Apariq

Final Independent Engineering Expert Opinion Report for the U.S. Office of Special Counsel (OSC) on Hydraulic Pumping Equipment Related to Three Major Flood Protection Structures in New Orleans

Covering Contract 20080028 OSC-MGT-045-2008 - Scope C-3 (Only)

20 May 2009

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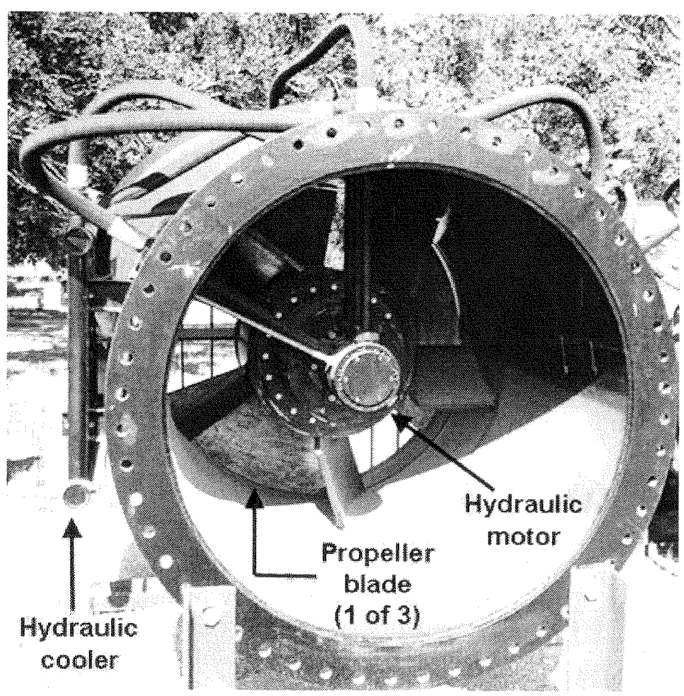
Founded as Veteran Owned Business in 1999

Registered Professional Mechanical Engineering Expert Testimony



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ACRONYMS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CCTV	Closed circuit television
cfs	Cubic feet per second
CM	Configuration Management
CO	Contracting Officer
COR	Contracting Officer's Representative
COTR	Contracting Officer's Technical Representative
DHP	Denison Hydraulic Pump (pumps hydraulic oil)
DOD	Department of Defense
DoDIG	Department of Defense Inspector General
ERDC	Engineer Research and Development Center
FAR	Federal Acquisition Regulation
FEM	Facilities & Equipment Maintenance
GAO	United States Government Accountability Office
GHz	Gigahertz
GOCM	Gear Oil Circulating Motor
gpm	Gallons per minute
HI	Hydraulic Institute
HPO	Hurricane Protection Office
HPU	Hydraulic Power Unit
Hz	Hertz
ICS	Interim Closure Structure
IG	Inspector General
IP	Internet protocol
IPET	Interagency Performance Evaluation Taskforce
ITR	Independent Team Report
KTR	Contractor
kVA	kilovolt Ampere
L10 Life	The theoretical life span of a bearing under a specific set of dynamic operating conditions associated with 90% reliability.
MFR	Memorandum for Record
MIL-SPEC	Military Specification
MIL-STD	Military Standard
MIPR	Military Interagency Procurement Request
mph	Miles per hour
MTBF	Mean time between failures
MWI	Moving Water Industries
NDE	Non-Destructive Examination
NEC	National Electrical Code

NFPA	National Fluid Power Association
NOAA	National Oceanic and Atmospheric Administration
NOD	New Orleans District
NPSH	Net Positive Suction Head
OIG	Office of the Inspector General
OIM	Operations Instruction Manual
OSC	Office of Special Counsel
psi	Pounds per square inch
psig	Pounds per square inch gauge
PTC	Performance Testing Code
QA	Quality Assurance
QAR	Quality Assurance Report
QC	Quality Control
RFP	Request for Proposal
RHM	Rineer Hydraulic Motor (hydraulic motor running on pressurized hydraulic oil)
rpm	Revolutions per minute
SCADA	Supervisory Control and Data Acquisition
SWB	(New Orleans) Sewerage and Water Board
TFH	Task Force Hope
U.S.	United States
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
WP	Water Pump (pumps water only)

1 EXECUTIVE SUMMARY

APARIQ, Inc. (APARIQ) is pleased to present opinions, conclusions, and unanswered questions regarding pumping equipment manufactured and installed by Moving Water Industries (MWI) within three (3) outfall canal structures located at 17th St., London Avenue, And Orleans Ave., New Orleans, LA.

APARIQ under contract to the Office of Special Counsel (OSC) was not authorized to visit MWI, talk with anyone from MWI, visit the three outfall canal structures in New Orleans, or talk with any person from the U.S. Army Corps of Engineers except for the whistleblower.

APARIQ has tried its best to make the most accurate expert evaluations and analyses regarding the design, performance, operation, maintenance, and vulnerability of the hydraulic pump systems without being authorized to visit MWI and the pumping stations in New Orleans.

While many documents were important, the more pivotal documents for this review included (but are not limited to):

- "OSC Report on Analysis of Disclosure, Agency Report, Whistleblower Comments, and Comments of the Special Counsel", OSC File No. 01-07-2724
- Public Law 109-234 Funding Hurricane Recovery, dated 15 June 2006
- USACE "Solicitation, Offer and Award" No.W912P8-06-R-0089 contract deliverables and amendments in late 2006 and early 2007
- "Phase 2 Conceptual Design Services for Permanent Flood Stations and Canal Closures at Outfalls, Alternative Considerations Report," prepared for USACE by Black & Veatch, dated **12 December 2006**
- "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used on New Orleans Outfall Canals" from ERCD/CHL by Dr. Stephen T. Maynord, Dated **December 2006**
- Public Law 110-28 Directing Pump Use Options 25May 2007
- Inspector General, United States Department of Defense, Report No. D-2008-TAD-005, "Policy and Oversight, Alleged Flawed Procurement of New Orleans Temporary Outflow Canal Pumps" dated **14 May 2008**
- "Independent Engineering Assessment of the New Orleans Temporary Outflow Canal Pumps", dated **27 February 2009**, *Prepared by Parsons (Corporation), under* Contract No. GS-00F-0005R, Parsons Project No. 746558
- "Permanent Enhancement of the ICS Facilities, Final Report", dated **27 April 2009**, prepared under contract to USACE by ECM-GEC Joint Venture in association with Black & Veatch Special Projects Corp
- Numerous factual records and documents from the whistleblower

Based on the review of documents for this report, there was:

1. **Little logical justification for *(Serious violations of laws or regulations, abuse of authority, or gross mismanagement as related to)***
    a. Restricting the emergency pumping capability solicitation No.W912P8-06-R-0089 to under-designed and untested hydraulic pump systems only, especially when the chosen hydraulic pump systems took longer to procure, design, factory test, and install than proven direct drive pumps (428 days vs. 236 days);
    b. Not adequately verifying that MWI had successfully run hydraulic pumping systems of the same size (and capacity) or larger for more than five years (otherwise most of this investigation would not be necessary):
    c. Allowing significant deviations from the solicitation requirements and bid proposal specifications, then relaxing critical requirements when MWI could not meet the requirements (which may have been a result of misleading or fraudulent representations);
    d. Not requiring the installation of a reliable pumping system which would adequately protect New Orleans, should additional funding be delayed or cancelled;
    e. Not requiring that any "temporary" (if they were truly "temporary" pumping systems be put on removable skids for ease of installation, ease of replacement, and ease of maintenance (both on-site and off-site).

2. **Little logical justification for *(Gross waste of government funds as documented in the 27 April 2009 ECM-GEC Joint Venture Report and reflected by)***);
    a. Spending $100's of millions (for pump procurement and pump infrastructure installation) in 2007 to install forty (40) MWI hydraulic pumps, which are scheduled to be replaced at an estimated cost of >$430 million within 3-5 years, when the purchase of proven direct drive pumps could have been accomplished more quickly, more reliably, and without planning for pump capacity replacement[1];
    b. Selecting and installing hydraulic pumping equipment that could not be maintained
        i. at the lowest operating and maintenance (O&M) costs, and
        ii. without using a large lifting crane;
    c. Installing hydraulic equipment which was not adequately protected against corrosion, which further decreased reliability, decreased operating lifetime, and increased O&M costs;
    d. Installing hydraulic equipment without containment protection to prevent hydraulic leaks (from system failures and storm damage) from polluting waterways, (potentially violating the Clean Water Act).

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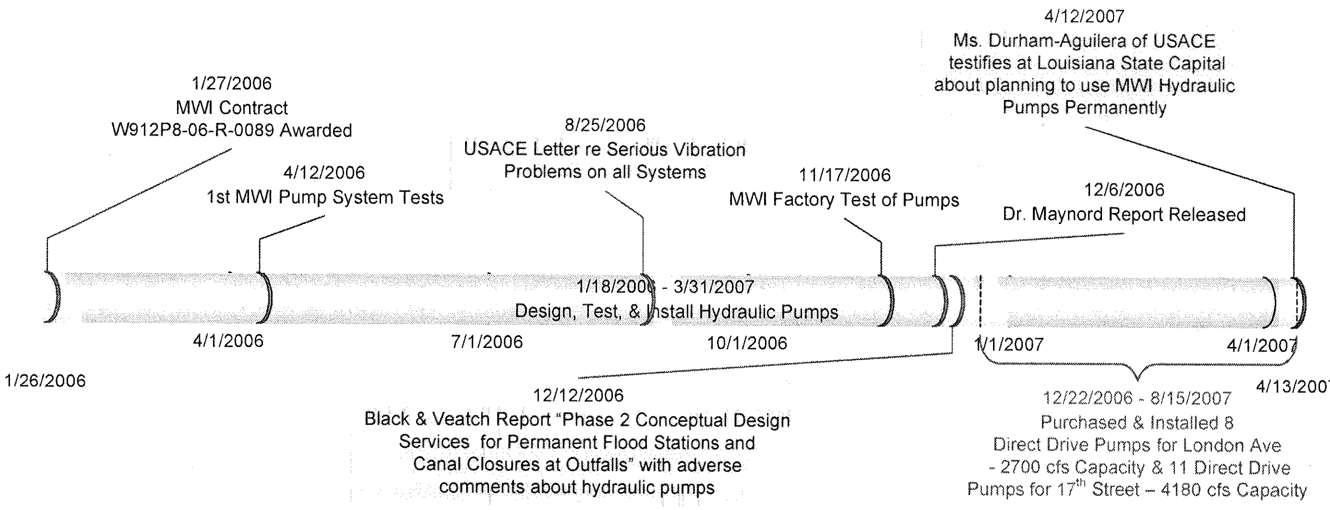
[1] The complaintant's comments in her response captures this item very well; "*3.5. Permanent Enhancement of the ICS Facilities Final Report dated April 27,2009. This Report, prepared for USACE, MVD, NOD by ECM-GEC Joint Venture, investigates and reports forward on what modifications are required to extend the life of the Interim Control Structures (ICS) at all three outfall canals to a 50 year design life. Amazingly this report recommends all the currently installed direct drive pumps remain and all the currently installed hydraulic pumps and their associated piping with support structures be removed and replaced with direct drive type pumps and associated structures. This Report goes on to state problematic operational and maintenance issues surrounding the hydraulic pumps are the main reason for recommending they be removed and replaced. This Report goes on further to recommend improving pumping capacity at all three outfall canals by adding direct drive type pumps to the existing ICS in order to meet the pumping capacity associated with a 100 year storm event.* "



The Black & Veatch report dated 12 December 2006, documented that as early as 4 August 2006, DMJM Harris prepared a report addressing issues "prior to construction and operation of a permanent system in 2010". The question of what would be included in the "permanent system" had not been finalized. As late as 12 April 2007, Ms. Durham-Aguilera of USACE testified at the Louisiana State Capital at a public hearing that the MWI hydraulic pumps would be permanent.

After the first factory tests about 12 May 2006, there appeared to be growing (but unspoken) concern about the reliability of the MWI hydraulic pumps and whether the pumps were temporary or not.

While it was less difficult to create a one-to-one mapping between (a) the parts of the 1st DoDIG Report dated 14 May 2008 and (b) rebuttal comments by the Complaintant about the 1st DoD IG Report, it was much more difficult to map the comments between the 2nd DoDIG Report, "Independent Engineering Assessment of the New Orleans Temporary Outflow Canal Pumps" Report by Parsons dated 27 February 2009 with the Complaintant's responses relative to each of the original 14 allegations, because the 2nd DoDIG Report did not reference any of the allegations directly.

In some cases Parsons presented information inaccurately and in other cases made statements that could likely lead an uninformed reader to false conclusions. Some examples of misleading or inaccurate statements are presented as examples below:

- Parsons stated on page 1-2 under 1.2 Scope "*The overall objectives of the assessment are to review the adequacy of testing of the temporary pumping systems and to identify and assess vulnerabilities of the hydraulic pumping systems to failures in the event of a hurricane (specifically a 10-year, 24-hour rainfall event to which USACE designed the systems)*"; when in fact the U.S. Corps of Engineer's Task Force Hope (TFH) was created to bring New Orleans regional flood protection up to 100-year storm standards.
- Parson stated on page 1-1 "Permanent pump stations are scheduled to be constructed by 2013." This is clearly different from the Black & Veatch same milestone for 2010. (2010 and 2013 cannot both be right.)
- Parsons made statements at least twice that "hydraulic…pumps were put in service…" without ever mentioning that the hydraulic pumps were run at low operating speeds.

- Parsons overlooked many fundamental considerations, including (but not limited to) missing the MWI failure to deliver the required startup clutches[2], overlooking undersized components such as the Durst Drive, and overlooking inadequate and inaccurate hydrostatic testing.

There are parts of the Parsons Report that are fundamentally accurate.

It is not reasonable to try to blame failures on one isolated subsystem or another when the success or failure of the entire system is a function of the successful integration of all the complements that might be represented in the figure below.

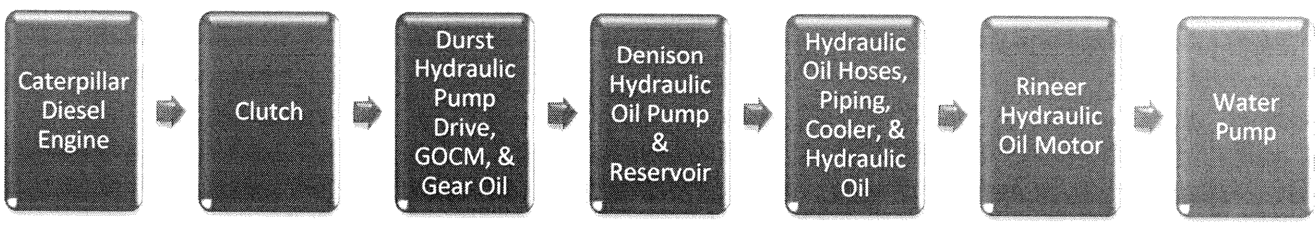


Figure 1 - Simple Representation of the MWI Hydraulic Pumping System

The key and most important issues remain, **"Will the hydraulic pumping equipment installed in three main structures by USACE constitute 'complete fully functional pumping system(s)' and 'protect New Orleans from a 100-year storm event' without the addition of any additional or replacement pumping capacity?"**

APARIQ also believes it is imprudent to accept any system as proven, simply because a company built a similar product/system before. Perhaps it is reasonable to make a comparison to several automobile analogies to put past performance in perspective with guaranteed performance of new products. In 1957 GM's Chevrolet Division manufactured one of the best American cars ever made, yet the 1958 Chevrolet was a quality control disaster. Oldsmobile had made high quality automobiles for years and diesel engines had a great reputation for long life and durability, so both the company and the technology had fantastic reputations; yet the Oldsmobile diesels produced from 1978-1985 were infamous for bad reliability. The first Jeep Grand Cherokees with six cylinder engines were very successful, but as soon as Jeep put a V-8 engine in the same car without redesigning the transmission, the higher torque (twisting force) from the V-8 engines caused an unprecedented number of transmission failures in what had been a very reliable automobile. Today, the future of both GM and Chrysler is uncertain, even though they were highly successful in the past. Past success does not guarantee future quality performance.

[2] APARIQ believes MWI did not properly consider all of the ramifications of using a 735 hp diesel engine operating at 1800 rpm, connected to an HPU. MWI probably could not find a single reasonably priced vendor with a clutch capable of handling the output horsepower and torque of the 3412 Caterpillar diesel engine, and therefore MWI had to circumvent a contract requirement to install a clutch between the engine and the hydraulic pump drive. Many components MWI had used previously on smaller systems were simply too small and undersized for the New Orleans pumping application.

Past performance from a proven vendor with a similar product provides no guarantee the next product or system will be as reliable, especially when the new product or system is the first of a new generation of larger products/systems, e.g. moving up to a higher horsepower engine does not necessarily mean that you can use all of the same auxiliary sub-system components without problems.

Because of the Complaintant's great level of detail and a plethora of actual facts in her responses to each one of these reports from the DoDIG (see sections 4 and 0 of this report), APARIQ has not made any effort to duplicate each and every one of the statements made by the Complaintant, unless the duplication of the statement was absolutely necessary for the explanation of APARIQ opinion relative to an allegation.

Based on the review of documents and communication with the whistleblower, APARIQ believes the allegations of the whistleblower have significant merit and should be seriously considered by OSC.

1.1 APARIQ's Very Brief Overview of the Validity of Complaintant's Allegations from OSC File No. DI-07-2724

The following very brief table of APARIQ opinions has been created from an extensive review of two DoDIG reports, many factual documents from the Complaintant, reviews of information from vendor's websites, a myriad of professional engineering handbooks and information, hydraulic Institute and ASME standards, and more than forty years of high pressure hydraulic system and pump experience. A more detailed set of opinions about each of the allegations is provided in Section 3 of this document.

1.1.1 *Design Allegations*

	Complaintant's Allegation	APARIQ's Summary Opinion about Allegation
#1:	Flawed design allowed air to enter into Denison hydraulic pumps on the HPUs causing damage and subsequent failure of the pumps.	Partially valid, but not the entire cause of related problems
#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 3,000 pound/square-inch (psi) hydraulic pressure as required.	Partially valid, because most of these related problems were caused by poor component selection, improper system design, overheating of hydraulics causing failure of seals. Pressure was not the root cause.

1.1.2 *Testing Allegations*

	Complaintant's Allegation	APARIQ's Summary Opinion about Allegation
#3:	Factory testing for the hydraulic pump and water pump was incomplete and defective equipment was shipped to the sites.	Valid
#4:	Ms. Garzino 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.	Valid

	Complainant's Allegation	APARIQ's Summary Opinion about Allegation
#5:	Ms. Garzino 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.	Valid and issues are more significant than stated by the Complainant.

1.1.3 *Installation Allegation*

	Complainant's Allegation	APARIQ's Summary Opinion about Allegation
#6:	Defective and untested pumping equipment was installed.	Valid

1.1.4 *Operational Capability Allegation*

	Complainant's Allegation	APARIQ's Summary Opinion about Allegation
#7:	USACE allowed less than full designed capacity performance as called out in the contract.	Valid

1.1.5 *Contract Issue Allegations*

	Complainant's Allegation	APARIQ's Summary Opinion about Allegation
#8:	Ms. Garzino alleged: TFG 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 the Contracting Officer to mitigate pumping design deficiencies.	This appears to be true.
#9:	USACE team personnel did not engage in usual and customary USACE contract administration practices or conduct project oversight and documentation that would ensure even minimum requirements could be met to protect the Government's interests.	This appears to be true.

	Complainant's Allegation	APARIQ's Summary Opinion about 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.	Unable to second guess the decisions of the proposal evaluators long after the bid proposal evaluations were completed.
#11	The complainant alleged: TFG ACE [USACE] team refused to hold the contractor responsible for providing accurate and truthful quality control documentation for pumping equipment, and refused to hold the contractor responsible for engaging in misleading and deceptive actions to conceal the 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, USACE was informed of the problems and corrections were made to address pumping system problems.	Valid
#12:	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.	Valid
#13:	The hydraulic piping supplied by the contractor is not in accordance with accepted industry standards.	Valid
#14:	Ms. Garzino 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.	Valid

1.2 In Some Cases, the Complainant's Allegations Only Identify System Symptoms and Not Necessarily Root Causes

As you review this document, APARIQ suggests you keep in mind that the requirement to contrast the 14 allegations from the Complainant against the two DOD IG reports is a contractual requirement; yet focusing on the allegations alone fails to fully unveil the complexity of the underlying issues.

From a holistic standpoint one could ask, "Will the installed pumping capacity adequately protect the City of New Orleans from a 100-year flood event or not, even though Parsons incorrectly described the scope of pumping need or vulnerability relative to a 10-year event *"... (specifically a 10-year, 24-hour rainfall event to which USACE designed the systems)."* in their DODIG report?"

If APARIQ tried to restrict analyses to simply addressing the validity of the Complainant's allegations and the two DoDIG reports, we would overlook a number of important issues that in some cases differ from the thrust of the allegations and in other cases might actually expand the scope of the allegations.

Cross-Correlation Between Allegations and MWI Sub-Systems Design & Planning Issues

Allegation	Diesel Engine	Clutch	Durst Pump Drive & GoCM	Denison Hydraulic Oil Pump & Reservoir	Hydraulic Oil, Hoses, Piping, & Cooler	Rineer Hydraulic Motor	Water Pump	Test Proce-dure Validity	Startup & Opera-tion Validity	Vulner-ability Validity
#1			1	1						
#2				1	1	1				
#3				1			1			
#4				1	1	1		1		1
#5								1		
#6									1	1
#7								1		
#8								1	1	1
#9								1		1
#10								1	1	1
#11								1	1	1
#12					1					
#13					1					1
#14								1		1

Key: [1] Indicates a cross-correlation between the allegations and the MWI required sub-systems
[ ] Indicates an indirect cross-correlation perhaps overlooked by the 14 Allegations

Figure 2 - Cross-Correlation between Allegations & MWI Sub-Systems Design & Planning Issues

For example, none of the 14 allegations address any problems with the failure of MWI to meet a contractual requirement to provide clutches between the diesel engines and the Durst pump drives, yet the failure of MWI to install a clutch as a contractual requirement and pretend that the installation of a solenoid operated hydraulic bypass valve was the equivalent of a clutch, most likely contributed to some of the equipment failures symptomatically described in a number of the allegations.

The yellow cells shown in Figure 2 illuminate indirect cross-correlations perhaps overlooked by the 14 Allegations and the red cells shown in Figure 2 indicate a direct cross-correlation between the allegations and the MWI required sub-systems.

While there are good things to be acknowledged about the two subject DoDIG reports and the work performed for the USACE, APARIQ believes the importance of examining the Complaintant allegation related documents falls into two distinct categories:

- Does the expert testimony of APARIQ support, mitigate, or contradict the allegations by the Complaintant? (Are the allegations valid?) and
- Are the allegations by the Complaintant symptomatic of much bigger and deeper "root cause(s)"[3] which have not been directly addressed?

"A chain is only as strong as its weakest link." The MWI "chain of sub-systems" might look like the following:

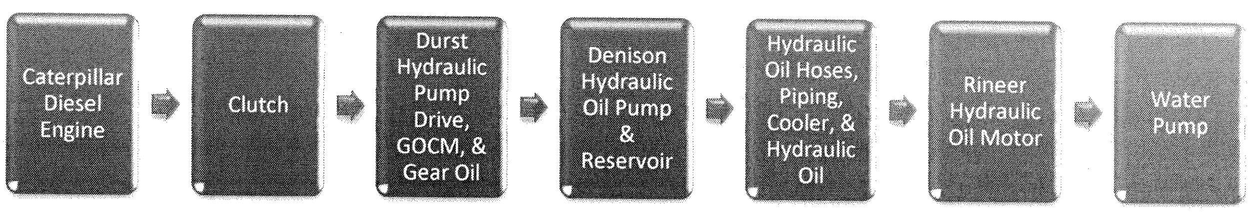


Figure 3 - "Chain of Sub-Systems" in MWI Pump System

If any one of the MWI "chain of sub-systems" is unreliable, the entire "chain of sub-systems" is only as strong as its weakest (most unreliable) link!

If all of the MWI hydraulic pump systems have to work at full rated speed and pressure for many days without failure to adequately protect the City of New Orleans against a 100-year storm event, then a failure of any combinations of the sub-systems will reduce the required pumping capacity and the City of New Orleans would not be adequately protected.

[3] A root cause of a consequence is any basic underlying cause that was not in turn caused by more important underlying causes. (If the cause being considered was caused by more important underlying causes, those are candidates for being root causes.) http://www.isixsigma.com/dictionary/Root_Cause-61.htm

2 BACKGROUND

2.1 DESCRIPTION OF CONTRACT SCOPE TO APARIQ, INC. FROM THE U.S. OFFICE OF SPECIAL COUNSEL (OSC)

The Office of Special Counsel entered into a contract with Apariq, Inc. (APARIQ) for an independent expert opinion on hydraulic pumping equipment as it relates to three major flood protection structures in New Orleans.

APARIQ was contracted to evaluate and provide an independent expert opinion based on generally accepted pump engineering industry standards, as a baseline to establish a fair determination of the integrity of the pumping equipment. The contract with APARIQ provided the following "SCOPE"(of work):

> "The Contractor (APARIQ) shall review the documents listed below independently, in order to form independent opinions, but will not have access to proprietary information or attorney product material. The Contractor shall contact OSC and the Whistleblower in order to consult about the materials submitted to the Contractor for review. The Whistleblower should be contacted through counsel, unless counsel authorizes otherwise. The Contractor will not have to travel to inspect sites, but will instead conduct a review of documentation and reports.
>
> "C-l. Specifically, the Contractor shall (by December 1, 2008) review government reports and materials (approximately 1500 pages of text and 100 pictures) provided to the Contractor by the Contracting Officer Technical Representative (COTR), including:
>
> - "information as it relates to OSC File No. DI-07-2724, namely documents submitted by a federal employee whistleblower, including her allegations and declarations regarding the design, testing, and installation of possibly defective hydraulic pumping equipment at three major flood protection structures in New Orleans, and material related to the Special Counsel's referral to the Department of Defense (DOD) which required DOD to investigate the allegations.
> - "an initial Department of Defense report responding to the allegations about the design, testing, and installation of possibly defective hydraulic pumping equipment at three major flood protection structures in New Orleans.
> - "comments from the federal employee whistleblower received pursuant to 5 U.S.C. § 1213(e)(l) in response to the Department of Defense's initial report, as well as OSC's subsequent findings in response to the initial report.
>
> "C-2. The Department of Defense is preparing a supplemental report which will be based, at least in part, on the use of an outside expert. The Contractor shall also review the pending DOD supplemental report, when it comes out, as well as the anticipated supplemental comments from the whistleblower concerning the adequacy of the DOD supplemental report's testing methodology, analyses, findings, supporting documents, and conclusions.
>
> "C-3. After review of the supplemental DOD report and supplemental comments from the whistleblower, the Contractor shall produce a written report giving an expert opinion into the allegations contained in OSC File No. DI-07-2724 and the validity of the two DOD reports and submit it electronically to the COTR along with five hard copies within 6 weeks of receiving copies of the material mentioned in C-2. Therefore it is important that the Contractor complete its review of the documents listed in C-l by December 1, 2008, in order to be ready to review the supplemental DOD report whenever it becomes available. If OSC deems it necessary, Contractor shall make a summary presentation to OSC, and/or make him/herself available for questions by OSC, if any.

2.2 APARIQ'S REVIEW OF INITIAL DOCUMENTS AND EXPANSION OF NUMBER OF DOCUMENTS FOR REVIEW

APARIQ completed the required review of all initially provided documents provided by OSC by 1 December and with OSC's permission began to communicate with the whistleblower, Ms. Maria Garzino.

APARIQ, by contract, was not authorized to visit MWI, not authorized to visit any of the pump locations in New Orleans, and not authorized to talk with any USACE personnel other than the Complaintant.

APARIQ has not had any contracts or subcontracts with the U.S. Army Corps of Engineers (USACE) and has not submitted any proposals of any kind to USACE, since APARIQ's incorporation in 1999.

After a careful and thoughtful review of the initial documents from OSC, many questions arose. After asking for additional information from OSC, APARIQ began asking the Complaintant for supplementary factual information which included additional pictures, drawings, correspondence, public records, test data, and other related factual information. The number of documents received by APARIQ for review quickly began to expand. Additionally, other manufacturer information was needed and many documents were retrieved from websites as sources for missing information necessary to supplement detailed independent engineering assessments, e.g. published sub-system design and operating limits.

In a small number of cases, both APARIQ and the Complaintant were not allowed to see relevant and important reports referenced in the 2nd and final "supplemental DOD report[4]" (DoD Parsons Report), specifically as described as follows on page 2-11 of the DoD Parsons Report in Section 2.6:

> "2.6 Laboratory Physical Sump Model Testing
>
> "A pump of this size and type can be sensitive to the approach flow hydraulics, and keeping with ANSI/HI standards, the HPO engaged the USACE ERDC in Vicksburg, MS, to conduct a physical model study of the Interim Pumping Stations at both the London Avenue Canal and 17th Street Canal. No physical model study was conducted of the Orleans Avenue Canal's pump station sump, as ERDC determined the modifications developed for the London Avenue Canal would be effective at the Orleans Avenue Canal's temporary pump station because the approach canal layouts were similar. The intake modifications which were developed for the London Avenue station were replicated at the Orleans Avenue station.
>
> "Two reports were developed for the physical model studies. The first report, "Physical Model Study of Interim Pumping Station at London Avenue Canal, New Orleans, Louisiana," dated January 2008 covers the study performed for the London Avenue Canal station. The second model study covered the 17th Street Canal station and is titled "Physical Model Study of Interim Pumping Station at 17th Street Canal, New Orleans, Louisiana," January 2008. The model studies were used to evaluate the potential for surface and subsurface vortices, flow pre-swirl entering the pumps, and the velocity distribution at the pump impeller location. The Parsons team reviewed the model studies with ERDC in New Orleans in November 2008."

Without access to the two physical model study reports mentioned above, APARIQ can only question why the USACE paid to have these studies performed after all of the hydraulic pumps were installed in New Orleans, especially if USACE planned (as the DoD Parsons Report states) to remove the hydraulic pumps by 2010-2013 (see the timeline in Figure 4). This seems like a waste of funds if the MWI pumps were temporary.

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[4] Independent Engineering Assessment of the New Orleans Temporary Outflow Canal Pumps, *Prepared by* Contract No. GS-00F-0005R, Parsons Project No. 746558, February 27, 2009

2.3 Relevant Timeline from Hurricane Katrina through 9/30/2008

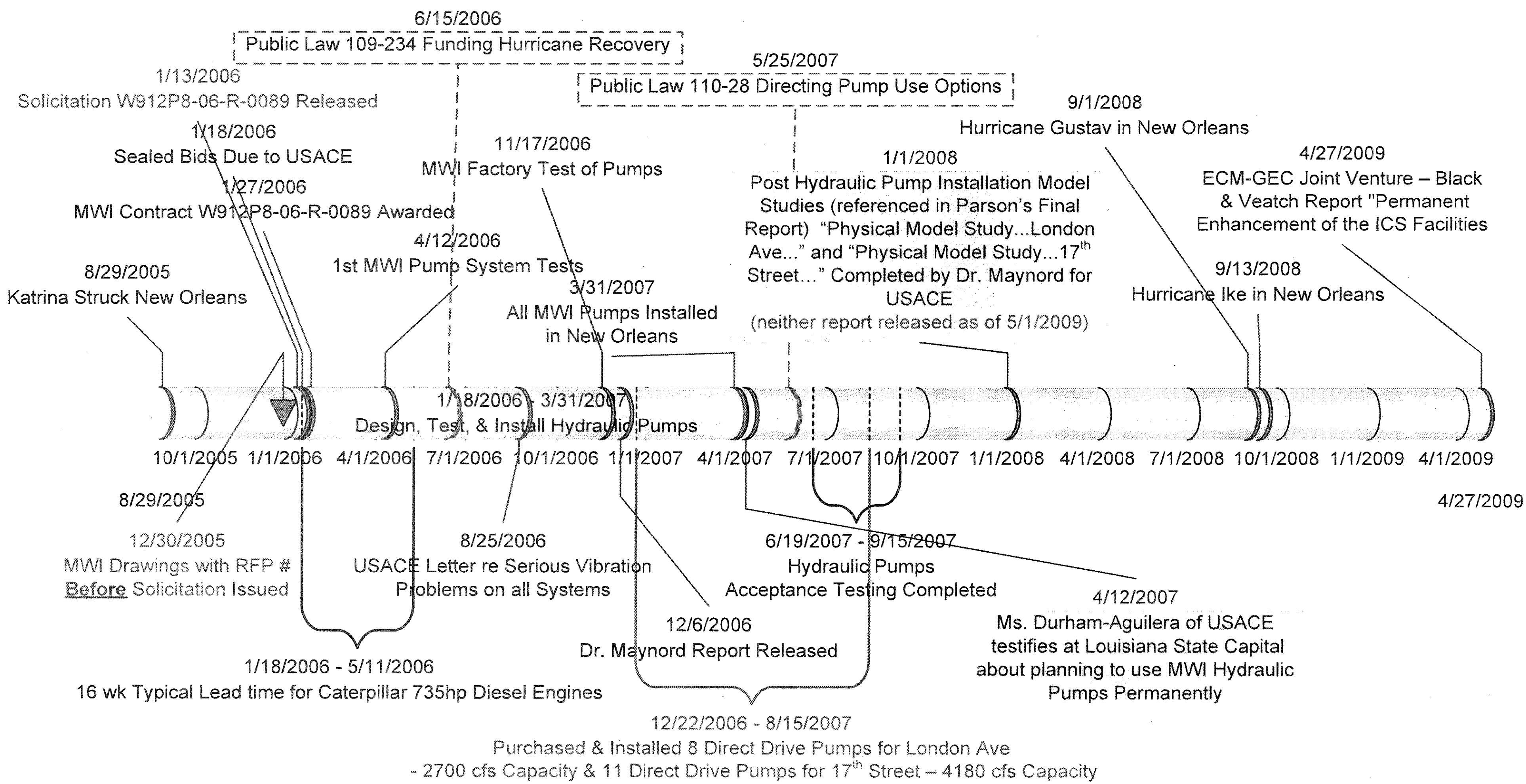

Figure 4 - Relevant Timeline from Hurricane Katrina through 9/30/2008

2.4 MWI Contract Deliverable Requirements NOT Met

There were a number of contractual requirements in the original solicitation and MWI contract award which were not met. Based on the review of the solicitation, the awarded contract, and other documentation the following contractual (deliverable) requirements were not met:

2.4.1 *Failure to Provide Professional Engineer Certified Guaranteed Pump Performance Curves (an initial USACE contract requirement)*

SECTION 11311 - DRAINAGE PUMPS AND DIESEL ENGINE DRIVES (Page 5 of 32)		
Section	*Solicitation and MWI Contract Requirements*	*Requirement Met?*
1.1	*The pump manufacturer shall furnish with the bid, guaranteed pump performance curves based on shop tests of pumps in accordance with procedures as specified by Standards of Hydraulic Institute. Gearboxes shall not be permitted. Any bid not including such curves shall be considered non-responsive and shall not be accepted.*	*"NO" - None Available for Review*
	Curves shall be certified by a professional engineer, registered in the state where the tests are conducted and employed full time by the pump manufacturer. Any bid not including such curves shall be considered non-responsive and shall not be accepted.	*"NO" - No evidence curves, if provided, were certified by a professional engineer.*
	No pump/engine packages shall be shipped prior to Government approval of testing.	*"NO" - Pump/engine packages shipped prior to Government approval of testing*
	Prior to delivery of pumping equipment, the pump manufacturer shall submit for the approval of the Government certified performance curves of the pumps, showing gallons pumped per minute, horsepower requirements and pump efficiency over the entire head range of the pumps.	*"NO" - None Available for Review*

The flow test data from the different flow tests were skewed as reported in December 2006 by Dr. Maynord in the USACE "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used On New Orleans Outfall Canals", for example the results from Flow Test 4-7 looked like the following as a percent (%) of the maximum flow rate in the piping during the testing:

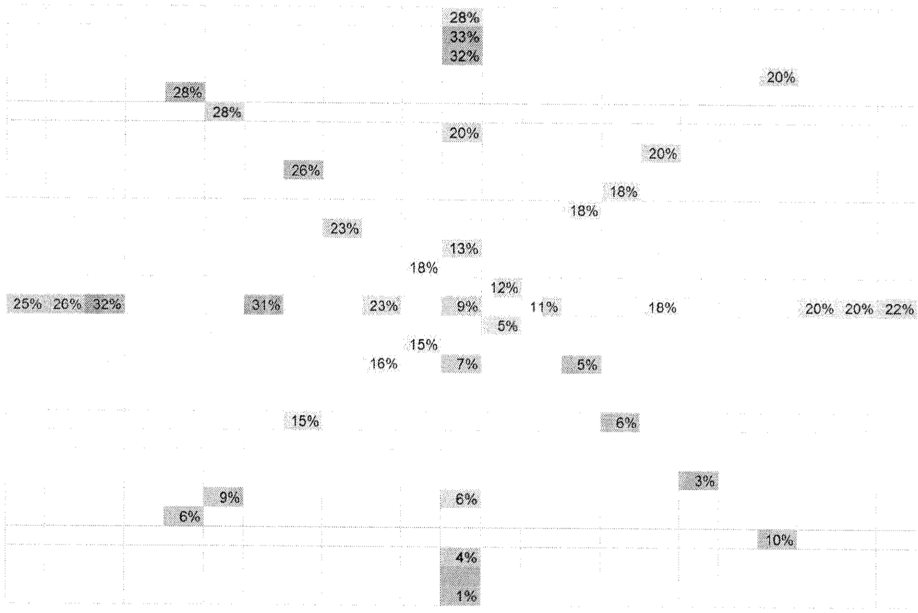

Figure 5 - Cross-section (across test piping) of Percentage of Maximum Observed Flow Measurements from Flow Test 4-7 Data

The information shown in Figure 5 portrays a 38% flow differential across the measurement cross section, and this type of flow differential can be caused by flow imbalances and cavitation and most certainly leads to inaccurate flow representations, especially when all of the measurement cannot be taken at the same time.

To help visualize the potential differences in flow rates across the pipe diameter, the data from the ERDC report for Flow Test 4-7 was plotted in a fashion similar to that shown in Figure 5 and the missing values were interpolated (filled in) to create the 3-D visualization of flow shown in Figure 6. This imbalance in flow is actually an imbalance in dynamic pressure and could potentially cause axial forces on the pump bearing to cause them to fail prematurely.

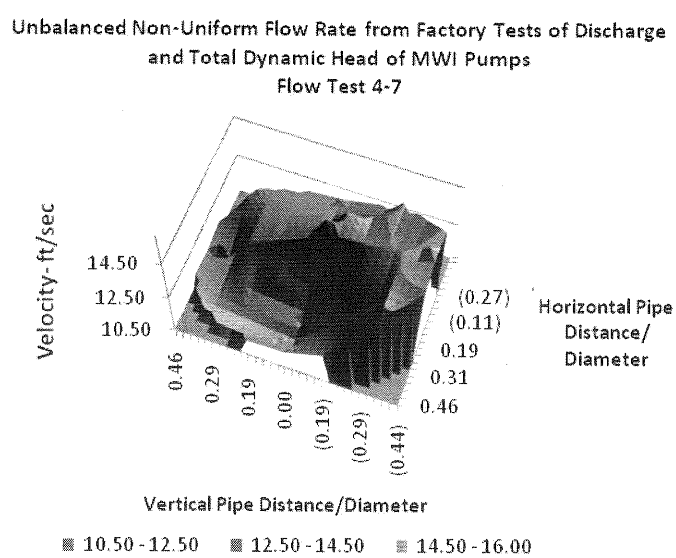

Figure 6 - Interpolated Representation from Flow Test 4-7

The bearings in the water pumps should be inspected for damage because of these turbulent flow observations, as well as inspecting the pump impeller for cavitation damage.

It is not possible to accurately measure pump flow when the flow across the pipe is not laminar.

2.4.2 *RINEER HYDRAULIC MOTOR BEARINGS NOT DESIGNED FOR MORE THAN 3,000 L10 HOURS OF USE (AN INITIAL USACE CONTRACT REQUIREMENT)*

2. DRAINAGE PUMP (Page 7 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.2.3	*The shaft bearing shall be sealed, self-lubricating by low pressure hydraulic oil designed for bearing life of 50,000 hours use.*	*"NO" - Bearing life from Rineer was not designed for more than 3,000 L10 hours of use.*

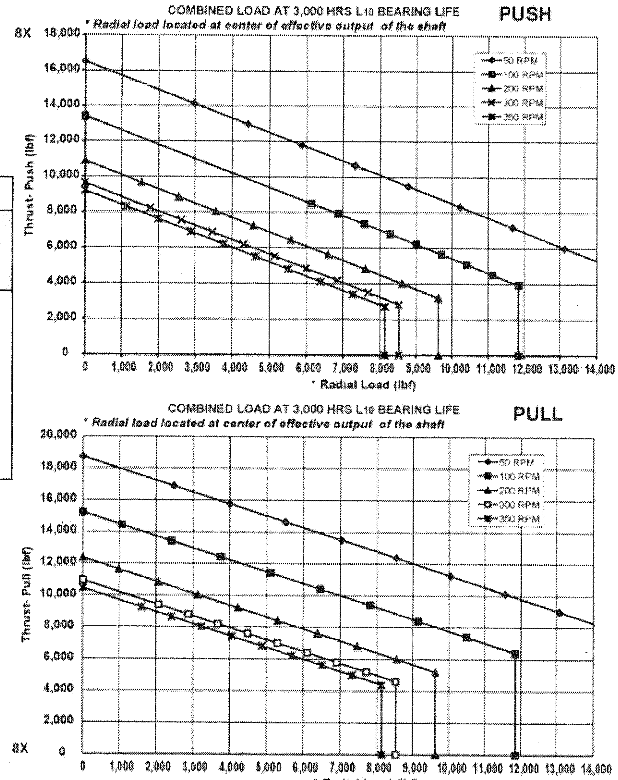

Figure 7 - Combined L10 Graphs from Rineer

The brochure for "Features of the 125 Series 4 –Port Motor" shows two graphs showing a maximum of 3,000 L10 hours of use, not 50,000 L10 hours of use.

While one could argue the bearings installed by MWI eliminated all stresses on the Rineer hydraulic motor, this would be unlikely. MWI has guaranteed 50,000 L10 hours of use for a part from another vendor without extensive testing to verify the 50,000 hours for L10.

2.4.3 *RINEER HYDRAULIC MOTOR WAS NOT DESIGNED FOR THE THRUST OF THE MWI HYDRAULIC SYSTEM (AN INITIAL USACE CONTRACT REQUIREMENT)*

2. DRAINAGE PUMP (Page 7 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.2.4	*Bearings designed to accept thrust in either direction, along with a reverse rotation mechanism, are contained within the hydraulic system.*	*"NO" - The Bearings are inadequate for the system thrust, horsepower, and no reverse rotation mechanism was provided.*

Bearing Data - Thrust Capable T1: 32

BEARING LOADING THRUST CAPABLE - The bearings in the 125 Series 4-Port Thrust capable motor can accept thrust and radial load per the push/pull capacity charts to the right. Thrust loading is allowed up to the parameters indicated on the charts with shaft configurations including standard keyed and splined as well as a light duty API drill motor. For applications not requiring thrust, see the standard motor bearing charts on the opposite page.

HORSEPOWER LIMITATION - Maximum horsepower limitation may vary with different applications. When using the 125 Series standard motor above 300HP, consult a Rineer Application Engineer.

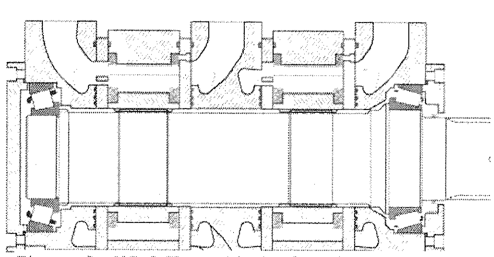

Figure 8 - HP & Trust Limits for Rineer Motor

Figure 8 has been extracted from the Rineer Brochure for "Features of the 125 Series 4 –Port Motor".

The maximum horsepower in one brochure is 300HP and the maximum horsepower allowed for the Catalog #2562700 125 Hi-Pressure Series Motor – 4500 PSI (Code 62) model is rated up to 400HP continuous from the Rineer website.

MWI did not provide any additional information that would convincingly show that the Rineer Motor used in the MWI hydraulic pump was fully capable of handling 735HP, as well as ensuring the combined axial and radial thrust does not exceed the limits.

APARIQ was not able to find any evidence of the contractually required "reverse rotation mechanism". When asked, the Complaintant was not aware of any tests or demonstrations of a required "reverse rotation mechanism."

2.4.4 NO ADEQUATE HYDRAULIC SYSTEM MONITORING DEVICE WAS INSTALLED (AN INITIAL USACE CONTRACT REQUIREMENT)

2. DRAINAGE PUMP (Page 7 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.2.4 & 2.3.4	*A hydraulic system monitoring device to allow diagnosing hydraulic system behavior even while pump is still submerged shall also be included.*	*"NO" - No adequate hydraulic system monitoring device was installed.*

Being able to detect leaks from the submerged part of the hydraulic system would be essential to prevent inadvertent and potentially continuous leakage of hydraulic oil into the water (a violation of the Clean Water Act). No such monitoring system was installed.

The temperature sensor for the hydraulic oil temperature was located upstream of the discharge of the Denison hydraulic motor.

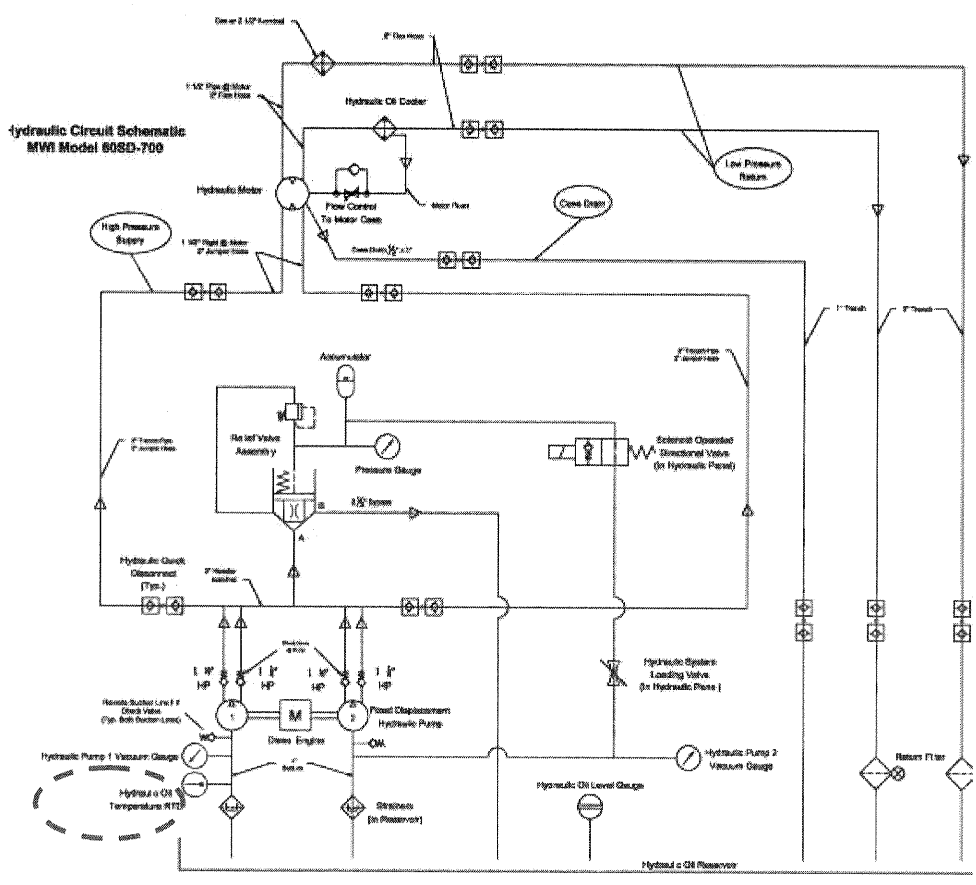

Figure 9 - Hydraulic Oil Temperature Sensor in Wrong Location

Discharge from the Denison hydraulic oil pump will always be hotter than the temperature on the suction side of the pump. Potentially the oil temperature on the discharge side of the Denison hydraulic oil pump could exceed the maximum allowable temperature for the Rineer seals and fail before an unacceptably high temperature is ever sensed by the hydraulic oil temperature detector (RTD)

The hydraulic oil system did not have an adequate monitoring system for these reasons, among others, including the ability to detect air in the system, hydraulic oil coagulation, the presence of water in the oil, or the presence of debris.

The Rineer brochure also lists 180 Degree F as the maximum hydraulic fluid temperature and states, "Elevated fluid temperature will adversely affect seal life while accelerating oxidation and fluid breakdown."

2.4.4.1 Failure to adequately preserve the complete pump assembly (an initial USACE contract requirement)

2. DRAINAGE PUMP (Page 7 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.2.5	*The complete pump assembly shall be sand blasted to near white and painted inside and out with black bitumastic enamel equal to Zophar triple A or with Porter Tarset epoxy or equal.*	*"NO" - Some pump assembly parts were not sand blasted and painted as required.*

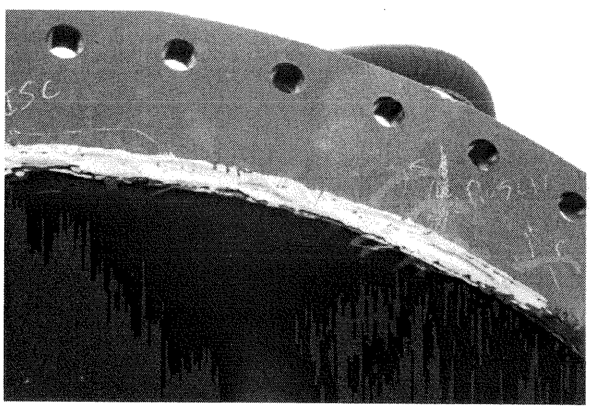

Figure 10 - Poorly Coated Part

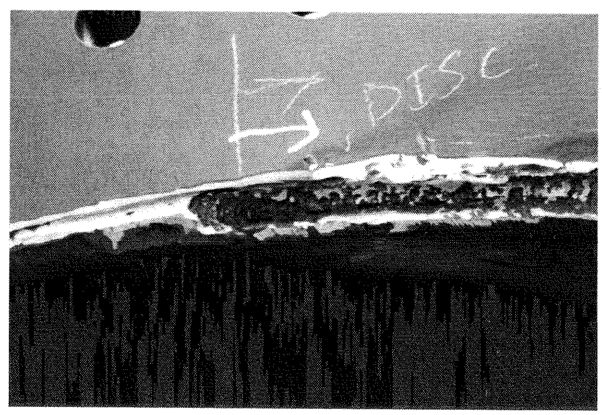

Figure 11 - Significant Corrosion

There are numerous pictures of exposed and uncoated parts of the pump system. Requirement 2.2.5 was not met.

2.4.5 DURST DIRECT DRIVE IS TOO SMALL AND OVER-TORQUED (AN INITIAL USACE CONTRACT REQUIREMENT)

2. DRAINAGE PUMP (Page 7 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.3.2	*The driver shall be non-overloading over the entire range of pump operation.*	*NO – The driver is overloaded through the entire range of pump operation.*

During the acceptance testing, there were problems with the Durst drives as noted in the following email:

-----Original Message----From:
Persica, Randy J MVN
To: Zillmer, Victor B LTC MVN; StGermain, James J MVN; Bradley, Daniel F MVN; Robinson, Carl WMVN
CC: Wisinger, John L MVN-Contractor; Newman, Raymond C MVN; Constantine, Donald A MVN
Sent: Sun Aug 05 14:30:24 2007
Subject: Re: Pump test @ LA
We appear to have an epidemic of Durst drive oil circulation pump problems. We're shutting down the east pump test and moving to test two west pumps.

Randy Persica, **P.E.**
OEB Structures/Pumps
(504) 628-5100
U.S. Army Corps of Engineers
New Orleans District
7400 Leake Ave
New Orleans, LA. 70118

> *" 'CO-005 Implementation of new programming for all the prime mover engine control systems for remote RPM set point through existing modbus network.'* (Note in Change Order P0019 to MWI Contract) *The programming refers to changing the programming on the caterpillar diesel engines to have them not run as fast as their rating (which is 1800 rpm).* The obvious consequence is that the pumps would flow less water than they should... " (Note from summary spreadsheet of contract changes

2.4.5.1 Durst Hydraulic Pump Drives Appear to be Undersized for This Application and The GOCM System is not Reliable

(Observation 2-A) In the spreadsheet provided by OSC, modification P0019 to the MWI contract from FPDS-NG prepared by Gayle Rouse and signed on 9/30/06 was described "Change Order to implement new programming for RPM set points" and contained the following note:

"This is a big deal. What this relates to is actually running the drive units slower than their rated speed, in order to lower the load on the hydraulic system. The programming refers to changing the programming on the Caterpillar diesel engines to have them run slower than their rating (which is 1800 rpm). The obvious consequence is that the pumps would flow less water than they should be (flowing). This appears to be evidence of the Corps actively helping the supplier to provide a product which does not meet the specifications. Dan Bradley, as the electrical engineer on the project, would have been the motivating force behind this mod."

(Observation 2-B) From the DURST Hydraulic Pump Drive Service Guide

Maximum Operating oil temp for all standard oils: 210°F (99°C)
Maximum Operating oil temp for all synthetic oils: 250°F (121°C)

RECOMMENDED OIL LUBRICANT GRADE

Below -10°F	Mobile SHC 630 Synthetic or equivalent
-10°F to 100°F	80w-90 or EP90 (APL-GL-5)
Above 100°F	Mobile SHC 630 Synthetic or equivalent

(Observation 2-C) Comparison of Mobil Synthetic and Mineral Oil Viscosity:

	Mobil Synthetic[5] *SHC 630*	***Gear Oil SAE 80W-90*** *Mineral Based*
Viscosity, Kinematic cSt at 40°C (104° F) cSt at 100°C (212° F)	 **216** **25.2**	 **139** **15.0**
Viscosity Index	**152**	**110**
Flash Point,°C(°F)	235 (455)	218(424)
Pour Point,°C(°F)	-39 (-38)	-27(-17)

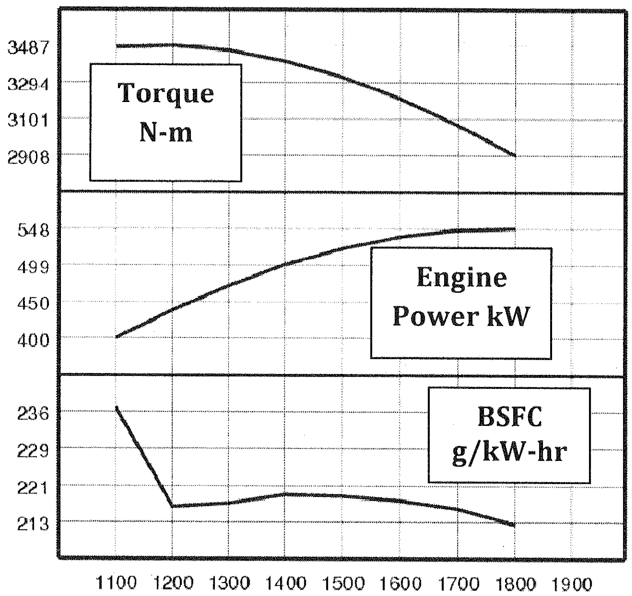

Figure 12 - Torque vs Engine RPM for Caterpillar 3412 Diesel Engine

(Observation 2-D) Torque on a diesel engine is higher at low RPM. Figure 12 shows that the torque on the Caterpillar 3412 Diesel Engine with 735 bhp delivers about 3476 Newton-meters (N-m) at 1100 rpm or 2564 ft-lbf.

(Observation 2-E) "Informed by MWI that wiring on gear oil circulation motors (GOCM) on the drive units is to be changed out – for all drive units - specifically, the wiring to the GOCM's will have a larger gauge wire installed and will be wired into the control boxes.[6]"

(Observation 2-F) "– during my presence, one of the hydraulic pumps is running over 30 degrees higher than its mate – the operating temps of the GOCM were at 190-210 degrees numerous times (even at under 1000 psi…)[7]"

(Observation 2-G) "Near the end of testing the Gear Oil Circulation Motor (GOCM) failed – it overheated (burned up). The GOCM was replaced with the same kind (19.6 amps). An electrician stated the GOCM was drawing 100 amps – a throttle switch was installed to manually switch it off if it began to burn up again after resuming testing.[8]

[5] Synthetic Benefits: (1) Reduced sludge and deposit formation, (2) Minimizes effects of micro slip in rolling contact bearings, & (3) Reduces overall friction and can increase efficiency in sliding mechanisms.

[6] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 1

[7] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 5

[8] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 10

(Observation 2-H) At every speed, the torque exceeds the maximum allowable input torque for the DURST 2DP10 Pump Drive[9]:

CATERPILLAR 3412 E Engine 735 bhp					Maximum Input Torque Rating (lb-ft) for **DURST** 2DP10 Pump Drive with Service Factor		
Engine Speed rpm	Engine Power hp	Torque Newton-metres (N-m)	Torque Ft-lbf		Max. lb-ft for Moderate Shock Service Rating 1.00	Max. lb-ft for Moderate Shock Service Rating 1.25	Max. lb-ft for Moderate Shock Service Rating 1.50
1800	735	2908	2145	>	1996	1597	1331
1700	732	3066	2261	>	1996	1597	1331
1600	720	3205	2364	>	1996	1597	1331
1500	699	3319	2448	>	1996	1597	1331
1400	669	3405	2512	>	1996	1597	1331
1300	632	3460	2552	>	1996	1597	1331
1200	587	3487	2572	>	1996	1597	1331
1100	536	3476	2564	>	1996	1597	1331

(Observation 2-I) "Testing was never continuous - during the testing procedure the testing was halted as the hydraulic oil in the system was 250+ F at the hydraulic pump) – the system is supposed to be shut down when the oil is above 130 degree F - it was determined failure was because the Gear Oil Circulation Motor never switched on during the testing – this was determined to be because the temp. sensor is in a location that never see's the 130 degree F temp needed to 'trip' the solenoid to turn the GOCM on – Daren said the 'fix' will be to wire the GOCM on continuous instead of intermittent (bypass the switch – which was never installed anyway). [10]"

(Observations 2-J) "They will also be collecting time delay data for the gear box temperatures/gear oil circulation motor – this is so they can decide on the necessary setting for a time delay devise for the gear box temperatures/GOCM. Testing started - 20 min. into testing the high pressure hose on the hydraulic pump melted/blew out (see pic of hydraulic hose and burn areas on it). MWI stated **DU 8839** would be repaired and retested while we wait."

and

"...at approx 6:30 p.m. the 5 hour endurance/reliability test commenced with **Drive Unit 8839** – 25 min. into the test, after reaching full operating pressure, speed, and temperatures, the other hydraulic pump's high pressure hose 'melted/burned' before my eyes (I took pics of this happening). [11]"

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[9] Durst Pump Drive Application Data Sheet, page 1 of 2

[10] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 9

[11] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 3

(Observation 2-K) The lowest maximum rated temperature (meaning that the temperatures go to a much higher rating) for dates and Ryco hydraulic hoses is 250° F. If the high pressure hydraulic hoses melted, this means that the hydraulic oil temperature had to exceed 250° F, unless the maximum temperature for the hydraulic hoses was higher, which would have meant that the hydraulic oil temperature was even higher than 250° F.

> **250° F *(Lowest Maximum Temperature High Pressure Hydraulic Hoses from Gates, a Major Supplier of Hydraulic Hoses)***
>
> ---
>
> **M3KH High Temperature Wire Braid Hose - SAE 100R17**Use for high pressure hydraulic oil lines. Meets SAE 100R17 requirements and performance requirements of EN 857 1SC. M3K hose has smaller exterior dimensions and significantly tighter bend radius than other SAE 100R1 and 100R2 hose.
>
> Check Gates eCatalog
>
> **M4KH**Use for high pressure hydraulic applications. Provides tighter than standard minimum bend radius and greater flexibility for easier plumbing.
>
> Check Gates eCatalog
>
> **TR500 Air Brake/Engine Hose**
>
> Use for air brake hose, pressurized hot oil return lines, rotary oil/air compressor lines, engine and transmission coolant lines and hot lube lines. Meets or exceeds DOT FMVSS 106-74 and SAE J1402.

(Observation 2-L) With more than 11 years of direct hands-on design, operation, and maintenance experience with many high pressure (~3000 psi) hydraulic systems, APARIQ copied the following explanations from the Internet http://www.insidersecretstohydraulics.com/hydraulic-fluid-2.html and APARIQ agrees completely with the comments that follow:

- **High Temperature Hydraulics results in Damage in Components**[12] – "As the temperature of petroleum-based hydraulic fluid increases, its viscosity decreases. If fluid temperature increases to the point where viscosity falls below the level required to maintain a lubricating film between the internal parts of the component, damage will result.
    - "The temperature at which this occurs depends on the viscosity grade of the fluid in the system. Hydraulic fluid temperatures above 180°F (82°C) damage seals and reduce the service life of the fluid. But depending on the grade of fluid, viscosity can fall to critical levels well below this temperature.

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[12] http://www.insidersecretstohydraulics.com/hydraulic-fluid-2.html

- The above example highlights the importance of not allowing fluid temperature to exceed the point at which viscosity falls below the optimum level for the system's components.
- Continuing to operate a hydraulic system when the fluid is over-temperature is similar to operating an internal-combustion engine with high coolant temperature. Damage is pretty much guaranteed.
- Therefore, whenever a hydraulic system starts to overheat, shut down the system, find the cause of the problem and fix it!"

- **Contaminated Hydraulic Fluid typically results in Damage to Components**[13] - "Contaminants of hydraulic fluid include solid particles, air, water or any other matter that impairs the function of the fluid.
  - "Particle contamination accelerates wear of hydraulic components. The rate at which damage occurs is dependent on the internal clearance of the components within the system, the size and quantity of particles present in the fluid, and system pressure.
  - Particles larger than the component's internal clearances are not necessarily dangerous. Particles the same size as the internal clearances cause damage through friction. However, the most dangerous particles in the long term are those that are smaller than the component's internal clearances.
  - Particles smaller than 5 microns are highly abrasive. If present in sufficient quantities, these invisible 'silt' particles cause rapid wear, destroying hydraulic pumps and other components.
  - While the type of failure described above is unusual in properly designed hydraulic systems that are correctly maintained, this example highlights the importance of monitoring hydraulic fluid cleanliness levels at regular intervals.
  - As in this case, if the high levels of silt particles present in the hydraulic fluid had been identified and the problem rectified early enough, the damage to this hydraulic pump and the significant expense of its repair could have been avoided."
- **>1% Water is Too Much**[14] - "Oil becomes cloudy when it is contaminated with water above its saturation level. The saturation level is the amount of water that can dissolve in the oil's molecular chemistry and is typically 200 - 300 ppm at 68°F (20°C) for mineral hydraulic oil. Note that if hydraulic oil is cloudy it indicates that a **minimum** of 200 - 300 ppm of water is present.
  - "Water in hydraulic fluid:
    - Depletes some additives and reacts with others to form corrosive by-products which attack some metals.
    - Reduces lubricant film-strength, which leaves critical surfaces vulnerable to wear and corrosion.
    - Reduces filterability and clogs filters.

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[13] http://www.insidersecretstohydraulics.com/hydraulic-pump.html
[14] http://www.insidersecretstohydraulics.com/water-hydraulic-fluid.html

  - Increases air entrainment ability.
  - Increases the likelihood of cavitation occurring.
- A number of factors need to be considered when selecting water contamination targets, including the type of hydraulic system and reliability objectives for the equipment. It's always wise to control water contamination at the lowest levels that can reasonably be achieved, ideally below the oil's saturation point at operating temperature.
- Like all other forms of contamination, preventing water ingress is cheaper than removing it from the oil. A major point of water ingression is through the reservoir headspace. Many hydraulic system reservoirs are fitted with breather caps that allow moisture (and particles) to enter the reservoir as the fluid volume changes through either thermal expansion and contraction, or the actuation of cylinders.
- Replacing the standard breather cap with a hygroscopic breather will eliminate the ingression of moisture and particles through the reservoir's vent. These breathers combine a woven-polyester media that filters particles as small as 3 microns, with silica gel desiccant to remove water vapor from incoming air. The result is relative humidity levels within the reservoir headspace that make condensation unlikely, therefore reducing water contamination of the oil."

2.4.5.2 Configuration Management for Hydraulic Pump Drives including Corrective Action after Testing

Undersized[15] Durst hydraulic pump drives, excessive heating of Durst hydraulic pump drives, high GOCM amperage, and overheating of the GOCM should have led to required disassembly and inspection of the Durst drives and the GOCM to check for damage and evidence of metal particles; as well as the specification for the gear oil. High amperage on the GOCM is indication of stalling or binding that could have been caused by metal particles from the hydraulic pump drives. Over-torquing of gear teeth in the Durst hydraulic pump drives, can lead to gear fatigue, gear tooth flank pitting, and scuffing; all of which not only potentially reduce the integrity of the pump drives but cause contamination in the pump drives. If the standard oil was used instead of the required Mobile SHC 630 Synthetic or equivalent oil or if the GOCM temperature exceeded the maximum allowable 250° F for synthetic oil (and 210° F for mineral oil), then the lubrication of the gears would have diminished and possibly contributed to pump drive surface gear damage. The only way to check and be sure about possible contamination levels in the gear oil, damage to the hydraulic pump drive gears, and internal damage to the GOCM is to disassemble several units and look. Short of disassembly or possibly filtering through an in-line 5 micron absolute filter, it is not possible to know if there was any gear wear or damage.

Adequate corrective action should include root cause analysis, and not simply replacing a failed component (the symptom) with a new component, without understanding the root cause and making necessary improvements and changes to all of the systems.

If MWI had followed National Electric Codes (NEC) for GOCM wiring size and anticipated voltage drops, the wires should NOT have overheated.

[15] See Section 2.4.5.1 Durst Hydraulic Pump Drives Appear to be Undersized for This Application on page 21 of this document.

2.4.5.3 Design of Hydraulic Pump Drive, GOCM System, & Gear Oil

The Combination of the Durst Hydraulic Pump Drive Selected, the GOCM Selected, the Chosen GOCM Operating Set-points, the GOCM Selected Sensor Points, and Gear Oil/Durst Hydraulic Pump Drive Integrated Sub-System Design was NOT Reliable and may STILL NOT be Reliable. If the proper subsystem components had been selected, the hydraulic pump drive should not have operated at elevated temperatures periodically exceeding 200° F, the gear oil circulation motors should not have drawn more than five (5) times the rated current for the motor, some of gear oil circulation motors should not have overheated and failed, and the operation of the hydraulic pump drives should not have potentially contributed to the overheating of the hydraulic oil[16] and the subsequent melting of the hydraulic hose.

2.4.6 *NO "CLUTCH" STARTING SYSTEM INSTALLED AS REQUIRED (AN INITIAL USACE CONTRACT REQUIREMENT)*

2. DRAINAGE PUMP (Page 8 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.3.5	*The drive system shall include a "clutch" starting system which allows the prime mover to start under a no-load condition and gradually engage the load over a 15 to 30 second time period. The "clutch" system shall be used to gradually disengage the load prior to shut-off of the prime mover upon receiving signal for pump shut-off. An automatic system option shall be provided.*	*"NO" - No clutch allowing engagement over a 15-30 second time period provided by MWI*

Clutches are defined in the Marks' Standard Handbook for Mechanical Engineers 11th Edition as "couplings which permit the disengagement of the coupled shafts during rotation". On page 3 of the MWI Bid Proposal, MWI clearly stated in their bid proposal they would provide a clutch:

> *"IV. DIESEL DRIVE UNIT*
>
> *"Each pump shall be supplied with an individual diesel power unit as shown on the drawings and as specified herein. The drive unit shall be manufactured and tested at the same factory as the pumping unit to provide a single source of responsibility and for the proper coordination of all components of the system.*
>
> *...*
>
> *"E. The drive system shall include a "clutch[17]" starting system which allows the prime mover to start under a no-load condition and gradually engage the load over a 3 to 5 second time period. The "clutch" system shall be used to gradually disengage the load prior to shut-off of the prime mover."*

[16] Overheating of the Durst hydraulic pump drive gears can easily conduct thermally through the drive shaft to hydraulic oil pump and heat the hydraulic oil.

[17] A **clutch** is a mechanism for transmitting rotation, which can be engaged and disengaged. Clutches are useful in devices that have two rotating shafts. In these devices, one shaft is typically driven by a motor or pulley, and the other shaft drives another device. In a drill, for instance, one shaft is driven by a motor, and the other drives a drill chuck. The clutch connects the two shafts so that they can either be locked together and spin at the same speed (engaged), or be decoupled and spin at different speeds (disengaged). http://en.wikipedia.org/wiki/Clutch

However, the maximum allowable torque, for the largest available clutch from Durst (the chosen vendor for the drive to connect the Caterpillar diesel engine to the Denison hydraulic pump, was only 1620 lb-ft and the maximum recommended engine horse power for the connected diesel engine was 308 hp. The Durst maximum allowable horse power of 308 is far below the USACE requirement of 735 hp.

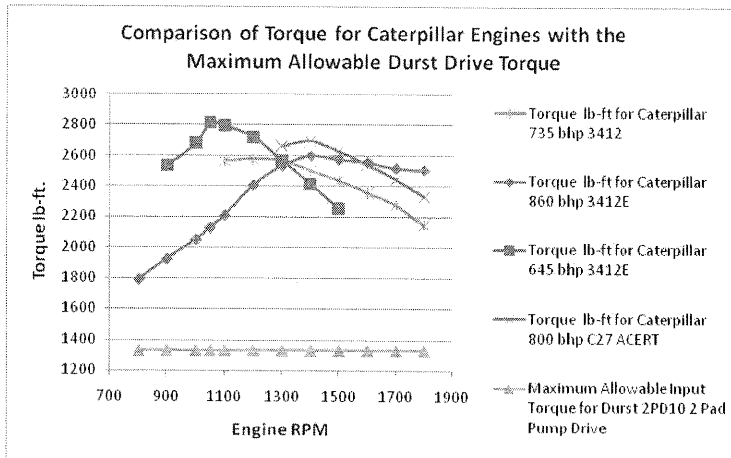


Figure 13 - Comparison of Caterpillar 3412 Engines Torques with the Maximum Allowable Durst 2DP10 2 Pad Pump Drive Torque

No matter which equivalent Caterpillar 3412 (or follow-on C27 ACERT) engine was selected, the engine torque would have exceeded the maximum allowable torque and the maximum allowable horse power for any available Durst clutch (see torque values as shown in Figure 13.

Therefore, it is clear that MWI did not provide the required clutch as represented in its proposal and MWI did not meet this clearly stated requirement in the USACE solicitation.

The applicable section of the "DURST PUMP DRIVE APPLICATION DATA SHEET 1 of 2" is presented in the table below:

"Duty Service for *(Durst Pump Drive)* **Clutch Models**

Clutch	Recommended Maximum Working Torque (lb-ft)	Recommended Engine HP LD	ND	HD	Max. Scale Operating Speed
8"	229	55	43	30	3050
10"	327	86	67	47	2650
11 ½"	386	111	87	61	2200
11 ½" D.P.	907	203	129	80	1950
14"	810	169	131	92	1950
14" D.P	1620	308	196	122	

Light Duty (LD)

The clutch should start the heaviest load within three (3) seconds with starting frequencies up to thirty (30) engagements per hr.
Engagement slip (sec.) X Engagements (per hr.) < 90"

...

On another note the MWI proposal clearly states, as shown earlier in this section, "*The drive unit shall be manufactured and tested at the same factory as the pumping unit to provide a single source of responsibility and for the proper coordination of all components of the system.*" How could the Durst drive unit be manufactured and tested at the same factory as the pumping unit when the pumping unit was manufactured by Denison? This clearly appears to be another misrepresentation in the bid proposal document.

MWI did install a solenoid bypass valve which they and the URS Group claim the "feature acts as an electric clutch and allows for starting, stopping and running the engine without a load. " This feature is not a clutch and shifting the discharge of the Denison pump from bypass operation to the system may occur in less than

0.5 seconds and could potentially cause internal damage to the Denison pump and/or the Rineer hydraulic motor because of a sudden hydraulic shock, since the pump impeller would be non-rotating in an incompressible fluid and the Denison pump and the Rineer motor vane would suddenly be exposed to very high and sudden shear stress and could seriously be degraded or damaged over repeated system starts. The HPU could be damaged if there was any air in the main hydraulic lines between the Denison pump and the Rineer motor when the solenoid valve suddenly ports high pressure oil to the Rineer motor. There is little to prevent operator error and cause serious system damage even though MWI did install a manual loading valve.

2.4.7 *Hydraulic Oil Frequently Overheated During Testing (An Initial USACE Contract Requirement)*

2. DRAINAGE PUMP (Page 8 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.3.6	*Sufficient hydraulic oil cooling capacity shall be provided to sustain direct sunlight radiation as well as ambient temperatures up to 122°F (50°C) without excessive heating of the hydraulic oil. The hydraulic oil shall be prevented, by the cooling system, from reaching a temperature which would produce any reduction of pumping capacity.*	*"NO" - Insufficient cooling capacity to prevent damage to system, including seals.*

During the testing there were numerous cases where the hydraulic return gauges were "in the red" (or too high), for example in an email:

> -----Original Message----
> From: Boudreaux, Jerome P MVN
> Sent: Monday, April 23, 2007 7:16 AM
> To: Barre, Clyde J MVN; Wisinger, John L MVN-Contractor; Persica, Randy J MVN; Upson, Toby MVN; Zillmer, Victor B LTC MVN
> Cc: Newman, Raymond C MVN; StGermain, James J MVN; Bradley, Daniel F MVN; Smith, Leroy MVN: Ducote, Francis C MVN-Contractor
> Subject: London Pump Test West 19 April 2007
>
> Here are the readings for the pump test at London Ave. All pumps ran well with the new Rineer motors in them. On drive unit 8850 (4 west) the oil temperature got up to 190F but the gauge on the drive unit didn't move. This was reported to Claudio of MWI. All of the hydraulic return gauges were in the red.
> Thanks,
> JPB

2.4.8 *No Proper Static Hydrostatic Test for 90 Minutes*

2. 5 PUMP TESTING (Page 9 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.5.1	Each pump and hydraulic power transmission system shall be factory pressure tested statically to maximum design psi for a minimum of 90 minutes at design operating temperatures with every plumbing connection checked for possible leaks. In the event a leak is observed or detected, it shall be repaired and the test be repeated until all leaks are eliminated.	*"NO" – These tests were not performed correctly*

The only way that the water pump could have been hydrostatically tested would have involved blanking off the inlet and outlet with plates and then hydrostatically testing the water pump to 150% of the normal operating pressure. These units were not even tested to the operating pressure using a static test with a hydrostatic pump. Additionally the word "hydrostatic" means fluids at rest (not flowing).

The static or hydrostatic test of the power transmission system was also performed incorrectly: The Complaintant noted:

"The actual static testing requirement changes three times over the life of the factory testing for the original pump assemblies. At first 90 min static testing in accordance with HI Standards was as the contract required. As was all things, MWI objected to this, asked for, and received, lessened static testing requirements which included "dead heading" the pumps – jam the impeller to keep it from turning and engage the pump assemblies. This could only be done for a minute or two as temperatures rose quickly and the pump assemblies had to be turned off or they would end their run with a large disengagement "bang" that would send the mechanics in the area scrambling. Only ***4*** *pump assemblies were tested using this method. The last static testing requirement were restored more to the original except instead of testing to 1.5 times operating pressures (4,800 psi) they tested to 0.93 times operating pressures (3,000 psi). Only* ***25*** *of the original 34 pump assemblies pass this revised static testing. The remaining* ***5*** *pump assemblies have no record of any static testing ever accomplished where the pump assemblies were either "dead headed" or tested for 90 min. with an outside pressure source."*

The way that MWI tested the hydraulic system with a blocked water pump impeller would most like cause internal damage to both the Denison pump and the Rineer motor, because the Denison pump was not designed to run at 1800 rpm against a shut-off head which would cause the Denison pump to rapidly overheat damaging seals, hydraulic hoses, and scoring the inside of the Denison pumps.

These were not the proper tests and the tests actually and most likely caused irrevocable damage to the hydraulic components. The system should have been disassembled to look for damage and the hydraulic oil should have been carefully examined for particles and evidence of overheating.

This is very, very serious; and very poor engineering planning.

2.4.9 *NO DYNAMOMETER USED DURING TESTING AS REQUIRED (AN INITIAL USACE CONTRACT REQUIREMENT)*

2. DRAINAGE PUMP (Page 9 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.5.2	*Each pump and hydraulic power transmission system shall be factory pressure tested dynamically to maximum operating speeds, pressures and temperatures for a minimum period of 15 minutes. The dynamic test shall be conducted in a horizontal variable speed dynamometer that is capable of varying torque loads from 0 to maximum required horsepower as specified.*	*"NO" - Apparently, no dynamometer was used during any of the testing.*

2.4.10 NOT ALL FULL SIZE FACTORY TESTING WITNESSED BY GOVERNMENT PRIOR TO SHIPMENT OF PUMPS (AN INITIAL USACE CONTRACT REQUIREMENT)

2. DRAINAGE PUMP (Page 9 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.5.4	*Full size factory testing shall be witnessed by the Government prior to shipment of the pumps.*	*"NO" - Full size factory testing was not conducted at full operating speed, pressure, and flow prior to shipment of the pumps, and this is the essence of the whistleblower's 14th Allegation.*

2.4.11 NO DOCUMENTED REGISTERED PROFESSIONAL ENGINEER PRESENT DURING TESTING (AN INITIAL USACE CONTRACT REQUIREMENT)

2. DRAINAGE PUMP (Page 9 of 32)		
Section	*Solicitation and MWI Contract Requirement*	*Requirement Met?*
2.5.5	*Pump discharge and head testing shall be conducted in an open sump at the manufacturer's testing facility in accordance with the Hydraulic Institute Standards and in the presence of a registered professional engineer.*	*"NO" - There is no documented evidence of the presence of a registered professional engineer during testing, and full performance pump discharge and head testing was not possible on the open tank at MWI.*

Amendment 0001 to the contract added the following requirement, "Technical Approach. Add: The offeror will provide the qualifications (to include resumes) of key personnel involved in the assembly, testing and supervision of the installation of the entire pump system." Therefore, if a registered professional engineer was present during the testing, it should be noted on the test and a copy of the resume of the professional engineer should have been submitted consistent with this requirement. However, APARIQ does not have copies of any of these MWI resumes for assembly, testing and supervision.

When APARIQ asked the following questions about MWI professional engineer opinions, the Complainant provided the following answers about 10 January 2009:

	<u>APARIQ's Question to Complainant</u>	<u>Complainant's Answer</u>
1.	Were there any written opinions (stamped with a professional engineer's seal or otherwise) at any time from a professional engineer, as required in the contract?	{Save my answer given in #i (welds), with regards to everything else, No – there has never been a P.E. to date that is willing to 'stamp' their opinions}
2.	Do you have copies of any of the written (professional engineer) opinions?	{No – not ones with a P.E. stamp…numerous without}

APARIQ's Question to Complainant	Complainant's Answer
3. If there were requirements for a professional engineer and these requirements were not met, how were these omissions noted and authorized?	{From my 11+ years of experience working for the Los Angeles District Corps of Engineers, the Corps has never done business as I have seen done on this project – having a P.E. review and sign off on variations in system designs is usual and customary practice on projects I have been involved with – just not on this project. Designs by the KTR were changed/modified, delivered products did not meet original design requirements, replaced system components with no documentation to indicate suitability – none addressed with a review and signed off by a P.E.. In addition, USACE never followed up on (did not enforce) this customary and usual requirement even when formally citing a need for P.E. review and sign-off on specific hydraulic systems suitability (e.g.: the high pressure piping issue as discussed in the USACE MVN ITR). It is my belief, given the nature of this project, it's direct impact on the lives and welfare of 100's of thousands of New Orleanians, the complete hydraulic pumping system must be given a thorough review and an opinion rendered that a P.E. is willing to put their seal to - USACE allowing for anything less is unprofessional and completely unsuitable (my opinion).}

2.5 Types and Approximate Pumping Capacity of Pumps Installed as of 9/15/2007 at 17th Street, London Avenue, and Orleans Avenue

If the procurement of MWI hydraulic pumps represented the most reliable, lowest cost, and fastest way to procure high performance post-Katrina pumping capacity for New Orleans, it is noteworthy that the USACE initiated procurement of direct drive pumps on 12/22/2006 before commencing on-site acceptance testing of the hydraulic pumps 6/19/2007. The selected equal capacity direct drive pumps were procured, installed and tested in less time than procurement, installation, testing, attempted repairs, and retesting for the MWI hydraulic pumps; *(236 days for the direct drive pumps vs. 596 days for the hydraulic pumps respectively)*.

2.5.1 Parsons Descriptions of Pump Performance During Hurricane Gustav and Ike are Different from Actual SCADA Data Information

One might conclude that it was necessary to run the hydraulic pumps during hurricanes Gustav and Ike and conclude the hydraulic pumps ran at full speed and performed very well from the reported information in the DoD Parsons Report of 27 Jan 2009 which stated:

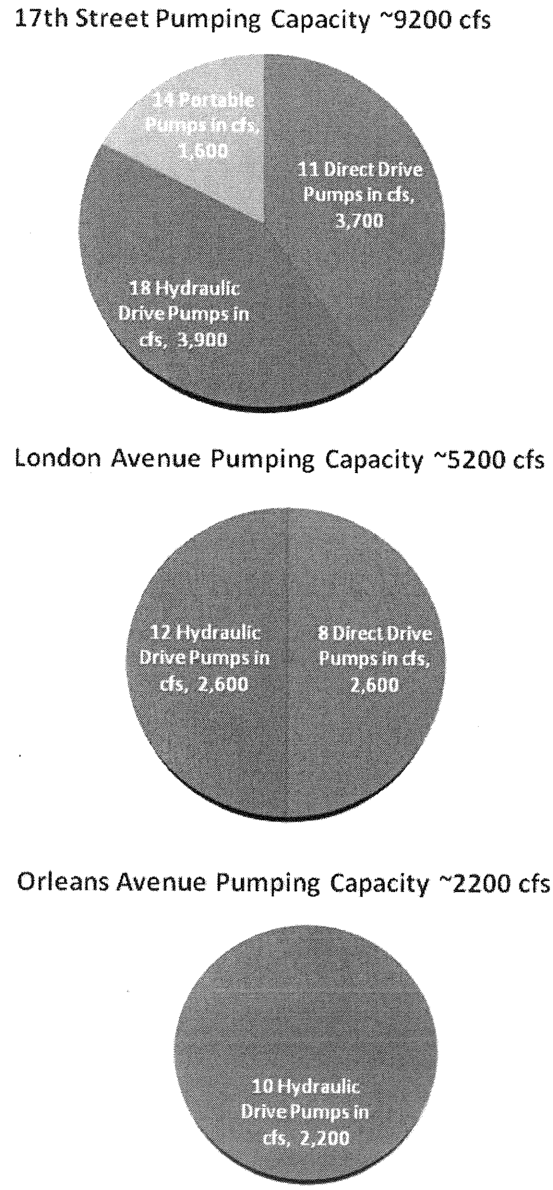


Figure 14 - Pumps and Capacities for 17th St,, London Ave, and Orleans Ave.

2.5.1.1 Parsons' Description of Pump Performance in the Hurricanes

"3.10.1 Hurricane Gustav

...

The records from USACE show that at the London Avenue Canal's temporary pump station all of the hydraulic and direct drive pumps were put into service. The total flow from the SWB pumps was 5,050 cfs on that day. With both, the hydraulic pumps and the direct drive pumps running at the London Avenue Canal pump station, the total flow pumped into Lake Pontchartrain was 5200 cfs, reducing the level of the canal down to a *safe level. The London Avenue Canal temporary pump station ran for 27 minutes, matching the discharge from the SWB and maintained a safe water level in the London Avenue Canal. After the first 27 minutes, 4 hydraulic pumps were shut down as the canal level got too low for the pumps to function efficiently. The 4 hydraulic pumps were started again after 48 minutes and all pumps ran for another 55 minutes before the 4 hydraulic pumps were shut down again due to low levels in the canal. The hydraulic pumps ran for 3 days intermittently with various numbers of pumps taken in and out of service to control the canal level with the gates shut for 36 hours. Out of the 12 hydraulic pumps in service, 2 pumps were taken out of service due to minor malfunctions. The fault on one was a disconnected control wire, and the second was a loose flange bolt. There were no pump mechanical malfunctions. ..."*

"The records show that at the 17th Street Canal temporary pump station and all of the hydraulic and direct drive pumps, except the portable pumps, were put into service. The total flow from the SWB pumps was approximately 5,050 cfs. With all available pumps running at the 17th Street Canal's temporary pump station (the portable pumps were not included), the total flow pumped into Lake Pontchartrain was approximately 7,240 cfs. The 17th Street Canal temporary pump station ran for 52 minutes, matching the discharge from the SWB and kept the level of the 17th Street Canal at a safe level. After the 52 minutes, all direct drive pumps, with the exception of 2 pumps, were taken out of service, leaving all hydraulic pumps running for 1 hour. As the canal water level dropped, the 2 direct drive pumps were taken out of service leaving all hydraulic pumps running. The hydraulic pumps ran for 2 days intermittently with various numbers of pumps taken in and out of service to control the canal level with the flood gates shut for a total of 18 hours. Out of the 18 hydraulic pumps in service, 1 hydraulic pump was taken out of service due to a hydraulic leak on a drive unit. There were no other pump mechanical malfunctions. ..."

"3.10.2 Hurricane Ike

...

Records show that the west bank direct drive pumps were put into service at the London Avenue Canal temporary pump station. The total flow from the SWB pumps was approximately 1,000 cfs, with the pumps running at the London Avenue Canal temporary pump station; the total flow pumped into Lake Pontchartrain was approximately 1,200 cfs. The London Avenue Canal temporary pump station ran for 58 minutes, matching the discharge from the SWB and kept the level of the London Avenue Canal at a safe level. After the first 58 minutes, 2 direct drive pumps were shut down as the canal water level dropped too low for the pumps to function efficiently. An hour and 10 minutes later, 6 hydraulic pumps were started again and ran for another 35 minutes before the hydraulic pumps were shutdown again as the canal level got low. The hydraulic pumps ran for 4 days intermittently with various numbers of pumps taken in and out of service to control the canal level with the gates shut for 60 hours. ..."

"Records show that at the 17th Street Canal temporary pump station, 10 direct drive pumps, and 6 hydraulic pumps were put in service. The total flow from the SWB pumps was 4,500 cfs, with 10 direct drive pumps and 6 hydraulic pumps running at the 17th Street Canal temporary pump station, the total flow pumped into Lake Pontchartrain was

5,200 cfs. The hydraulic pumps ran for 2 days intermittently with various numbers of pumps taken in and out of service to control the canal level with the gates shut for 36 hours. Out of the 18 hydraulic pumps in service, 1 hydraulic pump was taken out of service due to a hydraulic hose leak on a drive unit. ..."

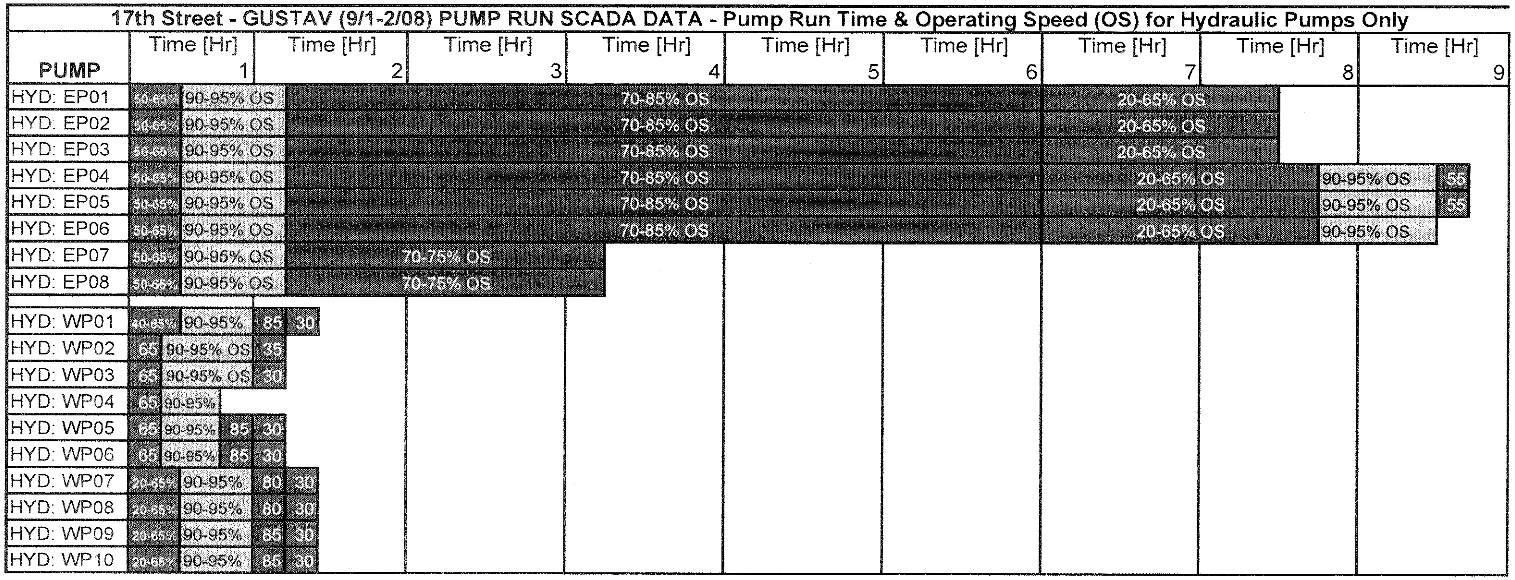
"Records show that while the storm surge was not enough to close the gates at the Orleans Avenue Canal, the USACE canal team decided to take advantage of the water levels to exercise the pumps and 10 hydraulic pumps were put in service at the Orleans Avenue Canal pump station. The 5 east bank pumps were put in service first and ran for 3 hours, the total flow pumped into Lake Pontchartrain was 1,044 cfs. After 3 hours, the pumps were taken out of service and the west bank pumps were put in service and ran for 3 hours at 1,054 cfs. The hydraulic pumps ran for two periods of 3 hours each. Total amount of water pumped at this facility was over 22 million gallons in this period without any pump major malfunctions with the 10 pumps. One HPU experienced a high temperature oil indication that turned out to be an electrical short circuit. This was repaired and the HPU was put back in service. ..."

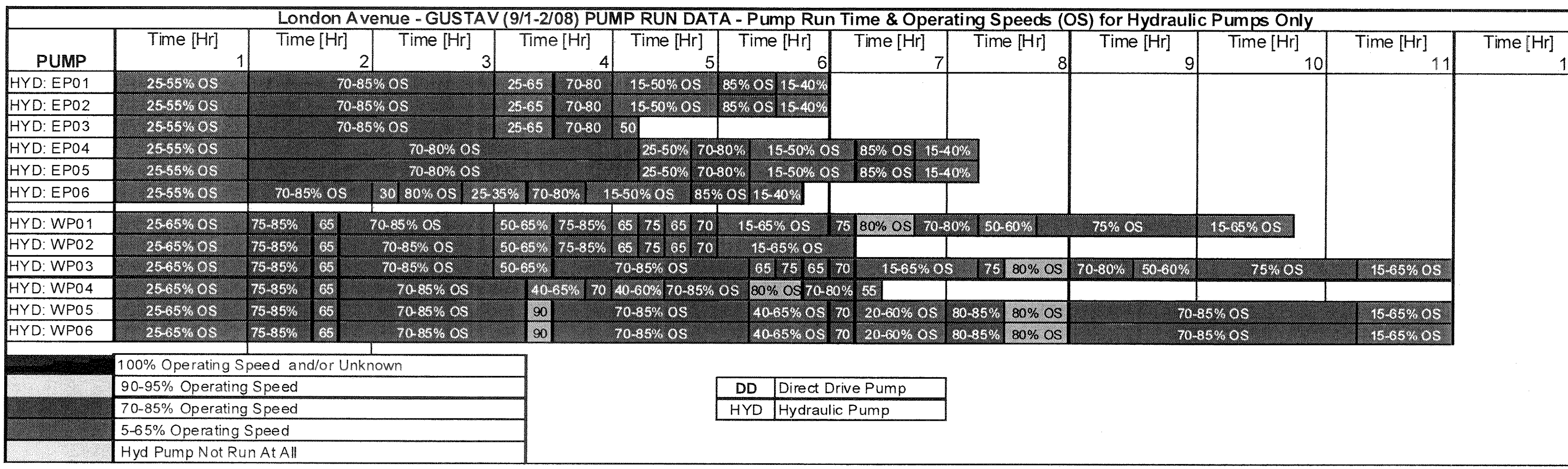
2.5.1.2 The Actual SCADA Data shows a Different Performance Story than Parsons Described

During Hurricanes Gustav and Ike on the 1st and 11th of September of 2008 the supervisory control and data acquisition (SCADA) data from the pumps indicated that the direct drive pumps were run at full capacity until the water level was reduced then the hydraulic pumps were run at low speeds less than the maximum operating speeds. Please examine the graphs on the next two pages.

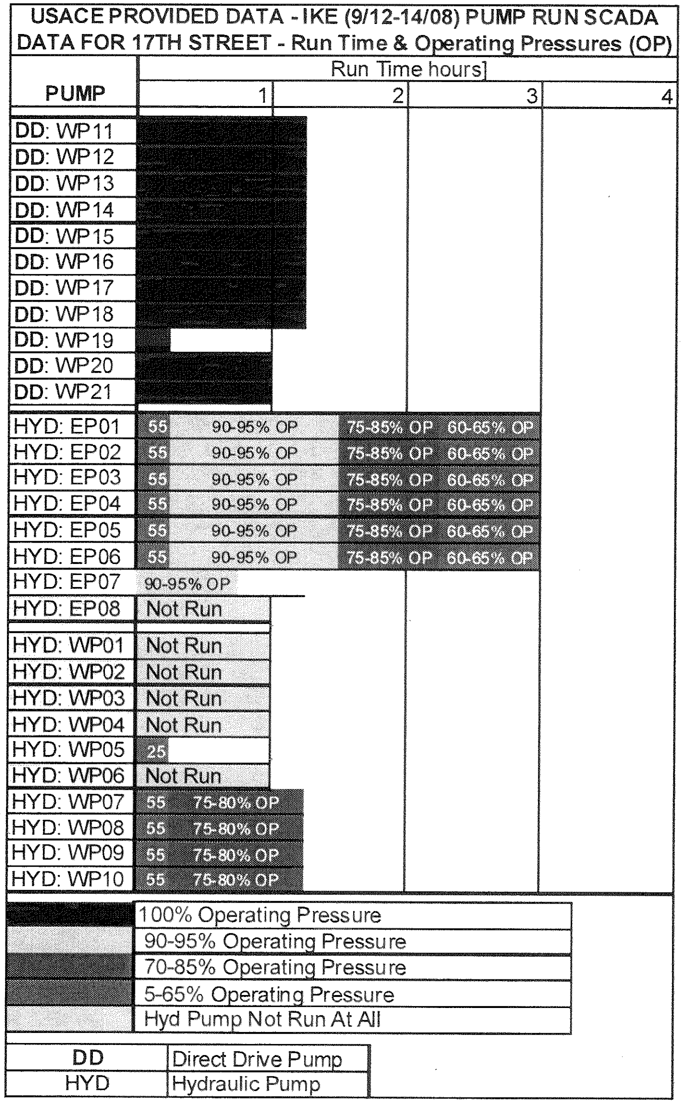
If the objective was to demonstrate that the hydraulic pumps could reliably be run at their maximum operating speeds, the SCADA data makes one wonder what was going on and why the hydraulic pumps were not run immediately and what the operators were trying to demonstrate.

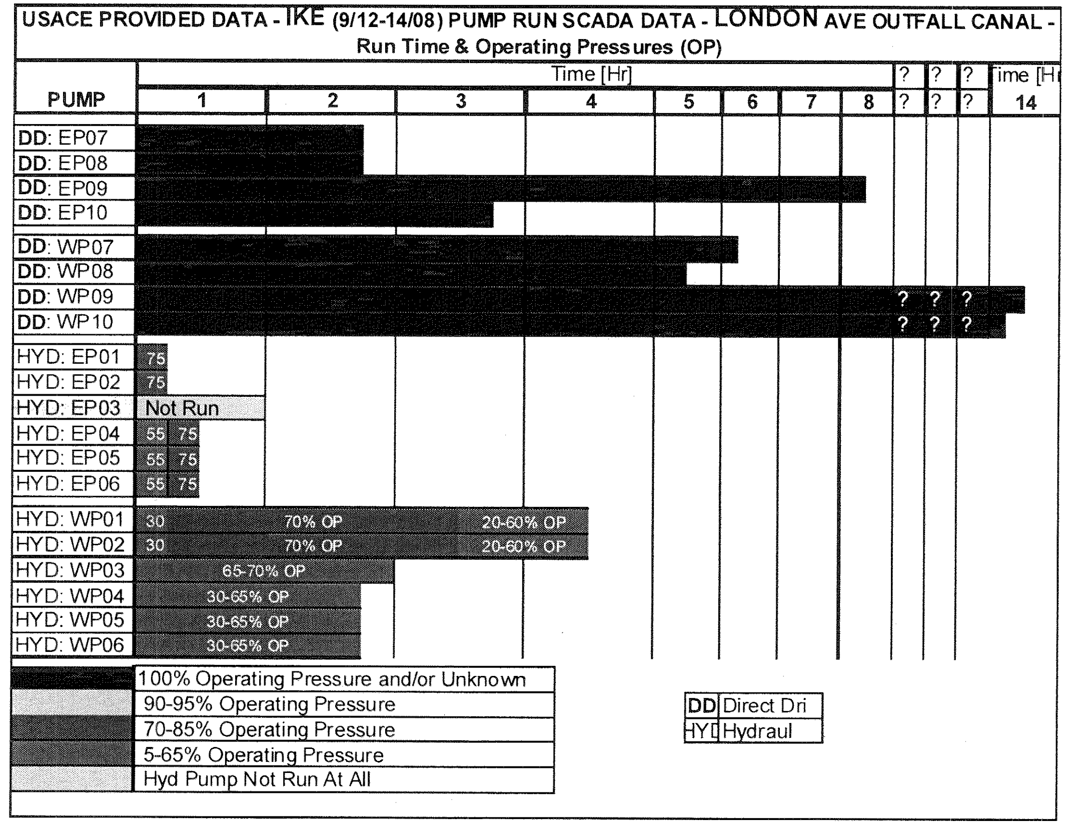
SCADA Data from 17th Street and London Avenue for Hurricane Gustav 9/1/2008





SCADA Data from 17th Street and London Avenue for Hurricane Ike (after Hurricane Gustav)





2.6 Choosing the Correct Contractual Pump Lifetime Definition for Evaluation

As an independent expert on hydraulic pumping equipment, APARIQ was charged with producing "a written report giving an expert opinion into the allegations contained in OSC File No. DI-07-2724 and the validity of the two DOD reports.

2.6.1 *Why is an Expected Pump Lifetime Definition Important?*

Engineering evaluations, business evaluations, and prudent planning efforts focus on similar initial topics (sometimes described with different titles, but are functionally the same logical sequence of initial issues):

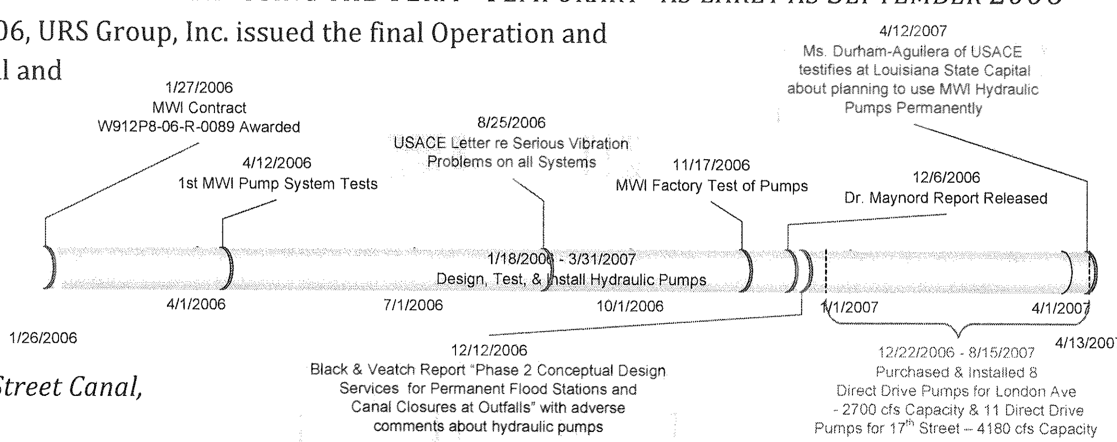
Effective Initial Situation Evaluation, Planning, and Implementation Steps

1. What are the core process requirements or needs, including the expected needs time horizons or product lives? Under what conditions?
2. What are the customer requirements, and who is able and willing to pay?
3. What are the fully integrated alternative costs, including procurement, installation, operation, maintenance, spare parts, and risk (e.g. potential environmental cleanup costs, reimbursement,...)
4. How will performance be measured? Safety? Loss of Life? Cost? Risk? Vulnerability? Reliability? Readiness?
5. How will success measurements be analyzed (and prioritized)?
6. What changes will be made or can be made after each measurement?

If APARIQ were contracted to provide an expert opinion on the adequacy of a food container without a definition of the expected lifetime requirement or need, then it would be very difficult to provide an expert opinion to compare the adequacy of a McDonald's fast food container designed for a hamburger, against a Zip-Loc bag for a sandwich, against a Zip-Loc bag for storing food in a freezer, against a Tupperware food container designed for refrigeration, against a freeze-dried food container which needed to keep food ready to eat for years. An expected product lifetime requirement definition is critical. For purposes of the APARIQ evaluation, APARIQ has assumed that required pumping capacity was well defined and the pump required lifetime definition was poorly defined as of January 2006 and over the next year as the reliability of the hydraulic pumps became suspect, the required hydraulic pump lifetime evolved to "temporary" meaning 5-7 years.

2.6.2 *USACE Contractors began using the term "Temporary" as early as September 2006*

As of September 2006, URS Group, Inc. issued the final Operation and Maintenance Manual and described the pump capacity on p25 as follows: "*The pump capacity of the temporary pumps at the temporary closure structures are 2800 cfs at 17th Street Canal,*



2330 cfs at Orleans Avenue Canal and 2800 cfs at London Avenue Canal. The corresponding pump capacities at the Sewerage and Water Board pump stations are 9480 cfs at 17th Street Canal, 2690 cfs at Orleans Avenue Canal and 4260 cfs at London Avenue Canal. Additionally, there is a Sewerage and Water Board pump station at I-10 and a Jefferson Parish Drainage Department Pumping Station at Canal Street which discharges into the 17th Street Canal. The pumping capacity of these stations is 860 cfs and 160 cfs, respectively."

2.6.3 THERE WAS ONLY ONE (1) EXPECTED LIFETIME DEFINITION IN THE SOLICITATION AND MWI CONTRACT AWARD # W912P8-06-R-0089

Throughout the solicitation # W912P8-06-R-0089 and contract award # W912P8-06-R-0089 there was no mention that the solicited hydraulic pumps would be temporary, interim, or permanent. Therefore, the bidders and the contact awardee could not contractually assume the pumps would be removed as temporary and should have provided equipment that would have run for 10's of years at a minimum.

2.6.3.1 Contract Requirement for L10 Life of 50,000 hours

The only numbers in the solicitation that could be possible associated with an expected lifetime were two descriptions associated with bearing life described in paragraphs 2.2.3 and 2.2.4 on page 7 of 32 which clearly stated:

> The shaft bearing shall be sealed, self-lubricating by low pressure hydraulic oil designed for bearing life of 50,000 hours use. (paragraph 2.2.3)
>
> and
>
> The shaft bearings shall be designed for an L10 life[18] of 50,000 hours and lubricated by low pressure hydraulic oil. (paragraph 2.2.4)

If we use 50,000 hours as the definition of the required life of the hydraulic pumps then expected life of the pumps (as defined by the 50,000 hours of use) could be used to define contractually required lifetimes as follows:

Running Pump Scenario	Lifetime in years for L10 Life of 50,000 hours under Corresponding Scenario
Continuously	5.7
Once a Month for a Week	24.5
Once every 10 Years for a Full Month	684.9

On page 2 of the MWI Bid Proposal, MWI stated (promised as a part of their bid specification):

> "D. BEARINGS - The propeller shaft shall be supported and contained in place by three multiple angular contact bearings. The shaft bearings shall be designed for an L10 life of 50,000 hours and lubricated by low pressure hydraulic oil. The propeller shaft and bearing assembly shall be contained in a machined bearing

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[18] The theoretical life span of a bearing under a specific set of dynamic operating conditions associated with 90% reliability. www.kaydonbearings.com/thin_section_bearings_definitions.html

housing centrally supported by flow straightening vanes in the propeller bowl assembly and shall be protected against sand particle intrusion. The bearings shall be designed to accept thrust in either direction. A non-reverse rotation mechanism will be included (except in two way pumping applications)."

2.6.4 *Interagency Performance Evaluation Taskforce (IPET) and Task Force Hope (TFH) Focused on Flood Protection up to a 100-year Storm*

The U.S. Corps of Engineer's Task Force Hope (TFH) was created to bring New Orleans regional flood protection up to a 100-year storm standards by 2010. Hurricane Katrina was a 400-year storm.

Lt. Gen. Carl Strock, the 51st Chief of Engineers, established Interagency Performance Evaluation Taskforce (IPET) on Oct. 10, 2005[19] "to determine the facts concerning the performance of the Hurricane Protection and Flood Damage Reduction System in southeast Louisiana in response to Hurricane Katrina.

"IPET was tasked to address five basic questions on:

1. the System (*what was the status of the protection system on 29 August 2005*);
2. the Storm (*what exact forces did Katrina put on the system*);
3. the Performance (*how did the system respond);*
4. the Consequences (*understanding the flooding and the losses); and*
5. the Risk (*what is the risk and reliability of the system)."*

From the USACE website "IPET Risk & Reliability Report"[20] the pumping protection system is focused on a 100-year storm, **not** the 10-year storm criteria described and used as the basis for the analysis in the "DoDIG Parsons Report" dated 27 February. The current USACE plans do not protect New Orleans against another Katrina Hurricane that is a 400-year storm.

This same website puts the probability of a 100-year storm in perspective on slide 3 of the Presentation "What does 100-year" really mean?"[21] in the following table:

Event Frequency[1]	Time Periods			
	Annual Chance	Chance Every 10 Years	Over Life of 30-year Mortgage	Over 100 year life of Infrastructure
50	2%	22%	45%	86.50%
100	1%	11%	26%	63.20%
500	0.20%	2.20%	5.80%	19.10%

[1] This is also call the return period and represents the likelihood of experiencing one or more events in the identified time period. The event might be a storm, a water level, or a failure for example.

[19] http://nolarisk.usace.army.mil/faqs.htm
[20] http://nolarisk.usace.army.mil/science.htm
[21] http://nolarisk.usace.army.mil/What%20does%20100-year%20really%20mean.mht

3 APARIQ OPINION REGARDING ALLEGATIONS CONTAINED IN OSC FILE NO. DI-07-2724

3.1 APARIQ OPINIONS REGARDING DESIGN ALLEGATIONS

3.1.1 *APARIQ'S OPINION REGARDING ALLEGATION #1:*

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

APARIQ believes this allegation valid, and it is highly likely that this is a symptom rather than a root cause.

APARIQ agrees with the Complaintant that an additional analysis of the hydraulic system needed to be performed, and it is highly likely that there were other flaws in the design and operation of the hydraulics system in addition to the air introduced into the Denison hydraulic pumps and HPU's.

When APARIQ asked the following questions about the Denison hydraulic oil pump, the Complaintant provided the following answers about 10 January 2009:

APARIQ's Question to Complaintant	Complaintant's Answer
• What was the maximum rpm rating for the installed Rineer Hydraulic Oil Motor?	*{350 rpm}*
• Was it less than the required 400 rpm?	*{Yes}*
• If so then how was this justified?	*{It wasn't to my knowledge}*

The Complaintant also provided the following additional information regarding these questions about the Denison hydraulic oil motor:

"Additional Information Regarding This Question:

Installed and operational hydraulic pump component:

- *Initial up to late 2007: Rineer 125 Series 4-Port Motor – 125 Series Standard Motor - 3000 psi (Code 61).*
- *Existing: The same Rineer 125 Series 4-Port Motor with heavier springs installed to provide for greater pressures (above the 3000 psi and more 'equivalent' to a Code 62).*

A review of the spec sheet for the supplied 125 Series Standard Rineer motor (Code 61) indicates speeds up to 350 rpm continuous. In addition, a review of the spec sheet for the 125 Hi-Pressure Series Rineer motor – 4500 psi (Code 62) indicates it too provides speeds up to 350 rpm continuous. (please see attached spec sheets).

For additional Rineer motor data please refer to **www.rineer.com**.

In early February 2007 three Rineer motors were torn down and a report of same was filed. This report documents some of the problems found and the replacing of the springs mentioned above. (please see attached email with attached report).

Of important note, please refer to another attached email with attached draft letter to MWI from the CO, two letters from Rineer, and a letter to MWI signed by the CO. This email with attachments is useful....

Also, please refer to attached "Executive Summary" doc – this documents was authored and sent by USACE MVN personnel to the GAO and DoDIG. This too is useful in understanding USACE MVN's position with regards to this and other issues.

In addition, please refer to attached "Outfall Canal Chronology" doc – this doc also was authored and sent by USACE MVN personnel to the GAO and DoDIG. This too is useful in understanding USACE MVN's position with regards to this and other issues.

To my knowledge, no entity (MWI, USACE, GAO, DoD) has looked at the rpm rating of the installed Rineer hydraulic oil motor needing to be above 400 rpm."

Before coming to additional conclusions consider the following observations:

(Observations 3-A) "Testing started - 20 min. into testing the high pressure hose on the hydraulic pump melted/blew out (see pic of hydraulic hose and burn areas on it). MWI stated **DU 8839** would be repaired and retested while we wait."

and

"...at approx 6:30 p.m. the 5 hour endurance/reliability test commenced with **Drive Unit 8839** – 25 min. into the test, after reaching full operating pressure, speed, and temperatures, the other hydraulic pump's high pressure hose 'melted/burned' before my eyes (I took pics of this happening). [22]"

(Observation 4-B) "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 Complaintant. 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.[23]"

(Observation 4-C) "(Denison) START-UP INSTRUCTIONS & RECOMMENDATIONS

- "All DENISON Hydraulics vane pumps & motors are individually tested to provide the best quality & reliability. Modifications, conversions & repairs can only be done by authorized dealers or OEM to avoid invalidation of the guarantee.

[22] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 3
[23] DoDIG Report Allegation #2

"The pumps & motors are to be used in the design limits indicated in all the sales bulletins. Please contact DENISON when trespassing the catalog limits.

Start-up: *(Note that there is no automatic start-up procedure described by Denison)*

The tank has been filled up with a clean fluid in proper conditions.

Flushing the system with an external pump prior to the start-up is good.

To allow a good priming of the pump, the air should be bled off.

The first valve on the circuit should be open to tank.

Air bleed off valves are available on the market place.

It is possible to bleed off the air by creating a leak in the P port of the pump.

Warning : this has to be done in low pressure mode as it could create a dangerous fluid leak. Make sure that the pressure cannot rise (open center valve to tank, pressure relief valve unloaded ...).

When oil free of air appears, tighten the connectors to the correct torque.

The pump should prime within a few seconds. If not, please read the troubleshooting guide (page 33).

If the pump is noisy, please troubleshoot the system.

Never operate the pump at top speed and pressure without checking the completion of pump priming.

(Observation 4-D) Maximum Allowable Temperatures and Water Contamination in the Fluid per "Denison Hydraulics, Overall instructions, Double van pumps, T7-T67-T6 services, B- C – D – E sizes"

Types of fluids : For all types of fluids, DENISON's products have different pressures, speeds & temperature limits. Please refer to the sales leaflets.

HF-0 = Anti-wear petroleum base.
HF-1 = Non anti-wear petroleum base.
HF-2 = Anti-wear petroleum base.
HF-3 = Water-in-oil invert emulsions.
HF-4 = Water glycol solutions.
HF-5 = Synthetic fluids.

The usual limiting factor of temperature (low or high) comes from the obtained viscosity. The seals are sometimes the limit : standard seals range from -30° C to 90° C (-9.4° F to 194° F).

Maximum fluid temperature (Θ)	° C	° F
HF-0, HF-1, HF-2	+ 100	+ 212
HF-3, HF-4	+ 50	+ 122
HF-5	+ 70	+ 158
Biodegradable fluids (esters & rapeseed base)	+ 65	+ 149

Minimum fluid temperature (Θ)(also depend on max. viscosity)	° C	° F
HF-0, HF-1, HF-2, HF-5 -	18	- 0.4
HF-3, HF-4	+ 10	+ 50
Biodegradable fluids (esters & rapeseed base)	- 18	- 0.4

Over or under these values, please contact DENISON.

Maximum acceptable content of water :
0.10 % for mineral base fluids.
0.05 % for synthetic fluids, crankcase oils, biodegradable fluids.
If the amount of water is higher, then it should be drained off the circuit.

3.1.1.1 All of the maximum temperatures shown in the "Denison Hydraulics, Overall instructions, ..." were exceeded for the hydraulic oil and the seals.

It should be noted that "All DENISON Hydraulics vane pumps & motors are individually tested to provide the best quality & reliability. Modifications, conversions & repairs can only be done by authorized dealers or OEM to avoid invalidation of the guarantee." as described in Observation 4-C that every one of the maximum temperatures described in Observation 4-D for the hydraulic oil and the seals was exceeded during the factory testing of the pumping systems.

3.1.1.2 The Denison instructions do not include any procedures for automatic, non-priming start

The DoDIG Report acknowledged the problem associated with priming the hydraulic oil pump when it stated the following:

> "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. During 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."

While there was evidence that the testing procedure had to be changed for the Denison hydraulic oil pump, I was not able to find any evidence in the documents provided that MWI had followed any prudent configuration management practices to write the testing procedures, to modify the operating procedures, and to take corrective action under best configuration management practices to ensure that the equipment was not damaged and that the Denison hydraulic oil pump would operate reliably with high integrity.

3.1.1.3 The Root Cause for the Failure of Seals and O-Rings in the Hydraulic System Should be Clearly Identified

The pumping equipment cannot be categorized as reliable or of high integrity when the root cause for failure of Seals and o-rings has not been clearly identified. The comments in observations 3-A and 3-B do not provide any definitive root cause analysis information. Possible causes for the failures of seals might include any and all of the following, but without the definitive examination and testing it is not possible to clearly identify the root causes of the failures :

Possible Cause No. 1 - Improper installation is a major cause of hydraulic seal failure. The important things to watch during seal installation are: (a) cleanliness, (b) protecting the seal from nicks and cuts, and (c) proper lubrication. Other problem areas are over tightening of the seal gland where there is an adjustable gland follower or folding over a seal lip during installation. Installing the seal upside down is a common occurrence, too. The solution to these problems is common sense and taking reasonable care during assembly.

Possible Cause No. 2 - Hydraulic system contamination is another major factor in hydraulic seal failure. It is usually caused by external elements such as dirt, grit, mud, dust, ice and internal contamination from circulating metal chips, break-down products of fluid, hoses or other degradable system components. As most external contamination enters the system during rod retraction, the proper installation of a rod wiper/scraper is the best solution. Internal contamination can be prevented by proper filtering of system fluid. Contamination is indicated by scored rod and cylinder bore surfaces, excessive seal wear and leakage - and sometimes tiny pieces of metal imbedded in the seal.

Possible Cause No. 3 - Chemical breakdown of the seal material is most often the result of incorrect material selection in the first place, or a change of hydraulic system fluid. Misapplication or use of non-compatible materials can lead to chemical attack by fluid additives, hydrolysis and oxidation reduction of seal elements. Chemical breakdown can result in loss of seal lip interface, softening of seal durometer, excessive swelling or shrinkage. Discoloration of hydraulic seals can also be an indicator of chemical attack.

Possible Cause No. 4 - Heat degradation is to be suspected when the failed seal exhibits a hard, brittle appearance and/or shows a breaking away of parts of the seal lip or body. Heat degradation results in loss of sealing lip effectiveness through excessive compression set and/or loss of seal material. Causes of this condition may be use of incorrect seal material, high dynamic friction, excessive lip loading, no heel clearance and proximity to outside heat source. Correction of heat degradation problems may involve reducing seal lip interference, increasing lubrication or a change of the seal material.

Consistent with observations 2-F, 2-G, 2-J, 3-A, 3-B, 4-D, 4-D, and 4-E, that a combination of high heat, contamination (air, metal shavings, and water), and chemical breakdown of the seal material all contributed to the failure of the o-rings and seals. This does not minimize the potential of seal failure by improper installation or the selection of the wrong material for the seals and o-rings.

While the authors of the 1st DoDIG report were dismissive of the 1st Allegation stating, "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." The observed damage to the Denison hydraulic pumps needed further investigation.

APARIQ believes that the observed damage could have been caused by one or more of the following potential root causes (and perhaps by other root causes not mentioned here):

- The hydraulic reservoir was open to allow absorption of high moisture content air (the hydraulic reservoir should have been covered with a nitrogen blanket or sealed with a rubber diaphragm to reduce the absorption of air and moisture.
- The MWI installation of a solenoid operated hydraulic by-pass valve (installed in lieu of the contractually required clutch which was never installed) could allow the Denison hydraulic pump to operated at very high speed with a low differential pressure across the pump during system startup which would allow dissolved gases in the hydraulic oil to be stripped out of the hydraulic oil inside the pump[24] and result in the release of gases inside the pump and possible pump damage.
- Since the maximum torque acceptable for the Durst pump drive was less than the minimum output of the Caterpillar diesel engine, it is highly likely that high temperatures generated in the Durst pump drive could contribute to higher temperatures in the Denison hydraulic pump and exacerbate the release of dissolved gases into the hydraulic oil, which would manifest itself as air in the Denison hydraulic pumps and would contribute to damage and subsequent failure of the pumps.
- If the hydraulic oil temperature was able to melt hydraulic hoses (as occurred in several tests), then the hydraulic oil temperature was certainly high enough damage seals and to cause internal damage to the Denison hydraulic oil pumps; and the high temperatures would also indicate that the hydraulic oil coolers were not adequate.

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[24] Gases (air) dissolved and moisture are easily absorbed in hydraulic fluids. The dissolved gas can escape from hydraulic fluid under low static pressure and high velocity (like the velocities inside the Denison hydraulic pump). The rate at which the gas escapes is usually higher than the speed at which the gases are absorbed in a reservoir. Gas which escapes as bubbles changes the compressibility of the fluids similar to air bubbles. Even at low pressures, a small quantity of air can drastically reduce the compressibility of hydraulic fluid. This undissolved air has a highly negative effect on the performance, the load rigidity, and the dynamics of the hydraulic system. As the pressurization of hydraulic system can be very rapid, any air bubbles can suddenly be compressed causing a high temperature (adiabatic compression) further exacerbating high temperature problems. Cavitation occurs where the pressure falls below the gas solubility or vapor pressure of the fluid. Cavitation can cause pump erosion, poor efficiency, pressure peaks, and excessive noise. (Lubricants and Lubrication, by Theo Mang, Wilfried Dresel)

- If these systems and hydraulic pump designs were so common and had been used as designed so many times in the past with great satisfaction, the observed problems and hydraulic pump damage should have never occurred.

When APARIQ asked the following questions about the Denison hydraulic oil pump, the Complainant provided the following answers about 10 January 2009:

APARIQ's Question to Complainant	Complainant's Answer
• What were the maximum rated temperatures for the seals in the Denison Hydraulic Oil Pumps?	*{212 ºF using hydraulic fluid approved to Denison HF-0 (i.e. Mobil DTE Excel 68)}*
• How did MWI justify using a startup procedure for the Denison Pump that was different from that recommended by Denison?	*{They didn't – their repeated and staunch statements regarding deviations from manufacturers recommendations were "that's how we've always done it....never had any problems before"}*
• Is there any evidence of any hydrostatic testing of any of the hydraulic system components?	*{Yes, at first with regards to the entire hydraulic pumping system, then with regards to the pump assemblies alone, not individual hydraulic components – but haphazard in approach and varied in methods. During factory testing everything from "dead heading" the hydraulic pumping system (resulting in 280-320 rpm propeller speeds for a couple minutes at most) to providing an outside pressure source to pressurize the hydraulic pumping system to 3000 psi for 90 minutes (resulting in 280-320 rpm propeller speeds). Both these methods I considered not to be performed in accordance with HIS.} Please refer to all trip reports (mine and SAJ) from the April-May 2006 period and testing spreadsheets for more specific data.*

The Complainant also provided the following longer answer regarding these questions about the Durst hydraulic pump drives:

<u>"Longer Answer & Personal First Hand Knowledge Regarding This Question:</u>

Installed and operational Denison hydraulic pump components/elements:

- *Denison Model T7EDS hydraulic pump [Model T7EDS <P1> <P2> 4L00 A100]. With the following cam displacement parings (pump cartridge series):*

  66/45 – initial

  66/50 – changed to this during testing at the manufacturing facility.

  72/45 – currently existing in the field.

- *Hydraulic oil – Mobil DTE Excel 68 (approved to Denison HF-0).*

- *Zinga TF-4060 (100 mesh) Strainer. Please see attached spec sheet.*

A review of the spec sheet for the supplied Mobile DTE Excel 68 hydraulic oil indicates this hydraulic oil conforms to Denison HF-0 type hydraulic fluid. Please see attached spec sheet.

A review of the spec sheet for the supplied Denison hydraulic pump drive reveals the maximum allowed fluid temperatures for the seals is 212 ºF (100 ºC). Please see attached spec sheet.

Of note, initially, when installing and bringing on line the hydraulic pumps MWI mixed different types of hydraulic oil – Mobil Excel and Texaco Rando hydraulic oils. This along with trace amounts of Calcium (left over from the pickling compound used to ship the hydraulic pipe) and water resulted in the hydraulic fluid turning into a jelly like substance. All pumping systems were exposed to this mixture for various amounts of rum time.

Regarding MWI deviating from the Denison start up procedures for the following:

- *MWI utilized a non flooded suction – contrary to industry usual and customary practices for hydraulic systems like ours. Also, given MWI's hydraulic component configuration inlet pressure at the Denison hydraulic pump was calculated by USACE MVN personnel to be insufficient – thereby causing the Denison hydraulic pumps to suck air and destroy themselves. Extensive documentation on this – please see various submitted docs.*
- *Denison states distance between the suction pipe & return lines in the hydraulic oil reservoir/tank should be at its maximum." - hydraulic oil reservoir/tank layout used by MWI has the suction line and return line side by side in the tank.*
- *Denison does not recommend using a suction strainer – MWI insisted/s on using a suction strainer.*
- *Denison requires the hydraulic pumps be bled off to ensure the pumps are fully primed – during factory testing it was witnessed by myself this was not done. Also, all 74 Denison hydraulic pumps were torn down in the field under my supervision (June 2006) and had their internal components inspected – over 40% of the Cam and rotor plates required replacement as they were severely damaged. Once these hydraulic pumps were reassembled at no time did MWI follow start up procedures that conformed to this priming requirement.*

MWI's response to myself and USACE TFG personnel was to state emphatically all supposed deviations were irrelevant and not of concern with regards to their hydraulic pumping system as they had utilized these same designs/configurations/operation in numerous past projects with no supposed adverse effects. In general, any request for MWI to conform to contract requirements, manufacturer's suggested requirements, HIS testing requirements, and general industry standards were for the vast majority of time successfully rebuffed by MWI with no adverse actions taken by USACE (did not hold the KTR accountable). This even included the flooded suction – a modification to the contract ordered MWI to retrofit the direct drives to accommodate a flooded suction to alleviate the fact that Denison pumps were sucking air and destroying themselves. The KTR refused to follow this directive for over a year and the USACE TFG pump team refused to make the KTR do this work (or do it for him). Only after BG Clear's MVN ITR team told the General failure to accomplishing work this meant the lives of the people of New Orleans *were in danger was the KTR then ordered to the site to accomplish this work...it took over a year to accomplish this and only after MVN's Commanding General was involved.*

With regards to hydrostatic testing of any of the hydraulic system components - hydrostatic testing was at first performed on the entire hydraulic pumping system for a few hydraulic systems, then later on the pump assembly alone - not individual hydraulic components. Two methods were employed, "dead heading, and later an attempt to follow the HIS procedure for same with regards to the pump assembly only (drive units were "endurance tested, not static tested).

Dead Heading involved jamming the propeller with large amounts of wood so it would not turn when the system was turned on, turn on the system, get it to speed/pressure as quick as possible, and then quickly check for leaks before the system overheats. Duration of this testing was minutes as the systems had no means of cooling and system temperatures climbed excessively fast. Nothing I said could dissuade the USACE TFG team to not allow this until almost a month into testing (when static testing requirements were changed by modification (P00004)).

The revised testing procedures did not conform to HIS procedures for hydrostatic testing with regards to required pressures and hydraulic components tested (all), MWI ended up providing an outside pressure source to pressurize the pump assemblies alone to at most 3000 psi for 90 minutes (resulting in 280-320 rpm propeller speeds).

Please refer to all trip reports (mine and SAJ) from the April-May 2006 period, numerous testing spreadsheets, and declarations/affidavits for more specific data.

In general, given the initial hydrostatic testing accomplished, the subsequent failures noted for various hydraulic components and the numerous disassembly/assembly of these numerous and various hydraulic components, and, the operation of hydraulic components with compromised systems (overheating systems, contaminated systems, etc.) - few if any hydraulic components have been adequately hydrostatically tested.

<u>Conclusions about the "Hydraulic Oil Pump & Hydraulic Reservoir"</u>

- Conclusion: While there may be other contributing factors, I believe that plans to operate the Denison hydraulic oil pump outside of its design parameters, including starting it up using a procedure different than required by the vendor, will significantly contribute to an unreliable pumping system with questionable integrity.
- Conclusion: There is insufficient information about the specifications for the seals in the hydraulic oil pumps, the hydraulic oil motors, or anywhere else in the system, except for the fact that the Denison instructions for the hydraulic oil pumps are very clear about temperature maximums for the seals (194o F) and the operating temperatures for the pumps (212o F), and these temperatures were exceeded during the factory testing.
- Conclusion: Since is no record of any hydrostatic tests (with hydraulic oil) on any of the hydraulic oil components in the system at the operating temperatures, it is not possible to guarantee with any reliability whether the hydraulic oil system and/or individual components in the hydraulic oil system can withstand the full system pressure of 3000 psi observed during the testing or operation, without seal or O-ring failure.
- Conclusion: There were so many problems with high component temperatures during the testing, contamination of the hydraulic oil, failure of seals, changes in the cams within the

hydraulic oil pumps, and problems with reservoir levels that it is not possible to achieve a high level of confidence in the reliability of the hydraulic oil pumps. The configuration management including the design, the implementation of the design, the testing of the components and the testing of the full system have been performed in such a haphazard manner that it is difficult to establish a high level of confidence in the reliability or integrity of any part of the hydraulic oil system, including the hydraulic oil pumps themselves.

- Conclusion: The maximum percentage of water allowed in the hydraulic oil per the Denison instructions is 0.10 % for mineral base fluids and 0.05 % for synthetic fluids (see Observation 4-D below), and these levels are far below the testing levels described in DoDIG Allegation #12.

APARIQ's Opinion Regarding Allegation #2:

Whistleblower 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.

For the most part, Allegation #2 is true except that the vast majority of the failures were caused by poor engineering design, poor selection of subsystems for a fully integrated hydraulic system, and a failure to recognize problems associated with engineering scaling factors that did not allow MWI to easily move from making smaller hydraulic pumping systems to the required 60 inch hydraulic pumping systems for New Orleans.

Additional comments about individual parts of the MWI hydraulic systems are provided throughout this report and are not repeated here for brevity.

If the hydraulic oil was not sometimes contaminated with particles, air, and/or water during the testing, and if the hydraulic oil was not overheated by the HPU system during operation, the seals on the various hydraulic components and hoses might have adequately contained the full system pressure.

However, overheating different components and subsystems at different times during the testing in the hydraulic system did cause the hoses to melt, the seals to fail in the Denison hydraulic pump, the seals to fail in the Rainier a joint motor, and possibly allow for inadvertent oil leaks into the waterways around New Orleans.

It is not acceptable to conclude that the hydraulic system design deficiencies were adequately mitigated, when most of the testing and most of the operational tests were performed that less than maximum operating speeds, less than maximum operating pressures, and less than full stress testing of the system.

It is not reasonable to try to blame failures on one isolated subsystem or another when the success or failure of the entire system is a function of the successful integration of all the components that might be represented in the figure below.

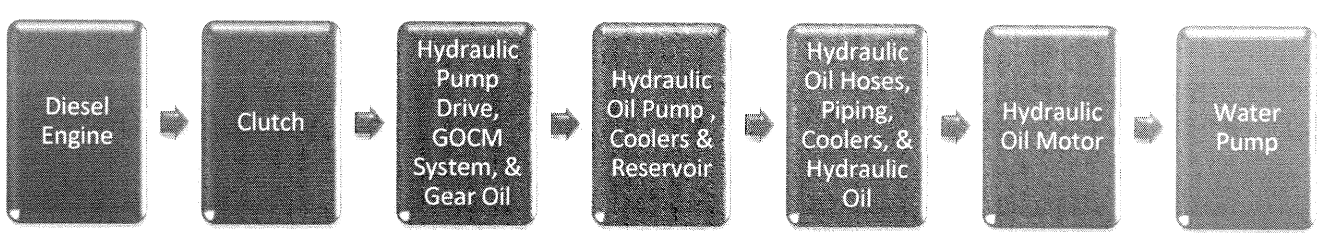

Figure 15 - Simple Representation of the MWI hydraulic Pumping System

3.2 APARIQ Opinions Regarding Testing Allegations

3.2.1 *APARIQ's Opinion Regarding Allegation #3:*

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

APARIQ believes this allegation valid.

The December 2006 "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used on New Orleans Outfall Canals" (from Dr. Stephen T. Maynord) were not conducted in accordance with Hydraulic Institute Standards (HIS).

The introduction of that report clearly stated:

"The Hydraulic Institute Standards (HIS) provide guidance on pump tests to determine discharge and head to compare to design values. HIS states that the chosen measuring technique must be capable of +- 1% at the best efficiency point. The HIS provides a variety of acceptable methods including volumetric, weighing, orifice meters, and venture meters to determine discharge. Concerning pitot tubes, the HIS states "Where it is impractical to employ one of the methods described above, the pitot tube is often used. When the flow conditions are steady during the time required to make a traverse, that is, with variations less than +- 0.5%, the flow may be determined with a fair degree of accuracy." HIS does not define what "fair degree of accuracy" is when referring to pitot tubes. Since an accuracy of +- 1% is a high degree of accuracy of flow measurement, the implication of the HIS is that a lesser accuracy is often accepted when conditions dictate the use of a pitot tube. HIS recommends the use of ANSI/ASME PTC 18.1-1978 Pumping Mode of Pump/Turbines for guidance in conducting Pitot tube measurements. The ANSI website states the document has been withdrawn. The ASME document PTC 18-1992 was obtained concerning use of point velocities (such as from a pitot tube) to measure discharge. The ASME document requires the following:

a. Straight conduit upstream and downstream of the measurement location of 20 and 5 pipe diameters, respectively.
b. Velocity distribution shall, as nearly as possible, be that of fully developed flow in a straight conduit, of uniform section.
c. The mean velocity shall not be less than 75% of the maximum velocity.
d. If flow conditioners are required, they should be placed 10 pipe diameters upstream.
e. Velocities in circular conduits shall be measured along a minimum of two mutually perpendicular diameters. The minimum number of measurement points is 5 points per radius.

In referencing the ASME codes, the Hydraulic Institute Standards (HIS) began referencing ASME document PTC 18-2002 (that was a "Consolidation of ASME PTC 18-1992 and ASME PTC 18.1-1978) that no longer includes Pitot tube flow measurement protocols. The ASME has recognized that the use of Pitot tube flow measurements have to unreasonably expensive to comply with all of these requirements. In the case of the MWI pump tests, the report was referencing outdated as of 2002) (ASME documents.

The side view and top view of Figure 16 shown on page 58 of this document, clearly shows that the first condition, mentioned above, "a. Straight conduit upstream and downstream of the measurement location of 20 and 5 pipe diameters, respectively." was not met for the testing. The nominal pipe diameter described at the location of the Pitot tube was 53.6 inches (4.5 ft.), which would mean that the Pitot tube measuring point was just only slightly more than two (2) pipe diameters instead of the required upstream 20 pipe diameters.

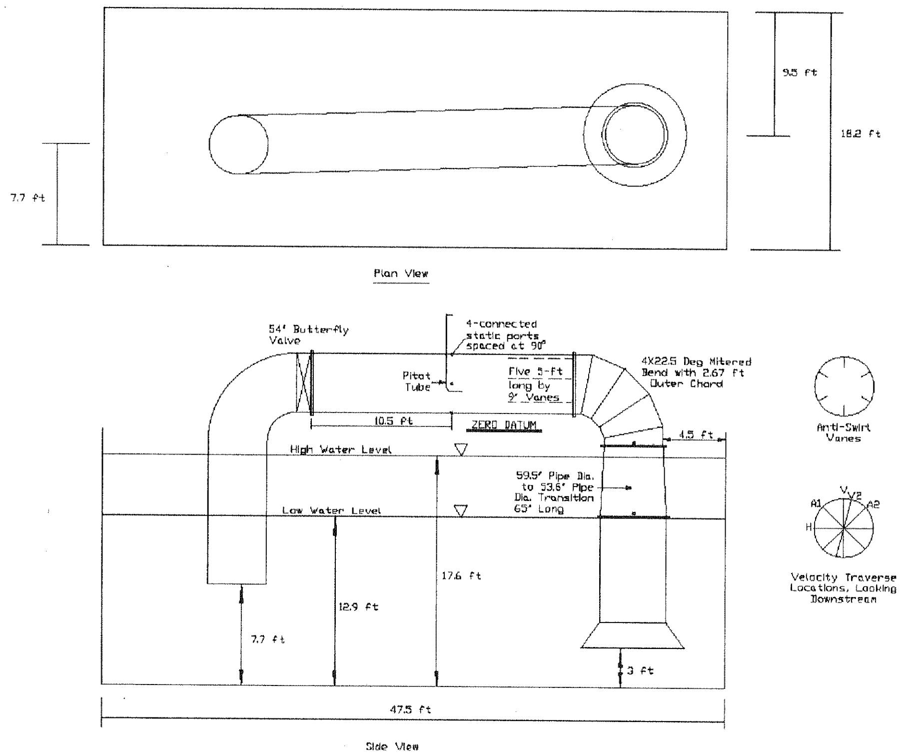

Figure 16 - Copy of Figure 2. Schematic of Test Flume from Factory Tests of MWI Pumps

The proximity of the 90° elbows shown in Figure 16, make it very difficult to conform to the second requirement mentioned above "b. Velocity distribution shall, as nearly as possible, be that of fully developed flow in a straight conduit, of uniform section."

The entire section of pipe where the measurements were made was far less than the required number of pipe diameters upstream and therefore did not meet the condition stated above of "d. If flow conditioners are required, they should be placed 10 pipe diameters upstream." This deficiency is obvious and apparent when viewing figure 4 showing the flow straighteners in the short (less than 5 pipe diameters away) section of pipe.

The flow test data from the different flow tests were skewed as reported in December 2006 by Dr. Maynord in the USACE "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used On New Orleans Outfall Canals", for example the results from Flow Test 4-7 looked like the following as a percent (%) of the maximum flow rate in the piping during the testing:

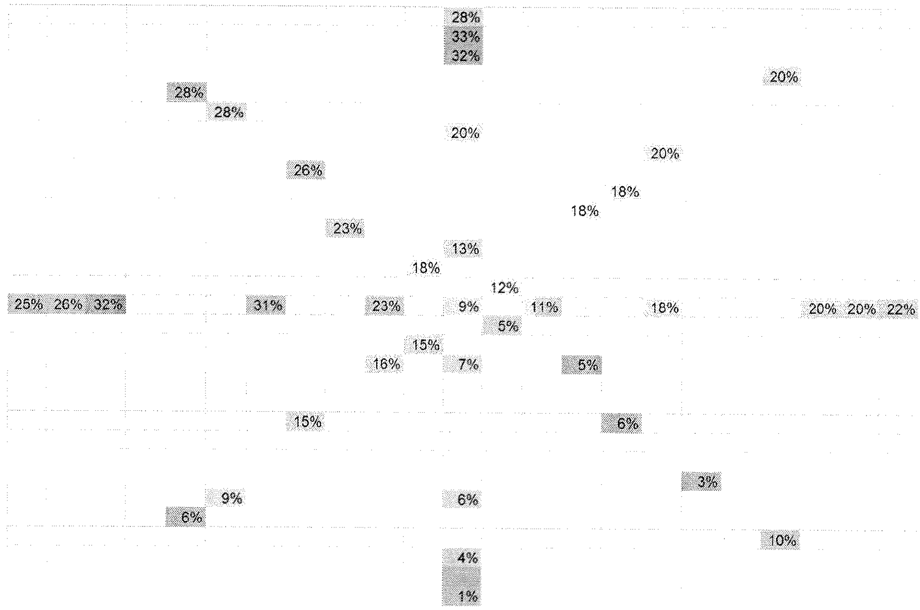

Figure 17 - Cross-section (across test piping) of Percentage of Maximum Observed Flow Measurements from Flow Test 4-7 Data

The information shown in Figure 17 documents nearly a 40% flow differential across the measurement cross section, and this type of flow differential can be caused by flow imbalances and cavitation and most certainly leads to inaccurate flow representations, especially when all of the measurement cannot be taken at the same time.

3.2.1.1 Configuration Management - No documented inspection for water pump damage after initial testing with turbulence and water heating

The Report of the first factory test of the MWI clearly stated that there was turbulence during the tests, which is an indication of cavitation in the water pump:

(Observation 1-A) "Visual observation of flow conditions in the sump showed a large amount of turbulence.[25]"

(Observation 1-B) "The sump used in the measurements was small and the continuous running of the pump caused the water temperature in the sump to reach about 92 degrees F."

(Observations 1- C) Close examination of the graphs on page 22 to 25 of the factory test of the MWI pump show that the flow distribution across the diameter of the pipe did not represent non-turbulent flow as shown in Figure 18. And in fact if you examine the "Velocity Profiles for Test 8-11" and plot those results on a polar coordinate grid, you will see that the flow rates in one fourth of the cross-section of the pipe was most likely 30% to 40% higher than the flow in the lowest quadrant of the pipe, which meant that the flow was not uniform, not laminar (as needed for an accurate pitot tube measurement), most likely turbulent,

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[25] "Data report on factory tests of discharge Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used on New Orleans Outfall Canals, U.S. Army Corps of Engineers, Engineer Research and Development Center, Dr. Stephen T. Maynord, December 2006, page 2.

and probably causing an imbalance of forces on the bearings in the pump which could ultimately lead to premature bearing failure. Also under supposedly similar test conditions, the test results seem to vary by more than ±5%.

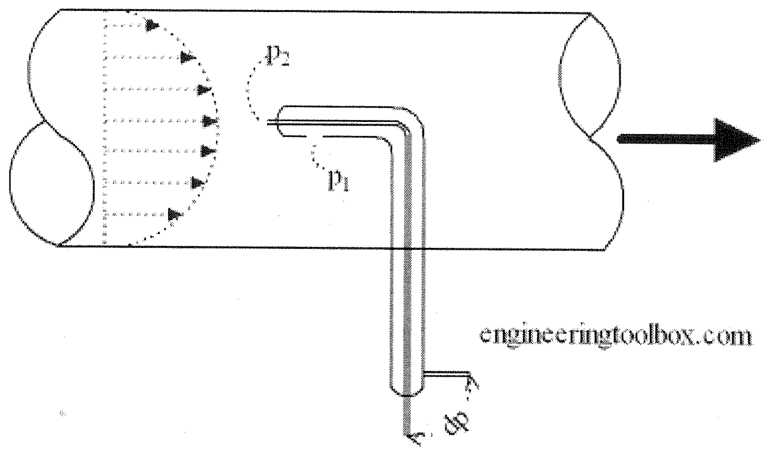

Figure 18 - Example of non-turbulent flow in a pipe

Observations A and B (turbulence and heating), together indicate that it was highly likely that there was insufficient net positive suction head [26] (NPSH) on the suction side of the pump and that cavitation[27] within the water pump was highly likely.

Observations 1-A., 1-B., and 1-C, together point to invalid flow measurements, possible bearing damage in the water pumps, and possible overheating of the hydraulic pumps do to unbalanced forces on the water pump impeller and bearings.

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[26] Net Positive Suction Head (NPSH) available is a function of the system in which the pump operates. It is the excess pressure of the liquid in feet absolute over its vapor pressure as it arrives at the pump suction. http://www.gouldspumps.com/cpf_0007.html

[27] Cavitation is a term used to describe the phenomenon, which occurs in a pump when there is insufficient NPSH Available. When the pressure of the liquid is reduced to a value equal to or below its vapor pressure the liquid begins to boil and small vapor bubbles or pockets begin to form. As these vapor bubbles move along the impeller vanes to a higher pressure area above the vapor pressure, they rapidly collapse.

The collapse, or "implosion" is so rapid that it may be heard as a rumbling noise, as if you were pumping gravel. In high suction energy pumps, the collapses are generally high enough to cause minute pockets of fatigue failure on the impeller vane surfaces. This action may be progressive, and under severe (very high suction energy) conditions can cause serious pitting damage to the impeller.

The accompanying noise is the easiest way to recognize cavitation. Besides possible impeller damage, excessive cavitation results in reduced capacity due to the vapor present in the pump. Also, the head may be reduced and/or be unstable and the power consumption may be erratic. Vibration and mechanical damage such as bearing failure can also occur as a result of operating in excessive cavitation, with high and very high suction energy pumps.

3.2.1.2 Testing Water Pump - It does not appear that any hydraulic pump was ever adequately Flow tested prior to shipment.

Pic. No. 15 – Unmarked pitot tube in the Discharge I

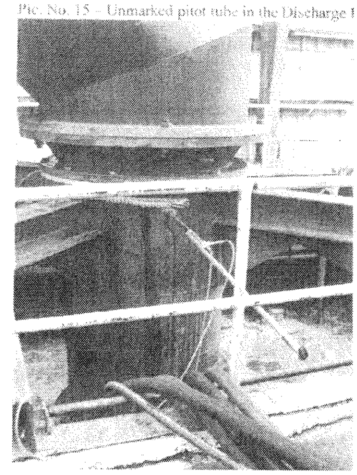

Figure 19

Solicitation W912P8-06-R-0089, including amendments 1-3, stated "the intent of this specification is to obtain from a pump manufacturer a complete fully functional pumping system" and all "tests shall be in accordance with Hydraulic Institute Standards." Pump discharge and head testing shall be conducted at the manufacturer's testing facility in accordance with the Hydraulic Institute Standards.

"Pic. No. 15 – Unmarked pitot tube in the Discharge Pipe on 4/12/2006" is shown in Figure 19 clearly shows that MWI was attempting to conduct some sort of flow measurement test that was unacceptable by HIS standards, unless there was a hidden section of vertical piping between the test point and the pump that was at least 22-88 feet long (or the tank had to be more than 22-88 feet deep.

However, the suspended unit shown in "Pic. No. 7-Original testing apparatus-note size of testing tank (outline by yellow handrail) in relation..." Clearly shows that the distance between the outlet of the pump and the point where the measurement was being made in Figure 19 of this document was no more than three pipe diameters when it should have been 5 to 20 diameters. Therefore, any flow measurements did not conform to the requirements of Gen. engineering principles for using pitot tubes and most certainly did not conform to ASME document PTC 18-2002 or ASME PTC 18-1992.

The ability to pump the required amount of water from each pump is the most fundamental requirement of all of the contract deliverables, and there is insufficient evidence in the documents provided from OSC (as of 11/04/08) to substantiate that any of the delivered hydraulic pumps were ever adequately tested prior to shipment, when considering the following observations about the testing described and depicted in the documents:[28]

- **PITOT TUBES DO NOT MEASURE TURBULENT FLOW ACCURATELY** - A pitot tube29 cannot be used to accurately measure variable turbulent flow, especially when the pitot tube measurement

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[28] *cav·i·ta·tion (kăv'ĭ-tā'shən) n. 1. The sudden formation and collapse of low-pressure bubbles in liquids by means of mechanical forces, such as those resulting from rotation of a marine propeller.* http://www.thefreedictionary.com/cavitation

[29] Pitot tubes can be used to indicate fluid flow velocity by measuring the difference between the static and dynamic pressures in fluids. "A Pitot-static tube can measure the fluid flow velocity by converting the kinetic energy in the fluid flow into potential energy.

point is less than five tube diameters away from the pump and accurate pitot flow measurements will be adversely affected by variable levels of cavitation from the axial flow centrifugal pump which will create non-uniform cycling pressure waves downstream of the pump.

Without the presence of significant static pressure (e.g. that might be produced by deep water of that is perhaps more than 20 feet deep) centrifugal pumps cavitate and the amount of cavitation, the pressure distribution across the pump blades, the available supply of water, the duration of the bubbles, the amount of dissolved gases in the water, and the velocity of the flow all contribute to variable turbulence in the discharge stream from the pump.

> *The use of the pitot tubes shown in the "Pic. No. 15 – Marked pitot tube..." could not have provided accurate flow measurements, especially considering the less than full pipe discharge volume shown in " Pic. No. 16 – Test being run..."*

Averaging pitot tubes are most suitable for flow measurements of clean liquids, gases or steam. The devices are not the best choice, however, for multiphase fluids, such as a liquid with entrained gas or with high levels of cavitation (and turbulence) are not good applications for this technology.

Many of the engineering reference books, e.g. Process measurement and analysis[30], require a straight pipe length of 5 to 25 pipe diameters between the upstream disturbances (in this case the pump

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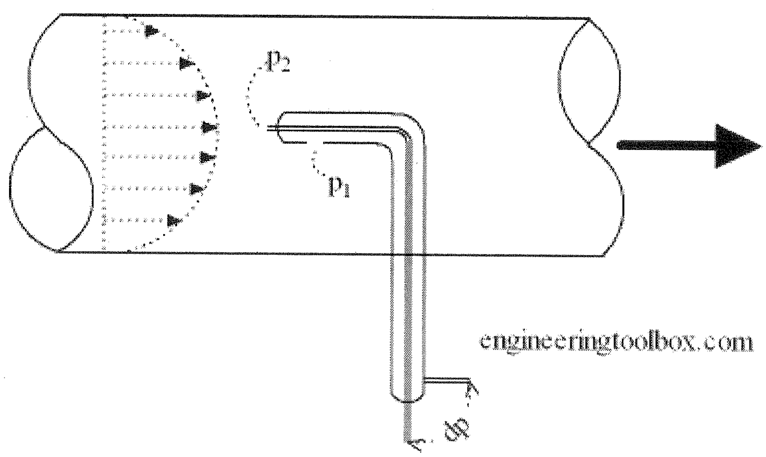

"The principle is based on the Bernoulli Equation where each term can be interpreted as a form of pressure

$p + 1/2\, \rho\, v^2 + \gamma\, h$ = constant along a streamline (1)

where

p = static pressure *(relative to the moving fluid) (Pa)*
ρ = density *(kg/m³)*
γ = specific weight *(kN/m³)*
v = *flow velocity (m/s)*
g = acceleration of gravity *(m/s²)*
h = *elevation height (m)*"[29]

Each term of this equation has the dimension force per unit area - N/m² or in imperial units psi, lb/ft².

[30] Instrument Engineers' Handbook: Process Measurement and Analysis, By Béla G. Lipták Contributor Béla G. Lipták, Published by CRC Press, 2003, p 282.

impeller) and the pitot element. The measurable velocity profile is also significantly affected by pipe surface roughness and by upstream valves, elbows, and other fittings.

Test Tanks Shown in Pictures Appear to be too Small - In the absence of accurate flow measurements from attempts to measure flow using a pitot tube as described above, accurate measurement of the amount of water pumped from a specific volume supply tank or to a specific volume discharge tank is the only logical way to verify the pumping capacity.

I created the following table using the information from "2.10 Schedule of Operating Conditions for Drainage Pump" along with a few additional calculations:

Design Condition	Max Head Design Point	Operating Point	Low Head Design Point
Max. Horse Power (HP)	720	690	640
Flow:	85,000 gpm	98,000 gpm	105,000 gpm
Total Gallons Pumped in 5 minutes:	425,000 gals	490,000 gals	525,000 gals
Cu.Ft. H2O Pumped in 55 minutes:	56,822 cu.ft.	65,513 cu.ft.	70,193 cu.ft.
Required length of Tank if Water level 20 ft deep x 20 ft across	142 ft. *(~1/2 a football field)*	164 ft. *(~1/2 a football field)*	175 ft *(~1/2 a football field)*

The one tank used for the testing shown in pictures 11, 12, 13 and 14 provided by OSC does not appear (no measurements of the volume of water in the tank were provided) to be adequate to support 85,000 gpm for 5 minutes for measure and it does not appear to be used only as a supply tank or a receiving tank for the water through the pump to verify the volume pumped during the test, and verify "...the pump manufacturer's certified performance curves of the pumps, showing gallons pumped per minute, horsepower requirements and pump efficiency over the entire head range of the pumps.[31]"

In fact, "Pic. No. 12 - Failed first run..." shows "water filling the testing facility (at ½ power), and there is no indication of a volumetric pumping measurement.

When APARIQ asked the following questions about the water pump, the Complainant provided the following answers about 10 January 2009:

APARIQ's Question to Complainant	Complainant's Answer
• What conclusive proof was provided at	*{None – at rated flow or at less than rated flow. In fact, in all known instances when*

[31] Contract section 1.3.

APARIQ's Question to Complainant	Complainant's Answer
any time, from any tests, to conclusively verify that the pumps could pump the rated amount of water at the required pressures, without damage to sub-system components?	*hydraulic sub-system components have been taken apart to inspect, damaged internal parts have always been encountered – more discussion below.}*
• Were any inspections made to look for cavitation damage to the pump impellers or the pump bearings after testing?	*{No – from my personal first hand knowledge, not at any time for testing done at the manufacturers testing facility, and, from my personal firsthand knowledge/discussions with USACE engineers in the field/complete review of all field testing and all acceptance testing documents, not at any time for the installed hydraulic pumping systems in the field.}*
• The initial water pump tests were conducted at 278-279 rpm. What discussions confirmations were made that the pumping testing reported as of December 2006 by Dr. Maynord in the U.S. ACE "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used On New Orleans Outfall Canals" was adequate?	{Most all discussions revolved around the adequacy of the testing tank set-up in order to confirm hydraulic pump flow values. They did not consider it possible to conform with HIS performance testing requirements even given Dr. Maynord inspired changes to MWI's testing setup. I believe the words used when this was explained to me by Mark Robertson (MVN ITR technical expert) were they tried to get as close as possible to HIS, and, Dr. Maynord's job was to then try and quantify the testing deviations so more <u>definitive</u> flow quantities could be reported forward (basically TDH values obtained scaled to 288 rpm using affinity laws – see USACE MVN ITR). I have extensive documentation regarding the testing set-up and back-and-forth discussions between USACE and MWI regarding the set-up/concerns/proposals/etc. – will provide in attachments as discussed below.}
• How did MWI explain the skewed turbulent test results from pumping testing reported as of December 2006 by Dr. Maynord in the U.S. ACE "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used On New Orleans Outfall Canals" that reported results from Flow Test 4-7 (as an example) which looked like the	*{I do not have MWI's response to Dr. Maynord's report.}*

APARIQ's Question to Complainant		Complainant's Answer
following as a percent (%) of the maximum flow rate in the piping during the testing?		
• Were any of the bearings in the water pumps disassembled and inspected after the hydraulic oil was overheated?	{No.}	
• After there were contaminants found in the hydraulic oil?	{No.}	
• After there was indication of jelly like deposits in the hydraulic oil?	{No.}	

The Complainant also provided the following longer answer regarding these questions:

> "<u>*Longer Answer & Personal First Hand Knowledge Regarding This Question:*</u>
>
> ***With regards to #i, at no time was there effort by USACE or MWI to demonstrate the hydraulic pumps could pump the rated amount of water at the rated pressures without damage to sub-system components. Extensive pressure has been brought by myself, during my tour of duty and after, to allow for hydraulic sub-component inspections to ensure internal damage has not taken place or in process (to allow for further insight as to possible additional hydraulic system design deficiencies). USACE has maintained that running the pumps, at whatever speeds/pressures/durations, without catastrophic failure (complete cease of operations) is sufficient to demonstrate hydraulic sub-system components are in satisfactory working order.***
>
> ***As already demonstrated, the pumps cannot pump at rated capacity. However, even pumping at lesser than rated amount of water, there was never a policy to inspect hydraulic sub-components for damage no matter the operational problems encountered (overheating, contaminated hydraulic oil, loss of sub-system operations, loud and unusual noise, vibrations, pulsations, etc).. The only time (with two very small exceptions) sub-system components were inspected for damage was the fiasco of my finally convincing the TFG pump team to allow me to remove/disassemble/inspect the Denison hydraulic pumps for evidence of a design deficiency (extensive documentation on this – declarations/affidavits/etc.). Recapping my findings – over 40% of the Denison hydraulic pump units were in a failed or failing state required replacement parts (cams/rotor plates). The two very small exceptions cited when sub-system components were inspected were when as follows:***
>
> - ***Three Rineer motors were disassembled and inspected for damage in early February 2007. To recap this reports finding with regards to damaged internal component – broken springs and the timing plates had marked evidence of rust. (please see attached email with attached report).***
> - ***In July 2006 a 36 hour endurance test was conducted for one hydraulic system, however only our drive units were utilized, not our pump assemblies and piping systems (the pump assembly used was a rental unit). Only the two Denison hydraulic pumps were inspected - at the end of testing both Denison hydraulic units were found to be Ok, however, it was during this testing process that the hydraulic oil reservoir was opened and I discovered a 4" thick layer of Jell-O like hydraulic oil. At this point I realized the***

jelly like substance I was witnessing inside the Denison hydraulic pumps we were tearing down and inspecting was a bigger problem than MWI was leading me to believe (When encountering the jelly like substance inside the Denison hydraulic pumps I asked them what was it and what kind of problem were we seeing – at that time I was told by MWI there was no problem, nothing was wrong).

With regards to #ii, I know dissemble of the pump assemblies at the factory testing facility was never done to inspect the pump impellers or pump bearings for damage after testing. In fact, one particular time when such an inspection was possible, when the pump assembly seals blew out and the motor mount housing was disassembled to allow inspection of same, MWI denied such was the case and stated only the gasket between the motor mount housing and Rineer motor was affected. See Declaration (10-13-2006), pg. 15 and pg. 23-24.

In addition, for all installed hydraulic pumping systems, disassembly of impellers has never been done to my knowledge – let alone inspection of same. This is based on my personal firsthand knowledge, discussions with USACE engineers in the field, and a complete review of all field testing and all acceptance testing documents. Only seal replacements and Rineer motor removal and replacements have taken place for the Pump Assemblies. While it was not noted how disassembly of the pump assembly was accomplished to facilitate seal replacements (numerous) at no time was it noted inspection of pump bearings took place. To help facilitate a better understanding of pump assembly component construction see attached drawing."

3.2.1.3 Conclusions and Recommendations about the "Water Pump"

- Conclusion: For the reasons mentioned earlier in this section, the tests were not conducted in accordance with the Hydraulic Institute Standards as required by the Solicitation W912P8-06-R-0089, including amendments 1-3, stated "the intent of this specification is to obtain from a pump manufacturer a complete fully functional pumping system" and all "tests shall be in accordance with Hydraulic Institute Standards." Pump discharge and head testing shall be conducted at the manufacturer's testing facility in accordance with the Hydraulic Institute Standards.
- Conclusion: APARIQ also does not believe that the test results should stand up as valid test results and therefore the pumping capacity of the original test pump is questionable, and may be inaccurate.
- Conclusion: The tests of the hydraulic water pumps prior to shipment, e.g. the testing shown in Figure 7 of this document, were invalid for accurately determining the flow capacity of the pumps prior to shipment.
- Conclusion: Because of these inaccuracies it is questionable whether the contractor met the most fundamental requirement of the contract, to verify according to the hydraulic Institute standards that the hydraulic water pumps actually pumped the correct amount of water as required.
- Recommendation: The main water pump bearings should be disassembled and inspected for possible damage and the pump impeller blades should be inspected for signs of cavitation pitting which could possibly indicate that the impeller blades were overstressed due to vibration and cavitation and could fail prematurely. If there is any observed pitting on the surface of the water pump impeller blades, then nondestructive examination tests of the impeller blades should be conducted to ensure that cracking has not started in the impeller blades which would lead to ultimate failure in the water pump.

- Recommendation: Both the hydraulic oil motor and hydraulic oil pump should be disassembled because of the observed heating that was described in "Observation B" to ensure that no damage had occurred inside the oil pumps because of the uneven loading and cycling that may have occurred during the testing on the hydraulic water pump, with the observed turbulence during the factory tests. Testing of Water Pump - The Original Factory Tests of Discharge and Total Head of MWI Pumps was NOT in Accordance with Hydraulic Institute Standards (HIS)

3.2.2 APARIQ'S OPINION REGARDING ALLEGATION #4:

Whistleblower Allegation #4: Ms. Garzino 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.

APARIQ believes this allegation valid.

3.2.2.1 Design of Hydraulic Pump Drive, GOCM System, & Gear Oil

The Combination of the Durst Hydraulic Pump Drive Selected, the GOCM Selected, the Chosen GOCM Operating Set-points, the GOCM Selected Sensor Points, and Gear Oil/Durst Hydraulic Pump Drive Integrated Sub-System Design was NOT Reliable and may STILL NOT be Reliable. If the proper subsystem components had been selected, the hydraulic pump drive should not have operated at elevated temperatures periodically exceeding 200° F, the gear oil circulation motors should not have drawn more than five (5) times the rated current for the motor, some of gear oil circulation motors should not have overheated and failed, and the operation of the hydraulic pump drives should not have potentially contributed to the overheating of the hydraulic oil[32] and the subsequent melting of the hydraulic hose.

When APARIQ asked the following questions about the Durst hydraulic pump drives, the Complainant provided the following answers about 10 January 2009:

APARIQ's Question to Complainant	Complainant's Answer
• Did the Caterpillar diesel engines provide more torque than the maximum acceptable torque for the Durst pump drives?	*{Yes – it appears that was/is the case}*
• If so, what design, operational, maintenance, etc. limitations were placed on the system to prevent exceeding the maximum allowable torque by the Durst manufacturer?	*{Time period up to the last formal Federal Agency investigation (first DoDIG report – January 2008), to my knowledge none. All design/operational/limitations to the Durst pump drive were ancillary and contemptibly unimportant to the issue of exceeding maximum allowable torque (i.e. if the Durst pump drives GOCM was burning out simply remove the burned out unit and replace with a higher rated amp GOCM, etc.}*
• Did you consider the Durst Pump Drives oversized or undersized?	*{At this time seriously undersized with regards to the diesel engine, however, likely properly sized with regards to the Denison hydraulic pumps that are attached}*

The Complainant also provided the following longer answer regarding these questions about the Durst hydraulic pump drives:

---

32 Overheating of the Durst hydraulic pump drive gears can easily conduct <u>thermally</u> through the drive shaft to hydraulic oil pump and heat the hydraulic oil.

*"**<u>Longer Answer:</u>***

Installed and operational hydraulic pump components:

- *Caterpillar 3412E DITTA rated 735 hp at 1800 rpm diesel engine*
- *Durst 2PD10 1:1 ratio Pump Drive*

A review of the spec sheets for the supplied Caterpillar diesel engine and Durst pump drive and the Durst application sheet, indicates the output torque of the Caterpillar diesel engine exceeds the maximum allowed input torque of the Durst pump drive (please see attached spec sheets and application sheet).

*Maximum input torque for the 2PD10 Durst pump drive is **1995 lb ft**. Output torque for the Caterpillar 3412E diesel engine is **2145 lb ft times a service factor**. The Caterpillar **service factor** is **1.5** as these units likely experience uniform loading and are designed to function as components in emergency pumping equipment operated during hurricane events – a direct hit hurricane event obviously last over 3 hours, and more likely far exceeds 10 hours.*

*As such, using a service factor of 1.5, the output torques from the Caterpillar diesel engine is **3218 lb ft** while the maximum input torque allowed by the Durst pump drive is **1995 lb ft**.*

However, of important note, as evidenced from historical hydraulic pump runs in the field (e.g. recorded SCADA data for outfall canal pump runs during Hurricane's Gustov and Ike) the hydraulic pumps spend the bulk of their time (more than ½) running at speeds of between 1250-1550 rpm, and the rest of the time at even lower speeds. This is important because the lower the prime mover speeds the higher the prime mover output torque - e.g. at 1400 rpm the Caterpillar output torque is 2511 lb ft – times a service factor of 1.5, the input torque the Durst pump drive sees is 3767 lb ft, or almost twice the maximum allowed.

<u>History of My Personal First Hand Knowledge Regarding This Question</u>:

The Contractor (MWI) informed me during a trip visit to their manufacturing facility in Deerfield Beach, Fl., they were changing the supplier for the pump drive – from a Funk pump drive to a Durst pump drive. They informed me they could not get 37 Funk pump drives as they had originally planned and the USACE Contracting Officer would not allow them to supply pump drives from multiple suppliers. As MWI had not provided USACE any specifications for the Durst pump drive I asked them to provide such – they did not comply even when I elevated this request to the head of the TFG pump team. The only info I was able to obtain was a service manual for the Durst pump drive that I found in their offices and asked them to copy for me (see attached). [Please note, during emergency operations computer and internet availability was slim to none – it was imperative the contractor comply with these requests from USACE and USACE follow up on these requests as personnel and available assets were extremely limited].

During factory testing I recorded elevated temperatures on the outside of the Durst pump drives (over 200 ºF). After witnessing numerous GOCM burning out and elevated temperatures on the outside casing and lines (200+ ºF), numerous Denison hydraulic pumps experience catastrophic failure, and numerous hydraulic lines melt/fail, I bought a digital temperature gun to monitor outer temperatures of these various hydraulic components as MWI was refusing to monitor and record these things on their own. In general, I noticed that the GOCM experienced failure quite rapidly when temperatures exceeded 200+ ºF on the lines leading to the GOCM and/or the outer body of the GOCM. Related to this, when excessive temperatures were seen at the GOCM a corresponding elevation in temperatures would also be seen on the outside of the Durst pump drive (also as high or exceeding 200 ºF).

I suspected multiple factors in the failures I was witnessing, including the Durst pump drive (all components were suspect), and requested MWI to provide me the complete engineering calculations for the entire hydraulic pumping system. At no time during my tour of duty on this project did MWI comply with these request. I made this request over a dozen times, elevated it to the head of the TFG pump team, and still never was given this critical info.

On 13 May 2006 this request was even elevated to an outside USACE engineering support team (the infamous Farkus Team). They also requested this same info as follows:

MWI should be requested to furnish a complete set of system computations for equipment sizing from the water pump to the diesel engine drive. All current components and pipe sizes should be used. Equipment data sheets should be provided for each piece of equipment used which indicate the exact values being used in the computations. This shall include curves for both the hydraulic motor and diesel engine to determine delivered power (torque) at various operating speeds.

*Sometime later MWI responded to this request as follows: "**In process.**"*

This cited request and answer is documented in Attachment 2 of the MVN Independent Team Report (ITR) (please see attached).

I have since learned that on 19 May 2006 MWI (Jim Endres – lead engineer for MWI) sent the head of the USACE TFG pup team (Jim StGermain) a complete set of hydraulic system calculations – I was never cc'd on any of this info, even when this same email with attached calculation sheet was then forwarded to a separate engineering team within USACE. This email with attached hydraulic pump system calculations sheet is attached.

*This 19 May 2006 system calculations sheet clearly shows MWI arrived at an assumed maximum overall hydraulic system pressure of **2500 psi** with a corresponding required horsepower supplied by the diesel engine of **531 hp** – the diesel engine actually supplied by MWI delivers **735 hp.** This email with attachment was provided to me by outside parties during mid to late 2008.*

In addition, during the period of the USACE MVN ITR (September 2006 through May 2007) the ITR lead technical engineer asked for these same engineering system computations. MWI took more than a month to reply to him with 6 or so excel spreadsheets with various system calculations, and, one of the USACE engineers to receive the 19 May 2006 hydraulic system calculations sheet forwarded same to him during this time period. The excel spreadsheets MWI provided USACE were forwarded to me in November 2006 by the lead technical engineer for the ITR (please see attached email with cited spreadsheet attachments). Of important note: there does not appear to be a specific analysis of the diesel engine output torque as relates to the maximum allowed input torque for the pump drive.

Also, unfortunately, in the USACE MVN ITR the main focus of the analysis, with regards to the Caterpillar engine and the Durst pump drive, is the related lack of a clutch starting system as it affected the hydraulic piping (shock loading of the hydraulic pipe), not the miss-matched prime mover and drive train systems. A complete copy of the MVN ITR and all cited attachments will be provided under a separate cover.

Regarding the Durst pump drive, MWI considered it to be adequately designed and did not specify any limitations/changes placed on the system during operations. In addition, to my knowledge, USACE (the Contracting Officer) did not have a differing opinion than MWI on this matter. This characterization of blanket suitability is consistent with how MWI characterizes/ed most all hydraulic components of their hydraulic pumping system, regardless of the varied and voluminous hydraulic pump component failures and the refusal/failure of MWI *to address same (determine root cause in lieu of simply removing and replacing the offending/failed hydraulic component with no forensic or engineering analysis). In addition, the blanket acceptance of MWI's assessments of hydraulic pumping equipment suitability was also consistent with how USACE TFG/TFH personnel addressed these failure issues/engineering inconsistencies.*

Additional Information Relevant to This Question:

There is existing documentation I have obtained that indicates there have been severe and extensive problems associated with Durst pump drives and GOCM's during subsequent field operations. Specifically, Quality Assurance (QA) reports from the short period of time during 'acceptance' testing (June-September 2007) indicates there were numerous failure issues/problems associated with the Durst pump drives and GOCM's. In addition, emails from USACE personnel in the field from this same time period speak to these Durst pump drive and GOCM failure issues – excerpts as follows:

Email sent on 03 August 2007 from the USACE Resident Engineer to the TFH pump team stating:

Pump 3E had an oil circ pump problem, so we're back to running 2E at a reduced speed in order to get 1E past the test.

Email sent on 03 August 2007 from the USACE Resident Engineer to the TFH pump team stating:

Pump no 2W had a gear drive temp problem after 25 min, so we're shutting it down and running 1W.

Email sent on 04 August 2007 from a USACE Construction Representative in the field to the TFH pump team stating:

Pump 2w failed after 1/2 hour because the gear oil in the Durst overheated.

...

Pump 3e failed because the gear oil in the Durst overheated.

Email sent on 05 August 2007 from the USACE Resident Engineer to the TFH pump team stating:

Pump 4W had a Durst drive oil temp problem and only ran for half an hour. It also developed a small leak at a coupling on the platform at the PU.

Email sent on 05 August 2007 from the USACE Resident Engineer to the TFH pump team stating:"

We appear to have an epidemic of Durst drive oil circulation pump problems. We're shutting down the east pump test and moving to test two west pumps.

When APARIQ asked the following questions about the GOCM, the Complaintant provided the following answers about 10 January 2009:

APARIQ's Question to Complaintant	Complaintant's Answer
• What explanations were given when current measurements exceeded the GOCM maximum current rating of 19.6 amps?	*{The only explanation given by MWI was the hydraulic oil must be too thick for the GOCM originally chosen}*
• How many GOCM's were inspected for internal damage after high current	*{Same answer – oil must be too thick}*

APARIQ's Question to Complainant	Complainant's Answer
measurements?	
• How many GOCM's were inspected for internal damage after high current measurements?	*{Durst recommends for ambient temperatures of -10 ºF to 100 ºF a 80w-90 or EP90 (APL-GL-5). Given the failures for GOCM's observed it is felt this is in fact the type oil MWI used (failure eminent when temperatures rose above 200 ºF).} {EP90 is not a synthetic oil}*
• What was the specification of the oil used in the GOCM? Synthetic or not?	*{Durst recommends for ambient temperatures of -10 ºF to 100 ºF a 80w-90 or EP90 (APL-GL-5). Given the failures for GOCM's observed it is felt this is in fact the type oil MWI used (failure eminent when temperatures rose above 200 ºF).} {EP90 is not a synthetic oil}*
• What corrections were made to all of the systems to improve the accuracy of the sensing points for automatic operation after the GOCM did not work correctly to support automatic operation during testing?	*{Wire the GOCM through the circuit box and reprogram the CAT diesel engine to automatically shut off at high temperature. Then two holes were drilled into the upper left hand corner of the Durst pump drive and a GOCM on sensor (140 ºF) and diesel engine off sensor (170 ºF) were installed – see CD Pictures Videos, 4-24, Dscn 0050.jpg.*
• How many units have had their gear oil tested for contamination? If so were there any additional inspections, disassembly, or unit replacements?	*{None during my tour of duty} {No, not during my tour of duty. The only measure taken by MWI to check the GOCM's was to measure the amps being drawn – this was done very infrequently, and seemingly only when severe objects were raised by USACE personnel}*

3.2.2.2 Conclusions and Recommendations from this Section and Sub-Sections about the "Hydraulic Pump Drive, GOCM System, & Gear Oil"

- Conclusion: The GOCM would have to stall, bind, attempt to pump an excessively viscous fluid, or experience blockage in the discharge line from the GOCM; otherwise the GOCM would not have drawn more than its rated 19.6 amps (some tests observed current measurements as high as 100 amps).
- Conclusion: The temperature of the Durst hydraulic pump drive (and consequently the temperature of the gear oil) was periodically measured in excess of 200° F and sometimes in excess of 250° F. The Durst product instructions require the use of Mobil SHS 630 synthetic oil when oil temperatures are expected to exceed 100° F, which they did in this case. If the correct oil was not used and the output torque from the diesel engine exceeded the maximum allowable torque to the hydraulic pump drive, it is highly likely that internal damage, gear oil contamination, and partial breakdown of the lubricating ability of the gear oil occurred.
- Conclusion: The sensing points for the automatic operation of the GOCM and the automatic operation settings for the GOCM did not work correctly, indicating a less than optimal design for the system. If the GOCM did not operate correctly, even with the correct synthetic

gear oil, this could lead to higher temperatures in the hydraulic pump drive, potential damage within the hydraulic pump drive, higher operating temperatures of the hydraulic oil, and a reduction in reliability of the entire water pumping system.

- Conclusion: The high temperatures in the Durst hydraulic pump drives could easily contribute to the high hydraulic oil temperatures because the hydraulic pump drives are mechanically, thermally, and directly connected to the hydraulic oil pumps.
- Recommendation: The gear oil on all units, especially those units that were tested at the factory, should be inspected for contamination and those hydraulic pump drives with the most operating hours should have the hydraulic pump drives drained to look for particulate matter as evidence of damage to the gears and internal mechanism of the hydraulic pump drives. If any particulate matter is found, then at least one hydraulic pump drive should be disassembled and inspected using NDE methods.
- Recommendation: Both the hydraulic oil motor and hydraulic oil pump should be disassembled because of the observed heating that was described in "Observation 2-B" to ensure that no damage had occurred inside the oil pumps because of the uneven loading and cycling that may have occurred during the testing on the hydraulic water pump, with the observed turbulence during the factory tests.

3.2.3 APARIQ'S OPINION REGARDING ALLEGATION #5

Whistleblower Allegation #5:
Ms. Garzino 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.

APARIQ believes this allegation valid and underlying issues are more significant than stated by the Complainant.

After carefully reviewing numerous documents, reading through the rebuttals from the Complainant about the comments made in the two DOD IG reports, and talking with the Complainant, APARIQ believes that there were significant deficiencies that can be summarized as follows:

- The testing requirements and reporting requirements in the solicitation and the awarded contract were deficient;
- Formal testing procedures in the factory and in the field should have been written and reviewed before any testing was performed and complete data recording sheets should have been reviewed and approved before the testing was performed;
- All deficiencies should have been fully documented with corrective course of actions fully documented and formal retest procedures written with full data sheets;
- All deficiencies should have been categorized to ensure that any testing deficiency was not a symptom of a much larger problem instead of a simple one time material failure that could be either corrected and overlooked; and
- It appeared that there was no formal review and follow-up process either at MWI or within US ACE that had any contractual enforcement or financial repercussions for the contractor.

Because all of the testing described in this allegation could significantly affect the loss of lives in New Orleans if a 100 year hurricane hits New Orleans, then urgency needed to be balanced by completeness to ensure that MWI contractually delivered what Congress and USACE believed they had procured.

The level of detail provided by the Complainant in her rebuttal to the comments made in the first DOD IG Report are presented below for easy reference by the reader of this report, and while it appears that these comments are accurate and true, one should read these comments with the idea that most of the comments are indicative of the symptoms and not the underlying problems as to why these testing issues surfaced and continued her research was during the factory testing, the field testing, and subsequent repairs in the field.

> **<u>To address specifics in the DoDIG Report:</u>**
>
> It is imperative to review my Supplemental Affidavit, dated May 15, 2008, and all previous discussions and cited documents.
>
> The subject acceptance testing cited by the DoDIG could not physically have taken place. A detailed discussion to provide clarification follows:
>
> **• Rebuttal to statement: acceptance testing of all 40 hydraulic pumps, "run for a minimum of 2 hours continuously with engine speeds of 1800 rpm and hydraulic pressure of 3,200 psi"**

The subject acceptance testing is memorialized in the internal USACE Newsletter of May 31, 2007 entitled *TASK FORCE HOPE STATUS REPORT:*

As Promised: Corps Delivers All 40 Temporary pumps

New Pumps At Three Outfall Canals Are Tested, Installed And Ready

. The Corps of Engineers set a self-imposed deadline of June1 - the start of hurricane season - to have all 40 of its temporary hydraulic pumps in place at the three outfall canals. That mission has been accomplished.

Id. Citing further from the internal USACE Newsletter:

A problem occurred last week with one pump motor during an Orleans Avenue test; that motor was replaced and the new one is working well. Now all 40 of the pumps are installed, they've been successfully tested, and all are ready for service this hurricane season if needed.

Id. (emphasis added). Also depicted boldly in the middle of the page is a trophy photo of Col. Bedey with the following quotation and caption:

"We said we'd be there on 1 June. We're there."

Col. Jeffrey Bedey, Commander, Hurricane Protection Office, on *having all* 40 *temporary pumps operational by the* start of *hurricane* season.

Id. Below that is a picture of the 17th Street Canal with the following celebratory caption:

(Picture of "On March 31, the Corps successfully demonstrated all 18 new temporary pumps at the 17th Street Outfall Canal")

There are similar pictures and captions for the London Avenue Canal and the Orleans Avenue Canal- both showing the gates closed and testing underway. Specifically, testing was depicted as being accomplished on March 31, 2007 at the London Avenue Canal, and on May 24, 2007 at Orleans Avenue Canal.

The internal USACE Newsletter was presented as a demonstration of the extensive "capabilities" of the New Orleans District to overcome adversity - highlighting their "accomplishments" .

Three days after the March 31, 2007 testing at the 17th Street Canal heralded in the internal USACE Newsletter, Col. Jeff Bedey went on public radio and reported on the state of the hydraulic pumps at that location. Here is what he said to the people of New Orleans:

Col. Bedey: "I'm really, really happy to report that we have all18 of the pumps reinstalled in at the 17th Street Canal - 16 of which have been fully tested, and in fact this Saturday we had 10 of the pumps operating and it was I would say a thing of beauty. We have multiple pictures of that and videos - very, very pleased with the progress we've made to this point ... for all the listeners, this is a very, very good news story . . . I can tell you we have 18 pumps in at the 17th Street Canal, 16 of them have been tested, the only reason we haven't tested the last two is we don't have enough water in the canal, and stored by the Sewage and Water Board to actually test them - we're moving forward. in my mind this is a good news story, people should be confident in where we are, where we are going ..."

Radio Broadcast on "Big 870 WWL 1053," April 3, 2007.

What follows is an analysis of the17th Street Canal and the likelihood 10 hydraulic pumps, not the 18 reported in the internal USACE Newsletter, were "fully tested" on March 31, 2007, or any time before May 31, 2007 - fully tested being what the Corps has reported to the DoDIG investigative team as merely a 2-hour acceptance test run, continuously, at full operating speeds and pressures.

The following analysis will utilize very conservative assumptions in order to give the benefit of the doubt to the statements made by the DoDIG Report, apparently by Col. Bedey and the TFG pump team.

Known: In order to perform acceptance testing on 10 hydraulic pumps at the 17th Street Canal, there had to have been a very large volume of water stored by the Sewage and Water Board.

Known: The volume of water the hydraulic pumps would need on their own to pump for two hours at full operating speeds and pressures is simply calculated to be their discharge rate multiplied by the time they ran – 200 cfs (cubic feet per second) times 2 hours - this would be roughly 115 million gallons of water.

Known: Next, in order to run the hydraulic pumps at something other than zero elevation, at which they cannot be run, there must be additional water stored to raise the canal level to a sufficient elevation in order to turn the pumps on. Conservatively, assuming that the test is run at high tide, this would bring the water elevation to about a 1-foot elevation. Next, in order to raise the water level an additional foot (for a turn-on elevation of 2 feet) - probably too low to work, but assumed for the sake of argument, there would have to be an additional volume of water conservatively estimated at 28 million gallons.

Known: What we know at this point is we need, conservatively, roughly 140 million gallons of water to perform these tests successfully.

In reality, this is the amount of water available on March 31, 2007 to run these tests:

On 03/01/07 there was 0.12" of rain in and around the affected drainage basin.
On 03114/07 there was 0.32" of rain in and around the affected drainage basin.
On 03/15/07 there was 1.29" of rain in and around the affected drainage basin.
On 03/21/07 there was 0.01" of rain in and around the affected drainage basin.
On 03/31/07 there was 0.35" of rain in and around the affected drainage basin.

Even under the best case scenario, in the month prior to the much-lauded "testing," only 2.09 inches of water fell in and around the affected drainage basin. Assuming for the sake of argument the Sewage and Water Board collected it all - every drop of it that made its way to their basin.

Known: Looking at the resultant amount of water actually collected in the collection system, the 2.09 inches of rain equates to less than 0.5 inches of water that is collected in the canals (as taken from a SCS Rainfall- Runoff Solution graph using Soil Type B (moderate infiltration rates) and medium density residential classification - giving a resultant curve number of 75).

Known: Calculating the affected drainage basin at the most to be 15 square miles, yields an estimated volume of water collected to be only 17.5 million gallons.

In sum, as it has been described to the DoDIG, 140 million gallons of water were needed to perform the acceptance testing successfully and we had approximately 17.5 million gallons of water available to do so. These facts are in direct conflict with the statements, analysis and conclusion reached by the DoDIG Report. Further, no more than a single hydraulic pump could have actually been tested.

Known: Assuming each pump being tested is at full operating speeds and pressures, the discharge rate is then 200cfs. Running the pump for 2 hours requires 10.8 million gallons of water. If there were 17.5 million gallons of water available, and one pump requires 10.8 million gallons of water, that that means 1.62 hydraulic pumps could be run. Since a fraction of a pump cannot be run when trying to get true testing done, this means only 1 pump was capable of being successfully tested on March 31, 2007. One pump, not 10 pumps.

Finally, with 17.5 million gallons of water available, 10 hydraulic pumps could really run only 20 minutes. With 200 cfs for each pump, 10 pumps, gives 2000 cfs, which is equal to roughly 875,000 gallons of water per minute. This yields less than 20 minutes of runtime-not 2 hours.

There have not been actual or simulated storm events (as evidenced by documentation of testing that has taken place and NOAA rainfall runoff records) that NOD could have used to test all of the hydraulic pumps at continuous, full operating speeds and pressures for any substantive period of time.

My analysis proves it is physically and mathematically impossible to have conducted acceptance testing for a single hydraulic pump, much less 10 hydraulic pumps, run continuously at full operating speeds and pressures for 2 hours on March 31, 2007.

In addition, given a review of the status of the hydraulic pumps (in various states of repair, installation, etc.), and given the rainfall records for the area surrounding the three outfall canals, it is not physically and mathematically possible to have completed this testing, as reported in the DoDIG Report, at any point during the time period in question (August 2006 through May 2007).

Next, Col. Bedey's statement that "we don't have enough water in the canal" when testing hydraulic pumps, and why such acceptance testing could not have take place, is really because there is a design flaw. **The Corps' own design flaw is what precludes effective testing of the installed hydraulic pumps** (a review of my Supplemental Affidavit, dated March 15, 2008, is imperative). The contractually-specified Maximum Head Operating Design Point, with a design discharge flow rate of 85,000 gpm, against Total Dynamic Head (TDH) for the hydraulic pump, was off by two feet (it was 16.8 feet rather than 18.8 feet.). This results in the currently-installed hydraulic pumping equipment being 2 feet less submerged than the original design criteria specified, and pumping at a TDH greater than originally specified.

At normal canal water levels (zero elevation), the original "pump on" design submergence (if no design flaw existed) left the pumping equipment operating at over 5 feet below that required by the Hydraulic Institute Standards (HIS) for submergence (about 10 ¾ feet, using the HIS 1994 Edition; 13 feet using the HIS 1998 Edition - for purposes herein, using the lesser value). To clarify further, the pump design specified by the Corps defined the "pump on" elevation as 4 feet, and a "bottom of bell" elevation of 6 feet, bringing total submergence to 10 feet - about 1 foot less than that required by the HIS. Adding this 1 foot to the lacking 4 feet of water (there were no storm hurricane conditions) required for "pump on" during "normal canal water levels" (zero elevation) results in a 5-foot deficit. Accordingly, it is reasonable to state, significantly beyond the edge of the pump design, it is difficult, but not impossible (wait for high tide, store water from rain events prior to testing, etc.), to operate pumps at anything but storm conditions. The design flaw has now subjected the pumping equipment to submergences over 7 feet below that required by HIS requirements during normal canal water levels, less than half that required by the HIS. Operation of the pumping equipment, to facilitate testing in place (installed), is not possible at zero water: elevation and below without severe and likely catastrophic damage to the pumping equipment. This explains why testing at continuous full operating speeds and pressures, for limited minutes, not hours, is the reality of what has been accomplished to date for all the hydraulic pumps.

The DoDIG Report makes further mention of the 36-hour test run as somehow relevant to their conclusions in this allegation. This issue has already been addressed, above. The subject test was done using a MWI rental pump, not one of "our" hydraulic pumps.

The DoDIG's conclusions as to what constitutes a reasonable duration of time for acceptance testing to be run are incorrect due to the facts upon which they relied. As has already been discussed, the subject 2-hour acceptance testing could not have taken place. Regardless, that the DoDIG Report would find a 2-hour acceptance test (mechanical integrity test) sufficient is without any basis given the documentation that exists. Documentation from May through July 2006, from the USACE, delineated TFG's own concepts as to an acceptable period of time the subject hydraulic pumps should be run during acceptance testing. An email dated May 17, 2006 from Jim Bartek (USACE, MVR) sent to Steve Farkus (USACE, MVS)-in the ITR, Jim St Germain explains that Steve Farkus was brought in to assist TFG with analysis and recommendations for the pumping equipment-reflects the way the Corps' own pump experts evaluated a suitable duration of time such acceptance testing should be run:

[T]hey are looking for input for field testing of the pumps. I would agree with Ms. Garzino's recommendations below. I believe we recommended a duration of 8 hrs for a test run. . .

Email from Jim Bartek to Steve Farkus, May 17, 2006. The reply to this states:

For the field testing one thought might be to test each individual pump for a period of time (6 hours?) and then test each set of 3 pumps at the same time for a short period (1 hour). The second test would allow for a check of the discharge header for possible leaks under full flow conditions . . .

Email from Steve Farkus to Jim Bartek, May 18, 2006.

Further, email from MWI to TFG pump team states:

Jim and Dan...

For the London Ave. East Platform, we are requested to perform the following:

Remove Denison pumps from 6 drive units on Friday June 7th

On Saturday, we will have a representative from Hydra-Dyne/ Denison present to inspect the cams and record condition. Then the Denison units will be reinstalled.

On Sunday, at 7am, we plan to start the 6 water pumps for a 6 hr test.

Upon conclusion of testing, we will again remove and inspect the Denison cams and record condition with a Hydra-Dyne/Denison representative present.

Id. (emphasis added). Email from Dana Eller, MWI, to Mr. Jim St Germain, July 7, 2006.

Also, in **June** 2006, the follow-on contract solicitation from the USACE TFG for the additional 6 hydraulic pumps cites in the specifications a 5-hour testing duration.

No documentation available to me as an engineer and contract administration specialist supports the conclusions of the DoDIG Report. Nor does publicly-available evidence. Nor does evidence cited by DoDIG investigators. All available documentation points in the opposite direction.

3.3 APARIQ Opinion Regarding Installation Allegation

3.3.1 APARIQ's Opinion Regarding Allegation #6:

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

APARIQ believes this allegation valid.

When APARIQ asked a question, "How did MWI justify operating some of the sub-system components outside of the recommended manufacturer limits? ", the Complaintant provided the following answers about 10 January 2009:

"Answer::

When confronted with issues of hydraulic system components being installed and operated outside the manufacturers recommended limits MWI gave explanations as follows for the following hydraulic components/systems:

- *Flexible high pressure hydraulic oil lines (max 3000 psi) – burst pressures were felt to be at least twice or more as that of the systems operating pressures (3200+ psi).*
- *High pressure hydraulic oil pipe (socket welded/2700psi pipe/shock loaded) – burst pressure of the pipe was thought to be 3-4 times that of the system operating pressures.*
- *Denison hydraulic pump maximum operating pressure (3000 psi) – blanket statement that exceeding 3000 psi operating pressures is not a problem at all; they have previously used this system configuration with no adverse affects.*
- *Rineer pump motor maximum operating pressure (3000 psi) – same as the Denison...done it before with no problems...*

Related to this, I asked MWI prior to factory testing what system operating pressures were expected - I was told 2500 psi (on more than one occasion by at least two of the design engineers (Endres, Eller)). When it became apparent system operating pressures were in the 3200 psi range I asked (many time, many different ways) how this was possible/acceptable. I was told, same as above, MWI has built many pumping systems like ours and they never had any problems previous. All actions/efforts by me to get beyond this unsuitable explanation were rebuffed by the USACE TFG pump team (and MWI).

Also related to this – all, ALL, welds on the pump housing were determined to be defective - defective on a level that our weld experts stated to me they had never seen such a compilation of welds defective on almost every level and of such magnitude they asked me if they could have one of the pump assemblies to use in their welding certification class instruction (they actually thought we would start over, not fix it, they were that bad). I remember one of the weld inspectors equated the problems he was encountering as tantamount to whoever did the welds must have been in a dirt parking lot in a wind storm using welding rods that were a left out far too long – and, his son who played the tuba and never did manual labor before save mowing the lawn (no slight intended he told me), could have done a better job (without any instruction from him). Yet, MWI stated they would not accept that the welds did not meet the code required for welding standards (called out on their own drawings no less) and were also refusing to be involved in fixing the pump welds.

This was the only instance USACE got heavily involved in documenting and fixing defective pumping equipment supplied by MWI. In addition, our own experts were incredulous (verbal outbursts in a high level meeting no less) when MWI presents their "experts" opinion (with a P.E. seal) that the welds were suitable - fit for service. The report can be seen on CD "Garzino Generated Docs", Emails, 5-18-2006, Weld Inspection Report. In general, MWI found an expert to sign off on the welds meet our intended use – to shorten the report: he basically states USACE only needed pumps to hold together for 10 start/stop cycles/year for 5 years...I guess our pumps were built to last for a hand full of hours....this is the level of effort MWI would go to avert responsibility on what one would think of as a horribly losing proposition – when they had more control over the information that could come forward (to delay, confuse, evade) they were equally staunch in their position all their pumping equipment was suitable and required no inspection/design review.

To overcome this position (working with a KTR, who was proving themselves to be a bad KTR, who was not conforming to contract requirements) I needed as much support and assistance as MVN TFG could provide – I would generalize the support I got as none to subversion of my efforts. ...

3.4 APARIQ OPINION REGARDING OPERATIONAL CAPABILITY ALLEGATION

3.4.1 APARIQ'S OPINION REGARDING ALLEGATION #7:

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

APARIQ believes this allegation valid.

3.4.1.1 Testing Water Pump - It does not appear that any hydraulic pump was ever adequately Flow tested prior to shipment.

Solicitation W912P8-06-R-0089, including amendments 1-3, stated "the intent of this specification is to obtain from a pump manufacturer a complete fully functional pumping system" and all "tests shall be in accordance with Hydraulic Institute Standards." Pump discharge and head testing shall be conducted at the manufacturer's testing facility in accordance with the Hydraulic Institute Standards.

Pic. No. 15 – Unmarked pitot tube in the Discharge I

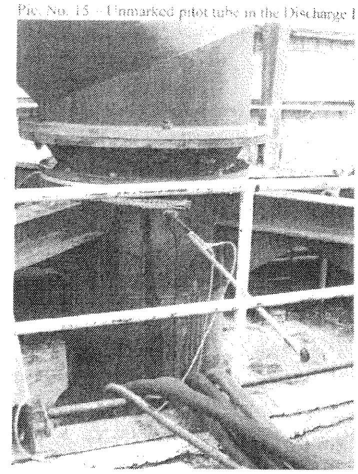

Figure 20

"Pic. No. 15 – Unmarked pitot tube in the Discharge Pipe on 4/12/2006" is shown in Figure 19 clearly shows that MWI was attempting to conduct some sort of flow measurement test that was unacceptable by HIS standards, unless there was a hidden section of vertical piping between the test point and the pump that was at least 22-88 feet long (or the tank had to be more than 22-88 feet deep.

However, the suspended unit shown in "Pic. No. 7-Original testing apparatus-note size of testing tank (outline by yellow handrail) in relation..." Clearly shows that the distance between the outlet of the pump and the point where the measurement was being made in Figure 19 of this document was no more than three pipe diameters when it should have been 5 to 20 diameters. Therefore, any flow measurements did not conform to the requirements of Gen. engineering principles for using pitot tubes and most certainly did not conform to ASME document PTC 18-2002 or ASME PTC 18-1992.

The ability to pump the required amount of water from each pump is the most fundamental requirement of all of the contract deliverables, and there is insufficient evidence in the documents provided from OSC (as of 11/04/08) to substantiate that any of the delivered hydraulic pumps were ever adequately tested prior to shipment, when considering the following observations about the testing described and depicted in the documents:[33]

- <u>**PITOT TUBES DO NOT MEASURE TURBULENT FLOW ACCURATELY**</u> - A pitot tube34 cannot be used to accurately measure variable turbulent flow, especially when the pitot tube measurement

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[33] *cav·i·ta·tion (kăv′ĭ-tā′shən) n. 1. The sudden formation and collapse of low-pressure bubbles in liquids by means of mechanical forces, such as those resulting from rotation of a marine propeller.* http://www.thefreedictionary.com/cavitation

[34] Pitot tubes can be used to indicate fluid flow velocity by measuring the difference between the static and dynamic pressures in fluids. "A Pitot-static tube can measure the fluid flow velocity by converting the kinetic energy in the fluid flow into potential energy.

point is less than five tube diameters away from the pump and accurate pitot flow measurements will be adversely affected by variable levels of cavitation from the axial flow centrifugal pump which will create non-uniform cycling pressure waves downstream of the pump.

Without the presence of significant static pressure (e.g. that might be produced by deep water of that is perhaps more than 20 feet deep) centrifugal pumps cavitate and the amount of cavitation, the pressure distribution across the pump blades, the available supply of water, the duration of the bubbles, the amount of dissolved gases in the water, and the velocity of the flow all contribute to variable turbulence in the discharge stream from the pump.

The use of the pitot tubes shown in the "Pic. No. 15 – Marked pitot tube..." could not have provided accurate flow measurements, especially considering the less than full pipe discharge volume shown in " Pic. No. 16 – Test being run..."

Averaging pitot tubes are most suitable for flow measurements of clean liquids, gases or steam. The devices are not the best choice, however, for multiphase fluids, such as a liquid with entrained gas or with high levels of cavitation (and turbulence) are not good applications for this technology.

Many of the engineering reference books, e.g. Process measurement and analysis[35], require a straight pipe

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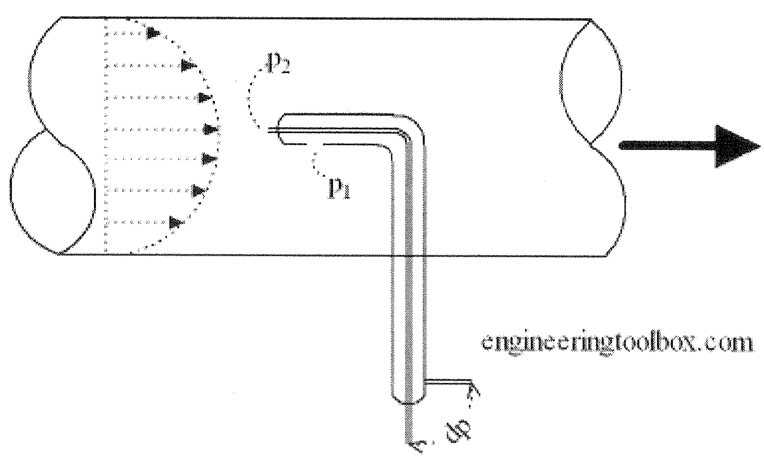

"The principle is based on the Bernoulli Equation where each term can be interpreted as a form of pressure

p + 1/2 ρ v² + γ h = constant along a streamline (1)

where

p *= static pressure (relative to the moving fluid) (Pa)*
ρ *= density (kg/m³)*
γ *= specific weight (kN/m³)*
v *= flow velocity (m/s)*
g *= acceleration of gravity (m/s²)*
h *= elevation height (m)"*[34]

Each term of this equation has the dimension force per unit area - N/m² or in imperial units psi, lb/ft².

[35] Instrument Engineers' Handbook: Process Measurement and Analysis, By Béla G. Lipták Contributor Béla G. Lipták, Published by CRC Press, 2003, p 282.

length of 5 to 25 pipe diameters between the upstream disturbances (in this case the pump impeller) and the pitot element. The measurable velocity profile is also significantly affected by pipe surface roughness and by upstream valves, elbows, and other fittings.

Test Tanks Shown in Pictures Appear to be too Small - In the absence of accurate flow measurements from attempts to measure flow using a pitot tube as described above, accurate measurement of the amount of water pumped from a specific volume supply tank or to a specific volume discharge tank is the only logical way to verify the pumping capacity.

I created the following table using the information from "2.10 Schedule of Operating Conditions for Drainage Pump" along with a few additional calculations:

Design Condition	Max Head Design Point	Operating Point	Low Head Design Point
Max. Horse Power (HP)	720	690	640
Flow:	85,000 gpm	98,000 gpm	105,000 gpm
Total Gallons Pumped in 5 minutes:	425,000 gals	490,000 gals	525,000 gals
Cu.Ft. H2O Pumped in 55 minutes:	56,822 cu.ft.	65,513 cu.ft.	70,193 cu.ft.
Required length of Tank if Water level 20 ft deep x 20 ft across	142 ft. *(~1/2 a football field)*	164 ft. *(~1/2 a football field)*	175 ft *(~1/2 a football field)*

The one tank used for the testing shown in pictures 11, 12, 13 and 14 provided by OSC does not appear (no measurements of the volume of water in the tank were provided) to be adequate to support 85,000 gpm for 5 minutes for measure and it does not appear to be used only as a supply tank or a receiving tank for the water through the pump to verify the volume pumped during the test, and verify "...the pump manufacturer's certified performance curves of the pumps, showing gallons pumped per minute, horsepower requirements and pump efficiency over the entire head range of the pumps.[36]"

In fact, "Pic. No. 12 - Failed first run..." shows "water filling the testing facility (at ½ power), and there is no indication of a volumetric pumping measurement.

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[36] Contract section 1.3.

3.5 APARIQ Opinions Regarding Contract Issues Allegations

3.5.1 APARIQ's Opinion Regarding Allegation #8:

Whistleblower Allegation #8:
Ms. Garzino alleged: TFG 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 the Contracting Officer to mitigate pumping design deficiencies.

This Allegation appears to be true, but requires additional verification through interviews and additional contractual document review.

APARIQ (as stated in the APARIQ contract) "will not have access to proprietary information or attorney product material." This restriction limits what APARIQ can review relative to this Allegation and limits APARIQ's ability to pragmatically arrive at a factual and balanced perspective for this Allegation.

The Complaintant, Ms. Maria Garzino, has provided significant and careful documentation regarding this allegation in rebuttal to the statements and conclusions drawn in both the first and the second DOD IG reports.

APARIQ believes that the OSC has significant expertise in sorting through the contractual facts, the documents, and the statements. and will arrive at an opinion about this contractual, contract administration, and procurement allegation without further comment from APARIQ.

3.5.2 APARIQ'S OPINION REGARDING ALLEGATION #9:

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

This Allegation appears to be true.

Based on the review of documents for this report, there was:

1. **Little logical justification for *(Serious violations of laws or regulations, abuse of authority, or gross mismanagement as related to)***
   a. Restricting the emergency pumping capability solicitation No.W912P8-06-R-0089 to under-designed and untested hydraulic pump systems only, especially when the chosen hydraulic pump systems took longer to procure, design, factory test, and install than proven direct drive pumps (428 days vs. 236 days);
   b. Not adequately verifying that MWI had successfully run hydraulic pumping systems of the same size (and capacity) or larger for more than five years (otherwise most of this investigation would not be necessary):
   c. Allowing significant deviations from the solicitation requirements and bid proposal specifications, then relaxing critical requirements when MWI could not meet the requirements (which may have been a result of misleading or fraudulent representations);
   d. Not requiring the installation of a reliable pumping system which would adequately protect New Orleans, should additional funding be delayed or cancelled;
   e. Not requiring that any "temporary" (if they were truly "temporary" pumping systems be put on removable skids for ease of installation, ease of replacement, and ease of maintenance (both on-site and off-site).

2. **Little logical justification for *(Gross waste of government funds as documented in the 27 April 2009 ECM-GEC Joint Venture Report and reflected by*)**;
   a. Spending $100's of millions (for pump procurement and pump infrastructure installation) in 2007 to install forty (40) MWI hydraulic pumps, which are scheduled to be replaced at an estimated cost of >$430 million within 3-5 years, when the purchase of proven direct drive pumps could have been accomplished more quickly, more reliably, and without planning for pump capacity replacement[37];
   b. Selecting and installing hydraulic pumping equipment that could not be maintained
      i. at the lowest operating and maintenance (O&M) costs, and
      ii. without using a large lifting crane;
   c. Installing hydraulic equipment which was not adequately protected against corrosion, which further decreased reliability, decreased operating lifetime, and increased O&M costs;
   d. Installing hydraulic equipment without containment protection to prevent hydraulic leaks (from system failures and storm damage) from polluting waterways, (potentially violating the Clean Water Act).

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[37] The complainant's comments in her response captures this item very well; "*3.5. Permanent Enhancement of the ICS Facilities Final Report dated April 27,2009. This Report, prepared for USACE, MVD, NOD by ECM-GEC Joint Venture, investigates and reports forward on what modifications are required to extend the life of the Interim Control Structures (ICS) at all three outfall canals to a 50 year design life. Amazingly this report recommends all the currently installed direct drive pumps remain and all the currently installed hydraulic pumps and their associated piping with support structures be removed and replaced with direct drive type pumps and associated structures. This Report goes on to state problematic operational and maintenance issues surrounding the hydraulic pumps are the main reason for recommending they be removed and replaced. This Report goes on further to recommend improving pumping capacity at all three outfall canals by adding direct drive type pumps to the existing ICS in order to meet the pumping capacity associated with a 100 year storm event.* "

3.5.3 APARIQ'S OPINION REGARDING ALLEGATION #10:

Whistleblower 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.

APARIQ is unable to second guess the decisions of the proposal evaluators long after the bid proposal evaluations were completed.

However, the integrity of the entire pre-solicitation efforts, the development of the statement of work, the development of the contract deliverable is suspect.

Based upon the review of documents, APARIQ believes the solicitation for this pumping equipment violated the Federal Acquisition Regulations (FAR) Section 11.105 and most certainly cannot be justified under FAR Section 6.302-1. While, a belief might exist that the clauses for "Unusual and compelling urgency" were compelling to procure hydraulic pumps only, the fact that the proven direct drives pumps were procured, installed, and tested on-site in less time than the hydraulic pumps should cause a prudent manager to question the wisdom of allowing the solicitation to functionally select and develop requirement peculiar to one manufacture.

(FAR) Subpart 11.1—Selecting and Developing Requirements Documents

11.105 Items peculiar to one manufacturer.

Agency requirements shall not be written so as to require a particular brand name, product, or a feature of a product, peculiar to one manufacturer, thereby precluding consideration of a product manufactured by another company, unless—

(a)(1) The particular brand name, product, or feature is essential to the Government's requirements, and market research indicates other companies' similar products, or products lacking the particular feature, do not meet, or cannot be modified to meet, the agency's needs;

(2)(i) The authority to contract without providing for full and open competition is supported by the required justifications and approvals (see 6.302-1); or

(ii) The basis for not providing for maximum practicable competition is documented in the file (see 13.106-1(b)) or justified (see 13.501) when the acquisition is awarded using simplified acquisition procedures.

(3) The documentation or justification is posted for acquisitions over $25,000. (See 5.102(a)(6).)

(b) For multiple award schedule orders, see 8.405-6.

(FAR Section)6.302-1 Only one responsible source and no other supplies or services will satisfy agency requirements.

(a) Authority.

(1) Citations: 10 U.S.C. 2304(c)(1) or 41 U.S.C. 253(c)(1).

(2) When the supplies or services required by the agency are available from only one responsible source, or, for DoD, NASA, and the Coast Guard, from only one or a limited number of responsible sources, and no other type of supplies or services will satisfy agency requirements, full and open competition need not be provided for.

(i) Supplies or services may be considered to be available from only one source if the source has submitted an unsolicited research proposal that—

(A) Demonstrates a unique and innovative concept (see definition at 2.101), or, demonstrates a unique capability of the source to provide the particular research services proposed;

(B) Offers a concept or services not otherwise available to the Government; and

(C) Does not resemble the substance of a pending competitive acquisition.

(See 10 U.S.C. 2304(d)(1)(A) and41 U.S.C. 253(d)(1)(A).)

(ii) Supplies may be deemed to be available only from the original source in the case of a follow-on contract for the continued development or production of a major system or highly specialized equipment, including major components thereof, when it is likely that award to any other source would result in—

(A) Substantial duplication of cost to the Government that is not expected to be recovered through competition; or

(B) Unacceptable delays in fulfilling the agency's requirements.

(See 10 U.S.C. 2304(d)(1)(B) or 41 U.S.C. 253 (d)(1)(B).)

(iii) For DoD, NASA, and the Coast Guard, services may be deemed to be available only from the original source in the case of follow-on contracts for the continued provision of highly specialized services when it is likely that award to any other source would result in—

(A) Substantial duplication of cost to the Government that is not expected to be recovered through competition; or

(B) Unacceptable delays in fulfilling the agency's requirements.

(See 10 U.S.C. 2304(d)(1)(B).)

(b) ***Application***. This authority shall be used, if appropriate, in preference to the authority in 6.302-7; it shall not be used when any of the other circumstances is applicable. Use of this authority may be appropriate in situations such as the following (these examples are not intended to be all inclusive and do not constitute authority in and of themselves):

(1) When there is a reasonable basis to conclude that the agency's minimum needs can only be satisfied by—

(i) Unique supplies or services available from only one source or only one supplier with unique capabilities; or

(ii) For DoD, NASA, and the Coast Guard, unique supplies or services available from only one or a limited number of sources or from only one or a limited number of suppliers with unique capabilities.

(2) The existence of limited rights in data, patent rights, copyrights, or secret processes; the control of basic raw material; or similar circumstances, make the supplies and services available from only one source (however, the mere existence of such rights or circumstances does not in and of itself justify the use of these authorities) (see Part 27).

(3) When acquiring utility services (see 41.101), circumstances may dictate that only one supplier can furnish the service (see 41.202); or when the contemplated contract is for construction of a part of a utility system and the utility company itself is the only source available to work on the system.

(4) When the agency head has determined in accordance with the agency's standardization program that only specified makes and models of technical equipment and parts will satisfy the agency's needs for additional units or replacement items, and only one source is available.

(c) ***Application for brand name descriptions.*** An acquisition that uses a brand name description or other purchase description to specify a particular brand name, product, or feature of a product, peculiar to one manufacturer does not provide for full and open competition regardless of the number of sources solicited. It shall be justified and approved in accordance with FAR 6.303and 6.304. The justification should indicate that the use of such descriptions in the acquisition is essential to the Government's requirements, thereby precluding consideration of a product manufactured by another company. See 5.102(a)(6) for the requirement to post the brand name justification. (Brand-name or equal descriptions, and other purchase descriptions that permit prospective contractors to offer products other than those specifically referenced by brand name, provide for full and open competition and do not require justifications and approvals to support their use.)

(d) Limitations.

(1) Contracts awarded using this authority shall be supported by the written justifications and approvals described in 6.303and 6.304.

(2) For contracts awarded using this authority, the notices required by 5.201 shall have been published and any bids, proposals, quotations, or capability statements must have been considered.

6.302-2 Unusual and compelling urgency.

(a) Authority.

(1) Citations: 10 U.S.C. 2304(c)(2) or 41 U.S.C. 253(c)(2).

(2) When the agency's need for the supplies or services is of such an unusual and compelling urgency that the Government would be seriously injured unless the agency is permitted to limit the number of sources from which it solicits bids or proposals, full and open competition need not be provided for.

(b) ***Application***. This authority applies in those situations where—

(1) An unusual and compelling urgency precludes full and open competition; and

(2) Delay in award of a contract would result in serious injury, financial or other, to the Government.

(c) Limitations.

(1) Contracts awarded using this authority shall be supported by the written justifications and approvals described in 6.303and 6.304. These justifications may be made and approved after contract award when preparation and approval prior to award would unreasonably delay the acquisition.

(2) This statutory authority requires that agencies shall request offers from as many potential sources as is practicable under the circumstances.

Based on the review of documents for this report, there is little logical justification for:

1. ***(Serious violation of law or regulation, abuse of authority, or gross mismanagement)***
   a. Restricting the emergency pumping capability Solicitation No.W912P8-06-R-0089 to under-designed and untested hydraulic pump systems only, especially when those systems took longer to procure, design, factory test, and install than capacity and application proven direct drive pumps, 428 days vs. 236 days;
   b. Not adequately verifying that MWI had successfully run hydraulic pumping systems of the same size (and capacity) or larger for more than five years (otherwise most of this investigation would not be necessary):
   c. Allowing significant deviations from the solicitation requirements and bid proposal specifications, then relaxing important requirements when MWI could not meet the requirements (which may have been a result of misleading or fraudulent representations);
   d. Not requiring the installation of an adequate pumping system which would adequately protect New Orleans, should additional funding be delayed or cancelled;
   e. If the hydraulic pumps were truly designated as "temporary", then it might have been far more economically to put all hydraulic pumps on removable skids for ease of installation, ease of replacement, and ease of maintenance (both on-site and off-site).

2. ***(Gross waste of government funds)*** as document in the 27 April 2009 ECM-GEC Joint Venture Report;
   a. Spending $100's of millions (for pump procurement and pump infrastructure installation) in 2007 to install forty (40) MWI hydraulic pumps, which will most likely be replaced at an estimated cost of >$430 million within 3-5 years, when the purchase of direct drive pumps and infrastructure could have been accomplished more quickly, more reliably, and without planning for pump capacity replacement;
   b. Selecting and installing hydraulic pumping equipment that could not be maintained at a low operating and maintenance (O&M) costs, and in some cases without the presence of a large lifting crane;
   c. Installing hydraulic equipment which was not adequately protected against corrosion, which further decreased reliability, decreased operating lifetime, and increased O&M costs;
   d. Installing hydraulic equipment without containment protection to prevent hydraulic leaks from system failures and storm damage from polluting waterways, (potentially violating the Clean Water Act).

3.5.4 APARIQ's Opinion Regarding Allegation #11:

Whistleblower Allegation #11: The complainant alleged: TFG ACE [USACE] team refused to hold the contractor responsible for providing accurate and truthful quality control documentation for pumping equipment, and refused to hold the contractor responsible for engaging in misleading and deceptive actions to conceal the 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, USACE was informed of the problems and corrections were made to address pumping system problems.

APARIQ believes this allegation valid.

Before discussing the validity of this allegation in any technical depth, it the allegation included the statement, "*The complainant alleged: TFG ACE [USACE] team refused to hold the contractor responsible for providing accurate and truthful quality control documentation for pumping equipment, and refused to hold the contractor responsible for engaging in misleading and deceptive actions to conceal the actual number and nature of failures.*" If MWI provided reliable equipment as required and all of the problems with the hydraulic pumps were corrected, then why would it be necessary to follow the recommendations in the "Permanent Enhancement of the ICS Facilities Final Report dated April 27, 2009", and remove the hydraulic pumps while leaving the direct drive pumps in place?

APARIQ agrees completely with Complaintant's review comments about the Permanent Enhancement of the ICS Facilities Final Report dated April 27, 2009, as follows:

> *"Pumping capacity was investigated and modifications to the existing ICS were identified that would meet the pumping capacity associated with a 100 year storm event. The identified ICS facility modifications required were as follows:*

- *Provide an additional 2,800 cfs of direct drive type pumps at the 17th Street Outfall Canal with associated piping with support structures.*
- *Provide an additional 750 cfs of direct drive type pumps at the Orleans Avenue Outfall Canal with associated piping with support structures.*
- *Provide an additional 2,100 cfs of direct drive type pumps at the London Avenue Outfall Canal with associated piping with support structures.*

Operation and maintenance issues were investigated and modifications to the existing ICS were identified that would extend the life of the ICS at all three outfall canals to a 50 year design life. The significant identified ICS facility modifications (higher dollar) required were as follows:

- *Remove all the hydraulic pumping Equipment from all three Outfall Canals and their associated piping and support structures.*
- *Replace all the removed hydraulic pumps with direct drive type pumps and associated support structures.*

- *Replace the existing knife gates with roller gates.*

The basis overall recommendation of the Report is that the hydraulic pumps, and all their associated components and their associated structures, be removed and replaced with more reliable direct drive pumps.

The Report goes on to list specific deficiencies/problematic issues associated with/surrounding the hydraulic pumps:

Figure 21 - Corrosion Protection is Poor

- *The hydraulic pumps are in-efficient.*
- *The hydraulic pumps are subject to corrosion and leakage.*
- *The hydraulic pump cooling capacity is subject to maintenance problems related to biologic growth and floating material.*
- *The distance between the hydraulic pump and the power units exceed the recommended distance per the manufacture – incredibly even though the manufacturer is responsible for the design of same (design a pumping system with the associated separation distances).*
- *The hydraulic fluid pressure in the hydraulic pipe may exceed the allowable 3000 psi capacity of the pipe.*
- *The hydraulic pumps pose excessive danger related to hydraulic oil spills.*
- *It is doubtful the hydraulic pumps can operate at lake levels resulting from a lake surge.*
- *Physical model tests were performed on the 17th Street and London Avenue Pumping Stations and indicated that the performance of the pumping station intakes was un-acceptable. Recommend replacing all hydraulic pumps with direct drive pumps."*

3.5.4.1 Pumping Test Documented by Dr. Maynord were Poorly Planned Leading to Suspect Conclusions

The December 2006 "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used on New Orleans Outfall Canals" (from Dr. Stephen T. Maynord) were not conducted in accordance with Hydraulic Institute Standards (HIS).

The introduction of that report clearly stated:

"The Hydraulic Institute Standards (HIS) provide guidance on pump tests to determine discharge and head to compare to design values. HIS states that the chosen measuring technique must be capable of +- 1% at the best efficiency point. The HIS provides a variety of acceptable methods including volumetric, weighing, orifice meters, and venture meters to determine discharge. Concerning pitot tubes, the HIS states "Where it is impractical to employ one of the methods described above, the pitot tube is often used. When the flow conditions are steady during the time required to make a traverse, that is, with variations less than +- 0.5%, the flow may be determined with a fair degree of accuracy." HIS does not define what "fair degree of accuracy" is when referring to pitot tubes. Since an accuracy of +- 1% is a high degree of accuracy of flow measurement, the implication of the HIS is that a lesser accuracy is often accepted when conditions dictate the use of a pitot tube. HIS recommends the use of ANSI/ASME PTC 18.1-1978 Pumping Mode of Pump/Turbines for guidance in conducting pitot tube measurements. The ANSI website states the document has been withdrawn. The ASME document PTC 18-1992 was obtained concerning use of point velocities (such as from a pitot tube) to measure discharge. The ASME document requires the following:

a. Straight conduit upstream and downstream of the measurement location of 20 and 5 pipe diameters, respectively.

b. Velocity distribution shall, as nearly as possible, be that of fully developed flow in a straight conduit, of uniform section.

c. The mean velocity shall not be less than 75% of the maximum velocity.

d. If flow conditioners are required, they should be placed 10 pipe diameters upstream.

e. Velocities in circular conduits shall be measured along a minimum of two mutually perpendicular diameters. The minimum number of measurement points is 5 points per radius.

In referencing the ASME codes, the Hydraulic Institute Standards (HIS) began referencing ASME document PTC 18-2002 (that was a "Consolidation of ASME PTC 18-1992 and ASME PTC 18.1-1978) that no longer includes Pitot tube flow measurement protocols. The ASME has recognized that the use of Pitot tube flow measurements have to unreasonably expensive to comply with all of these requirements. In the case of the MWI pump tests, the report was referencing outdated as of 2002) (ASME documents.

The side view and top view of Figure 16 shown on page 58 of this document, clearly shows that the first condition, mentioned above, "a. Straight conduit upstream and downstream of the measurement location of 20 and 5 pipe diameters, respectively." was not met for the testing. The nominal pipe diameter described at the location of the Pitot tube was 53.6 inches (4.5 ft.), which would mean that the Pitot tube measuring point was just only slightly more than two (2) pipe diameters instead of the required upstream 20 pipe diameters.

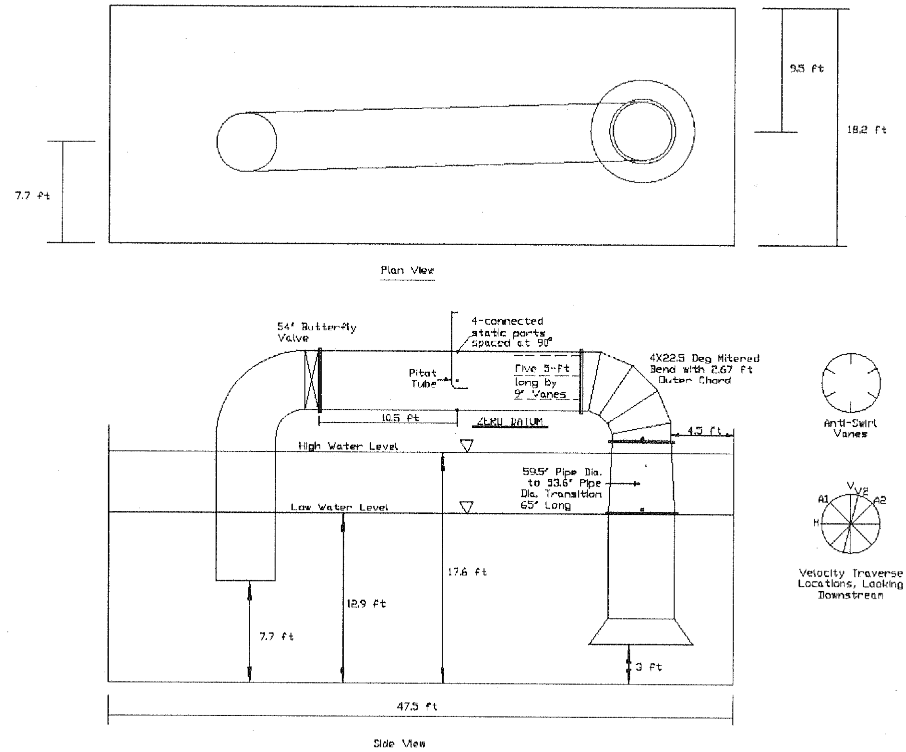

Figure 22 - Copy of Figure 2. Schematic of Test Flume from Factory Tests of MWI Pumps

The proximity of the 90° elbows shown in Figure 16, make it very difficult to conform to the second requirement mentioned above "b. Velocity distribution shall, as nearly as possible, be that of fully developed flow in a straight conduit, of uniform section."

The entire section of pipe where the measurements were made was far less than the required number of pipe diameters upstream and therefore did not meet the condition stated above of "d. If flow conditioners are required, they should be placed 10 pipe diameters upstream." This deficiency is obvious and apparent when viewing figure 4 showing the flow straighteners in the short (less than 5 pipe diameters away) section of pipe.

3.5.5 CONFIGURATION MANAGEMENT - NO DOCUMENTED INSPECTION FOR WATER PUMP DAMAGE AFTER INITIAL TESTING WITH TURBULENCE AND WATER HEATING

The Report of the first factory test of the MWI clearly stated that there was turbulence during the tests, which is an indication of cavitation in the water pump:

(Observation 1-A) "Visual observation of flow conditions in the sump showed a large amount of turbulence.[38]"

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[38] "Data report on factory tests of discharge Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used on New Orleans Outfall Canals, U.S. Army Corps of Engineers, Engineer Research and Development Center, Dr. Stephen T. Maynord, December 2006, page 2.

(Observation 1-B) "The sump used in the measurements was small and the continuous running of the pump caused the water temperature in the sump to reach about 92 degrees F."

(Observations 1-C) Close examination of the graphs on page 22 to 25 of the factory test of the MWI pump show that the flow distribution across the diameter of the pipe did not represent non-turbulent flow as shown in Figure 18. And in fact if you examine the "Velocity Profiles for Test 8-11" and plot those results on a polar coordinate grid, you will see that the flow rates in one fourth of the cross-section of the pipe was most likely 30% to 40% higher than the flow in the lowest quadrant of the pipe, which meant that the flow was not uniform, not laminar (as needed for an accurate pitot tube measurement), most likely turbulent, and probably causing an imbalance of forces on the bearings in the pump which could ultimately lead to premature bearing failure. Also under supposedly similar test conditions, the test results seem to vary by more than ±5%.

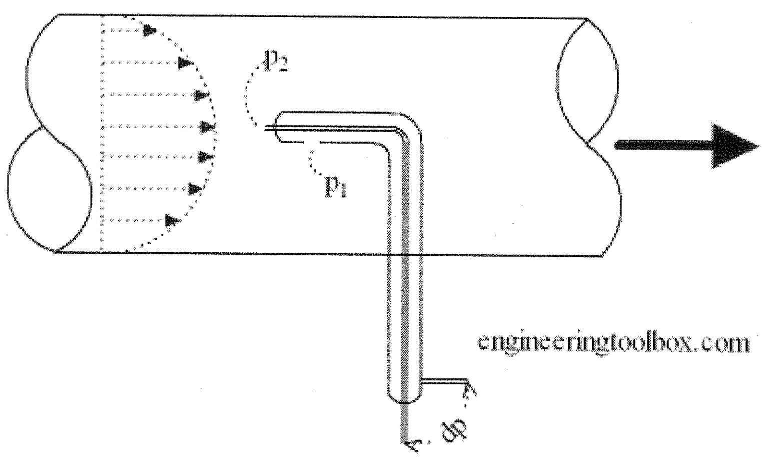

Figure 23 - Example of non-turbulent flow in a pipe

Observations 1-A and 1-B (turbulence and heating), together indicate that it was highly likely that there was insufficient net positive suction head [39] (NPSH) on the suction side of the pump and that cavitation[40] within the water pump was highly likely.

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[39] Net Positive Suction Head (NPSH) available is a function of the system in which the pump operates. It is the excess pressure of the liquid in feet absolute over its vapor pressure as it arrives at the pump suction. http://www.gouldspumps.com/cpf_0007.html

[40] Cavitation is a term used to describe the phenomenon, which occurs in a pump when there is insufficient NPSH Available. When the pressure of the liquid is reduced to a value equal to or below its vapor pressure the liquid begins to boil and small vapor bubbles or pockets begin to form. As these vapor bubbles move along the impeller vanes to a higher pressure area above the vapor pressure, they rapidly collapse.

The collapse, or "implosion" is so rapid that it may be heard as a rumbling noise, as if you were pumping gravel. In high suction energy pumps, the collapses are generally high enough to cause minute pockets of fatigue failure on the impeller vane surfaces. This action may be progressive, and under severe (very high suction energy) conditions can cause serious pitting damage to the impeller.

The accompanying noise is the easiest way to recognize cavitation. Besides possible impeller damage, excessive cavitation results in reduced capacity due to the vapor present in the pump. Also, the head may be reduced and/or be unstable and the power consumption may be erratic. Vibration and mechanical damage such as bearing failure can also occur as a result of operating in excessive cavitation, with high and very high suction energy pumps.

Observations 1-A., 1-B., and 1-C, together point to invalid flow measurements, possible bearing damage in the water pumps, and possible overheating of the hydraulic pumps do to unbalanced forces on the water pump impeller and bearings.

3.5.5.1 Conclusions and Recommendations from this Section and Sub-Sections about the "Water Pump"

- Conclusion: For the reasons mentioned earlier in this section, the tests were not conducted in accordance with the Hydraulic Institute Standards as required by the Solicitation W912P8-06-R-0089, including amendments 1-3, which stated "the intent of this specification is to obtain from a pump manufacturer a complete fully functional pumping system" and all "tests shall be in accordance with Hydraulic Institute Standards." Pump discharge and head testing shall be conducted at the manufacturer's testing facility in accordance with the Hydraulic Institute Standards.
- Conclusion: APARIQ also does not believe that the test results should stand up as valid test results and therefore the pumping capacity of the original test pump is questionable, and may be inaccurate.
- Conclusion: The tests of the hydraulic water pumps prior to shipment, e.g. the testing shown in Figure 7 of this document, were invalid for accurately determining the flow capacity of the pumps prior to shipment.
- Conclusion: Because of these inaccuracies it is questionable whether the contractor met the most fundamental requirement of the contract, to verify according to the hydraulic Institute standards that the hydraulic water pumps actually pumped the correct amount of water as required.

3.5.5.2 Conclusions and Recommendations from this Section and Sub-Sections about the "Hydraulic Motor"

- Conclusion: It is not clear from the documentation provided how a Rineer hydraulic motor that is rated only for 300 RPM continuous can fulfill the contract requirements to run at 400 RPM and deliver the required pumping capacity, without damaging the hydraulic motor. Additional information about the specification for the Rineer hydraulic motor are needed including the limitations on speed, torque, and other conditions that might be different from the limitations of other hydraulic system components.

(Observation 5-A) "Contrary to what the DoDIG Report implies, none of the failures have ever been proven to be pressure-related. Questions have been raised about the ability of the hydraulic system components to safely operate at 3200 psi because the hydraulic components appear to be on the edge of design - however, there has never been any formal finding proffered that I'm aware of that these failures they cite are due to operating pressures of 3200 psi and above. The myriad failures that I witnessed were found, and documented, to be caused in large part by air entrainment, excessive heat caused by internal components self-destructing, foreign matter (metal shavings) running through the pressure plates of the Rineer motor, and internal seals rupturing on the Rineer motor(s) for unknown reasons (excessive pressure being one of the two theories presented).[41]"

(Observation 5-B) "The DoDIG Report also incorrectly identifies the failure issues the pumping equipment experienced. The most important and serious failure modes are not even mentioned - as if they never

[41] Comments from complaintant regarding Allegation #2

existed: air entrainment causing the Denison hydraulic pumps to "suck" air and destroy themselves; Rineer motor failure(s) due to metal pieces coming off the self-destructing hydraulic pumps and running through the motor; and internal seals rupturing on the Rineer motor(s) (for still unknown reasons). The massive number of known failures due to these omitted failures has been overlooked. These failure issues have been extensively documented - see my MFR dated May 3, 2006, my original Declaration, and my follow on Affidavit.[42]"

(Observation 5-C) "...**numerous problems** with the pump assemblies (PAs) during the factory testing. Of the original 34 PAs, only 8 were performance tested (actually pumped water): one of those was for minutes at best, and another at 1/3 operating speeds and pressures. Of these 8 PAs actually "performance tested," 4 PA Rineer motors experienced **catastrophic failure** (requiring complete replacement of the motor). In addition, there were 7 related Denison hydraulic pump failures, 2 related Gear Oil Circulation Motor (GOCM) failures, 3 related Hydraulic oil high pressure line failures, 1 related PA experiencing a loud abnormal noise, 1 related PA experiencing abnormal violent vibrations, 1 related PA experiencing violent surging hydraulic lines, and 1 PA experiencing overheating of the hydraulic oil.[43]"

(Observation 5-D) Rineer Hydraulics, Inc. only lists one 125 Hi-Pressure 4-Port HD Motor of operating up to 4500 psi and up to 780 hp, yet it has a maximum speed of 300 RPM continuous.

From The Basic Contract as Awarded 27 Jan., 2006; Contract No. W912P8-06-C-0089:

"SECTION 11311 - DRAINAGE PUMPS AND DIESEL ENGINE DRIVES"

"2.10 Schedule of Operating Conditions for Drainage Pump

Design Condition	Max Head Design Point	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

It is not clear from the documentation provided how a Rineer hydraulic motor that is rated only for 300 RPM continuous can fulfill the contract requirements to run at 400 RPM and deliver the required pumping capacity, without damaging the hydraulic motor.

[42] Comments from complaintant regarding Allegation #2
[43] Comments from complaintant regarding Allegation #3

3.5.5.3 Conclusions and Recommendations from this Section and Sub-Sections about the "Water Pump"

- Conclusion: For the reasons mentioned earlier in this section, the tests were not conducted in accordance with the Hydraulic Institute Standards as required by the Solicitation W912P8-06-R-0089, including amendments 1-3, stated "the intent of this specification is to obtain from a pump manufacturer a complete fully functional pumping system" and all "tests shall be in accordance with Hydraulic Institute Standards." Pump discharge and head testing shall be conducted at the manufacturer's testing facility in accordance with the Hydraulic Institute Standards.
- Conclusion: I also do not believe that the test results should stand up as valid test results and therefore the pumping capacity of the original test pump is questionable, and may be inaccurate.
- Conclusion: The tests of the hydraulic water pumps prior to shipment, e.g. the testing shown in Figure 7 of this document, were invalid for accurately determining the flow capacity of the pumps prior to shipment.
- Conclusion: Because of these inaccuracies it is questionable whether the contractor met the most fundamental requirement of the contract, to verify according to the hydraulic Institute standards that the hydraulic water pumps actually pumped the correct amount of water as required.
- Recommendation: The main water pump bearings should be disassembled and inspected for possible damage and the pump impeller blades should be inspected for signs of cavitation pitting which could possibly indicate that the impeller blades were overstressed due to vibration and cavitation and could fail prematurely. If there is any observed pitting on the surface of the water pump impeller blades, then nondestructive examination tests of the impeller blades should be conducted to ensure that cracking has not started in the impeller blades which would lead to ultimate failure in the water pump.
- Recommendation: Both the hydraulic oil motor and hydraulic oil pump should be disassembled because of the observed heating that was described in "Observation B" to ensure that no damage had occurred inside the oil pumps because of the uneven loading and cycling that may have occurred during the testing on the hydraulic water pump, with the observed turbulence during the factory tests.

3.5.6 APARIQ'S OPINION REGARDING ALLEGATION #12:

Whistleblower Allegation #12:
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.

APARIQ believes this allegation valid.

From many descriptions and pictures there a miles of piping that would have to be flushed in the hydraulic systems, in the event of hydraulic oil contamination. Black & Veatch calculated "there Four 3 inch and 2 smaller hydraulic lines connect the hydraulic motor to the hydraulic power unit. To power the ... MWI units ..., there is approximately 10 miles of hydraulic pipes and hoses with over half of these over the canal."

When APARIQ asked the following questions about the Hydraulic Oil, the Complaintant provided the following answers about 10 January 2009:

APARIQ's Question to Complaintant	Complaintant's Answer
• How many inspections were made for contamination in the hydraulic oil?	*{During field testing June-July 2006, 3 or so times on 3 or so drive units. Email with the results of one of the inspections is attached and also cited in various docs. Subsequently, during the period after (July-November 2006) there is documentation that all pumping systems had their hydraulic oil tested again (to satisfy acceptance testing requirements) – please see attached USACE NOD authored acceptance testing document with hydraulic oil test results (NAS rating and water content) for each drive unit. Other field records exist for the period beyond November 2006, however I have not been through them yet – when I do I will forward were relevant to this issue.*
• What corrective actions were taken after the inspections?	*{Initial corrective actions were to initiate and accomplish a complete flushing of the hydraulic oil systems for all three outfall canal pumping systems in the July-November 2006 time period. This complete systems flushing took place only once to my knowledge and at a cost of $683,000.00. Please see my Response to DoDIG doc, Contract Issues – Allegation No. 12. Since the last flushing, further contamination has been documented yet it remains unknown to me what measures were taken (again, after review of additional field docs I will forward were relevant to this issue).}*

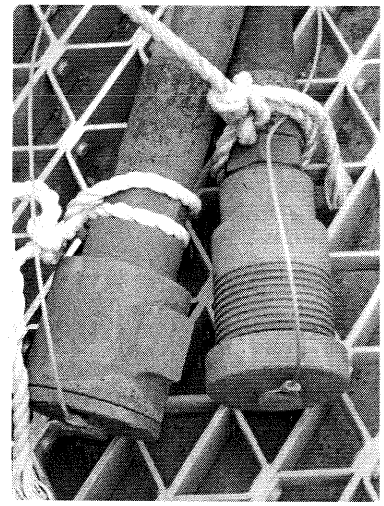
APARIQ's Question to Complainant	**Complainant's Answer**
• Were any of the sub-systems inspected for internal damage, if contamination was found?	*{No.}*
• When the high temperatures were noted on the Durst hydraulic pump drives, what were the measured temperatures on the hydraulic oil?	*{Don't know exactly – the only data I have that shows the two temperatures recorded together are when I was recording Durst drive temps as related to Denison hydraulic pump temp. Basically, the Durst drives were running about 160+ F when GOCM's were not failing and Denison's were running simultaneous temps of 185-195 F. I did note that as the GOCM temps went towards the failing temperature (215+ F) there were corresponding increases in the Durst Drive temps, Denison pump temps, and hydraulic oil line temps.}*
• Where there any inspections made on the oil drained from the Durst hydraulic pump drive for contamination after the Durst hydraulic pump drives overheated?	*{No.}*
• What components were disassembled for inspection after water was found in the hydraulic oil?	*{None.}*
• What were the written specifications for the flushing requirements of the hydraulic system after installation?	*{The government did not have specific written specs for the flushing procedure – it was the responsibility of the KTR to do so in accordance with industry standards and have an end product that met all cleanliness requirements. MWI's flushing requirements are attached.} After MWI did their flushing procedure it was discovered that the hydraulic oil was severer contaminated – please refer to all my submitted docs. They were then asked to submit their "fix" – please see attached emails referencing same and MWI's proposed "fix". The result was USACE did not allow MWI to accomplish this task as they felt MWI was not capable/competent to do so and had MWI contract with an outside firm (Tube Mac) to perform this work - please see my DoDIG response doc. I believe mod P00009states the flushing requirements – please see CD's\Hyd Pump Contract & Data\MWI Contract Docs\MWI Basic Contract with Mods pdf doc – this is the entire base contract and complete compliment of USACE issued mods for same in addition to back-&-forth emails/correspondence regarding same. To start, see page 38 of 439, pg 217 on, ...it spells out the flush procedure and more (what they did)...}*
• After maintenance?	*{Please see O & M Manual – CD Hyd Pump Contract*

APARIQ's Question to Complainant	Complainant's Answer
	& Data, Word Doc O & M Manual 10_03_06, page 195 and others}

3.5.6.1 Conclusions and Recommendations from this Section and Sub-Sections about the "Hydraulic Oil Hoses, Hydraulic Piping, Hydraulic Coolers, & Hydraulic Oil"

- Conclusion: If the coolers were properly designed, positioned, and sized the temperature of the hydraulic oil should have never been able to raise high enough to melt the hoses.
- Conclusion: The documentation provided by OSC did not provide the exact specifications for the hydraulic hoses and the hydraulic oil. From the information provided, it is not possible to check for design consistency and compliance with configuration management best practices about the performance of inadequately specified hoses and hydraulic oil.
- Conclusion: There was insufficient information to determine if there were any testing or operational considerations that would require periodic testing of the hydraulic oil and the conditions for changing the oil based upon contamination levels. I was not able to find a consistent set of requirements for the vendor and type of hydraulic oil that should be used. I was not able to find a documentation of flushing requirements for the system in the event of contamination, and especially after use during a storm when it might be highly likely that there would be very high water contamination levels in the hydraulic oil.

Apariq



3.5.7 APARIQ'S OPINION REGARDING ALLEGATION #13:

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

APARIQ believes this allegation is valid.

In the ECM-GEC Joint Venture Report[44] dated 27 April 2007 the authors of that document clearly identified the following require coating protection against corrosion, "including the: ..., 2) hydraulic piping and pipe supports, 3) pump platform substructures, 4) discharge piping supports, 5) discharge piping internal surfaces, 6..."

When APARIQ asked the following questions about the hydraulic oil coolers, the Complainant provided the following answers about 10 January 2009:

APARIQ's Question to Complainant	Complainant's Answer
• Where you ever shown any design specifications regarding the adequacy of the hydraulic cooler design and positioning of the hydraulic oil coolers?	{No}

The Complainant also provided the following longer answer regarding these questions about the hydraulic oil coolers:

"Longer Answer & Personal First Hand Knowledge Regarding This Question:

Other than the contract specifications (which state "Sufficient hydraulic oil cooling capacity shall be provided..."), the only information provided by MWI regarding the hydraulic oil cooler were drawings related to same –

- *MWI drawing A65200; Titled HYDRAULIC OIL COOLER 150 000 BTU/HR. This drawing provides the construction and physical configuration of the hydraulic oil cooler.*
- *MWI drawing 06015A-F; Titled General Arrangement MWI Model HAC360. This drawing shows how/where the hydraulic cooler is situated on the pump assembly.*
- *NY Associates, Inc. drawing Figure 1 of 2; 17th St. Canal Temporary Drainage pump Station Procurement Package 60" Hydraulic Axial Flow Pump. This drawing shows the intended submergence of the hydraulic coil cooler with relation to the canal elevation. Of note, the actual submergence is 2' less due to a USACE design flaw – please refer to Supplemental Affidavit (3-15-2008).*

..."

[44] "Permanent Enhancement of the ICS Facilities, Final Report", dated **27 April 2009**, prepared under contract to USACE by ECM-GEC Joint Venture in association with Black & Veatch Special Projects Corp, page 3 as well as other locations in the report.

No calculations were provided by MWI to substantiate a 150,000 BTU/HR rated hydraulic oil cooler.

Flow through the hydraulic oil cooler can be derived from system calcs ..., Rineer spec, etc..

Related to this issue (cooling, but including flow interference problems): the sizing (approx. 200 gal) of the hydraulic oil reservoir on the MWI drive unit was questioned as inadequate (by myself and USACE MVN personnel) and at no time did MWI provide system calcs to show their reservoir sizing was correct.

Also related to this issue: a reoccurring problem was documented in late June 2006 - thermal expansion of the hydraulic oil in the piping causing the oil to come up and out the fill cap in significant quantities (gallons). ..."

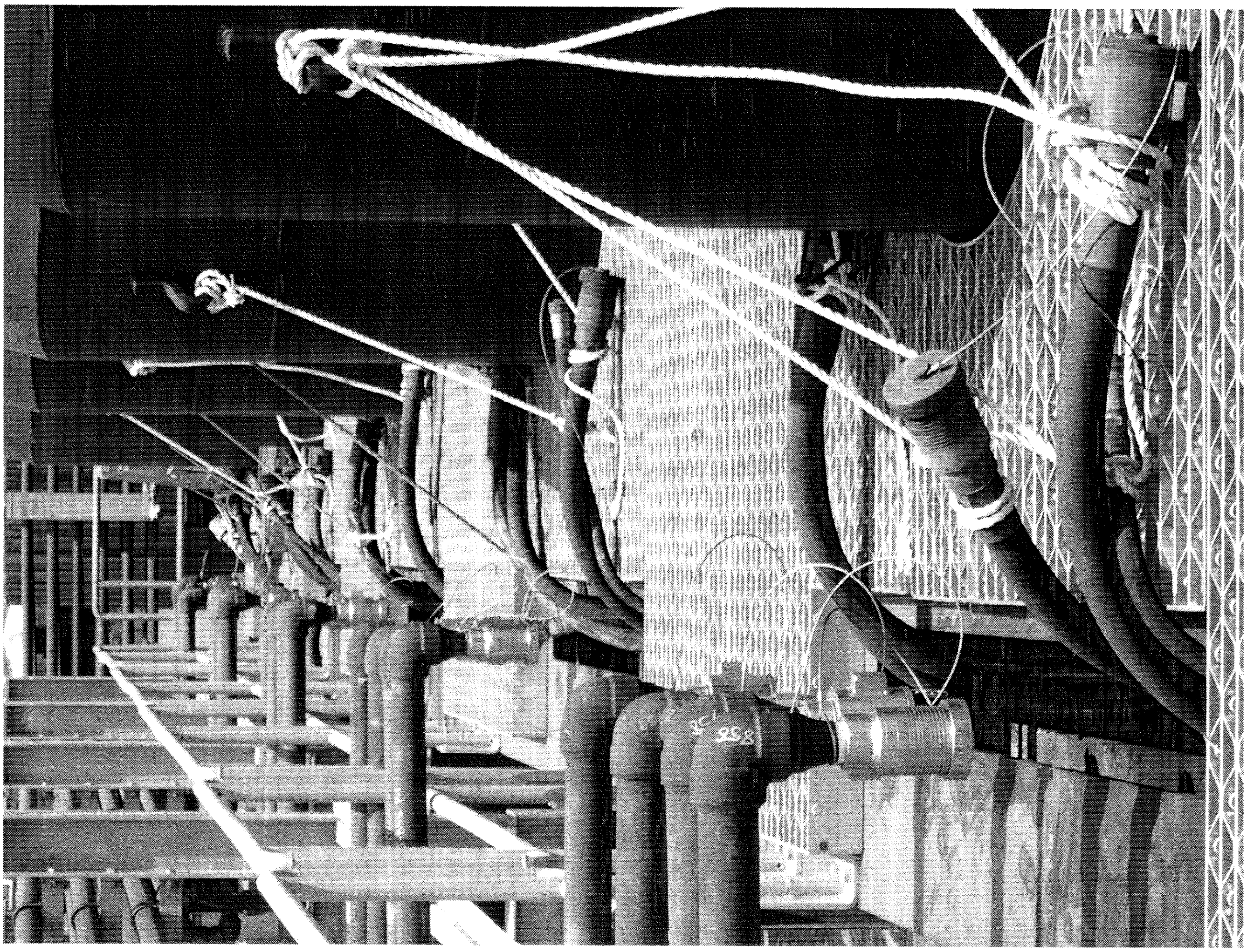


Figure 24 - Rusty Corroding Untreated Pipes and Components

3.5.7.1 Hydraulic System Coolers were Undersized, Improperly Designed, Oriented Incorrectly, Subject to Fouling, Should have had Forced Air Cooling, Were Located in the Wrong Position, or Some Combination of All of the Above

(Observations 4-A) "They will also be collecting time delay data for the gear box temperatures/gear oil circulation motor – this is so they can decide on the necessary setting for a time delay devise for the gear box temperatures/GOCM. Testing started - 20 min. into testing the high pressure hose on the hydraulic pump melted/blew out (see pic of hydraulic hose and burn areas on it). MWI stated **DU 8839** would be repaired and retested while we wait."

and

"...at approx 6:30 p.m. the 5 hour endurance/reliability test commenced with **Drive Unit 8839** – 25 min. into the test, after reaching full operating pressure, speed, and temperatures, the other hydraulic pump's high pressure hose 'melted/burned' before my eyes (I took pics of this happening). [45]"

(Observation 4-B) "2.2.2.3 Hydraulic Coolers On the outside of the impeller bowl, and mounted 180 degrees apart from each other, are two hydraulic fluid coolers. The fluid coolers are located on the low pressure return line from the pump. Coming off of each cooler is a low pressure return line quick disconnect. On the side of the diffuser section of the pump are two high pressures disconnects for the high pressure supply lines. There is also a quick disconnect for the case drain.[46]" Design

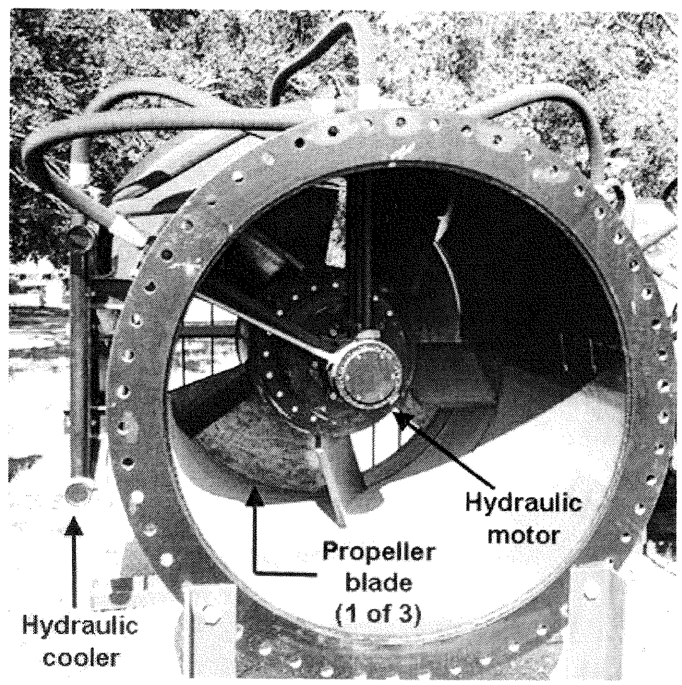


Figure 25 - Note Position of Oil Cooler

- **Hydraulic Oil Coolers were Either Undersized or Improperly Designed**. During testing there were many recorded events of very hot hydraulic oil and at least two instances the hydraulic hoses melted. If the hydraulic oil cooler were properly sized and properly designed the hydraulic oil should not have realized a temperature much higher than the temperature (<100° F) of the pumped water.

(Observation 4-C) "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 Complaintant. A number of test failures were attributed to improper functioning of Denison hydraulic pump units. The problems identified with the hydraulic pump

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[45] Trip Report-2 - FLORIDA TRIP – MWI - TESTING APR 17, page 3

[46] Interim Operating Instructions For The Interim Closure Structures and Temporary Pumps at 17th Street, Orleans Avenue and London Avenue Canals, Jefferson and Orleans Parishes, Louisiana, July 24, 2006, page 51

components were: inappropriate cam and hydraulic hose sizes, seals, o-ring failures, and excessively hot hydraulic oil.[47]"

(Observation 4-D) "Contrary to what the DoDIG Report implies, none of the failures have ever been proven to be pressure-related. Questions have been raised about the ability of the hydraulic system components to safely operate at 3200 psi because the hydraulic components appear to be on the edge of design - however, there has never been any formal finding proffered that I'm aware of that these failures they cite are due to operating pressures of 3200 psi and above. The myriad failures that I witnessed were found, and documented, to be caused in large part by air entrainment, excessive heat caused by internal components self-destructing, foreign matter (metal shavings) running through the pressure plates of the Rineer motor, and internal seals rupturing on the Rineer motor(s) for unknown reasons (excessive pressure being one of the two theories presented).[48]"

(Observation 4-E) Note the position of the oil cooler in Figure 25. Without examining the detailed design the effectiveness of the hydraulic oil cooler is very poor. The hydraulic oil overheated or ran at very high temperatures (in excess of 200° F) during many of the factory tests. Picture No. 58 provided from the OSC shows an oil cooler with a relatively small surface area for the transmission of thermal energy from hot hydraulic oil to the surrounding water, and because the water around the outside of the water pump may not be moving very much, then the thermal gradient from the inside of the cooler to the outside of the cooler will diminish over time and consequently the effectiveness of the cooler will go down. If there is any turbulence around the water pump intake, the effectiveness of the hydraulic oil cooler will be even less. This is a very poor design and a very poor location for the hydraulic oil cooler. The hydraulic oil cooler would have been much more effective if the designer had put fins on the outside of each one of the pipes to increase the cross-sectional area on the outside of the pipes.

3.5.7.2 The Root Cause for the Failure of Seals and O-Rings in the Hydraulic System Should be Clearly Identified

The pumping equipment cannot be categorized as reliable or of high integrity when the root cause for failure of Seals and o-rings has not been clearly identified. The comments in observations 4-C. and 4-D do not provide any definitive root cause analysis information. Possible causes for the failures of seals might include any and all of the following, but without the definitive examination and testing it is not possible to clearly identify the root causes of the failures :

Possible Cause No. 1 - Improper installation is a major cause of hydraulic seal failure. The important things to watch during seal installation are: (a) cleanliness, (b) protecting the seal from nicks and cuts, and (c) proper lubrication. Other problem areas are over tightening of the seal gland where there is an adjustable gland follower or folding over a seal lip during installation. Installing the seal upside down is a common occurrence, too. The solution to these problems is common sense and taking reasonable care during assembly.

[47] DoDIG Report Allegation #2
[48] Comments from complaintant regarding Allegation #2

Possible Cause No. 2 - Hydraulic system contamination is another major factor in hydraulic seal failure. It is usually caused by external elements such as dirt, grit, mud, dust, ice and internal contamination from circulating metal chips, break-down products of fluid, hoses or other degradable system components. As most external contamination enters the system during rod retraction, the proper installation of a rod wiper/scraper is the best solution. Internal contamination can be prevented by proper filtering of system fluid. Contamination is indicated by scored rod and cylinder bore surfaces, excessive seal wear and leakage - and sometimes tiny pieces of metal imbedded in the seal.

Possible Cause No. 3 - Chemical breakdown of the seal material is most often the result of incorrect material selection in the first place, or a change of hydraulic system fluid. Misapplication or use of non-compatible materials can lead to chemical attack by fluid additives, hydrolysis and oxidation reduction of seal elements. Chemical breakdown can result in loss of seal lip interface, softening of seal durometer, excessive swelling or shrinkage. Discoloration of hydraulic seals can also be an indicator of chemical attack.

Possible Cause No. 4 - Heat degradation is to be suspected when the failed seal exhibits a hard, brittle appearance and/or shows a breaking away of parts of the seal lip or body. Heat degradation results in loss of sealing lip effectiveness through excessive compression set and/or loss of seal material. Causes of this condition may be use of incorrect seal material, high dynamic friction, excessive lip loading, no heel clearance and proximity to outside heat source. Correction of heat degradation problems may involve reducing seal lip interference, increasing lubrication or a change of the seal material. In borderline situations consider all upper temperature limits to be increased by 50 degrees F in hydraulic cylinder seals at the seal interface due to running friction caused by the sliding action of the lips.

Consistent with observations 2-F, 2-G, 2-J, 4-D, 4-D, and 4-E, that a combination of high heat, contamination (air, metal shavings, and water), and chemical breakdown of the seal material all contributed to the failure of the o-rings and seals. This does not minimize the potential of seal failure by improper installation or the selection of the wrong material for the seals and o-rings.

3.5.8 *APARIQ'S OPINION REGARDING ALLEGATION #14:*

> *Whistleblower Allegation #14:*
> *Ms. Garzino 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.*

APARIQ believes this allegation valid.

3.5.8.1 Configuration Management for Hydraulic Pump Drives including Corrective Action after Testing

Undersized[49] Durst hydraulic pump drives, excessive heating of Durst hydraulic pump drives, high GOCM amperage, and overheating of the GOCM should have led to required disassembly and inspection of the Durst drives and the GOCM to check for damage and evidence of metal particles; as well as the specification for the gear oil. High amperage on the GOCM is indication of stalling or binding that could have been caused by metal particles from the hydraulic pump drives. Over-torquing of gear teeth in the Durst hydraulic pump drives, can lead to gear fatigue, gear tooth flank pitting, and scuffing; all of which not only potentially reduce the integrity of the pump drives but cause contamination in the pump drives. If the standard oil was used instead of the required Mobile SHC 630 Synthetic or equivalent oil or if the GOCM temperature exceeded the maximum allowable 250° F for synthetic oil (and 210° F for mineral oil), then the lubrication of the gears would have diminished and possibly contributed to pump drive surface gear damage. The only way to check and be sure about possible contamination levels in the gear oil, damage to the hydraulic pump drive gears, and internal damage to the GOCM is to disassemble several units and look. Short of disassembly or possibly filtering through an in-line 5 micron absolute filter, it is not possible to know if there was any gear wear or damage.

Adequate corrective action should include root cause analysis, and not simply replacing a failed component (the symptom) with a new component, without understanding the root cause and making necessary improvements and changes to all of the systems.

If MWI had followed National Electric Codes (NEC) for GOCM wiring size and anticipated voltage drops, the wires should not have overheated.

[49] See Section 2.4.5.1 Durst Hydraulic Pump Drives Appear to be Undersized for This Application on page 21 of this document.

4 Comparison of DoDIG Report No. D-2008-TD-005 with Complaintant Responses for All 14 Complaintant Allegations

*Comparison of DoDIG Report No. D-2008-TD-005 with Complaintant Responses for **Allegation #1*** **(According the DoDIG Report):** *Flawed design allowed air to enter into Denison hydraulic pumps on the HPUs causing damage and subsequent failure of the pumps.*		
According to the DoDIG Report No. D-2008-TD-005	**Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position**	**APARIQ Related Comments**
Facts *(According the DoDIG Report):* 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 defect 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. During 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	<u>To address specifics in the DoDIG Report:</u> While the Denison hydraulic pump design was standard, it is documented that it was incorrectly sized, which means it was not used in a standard manner. For the Denison hydraulic pump configuration chosen by Moving Waters Industries Corp. (MWI), the design of the hydraulic system was proven to be flawed. The inlet pressure at the Denison pumps was calculated to be insufficient, thereby causing the pumps to suck in air and self-destruct. Quoting briefly from the email showing the calculations that prove a design flaw with the inlet pressure to the Denison hydraulic pump: In light of our recent problems with at least 9 Denison Hydraulic Pump failures, I have completed an analysis of the hydraulic pump suction design. I acknowledge that the engine/pump start up procedure has been modified since installation at Orleans to minimize the strain on the pumps. However the calculations show that we continue to run these pumps at less than the required inlet pressure until the hydraulic fluid warms up to over 80 F. The damage may be done at start up, with complete failures not showing until we have temperature and load. Email from Ray Newman, U.S. Army Corps of Engineers (USACE) Engineer, to Task Force Guardian (TFG) pump team, June 13, 2006. After the above-cited evidence was presented to the TFG pump team, I was then able to inspect each and every Denison hydraulic pump for damage. I discovered that over 40% of all the pumps installed and in the field were in a failed or failing state, with their internal components evidencing severe internal damage due to air entrainment (shredded port plates, cams	APARIQ believes this allegation valid, and it is highly likely that this is a symptom rather than a root cause. APARIQ agrees with the Complaintant that an additional analysis of the hydraulic system needed to be performed, and it is highly likely that there were other flaws in the design and operation of the hydraulics system in addition to the air introduced into the Denison hydraulic pumps and HPU's. For further discussion about this allegation, please see Section 3.1.1 on page 46.

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ***ALLEGATION #1*** **(ACCORDING THE DODIG REPORT):**
FLAWED DESIGN ALLOWED AIR TO ENTER INTO DENISON HYDRAULIC PUMPS ON THE HPUS CAUSING DAMAGE AND SUBSEQUENT FAILURE OF THE PUMPS.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
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 floated 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.	showing "severe wear," etc.). *See also* Response to Allegation Nos. 2 and 3 for pictures. The start-up procedure in question was not standard, initially. It was added later and, as documented in emails, it was added to remedy an unexpected problem that was created by the unsuitability of the pump design to the project's demands. An excerpt from an email reflects the way the Corps' own managers judged the pumps and the company that assembled and installed them: It appears to me that MWI is just trying to "make it work" to get by. Everyone agrees that the Denison pumps are operating in a dry run condition. While the priming procedure described below may work as a one time or short term fix. I feel, and I think Steve agrees, it will not hold up over the long term. There will be entrained air that will percolate out and also air leaking in through the tank etc that will get trapped. They need to look more at root causes than quick fixes of the problems. This could be pump sizing or relocating the suction intake to a more suitable location. Email from Jim Bartek, USACE) Engineer, to Jim St. Germain, USACE TFG, "Issues on Hydraulic Drive Units and Pump" [May 31, 2006]. I personally witnessed MWI deviate from this start-up procedure, or skip it entirely (as documented in pump run data sheets), which suggests that it was not treated as standard, even if it is memorialized on paper as the procedure. This was further documented in a Memorandum for the Record (MFR) I sent to the TFG Resident Engineer of the Closure Structures and the entire TFG pump team: I have no communiqué regarding MWI addressing a problem with their hydraulic system - the closest I have seen them get to admitting they have a problem with their hydraulic system is derived from what Jim St. Germain passed on to me (email of 5/23) - MWI gave him revised start up procedures meant to minimize the problem of air entraining in the hydraulic oil and entering the Denison pump - the revised procedures included starting the Drive Unit at 1000 RPM for 2 minutes and ramp up 200 RPM every 2 minutes until they get to 1800 RPM (10 minutes total time), and, the installation of check valves on the hydraulic intake line to the Denison hydraulic pumps which would allow an air compressor to be hooked up to it and	

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	pressurize the oil in the line . . . from my own observation, MWI does not even believe in their own revised procedures, because, the entire time they have been at the Orleans Ave. Closure Structure, they have not once used the air compressor to hook to the check valve and pressurize the hydraulic line, nor for that matter have they adhered to the ramp up gradually to 1800 RPM procedure – from my observations, most of the time when they start the Drive Units they at best take 2-4 minutes to get to 1800 RPM, not 10 minutes."- MFR from Maria Garzino to TFG Pump Team and Resident Engineer, "Implementation of New Corrective Measures to Correct Pumping Equipment Deficiencies," May 29, 2006. The Contracting Officer (CO) ordered the retrofit flooded suction. That office communicated to me in numerous indirect ways that the Corps generally, and the TFG pump team specifically, considered a retrofit necessary to solve the problem of air entrainment. Documents that support this include the following e-mails: I have completed an analysis of the hydraulic pump suction design. I acknowledge that the engine/pump start up procedure has been modified since installation at Orleans to minimize the strain on the pumps. However the calculations show that we continue to run these pumps at less than the required inlet pressure... <u>Recommendations –</u> ...Modify the hydraulic tanks to provide flooded suction to the hydraulic pumps. Email from Ray Newman, U.S. Army Corps of Engineers (USACE) Engineer, to Task Force Guardian (TFG) pump team, "Analysis of Hydraulic Pump Suction Loss on MWI Power Units" [June 13,2006]. Further: MWI has proposed to redesign the hydraulic tank and hoses to form a flooded suction for the two Denison hydraulic pumps. MWI will raise the hydraulic fluid tank and reposition the hoses to the Denison pump. This fix should prevent air from entering the motor ... We should immediate [ly] have MWI retrofit the engines at 17th that are not installed. Coordinate with the three contractors on swap outs to minimize impacts to buildings.	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ***ALLEGATION #1*** **(ACCORDING THE DODIG REPORT):**
FLAWED DESIGN ALLOWED AIR TO ENTER INTO DENISON HYDRAULIC PUMPS ON THE HPUS CAUSING DAMAGE AND SUBSEQUENT FAILURE OF THE PUMPS.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	Avoid any impacts to pumping capacity. Have MWI develop a plan to retrofit in place. --Jim St. Germain Email from Jim St. Germain to TFG Commander Col. Bedey, "MWI Proposal to Retrofit Flooded Suction for Denison Hydraulic Motor," [June 19, 2006]. The TFG pump team again communicated their grave concerns about a design flaw and the hydraulic pumping system's operability: We believe that the existing design may have caused numerous problems with the hydraulic motor. This is unacceptable ..... Attachment to MWI in Email from Jim St. Germain, USACE CO of TFG, June 25, 2006. Jim St Germain, TFG pump team leader, communicated this to the entire team, upper command of TFG, New Orleans District (NOD) Operation Division, the CO, and field personnel at the gated closure structures. The urgency of the matter is reflected in the language of the SF-30: Proceed immediately with making these changes. The DoDIG Report further misrepresents the USACE Mississippi Valley Division (MVD) Independent Team Report (ITR) findings on this issue, and uses this misrepresentation to buttress their position when it in fact rebuts DoDIG's position: The flooded suction intakes have only been accomplished on the new additional contracted 6 pumps, the original contracted 34 pumps have not been revised to add the flooded suction intake as was agreed upon to be revised in June *2006*. MWI has only provided a vacuum type check valve for priming the suction to the Denison Hydraulic Pumps. This is only a facade in addressing the real issue and requires the operation of vacuum equipment to prime the hydraulic pumps. If the vacuum is not drawn properly, then the pumps will aerate and create irreversible damage to the components of the pumps. The bilateral contract modification to change the intakes to a flooded suction at no cost to the Government has been in place since 12 July *2006* and has not been accomplished as of this date on any of the original 34 pumps. USACE MVN Outfall Canal Pumps Independent Team Report, Released May 24, 2007.	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ALLEGATION #1 (ACCORDING THE DODIG REPORT):
FLAWED DESIGN ALLOWED AIR TO ENTER INTO DENISON HYDRAULIC PUMPS ON THE HPUS CAUSING DAMAGE AND SUBSEQUENT FAILURE OF THE PUMPS.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	The DoDIG report implies that "operator error" was responsible for the mammoth hydraulic pump failures. **The fact is, all the known failed hydraulic pump components were the result of operation during the time when the pumping equipment manufacturer was in sole possession of the equipment.** If the pump *manufacturer* cannot operate the pumping equipment without causing massive and catastrophic failures of the hydraulic pump components, then it is not reasonable to expect the *user* to do a better job. This, in and of itself, defines a design flaw. The design flaw in question required an analysis of the hydraulic system at issue, a synthesis, or selection of components to shape a system that meets the original contract requirements, a subsequent appraisal of the modified system performance; and feedback to analyze the synthesis of information obtained in the system evaluation - all in order to mitigate effects of the identified design flaw. The contract modification that the DoDIG Report cites as a reasonable approach to resolving air entrainment was not implemented by the TFG pump team until a year after it was ordered, and only then when Brigadier General Crear of Mississippi Valley Division (MVN) was informed by the ITR team that not performing the retrofit actions called for in this modification posed a substantial danger to public safety. The concealment of the design flaw in the hydraulic pumping equipment by the TFG pump team-without measures taken to mitigate its effect on the intended operation of the hydraulic pumping system at all these outfall enclosure structures – endangered and continues to endanger *(see* Response - Allegation No.5) the lives of the citizens of New Orleans and impairs the government's ability to hold MWI responsible for the manufacture of defective hydraulic pumping equipment. No documentation available to me as an engineer and contract administration specialist supports the conclusions of the DoDIG Report. Nor does publicly-available evidence. Nor does evidence cited by DoDIG investigators. In fact, the available documentation points the opposite way.	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ***ALLEGATION #2*** **(ACCORDING THE DODIG REPORT):** *THE COMPLAINTANT 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 COMPLAINTANT 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.*

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
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 complaintant. 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 complaintant 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...	<u>**Response: Design - Allegation No.2**</u> To address specifics in the DoDIG Report: Contrary to what the DoDIG Report implies, none of the failures have ever been proven to be pressure-related. Questions have been raised about the ability of the hydraulic system components to safely operate at 3200 psi because the hydraulic components appear to be on the edge of design - however, there has never been any formal finding proffered that I'm aware of that these failures they cite are due to operating pressures of 3200 psi and above. The myriad failures that I witnessed were found, and documented, to be caused in large part by air entrainment, excessive heat caused by internal components self-destructing, foreign matter (metal shavings) running through the pressure plates of the Rineer motor, and internal seals rupturing on the Rineer motor(s) for unknown reasons (excessive pressure being one of the two theories presented). In addition, I have never stated there has been any failure of hydraulic pipe. To be clear, I simply stated that the engineering calculations proved the pipe to be undersized and not meeting industry standards for Schedule 80 hydraulic pipe operating at 3200 psi, and that this posed an unreasonable risk of failure (not that failure had occurred). The DoDIG investigation appears to be confused - it was the cams I discovered and later reported (during the initial tear-down of 4 hydraulic pumps at the Denison Reps factory in June 2006) that were rated at only 3000 psi. However, this fact does not mean the cams would fail if operated - that would be an unfounded finding. The mere fact the cams were only rated to 3000 psi meant the life expectancy would be less than the manufacturer guaranteed if used, for example, at 3200+ psi. It is even documented that I was not concerned about cams rated at 3000 psi inside the hydraulic pumps: One thing that did come up was the *066* cam appears to be built to sustain a maximum 3000 psi operating pressure, not the over	For the most part, Allegation #2 is true except that the vast majority of the failures were caused by poor engineering design, poor selection of subsystems for a fully integrated hydraulic system, and a failure to recognize problems associated with engineering scaling factors that did not allow MWI to easily move from making smaller hydraulic pumping systems to the required 60 inch hydraulic pumping systems for New Orleans. Additional comments about individual parts of the MWI hydraulic systems are provided throughout this report and are not repeated here for brevity. If the hydraulic oil was not sometimes contaminated with particles, air, and/or water during the testing, and if the hydraulic oil was not overheated by the HPU system during operation, the seals on the various hydraulic components and hoses might have adequately contained the full system pressure. However, overheating different components and subsystems at different times during the testing in the hydraulic system did cause the hoses to melt, the seals to fail in the Denison hydraulic pump, the seals to fail in the Rainier a joint motor, and possibly allow for inadvertent oil leaks into the waterways around New Orleans. It is not acceptable to conclude that the hydraulic system design deficiencies were adequately mitigated, when most of the testing and most of the operational tests were performed that less than maximum operating speeds, less than maximum operating pressures, and less than full stress testing of the system. It is not reasonable to try to blame failures on one isolated subsystem or another when the success or failure of the entire system is a function of the successful integration of all the components

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR **ALLEGATION #2** **(ACCORDING THE DODIG REPORT):**
THE COMPLAINTANT 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 COMPLAINTANT 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.*

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
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 ~ 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.	3100-3200 psi *it* has been seeing - however, operating them at 3100-3200 psi would not cause the damage we were looking at, this issue speaks to the longevity of the pumps... Email from Maria Garzino to the head of the TFG pump team, Mr. Jim St. Germain, June 2, 2006, The DoDIG Report also incorrectly identifies the failure issues the pumping equipment experienced. The most important and serious failure modes are not even mentioned - as if they never existed: air entrainment causing the Denison hydraulic pumps to "suck" air and destroy themselves; Rineer motor failure(s) due to metal pieces coming off the self-destructing hydraulic pumps and running through the motor; and internal seals rupturing on the Rineer motor(s) (for still unknown reasons). The massive number of known failures due to these omitted failures has been overlooked. These failure issues have been extensively documented - *see* my MFR dated May 3, 2006, my original Declaration, and my follow on Affidavit. The DoDIG Report then discusses a failure issue that is not only incorrect, but also raises serious questions about the DoDIG's comprehension. The hydraulic oil high pressure lines that were observed failing were on the drive unit (a DU or HPU [Hydraulic Power Unit]), and the hydraulic high pressure line they are talking about that was "fixed" is the hydraulic line on the pump assembly (a PA or WP [Water Pump]). As should be quickly understood from this description, fixing the hydraulic line on the pump assemblies has nothing to do with the observed hydraulic high pressure line failures on the DU's. The DoDIG Report is also inaccurate when restating and relying on earlier misrepresentations that all the Denison pumps were thoroughly inspected at the sites (the three outfall closure structures) for defective parts in order to uncover and replace *undersized cams.* This is a false and misleading statement. All the Denison pumps were thoroughly inspected in the field to uncover and replace *failed or failing port plates and cams,* which were not suitable for, and not capable of, continued operation. In doing so I	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR **ALLEGATION #2** **(ACCORDING THE DODIG REPORT):**

THE COMPLAINTANT 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 COMPLAINTANT 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.*

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	discovered over 40% of the pumping equipment installed and in the field required immediate replacement of hydraulic pump components. Their failed or failing state was due to a design flaw - a design flaw that was extensively documented, as discussed above. Again, the undersized cams mentioned by the DoDIG report posed nothing more serious than a *longevity* issue, not an *operability* issue. (*See* the above discussion and referenced documentation.) Moreover, USACE and MWI have never believed that the cams for the hydraulic pumps were incorrectly installed or had manufacturing defects, and there is no proof of this. All efforts and documentation support the conclusion that a hydraulic system design flaw caused the massive Denison hydraulic pump failures. Finally, as I will discuss later in this document, the "acceptance testing" performed was not, as DoDIG portrayed, a remedy towards assuring that the pumps will work as intended. In fact, this "acceptance testing" could not have occurred as portrayed at all. *See* Response - Allegation No.5. No documentation available to me as an engineer and contract administration specialist supports the conclusions of the DoDIG Report. Nor does publicly-available evidence. Nor does evidence cited by DoDIG investigators. In fact, the available documentation points the opposite way.	

*Comparison of DoDIG Report No. D-2008-TD-005 with Complaintant Responses for **Allegation #3*** (According the DoDIG Report):
Factory testing for the hydraulic pump, and water pump was incomplete and defective equipment was shipped to the sites.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
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 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 a 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 complaintants' 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	<u>**Response: Testing - Allegation No.3**</u> <u>To address specifics in the DoDIG Report:</u> The "consultant" referred to was Mr. Dennis Strecker-not a Corps of Engineers employee but a contractor for the Corps. Mr. Strecker was acting with implied authority and was responsible for an unauthorized commitment when he instructed MWI that the Corps would relax and delete the aforementioned testing. This relaxation and elimination of testing requirements was not initiated by MWI. In addition to my own extensive documentation of this, the MVN ITR also discusses Mr. Strecker's inappropriate and apparently illegal actions: More than one revision to the testing procedures occurred and changes were made by implied authority by email and verbal communications from both Corps and <u>non Corps of Engineers employees</u> without any Contracting Officer authorities. USACE MVN Outfall Canal Pumps Independent Team Report, Released May 24, 2007. Mr. Strecker's submitted trip report dated April 24, 2006 (Attachment No.9 of the ITR), also documents that he, not MWI, initiated the relaxation and deletion of the subject factory testing: I recommended dropping the pump performance tests and adding an endurance test. Mr. Strecker instructed MWI to offer this as their own proposal and that the Corps would agree to implement it as stated above (this was witnessed not only by myself, but also by the USACE field engineer in charge of all quality assurance (QA) personnel for the USACE Jacksonville District (JAX). The CO was not apprised of this change during or after its ordered implementation; rather, it became known to her only when I inquired about it some weeks later (*see* my Original Declaration and Affidavit). Once again, this fact was witnessed not only by myself, but also by the USACE field engineer in charge of all QA personnel for JAX. The reasons for the relaxation and deletion of the abovementioned testing was not because it was an insightful and appropriate engineering decision, as I have discussed extensively in documentation already on file. **In fact, this bargain is the leading factor in defective hydraulic**	APARIQ believes this allegation valid. The December 2006 "Data Report on Factory Tests of Discharge and Total Dynamic Head of MWI Pumps Used on New Orleans Outfall Canals" (from Dr. Stephen T. Maynord) were not conducted in accordance with Hydraulic Institute Standards (HIS). For further discussion of this allegation, please see Section 3.2.1 on page 57.

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ***ALLEGATION #3*** **(ACCORDING THE DODIG REPORT):**
FACTORY TESTING FOR THE HYDRAULIC PUMP, AND WATER PUMP WAS INCOMPLETE AND DEFECTIVE EQUIPMENT WAS SHIPPED TO THE SITES.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
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.	**pumping equipment being delivered to New Orleans.** *See* previous discussions and reference all cited documents. The following- pictures of failed and failing hydraulic pumping equipment components are the direct result of the relaxation and elimination of certain factory testing requirements, which resulted in defective hydraulic pumping equipment being delivered to New Orleans. Contrary to what Colonel Bedey has stated, there was absolutely no plan to "fix the machinery while it was in place." *(See* previously cited documents). *(See actual pictures showing "Failed port plates due to design flaw (as found in the field – New Orleans, LA):" and "Failed/Failing severely worn cams (unsuitable for further service) due to design flaw (as found in the field – New Orleans, LA):* The DoDIG Report acknowledges that there were "numerous problems" with the DUs during the factory testing. It fails to mention, however, that there were also **numerous problems** with the pump assemblies (PAs) during the factory testing. Of the original 34 PAs, only 8 were performance tested (actually pumped water): one of those was for minutes at best, and another at 1/3 operating speeds and pressures. Of these 8 PAs actually "performance tested," 4 PA Rineer motors experienced **catastrophic failure** (requiring complete replacement of the motor). In addition, there were 7 related Denison hydraulic pump failures, 2 related Gear Oil Circulation Motor (GOCM) failures, 3 related Hydraulic oil high pressure line failures, 1 related PA experiencing a loud abnormal noise, 1 related PA experiencing abnormal violent vibrations, 1 related PA experiencing violent surging hydraulic lines, and 1 PA experiencing overheating of the hydraulic oil. Finally, to clarify, of the original 34 total PAs, **24** were not "performance tested"-nearly three times the 9 cited in the DoDIG Report. These facts are extensively and painstakingly documented in my previously-cited submissions (MFR of May 3, 2006, original Declaration, original Affidavit, MFR "Factory Testing Requirements and Field Testing Requirements of the Pumping Equipment for Contract No. W912P8-06-C0089, etc.)	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ***ALLEGATION #3*** **(ACCORDING THE DODIG REPORT):** *FACTORY TESTING FOR THE HYDRAULIC PUMP, AND WATER PUMP WAS INCOMPLETE AND DEFECTIVE EQUIPMENT WAS SHIPPED TO THE SITES.*

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	The discussion in the DoDIG Report related to MWI's quality control (QC) and their documentation of it makes inaccurate, misleading and often false statements. **The facts are that MWI's QC forms were filed with false representations and** assertions. I reviewed and extensively documented the specifics for the TF, as evidenced by a contemporaneous email I sent the pump team: After initial review of MWI's , submitted QC data for Drive Units *8840* thru *8849* I find they are generally incomplete and do not address the numerous testing and component failures these Drive Units have experienced during their lifetime in the assembly thru testing process. As I discussed with MWI on numerous occasions, the most basic requirement that each Drive Unit and Pump Assembly have documented the various component failures and actions taken to remedy same appears to not have been followed by them. . . In addition, review of the QC data submitted by MWI for Drive Units *8850* thru 8873 reveal the same *level* of incompleteness. Email from Maria Garzino to TFG pump team, June 4, 2006. It goes on to outline specifically the failure issues and problems that were omitted in MWI's submitted QC Reports. The DoDIG Report further contends that the modification to change factory testing requirements was accomplished as specified. This is an inaccurate statement as evidenced by my previously-cited submitted submissions and also by the ITR. The ITR states clearly that the factory testing was not performed in accordance with the contract requirements: Modification P00004 revised the static test procedures by clarifying the actual steps to follow but nowhere did it delete the requirements of the full size water testing for each pump. This testing was not performed in accordance with the contract requirements and a **significant credit** is due to the Government for the nonperformance of it. *Id.* (emphasis added). For the record, 3 PAs (PA #4580, PA #4596, and PA #4582) were shown not to have even undergone the "testing" mentioned-referencing for a "static" test-as all performance testing was abolished by that time. The DoDIG Report only cites one DU - #8852 was the DU in question that there is no	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR **ALLEGATION #3** (ACCORDING THE DODIG REPORT): *FACTORY TESTING FOR THE HYDRAULIC PUMP, AND WATER PUMP WAS INCOMPLETE AND DEFECTIVE EQUIPMENT WAS SHIPPED TO THE SITES.*		
According to the DoDIG Report No. D-2008-TD-005	**Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position**	**APARIQ Related Comments**
	record of testing. No documentation available to me as an engineer and contract administration specialist supports the conclusions of the DoDIG report. Nor does publicly-available information. Nor does evidence cited by DoDIG investigators. In fact, all available documentation points in the other direction.	

Comparison of DoDIG Report No. D-2008-TD-005 with Complainant Responses for **Allegation #4** **(According the DoDIG Report):** *The complaintant 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.*

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<tr><th>According to the DoDIG Report No. D-2008-TD-005</th><th>Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position</th><th>APARIQ Related Comments</th></tr>
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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 onsite 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 from7 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 ACE 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.

(Charts are shown in original document)

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.

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<u>Response: Testing - Allegation No.4</u>

<u>To address specifics in the DoDIG Report:</u>

As already discussed above, and in my previously-cited documents, **the factory testing did not instill confidence in the reliability of the hydraulic pumping equipment, but rather just resulted in defective pumping equipment being delivered to New Orleans.** In addition, the DoDIG portrayed 2 hour "acceptance tests" as a remedy towards assuring that the pumps would work as intended. The fact of the matter, however, is that this **"acceptance testing" could not have occurred as the DoDIG Report portrays *(see* Response - Allegation No.5).** None of the cited testing has been done in a manner that can check the mechanical integrity of the pumping equipment (run at continuous full speeds and operating pressures for a substantive amount of time approximating real-life hurricane conditions).

None of the massive testing trumpeted in the DoDIG Report was for testing the hydraulic pumping equipment at continuous full operating speeds and pressures for substantive amounts of time. There was a single 36-hour run mentioned, but of important note, this mentioned test is misleading and falsely represents that one of "our" hydraulic pump assemblies was utilized. It was not. **The pump assembly used in this 36 hour test run was a "MWI Rental Unit," not one of "our" hydraulic PAs.** This 36 hour run was to "test" the Denison hydraulic pumps on a DU only, nothing else. I was present for this "test" and witnessed over 16 hours of it (including logging data for it personally). I also documented the fact that this was an MWI rental PA that was used:

> Our '36 hour endurance test' is done - and no, we did not start yesterday - we got about 4.5 hours into it and we are down for the count as there is something very wrong with the water pump (the MWI renta1 60"er) - it has lost a lot of oil . . .

<u>Email from Maria Garzino to TFG Pump Team, July 5, 2006. The</u>

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APARIQ believes this allegation valid.

<u>The Combination of the Durst Hydraulic Pump Drive Selected, the GOCM Selected, the Chosen GOCM Operating Set-points, the GOCM Selected Sensor Points, and Gear Oil/Durst Hydraulic Pump Drive Integrated Sub-System Design was NOT Reliable and may STILL NOT be Reliable.</u> If the proper subsystem components had been selected, the hydraulic pump drive should not have operated at elevated temperatures periodically exceeding 200° F, the gear oil circulation motors should not have drawn more than five (5) times the rated current for the motor, some of gear oil circulation motors should not have overheated and failed, and the operation of the hydraulic pump drives should not have potentially contributed to the overheating of the hydraulic oil[50] and the subsequent melting of the hydraulic hose.

For further discussion of this allegation please see Section 3.2.2 on page 68.

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[50] Overheating of the Durst hydraulic pump drive gears can easily conduct <u>thermally</u> through the drive shaft to hydraulic oil pump and heat the hydraulic oil.

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ALLEGATION #4 (ACCORDING THE DODIG REPORT): THE COMPLAINTANT 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.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	subject 36 hour test was "successfully" completed on the morning of July 7, 2006, and an inspection of the Denison hydraulic pumps that ran for 36 hours ensued - this was also documented in an email from my USACE engineering intern to... me The 36 hour duration test at Leon C Simon is complete. I put the data logs on your chair..... I met with Daren and crew (including Hydradine Rep) this morning, and they are going to begin their initial inspections of the Denison Pumps today ... Also, they are going to inspect the Denison's on the drive unit we just ran for 36 hrs. Email from USACE intern to Maria Garzino, July 7, 2006. As discussed elaborately in all my previously-cited documents, when run at continuous full operating speeds and pressures the drive units (HPU's) and pump assemblies (Water Pumps) have experienced severe and catastrophic failures of their hydraulic system. Only when run at reduced operating speeds and pressures, for more substantive amounts of time, do the PAs and drive units experience significantly fewer failures and failure rates. This has been documented by me - it is imperative the reader reviews my Supplemental Affidavit, dated May 15, 2008. In my Supplemental Affidavit, I reiterate how MWI and TFG learned in April 2006 that running hydraulic pumping equipment at less than continuous full operational speeds/pressures allowed the equipment to experience a much slower failure rate. I proved and documented this when witnessing the Vero Beach 24-hour test run on April 21-22, 2006, and subsequent field test runs for the same hydraulic pumping equipment when it was shipped to New Orleans and installed at the Orleans Avenue Closure Structure. For the 24-hour Vero Beach run, PA #4588 and DU #8842 were run at 1000 psi (1/3 of full operating pressure) for 24 hours, during which I identified one of the Denison hydraulic pumps on the DU as a strong candidate for failure, with fluctuating high temperatures ranging from 1850 - 2100 F. As already discussed in my original Declaration, both MWI and TFG refused to investigate and examine the issue and instead deemed the equipment, including DU #8842, as "passed" and shipped and installed it at the Orleans Avenue Closure Structure. A month later (5/24/06), at the Orleans Avenue Closure	

Comparison of DoDIG Report No. D-2008-TD-005 with Complaintant Responses for ***Allegation #4*** **(According the DoDIG Report):** *The complaintant 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.*		
According to the DoDIG Report No. D-2008-TD-005	**Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position**	**APARIQ Related Comments**
	Structure, when turning on this same pumping equipment (DU #8842) to perform field testing at continuous full operating speeds and pressures, the pumping equipment experienced catastrophic failure. The previously suspect Denison hydraulic pump on DU #8842 failed completely. Later, on 6/01/06, the same DU was again field tested at continuous full operating speeds and pressures, and within a short period of time experienced a loud vibration from the other Denison pump, which was later determined to require replacement. As will be discussed in the next Response to Allegation No.5, there has not been a storm event that was utilized by the NOD to test all the hydraulic pumps at continuous full operating speeds and pressures for any substantive period of time. (Also evidenced by rainfall runoff records from NOAA). None of the hydraulic pumps have been tested to ensure mechanical integrity-including the cited onsite operational tests and maintenance runs. "Exercise" runs and "demonstration" runs (not running hydraulic pumps, but running direct drives only); running hydraulic pumps at lesser speeds/pressures; and running hydraulic pumps for very short periods of time at these lesser speeds/pressures-do not substitute for adequate mechanical integrity testing, nor determine if the pumping equipment's hydraulic system is functioning properly. For an analogy, it is like turning an Indy 500 car on in the pits and either staying there the entire race idling away, or intermittently taking caution laps before reentering the pits again to continue idling-nothing is proven as to the car's actual ability to survive racing the 500 mile distance around the track at full speed. Documenting some information, such as the required number of gas fill-ups lends the same value - none. No documentation available to me as an engineer and contract administration specialist supports the conclusions of the DoDIG Report. Nor does any publicly-available information. Nor does evidence cited by DoDIG investigators. In fact, the available documentation shows otherwise.	

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR **ALLEGATION #5** (ACCORDING THE DODIG REPORT): THE COMPLAINTANT 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, 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 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.		
According to the DoDIG Report No. D-2008-TD-005	**Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position**	**APARIQ Related Comments**
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 rpm instead of the required 1800. The reduced runtimes 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 **Analysis:** The allegation was partially substantiated, in that test runs were shorter than the 12 to 24 hours recommended by the complaintant. However, the USACE did develop a test plan and	<u>**To address specifics in the DoDIG Report:**</u> It is imperative to review my Supplemental Affidavit, dated May 15, 2008, and all previous discussions and cited documents. The subject acceptance testing cited by the DoDIG could not physically have taken place. A detailed discussion to provide clarification follows: **• Rebuttal to statement: acceptance testing of all 40 hydraulic pumps, "run for a minimum of 2 hours continuously with engine speeds of 1800 rpm and hydraulic pressure of 3,200 psi"** The subject acceptance testing is memorialized in the internal USACE Newsletter of May 31,2007 entitled *TASK FORCE HOPE STATUS REPORT:* *As Promised:* Corps Delivers All 40 Temporary pumps New Pumps At Three Outfall Canals Are Tested, Installed And Ready . The Corps of Engineers set a self-imposed deadline of June1 - the start of hurricane season - to have all 40 of its temporary hydraulic pumps in place at the three outfall canals. That mission has been accomplished. *Id.* Citing further from the internal USACE Newsletter: A problem occurred last week with one pump motor during an Orleans Avenue test; that motor was replaced and the new one is	APARIQ believes this allegation valid and underlying issues are more significant than stated by the Complaintant. After carefully reviewing numerous documents, reading through the rebuttals from the Compliantant about the comments made in the two DOD IG reports, and talking with the Complaintant, APARIQ believes that there were significant deficiencies that can be summarized as follows: • The testing requirements and reporting requirements in the solicitation and the awarded contract were deficient; • Formal testing procedures in the factory and in the field should have been written and reviewed before any testing was performed and complete data recording sheets should have been reviewed and approved before the testing was performed; • All deficiencies should have been fully documented with corrective course of actions fully documented and formal retest procedures written with full data sheets; • All deficiencies should have been categorized to ensure that any testing deficiency was not a symptom of a much larger problem instead of a simple one time material failure that could be either corrected and overlooked; and • It appeared that there was no formal review and follow-up process either at MWI or within US ACE that had any contractual enforcement or financial repercussions for the contractor. Because all of the testing described in this allegation could significantly affect the loss of lives in New Orleans if a 100 year hurricane hits New Orleans, then urgency needed to be balanced by completeness to ensure

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR ***ALLEGATION #5*** **(ACCORDING THE DODIG REPORT):**

THE COMPLAINTANT 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, 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 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.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
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.	working well. Now all 40 of the pumps are installed, they've been successfully tested, and all are ready for service this hurricane season if needed. *Id.* (emphasis added). Also depicted boldly in the middle of the page is a trophy photo of Col. Bedey with the following quotation and caption: "We said we'd be there on 1 June. We're there." *Col. Jeffrey Bedey, Commander, Hurricane Protection Office,* on *having all* 40 *temporary pumps operational by the* start of *hurricane* season. *Id.* Below that is a picture of the 17th Street Canal with the following celebratory caption: *(Picture of "On March 31, the Corps successfully demonstrated all 18 new temporary pumps at the 17th Street Outfall Canal")* There are similar pictures and captions for the London Avenue Canal and the Orleans Avenue Canal- both showing the gates closed and testing underway. Specifically, testing was depicted as being accomplished on March 31, 2007 at the London Avenue Canal, and on May 24, 2007 at Orleans Avenue Canal. The internal USACE Newsletter was presented as a demonstration of the extensive "capabilities" of the New Orleans District to overcome adversity - highlighting their "accomplishments".	that MWI contractually delivered what Congress and USACE believed they had procured. For further discussion of this allegation please see Section 3.2.3 on page 74.

COMPARISON OF DODIG REPORT NO. D-2008-TD-005 WITH COMPLAINTANT RESPONSES FOR **ALLEGATION #5** (ACCORDING THE DODIG REPORT):

THE COMPLAINTANT 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, 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 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.

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	Three days after the March 31, 2007 testing at the 17th Street Canal heralded in the internal USACE Newsletter, Col. Jeff Bedey went on public radio and reported on the state of the hydraulic pumps at that location. Here is what he said to the people of New Orleans: Col. Bedey: "I'm really, really happy to report that we have all18 of the pumps reinstalled in at the 17th Street Canal - 16 of which have been fully tested, and in fact this Saturday we had 10 of the pumps operating and it was I would say a thing of beauty. We have multiple pictures of that and videos - very, very pleased with the progress we've made to this point ... for all the listeners, this is a very, very good news story . . . I can tell you we have 18 pumps in at the 17th Street Canal, 16 of them have been tested, the only reason we haven't tested the last two is we don't have enough water in the canal, and stored by the Sewage and Water Board to actually test them - we're moving forward. in my mind this is a good news story, people should be confident in where we are, where we are going ..." Radio Broadcast on "Big 870 WWL 1053," April 3, 2007. What follows is an analysis of the17th Street Canal and the likelihood 10 hydraulic pumps, not the 18 reported in the internal USACE Newsletter, were "fully tested" on March 31, 2007, or any time before May 31, 2007 - fully tested being what the Corps has reported to the DoDIG investigative team as merely a 2-hour acceptance test run, continuously, at full operating speeds and pressures. The following analysis will utilize very conservative assumptions in order to give the benefit of the doubt to the statements made by the	

Comparison of DoDIG Report No. D-2008-TD-005 with Complaintant Responses for ***Allegation #5*** **(According the DoDIG Report):** *The complaintant 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, 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 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.*

According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	DoDIG Report, apparently by Col. Bedey and the TFG pump team. Known: In order to perform acceptance testing on 10 hydraulic pumps at the 17th Street Canal, there had to have been a very large volume of water stored by the Sewage and Water Board. Known: The volume of water the hydraulic pumps would need on their own to pump for two hours at full operating speeds and pressures is simply calculated to be their discharge rate multiplied by the time they ran – 200 cfs (cubic feet per second) times 2 hours - this would be roughly 115 million gallons of water. Known: Next, in order to run the hydraulic pumps at something other than zero elevation, at which they cannot be run, there must be additional water stored to raise the canal level to a sufficient elevation in order to turn the pumps on. Conservatively, assuming that the test is run at high tide, this would bring the water elevation to about a 1-foot elevation. Next, in order to raise the water level an additional foot (for a turn-on elevation of 2 feet) - probably too low to work, but assumed for the sake of argument, there would have to be an additional volume of water conservatively estimated at 28 million gallons. Known: What we know at this point is we need, conservatively, roughly 140 million gallons of water to perform these tests successfully. In reality, this is the amount of water available on March 31, 2007 to run these tests: On 03/01/07 there was 0.12" of rain in and around the affected	

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According to the DoDIG Report No. D-2008-TD-005	Ms. Garzino Rebuttal of DoDIG Report No. D-2008-TD-005 Documented Position	APARIQ Related Comments
	drainage basin. On 03114/07 there was 0.32" of rain in and around the affected drainage basin. On 03/15/07 there was 1.29" of rain in and around the affected drainage basin. On 03/21/07 there was 0.01" of rain in and around the affected drainage basin. On 03/31/07 there was 0.35" of rain in and around the affected drainage basin.	
	Even under the best case scenario, in the month prior to the much-lauded "testing," only 2.09 inches of water fell in and around the affected drainage basin. Assuming for the sake of argument the Sewage and Water Board collected it all - every drop of it that made its way to their basin. Known: Looking at the resultant amount of water actually collected in the collection system, the 2.09 inches of rain equates to less than 0.5 inches of water that is collected in the canals (as taken from a SCS Rainfall- Runoff Solution graph using Soil Type B (moderate infiltration rates) and medium density residential classification - giving a resultant curve number of 75). Known: Calculating the affected drainage basin at the most to be 15 square miles, yields an estimated volume of water collected to be only 17.5 million gallons. In sum, as it has been described to the DoDIG, 140 million gallons of water were needed to perform the acceptance testing successfully	