

SOTONSAFE

A BRIEF REVIEW OF THE

OFF-SITE EMERGENCY PLANNING MEASURES

RELATING TO THE

BERTHING ROYAL NAVY NUCLEAR POWERED

SUBMARINES AT SOUTHAMPTON

PAPER SUPPLEMENTING THE PRESENTATION
TO
SOUTHAMPTON CITY COUNCIL
OF
4 NOVEMBER 2009

CLIENT: SOLENT COALITION AGAINST NUCLEAR SHIPS

REPORT REF N° R3185-A2

1 ST ISSUE	REVISION N°	APPROVED	CURRENT ISSUE DATE
2 NOVEMBER 2008	R3185-A5-R6		3 NOVEMBER 2009

**BRIEF REVIEW OF THE
OFF-SITE EMERGENCY PLANNING MEASURES
RELATING TO THE
BERTHING ROYAL NAVY NUCLEAR POWERED SUBMARINES AT SOUTHAMPTON**

General Findings: I first reviewed the REPPIR off-site emergency arrangements in 2001, when REPPIR was originally introduced, and then later in May 2003 by which time Southampton City Council had established its first version of SotonSafe.

In 2001 I reported my overriding conclusion that because the Ministry of Defence (MoD) was not prepared to release crucial information for reasons of national security this, I considered, precluded Southampton City Council (SCC) being able to prepare a realistic and workable emergency plan. I concluded that SotonSafe would not achieve its purpose of practically mitigating the radiation exposure of members of public should a nuclear powered submarine incident occur at the Z-Berth, or while the vessel is in transit in the busy commercial shipping waters leading to and from the berth.

I found the MoD's nominated *Reference Accident* to be unrealistically moderate in damage severity and, particularly, in the amounts of radioactive release which, coupled with the MoD's refusal to release crucial projections of the radiation dose exposures to members of public in the residential and commercial areas nearby Southampton Docks, resulted in SotonSafe being then fundamentally flawed.

In 2003, at a time that SotonSafe had been bedded down for three years I found that a number of niggling wrinkles had been ironed-out and certain ambiguities addressed. However, overall, the fundamental problem of the MoD's reluctance to include a reasonable level of damage severity resulting in a realistic level of radioactive release, together with failure to publish meaningful radiation dose rate information remained and continued to undermine the achievement of any significant improvement in effectiveness of the emergency plan.

This latest involvement in SotonSafe for the *Solent Coalition Against Nuclear Ships* (SCANS) provided me with further opportunity to examine not only the present version of SotonSafe but also the reasoning as to why SCC considers it justified to reduce the pre-prepared emergency zone (CMZ) from the present 2km radius (which I consider to be wholly inadequate as it stands) down further to 1.5 km radius.¹

My main findings and concerns about the present and, particularly, the proposed amendment of SotonSafe are as follows:

Incident Severity: The MoD continues to downplay the damage severity, and hence the quality and quantity of radioactive release from a reasonably foreseeable incident involving the Z-berthed (etc) submarine, particularly in that:

- i) The MoD Hazard and Risk Evaluation (HIRE) excludes malicious acts (such as sabotage and acts of terrorism), acts of war, and events external to the nuclear plant which I assume includes malfunctioning (explosion, fire, etc) of any part or the whole of the considerable arsenal of conventional weaponry carried as a matter of course by nuclear powered submarines.
- ii) The refusal of the MoD to make public its projected radiation dose rates, from hull gamma shine and fission product release is unjustified on the basis that the “. . . *dose contour graphs contain classified information.* . . .” and, even more bizarre, that it considers for a submarine afloat that there are “. . . *no reasonably foreseeable routes that will result in a release to the water surrounding the submarine.*”

Dose Exposure: Obviously, to prepare the appropriate countermeasures to minimise the health harm (both short and long term) the radioactive release has to be defined in terms of its composition (radionuclide inventory), amount of radioactivity involved and released (the release fraction), and the timing and duration of the release have to be established for a number of viable incident scenarios. Once a radioactive release is underway, it is necessary to trigger an assessment of the extent of the dispersion of

¹ Full access to all of the correspondence, reports, Freedom of Information requests and responses, etc., is available at <http://www.largeassociates.com/cz3185.htm>

the radioactive cloud, its deposition and concentration and, from evaluation of these, implement countermeasures to minimise the radiation exposure to members of the public. However:

- The MoD refuses to publish its own analysis of the dispersion and deposition of any radioactive release from the submarine, nor will it provide any information whatsoever on the radiation dose rates and the projected exposures for its own personnel who have been instructed to participate in emergency actions and counteractions – these dose assessments have to be completed under *Regulation 14* of REPPiR.
- Moreover, the MoD is dismissive of the need of the other participating parties (including SCC, the other local authorities, the ambulance trust, police, etc) to comply with *Regulation 14* with the somewhat disingenuous remark that “. . . *It is the responsibility of each employer to identify the potential emergency exposures of their employees.* “.
- The point here is how can these other parties inform, reach agreement with, and train and resource a significant number of their employees (as required by *Regulation 14*) in the absence of the crucial radiation dose projections. Seemingly compromised in the absence of this information SCC, for example, has interpreted the MoD HIRE findings to mean that in no foreseeable incident scenario will any SCC employee be at risk of receiving any increment of dose whatsoever whilst undertaking SotonSafe duties.
 - The result of this somewhat artificial construct is that no SCC employee qualifies for and is subject to *Regulation 14*. The outcome is that since no employees have agreed to put themselves at risk of additional radiation exposure incurred whilst undertaking their duties in the CMZ, all employees will have to be withdrawn from the CMZ in any incident where the radiation release is greater than the nominal quantity (about 0.05% of the radioiodine inventory proffered by the MoD).
 - For the severe loss-of-coolant and the ‘explosive’ fuel meltdown scenario nominated in the MoD HIRE, I consider it more probable than not that the fission product release will exceed the 0.05% release fraction assumed by the MoD.
 - The inability of the participating parties to meet with a contingency (which I consider more probable than not) of a greater than nominal radioactive release renders SotonSafe an ineffectual emergency plan.

SotonSafe Implementation Anomalies: Accounting for the radiological environment in the aftermath of the incident throws up some anomalies, for example

- For those emergency services personnel that have in place a dose limitation system (that is the firefighters, unlike their emergency services colleagues the ambulance trust employees and the police who all seem to have a zero tolerance to radiation dose receipt), their effectiveness in the immediate area of the submarine might be impaired by the very high dose rates:
 - For example, stationed at 200m distance from the stricken submarine, from exposure of gamma shine alone a firefighter would exhaust his entire 20mSv incident dose (and then have to withdraw from the fireground) within 30 minutes.
 - Because the intense gamma shine rates inside and in close proximity to the submarine, ambulance personnel at zero dose tolerance could not participate in close (less than, say, 800m) rescue and immediate medical treatment activities, and firefighters are likely to completely exhaust their incident dose limit in the approach and recovery operation for a single incapacitated crew member. Recovery more than a few casualties of the 120 or so crew from in and around the submarine hull would be impracticable, if not impossible within the first few hours following the onset of the incident.
- On the other hand, because the MoD so cautiously limits the amount of fission product released from the reactor compartment containment to the atmosphere, participating employees may in advance of any incident be so beguiled by the promised absence of dose risk, believing that they are

not, individually and/or collectively at risk of radiation exposure. For example, in the CMZ environment beyond the hull gamma shine zone regime:

- By back calculating from the 1.5km radius zone, the amount of radio-iodine (I-131) assumed to be released is unjustifiably low at just 0.05% of the total I-131 inventory of the reactor core – a more realistic release fraction the gaseous iodine would be around few to 10% at least, and this would require, in the absence of any other fission product release (ie caesium, strontium, etc), the PITS prophylactic administration being extended out to 13 km from the incident centre.
- If the *World Health Organisation* intervention level to avert serious health consequences is adopted for neonates, children, adolescents, pregnant and nursing mothers (ie 10mSv), the PITS prophylactic countermeasure would need to be extended to a very much larger area (up to 40 or so km).
- However, some of the actions and resourcing included in SotonSafe suggest that there is the contingency to respond to an incident that has resulted in a significant radioactive release of particulate fission product, much greater than that suggested by the 0.05% I-131 aerosol release fraction. Examples of this apparent contradiction include:
 - The most recent Foxwater 09 exercise identifies a shortage of ‘body bags’ for contaminated patients being transferred into hospital but, according to the MoD HIRE these would never be needed because the release of particulate fission products in the worst case incident would be insignificant.
 - Similarly, the ambulance trust participants in Foxwater 09 note the inability to decontaminate stretcher bound casualties within the CMZ but do not seem to recognise that their own physical involvement with contaminated casualties would invariably result in their own dose exposure, to which ambulance trust employees have a zero tolerance.
 - Provisions are set down for decontamination areas following the incident, including vacuum sweeping and fire hosing, grass collection, soil removal, ploughing, tree felling and shrub removal and restricted access measures relating to the exposure rate and time that any individual might spend in such a contaminated area – all of this extends the fall-out of and contamination by fission products well beyond the ‘contained’ *Category 2* scenario postulated by the MoD.

Account of the PWR2 Nuclear Plant: The latest MoD HIRE assessment also includes for the later PWR2 naval propulsion reactor as well as the PWR1 nuclear plant adopted as the mainstay basis of the first editions of SotonSafe. The PWR2 is rated at about twice the power output of the PWR1 (130MWe vs 70MWe) and, importantly, its fuel *Core H* is expected to achieve a much higher irradiation level (ie burn-up) consistent with the aim of the core lasting out the entire submarine service life (30 years compared to 10 or so years for the *Core G* fitted in the PWR1 reactor).

- Put simply, the greater the power output and, particularly, the higher fuel core burn-up then the greater the radioactivity available for release in the form of fission products from the fuel - in this respect:
 - It would be a quite remarkable achievement that when the second generation PWR2 reactor was first included in the HIRE assessment, even with its much larger potential release fraction, it was still found to be justified (although not at all demonstrated publicly) that the pre-prepared countermeasures zone could be reduced from 2km to 1.5km radius.
 - That application of the PWR2 I-131 core inventory to the 1.5km PITS administration means that the very (if not unachievable) low 0.05% release fraction has had to be reduced to an even lower and, in my judgement, unachievable level for the larger PWR2 in-core radioiodine inventory.

Overall: SotonSafe is fundamentally flawed by

- By the failure of the MoD to provide adequate and meaningful information and data about the submarine incident severity, type and the timescales projected for its development.
- In justifying how it is possible to accept the inadequacy and, indeed, absence of the basic data and information necessary to put in place an effective emergency plan, there seems to be a underlying acceptance that if the Nuclear Installations Inspectorate (ie the civil nuclear safety regulator) is involved then the naval nuclear safety case (ie the basis of the HIRE) must be acceptable.
- If so, this is a fundamental misunderstanding of the role of the NII under REPPIR because it simply does not have the power to intervene in the nuclear safety case of the Navy's nuclear propulsion system – it is excluding from doing so by legislation, mutual defence agreements with the United States, and inter-agency memoranda of agreement – and, indeed, its individual inspectors may have been denied access to critical design features of the plant, particularly the highly enriched uranium *cermet* fuel system which is quite unlike any fuel used in the civil nuclear power programme.
- In this last respect, it may be that the HSE, via the involvement of its NII division, is itself not sufficiently informed to determine the potential severity of the incident and the quantities and rates of release of radioactive fission products from the melted fuel.
- On the basis that the containment surety of the PWR1 system could not be that much improved (ie it was and remains about as good as it could be), the introduction of the new PWR2 reactor, with its increased fuel core mass and greater irradiated fission product inventory, suggests that the CMZ should be increased rather than reduced in area.
- There is a responsibility and duty of care of SCC, irrespective of the advice it receives from the MoD and HSE, to satisfy itself that the SotonSafe emergency plan is adequate in all practicable respects – it appears not to have done so and, accordingly, the substantial change of reducing the CMZ should be referred back to the Council Cabinet.

In Finding: I conclude that the proposed revision of the SotonSafe off-site emergency plan reducing the pre-prepared planning zone from 2 to 1.5km radius to be a substantial and unjustified change and, as such, it should not be taken under Officers Delegated Powers but referred back to the Southampton City Council Cabinet for decision by Elected Members.

JOHN H LARGE
LARGE & ASSOCIATES
Consulting Engineers, London