



SAFETY ALERT

Parts A, B & C

Subject: Failing reinforced concrete roof slabs to Bulk Fuel Installation (BFI) pump-houses

Number: SA 2020/51

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Date of issue: 14th July 2020

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This Safety Alert is to be read by the following so appropriate action can be taken:

1. Heads of Establishment (HoE)
2. DIO Service Manager (or equivalent for non NGEC contracts)
3. DIO's Maintenance Management Organisations
4. Top Level Budget Holders

5. Others interested in the content of this Safety Alert might include:

TLB Infrastructure Branches, Prime Contractors, Private Finance Initiatives, Public-Private Partnership and other traditionally procured contracts, Project Managers, Estate Facility Managers and Property Managers with responsibility for MOD projects and Property Management Works Services (including the legacy work of EWCs/WSMs), Health & Safety Advisors

When it takes effect: Immediately

When it is due to expire: When updated or rescinded.

Health and Safety

This Safety Alert does not necessarily cover all aspects of the subject matter and readers should make themselves aware of other potential issues. Readers should also not rely on DIO Safety Alerts as their only means of becoming aware of safety issues, but they should consult widely across other media to maintain awareness.

Aim

1. To bring to the attention of appropriate persons that there is a potential risk of failing reinforced concrete (r.c) roof slabs to the pump-houses that serve aviation bulk fuel installations. A generic design from c.1960 provided r.c. roof slabs that had an excessive span/depth ratio and these slabs are now showing signs of distress with deflection and cracking apparent. There is a risk of collapse with the potential for serious injury, fatality or significant damage/rupture to the fuel pump-houses at these installations.

Introduction

2. Compliance with the contents of this Alert will enable compliance with the Health and Safety at Work etc Act 1974 and its subordinate Regulations.
3. The appropriate MOD officer shall arrange for the Maintenance Management Organisation (MMO) contractor to carry out actions in accordance with the alert.
4. Contractors and MMOs are to keep informed the establishment Health, Safety and Environmental Protection Adviser and 4Cs Duty Holder on behalf of the Head of Establishment regarding progress of actions required of this Safety Alert.
5. Any work required as a result of this Safety Alert must be carried out in accordance with JSP 375.
6. On MOD Establishments occupied by United States Visiting Forces (USVF), responsibility is jointly held by USVF and DIO (USF). At base level this jointly managed organisation is to take appropriate action to implement the contents of this Alert. Where the Alert contains procedures, which differ significantly from USVF practice DIO (USF) code of practice will be issued.

Background

7. Problems have been identified with the reinforced concrete (r.c) roof slabs over the pump-houses that serve bulk fuel installations (BFI) at some establishments. It is believed that the design dates from c.1960 and was used up to the mid-1990s for which the r.c. roof slabs have an excessive span/depth ratio, such that some of these are now noticeably sagging with cracking evident.
8. Span/depth ratios for r.c. slabs should typically be 20 and no more than 25 even at early 1980s standards, but with spans up to 10m and a reported slab thickness of just 250mm, the as-built span/depth ratio is 40. The ratio should also be based on "effective depth" (ie. depth of tension reinforcement below top of slab), which would be in the order of 210mm, making the as-built ratio as much as 48 for a 10m span. Sagging of some slabs has been reported and there is a risk of serious failure, such that the extent of the problem needs to be identified along with the causes, and appropriate action taken. Causes are likely to include a combination of long term creep due to excessive deflection and thermal effects.
9. Other than at operational airfields, the full extent of other similar BFI pump-houses is not known but may extend to other establishments that store fuel in bulk on this scale, including the overseas estate and PFI sites. Similarly, the extent of use of this generic design is also not yet known.

Requirement

10. In order to confirm the risk, all pump-house buildings that may be of the suspect design need to be identified. Further checks will be necessary to determine if unsafe situations prevail.
11. Temporary propping may be required where considered necessary to make safe in the short term.
12. An assessment of the causes will be required by survey, to inform the process to consider and develop a suitable solution(s), which may need to vary according to the findings for each site or building.

Part A

13. The DIO Service Manager (or equivalent), is advised to direct the Maintenance Management Organisation (MMO) to initiate the following tasks:
- a. Identify all current and former pump-houses serving BFIs on the MOD estate, both in the UK and worldwide. Some decommissioned pump-houses may still be in use for other functions, while there may be other buildings in the BFI vicinity of the same construction.
 - b. Report the type of construction of each pump-house building, advising if they have r.c. roof slabs and to confirm the spans and thicknesses of these slabs, along with the estimated year of construction. Also check other buildings in the BFI vicinity, eg. Ops rooms/offices.
 - c. By visual survey, report if any obvious defects are apparent, including sagging or cracking of the roof slab and any signs of water ingress.
 - d. It needs to be considered that some apparent sagging may have always existed because of how it was constructed in first place and for example, shutters may have sagged during the concrete pour.
 - e. For pump-houses with concrete roof slabs, check the site records for:
 - i. As-built drawings and any design calculations of the pump-house structures.
 - ii. Any reports arising from HFMST Task 258 or Spec 005 Tasks 582-585 under previous contracts, and what findings were reported.
 - iii. Findings arising from investigations undertaken in response to DIO Safety Alert SA 2019/01 for RAAC planks. Being concrete flat roofs, it is very possible that the pump-house roof slabs have already been included in the list for that Safety Alert, but it is not thought likely that these large span slabs would have been built from RAAC planks. Do not assume the RAAC data includes all these pump-houses.
 - iv. Any record of remedial works already having been undertaken on these pump-house structures.
 - f. Undertake a risk assessment (RA) to consider the continued use of each asset. Where the condition of the roof slab appears to present immediate safety concern, the need for restricted access must be considered by DIO and the HoE.
 - g. The need for temporary propping shall also be considered whether to allow continued access or to prevent potential failure. If propping is required, then due care shall be provided to ensure the slab is propped firmly but only to prevent further sagging, and not to try and push the slab back up to reduce the sag; as this may induce undesirable hogging in a slab that is not designed to have a central support, which could induce new cracking and bring a risk of failure or deterioration quicker than would otherwise occur. Creep of concrete is a long term process over years and cannot normally be reversed without extreme care or risk of further damage. Additionally, any temporary works should be designed and executed such that the required operability and maintainability of the assets within the pump room are accounted for.
 - h. For decommissioned pump-houses, consider preparation of a closure RA and demolish.
 - i. Collate information from all sites that have pump-houses with suspected structural issues, including but not limited to the asset location and identification, nature of the defect, source of the information and current status, to be reported by region and TLB.
14. The MMO is to notify the DIO Regional Delivery Safety Alerts Team (DIO-RDSafetyAlerts@mod.gov.uk) through their respective DIO Service Manager, identifying the location of any pump-house buildings with r.c slabs along with the findings from the initial investigations.
15. The information requested at paragraph 13 is required by [29 Oct 20](#) and will be reviewed on [2-3 Nov 20](#).

Part B

16. Findings from Part A will dictate how Part B proceeds.
 - a. If the suspect design does not repeat across several establishments, then solutions are to be developed by the respective regional MMO for the Contract applicable to the site concerned.
 - b. If the suspect design is found to repeat widely across the MOD estate, then it is considered likely that the current MMO for the four regional UK contracts would be best placed to lead and coordinate the way forward to develop a suitable solution(s).
 - c. In both of these cases, there shall be consultation with DIO TS E&C-Structures and the other incumbent MMOs for establishments where these pump-houses are found to exist, whether in the UK or overseas.
17. The DIO Service Manager (or equivalent), is advised to direct the Maintenance Management Organisation (MMO) to initiate the following tasks:
 - a. Engage a suitably experienced Chartered Structural or Civil Engineer to agree the way forward in agreement with DIO TS E&C-Structures.
 - b. As far as is reasonably practicable, determine the causes of the defects and consider the need for further surveys to ascertain the causes. Surveys may be of a specialist nature with monitoring, non-destructive testing (NDTs), intrusive sampling or possible coring. Coring should only be undertaken in a pre-planned manner with good reason and if considered necessary to provide a perceived benefit to the investigation. Liaison with the operating authority and AE Fuels will be required for any intrusive work.
 - c. Consider the extent of the problem, the causes and if a generic widespread solution can be utilised.
 - d. Undertake a risk assessment to consider the continued use of each asset, what measures are required to make the asset safe - for example no action, monitoring, possible repairs, permanent support or the need for roof replacement, demolition or other means to mitigate the risk of a catastrophic failure.
 - e. Develop suitable solutions for each pump-house roof slab that requires attention to resolve the structural problems, taking account of risk, cost, operational impact and making use of the potential for repetitive solutions.
 - j. Where solutions are to be developed for MMOs that are outside of the 4 UK regions, there needs to be liaison and agreement over the solution, again with the support of DIO TS E&C Structures. All affected MMOs are entitled to have an input to the development of solutions, particularly when it is to be imposed on an asset under their responsibility. It is accepted there may need to be more than one solution, however the need remains to ensure that the operability and maintainability of the assets within the pump room remain adequate.
18. The respective MMO of each area is to confirm the status of all BFI pump-house buildings on:
 - a. completion of the investigation,
 - b. completion of any remedial works necessary to rectify deficiencies if present, and what those works entailed,
 - c. or if any monitoring remains ongoing.
19. Once actions at Paras 16 to 18 have been completed, the MMO is to notify the DIO Service Manager, HoE and establishment 4Cs Duty Holder for the location of all BFI Roofs which have been modified under this Safety Alert. In addition, the 4Cs risk register should be suitably annotated, along with asset records held on IMS and the MMO's asset information records.

Part C

20. The MMO is to notify the DIO Regional Delivery Safety Alerts Team (DIO-RDSafetyAlerts@mod.gov.uk) through their respective DIO Service Manager of the completion date for the actions detailed in Part B paragraphs 16-18.