DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA 23511

TELEPHONE NO.
444-9703

IN REPLY REFER TO:
09A21B5:DPC:s11
11010/MCAS (H)
NEW RIVER

01 FEB 1984

From: Commander, Atlantic Division, Naval Facilities Engineering Command
To: Commanding General, Marine Corps Base, Camp Lejeune, North Carolina 28542

Subj: ESR No. 11E83, Study of Pipe Corrosion System, Building AS-4100, Marine Corps Air Station (Helicopter), New River, Jacksonville, North Carolina

Encl: (1) ESR No. 11E83 of 23 Mar 1983
(2) Study of Pipe Corrosion of 25 Jan 1984 by LANTNAVFACENGCOM

1. Enclosure (1) requested engineering services to perform a study of the Foam Concentration Fire Protection System in Building AS-4100.

2. In response to same, enclosure (1) is returned and signed as complete with enclosure (2) acting as the solution to the loss of foam due to pipe corrosion.

3. If you have any questions or need additional information, please contact Mr. D. P. Coghlan of this Command, telephone AUTOVON 564-9703.

D R Phelps

D. R. PHELPS
By direction

Copy to:
MCAS (H) NEW RIVER

ENGINEERING SERVICE REQUEST (ESR)
NAVFAC 11000/7 (4-78)
Supersedes NAVDOCKS 2038
S/N 0105-LF-010-0035

Instructions on Reverse

Copy No /

SECTION A FOR USE BY REQUESTER

1. FROM (*Activity and location*)
Commanding General, Marine Corps Base, Camp Lejeune, NC 28542

2 TO
Commander, Atlantic Division, Naval Facilities Engineering Command, Norfolk, VA 23511

3 REFERENCE(S)

4. ESR IDENTIFICATION NUMBER (*if applicable*)
11E83

5. ENCLOSURE(S) (*check*)
☐ NAVCOMPT 140 ☐ OTHER (*specify*)
☐ NAVCOMPT 2038
☐ NAVCOMPT 372

6. TYPE OF FUNDING (*check*)
☐ O&MN ☐ OTHER (*specify*)
☐ NIF
☐ NAF

7. TYPE OF SERVICES REQUESTED
Study of pipe corrosion in foam concentrate fire protection system, Bldg. AS-4100, MCAS(H), New River, Jacksonville, North Carolina

8. DESIRED COMPLETION DATE

9. DESCRIPTION OF WORK

I. GENERAL: Engineering services are required to perform a study of the foam concentrate fire protection system in Bldg. AS-4100, MCAS(H), New River, Jacksonville, N.C., to determine cause of loss of foam due to pipe corrosion and to provide a plan for necessary corrective action.

II. BACKGROUND: Corrosion action at fittings and piping caused the loss of all of foam concentrate in the piping and storage tanks in Building AS-4100. The

10. FOR INFORMATION CONSULT (*Name and phone*)
T. H. HANKINS, JR., P.E.
AV: 484-3238/FTS: 676-3238

11. OFFICIAL REPRESENTATIVE (*Signature*)
R. E. CARLSON
By direction

12. DATE
28 MAR 1983

SECTION B FOR USE BY EFD

1. SCOPE OF SERVICES

2. DATE RECEIVED

3. ESR NUMBER

SECTION C INTERIM ENDORSEMENT

1. REMARKS

2. EST. COMPLETION DATE

3. AUTHORIZED REPRESENTATIVE (*Signature*)

4. DATE

SECTION D FINAL ENDORSEMENT

1. ENCLOSURE(S)
☐ DRAWINGS AND MAPS ☐ SPECIFICATIONS ☐ REPORT
☐ OTHER (*specify*) Study completed 1/25/84

2. EST. COST (*if applicable*)
$

3. AUTHORIZED REPRESENTATIVE (*Signature*)
K. E. Godfrey
K. E. GODFREY
By direction

4. DATE OF COMPLETION
26 JAN 1984

COPY TO FAC; MAIN

13649

encl: (1)

ENGINEERING SERVICE REQUEST

PIPE CORROSION IN FOAM FIRE PROTECTION SYSTEM

HANGAR AS-4100

MCAS (H) NEW RIVER

JACKSONVILLE, NORTH CAROLINA

25 JANUARY 1984

SURVEYED BY:

J. O. ROBERSON
FIRE PROTECTION ENGINEER
FIRE PROTECTION ENGINEERING BRANCH
DESIGN DIVISION
ATLANTIC DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA

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encl (2)

PIPE CORROSION IN FOAM FIRE PROTECTION SYSTEM
HANGAR AS-4100
MCAS (H) NEW RIVER
JACKSONVILLE, NORTH CAROLINA
25 JANUARY 1984

1. Purpose

This report is furnished in response to Engineering Service Request No. 11E83, for a survey to determine cause of pipe corrosion in the foam fire protection system for Hangar AS-4100. Recommendations resulting from this survey were also requested and are included in this report.

2. Current Conditions

Building AS-4100 is a helicopter maintenance hangar of one-high-story, noncombustible construction and consisting mainly of two large hangar bays. The two bays are protected by overhead foam-water deluge sprinkler systems and two independent oscillating nozzle systems, with each of the systems designed to protect one bay. The foam-water fire protection systems were installed in 1974 at the time of construction of the hangar. Leaks in the foam piping system later developed at the threaded pipe connections. These leaks were not obvious at time of original installation.

The foam concentrate piping is normally kept pressurized by a small jockey pump such that the pressure will force open the foam deluge valves when actuated by the heat detection system control panel, which also actuates the starting circuits to two 300 GPM foam concentrate pumps. However, practically all of the threaded pipe connections in the foam concentrate piping system are corroded and leak. Therefore the foam concentrate jockey pump and two 300 GPM pumps can no longer be maintained in automatic service and have recently been set on manual.

Under current conditions, the hangar bays are protected by automatic water deluge sprinkler and nozzle systems which have a good water supply augmented by fire pumps. Although water deluge fire protection systems afford adequate protection for many occupancies, water-form deluge systems are necessary in maintenance hangars to readily control fires involving fuels and aircraft.

The problems recently experienced with the foam system must be promptly corrected and the water-foam extinquishing systems restored to automatic operation.

3. Cause of Corrosion

The foam concentrate liquid used in this water-foam fire extinquishing system is 6 per cent aqueous film forming foam (AFFF). AFFF liquid contains flourinated substances which are corrosive to steel when exposed to air over a long period of time.

Leaking foam concentrate liquid from the threaded pipe connections caused corrosion at practically all threaded pipe connections in the foam concentrate piping. The black steel pipe and cast-iron screwed fittings that were installed in the AFFF system are approved for foam-water systems, and black steel pipe has proven satisfactory in foam systems at other similar

installations. However, the installation of the foam system at this facility was done in a manner that resulted in poor workmanship in cutting, threading and fabricating the black steel pipe.

Practically all of the steel pipe in this foam system was threaded excessively and resulted in leaks at the threaded connections. Excessively threaded pipe prevented the permanent sealing of the threaded pipe connections when fabricated because of a lack of metal-to-metal meshing of threads and grooves along the entire tapered cut of the pipe thread. The cut of threaded pipe is such that the deepest groove is located at end of pipe and gradually becomes shallow at the end of the tapered cut. Properly cut and threaded pipe for sizes involved in this installation should have no more than approximately 4 to 5 threads exposed to view when fabricated wrench-tight in accordance to the American National Standard Institute, Inc. Numerous deeply-threaded grooves were left exposed in the pipe where connected to fittings and components of the AFFF concentrate system.

It should also be noted that the AFFF concentrate piping was originally specified to be constantly pressurized between 50 and 75 psig by a small jockey pump. Currently the jockey pump controller is set at 106 psig, which is considered excessive pressure and may have contributed to the leaks in the AFFF piping.

In summary, the excessively threaded pipe connections allowed AFFF concentrate to leak under constant high pressure and subsequently resulted in corrosion and deterioration of the foam piping system.

In addition the AFFF concentrate is stored in two 2,880 gallon cube type steel tanks from which the foam concentrate pumps are supplied. These tanks have not been kept completely filled with AFFF concentrate recently which has resulted in slight corrosion to interior surfaces of these tanks where exposed to air.

4. Recommendations - (See attached As-Built Drawings for Reference and Dimensions)

a. Replace all the threaded pipe and threaded fittings in the AFFF concentrate system from the elbow piece ahead of the check valves at the discharge headers of the two 300 GPM foam pumps, to the O S & Y control valves below each foam deluge valve in the sprinkler and oscillating nozzle systems. Replace any flanged component in the foam piping system which is determined unuseable upon internal inspection. Also, replace all piping and threaded fittings from the AFFF concentrate jockey pump to the point of connection to the 4-inch AFFF concentrate supply pipe (As-Built Drawing sheet 5 of 5.) All piping, fittings and fabrication of the new AFFF concentrate system shall conform to the following:

(1) Piping shall be standard-weight schedule 40 black steel pipe conforming to ASTM A53 or A120. Pipe threading shall be in strict conformance with the American National Standard Institute (ANSI) standard B2.1, "Pipe threads". Perform good workmanship in the threading and fabrication of the piping system. Welding is permitted when it can be done without introducing fire hazards and upon approval of the Base Fire Department.

(2) Threaded fittings shall be black cast iron conforming to ANSI B16.4, class 125. Fittings shall be provided for changes in direction of piping. Changes in pipe size shall be made through standard reducing pipe fittings. The use of grooved-end fittings will not be permitted.

(3) Flanges shall be provided at valves and piping connections at each piece of equipment. Flanges and flanged fittings shall conform to ANSI B16.1, class 125.

b. Provide an O.S & Y control value in the suction pipe between the jockey pump and the AFFF liquid storage tank.

c. Thoroughly clean, prime, and paint exterior surfaces of all piping and fittings in both new and existing portions of the AFFF concentrate system.

d. The normally pressurized portion of the AFFF liquid piping system should be hydrostatically tested at 200 psig for a period of 2 hours upon completion of new pipe construction. Make corrections to any leaks.

e. Thoroughly clean and prime interior surfaces of the two AFFF concentrate storage tanks and finish these tank surfaces with epoxy paint to protect against corrosion. After these tanks have been reconditioned and returned to service, keep these tanks completely filled with AFFF concentrate up to the shallow space in the raised manhole hatch on top of each tank to minimize surface areas in contact with air and foam concentrate such that corrosive conditions inside these tanks are prevented.

f. Restore the foam-water fire extinquishing systems to automatic operation upon completion of repair. Adjust the controller to the AFFF system jockey pump to start this pump at 50 psig and shut off pump at 75 psig.

Report prepared by:
J. O. Roberson
J. O. ROBERSON
Fire Protection Engineer
Atlantic Division
Naval Facilities Engineering Command