devonport
Basic Operational Sea Training off west coast of Scotland
- 25 January: At Faslane
- 26 January: Sets sail again
- 4 February: Leak detected (Hansard 4 March)
(first notification to Defence Nuclear Safety Regulator at 14.26)
- 5 February: Ministers informed (Hansard 15 April)
- 6 February: Arrives Plymouth at approximately 14.00
Berths at Devonport 8 Wharf North.
? Reactor shut down.
- 7 February: Visual inspection of reactor compartment.
DNSR issues consent for radioactive discharge.
- 8 February ? Reactor compartment ventilated to allow physical inspection.
- 12 February ? Leak stops after 192 hours.
- 15 February: Defensive news briefing on the incident prepared by MoD:
'Primary Coolant Leak within HMS Tireless'
- 17 February: First news report about the incident appears in Sunday Express
- 21 February: Two star review meeting on implications of the incident within MoD.
- 19 June: Ministers confirm HMS Tireless will return to service in response to a Parliamentary Question.
- 9 July: Tireless leaves Devonport.
- 15 July: Tireless berths at Gibraltar.

Annex: Parliamentary answers relating to HMS Tireless

1 Mar 2013: Column 718W

HMS Tireless

Angus Robertson: To ask the Secretary of State for Defence (1) what the cause was of the reactor coolant leak on board HMS Tireless; what the expected duration and cost is of repairs to that submarine; what steps have been taken to establish whether similar faults may occur on other Royal Navy submarines; what effect the loss of HMS Tireless from service will have on the UK's Tomahawk Land Attack Missile launch capability; and if he will make a statement; [145149]

(2) what investigations the Defence Nuclear Safety Regulator has made into the reactor coolant leak on board HMS Tireless; and if he will place a copy of the Regulator's report in the Library. [145150]

Mr Dunne [holding answer 28 February 2013]: The recent coolant leak onboard HMS Tireless was a very small quantity and was caused by a very small defect in a system within the sealed reactor compartment of the submarine. There was no risk to the public, environment or the crew. As repair plans are currently being developed, it is too early to confirm the duration or cost of such repairs. The impact of this defect on other submarines has been fully considered and, accordingly, it is not deemed necessary to carry out additional maintenance or inspections as a result.

The Defence Nuclear Safety Regulator (DNSR) requires the Naval Reactor Plant Authorisee to investigate thoroughly incidents of this nature. Given this investigation, a further investigation by the DNSR is considered unnecessary in this instance.

I cannot comment on Tomahawk Land Attack Missile launch capability as the disclosure of this information would, or would be likely to, prejudice the capability, effectiveness or security of our armed forces.

4 Mar 2013 : Column 846W

HMS Tireless

Paul Flynn: To ask the Secretary of State for Defence when the leak from the reactor on HMS Tireless was first discovered; for what reasons the submarine was

4 Mar 2013 : Column 847W

moved through the Irish sea to Devonport from off the west coast of Scotland after discovery of the leak; whether the Government of the Republic of Ireland was informed of the problem with the submarine; what steps have been taken to rectify the problem at Devonport docks; and what estimate he has made of the cost of repairs. [145329]

Mr Dunne: A very small coolant leak, contained within the sealed reactor compartment onboard HMS Tireless, was discovered on 4 February 2013. This presents no safety risk to members of the public, the environment or the crew.

The submarine was in international or UK territorial waters throughout her journey to Devonport, where there is a specialist submarine maintenance facility. There was no requirement to engage with or to inform the Government of the Republic of Ireland.

Repair plans are being developed and it is too early to confirm the detail or cost.

18 Mar 2013 : Column 438W

HMS Tireless

Angus Robertson: To ask the Secretary of State for Defence pursuant to the answer of 1 March 2013, *Official Report*, column 718W, on HMS Tireless, if he will place in the Library a copy of the report of the investigation into the recent coolant leak from the reactor of HMS Tireless conducted by the Naval Reactor Plant Authorisee. [148321]

Mr Dunne: The investigation into the recent coolant leak on HMS Tireless remains under way.

15 Apr 2013 : Column 59W

HMS Tireless

Paul Flynn: To ask the Secretary of State for Defence pursuant to his answer of 4 March 2013, *Official Report*, column 846W, on HMS Tireless, on what date Ministers in his Department were informed of problems with the nuclear reactor cooling system on HMS Tireless; whether the incident was categorised as an abnormal event with the potential to challenge a nuclear safety system; and whether any of the submarine's crew members were exposed to additional, unexpected doses of radiation as a result of the incident. [151077]

Mr Dunne: The very small coolant leak, which was wholly contained within HMS Tireless' sealed reactor compartment, was not categorised as an abnormal event with the potential to challenge a nuclear safety system because the operating philosophy, design and safety justification for the reactor plant allows for safe management in such cases.

No members of the crew were exposed to additional or unexpected doses of radiation. As soon as the facts related to the incident had been established and assessed by the relevant Ministry of Defence authorities, Ministers were notified on 5 February 2013.

14 May 2013 : Column 152W

HMS Tireless

Paul Flynn: To ask the Secretary of State for Defence with reference to the answer of 15 April 2013, *Official Report*, column 59, on HMS Tireless, what the duration of the leak was in hours and minutes; what the volume of the lost coolant was; whether the reactor closed down or tripped as soon as the leak occurred; whether such a leak automatically closes down or trips the reactor in this class of submarine; whether the leak has been investigated to ascertain if the reactor was in operation for any length of time before the leak was discovered; when a radiological analysis of the leaked coolant was carried out or estimated; what the radiological inventory of the leaked coolant was; what clean-up action was required inside the submarine as a result of

14 May 2013 : Column 153W

the leak; whether any radioactively contaminated solids or liquids were off-loaded at Devonport; and whether any of the leaked radioactively contaminated coolant was discharged to sea. [154050]

Mr Dunne [*holding answer 13 May 2013*]: The duration from the initial report of the problem to

the cessation of the leak was approximately 192 hours, throughout which normal radiological monitoring of the reactor compartment was conducted.

Although the extremely sensitive radioactivity monitors indicated that elevated levels of airborne radioactivity had been detected, the coolant leak was not sufficient to produce a measurable quantity of liquid or affect the normal operation of the reactor, which was in operation throughout.

On return to Devonport the reactor compartment was surveyed and a small amount of dry surface radioactive contamination was detected in the vicinity of the leak. The area was cleaned, following standard nuclear procedures, after which no further surface contamination was detected.

No liquids associated with the leak were offloaded at Devonport or discharged at sea, and solid wastes arising from the cleaning and subsequent repair work have been removed in accordance with normal waste disposal procedures.

I am withholding the information regarding the details of the radiological inventory as its disclosure would, or would be likely to prejudice the capability, effectiveness or security of the armed forces.

17 Jun 2013 : Column 497W

HMS Tireless

Mr Godsiff: To ask the Secretary of State for Defence what steps his Department has taken to prevent further leaks of coolant from HMS Tireless; and if he will take steps to ensure that replacement submarines are constructed in such a way as to ensure that such leaks cannot occur. [157693]

Mr Dunne: The defect investigation into the recent leak of a very small quantity of coolant on HMS Tireless and the consequent repairs have both now been completed.

The designs of Naval nuclear reactor plants are informed by lessons from earlier designs, including experience of any in-service defects. Such lessons are applied wherever practicable, including on submarines that are either being built or designed.

Paul Flynn: To ask the Secretary of State for Defence what regulatory permissions have been issued by the Defence Nuclear Safety Regulator in regards to HMS Tireless since its reactor coolant leak was identified; and if he will place copies of any such permissions in the Library. [159820]

Mr Dunne: The Defence Nuclear Safety Regulator has permissioned three activities related to the coolant leak in HMS Tireless:

permission to vent the reactor compartment to atmosphere external to the submarine;

permission to conduct repairs at Her Majesty's Naval Base Devonport; and

permission for continued operation of HMS Tireless following completion of repairs.

The documents incorporating these permissions are being redacted and will be placed in the Library of the House as soon as they are available.

19 Jun 2013 : Column 719W

HMS Tireless

Paul Flynn: To ask the Secretary of State for Defence (1) whether any radioactive emissions were vented to the atmosphere following the recent reactor coolant leak of HMS Tireless; where such

releases were emitted; when they took place; and what quantities of radioactivity was released; [159821]

(2) where and when the reactor of HMS Tireless was shut down following its recent reactor coolant leak; [159822]

(3) with reference to the answer to the hon. Member for Moray of 1 March 2013, *Official Report*, column 718W, on HMS Tireless, what the expected duration and cost of repairs to HMS Tireless is; and whether a decision has yet been made as to whether the submarine will remain in service following the recent reactor coolant leak. [159823]

Mr Dunne: The reactor in HMS Tireless was shut down on her return to Her Majesty's Naval Base Devonport to allow investigations to be carried out and repair plans to be developed. Laboratory tests confirmed that the level of airborne radioactivity in the reactor compartment was well within the normal permitted

19 Jun 2013 : Column 720W

limits for discharges to the environment. Following regulatory approval, normal alongside reactor compartment ventilation was resumed.

Repairs to HMS Tireless have now been completed and she will return to operational service in due course. It is too early to confirm what the final cost of the repairs will be.

2 July 2013 : Column 608W

Nuclear Submarines

Paul Flynn: To ask the Secretary of State for Defence pursuant to the answer of 19 June 2013, *Official Report*, column 719W on HMS Tireless, on how many occasions radioactive emissions were vented to the atmosphere from nuclear powered submarines at Devonport Dockyard in each of the last five years; what quantity of radioactivity and which radionuclides were emitted in such fashion in each of the last three years; what the permitted levels of discharge are under such circumstances; and which regulatory agency sets such limits. [162431]

Mr Dunne: I will write to the hon. Member with the information requested.