

Memorandum

Large
and
ASSOCIATES

Consulting Engineers

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To: **Liz Clachan** Naval Service FOI Coordination Cell M3185-A19

From: **John H Large** 16 November 2009

Cc: David Hoadley - SCANS
M Hancock - Member for Plymouth South
Rt Hon J Denham - Member for Southampton Itchen
A Whitehead – Member for Southampton Test

Subject: **SOTONSAFE – SCANS**

Large & Associates has been further instructed by SCANS¹ to provide a Briefing Note on the potential radiological environment in the local vicinity of *Berth 38/39* at Southampton in the aftermath of a LOCA-based incident to a submarine nuclear propulsion plant.

The L&A assessment is to include and take account of the weather and atmospheric stability conditions prevalent during the week, as example, of the receipt of the SCANS instruction (8 to 14 November 2009); the effectiveness of the pre-prepared countermeasures described in *V4 SotonSafe*; and the assessment is to extend to the ground area out to approximately 1000m distance from the berth, that is including within the assessment the National Oceanography Centre located in the Eastern Dock Area.

During the public meeting of 4 November 2009 at Southampton City Council, the RN Commander present most generously invited L&A to write reiterating the requests made at the meeting by L&A and SCANS members. Rather than go over the detailed request again,² I ask if the Commander and the accompanying Ministry of Defence official will now provide the information requested at the meeting, particularly in the context of our Briefing Note assessment referred to above.

The general areas of information sought at the meeting were as follows:

- 1) The complete end-of-core-life fuel core radionuclide inventory for each submarine class (PWR1 and PWR2 nuclear plant), together with the previous power history - if the *Core H* inventory is not to be made available then L&A will assume that the USN S9G core inventory will be sufficiently similar to Core H of PWR2 for adoption in the L&A assessment;
- 2) details of any restrictions in place related to *item 1*) above that would prohibit the use of the Southampton Z-berth at and above specified levels of the fuel core inventory and/or its power history;

¹ See <http://www.largeassociates.com/3185%20SOTONSAFE/SCANS%20INSTRUCTION%20%2012-11.eml>
² SCANS are able to provide a verbatim record of these requests or such should be available from the minutes taken by SCC secretariat throughout the meeting.

- 3) the beyond-containment (either as a direct breach of the hull or via bypass) *Release Fractions* assumed for both PWR1 and PWR2 nuclear plant fuel cores applied to *item 1*), for each of the categories of fission products in the form of i) aerosols, ii) noble gases and iii) gaseous iodine (as identified by FLEET/585/1 of 30 October 2009);
- 4) the above waterline γ shine gamma attenuation coefficient (μ) for the exposed section of the submarine hull and casing, assuming the appropriate degradation of internal shielding layers as a result of the temperature environment within the reactor compartment; and
- 5) as for *item 4*) but to within the boat manned spaces via the fore-aft bulkheads of the reactor compartment, assuming ECCS and diesel tanks, or whatever, are emptied during the active phase of the incident.

More generally, the Commander offered to provide further information relating to:

- 6) his claim that the surety of containment (and bypass) leakage rates for *Astute* and *Vanguard* classes were such that the maximum leakage and leakage rate to the atmospheric environment would not result in a public sector radiological consequence exceeding that predicted for the worst case (*Category 2 Trafalgar (Swiftsure)*) incident;
- 7) relating to *item 6*), during and following the HIRE LOCA incident the reactor compartment pressure transients (and peaks), again for *Astute*, *Vanguard* and *Trafalgar* class nuclear plant and RC layouts and volume:
 - i) the initial pressure transient within the RC resulting from the rapid depressurisation of the reactor primary circuit via a LOCA at an unisolable section of the RPC (eg at the same locality as the year 2000 *Tireless* fault at the pressurizer pipe/RPC junction);
 - ii) the second transient at the flashover or boiling off of the residual coolant remaining in the RPV below the ports;
 - iii) the following transient generated by the fuel mass (radio)active decay heat rate exceeding the hull heat dissipation capability; and
 - iv) further transients arising from a) hydrogen release; b) a metal-steam explosion via pressure suppressed boiling, and c) rupture of the secondary circuit barrier (ie in the steam generators).

In your response it would be helpful if you refer to my order of itemisation above.

Please note SCANS are to copy this request for further information to the local constituency Members of Parliament the Rt Hon John Denham and Alan Whitehead, and also to William Hancock (Member for Portsmouth South) who has expressed a recent interest in this matter. Accordingly, it would be appropriate for your response also to be copied to these individual Members of Parliament.