Operational History Review: Potential Usage of Aqueous Film Forming Foam (AFFF)/Perfluorooctanoic Acid (PFOA)/Perfluorooctane Sulfonate (PFOS) at Nike and Atlas Missile Sites

**BLUF**

*Based on review of historic documents and project-specific preliminary assessments prepared for some of the missile sites in question, there are no fire training areas nor evidence of use or acquisition of Aqueous Film Forming Foam (AFFF) for Nike or Atlas missile sites. Therefore, there is no evidence for concern for past release of Perfluorooctanoic Acid (PFOA)/Perfluorooctane Sulfonate (PFOS) at these sites.*

**Tasking**

The EM CX was tasked by HQ USACE on 20 September 2016 to review operational history and timeline information such as that found in the Common Operations Reports regarding usage of Aqueous Film Forming Foam (AFFF) at Nike sites based on an inquiry from the Maryland Department of the Environment that was forwarded to them through the US Army Legal Services Agency. On 28 September 2016, the tasking was expanded to include a similar request for Atlas sites based on an inquiry from the Wyoming Department of Environmental Quality. The Atlas inquiry was slightly different in nature, in that it was not specific to AFFF, rather, it was specific to Perfluorooctanoic Acid (PFOA)/Perfluorooctane Sulfonate (PFOS).

**AFFF Background** (Source: FUDS Factsheet on Perfluorinated Compounds (PFCs))

AFFF was developed by the Navy and the Minnesota Mining and Manufacturing Co., now 3M in the 1960s. The Department of Defense (DoD) uses AFFF-containing PFCs in shipboard and shore facility fire suppression systems, fire fighting vehicles, and at fire training facilities. Where used, AFFF would be the most significant source of PFCs in the Defense Environmental Restoration Program (DERP). Only facilities that had such activities performed and remained under DoD jurisdiction after 1970 would have a likelihood of AFFF being in their inventory and used at the site. An initial military specification was issued in 1963 for a 25% mixture of AFFF with freshwater. However, due to practical limitations, it did not see widespread use by DoD until military specification Mil-F-24385 was issued in 1969 for AFFF that could be used as a 6% mixture and mixed with either freshwater or seawater. AFFF started being used for fire suppression and training outside of DoD around 1965; the Navy reports that by 1979 AFFF was used at over 90 municipal airports and also at many civilian fire departments.

**Period of Use Analysis**

Nike missile sites had two different missile configurations, Nike Ajax and Nike Hercules. Each configuration will be addressed separately for the AFFF evaluation.

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1. [75th Anniversary Awards for Innovation, Naval Research Laboratory](http://www.nrl.navy.mil/content_images/75awards.pdf)
• Nike Ajax was first deployed in 1954 and remained in use until 1964.6 Based on this period of use and the limited availability of AFFF prior to 1965, Nike Ajax sites would not be a potential source of PFCs. Atlas missiles had six models. Atlas A, B, and C were prototypes used solely for test flights. Models D, E, and F were the models that were fielded (placed on operational alert). The D, E, and F models were deployed at 123 launch complexes serviced by 10 parent airbases. These sites were operational between 1960 and 1965.9 Based on this period of use and the limited availability of AFFF prior to 1965, Atlas sites would not be a potential source of PFCs.

Nike Hercules was introduced in 1958 and gradually replaced the Nike Ajax as the sites were reconfigured. Most Nike Hercules sites were deactivated by 1974. Alaskan sites were deactivated in 1978 and Florida sites in 1979.7,8 This period of use overlapped the initial availability of the AFFF systems. Since the sites were constructed prior to the availability of the AFFF systems, it was thought unlikely that they would have been reconfigured to use AFFF in lieu of older materials, but further analysis was needed to confirm whether AFFF was used on Nike Hercules sites.

Key Word Analysis

To identify whether AFFF was used on the Nike Hercules sites that were in use after 1969 (when Mil-F-24385 was issued), numerous documents related to Nike missiles that are available in house through the EM CX were key word searched by directory with the material reviewed in context to determine if it was relevant. The key words used included the following single and/or combinations of words (Table 1), which were based on a list developed by the Department of the Navy10:

<table>
<thead>
<tr>
<th>Fire crash training</th>
<th>Fire train</th>
<th>Burn</th>
<th>Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burn area</td>
<td>Fire fight</td>
<td>AFFF</td>
<td>Plating</td>
</tr>
<tr>
<td>Plating shop</td>
<td>Firefight</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two types of sources were reviewed. The first were not site-specific and consisted of Technical Manuals, Field Manuals, and other historical sources. No evidence of use of AFFF being acquired or used at Nike sites was found. Some representatives sources that were reviewed with no key word related findings

7 Ibid.
8 Lonnquest and Winkler, 1996. To Defend And Deter - The Legacy Of The United States Cold War Missile Program. USACERL Special Report 97/01.
10 Department of the Navy Office of the Assistant Secretary (Energy, Installations, and the Environment), 2016. Memorandum for Commander Naval Installations Command, Deputy Commandant of the Marine Corps (Installations and Logistics) – Subject: Perfluorinated Compounds/Perfluoroalkyl Substances (PFC/PFAS) – Identification of Potential Areas of Concern (AOCs).
The second type of documents were site-specific preliminary assessments for Nike sites that were converted or newly constructed for the Hercules missiles. These documents were obtained from EM CX files for five missile sites. General site descriptions, figures and as-built figures were examined for fire training areas and none were found. This further supports the conclusion that AFFF was not used at Nike Hercules sites, as the anticipated use of AFFF would have been to train for firefighting.

**Findings**

The period of use analysis for Atlas missile sites documents that they could not be potential source of PFCs. This missile system were taken out of service prior to 1965, which is before AFFF had become available within DoD for widespread use.

The period of use analysis for Nike Hercules missile sites documents that there is a small overlap in the operational period of these missile systems with the period that AFFF had become available. However, based on review of system documents for key words and of project-specific PAs for fire training areas, no evidence of use or acquisition of AFFF was found.

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11 Lonnquest and Winkler, 1996. To Defend And Deter - The Legacy Of The United States Cold War Missile Program. USACERL Special Report 97/01.