REPORT NO. D-2008-TAD-005

Inspector General

United States Department of Defense

POLICY AND OVERSIGHT

Alleged Flawed Procurement of New Orleans Temporary Outflow Canal Pumps

May 14, 2008

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Acronyms

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CO	Contracting Officer
COR	Contracting Officer's Representative
DOD	Department of Defense
ERDC	Engineer Research and Development Center
FAR	Federal Acquisition Regulation
GAO	Government Accountability Office
HI	Hydraulic Institute
HPU	Hydraulic Power Unit
IG	Inspector General
ITR	Independent Team Report
MFR	Memorandum for Record
MIPR	Military Interagency Procurement Request
NOAA	National Oceanic and Atmospheric Administration
OIG	Office of the Inspector General
OSC	Office of Special Counsel
QA	Quality Assurance
QARs	Quality Assurance Reports
QC	Quality Control
RFP	Request for Proposal
USACE	United States Army Corps of Engineers

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-4704

MAY 14 2008

The Honorable Scott J. Bloch
Special Counsel, U.S. Office of Special Counsel
1730 M. Street, N.W.
Suite 300
Washington, D.C. 20036-4505

Re: OSC File No. DI-07-2724

Dear Mr. Bloch:

This is in response to your September 21, 2007, letter to the Secretary of Defense regarding "serious allegations which cast doubt on the integrity of costly pumping equipment installed in three main structures by USACE and its ability to protect New Orleans from further flooding," pursuant to 5 U.S.C. § 1213.

We have reviewed the allegations, prior reviews, and project documentation and interviewed the complainant and U. S. Army Corps of Engineers' project personnel. Our review did not find reasonable grounds to believe that there were criminal violations or deficiencies in the pump acquisition that constituted a danger to public health or safety.

Our report of investigation is enclosed. By memorandum from the Secretary of Defense dated February 9, 1998 (copy enclosed), the DoD Inspector General has been delegated authority to respond to requests for investigations under 5 U.S.C. § 1213.

If you have any additional questions regarding this matter please contact Mr. John R. Crane at (703) 604-8234.

Sincerely,

Claude M. Kicklighter

Enclosures: As stated

cc: Chief of Engineers, U.S. Army Corps of Engineers
Inspector General, Department of the Army

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THE SECRETARY OF DEFENSE
WASHINGTON, DC 20301

IG
c/brief

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MEMORANDUM FOR INSPECTOR GENERAL, DEPARTMENT OF DEFENSE

SUBJECT: Delegation of Authority to the Inspector General

In accordance with the authority contained in Title 10, United States Code (U.S.C.), Section 113, I hereby delegate to the Inspector General, Department of Defense, full power and authority to act for the Secretary of Defense to respond to requests for investigations under Title 5, U.S.C. Section 1213 from the Special Counsel, Office of Special Counsel, relating to allegations of violations of law, gross mismanagement and certain other matters.

The authority delegated herein may not be redelegated.

William S. Cohen

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Department of Defense Office of the Inspector General

Report No. D-2008-TAD-005 **May 14, 2008**

Alleged Flawed Procurement of New Orleans Temporary Outfall Canal Pumps

Introduction and Background

On September 21, 2007, the U.S. Office of Special Counsel (OSC) referred allegations to the Secretary of Defense concerning the United States Army Corps of Engineers (USACE) installation of pumping equipment in three main structures to protect New Orleans from further flooding. The OSC is authorized by 5 U.S.C. § 1213(a) and (b) to receive disclosures of information from Federal employees alleging violations of law, rule, or regulation, gross mismanagement, gross waste of funds, and abuse of authority, or a substantial and specific danger to public health or safety. When the Special Counsel finds that there is a substantial likelihood that one of these conditions exists, he is required to advise the appropriate agency head, and the agency head is required to conduct an investigation of the allegations and prepare a report, pursuant to 5 U.S.C. § 1213(c) and (g).

In this case, the Special Counsel concluded that there was a substantial likelihood that the information provided by a Federal employee disclosed allegations covered by 5 U.S.C. § 1213, and referred the matter to the Secretary of Defense for investigation. The Special Counsel summarized the whistleblower allegations as follows:

> (1) the costly pumping equipment at three "outfall gated canal closure structures," which is part of the flood protection design to protect New Orleans, was inherently flawed due to poor pumping and hydraulic systems designs;
>
> (2) pumping equipment that had previously malfunctioned under favorable contractor testing conditions, and subsequently shown to be defective, was knowingly installed by USACE employees and . . . [the contractor] personnel; and
>
> (3) USACE employees and . . . [the contractor] personnel circumvented contract requirements related to contract modification and notifications at the expense of public safety and proper contract oversight.

Prior to Hurricane Katrina, the New Orleans Sewerage and Water Board pumped rainwater from the city into three drainage canals at 17th Street, London Avenue, and Orleans Avenue. These three canals flowed into Lake Pontchartrain unrestricted and while they were sufficient to prevent some, but not all, flooding from rainfall events, they were vulnerable to storm surges during a hurricane. The floodwalls lining both sides of the canals were designed to protect residents

from surges in Lake Pontchartrain driven by storms up to the "Standard Project Hurricane," roughly equivalent to a fast-moving category 3 hurricane. During Hurricane Katrina in August 2005, however, several breaches occurred in the floodwalls. This allowed a significant amount of water from Lake Pontchartrain to enter the city of New Orleans.

The United States Army Corps of Engineers (USACE) took action to restore New Orleans' flood protection to a pre-Katrina level by June 1, 2006, the beginning of the next hurricane season. The USACE considered strengthening the drainage canal floodwalls but decided to postpone this effort due to cost and time constraints. Instead, USACE decided to install three interim closure structures at the points where the canals meet Lake Pontchartrain. These closure structures, which remain open during normal weather periods, would be closed during major storm events to prevent a Lake Pontchartrain storm surge from entering the canals, breaching the floodwalls, and overflowing into the city. However, the closures would also prevent rainwater in the canals from flowing into the lake. Because the gates remained closed during a storm surge, large capacity pumping systems were needed to pump water out of the canals and into the lake.

The National Oceanic and Atmospheric Administration (NOAA) created storm event rainfall models for 10, 50, and 100-year storm events for the New Orleans canal system. The storm model used historical data to determine the average of the worst storms that have occurred every 10, 50, and 100 years. The statistical data was then used to predict an event that has a 1% probability of being equaled or exceeded in any year.

The Interim Closure Structure's Temporary Pumping System was designed to pump water for a 10-year rainfall event; not a 50-year or 100-year rainfall event like Katrina. A permanent pump system is planned to be completed by 2012 and will be designed to handle a 100-year storm event.

The USACE initiated the procurement of 34 large capacity hydraulic pumping systems to provide pumping capacity by June 1, 2006. Six additional pumps were procured to supplement the pumping capacity at the 17th Street Canal, the largest canal. The USACE stated that additional analysis in mid 2006, determined that a significant additional pumping capacity would be required at the 17th and London Avenue Canals to meet the 10-year rainfall event. Therefore contracts were let in 2007 for 19 direct-drive pumps to meet the 10-year rainfall event.

Each pumping unit consists of two major mechanical components; the hydraulic power unit (HPU), which is located on an elevated equipment platform, and the water pump, located in the canal on the protected side of the closure structures. The two components are connected by hydraulic lines. The water discharge piping runs from the water pump around the closure structure and then discharges into Lake Pontchartrain. The following terms are used in this report to distinguish components of the New Orleans Outflow Canal Pumps:

Hydraulic Pumping System

1. Pumping Unit
    a. Hydraulic Power Unit (HPU)
    b. Water Pump
2. Hydraulic Lines
3. Water Discharge Piping

Each pumping unit underwent testing at the factory and in the field. Problems were continuously encountered and corrected throughout the acquisition process. Final contractual acceptance testing was completed on September 15, 2007.

Conduct of the Investigation

We began the investigation on October 26, 2007, based on information provided by the Office of Special Counsel, which included the "Whistleblower Disclosure Affidavit" dated August 13, 2007; a Memorandum for Record (MFR) dated May 3, 2006, entitled "Defective Pumping Equipment," a "Declaration of ... [the complainant]," dated October 13, 2006, and a "Declaration of ... [the complainant],"dated April 23, 2007.

Based on the information described above, as well as a subsequent interview with the complainant, we categorized the specific allegations into the following five areas in order to cover the full range of concerns: Design, Testing, Installation, Operational Capabilities, and Contract Issues. Specific allegations in each category were then addressed during our fieldwork.

The interview with the complainant included the USACE, Los Angeles District counsel, who participated as an observer at the request of the complainant. During our interview, the complainant provided shop inspection reports, the contractor Quality Control (QC) reports, the complainant's testing documentation detailing test results of most pumps, and a MFR dated May 29, 2006, entitled "Implementation of New Corrective Measures to Correct Pumping Equipment Deficiencies."

We also interviewed personnel serving with the New Orleans District USACE, including the Project Manager, the Assistant Project Manager, the Contracting Officer (CO), and the Resident Engineer / Contracting Officer's Representative (COR). They provided contract documentation including the contractor proposal and the 33 contract modifications, New Orleans Military Interagency Procurement Request (MIPR) to the Jacksonville district for QC services,[1] USACE and Hydraulic Institute (HI) standards, storm event studies, operational test procedures, test logs, USACE's Engineer Research and Development Center

[1] The USACE New Orleans office issued a MIPR to the Jacksonville district office to obtain quality control services at the contractor's production facility in Deerfield, Florida.

(ERDC) capacity test reports, USACE's Quality Assurance Reports (QARs) at the installation sites, and pump maintenance logs. Meetings were held with USACE Headquarters and Government Accountability Office (GAO) Headquarters.

As part of our work, we examined other studies and evaluations of matters concerning post-Katrina flood control in New Orleans. Some of these studies specifically addressed the allegations made by complainant and will be referenced in this report when appropriate. Those studies included the following:

- U.S. Army Audit Agency, "Contracts of the Hurricane Protection System in New Orleans," (A-2006-0198-FFD) August 22, 2006

- U.S. Army Corps of Engineers, "Final Report MVN [Mississippi Valley, New Orleans] Outfall Canal Pumps," *Independent Team Report (ITR)*, May 11, 2007

- Government Accountability Office, "U.S. Army Corps of Engineers' Procurement of Pumping Systems for the New Orleans Drainage Canals," (GAO-07-908R) May 23, 2007

- U.S. Army Corps of Engineers, "MVN Outfall Canal Pump Report," *Memorandum for Record (MFR),* June 4, 2007

- U.S. Army Audit Agency, "Contracts to Restore and Enhance the Southern Louisiana Hurricane Protection System," (A-2007-0216-FFD) September 11, 2007

- Government Accountability Office, "Army Corps of Engineers Known Performance Issues with New Orleans Drainage Canal Pumps Have Been Addressed, but Guidance on Future Contracts Is Needed," (GAO-08-288) December 31, 2007

Summary of Evidence and Analysis

As discussed above, we categorized allegations concerning the Interim Closure Structure, Pumping Station Project, into five issue areas: Design, Testing, Installation, Operational Capabilities, and Contract Issues. We assigned numbers to the allegations for ease of reference.

Design Allegations

Allegation #1: Flawed design allowed air to enter into Denison hydraulic pumps on the HPUs causing damage and subsequent failure of the pumps.

Facts: The contract states:

> The work under this section shall consist of providing all pumping equipment including the hydraulically driven pumps, diesel drive units, and all piping, appurtenances, mechanical and electrical system as shown on the drawings and as specified herein.

It goes on to state:

> The supplier of the pumping equipment mentioned above shall assume responsibility for the proper functioning of the hydraulic motors, pumps, and hydraulic drive units as a complete system

The clause concerning the Contractor's obligation under Warranty of Supplies of a Noncomplex Nature, states:

> All supplies furnished under this contract will be free from defects in material and workmanship and will conform with all requirements of this contract...

The USACE stated that the Denison hydraulic pump design used in this acquisition was a standard design. The December 31, 2007, GAO report stated:

> ...according to the Lake Borgne Levee District official, this pump has been successfully used for about 20 years without having to prime the pumps prior to start-up.

The design required a prescribed start-up procedure for the HPU. The operating procedure required the operator to start-up the HPU at a slow speed and gradually increase it to the normal operating speed. Doing so would properly dissipate air that entered the hydraulic pipe whenever the suction pipe was opened for repairs and maintenance. If operators did not follow prescribed procedures for the initial start-up of the hydraulic power unit (i.e., conducted a rapid run-up), trapped air would cause a "dry run" and tear up the hydraulic pump.

The problem was addressed in the December 31, 2007, GAO report as follows:

> Corps officials from the New Orleans District emphasized to us that the redesign was requested to more adequately meet their needs, not because of concerns about the pumping systems operating as intended. ...[the contractor] subsequently agreed to modify the design of the hydraulic intake line at the request of the Corps. According to Corps officials, by the end of July 2007 and at its own expense...[the contractor] had redesigned and reinstalled the new flooded suction design on all 40 pumping systems.

The June 4, 2007, MFR and May 11, 2007, ITR also addressed this issue and made recommendations that have since been implemented.

This air intake problem first occurred during factory testing and surfaced again in June-July 2006 after the water pump systems were installed at sites. The contractor provided a temporary solution by first installing a safety valve on the hydraulic intake pipe to bleed the trapped air. The problem was resolved permanently when suction pipes were submerged in oil and moved to a "gravity feed" position in the hydraulic tank. On July 12, 2006, a no cost contract modification was issued that required the contractor to modify all existing hydraulic tanks to a flooded intake for the hydraulic pumps. After the implementation of the modification, each of the hydraulic pumps was tested prior to acceptance.

Analysis: The allegation was not substantiated. The hydraulic pump design was a standard design that required a prescribed start-up procedure. The air intake problem arose when the operator did not follow the prescribed hydraulic power unit start-up procedure subsequent to suction pipe flange repairs. The possibility of damage from improper start-up was eliminated by implementing a no cost modification that required that the suction pipes be moved to a "gravity feed" position in the hydraulic tanks that submerged intake pipes in the hydraulic oil tank thus preventing the air from entering into the pump. We concluded that this was a reasonable approach to eliminate the risk of damage and was accomplished at no additional contract cost to the Government.

Allegation #2: The complainant alleged:

> While trying to meet the contractually required testing requirements the pumping equipment experienced voluminous severe hydraulic system component failures, and ultimately, catastrophic pump assembly failures.

The complainant went on to state that failure occurred because the HPU components, including cams, hoses and piping were not designed to operate at 3000 pound/square-inch (psi) hydraulic pressure as required.

Facts: The contract explicitly states:

> All reinforced supply hose … shall have a minimum safe working pressure of 3,000 psi.

During April 2006, HPUs and the water pumps were tested together at the contractor facility. The tests were observed by the USACE representatives from the Jacksonville District quality assurance team including the complainant. A number of test failures were attributed to improper functioning of Denison hydraulic pump units. The problems identified with the hydraulic pump components were: inappropriate cam and hydraulic hose sizes, seals, o-ring failures, and excessively hot hydraulic oil. These discrepancies were reported by the complainant and were acknowledged and addressed in the ITR as follows:

> b. 12 April first initial wet test and within 95 minutes there is a failure of pumping components.
>
> c. 13 April determined cam rings in hydraulic oil pump were wrong size causing failures. Originally the hydraulic oil pumps had cams of type no. 66 & 42;...[the contractor] replaced the 42 with a 50 to increase oil flow to the Rineer motor [water pump motors]. Corps personnel discovered that the 50 cam could not handle a continuous running pressure above 3000 psi. The cams were then at Denison's request to replace all hydraulic oil pumps with type 72 & 45, which Denison later indicated will run satisfactorily at a continuous running pressure of 3200 psi...

The ITR discussed the cam size issue further and stated:

> Also, sometime in July 2006, it was also found that...[the contractor] had installed cams that would not operate at pressures >3000 psi, the current system pressure being developed ranges from 3000 to 3200 psi. They had to replace the cams in the hydraulic system that would work for pressures >3000 psi. The current hydraulic systems now have the proper cams in place according to the manufacturer...

The ITR also addressed the flexible hose problem; it stated that the hydraulic oil high pressure hoses failed and the flexible hydraulic hoses that were below the water line were replaced with rigid piping. This corrected corrosion issues with the galvanized quick connects under water.

USACE representatives told us that some of the 4-inch diameter intake hoses attached to hydraulic pumps were rated for water use but were not rated for hydraulic oil. The contractor replaced the water hoses when the problem was brought to their attention. Some of the hyper extended o-rings/seals and improperly installed seals on the water pump motors were also replaced at installation sites. All Denison pumps were 100

percent inspected at the sites for defective parts. All inappropriately sized cams were replaced at the factory as well as at installation sites. No underrated components were allowed to remain on the HPUs.

Analysis: The allegation was substantiated. HPUs initially failed factory tests due to pump component failures. The cams, hoses, o-rings and seals failed because they were under rated and did not meet the 3000 psi requirement, were of inappropriate size, were incorrectly installed, or had manufacturing defects. We concluded that reasonable corrective actions were taken when problems were detected during factory tests, during 100 percent field inspection of the HPUs, and during acceptance tests conducted in the field. Corrective actions for the above items were accomplished at no additional cost to the Government.

Testing Allegations

Allegation #3: Factory testing for the hydraulic pump, and water pump was incomplete and defective equipment was shipped to the sites.

Facts: The original contract called for a performance test that measured pumping capacity. USACE representatives stated that they had problems performing these tests and obtained the services of an outside consultant to investigate these issues. The consultant reported that it was not a normal practice to test the capacity of every pump in the same production run. Variation in performance between identical pumps is expected to be slight based on manufacturing tolerances. Based on that assessment, USACE decided to replace the performance test with a 5-hour endurance test, which focused on the HPU. Each HPU was connected to a water pump for the test. Accordingly, the contract modification backup documentation stated:

> The prior testing required a 1 hour run test per pump and drive unit which was being conducted simultaneously, as well as two full size, seven point tests on two pumps, the new procedures requires 5 hours per drive unit as well as a 24 hour run test on one drive unit and pump combination.

The 5-hour test was later reduced to 3-hours based on the recommendations from USACE engineers and the consultant who stated that there would be no benefit to conducting the test for longer than 3 hours.

The contract modification deleted the requirement for testing each hydraulic pumping system. However, because there were numerous problems with the HPU during the factory test, the USACE decided to test every HPU, but test only a sample of water pumps. Ultimately, 9 water pumps were not tested.

The contractor's quality control forms documented that each of the HPUs completed the 3-hour factory test before being shipped. However, our review of the complainants' documentation and the Jacksonville shop inspection reports revealed that the Government identified one unit as not accepted. The Jacksonville shop inspection states:

> This DU was previously tested on 4/29/06 at 1955 Hrs. The unit shut down during the test for no apparent reason. CAT personnel troubleshot the unit and found a burned fuse and replaced it. When the engine was turned on it went through the automatic throttle, but could not hold the 1800 RPM. Also, the auto accumulator solenoid valve was not holding the pressure due to a possible internal leak. The pumps have to be engaged manually. Therefore, this engine is not acceptable.

Despite the failed test, the HPU was shipped to the installation site. When the USACE found out that the pump was shipped without the Government's approval of the testing, the project manager reviewed the issues found during factory tests and decided to correct the problems with the unit at the installation site rather than sending it back to the factory. After repairs were made, that pump completed the acceptance test in the field and accumulated a total of 25 hours as of March 2008.

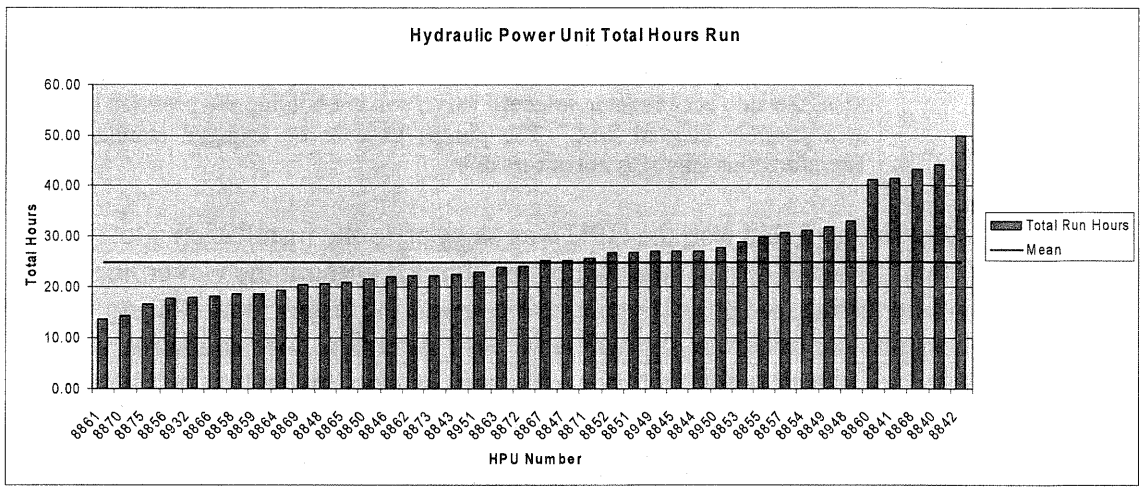
Analysis: The allegation was partially substantiated. The Jacksonville shop inspection reports show that one HPU did not pass the 3-hour factory test. We believe that the project manager's decision not to return the unit back to the factory and to correct all the problems with this pump at the site was reasonable, under the circumstances, because repairs could be accomplished in the field without incurring the delay and expense of returning the unit to the factory. Ultimately, this HPU passed the acceptance test at the site and logged more than 25 running hours. Testing of other units was accomplished as specified by the contract modification.

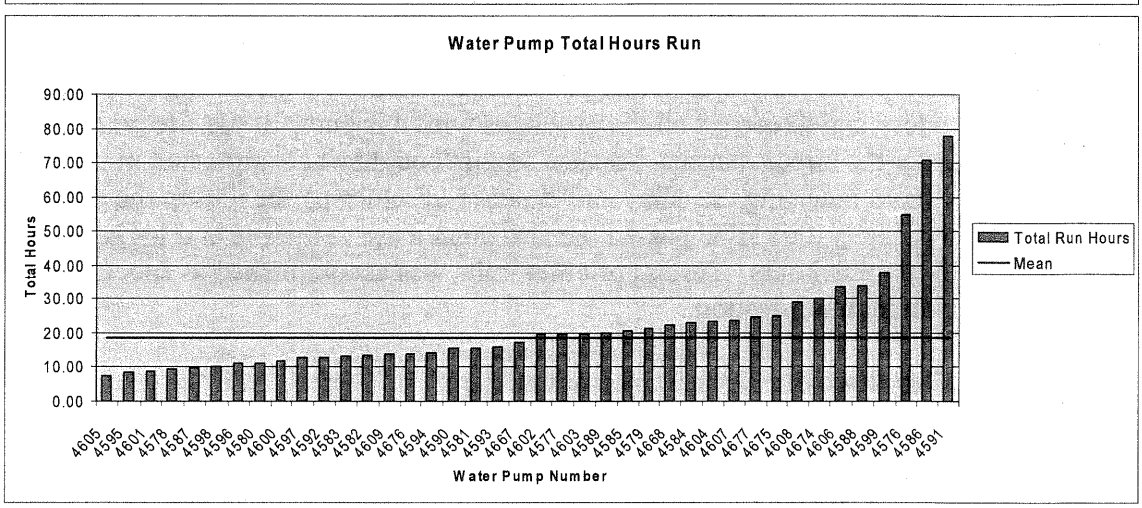
Allegation #4: The complainant alleged:

> New Orleans TFG pump team personnel were fully aware of the voluminous pumping equipment failures at the contractor testing facility, and were also fully aware that the more the pumping equipment was run the more it experienced catastrophic failures of the pump assemblies and the hydraulic systems components.

Facts: Although the factory and installation testing of the hydraulic pumping systems revealed numerous problems, the USACE and the contractor took corrective actions by performing inspections and fixing the problems as they found them. Confidence in the reliability of the hydraulic pumping systems has grown with the number of hours that have been accumulated from the 3-hour factory tests, the on site operational tests, the 2-hour on site acceptance tests, and subsequent maintenance runs.

As of the end of March 2008, the HPUs have run from 13 to 50 hours, with an average of 24 hours, and the water pumps have run from 7 to 77 hours, with an average of 18 hours. Beside the vigorous 3-hour factory tests, 2-hours acceptance test, and accumulated total running hours, the USACE also ran continuous 12-hour tests on two hydraulic pumping units at 1000 psi at the factory and a continuous 36-hour test on one HPU at 3000 psi at the site. See charts below.





The hydraulic pumping systems are now operational and managed by the New Orleans District Operation Division. The systems exercised periodically to ensure their readiness. Logs are kept with problems each pump encounters. Confidence in the reliability of the hydraulic pumping systems is also supported by the low number of problems encountered by the New Orleans District Operation Division as documented in their maintenance log files. We reviewed these files and only found routine maintenance items.

Analysis: The allegation was not substantiated. Although the factory testing of the HPU revealed several problems with specific components of the hydraulic pumping system, the USACE and the contractor took appropriated actions to correct known performance problems. Additionally, the average total running hours of each hydraulic pumping system up to March, 2008, gives us additional confidence that the system will reliably operate when needed.

Allegation #5: The complainant alleged:

> Appropriate and sufficient field testing requires delineating specific and befitting operating parameters with suitable engineering testing formulation, field engineering oversight, and record keeping - to date, to my knowledge, this has not occurred. Simply turning one, a couple, or a few pumps on for 15 to 45 minutes, under unknown conditions, with minimal oversight, and with no record keeping of the conditions, parameters, or oversight is not sufficient. The pumping equipment failures I witnessed most often became evident after hours of run time under normal operational speeds and pressures. At a minimum, real event operating conditions (as in a hurricane, i.e., full operating speeds and pressures) and run times (12 to 24 hours or more) should be applied for any field testing to ensure the pumping equipment operates as intended, and design defects have been mitigated properly.

Facts: The USACE prepared a test plan for the final acceptance of the hydraulic pumping systems in the field. The plan included the requirement to run for a minimum of 2 hours continuously with engine speeds of 1800 rpm and hydraulic pressure of 3,200 psi. The testing monitor was to verify a steady state condition with engine rpm, hydraulic system pressure, hydraulic oil temperature, engine jacket water temperature, canal level, ambient conditions, and no leaks from hydraulic and fuel systems.

The final acceptance tests for each hydraulic pumping system were conducted in the field by the contractor with oversight by USACE. USACE documented the tests with quality assurance reports (QARs) which recorded the testing parameters including pump speeds, run times, temperature, and deviations from test procedures. The 40 systems were accepted by the Government. The QARs documented that 4 of the hydraulic pumping systems were accepted with only 1.5 hours of testing and 6 systems were accepted with reduced speeds for the last half hour of the 2-hour tests, 1400 rpms instead of the required 1800. The reduced run times and speeds for the acceptance tests were caused by the canals running out of water, rather than an actual or anticipated equipment failure. USACE personnel stated that they accepted the systems with reduced hours and speeds because performance was demonstrated in the first 45 minutes by reaching steady state conditions.

In addition to the acceptance test for the hydraulic pumping systems, the USACE also performed a 36-hour test to prove that the HPU would function for that period of time. This test was performed with a HPU connected to a rented water pump in the canal.

Analysis: The allegation was partially substantiated, in that test runs were shorter than the 12 to 24 hours recommended by the complainant. However, the USACE did develop a test plan and recorded in QARs the extent to which each pumping system met the test requirements. Due to the limitation of the water level in the canal, the test procedures performed by the USACE and contractor were adjusted, but sufficient to demonstrate that the hydraulic pumping systems will function as designed. The 36-hour test on the HPU and the additional run hours on the hydraulic pumping systems provide additional evidence that these hydraulic pumping systems will meet endurance requirements.

Installation Allegation

Allegation #6: Defective and untested pumping equipment was installed.

Facts: As discussed above, 9 water pumps were not factory tested prior to installation and one HPU was received at the site without Government approval of the 3 hour factory testing. Problems identified at the factory testing included undersized gear oil circulation motors, hydraulic motor vibrations, suspect pipe welds, and lower than expected pumping capacity. Under the contract, final acceptance of the hydraulic pumping systems was not at the factory. It occurred in the field after, final acceptance testing.

Additional hydraulic pumping system issues were identified and corrected in the field, including hydraulic oil with foreign contamination (metal shavings and a jello like substance). We found that the problems were solved and that the systems are now fully operational.

The December 31, 2007 GAO Report addressed the issue as follows:

> Each pumping system has been successfully tested on site ... providing greater assurance that they perform as designed during future hurricane seasons...the Corps stated that all of the outstanding repairs have been completed and on-site testing indicates that the Hydraulic pumping systems are fully operational. Final acceptance of the pumping systems is expected to be completed early in calendar year 2008.

Analysis: The allegation was partially substantiated. All HPUs were tested at the factory before shipping. However, as noted above, one HPU failed factory test but was shipped to the site and 9 water pumps were not tested at the factory. However, all defects related to these problems were fixed at the installation sites. Indeed, the USACE has taken extensive corrective actions to fix the problems at the sites from April 2006 until May 2007. All 40 HPUs are in place and have been successfully installed and tested. We consider this approach reasonable in view of the urgency of achieving an immediate improvement to New Orleans' flood control protection and the unprecedented capacity of these individual pumping units.

Operational Capability Allegation

Allegation #7: USACE allowed less than full designed capacity performance as called out in the contract.

Facts: The contract stated that the pump shall be able to operable through the entire range and within a tolerance of 0 to plus 5% of capacity in gallons/minute (gpm) at a given Total Dynamic Head in feet of water. The required capacity in this operable range is specified in the following chart from the contract:

Design Condition Design Point	**Max Head**	**Operating Point**	**Low Head Design Point**
Flow	85,000 gpm	98,000 gpm	105,000 gpm
Total Dynamic Head (TDH)	16.8 FT.	12.1 FT.	8.5 FT.
%efficiency	80%	81%	80%
Max. Speed	400 RPM	400 RPM	400 RPM
Max. Horse Power (HP)	720	690	640

The Request for Proposal (RFP) required and the contractor provided a certified pump curve based on model studies identifying that the pumps proposed met contract requirements. The original contract required a full scale capacity test on each pump. Following the initial full size factory tests, USACE's pump testing consultant traveled to the contractor's facility to assess testing issues and production delays. The consultant's report stated:

> I recommended dropping the pump performance tests and adding an endurance test for three main reasons. First, there was expected to be only slight variations in pump performance considering they were all manufactured to be identical. Secondly, I had a low confidence level in the validity of the current performance tests and third we needed endurance testing to weed out mechanical problems before the pumps are shipped to New Orleans.

The USACE initiated a contract modification to implement these recommendations and replace the full scale capacity test with a model test.

In order to validate the contractor's original model test results, a full scale factory test was performed by the contractor in conjunction with ERDC in December 2006. The test results indicated that at the specified operating total dynamic head conditions, the measured discharge capacity was less than required as shown in the following chart:

TDH	Required Capacity	Actual Capacity	% Reduction
16.8 ft	85,000 gpm	82,960 gpm	6.5%
12.1 ft	98,000 gpm	93,982 gpm	4.1%
8.5 ft	105,000 gpm	98,280 gpm	2.4%

USACE stated that the accuracy of the instrumentation for this test was +/- 5%.

Because the original model test was not witnessed by the Government, the USACE and the contractor agreed to perform an additional model test to ensure the accuracy of the measured capacity of the pumping systems. The model test was conducted by the contractor in cooperation with USACE's ERDC in September 2007. The model test revealed that the hydraulic pumping systems' capacity was 1.4 percent less than required by the contract. The USACE stated that the deficit did not have significant impact because the 1.4 percent was within the testing equipment margin of error and the interim system comprised of both the hydraulic and direct drive pumping systems still exceeded the 10-year event system design criteria.

Model testing was considered more accurate for pumping capacity. The use of a model test is standard practice for a pump of this size according to both the USACE Engineering Manual 1110-2-3105 and the HI Standard, ANSI/HI 2.6-2000.

Analysis: The allegation was substantiated. The model testing did show that the hydraulic pumping systems' capacity was 1.4 percent less than required by the contract. However, the USACE stated that the deficit did not have significant impact because the 1.4 percent was within the testing equipment margin of error and the interim system comprised of both the hydraulic and direct drive pumping systems still exceeded the 10-year event system design criteria. Because the total system is capable of meeting the 10-year event design criteria, we find no basis to recommend equipment redesign or upgrade.

Contract Issues Allegations

Allegation #8: The complainant alleged:

> The Task Force Guardian ACE [USACE] team violated Federal procurement regulations with numerous and consequential unauthorized commitments, acted with implied authority without the knowledge or consent of the Contracting Officer, failed to take corrective action when knowledge of contracting improprieties were made evident, and refused to implement contract administration actions ordered by Contracting Officer to mitigate pumping design deficiencies

Facts: The USACE contracting officer stated that she was in constant contact with the USACE team. We reviewed numerous emails, memorandums, records

of daily phone calls, and documentation of meetings with the USACE project manager that confirmed continual contact throughout the entire process of the testing and delivery of the hydraulic pump system to the three sites. We found evidence that the USACE team addressed each of the problems identified in those records, both at the factory and on site. As a result, of the continuous involvement of the contracting officer, 33 modifications were made to the contract from February 15, 2006 to November 13, 2007. For example the modifications involving funds included specification changes to hydraulic piping and hose. Additionally, revisions of testing procedures were made at no cost to the Government.

The December 31, 2007 GAO report stated:

> We found much of the documentation that the ITR specifically cited as missing - including request for proposals, independent government estimates, certified cost or pricing data, technical analyses, and price negotiation memorandums - was not required, because documentation was not relevant to the contract modifications in question...our review found that, for the most of the contract modifications, there was evidence of some analysis by the Corps and extensive back and forth discussion, usually by e-mail, between officials form the Corps and ... [the contractor].

Analysis: We found insufficient evidence to support the allegation. Documentation confirmed continual interaction between the contracting officer and other members of the USACE team throughout the acquisition process. The contracting officer stated that she was in daily contact with the project manager throughout the duration of the project. The Jacksonville quality control team provided technical support for the USACE team by providing oversight of the factory testing.

Allegation #9: USACE team personnel did not engage in usual and customary Corps of Engineers contract administration practices or conduct project oversight and documentation that would ensure even minimum requirements could be met to protect the Government's interests.

Facts: The contract stated:

> The field test shall be witnessed by the Government . . . Start-up tests and demonstration shall be performed by the pump manufacturer's representative and the Contractor, and witnessed by the Government...

The contract also required full size factory testing witnessed by the Government prior to shipment of the pumps. However, we found that the process for Government sign-off on the factory testing and designation of who had the authority to approve that the equipment was ready for shipment was not formalized.

The contract administration and documentation issue was extensively addressed by the MFR, ITR and the GAO reports. These reports found numerous deficiencies in contract documentation.

The June 4, 2007, MFR has addressed documentation, contract administration and oversight issues partially. It stated:

> My expectation is that the team should document their ongoing contract procurement actions even while working under crisis conditions. I will form a team to help them bring the documentation file up to date. An improvement in future operations would be to deploy a contract administration team to work along side the project delivery team, with the sole focus of performing and assuring correct and complete contract actions and documentation." It further stated: "Meanwhile our team of engineers worked with the manufacturer in the factory to adjust/retrofit/improve the pumps in actual field conditions daily to assure that the pumps reached the required level of reliability.

The ITR found certain key elements of the solicitation documents missing from the contract files. The ITR also noted several change orders (contract modifications) with apparent missing documentation.

The December 31, 2007 GAO report also stated:

> Contract files for the pumping systems, although incomplete at the time of the ITR review, now contain the required documentation for the type of contract and value of the associated modifications. In a number of cases, Corps officials inserted required documentation in the contract files several months after modifications were issued and only after the ITR reported its findings. The ITR correctly noted the absence of some required documentation. However, we found much of the documentation that the ITR specifically cited as missing—including requests for proposals, independent government estimates, certified cost or pricing data, technical analyses, and price negotiation memorandums—was not required, either because documentation was not relevant to the contract modifications in question . . . Further, the contract itself was not written as precisely as it should have been. Specifically, the original factory test requirements were ambiguous, there were limited provisions for on-site testing, and there were no criteria for acceptance of the pumping systems by the government.

GAO recommended that the USACE:

> Take steps, through additional guidance or otherwise, to reinforce the importance of adherence to sound acquisition practices even during expedited procurements, including ensuring that important contract provisions, such as any required testing, are clear and that the contractor and the government understand what conditions or criteria must be met for successful completion of the contract.

DoD (and the Army) concurred with the recommendation and stated that USACE will review and revise, as necessary, current policies and regulations to ensure that a reasonable period of time is identified for completing and filing contract documents.

We found evidence of Government's project oversight during factory and on-site testing of the pumping systems. The complainant herself was a member of the factory test oversight and site installation teams. Although a supply contract did not require appointment of a contracting officer's representative (COR), USACE appointed the on-site resident engineer as the COR for the pump contract. The USACE stated that a COR was not appointed at the factory, as there was a shortage of qualified personnel.

Analysis: The allegation concerning inadequate documentation was substantiated. Several audits and examinations found significant deficiencies in contract documentation. We consider it appropriate that the Army has taken actions to emphasize the future need for proper documentation, despite project urgency. We found that USACE provided ample project oversight at the factory as well as at the installation sites.

Allegation #10: Original bidders for the contract would not have been rejected if the requirement for factory load testing that was subsequently deleted from the contract had not been in the Request for Proposal.

Facts: The December 31, 2007 GAO Report addressed the issue as follows:

> The testing specifications used for the RFP were nearly identical to those published by ... [the winning contractor], which included an open sump test requirement. After the other manufacturers complained that the open sump test requirement was restrictive because only ... [the winning contractor] had an open sump, the Corps amended the RFP to delete this requirement. This open sump test requirement was incorporated into the contract at the time of award, however, because it was offered by ... [the winning contractor] as part of its proposal.

USACE representatives stated that the open sump test requirement was deleted from the RFP and was not a factor in the source selection. It, therefore, had no effect on the original bidders' ability to compete. According to the contracting officer, who was also the Source Selection Official, neither the full scale open sump test nor the contractor facilities was a factor in the final selection of the pump manufacturer. During the source selection, each contractor was judged only on its technical approach, project management expertise, past performance, and small disadvantaged business initiatives. The winning contractor was rated significantly higher on the selection criteria.

The winning contractor's proposal included the conduct of full scale performance testing at the factory and therefore, it was left in the contract.

Analysis: The allegation was not substantiated. Indeed, the requirement for open sump testing that some bidders found objectionable was deleted from the RFP in order to enhance competition. Moreover, the Source Selection Official stated that test facilities were not a factor in judging the bidders.

Allegation #11: The complainant alleged:

> The Task Force Guardian ACE [USACE] team refused to hold the contractor responsible for providing accurate and truthful quality control documentation for pumping equipment, and refused to hold contractor responsible for engaging in misleading and deceptive actions to conceal actual number and nature of failures.

Facts: The contract required the contractor to provide test documentation as follows:

> The Contractor shall provide and maintain an inspection system acceptable to the Government covering the supplies, fabricating methods, and special tooling under this contract. Complete records of all inspection work performed by the Contractor shall be maintained and made available to the Government during contract performance and for as long afterwards as the contract requires.

Documentation from the complainant and from the Jacksonville shop inspection reports show problems and corrections at the factory that were not all recorded in the contractor's factory quality control reports. However, the USACE was informed of the problems and corrections were made to address pumping system problems.

Analysis: The allegation was partially substantiated. The contractor's documentation did not include every problem and correction. However, the Jacksonville QC team also provided documentation and USACE took corrective actions when they became aware of the problems. We found insufficient evidence to conclude that the contractor engaged in deception to conceal equipment failures. We agree with the December 31, 2007, GAO report recommendation:

> Develop procedures to ensure that any contract related documentation, including that related to contract pricing, is completed and filed within a reasonable period of time.

Allegation #12: The USACE team personnel refused to hold the contractor responsible for hydraulic oil with foreign object contamination (metal shavings, etc.), and hydraulic pipe flushing procedures that caused hydraulic oil to solidify within the hydraulic system.

In the complainant's October 13, 2006 Declaration the complainant alleged:

> We have had issues of the hydraulic oil in the hydraulic system of the pumps in the field turning to a Jell-O (like Jell-O shots) consistency and requiring every part of every pumping equipment component to be flushed and refilled...during an inspection of the hydraulic reservoir there was discovered a large amount of hydraulic oil in the bottom that had turned to a Jell-O like consistency (4" thick slab about 1.5' x 4'). In addition, during the inspection of the Denison hydraulic pumps there was observed large number of pumps that had a jelly like substance through out their internal workings. It was later discovered by our testing lab that the Jell-O like substance was caused by a reaction of calcium and water within the hydraulic oil. The calcium was introduced by the pickling compound used in the hydraulic piping provided by [...the contractor] and the water was present by virtue of the hydraulic system not being 100% contained [...the contractor's] own flushing procedure caused the pickling compound to be introduced to the hydraulic oil, and the subsequent introduction of water caused the reaction to occur. [...The contractor] stated during a meeting on this subject that they did not feel it necessary to rectify this problem and would not take measures to correct it. When I asked [...the contractor] if the jell-O like hydraulic oil met the specifications of the hydraulic oil required by the Denison hydraulic pump and Rineer motors, they did not answer. My understanding was the government was to bear the cost of flushing/cleaning/refilling all the hydraulic pumping systems because [...the contractor] refused to do so (a day before I left New Orleans three contracts were being awarded to outside contractors to perform the needed flushing/cleaning/refilling). This cost, and all associated costs, should be born by [...the contractor].

Facts: The contract incorporated several FAR clauses by reference and stated:

> All supplies furnished under this contract will be free from defects in material or workmanship and will conform to all requirements of this contract.

The contract stated that the contracting officer may require, by written notice, the prompt correction or replacement of any supplies. Even though the contract does not specifically mention hydraulic oil, the above clause applies to the hydraulic oil.

Numerous impurities were noticed in the hydraulic system installed at the sites. The impurities were attributed to slag from welding operations and metal shavings from sawing and pipe cutting operations entering hydraulic pipes during the building of pipe racks by the on-site contractors.

Additionally, a jelly like substance in the hydraulic fluid reservoirs, on the tank filters, and hydraulic pumps located at Orleans and London Avenue canals was observed. Testing of the filter indicated a high level of Calcium, Boron, and Silicon, which was believed to be the result of the oils used in the pickling process. Additionally, the suction strainers and hydraulic fluid reservoirs contained large amounts of metal particles. USACE personnel informed us that

the hydraulic pump units were shipped to the New Orleans sites with hydraulic oil in the reservoirs. During installation of HPUs additional hydraulic fluid from a local supplier was added. When the two hydraulic fluids mixed, a jello like substance formed. An analysis of the hydraulic fluids revealed that the two hydraulic fluids had different consistencies. The contractor replaced the hydraulic fluid but insisted that the hydraulic system was clean and did not require further flushing and cleaning. The contract did not specify a specific procedure for flushing and cleaning the hydraulic pipes. Therefore, the USACE decided that long-term reliability would be best served by requiring a cleaning process that was not specified in the contract. In July 2006 two contract modifications were issued to implement new cleaning and flushing of hydraulic piping at the three installation sites.

Analysis: The allegation was not substantiated. The USACE enforced contract provisions. The contractor replaced the contaminated hydraulic fluid that had turned into jell-O like substance but insisted that the hydraulic system was clean and did not require further flushing and cleaning. The USACE realized that the contract did not specify a specific procedure for flushing the hydraulic pipes. Therefore, USACE determined that for long term reliability the system required a more thorough cleaning to prevent metal particles and other impurities from getting into the hydraulic pump units. The additional cleaning was accomplished through contract modifications at Government expense.

Allegation #13: The hydraulic piping supplied by the contractor is not in accordance with accepted industry standards.

Facts: Sub-section 2.4 of the contract stated the hydraulic piping requirements as follows:

> Hydraulic lines connecting the power unit to the pumping unit shall be a combination of black steel pipe and reinforced hose and shall be installed in accordance with the drawings and as specified herein. Supply pipe shall be ASTM A106, Schedule 80 seamless black steel pipe, and return pipes shall be ASTM A106, Schedule 40 seamless black steel pipe...

USACE representatives stated that the contractor supplied the pipes to the standards specified in the contract. The contract required pipe meeting American Society for Testing and Materials (ASTM) A106. ASTM A106 is a material properties specification which is verified by mill certifications. The properties identified in ASTM A106 are used in the formulas of the American Society of Mechanical Engineers (ASME) codes B31.1 and B31.3 to determine the pipe size.

However, the ITR stated, "The hydraulic piping does not meet the requirements of ASME B31.1..." and recommended, "...that a certified hydraulic systems inspector determine if the system is free of shock loading and certify that the system as built is safe to operate for the intended use."

In response to the recommendation made in the ITR, USACE hired a professional engineer who performed an evaluation to determine the suitability of the hydraulic piping system design and construction. The consultant was advised by an ASME representative that code B31.3, not code B31.1, was the proper code for this application. Using the formulas found in ASME code B31.3 and the properties of ASTM A106 pipe, the consultant determined that the piping was in accordance with the appropriate industry standard. In addition, he tested the installed piping system at 1.5 times the design pressure (4500 psi) and observed no failure in piping and found the system working satisfactorily. The professional engineer concluded that the hydraulic piping system, design, and construction were suitable for transmitting power from the diesel engine to the vertical water pumps. Shock loading in the drive was not an issue. There were no rapid closing valves in the oil power system. Engineering calculations indicated that the pipe envelope did not present a safety hazard. In summary, the professional engineer found the existing hydraulic pipes adequate.

In addition, another consultant analyzed the adequacy of the ASTM A106 Schedule 80 black steel pipe used as hydraulic conduits for the pumps. He stated in his report:

> Based on the above observations and ...[the contractor representative] e-mail dated May 18, 2006, we believe that the 3" diameter Sch. 80 seamless black steel pipe is adequate for the hydraulic conduits for the hydraulic pumps at the 17th Street Canal Interim Pump Station.

Analysis: The allegation was not substantiated. The hydraulic pipes supplied by the contractor met the contractual specifications and accepted industry standards. The ASME advised that the correct standard for this purpose was ASME B31.3.

Allegation #14: The complainant alleged:

> ...they [the contractor] referred to my mandated 100% presence for pump testing oversight by USACE QA [Quality Assurance] personnel, including full QA and photographic documentation of all ongoing pump equipment testing, to be excessive, unnecessary, and somehow detrimental to getting pumps delivered to the city of New Orleans.

Facts: The USACE representatives told us that the contract did not specify the extent of oversight during factory testing. The contract states:

> Full size factory testing shall be witnessed by the Government prior to shipment of the pumps.

The contract also includes by reference FAR 52.246-2 which states:

> The Government has the right to inspect and test all supplies called for by the contract, to the extent practicable, at all places and times, including the period of manufacture, and in any event before acceptance. The Government shall perform inspections and tests in a manner that will not

> unduly delay the work. The Government assumes no contractual obligation to perform any inspection and test for the benefit of the Contractor unless specifically set forth elsewhere in this contract.

In response to the contractor's expressed concerns regarding the complainant's oversight activities, USACE assessed the issue and included the following statement in a contract modification:

> Inspectors are to be notified of the initiation of test with enough time to travel between test sites and witness the beginning and ending of all tests, even if only one inspector is on duty at that time.

Analysis: We confirmed that the contractor raised objections to the complainant's rigorous oversight activities because the original contract intent was not clear regarding the extent to which Government representatives would be involved in pump testing. We concluded that USACE management reasonably attempted to balance the need for Government involvement in testing with the need to avoid the type of interference which could slow production. The USACE decision to modify the contract to require the Government representative to witness the beginning and end of each test was an acceptable approach.

Conclusion and Actions Taken or Planned

The New Orleans Temporary Outfall Canal Pumps were procured and installed under emergency conditions. The project team made many hurried decisions that sometimes left protocol and documentation lacking. However, our review revealed a dedicated effort by committed professionals, including the complainant, to procure, debug, and install a temporary outfall canal pumping system to help protect the people of New Orleans. According to information we obtained, this was the largest pumping system ever procured by the USACE, having a 60-inch water pump diameter. The largest pumps previously procured by the USACE had a 42-inch diameter.

As indicated in this report, we found several of the allegations were substantiated. Testing at the factory and on-site disclosed numerous deficiencies that were corrected by the contractor at no cost to the Government, or through contract modification when necessary. Furthermore, the effort to produce and install the pumping systems on an expedited basis resulted in the failure to properly document the contract files. However, we consider these deficiencies performance-related shortcomings that did not rise to the level of a serious violation of law or regulation, abuse of authority, or gross mismanagement. Nor did they result in a gross waste of funds or a danger to public health or safety. Accordingly, we found insufficient basis to make a referral to the Attorney General pursuant to Section 4(d) of the IG Act or to recommend disciplinary action against any Government employee.

The Army is implementing recommendations that were made by the GAO to improve the management of future expedited projects as set forth below. We make no additional recommendations.

GAO REPORT 08-288, 'ARMY CORPS OF ENGINEERS: KNOWN PERFORMANCE ISSUES WITH NEW ORLEANS DRAINAGE CANAL PUMPS HAVE BEEN ADDRESSED, BUT GUIDANCE ON FUTURE CONTRACTS IS NEEDED,' DATED DECEMBER 31, 2007, (GAO CODE 360879)

DEPARTMENT OF DEFENSE RESPONSE TO THE RECOMMENDATIONS

Recommendation 1: We recommend that the Secretary of Defense require the Chief of Engineers to:

Take steps, through additional guidance or otherwise, to reinforce the importance of adherence to sound acquisition practices even during expedited procurements, including ensuring that important contract provisions, such as any required testing, are clear and that the contractor and the government understand what conditions or criteria must be met for successful completion of the contract.

DOD RESPONSE: CONCUR: The U.S. Army Corps of Engineers will send a memo to all Corps offices reinforcing the importance of adherence to sound engineering practices even during expedited procurements. The memo will relate lessons learned and emphasize the need for technical specifications, such as those required for equipment testing, to be clear so that the contractor and the government understand what conditions or criteria must be met for successful completion of the contract. The anticipated date to transmit the memo is 14 March 2008.[[2]]

Recommendation 2:
Develop procedures to ensure that any contract related documentation, including that related to contract pricing, is completed and filed within a reasonable period of time.

DOD RESPONSE: CONCUR: The U.S. Army Corps of Engineers will review and revise, as necessary, current policies and regulations to ensure that a reasonable period of time is identified for completing and filing contract documents. Estimated completion date is 30 May, 2008.[[3]]

[2] The memo was distributed to all USACE districts and divisions on February 25, 2008
[3] The USACE completed revisions of policies and regulations on February 27, 2008