REDACTED REPORT

DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC

Office Of The General Counsel

December 7, 2011

SAF/GCA
1740 Air Force Pentagon
Washington D.C. 20330-1740

Catherine A. McMullen
Chief, Disclosure Unit
United States Office of Special Counsel
1730 M. Street, N.W., Suite 218
Washington D.C. 20036-1505

Re: Office of Special Counsel File No. DI-11-0487

Dear Ms. McMullen:

On December 7, 2011, the Air Force delivered its Report of Investigation (ROI) for the above-referenced matter to your office. In that letter, the Secretary of the Air Force explained that a redacted version of the ROI was included for purposes of your public disclosure requirements.

The redactions made in this ROI were of the names of witnesses and other individuals specifically identified within the ROI, with the exception of the whistleblower.[1] The redacted names were substituted with duty titles or position titles. The purpose of removing personally identifying information of the individuals/witnesses was to protect them and their families from an unwarranted invasion of personal privacy which could result in harm, embarrassment, inconvenience, or unfairness. The altered language does nothing to change the substance of the ROI. Because the alterations are immaterial to the meaning of the evidence, the law, the analysis and the conclusions, the attached redacted report for public release is substantively identical to the unredacted version.

Our request for these redactions is based on exemptions 6 and 7(C) of the Freedom of Information Act (FOIA). See 5 U.S.C. §552. Both exemptions protect from public release information that would amount to an unwarranted invasion of personal privacy. To determine whether the information falls under either exemption, the agency conducts a balancing test that weighs the interests of the privacy interests of the individual versus the public's interest in the disclosure. If the balancing test favors the public, the information must be released. If it favors the individual, however, the FOIA prohibits the release. The Air Force has conducted this balancing test with respect to the names of witnesses and other individuals named in the ROI. The witnesses and certain other named individuals have a reasonable expectation of privacy in

[1] According to correspondence with your office, the whistleblower consented to the release of his name.

the information presented in the ROI. Further, disclosure of their names or other identifying information would not benefit the general public in that the specific identity of the individuals need not be revealed in order for the reader of the redacted report to understand the relevant facts. That is, the redacted information does not in and of itself reveal anything regarding the operations or activities of the Air Force, or the performance of its statutory duties. In our view, the individuals' probable loss of privacy outweighs the public interest in knowing the names of the individuals or other personally identifiable information. Therefore, the names redacted are done so because the FOIA, and by implication 10 U.S.C. § 1219(b), requires it.

Our request for these redactions is also based upon the Privacy Act which prohibits disclosing personal information to anyone other than the subject of the record without his or her written consent (unless such disclosure falls within one of the Privacy Act exceptions not applicable herein). *See* 5 U.S.C. §552a.

With regard to the copy of the ROI sent to the whistleblower, we understand that under OSC policy, the whistleblower received an unredacted version of the ROI and we express no objection.

For your convenience, the Air Force attached a witness/name legend to the redacted version. Thank you for your consideration of this request. If you have any questions regarding this request, please contact Deborah Gunn at 703-695-4435 or by email at deborah.gunn@pentagon.af.mil or you may contact Major Garrett Condon at 703-695-6552 or by email at garrett.condon@pentagon.af.mil.

Sincerely,

Cheri L. Cannon

CHERI CANNON
Deputy General Counsel
(Fiscal, Ethics and Administrative Law)

REPORT OF INVESTIGATION

OSC File No. DI-11-0487

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INFORMATION INITIATING THE INVESTIGATION

By letter dated July 1, 2011 and signed by the Special Counsel, the Office of Special Counsel (OSC) referred to the Secretary of the Air Force for investigation a whistleblower disclosure case (OSC File No. DI-11-0487), alleging that employees at the Department of the Air Force, 50th Civil Engineering Squadron (50 CES), Schriever Air Force Base (AFB), Colorado, engaged in conduct that may pose a substantial and specific danger to public safety. Specifically, according to OSC, the whistleblower, Keith D. Anderson,[1] a Utility Systems Operator in the 50 CES, disclosed that cooling towers at Schriever AFB do not have operational vibration and oil level switches, which could cause serious damage in the event of a failure in the cooling system. After review and based on the information disclosed by Mr. Anderson, OSC "concluded that there is a substantial likelihood that the information that Mr. Anderson provided discloses a substantial and specific danger to public safety" and referred the allegations to the Air Force for investigation.

OSC SUMMARY OF DISCLOSURE INFORMATION

According to the OSC Referral Letter, Mr. Anderson provided the following information to OSC:

(1) Mr. Anderson disclosed that seven cooling towers, located in the Central Utility Plant at Schriever AFB, do not have operational vibration and oil level switches. According to Mr. Anderson, the cooling towers are components of an air conditioning system used to control air temperature in rooms containing critical electronic equipment. The purpose of the vibration switches is to interrupt power to the cooling tower gear drives should vibration in the drives exceed acceptable levels. They also indicate the onset of a malfunction in the rotating equipment components.

(2) The purpose of the oil level switches is to interrupt power to the cooling tower gear drives should the oil level within the gear drive decrease to a dangerous level, thus mitigating damage to the gear drive. The vibration and oil level switches signal the cooling tower operator through system shutdown that a potential damaging condition is present in the fan drive system, thereby preventing damage to the fan drive equipment and the surrounding cooling tower structure. According to Mr. Anderson, five of the seven cooling towers currently have vibration and oil level switches physically attached to the towers but not connected to the tower circuitry. In the remaining two, either the vibration switch or the oil level switch is not present.

(3) Mr. Anderson further disclosed that excessive vibration can severely damage the gear drive and cause fan blades attached to the drive to shear off, potentially injuring anyone in the vicinity of the cooling tower. He also

[1] Mr. Anderson, according to the OSC Referral Letter, has consented to the release of his name in conjunction with this Report of Investigation.

asserted that the cooling tower gear drives have suffered severe internal damage because of the lack of functional oil level switches. According to OSC, Mr. Anderson reported this matter to management officials repeatedly between 2004 and 2008 and provided supporting documentation of his reports.

(4) On October 25, 2004, November 5, 2004, January 16, 2005, February 27, 2005 and May 5, 2005, Mr. Anderson notified [Master Sergeant 1], 50th Space Wing Ground Safety Manager, that the vibration and oil level switches were not properly installed on the cooling tower gear drives. He also notified [Major 1], Operations Flight Chief, on December 17, 2008 and [Staff Sergeant 1], 50th Space Wing Ground, on October 23, 2004 and November 9, 2004. Further, according to OSC, Mr. Anderson informed management official [Safety Official] of this matter on September 19, 2006. He also notified [Major 2], then Operations Flight Chief, of these same problems on October 5, 2004 and October 28, 2004.

(5) In addition, Mr. Anderson provided emails from both [Major 2] and [Master Sergeant 1], dated October 28, 2004 and May 6, 2005, respectively, signifying their agreement that the switches should be connected. Mr. Anderson further provided a notice dated June 9, 1989, submitted to the Air Force by the Ceramic Cooling Tower Company, the installer of the cooling towers. According to OSC, this notice states that the failure to install safety switches "may result in serious damage to the cooling tower and/or personnel" and will void any warranties issued by the company. According to OSC, despite these warnings, Mr. Anderson reported that as of June 26, 2011, vibration and oil level switches had not been properly installed on the cooling towers.

CONDUCT OF THE INVESTIGATION

The OSC Referral Letter was forwarded for investigation, through the Air Force Inspector General (SAF/IG), to the Inspector General of Headquarters Air Force Space Command (AFSPC/IG). On August 8, 2011, AFSPC/IG appointed an investigating officer (IO) to conduct an investigation into the whistleblower allegations contained in the OSC Referral Letter. A subject matter expert (referred to hereinafter as IO2)[2] was assigned to the investigation to work with the IO. In the course of the OSC investigation, the IO conducted an initial complaint analysis interview with Mr. Anderson and thereafter interviewed 13 witnesses[3]

[2]The subject matter expert currently serves as the Headquarters AFSPC "Command Mechanical Engineer." His engineering experience spans 37 years; 11 years as a Mechanical Contractor, 13 years as a Consulting Engineer, 6 years as the Engineering Facility Manager at the Rocky Mountain Arsenal and 7 years with Air Force Space Command.

[3] The allegations set forth in the OSC Referral letter referenced a number of former employees of the Plant. These former employees were not interviewed during the course of the investigation. Due to moves related to military duty, deployments, retirements and other witness testimony obtained, the IO believed that the current plant employees had sufficient information with which to conduct the investigation. A majority of the employees

including Mr. Anderson.[4] The IO conducted the initial interview with Mr. Anderson on August 17, 2011. The additional interviews were conducted between August 17 and August 29, 2011. The IO also collected and examined relevant documentation regarding the original installation of the cooling towers and associated equipment, maintenance work done, safety and maintenance procedures and checklists from the Central Utility Plant, incident reports, and applicable Air Force Space Command reporting requirements regarding utility systems. The IO also reviewed the ample documentation provided by the complainant, including his previous communications regarding the issue.

The standard of proof used in determining the finding for each allegation was the preponderance of the evidence, *i.e.* was it more likely than not that the alleged violation occurred.

Pursuant to 5 U.S.C. § 1213(c), an agency is afforded 60 days to complete the required report of investigation. The Air Force has been granted two extensions for its response to the OSC Referral Letter, which is due on December 7, 2011.

SUMMARY OF EVIDENCE

Background

The Central Utilities Plant (also referred to as Utilities Plant or Plant), where Mr. Anderson works, provides emergency power to Schriever AFB in case there is a loss of commercial power. The Plant falls under the 50th Civil Engineering Squadron (50 CES)[5] located on Schriever AFB, Colorado and is a unit within the Operations Flight.[6] The Commander of the 50 CES is [Lieutenant Colonel (Lt Col) 1], who took command on July 30, 2010.[7] [Deputy Base Civil Engineer][8] is the Deputy Base Civil Engineer for the 50 CES. [Deputy Chief of Operations][9] serves as the Deputy Chief of the Operations Flight.

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interviewed had continuous employment that included the time span of 2004 to 2011. Some civilian employees interviewed were prior military and had extensive employment in and around the Central Utilities Plant.

[4] A complete list of the witnesses interviewed is set forth in the Appendix of this Report.

[5] According to its mission statement, the 50 CES maintains $447 million in real property, ensuring uninterrupted power in support of the $11-billion Air Force Satellite Control Network. The squadron provides fire and environmental protection; contingency planning and disaster response; and operations, maintenance, housing referral and support services for vital national navigation, weather, communications and surveillance satellite missions assigned to Schriever AFB and 12 worldwide sites.

[6] The mission of the Operations Flight, 50 CES, is to operate, maintain, repair, construct, and demolish real property and real property installed equipment to accomplish the wing's mission in the most timely and economical manner. It is composed of the following units: Facility Maintenance Element, Maintenance Engineering Element, Infrastructure Support Element, Operations and Maintenance Contract Element, Material Acquisition Element, and the Central Utilities Plant.

[7] [Lt Col 1] indicated that as Commander of the 50 CES, "ultimately I'm responsible for providing a certain level of utility reliability to the restricted area and the mission-critical operations that go on here in the restricted area. We have a requirement to maintain a five-nine [99.999%] reliability in terms of utilities and so I ensure that that gets done through the utility plant."

[8] [Deputy Base Civil Engineer] (GS-13) has served as the Deputy Base Civil Engineer for the 50 CES for about seven years. He came to Schriever AFB around 2001 as the Chief of Engineering. According to [Deputy Base Civil Engineer], his role is one of general management of personnel and strategic direction of projects. He stated that he

The Plant is manned "24/7" -- every hour of the day and every day of the year. According to Mr. Anderson, "[t]here's two [employees] per shift, one power pro, ... power generator guy who starts and stops generators if we need to, and a heating and air conditioning ventilation refrigeration [guy] like myself." Mr. Anderson stated that there were "four power pro guys," four "A-track" (HVAC) guys and a "WS-9 supervisor." Mr. Anderson testified that the employees work a twelve hour shift "four [days] on, four off, three [days] on, three off." In addition to Mr. Anderson, [Power Plant Operator 1],[10] [Power Plant Operator 2][11] and [Power Plant Operator 3][12] work at the Utilities Plant. With regard to supervision, there is traditionally a plant supervisor, an HVAC supervisor, a power supervisor and an active duty enlisted plant superintendent at the Plant. [Plant Supervisor 1][13] (the WS-9 supervisor) became the plant supervisor in 2005. However, due to vacancies, he currently covers the duties of all three supervisors. The Plant Superintendant, [Master Sergeant (MSgt) 2], is deployed to Afghanistan and expected to return in December 2011. [Technical Sergeant (TSgt) 1][14] currently serves as the Superintendent at the Plant.

Employees from the 50 CES, including Mr. Anderson, continuously monitor and maintain the cooling towers and their components. A Plant Operations Log is used daily by the plant employees. The log documents who worked on the A (day) and B (night) shifts as well as the condition of the cooling towers. The seven towers are marked with either an "S/B" for standby or "O/L" for online. The cooling tower sequence is also marked, indicating the order in which the towers should be brought online. [Plant Supervisor 1] as the plant supervisor posts notes in the "Notes to Power and HVAC Operator" section. For the last three years, the logs have directed the employees to manually run the pump and fan rather than operate in automatic mode. During their shifts, employees make entries, such as "performed clean-up around cooling towers on roof-CR/TD," or "changed gear oil on tower #1 fan gear drive-CR," indicating tasks

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is more involved in overall strategic management and does not "have day-to-day management or insight in to ... the operation" of the Utilities Plant.

[9] [Deputy Chief of Operations] (GS-14) has held his current position as Deputy Chief of Operations for 10 years. He retired from the Air Force as a chief master sergeant with 29 ½ years. He "came up in the HVAC [heating, ventilation and air conditioning] career field with assignments all over the world."

[10] [Power Plant Operator 1] (WG-11) works as a power plant operator as a civilian and has done so since October 7, 2002. In the Plant, he "run[s] the generators, the generator side of the house and closes the electrical breakers to restore power to the base after an outage." He also worked at the Plant from 1994 through 2000 as the last Non-Commissioned Officer in Charge (NCOIC) at the power plant. He worked both on the electrical side and in maintenance engineering. [Power Plant Operator 1] stated that, "[b]ecause we are so low manned, I assist [the] HVAC side of house with maintenance."

[11] [Power Plant Operator 2] (WG-11) has worked at the Plant as a power plant operator since July 17, 2010. His current role is to maintain chillers and boilers in the Plant.

[12] [Power Plant Operator 3] (WG-11) has worked at Schriever AFB since January 15, 2001. For the first six years or so, he "worked in the EMCS side of the house, energy management control systems, and a position opened up in the maintenance side of the house and it looked a lot better than what I had, so I moved up, and I've been an HVAC mechanic since [June 15, 2006] then."

[13] [Plant Supervisor 1] arrived at the Plant in 2002 as a plant operator. He became the plant supervisor in 2005 and at times covers the duties of all three supervisors due to vacancies. According to [Plant Supervisor 1], "[p]resently, I'm supervising HVAC operations and power productions along with the facility manager for Building 600."

[14] [TSgt 1] used to be the Non-Commissioned Officer in Charge (NCOIC) of the Electric Shop. When [MSgt 2] was deployed in May 2011, he was moved up to the Superintendant position. Recently he received the HVAC slot and now runs three sections.

completed and observations made. The logs are required to be initialed by the operators and submitted to [Plant Supervisor 1] and [TSgt 1] for their review.

The Plant employees' efforts are regularly augmented by inspections and additional maintenance tasks performed by contractor representatives of Trane, Inc.[15] The role of Trane throughout the time period between 2004 and 2011 was to provide service calls (maintenance) for the base chillers, but also provide service for the cooling towers and its associated components. The record reflects that two employees from Trane, [Trane Employee 1][16] and [Trane Employee 2],[17] have been involved with the Utilities Plant at Schriever AFB. [Trane Employee 1] started working with the 50 CES as a Trane service technician in about 1996.[18] [Trane Employee 2] stated that with the cooling towers, "we never did any maintenance ...," only repairs as instructed. According to [Trane Employee 1], "[t]here [have] been a couple of times we've changed out a gear box and ... And we've had some bleed issues and alignment issues, we've done some alignment on them."

The Utilities Plant houses seven cooling towers as part of its backup air conditioning system. Cooling towers are heat exchangers that use water and air to transfer heat from air conditioning systems to the outdoor environment. According to the IO, the Schriever AFB cooling towers are of the forced draft configuration, which use a fan at the air inlet to force air into the tower fill area and out through the discharge opening. The training document on general procedures for cooling towers sets forth the following "principles of operation":

> (A) As the condenser water removes the heat of compression from high pressure, high temperature refrigerant vapor, allowing it to condense and continue the refrigeration cycle, it is pumped into the cooling tower.
> (B) Depending on the type of tower being used, the water is sprayed or falls (cascades) over the tower fill material or distribution desk. The more spread out or smaller the water droplets become, the more surface area is exposed to the tower air flow, thus increasing evaporation efficiency.

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[15] Trane, Inc is a subsidiary of Ingersoll Rand and is the successor company to the American Standard Companies. It is a global provider of HVAC systems and building management systems and controls under the Trane and American brand names. Two employees from Trane were interviewed, [Trane Employee 1] and [Trane Employee 2].

[16] [Trane Employee 1] works for the Trane Company as an area field supervisor in Colorado Springs, Colorado. He has been with Trane for 15 years in the Colorado Springs area and has 25 years total in the business. He was hired on as a service technician and has worked in a field supervisor role for about the last five years. As a field supervisor, he stated, "[p]retty much I'm responsible for making sure that all the service calls – have been dispatched as far as providing assistance to all the service technicians out in the field and just ensuring that the scope of the work and the quality of work is done up to par and the customers are happy."

[17] [Trane Employee 2] is an account manager for Trane in Colorado Springs. "I'm pretty much just a project developer and estimator for Trane on a direct sales side of the business. Over the course of the years, I'm trying to think of what year it was. It's five or six years ago I went from the service management position over to the sales side of the house... Service manager is less hands-on and directs the service technicians and that type of thing. In the position I am now, I move everything through the service manager. I don't have any direct hands-on contact with the jobs."

[18] According to [Trane Employee 2], "typically on these towers, there's one technician that -- that does most of the work because he does all the vibration and alignment, and he's now our field supervisor, but he's -- he's trained in vibration analysis and balancing fans and that type of thing. I don't know of anybody else that's really done work on them other than [Trane Employee 1]."

(C) The main principle of operation of the cooling towers is sensible heat loss due to evaporation as the water falls through the tower; it is slightly cooled by the tower air flow. Most of the cooling effect is caused by the evaporation of some of the water into the air stream taking the heat load out of the water and being discharged.
(D) The remaining water then flows by gravity to the water collecting basin or sump and is ready to be returned to condenser. All heat transferred from the refrigerant vapor to the tower water is in turn transferred to the atmosphere.

In simple terms, the cooling tower operates by in-taking ambient air lower in the tower which is forced up by the movement of the fan through a spray of water. As the air passes through the water, heat is transferred (through evaporation) from the water to the air and the heated air is then expelled into the outside air by the fan through the top of the cooling tower. The cooled water drops into a basin at the bottom of the tower for use in the cooling process.

The cooling towers in use at Schriever AFB were manufactured by the Ceramic Cooling Tower Company and installed in 1982 or 1983 (when Schriever AFB was known as Falcon AFB). [Deputy Base Civil Engineer], the Deputy Base Civil Engineer, indicated that the Central Utilities Plant with the cooling towers was one of the original structures on base. According to the American Society of Heating, Refrigerating and Air-Conditioning Engineers as well as the Chartered Institute of Building Services Engineers, the life expectancy or lifespan of the Ceramic Cooling Towers is around 34 or 35 years – which for these cooling towers ends sometime around 2016 to 2018.

Each cooling tower provides 1,000 tons of water cooling capacity (1,200,000 BTU each), with a sump capacity of 106,000 gallons total. The combined capacity of the proper operation of all seven cooling towers provides redundant cooling function in excess of mission requirements. While the record does not identify or state a minimum amount of cooling function, or the minimum number of cooling towers which must be properly operating to provide that function, the record does indicate that the simultaneous use of all seven cooling towers would be well beyond the cooling needs for the base. The extra cooling towers exist to build redundancy into the cooling system, which allows for a failure of one or more towers without losing the ability to adequately cool the base. While individual towers were sometimes inoperable or operating at less than full capability, the record does not identify any occasion on which the cooling function fell below mission critical levels.

The cooling towers are made of concrete and stand approximately 30 feet high with a diameter of 12 feet. They are located inside the Plant, with the upper portion of the cooling towers extending through the roof of the Plant by about six to eight feet. Each cooling tower has a fan with six blades approximately five to six feet in length. The fan blades are constructed of or contain components of fiberglass. The fan is mounted atop a right angle gear box which is powered by a six foot drive shaft with flexible disc couplings attached to an induction motor.[19] The motor is located outside of the cooling tower and the drive shaft runs horizontally into the tower at a right angle to the gear box. The fan drive system resides near the top of the cooling tower assembly, high above ground level, with the gear box located in the center of the tower.

[19] According to an undated training document on general procedures for the cooling towers, the fan motors for the cooling towers were obtained from Reliance Electric and the fan blades were manufactured by Hudson Products.

The cooling tower has a metal grate covering the opening at the top of the cooling tower, about three to four feet above the fan. The fans operate at only two speeds, high and low. The fan circulates in the tower with about a one-eighth to one-fourth inch clearance from the outside walls at speeds around 800 to 1100 RPMs, when operating at high speed. The cooling tower can be operated automatically or manually by hand.

The gear boxes require a proper level of lubricating oil (the level of which can be visually inspected via a sight glass). The drive shafts and fan blade assemblies must be very carefully balanced within a narrow range of tolerance, because of their high operating speed. Balancing components include various shims, discs, flanges, and couplings. Normal wear and tear of these components appears to require regular inspection and replacement in order to properly maintain and operate the cooling towers.

Vibration Switches and Oil Level Switches

In his interview, Mr. Anderson describes the alleged "problem" as the lack of vibration and oil level switches. According to Mr. Anderson, the oil level switches "protect the cooling tower gear drives and fan motors in case the oil level decreases in the gear drive by leak or by leaking through gaskets or through seals." Mr. Anderson described how the oil level switches monitor the level of oil. He explained that there is a float ("like a toilet bowl float") that is inside the crank case of the gear drive. "Once the oil gets down to a certain level ... it should open up the switch and kill power to that fan and fan motor and gear drive, it will take it off-line." Mr. Anderson stated that it should also send a signal to someone to add more oil.

Mr. Anderson testified that, "[t]he vibration switches they lack prevent the gear drives from suffering damage, *i.e.* damage to the drive shafts, flexible discs, gear drive and the motor." According to the evidence in the record, five of the seven towers have vibration switches physically attached but not installed or operating, while the switches are totally absent from the other two towers. The vibration and oil level devices, if installed and operating properly, could function to shut down the fan if it experienced potentially damaging vibration or a critical loss of lubricating oil in the gear box. The devices could be installed to operate either to shut down automatically or to provide sensor information to a controller outside the Plant who could manually shut down the fan's operation to prevent or minimize damage.

Mr. Anderson explained how he learned about the lack of vibration and oil level switches. In early 2004, "two gentlemen from [Trane], who had come to look at a job on one of the cooling towers, told [Mr. Anderson] none of the vibration switches or oil level switches, none of them had ever been hooked up and we could do it but it would cost the government quite a bit of money." According to Mr. Anderson, [Plant Supervisor 2], who was the plant supervisor at that time, told him the switches had "never been hooked up." Mr. Anderson testified that before the Trane technicians came out, he "went up to the cooling tower and physically checked all the wiring on every tower . . . There's a little metal junction boxes where they have wires coming out from the vibration switches and oil level switches." Mr. Anderson "took a screwdriver, opened every one, and it looked like all the wires were fresh with a little bit of corrosion on the, cut." Mr. Anderson indicated "that confirmed – it appeared to be what I had thought about what

I saw originally, the wires that were cut, they were never hooked up." He indicated that he "didn't tell anybody what [he] was looking at, for obvious reasons."

The record testimony from other witnesses evidences wide-spread knowledge that the vibration and oil level switches[20] were not installed, connected and/or operational.

[Lt Col 1] described the function of the vibration controls. "As I understand it, those controls or switches are installed and I'm not sure if they are installed on the actual fan themselves or the gear shaft, but it—it would detect excessive vibration that would occur during the operation of the cooling tower fan units individually and that if there were excessive vibration that would occur, that these new switches and sensors that were installed would send a signal to our 24/7 ATCC, Automatic Tracking and Control Center, and they would be able to remotely shut down whatever cooling fan that was vibrating excessively." [Lt Col 1] stated that none of the vibration controls were being monitored. "I believe that there are controls in place on two, however, they're not wired or hooked up and they're outdated. The sensors that were purchased, I'm not sure how many years ago."

[Power Plant Operator 1] testified that to his knowledge the vibration controls were not hooked up and monitored by the ATCC. As for the oil level switches, he stated that they "haven't been installed. There's a visible sight glass on a thing on the inside of the tower where they sit and you can check them, but they've [oil level switches] never been installed that I'm aware of."

[Power Plant Operator 2] indicated that oil is checked "[t]hrough a sight-glass or I've got to shut towers off and I can visibly crawl in [the tower] and look at the sight-glass on the side of the gear box." He indicated that not all of the cooling towers had sight glasses present on the outside of the tower. He believed "cooling tower 2, 6 and 7," did not have the sight glasses on the outside and he had to shut down the tower and "I actually have got to crawl inside and look at the oil level on the sight-glass on the side of the ...gear box." He checks the oil level every two days when he's on the shift. [Plant Supervisor 1] indicated that employees are required to do a weekly check of oil levels.

[Deputy Chief of Operations] stated that there are sight glasses which the employees look at to check the oil levels in the cooling towers. When asked if he knew if all seven of the cooling towers have the oil level glass outside the concrete barrier, he responded, "No, I notice—I know that they're inside. I don't know if there—there's one or two, I think, that are possibly outside. It might have been one—one of those—or there could have been one missing on that." When asked if he knew if the ATCC had the ability to monitor vibration controls or oil level switches, [Deputy Chief of Operations] stated, "[t]hey have the—they have the ability to. Right now it's not hooked up because of the way we're operating. We're operating in—in manual and hand mode and so—and there's none of the—the EMCS [Environmental Management Control System] hooked up right now that sends—well, there are some. They do read some things, but I don't think the oil—well, I know the vibration they don't and I don't believe there's the oil sensor."

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[20] Every cooling tower had an oil sight glass, allowing employees to view and monitor oil levels. However, two or three of the sight glasses were located inside of the cooling tower.

[Power Plant Operator 3] stated that since he arrived at the Utilities Plant in 2006, "at no time have they [vibration controls] ever been hooked up." He also testified that during the time he worked in the EMCS which has the ATCC monitoring system (from 2001-2006), the vibration controls were not monitored. "No, they were never connected upstairs in order to, you know, the -- and this is funny. I mean, obviously, we don't install major stuff like this. This is done by a contractor. Why they didn't install them. I mean, I'm not saying that they were installed and maybe cut or disconnected or something. I have no idea. When I first went up on the roof just to check it out, it -- it was a disconnected system at that point. When, where and how they became disconnected, I don't know."

[Control Technician],[21] who works as a control technician in the control shop, testified that to his knowledge the vibration controls and oil level switches have never been monitored.

> My heading the automation system is where the controls would report to. We monitor the speed of the towers, the chilling towers, everything that goes in with it. Now, a number of years ago, there was an incidence where they lost a tower fan and they asked me to look into it to find out why none of the switches were working up there. They thought it was hooked into the automation system. When we did our look up there, we found out that nothing from up there pertaining to those two controls had been hooked in. We discussed with the maintenance engineer who was here at the time, [Maintenance Engineer], and she said that the Air Force had never decided to pay the money to have that hooked into the automation system.

[Control Technician] recalled that this occurred "around 2003 or so." According to [Control Technician], "[Plant Supervisor 2], that used to be the supervisor down here, told [Deputy Chief of Operations] over across the street in Ops [the Operations Flight] that the control shop had gone up and disconnected the controls and that's when they asked me to go up and take a look to see what was going on and we ascertained that there was a big bundle of wires coming down the ceiling in the far side of the plant and nothing had ever been connected in."

[Trane Employee 1] indicated that he was "familiar with the vibration controls as far as what's up there." He indicated that to his knowledge, the vibration switches were not monitored. According to [Trane Employee 2], Trane was asked to do a proposal for vibration controls and oil level switches in or about 2008. [Trane Employee 2] testified that "we went out and did an assessment and put together a list of problems, known problems and what should be done to remedy any problems." In his interview, [Trane Employee 2] read the following from a list of recommendations made by Trane:

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[21] [Control Technician] (WG-12) is an electronic instrument control mechanic. He works for the 50 CES in the control shop as a control technician for all the electronic controls and automation controls on the base. He has been at Schriever AFB for since January 2002, about 9 ½ years.

Cooling tower fan one with level vibration switch are not connected to the control circuit for shutdown, and there were some repairs made on that. We replaced the drive shaft, blades and re-anchored the gear box, and it was noted that the vibration switches were disconnected on it at that time.

Fan two needs additional anchors to the gear box, which is pretty much an error on all of those. They vibrate enough that they'll work loose after while. Needs the drive shaft aligned. The access door hinge is broke, it's just screwed on with screws. The drive shaft guard needs to be anchored. The vibration and oil level switches are wired in for vibration and oil levels which are not wired in for safety shutdown.

Fan three -- cooling tower three, gear box has an oil leak. On the upper and lower coil line to the oil level switch, also sight glass is leaking. The oil drain line is deteriorated and needs to be replaced. The oil level and vibration switches are -- are not wired into the controls for safety shutdown. The fan blades are cracked, coming apart. Need to replace the blades and hub. The concrete's deteriorating on the base and the fan riser near the door. Access door hinge is broke and the door is screwed on.

Tower four, gear box has multiple oil leaks and also has a looseness in the output shaft. Need to plan on changing the gear box. Bearings are noisy on the motor. The vibration level of the switches [is] not wired into the control circuit for safety shutdown.

Tower five, gear box has oil leaks on the upper and lower oil line, oil level, and to the oil level switch. Need to realign the drive shaft which may require gear box anchors be repositioned. The screen is damaged from past fan failures and needs to be repaired. The access door is gone. The vibration and oil level switches are not wired into the control circuit for safety shut down.

Tower six, gear box has oil leaks on the lower oil line and oil level switch. Drive shaft shim packs are cracked and need to [be] replaced. Need access door installed. Need tower _____ [missing from transcript] to gear box and base plate. Motor bearings are noisy, vibration and oil level switches are not connected to the control circuit for safety shutdown.

Fan seven -- tower seven. Gear box has oil leak on the lower oil line and the oil level switch. Drive shaft shim packs need to be replaced. Need to power wash the gear box and plate. New access door needs to be installed. New access door will also need to be

> grouted and the cement. There again, the vibration oil level switches are not -- are not wired in.

When asked whether, to his knowledge, the vibration controls for the cooling towers "were ... ever being monitored," [Trane Employee 2] testified, "[n]ot that I'm aware of."

According to the evidence in the record, the cooling tower fan/motor assemblies do not have, and have never had, functioning automatic vibration and oil level cut-off switches.

Defense Hotline Report

In late 2009, an anonymous Department of Defense (DoD) Hotline complaint alleged the same issue presented here – the alleged lack of operational vibration and oil level switches. The 50 CES ([Deputy Base Civil Engineer], Schriever AFB Deputy Base Civil Engineer) conducted an analysis in response to the complaint in February 2010. The resulting Defense Hotline Report was signed by [Schriever AFB Inspector General], the Schriever AFB Inspector General and concluded "while each of these issues addressed in the complaint are valid concerns, 50 CES was fully aware of responsibilities and guidelines and had a strong handle on the matters. Based on the information obtained during analysis none of the allegations were substantiated. Recommend this complaint be closed." An undated memo, Defense Hotline Case Number 110928, stated that the February 2010 report was forwarded to the Office of the IG's Technical Assessment Directorate (TAD) for further review and analysis. TAD's analysis determined that the Hotline Completion Report essentially responded to the issues in the complaint. The memo was signed by [Defense Hotline Director], Director, Defense Hotline.

This investigation determined that a factual error in the Defense Hotline Report led to a false conclusion. The report states "there was an extended period of time prior to 2005 when the vibration safety switches were present but not operational. This was corrected in 2005 utilizing a contracted effort. The current devices provide a signal to the 50 CES Automated Technical Control Center (ATCC), 24 hours, 7 days per week manned office. ATCC have remote capability to shut off the cooling tower fans if an issue arises."

The IO obtained evidence from the ATCC operators -- two printouts provided for gear lube alarms and vibration alarms. The printout on August 29, 2011 shows "normal status" for both the vibration and oil level switches. The ATCC operators thought they were monitoring the cooling towers for vibration because their screens showed the cooling tower status as "normal." The system is configured so that the alarms for the lack of vibration and oil level switches do not constantly go off. There have been no alarms during the 2004 to 2011 time frame.

It was determined during this investigation that the cooling tower fans have never been monitored with operational vibration and oil level switches. Therefore, ATCC did not have the remote ability to shut down the cooling towers. In addition, per [Plant Supervisor 1]'s direction that the towers be operated in hand mode, it required the HVAC operators to manually turn the fans on and off. The IO for this investigation confirmed that ATCC is not actively monitoring the vibration and oil level switches as mentioned in the Defense Hotline Report.

Notification to Supervisors

In his testimony and the documentation he provided to OSC and the IO, there is sufficient evidence that Mr. Anderson notified his immediate supervisors, the wing safety office, and several management officials alleging safety concerns with fans associated with the cooling towers. From 2004 to 2011, Mr. Anderson made and documented numerous attempts to bring attention to the lack of vibration and oil level switches. Many of these are highlighted in the information provided by OSC in the OSC referral letter.

The IO was provided with emails (from both OSC and Mr. Anderson) which demonstrated that on October 25, 2004, November 5, 2004, January 16, 2005, February 27, 2005 and May 5, 2005, Mr. Anderson notified [MSgt 1], 50th Space Wing Ground Safety Manager, that the vibration and oil level switches were not properly installed on the cooling tower gear drives. He also notified [Major (Maj) 1], Operations Flight Chief, on December 17, 2008 and [Staff Sergeant (SSgt) 1], 50th Space Wing Ground, on October 23, 2004, and November 9, 2004. The emails also show that Mr. Anderson informed management official [Safety Official] of this matter on September 19, 2006. He also notified [Maj 2], then Operations Flight Chief, of these same problems on October 5, 2004 and October 28, 2004.

When Mr. Anderson was asked by the IO if he sat down with any supervisor and showed them all the documentation that he revealed to the IO, he stated "no." He stated he was concerned about questioning the chain of command and getting disciplinary action due to previous attempts to bring his concern to their attention. Mr. Anderson provided evidence that he attempted to notify [Maj 1] (former officer in the 50 CES) and explain the history of the towers on December 17, 2008. Mr. Anderson indicated that meeting never occurred. In April 2009, [Maj 1] reminded Mr. Anderson via email to the use the chain of command and included an August 6, 2004 memorandum titled "Proper Use of the Chain of Command." According to his email, [Maj 1] wanted to ensure [Plant Supervisor 1] (Plant Supervisor) was involved and stated "although I'd like to get involved into the inner-workings of the plant, I trust the Central Utility Plant supervisors to 'get into the weeds' on a daily basis. Our chain of command exists for orderly flow/decisions and to ensure that every little problem doesn't need my approval/attention."

Mr. Anderson testified that he does not always say things because "some people appear not to listen and I don't do things just because I've been told I'm – always want to be right. I do things because we have a mission to maintain here, safety." Mr. Anderson indicated that he prefers to show someone the issue in person. My "M-O … is let me show you." He states this is the best method of communication for him "because I've been kind of shunned" at work. Mr. Anderson indicated that while he wants to show his supervisors the issues he discovers, the response from his supervisors is "I'm busy."

[Plant Supervisor 1] testified that "Mr. Anderson has told me a couple of times the different concern. Mostly it's vibration switches and I explained to him how we were trying to get it resolved." [Plant Supervisor 1] believed but was not sure whether Mr. Anderson

understood that the new switches had been purchased and that there was a project in place where the new switches would be installed.

Requirement or Option

Mr. Anderson provided both OSC and the IO with a one page document which appears to be an excerpt (page 2 of 11) from a submission from the contractor Ceramic Cooling Tower Company to the contracting officer.[22] The one page excerpt is dated May 9, 1989 and addresses the function of vibration switches as part of a safety shutdown system. According to the excerpt, the system function is twofold: 1) to provide constant monitoring and automatic shutdown of drive train when excessive (damaging) vibration occurs at vibration switch location, and 2) provide automatic shutdown of the fan drive system when the operating oil level in the gear reducer falls below the minimum level. The system is intended to notify the tower operator (by shutting down the system) that a potential damaging condition is present in the fan drive system, and to prevent damage to the fan drive equipment and the surrounding cooling tower structure. The document provides a "warning" which states, "[f]ailure to wire or connect these devices to protect rotating equipment and components will void any and all applicable warranties and may result in serious damage to the cooling tower and/or personnel."

Excerpts from Volumes 3C of the Operation and Maintenance Manual for the Central Utilities Plant at Falcon AFB (now named Schriever AFB) obtained by the IO contain similar warnings. By its title page, the manual appears to have been prepared by a contractor for the Army Corps of Engineers. It provides some background including that the cooling towers have typical components which consist of the cooling tower fan, fan motor, and fan controls; the pump and its control valves; the local controls; the "DDC/EMCS" (now ATCC) controls; and the make-up water and water level control valves. Table 3-11-2 of the manual outlines troubleshooting procedures for the cooling towers. The manual sets forth the recommended procedures if the cooling tower fan vibrates (including what to do in case of vibration cut-off switch failure and vibration cut-out switch set too high). According to the IO, these would be the manufacturer recommended procedures for these problems if the vibration switches were properly installed and monitored. The manual sets out the following warning with regard to the vibration cut out switch, "[f]ailure to wire and connect these devices to protect the rotating equipment will void all applicable warranties by the manufacturer and may result in serious damage to the equipment and injury to personnel." The manual also includes information on the oil level switches. A similar "warning" is included. "Failure to wire and connect this device to protect the gear reducer will void all of the manufacturer's warranties and may result in serious damage to the cooling tower gear reducer."

When asked whether the vibration controls were required, Mr. Anderson testified they were not. "It was an option. It was supposed to be –if—if the government was going to install them on these cooling towers, part of the contract work that I don't remember where I saw, it's somewhere in this plant, I don't have a copy of it because I'd love to give you a copy, stated it was optional equipment but it was recommended by Ceramic Cooling Towers for the very reason of catastrophic damage or damage to personnel… so it was an option. Why they weren't

[22] The circumstances and context surrounding this excerpt are not clear from the face of the document or testimony given. As the Air Force apparently did not contract to install operational vibration and oil level switches, it is not clear how this document applies to the cooling towers at Schriever AFB.

installed, I don't know." Mr. Anderson also agreed that there was no requirement that the vibration controls and the oil level switches had to be monitored. He indicated that it was a manufacturer's recommendation that these controls should be in place due to personnel safety.

[Lt Col 1] was not sure if vibration control switches are required. "Since I have been here, I have not heard of a requirement to have those switches and sensors installed." Likewise, [Deputy Base Civil Engineer], [Deputy Chief of Operations], and [Power Plant Operator 1] testified that they do not know whether vibration controls are a requirement or a manufacturer's recommendation. According to his testimony, [TSgt 1] does not know if there is a requirement for the cooling towers to have vibration controls. When asked whether there's a requirement to have the vibration switches in place, [Plant Supervisor 1] responded, "[w]ell, I don't know if there's a specific requirement. It makes good engineering practice. It's safer for operation..."

[Power Plant Operator 3] stated that he did not think it was a requirement for the cooling towers to have vibration controls and oil level switches and was not aware of any specific documents that state that the cooling towers must have vibration controls and oil level switches.

> I mean, it's almost like -- I think that's something you would buy kind of extra to have installed to -- to help you, really. Now, whether it's mandatory, I mean, we get equipment that -- and then you go somewhere else, you go, "Yeah, how come they've got three more bells and whistles than we have," and they bought it.
> ...
>
> In a way -- like the safeties, like the idiot light in your -- in your car. Trust me, by the time that comes on, that motor's almost gone . . . so it's a nice to have but that engine will run without that little idiot light if the idiot light's wrong. I had one one time, I went to pick up a car in the southern part of Spain, and I'm -- I'm 300 miles from home and this little idiot light comes on and I'm going, oh [expletive], is it working or not? And you -- you know -- you -- so I stopped the car, opened up the thing and I can see the water -- I mean the oil squirting inside the -- the valve cover. Well, we're going to drive back to Madrid. The worst than can happen is just burn up. I mean, I'm not going to stop on the side of the road waiting for a new switch. It was a bad switch, it told me the wrong answer, but it was -- it could have been right.

When asked if he knew whether it's a requirement for the cooling tower fans to have vibration controls and oil level switches, [Trane Employee 1] stated,

> W: It's a good requirement, you know? Is it – is it really required? And again, you know, every facility is different requirement basically, you know, if it's there, you know, was it sold with it, was it just put on there, you know, option, not every hooked up or whatever, it – it is a good – it is a good, you know,

> investment and it's a good safety or, you know, a safety monitoring tool just for the – for the equipment itself, you know.
> IO: In your opinion, though, is it – is it a requirement to have these or more of a manufacturer recommendation or some other option?
> W: It could be a manufacturing op [option], you know. I know of – we sells [sic] you know, we sell a lot of fans. We don't really sell any cooling towers or anything like that, but, you know, that's just a—an extra package that simple is...
> IO: so the fans...
> W: that is required.
> IO: the fans don't come with vibration controls as a standard feature? It's – it's an option?
> W: Probably an option, depends on how it's sold, how it's put in...and what the original job requirements are, the control requirements are, safety ...We've got a lot of towers in the [Colorado] Springs that don't even have vibration switches, no oil level switches.

[Trane Employee 2] was also asked if he knew whether there's a requirement to have operational vibration controls or whether some other standard applies. He indicated that a vibration cutout switch is "simply a recommendation from the manufacturer purposes [sic] [proposes] to protect that piece of equipment..." from self destructing. He indicated that from a manufacturer's standpoint, "we want to see as much protection on [the equipment] as we can because we're ... warranting that equipment." When asked whether a lack of a vibration control would null and void any warranties, he responded, "[n]ot that I'm aware of." As to whether a vibration switch was standard or optional equipment, he stated,

> You know, back in the day when those were put in, I – I'll bet it was an option, but nowadays, that it probably is standard on equipment. You know, these -- these towers, we don't erect these towers. We do erect _____ [missing text in transcript] which is kind of a sister company to Ceramic Cooling Towers, but a lot of towers don't have any safety vibration switches on them, so it's -- these are probably the only ones, tower-wise, so the only ones I know of. But now on return air fans and supply air fans, with their high-speed prop fans, these are pretty standard on them. It just depends on, you know, the piece of equipment. But these [Plant fans] are low-speed. I mean, they are -- if they turn 800 RPMs, I'd be surprised.

There is no testimony or evidence that indicates or states operational vibration and/or oil level switches are required equipment. The IO found that based upon the preponderance of evidence in the record that the vibration control switches and the oil level switches were manufacturer recommended options but not required equipment.

Efforts to Install Vibration Switches

As stated above, on numerous occasions beginning in 2004, Mr. Anderson raised concerns within 50 CES as well as the 50th Space Wing Safety Office regarding the towers' lack of vibration and oil-level switches. There is sufficient evidence in the record that management officials agreed with the recommendation to connect the switches.

On October 28, 2004 [Maj 2], a former officer in the 50 CES, emailed Mr. Anderson stating "I asked [Plant Superintendent] to look into it and he said there is a plan to connect the wires." This email was in response to Mr. Anderson's email inquiring as to whether [Maj 2] had talked "with [Plant Superintendent] about the cooling towers safety switches connections."

In an email dated January 18, 2005, [MSgt 1] from the Wing Safety office clearly stated he "recommended that the system be connected." When [MSgt 1] asked several months later on May 5, 2005, if they have been connected, Mr. Anderson replied "no...the safeties have not been reconnected/hooked up." The next day on May 6, 2005, [MSgt 1] then emailed [Lieutenant 1], [SSgt 2], and [TSgt 2]. He asked them for an update on the status of the switches and why they were still not activated. As evidenced by his emails, Mr. Anderson remained in contact with the new Wing Safety representative later on. He emailed [Safety Official] on September 19, 2006 and told him the cooling towers have operated with disconnected safety switches. He emphasized that he is unable to support the mission when the towers are down. There is no reply documented from [Safety Official] or what he did with the information.

The evidence in the record shows that management officials affirmatively tried to install the vibration switches. [Plant Supervisor 1] testified that,

> we have been trying to address [the issue of the vibration switches] for about—since I came on board about five years ago and in doing various processes to get it resolved, but to date we haven't. There's some parts is [sic] operational, some are not and we've – we did have a 332 [work order request] in to redo most of the cooling tower drag units and as part of that, we were looking at doing the vibration switches also, but [Engineering Employee], in engineering, the course we were going to take a direct drive unit and he did not feel that was improving technology, so I believe he dismissed it. Approximately about two, maybe three years ago, I purchased some new vibration switches and I've been trying to pursue in-house to get them installed and at that time they did not have the resources and personnel. And I went out and got quotes from a company in town, but that was at the same time that they decided to place it on the 332 as the overall project, so I was instructed to dismiss pursuing that.

According to [Plant Supervisor 1], the dismissal "was agreed upon with [MSgt 2] and I think the fellow in engineering."

[Control Technician] testified that, "a project was set up [he believes in 2007] to go ahead and have the controls hooked up to the vibration switches and the oil level switches. We've had wiring run up to them. Since a contractor who was in here replacing all the motor control centers [MCC], all the MCCs, had cut out all the shut trips coming down to the -- the old gear, they removed them since they said nothing was working anyway, they didn't want to pay the money, take the time to have to go ahead and run new wiring for sent trips, so we told them we could program the head end. … So we've got the programming, we've got the points, we've got the wiring, but the switches up there were bad at the time and the oil level switches, they couldn't open up so we could get the wiring put in correctly."

[Control Technician] explained that [Plant Supervisor 1], the supervisor at that time, "said that they were going to go ahead, get new vibration switches put in and change out the oil level switches. At such time I could hook up my wiring to it and then, if any control, or if any vibration switch went in alarm or any oil switch went in alarm, then the automation system would automatically shut down the corresponding unit, but as of yet, none of the switches have been changed."

[Plant Supervisor 1] indicated that they "still have the new vibration switches available … We started a couple of those different projects to get that done [vibration controls hooked up] and we weren't able to get them started. We looked at it in-house and the electricians weren't able to accomplish it, so like I say, then I went out and got the quote with a local company and we were initiating the process through contracting when they decided to … incorporate it all into the engineering project."

[Deputy Chief of Operations] indicated that the first project involving the vibration switches started around 2008, possibly earlier. "The latest plan is we do have a project that went up to contracting. It was pulled out of a main project to go ahead and put vibration switches, install them on the fans as they are now until we go to the – we go to a new … til we go to a new design, which is what we're wanting."

> Well, the plan now is to go contract. The plan then was to try to do it in-house. I don't know if anybody's explained to you how many supervisors we've lost in the plant, how many operators we don't have now, how our electric shop is manned and—and their level of experience. And we got the—we got the vibration switches, we—they tried to install them and do it and it was above their head. We went out for some quotes to—to have a contractor come in here and, in the meantime, you know, their more discussion was about the project, getting the proj—this project done, redoing our total redesign, total and it was not completed.
>
> The reason the vibration controls could not be installed in house: "We didn't have the experience to do it. When they started doing it, they just—they couldn't do it, and you know, we took a HVAC individual, a master sergeant, put him in the plant for awhile. He looked at it in a different perspective and—and was more so, 'Hey,

let's get this—let's get this project going, get this thing done the right way.' And it just wasn't done."

According to [Lt Col 1], the "engineering project" is "a $1.5 million repair project." He testified that the 50 CES is working on a project to upgrade the cooling system in Building 600. The project, which is much larger than installing vibration and oil level switches, is in the design phase. "For the work that's going on in the utilities plant, given that the – a lot of critical operations are involved which is why we're going through a full design bid, build process with this project, that you're probably looking at a couple of years, just from, okay, start to design, get it designed, get it awarded, do the work, you're probably looking at a couple of years from start to finish." [Lt Col 1] indicated that the vibration switches were originally part of this large project but have been pulled out and placed on a separate contract.

[Deputy Base Civil Engineer], in discussing this larger project, explained that they "won't replace cooling towers; but are looking at replacing shaft and fan configuration." According to [Deputy Base Civil Engineer], the design of the shaft system for the fans for the towers "is lacking ... It was designed poorly and there was a potential that there could be some vibration that causes problems associated with...those fans in the ... towers ... The configuration, the original design of this has got two shafts that are at 90 degrees that ... it's not a particularly good design, so they were already looking into – they, our design engineers, were already looking into a project to – to reconfigure, re-work that whole system, so they were planning on just rolling those switches into ... that project."

[Deputy Base Civil Engineer] also stated that the installation of the vibration switches has been pulled out of the larger project. "It appears that ... they don't have the ability that we originally thought to – to do the remote sensing of the – the vibration, so since that came to light, we said, hey, verify that and if that's not the case, then we need to break out the – the vibration sensor part of it and get that done, because it could be quite awhile before we get the project funded to be able to redo a whole – the whole configuration."

In describing the issue with the design, [Deputy Base Civil Engineer] stated that because "the shafts have to be perfectly balanced within this concrete cylinder that the fan's contained within, and there's little shims that they use to...keep this fan balanced and those shims seem to wear out occasionally, and it's not a real frequent occasion that it – that it happens, but – but I think since I've been here, once or twice the – the shims have—have worn out enough that it put it in enough of a unbalanced state that the—the fans started shaking that they had to shut it down."

[Plant Supervisor 1] explained that under the present design, the fans can only be operated at high speed or low speed. According to [Plant Supervisor 1], "[t]he transitioning between high and low was an issue because it would just boom, go all of a sudden, and that put a lot of strain on ... to the direct drives, the shim couplers, that's a very rigid." [Plant Supervisor 1] explained that about three years ago a program was installed to establish a delay between the high speed going to the low speed, to avoid the abrupt shock. [Plant Supervisor 1] explained his rationale for placing the operation mode on manual which happened about two years ago. "I just

felt the manual operation with the operators keeping careful eye on it, which all of them do, we – we'd better control our temperatures and we'd have less wear and tear on the towers."[23]

[Power Plant Operator 4] also discussed problems with the current design.

> Our biggest problem has been – is the – the motor sits outside the tower, there's a drive shaft that runs the ... angle drive gear box which, in turn, turns the fan, but our biggest problem is there's about six feet of stainless steel drive shaft between the fan – the motor and the – and the fan, and they're driven by – they have two couplings, flex couplings. We call them our shim packs, but – and it's very difficult to line that – align all that stuff properly and those – those shim packs, of course they flex and stuff like that, so they wear and then they crack and sometimes they fail.
>
> If they fail next to the motor side of the drive shaft, it falls down and it's not too bad. It might damage the other side, but the drive shaft is probably reusable. If it fails on the ... on the flywheel ... the driven portion, the angle drive gear box side of it, then... there's a six feet of drive ... shaft whipping around ... and ... the damage that causes, and ... then they have to replace the drive shaft plus two shim packs ... and then there's the down time ..."

[Power Plant Operator 4] indicated that "there is so much better technology out there ... The best thing we can come up with is a direct drive fan – motor that sits directly beneath the fan which eliminates all the drive shafts, it eliminates the – there's a gear box attached to the – the motor itself, and then ... the fan mounts directly to the motor. ... It's on a[n] electronic speed control ... with the variable speed control, you could have a soft start ..."

[Power Plant Operator 2] stated that, "[i]t would be nice to see them updated, get rid of that old drive system and go direct drive." When asked what the benefit of direct drive, he responded, "[g]et rid of that drive shaft, get rid of those shim packs and if we do direct drive, get rid of an extra gear box and have everything into one, we can variable speed instead of being on or off, because I do everything in hand mode right now. They wanted to go back to automatic, that would be the way to go, do variable speed fans."

[Power Plant Operator 1] testified that, "[t]he way it's set up now, you've got an electric motor outside with a shaft going and you've got two sets of shim packs. Well, it's a flex-drive system. That absorbs the vibration, and then you have the gear drive, which is nothing more than

[23] The Operations Plant Logs reflect that [Plant Supervisor 1] has directed employees to leave the cooling towers in hand mode. In hand mode, the ATCC is not able to automatically shut off the cooling towers even if the vibration and oil level switches were properly installed and monitored. For the ATCC to shutdown a cooling tower, for example due to excessive vibration of the fans, then the cooling towers would need to be left in auto mode.

a gear drive like a transmission, sitting in the center there connected to a fan, whereas the new design that Mr. Anderson researched, had the motor in the center with the shaft from the motor straight to the fan so there are no shim packs. So your vibration is nil, because it is a direct drive shaft to the motor." He further stated that he knew "Mr. Anderson complained about it and he came up with a design, a better drive shaft because what happens is when the drive shafts break, that's when the damage occurs and you get the vibration. And he researched a direct drive electric motor where on the shaft of the motor the fan blades go. And that would reduce your -- your two vulnerable U-joint points with the shim packs and it would be a direct drive, soft start versus a, you know, you hit the switch and the engine's going from zero RPMs to, you know, right there real quick."

According to [Power Plant Operator 1], "[i]n the power plant, it comes down to basically money and, you know, it's -- the whole mentality since I've been there, since '94, has been it's one of the newest Air Force Bases, you know, and money was spent for -- there's different colors of money in the Air Force. You've got maintenance, you've got new construction, stuff like that. Well, they always have money for new construction, they always have money for contractors, but for like maintenance, it's – it's hard to get money. Now, we have done a lot of work in that plant. We've – we're putting in new generators, we've put in new boilers, we've put in new chillers and this is all since 2002. And the cooling towers were scheduled, as far as I know, to be looked at, but then we had to go and put breakers in the -- in the power plant room because of the electrical fire."

Damage to Equipment

The information presented by Mr. Anderson included his own extensive personal recollection, emails, over 150 pages of plant operations logs and a history of the outages associated with the cooling towers from 2004 to 2011. In a two page tracking document he prepared (dated June 2011), Mr. Anderson outlined his concerns about "the on-going cost of the damage to the cooling towers," and the cost to the taxpayer for repeated failures of equipment associated with the cooling towers. Mr. Anderson's tracking document set forth below cites 16 incidents between May 1999 and June 2011 where the cooling towers incurred damage to equipment, resulting in outages. Mr. Anderson estimated the total cost of the damage to be $110,000, which he views as preventable. At the bottom of this two page tracking document, Mr. Anderson stated, "safety as another concern."[24]

[24] Mr. Anderson indicated at one point in his testimony that, "my concern is safety of the taxpayer, the mission." This would be consistent with his concern that much of the expense in repairing damage to the cooling tower equipment was "preventable."

COMPLAINANT PROVIDED

IL Ex 1

Anderson, Keith D Civ USAF AFSPC 50 CES/CEOIP

Subject: the on-going cost of the damage to the cooling towers/updated 06/2011

The following information concerns the cost of on-going damage to the cooling towers:

Date	Damage	Cost
May 16, 1999	Cooling tower #1- The gear drive, fan blades, gear drive shaft, electrical disconnect switch were all destroyed. Equipment downtime- 60 days (THIS WAS PREVENTABLE)	$13,000.00
Dec 31, 2003	Cooling tower #5 –The gear drive was destroyed. Equipment downtime- 37 days (THIS WAS PREVENTABLE)	$9,000.00
July 20, 2004	Cooling tower #1 – the fan blades were destroyed. Equipment downtime – 40 days (THIS WAS PREVENTABLE)	$5,450.00
Nov 18, 2004	Cooling tower #4 – the fan blades were destroyed. Equipment downtime- 80 days (THIS WAS PREVENTABLE)	$7,450.00
Feb 14, 2005	Cooling tower #1 –the gear drive was damaged. Equipment Downtime- 190 days (THIS WAS PREVENTABLE)	$4,900.00
April 19, 2005	Cooling tower #4 –the shaft coupling/shims were destroyed. Equipment downtime – 7 days (THIS WAS PREVENTABLE)	$4,000.00
May 10, 2005	Cooling tower #5 – The gear drive, gear drive shaft, the coupling /shims were destroyed. Equipment downtime- 93 days (THIS WAS PREVENTABLE)	$9,500.00
July 2, 2007	Cooling tower #4 – The gear drive was destroyed. Equipment Downtime – 48 days (THIS WAS PREVENTABLE)	$6,000.00
Feb 27, 2008	Cooling tower #7 - the gear drive shaft damaged. Equipment downtime – 220 days (THIS WAS PREVENTABLE)	$5,500.00
Feb 29, 2008	Cooling tower #4 – the gear drive shaft, the coupling / shims were damaged. Equipment downtime - 110 days (THIS WAS PREVENTABLE)	$6,500.00
April 15, 2008	Cooling tower #6 – the gear drive coupling was destroyed. Equipment downtime – 75 days (THIS WAS PREVENTABLE)	$4,000.00
July 28, 2008	Cooling tower(s) #2 & #4 – gear drive shafts destroyed. Equipment downtime for cooling tower #4- 10 days. Equipment downtime for cooling tower #2 – 40 days (THIS WAS PREVENTABLE)	$10,500.00
Aug 18, 2009	Cooling tower #2 - coupling to gear drive damaged. Equipment downtime unknown- estimated completion date of repair-unknown 2 sets-shims (THIS WAS PREVENTABLE)	$4,500.00

1

(This was preventable - the cost to the taxpayer - $88,300.00)

Gear CT2 in need of replacement 9/09- still down at the present time 03/01/2010 $3,500.00
Down time so far/200 days++ (THIS WAS PREVENTABLE)

CT4- July 2009-September 2010 2 gear drive replaced/ two fan motors / three drives shafts/ three sets of flex disc/one laser alignment (THIS WAS PREVENTABLE) $20,500.00 + labor
(gear drive operated w/o oil + had a bent shaft)+(motors shorted out)

Estimate total to date- $ 110,000.00

Please note the cooling tower gear drives have operated without / lack the necessary safety devices i.e. (vibration switches and oil level switches) the damage is still on-going continuous to this day-the cost will continue to escalate.

CT4 – june 1, 2011 five fan blade disengaged/damaged in need of replacement ($4000.00) + 1 each set of flexible discs ($2000.00) / mounting base to gear drive bent + cement base for metal gear drive not level at all / off by 10 to 15 degrees /shims have been placed underneath the four mounting bolts for the gear drive to compensate the unevenness of the gear drive. 1 bolt has 1 shim/ the 2 and 3rd bolts appear to have 2 shims and the 4th Bolt appears to have 5 shims to compensate the unleveled gear drive. (THIS WAS PREVENTABLE) $6000.00

Safety is another concern.

In his interview, Mr. Anderson went through each of these incidents, often citing directly from the Plant Operations Logs. Mr. Anderson testified that he had "seen up in the cooling tower area several times where there have been fan blades literally scattered, disengaged everywhere, including outside the shrouds, the enclosures of the cooling tower gears drives also, so my concern is safety." He acknowledged, however, that "I haven't been up there when they – the fan blades or anything has disengaged or anything like that, but I've been there after the fact to survey the damage along with other employees."

According to Mr. Anderson, he first became aware of broken fans associated with the cooling towers in July 1995 when he was on the rooftop with [SSgt 3]. "I happened to go up on the cooling tower roof to talk with a [Staff Sergeant 3] and he was up there working on a gear drive. Some of the fan blades were disengaged at the time and he explained he was up there doing a repair job to the gear drives, replacing it." Mr. Anderson does not indicate that the fan blades in this incident were outside the cooling tower; nor is there any corresponding Plant Operations log for that time period. There is no evidence that anyone was injured.

According to his statement, Mr. Anderson identified a single occasion on July 20, 2004, when a representative from Trane, Inc. was actually on the roof when a cooling tower fan assembly reportedly disintegrated. Mr. Anderson read into the record the entry from the Plant

Operations Log which states: "12:05 p.m. #101 COOLING TOWER FAN BLADES ALL DISENGAGED ROTOR DURING OPERATION / AS PER [Trane Employee 1] FROM TRANE COMPANY WHO WAS ON THE ROOF AT THE TIME OF MALFUNCTION BLADE IN PIECES / IN VARIOUS AREAS OF COOLING TOWER UPPER / LOWER AREAS / LOCK OUT TOWER FAN DISCONNECT AT UNIT / NOTIFY ATTCC/ LOG LOCK OUT / TAG OUT IN SAFE CLEARANCE LOG / NOTIFY [Power Plant Operator 5] / [Plant Supervisor 2] / [initials of Power Plant Operator 7] / [initials of Power Plant Operator 6]." (Emphasis in original). Mr. Anderson explained that "[initials of Power Plant Operator 7]" was [Power Plant Operator 7] and "[initials of Power Plant Operator 6]" was [Power Plant Operator 6].

According to Mr. Anderson, "[Trane Employee 1], July 20, 2004 had dove to the ground and I heard this from [Power Plant Operator 7] and I said, 'So why did he dive to the ground? Well, I think it was cooling tower four, 104, the fan blades disengaged, blew apart, whatever, ... [Power Plant Operator 7] told me that [Trane Employee 1] dove to the ground based upon this particular incident." Based upon the Plant Operation Log and Mr. Anderson's testimony, neither Mr. Anderson nor [Power Plant Operator 7] have personal knowledge of the incident.

[Trane Employee 1] was interviewed for this investigation. He was asked whether he had "seen any of these fans have issues coming apart where you were physically there when these things happen?" [Trane Employee 1] responded, "No."

Mr. Anderson identified only two other occasions (November 18, 2004 and June 1, 2011) when fan blades disengaged or were damaged. According to Mr. Anderson, on November 18, 2004, he "went up there [on the roof] and the fan blades [were] blown apart, disengaged again and this was cooling tower four." The Plant Operations Log from that date states: "12:45 TOWER #104 FAN BLADES DISENGAGED / DISCOVERED BY CONTRACTOR / ALL BLADES OFF HUB / TOTAL DAMANGE UNKNOWN / LOCK OUT / TAG OUT / MCC AND DISCONNECT ON ROOF / [initials of Power Plant Operator 7]." (Emphasis in original).

There is no indication in Mr. Anderson's testimony or the Plant Operations Log that the fan blades were blown outside of the cooling tower enclosure for this November 2004 incident. There is also no evidence that Mr. Anderson or anyone else was present on the roof at the time of this event, or that anyone was injured by them.

On June 1, 2011, Mr. Anderson, in his table chart indicates that "five fan blades disengaged/damaged in need of replacement." The Plant Operations Log from that date provides: "13:30 COOLING TOWER #4 FAN INOP – BLADES CAME OFF – [initials of Power Plant Operator 2]." (Emphasis in original). Mr. Anderson stated that "[initials of Power Plant Operator 2]" is [Power Plant Operator 2]. There is no indication that anyone was present on the roof at the time the fan blades became inoperable, nor is there any evidence that anyone was injured by them. Neither the records nor Mr. Anderson's testimony indicate that the disengaged fan blades escaped the cooling tower.

Mr. Anderson described two occasions where lubrication loss apparently caused damage requiring repairs to cooling tower components. On December 31, 2003, the oil drain pipe in

cooling tower #5 rusted out causing the gear drive oil to completely drain from the gear drive. According to Mr. Anderson, the gear drive was destroyed. On the second page of his chart, Mr. Anderson indicated that between July 2009 and September 2010, the gear drive in cooling tower #4 "operated without oil and had a bent shaft." While Mr. Anderson does not explicitly diagnose over-vibration as the cause for the damaged equipment in each of the other incidents listed on his chart, he does strongly imply as much. Regarding each of these events, Mr. Anderson does not describe or allege that the fan blades or other parts "blew apart" and scattered on the roof or elsewhere. Rather, he asserts that the lack of operational vibration and oil-level cut-off switches contributed to or caused more serious damage to equipment, resulting in higher maintenance time and repair costs than would otherwise have occurred.

In his interview, [Deputy Base Civil Engineer] stated that he had done an assessment from 1999 to 2008 regarding the kind of maintenance or replacement that was required to be done in each of the cooling tower components (i.e. gear drive, fan blades, the gear drive shaft, the coupling shims). Based upon his review, he stated, "[t]here wasn't any kind of excessive expenditures that – that we're having to put to the – towards the cooling towers because of neglect or lack of maintenance, no. There's one incident of gear shaft on cooling tower four that – that was five months apart that – that was the only item that appeared to me to be really questionable, but the amount of money spent over the – the length of time that I could get records for, didn't seem to be out of line with normal O&M [Operations and Maintenance]." According to [Trane Employee 2] from Trane, the level of maintenance required for the cooling towers at Schriever AFB was "below average."

Safety Concerns

The safety of the Plant operators is a commander responsibility and [Lt Col 1] has a signed and posted Commander's Safety Policy letter dated October 4, 2010. [Plant Supervisor 1] is the safety representative for the Plant. He maintains a safety binder in the Plant. The IO noted two safety documents -- the Job Safety Training Outline (JSTO) and the Form 55s. The JSTOs are required in accordance with Air Force safety regulations. A JSTO is tailored to the job. It describes hazards of the job tasks, safety procedures to be followed, personal protective equipment needed, applicable emergency procedures and dangers involved with daily tasks. The list of hazards includes "mechanical." Although the cooling towers and associated parts are not directly listed as a hazard, mechanical would include the fans associated with the cooling towers. The JSTO also includes reporting requirements to report unsafe equipment conditions or procedures to supervisors. "The detection of unsafe or unhealthy working conditions at the earliest possible time and at the lowest working level is an essential segment of the AFOSH [Air Force Occupational Safety and Health] program. Hazards should first be reported to the supervisor, building custodian, unit/base safety representative, or local safety agency." It further states, "oral reports for imminent safety situations are encouraged. If the hazard cannot be eliminated at the working level, an AF Form 457, USAF Hazard Report may be submitted."[25]

The Air Force Form 55 is a second critical safety document which documents the Employee Safety and Health Records for the 50 CES Central Utilities Plant operators. The Form

[25] There is no evidence of an AF Form 457 being submitted for the fans/cooling towers; however, Mr. Anderson did ask wing safety in 2005 on whether a form would help his request.

55s are required for each employee and indicate the currency of safety training for each HVAC employee to be working in and around the plant and cooling towers associated with their duties (as outlined in the Core Personnel Document). These forms were reviewed by the Peterson AFB wing safety office and no discrepancies were identified.

The IO also notes a key safety procedure, which is documented in the 50 CES Lockout/Tagout (LOTO) Device Log. The procedures to perform LOTO are outlined in AFOSHSTD [Air Force Occupational Safety and Health Standard] 91-501 dated July 7, 2004. Under this procedure, all equipment is locked out or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel. LOTO is used to isolate all energy sources to a machine or equipment. Once the system (energy sources such as electricity) is locked or tagged out, all potentially hazardous stored or residual energy shall be relieved, disconnected or restrained. This allows personnel to safely work on the equipment. Only authorized personnel may perform a LOTO. With the cooling towers, the HVAC operators cut the circuit breaker at the base of the cooling tower and place a standard lock on it to ensure it does not get energized while under maintenance or if locked out for an outage pending repairs. In addition, the employees climb a ladder and go to the rooftop and again disengage power to a specific cooling tower and place a lock on it. These procedures, when properly applied, ensure the safety of the employee that may be working on a fan blade, or gear drive, or changing the oil. LOTO is used on the cooling towers, for example, during the unscheduled outages. There are numerous examples of a cooling tower being LOTO since 2004. The AFOSHSTD 91-501 requires training and annual re-training in the procedure. Re-training on lockout/tagout procedures was accomplished for all the plant employees in August 2011.

The IO asked each of the witnesses whether they had safety concerns with the cooling towers or the lack of vibration switches. Most, if not all of the witnesses, with the exception of Mr. Anderson, did not express concern about the safety of the cooling towers or the lack of vibration switches.

[Plant Supervisor 1] was asked if the cooling towers themselves are unsafe without the vibration controls. He stated, "[n]o. No, I think we have had a good observation by the operators and I have felt the operators are all very conscientious, attentive to – to the cooling towers realizing that's the basis of their—their plan and I think they do a very good job maintaining their observations. And there's –there's different parameters which would indicate if there's a problem that they can—every hour their readings are taken and I know at least once, twice an hour, guys around the plant and they know the different levels of what's going on and...I know at least once a shift they're on the roof checking."

He further stated that "as far as operational, I feel that they're safe ...if we maintain our – our checks on them and our maintenance." He also stated that he could not "guarantee 100 percent, that [cooling towers are] actually safe just because ..." there were inherent problems with the design of the current cooling towers. He did indicate that the vibration switches "would be ...the optimum tool to maintain it."

[Trane Employee 2], the Trane account manager, was asked did he "feel that the cooling towers are safe in manual mode without the vibration controls operational?" He responded:

> Well, in my experience out there, is – there's [sic] disconnects located on the wall close to the towers, and if any -- any work's going to be done on those, they ought to lock out those before they -- and if I can remember right, I think down in the plant themselves there are -- the starters are located down there, so they could be shut off prior to going to the roof, and if good safety practices are used, it shouldn't put anybody in any danger.

He further stated that, "I'm not aware of -- of a vibration control being a safety device. If it's a safety, it's the -- say the fan. If it should start to vibrate or shut it down so that it doesn't tear itself up. But as far as safety to anybody else, no. In fact, we have big flak fans that -- that produce a lot more energy than what those -- those are pretty slow speed fans, but these flak fans, they'll – they'll run thousands of RPM and a lot of times they don't have vibration switches on them. It's just to protect the fan, not really to protect a person. I mean, if you're using good safety practices, no."

When asked if he had any safety concerns with the towers, [Power Plant Operator 1] expressed concern for the mission, not the safety of personnel. "My main concern with the cooling towers, sir, is – it's up -- up on the roof where the area is, the design is a[n] old design and we have trouble with the shim packs. There's nobody really standing there 24/7. My concern is when they break, I don't have the capability, depending on what the weather is, to bring up the electrical power plant and electricity submission behind cooling there. And the generators depend -- they don't have their own radiator, so they add load to the cooling towers and -- and chill the water systems, and if those overheat, we lose everything. We lose the electricity to the base and we lose the mission."

[Power Plant Operator 2] stated that he was not aware of any safety mishaps associated with the cooling towers. He indicated that he did have some safety concerns with the cooling towers. "To me they're starting to crumble, the concrete's starting to crumble and the other thing I don't like is when you do have to crawl into the cooling towers, it is a round cooling tower and it's got a square grate, so if you roll off, you're going for a ride. I think there should be some kind of leased hard point to attach a safety harness, or something, because it is a fall greater than six feet." When asked to characterize the safety within the Utilities Plant, he stated, "[f]or the most part, I think everybody's pretty safe."

When asked if he had any safety concerns with the cooling towers, vibration controls or oil level switches, [Power Plant Operator 3] stated, "[f]rom an equipment standpoint, I think it would be good. From a personnel standpoint, and again, that's, you know, that's not an area we work with or around on a daily basis, so having a -- a gear drive come apart and start chucking fan blades and stuff is -- that wouldn't happen on 99.9 percent of the time. But I mean, I could go up and start working on number four and all of a sudden number three just starts going haywire, if those switches and whatnot were in place, people would, you know, safety of the -- of the individual would be taken care of. As it is now, on a personal or physical sense, no, it's – it's not taken care of." He stated that he had not been on the rooftop when the equipment started coming apart.

With regard to the vibration and oil level switches, [Control Technician] expressed more concern about the safety of the equipment.

> W: Well, yes, sir. If you've got people up there and one of those tower fans take off, my biggest concern is the safety of the equipment. Over the years we've had a number of the tower fans go bad and it damages a lot of stuff.
> IO: So if vibration and/or oil level switch would provide more of a safety for saving the equipment?
> W: Yes, sir.
> IO2: And that would be the main purpose of those switches?
> W: Usually, because...
> IO2: To shut it down before...
> W: ...you're -- you're 50 feet up on the -- on the roof there. Those things, you're not really going to hurt too many people unless one of your operators happen to be up there doing site checks. Ninety-nine percent of the time, you don't have anybody up there when one of these towers go, so, in my mind, you know, the personal safety isn't really the critical thing, but the tens of thousands of dollars that have been spent over the years is a pretty critical thing. When those tower fans take off, they do quite a bit of damage and, rather than just getting things taken care of, you end up having to replace motors, you end up having to replace shafts, you know, you're constantly hearing the guys in here talk about things that have been replaced, so -- that may seem heartless, but my -- my first concern...
> IO2: No.
> W: ...there really is the equipment.

[Trane Employee 1] stated that "[t]he only concern I would have is [with the vibration controls], you know, pretty much the vibration switches, it's a safety for – for the equipment itself, and it's kind of like the oil light on the dash of a car." When asked whether, in his opinion, there are safety concerns for personnel with the lack of vibration controls, he responded, "[n]o, not in my opinion. … If it's going to be a catastrophic failure and you're in the area, the vibration switch is still not going to save you or save the equipment, you know. If it's going to blow, it's going to blow. And you've got all that coast down time. If you lose one blade, the vibration switch is still going to coast down probably grenade more parts." [Trane Employee 1] stated that he is aware of equipment "grenade" [exploding], even with vibration switches. He indicated that a flat fan which runs at a very high rate of speed (3,000 RPMS or higher), the fan can go through the grate covering at the top of the cooling tower. The fans at Schriever AFB run at a much lower speed, but according to [Trane Employee 1], "could probably cause some damage to [the grate covering]."

> IO: Do you think it could cut through it and strike an individual, given the right circumstances?

W: It – to be honest with you, I'd say yeah, anything's possible, probably, you know, kind of be that old saying, you're in the wrong place at the wrong time. It could – it wouldn't be as violent like I say, you know, [a high speed] fan coming apart, but it definitely would get your attention up there.
IO: Do you have any safety concerns with the location of the fans where they're at?
W: No, no safety. ...you do a lock out tag on it and verify it, you know, kill the MCC down here, lock the MCC and I believe there's also disconnects on the roof. You get it locked out, verify the lock out. Do the proper lock out/tag out on them and I'd say you're just fine, as long as you're working on them.
IO: Do you feel likes there's any public safety concerns with the way the fans are and how they operate?
W: Safety concerns? I would – I would say no safety concerns is – is the way they operate. Do I think they could operate better, yeah.

In his assessment of the safety within the Utility Plant, [Power Plant Operator 4] stated, "I think generally we're pretty safe." He stated the only accident he knows of is someone [Mr. Anderson] fell from a ladder." [Deputy Chief of Operations] testified that, "I think we have a pretty good—I think we have a pretty good safety program. I think, you know, what we—the amount of real safety incidents we've had was, I mean, for what we do, is really, really low, so it's—I think all the supervisors pretty well have a handle on—on our program."

When asked about safety of the cooling towers and fans, [TSgt 1] stated, "I know they—they can be unsafe if it's not properly locked out and tagged out right, but since I've been here and the work that we've done, we've always locked and tagged out at and we've always maintained that through—with the operation and with [Plant Supervisor 1], the supervisor, and I've never had any issue. I think it's safe, yes, sir." He was not aware of any safety mishaps with the cooling towers since he has been at the Utility Plant.

[Lt Col 1] testified that he did not know of any safety mishaps or safety hazard reports associated with the cooling towers. "I know there's not a RAC that has not been assigned to the cooling towers and not having a vibration safety switches... RAC stands for Risk Assessment Code and the local safety office here with the 50th Space Wing would have assigned that RAC. And I know they've been contacted several times, if you read through the complaint. The complainant contacted them several times and so they knew about the issue. Again, I—I don't have any documentation that they ever assigned a RAC to the cooling towers." In his opinion, he was not concerned about safety with the cooling towers. "[S]ince I've been here, there have not been any, I guess, catastrophic or personal issues. We, of course, have plant operators that work in that plant and they do the day-to-day maintenance. There's has not been a mishap, safety issue with any of those operators that maintain and look after those cooling towers as well as the chillers and everything else in there, so I guess, that's my rationale that there's not a safety issue."

According to [Deputy Base Civil Engineer], there was an inquiry to safety office with regard to the lack of vibration switches. The safety office had also received complaints regarding safety. [Deputy Base Civil Engineer] stated that the safety office "looked into it and never RAC coded the – the shafts or the vibration and never had approached anyone else from civil engineering after they had looked into it – to make any kind of adjustment or any kind of immediate change and I talked to the safety office and they had – it was different people that I had talked to then who he had – had emailed, but – but they had confirmed that they had looked at it and that they didn't see that it was a---an issue that needed to be addressed right away." [Deputy Base Civil Engineer] is not aware of anyone reporting a safety hazard report associated with the cooling towers (other than Mr. Anderson falling off the ladder) and none associated with the vibration controls or the oil level switches. To his knowledge, no safety hazards have been reported.

By a preponderance of the evidence, the IO found that, with the exception of Mr. Anderson, the lack of operational vibration and/or oil level switches is not a personnel safety concern for the Plant employees.

Other Matters

Air Force Space Command Instruction (AFSPCI) 32-1010, *Utility Outage and Incident Reporting*, 1 November 2004, states at paragraph 1.1 that "AFSPC tracks utility reliability by exception through utility outage reports." Included in the definition of "mission-critical" utilities is cooling distribution. (See id.) Paragraph 3 of AFSPCI 32-1010 requires reporting to higher headquarters (AFSPC) when "Red Time" or "Yellow Time" outages occur. "Red Time" is defined as "Critical Mission Downtime" and "[t]he amount of time that a mission is down due to an unscheduled outage of a Civil Engineer maintained or UPS system failure." (See AFSPCI 32-1010 at paragraph 2.2.2.) "Yellow Time" is defined as "Reduction of Critical Utility Redundancy" and "[t]he amount of time that mission redundancy is reduced due to an unscheduled outage of a Civil Engineer maintained or UPS utility system failure." (See AFSPCI 32-1010 at paragraph 2.2.3.) "Utility Yellow Time" is defined as "Mission is operating at diminished capacity due to a mission critical utility outage and loss of utility redundancy." (AFSPCI 32-1010 at paragraph 2.2.5.)

For "Red Time" outages, a preliminary report is required to be made within two hours from the time the incident or outage began. (See AFSPCI 32-1010 at paragraph 5.2.1.1.) An interim report is then required, filed within eight hours after the incident started or 1100 Zulu time[26] on the day of the incident, whichever is later. (See AFSPCI 32-1010 at paragraph 5.2.1.2.) A final report is then due when the outage or incident has been completely resolved, but only if the resolution occurs after the eight-hour time period specified for the interim report filing. (See AFSPCI 32-1010 at paragraph 5.5.1.3.) For "Yellow Time" outages, a preliminary report, an interim report, and a final report are also required, but the interim report is due 96 hours after the incident started and no final report is necessary if the problem is resolved within the 96 hour interim report time period. (See AFSPCI 32-1010 at paragraphs 5.2.2.1 and 5.2.2.2.) For

[26] Zulu time refers to the time standard of coordinated universal time, which is commonly known as the time at the prime meridian (previously Greenwich Mean Time). By referring to Zulu time, rather than local time, the military can use one universal time reference without having to adjust for time zone differences across the world.

scheduled outages, a "Precautionary Utility Incident Report" is required 48 hours prior to the actual outage. (See AFSPCI 32-1010 at paragraph 2.4.1.)

There was no evidence found that the cooling towers ever underwent a "Red Time" outage. In other words, the cooling towers have always functioned with a capacity high enough to provide adequate cooling and accomplish the mission. However, the plant operations logs provided by Mr. Anderson showed that one or more cooling towers were not operational for periods of time, including in some cases over 200 days. This evidence showed that, while the cooling function was always adequate, there was a decrease of redundancy during various times. Further, with these outages, the IO discovered that the 50 CES did not provide evidence that outages associated with the cooling towers were properly reported to AFSPC in accordance with AFSPCI 32-1010. The record reflects that no reports were submitted to AFSPC until September 27, 2011, which was when the IO asked if a report was submitted for a recent outage.[27]

The IO also found that there was a memorandum in the Central Utilities Plant indicating as early as November 2002 employees were directed to review utility outage and incident reporting procedures. The memorandum was signed by many of the same employees working in the plant now. The employees also had an All Purpose Checklist (Air Force Form 2519) for 50 CES utility outage reporting procedures, which was dated November 25, 2002. This document showed that the employees had procedures in place for reporting utility outages and incidents. In addition, an AFSPC Form 7 exists to make it simple to report mission critical utility outages

ANALYSIS

The IO did not substantiate that between 2004 and 2011, there was a substantial and specific danger to public safety due to the lack of operational vibration and oil level switches on the cooling towers. This investigation led to the conclusion that there is no evidence that the vibration and oil level switches have ever been installed, fully operationally or monitored. However, there is no known requirement for this equipment to be operational. By a preponderance of the evidence, the IO found that the vibration and oil level switches are a manufacturer recommendation or option for management officials to consider adding in project design while weighing risk management for potential damage to the cooling towers and associated components, as well as personnel safety. It is unknown why this optional equipment, some of which was installed around 1982, was not operational. However, the cooling towers have operated for over 25 years without injury to any employee or a member of the public due to damage occurring to cooling tower equipment.

The evidence further demonstrates that the likelihood of any danger resulting from the lack of such switches is minimal.[28] The cooling towers are located on a rooftop of a building away from the general public. The fans inside the cooling towers are enclosed in a cement shroud and covered with a metal grate. The only personnel having recurring access to these

[27] The Commander, 50 CES has indicated that at least one report had been submitted prior to this investigation.
[28] As previously stated, the cooling towers have sight glasses which Plant operators check to determine adequate oil levels. In light of Plant maintenance requirements and the availability of sight glasses to monitor oil levels, the installation of oil level switches would offer the utility plant a redundant safety device.

cooling towers are the Plant Operators, who have proper safety training to work around the cooling towers. Testimony indicates that even Plant operators engaged in maintenance of the cooling towers and its equipment have limited exposure to the roof area of the cooling towers. When it is necessary for employees to access the rooftop area for repair of equipment, the LOTO procedure provides protection for the employee when the employee is working on a cooling tower. While the Plant operators would be the ones who might face risk of injury due to a safety mishap with the cooling towers if one occurred, this possibility is mitigated through required and documented safety training.

In the worst-case scenario, the malfunctioning of a cooling tower fan due to unbalanced vibration and/or oil loss could result in the physical disintegration of some or all of the fan assembly. In that event, fan blades and/or other parts/components would probably be contained within the cement shroud and metal grating of the cooling tower, but could potentially breach the encasing at the top of the tower air shaft. In order for a person to be injured by flying debris in such a circumstance, not only would the debris have to pierce the protective casing of the tower but a person would also have to be on the rooftop in the vicinity of the tower at precisely the same time. The evidence showed that work requirements place Plant employees on the roof on an infrequent basis and that other members of the public are never within the vicinity of the tops of the cooling towers. While harm could occur to any plant employee given a possible (but highly unlikely) sequence of events, the chances of such a safety mishap are exceedingly low. As two witnesses testified, the odds of a safety mishap occurring in the foreseeable future are less than one percent. Because the risk of physical harm is so attenuated and minimal, it could not be said that the lack of vibration switches or oil level switches on these cooling towers posed a substantial danger to public safety.

Other Matters

In his statement (as well as earlier complaints and correspondence with Schriever AFB officials), Mr. Anderson identified non-compliance with a mandatory reporting requirement regarding reduced redundancy of mission-critical utility systems. Indeed, the apparent failure to provide "Yellow Time" reports to AFSPC constitutes a potential violation of AFSPCI 32-1010, paragraphs 5.2.2.1 and 5.2.2.2. This is significant because the cooling towers conduct a mission-critical function. While there were no outages associated with the seven cooling towers that directly resulted in a loss of mission capability, there was a clear loss of utility redundancy. AFSPC cannot fix or address a problem if it is not notified of the outages or extended downtimes associated with the cooling towers.

CORRECTIVE ACTION

As a result of this investigation, the discovery that there was false information contained in the February 15, 2010 Defense Hotline Report, and upon greater leadership involvement in the unit, the 50 CES reviewed their open work requests and expedited a previously submitted work order request dated June 24, 2010 (which had been incorporated into a large engineering repair project) to have operational vibration switches installed and monitored at an estimated cost of $24,000. Once installed, the vibration switches will shut down the cooling tower and send a

signal to the ATCC if excessive vibration in the tower occurs. The installation of these switches should eliminate the extremely minimal risk now posed to Plant employees, as well as act as a preventative measure to the potential for costly damage to the cooling towers. The work order was awarded as of September 14, 2011 and is expected to be complete in or about the middle of December 2011. There are no plans to install and monitor oil level switches which will therefore remain an item for the Plant operators to routinely check off manually. However, the oil level sight glasses on every tower have been replaced, and those that had been located inside the towers were relocated outside the towers. Locating the sight glasses on the outside of the concrete structures of the towers will allow Plant employees the ability to quickly and accurately check oil levels on each tower.

In addition, all Plant employees were provided annual lockout/tagout training in August 2011, possibly as a result of interview inquiries.

Mr. Anderson brought it to the attention of the IO that a cooling tower went down in September 2011. As a result of the investigation, 50 CES is now making proper outage reports as required under AFSPCI 32-1010.

CONCLUSION

Upon review of the evidence and testimony adduced during the investigation, and based upon a preponderance of the evidence, the IO did not substantiate the allegations, finding that there is not a substantial and specific danger to public safety, even though the cooling towers do not have optional operational vibration and oil level switches. The IO did find an apparent violation of AFSPCI 32-1010, paragraphs 5.2.2.1 and 5.2.2.2, which require the 50 CES to report "Yellow Time" outage reports to AFSPC.

The investigation did not reveal a criminal violation. Therefore, referral to the Attorney General, pursuant to 5 U.S.C. Sections 1213(c) and (d) is not appropriate. This Report is submitted in satisfaction of my responsibilities under 5 U.S.C. Sections 1213(c) and (d).

APPENDIX

WITNESSES INTERVIEWED
(Alphabetical Order)

Keith D. Anderson (Complainant)
[Power Plant Operator 4]
[Deputy Chief of Operations]
[Trane Employee 2]
[Control Technician]
[Power Plant Operator 1]
[Technical Sergeant 1]
[Deputy Base Civil Engineer]
[Plant Supervisor 1]
[Power Plant Operator 3]
[Power Plant Operator 2]
[Trane Employee 1]
[Lieutenant Colonel 1]

ABBREVIATIONS USED

AFB – Air Force Base
AFI – Air Force Instruction
AFOSH – Air Force Occupational Safety and Health
AFOSHSTD – Air Force Occupational Safety and Health Standard
AFSPC – Air Force Space Command
AFSPCI – Air Force Space Command Instruction
AFSPC/IG – Inspector General of Headquarters Air Force Space Command
AFSPCI – Air Force Space Command Instruction
ATCC – Automatic Tracking and Control Center
BTU – British Thermal Unit
CES – Civil Engineering Squadron
DoD – Department of Defense
EMCS – Energy Management Control Systems
HVAC – Heating, Ventilation and Air Conditioning
IG – Inspector General
IO – Investigating Officer
IO2 – Subject Matter Expert (second investigating officer)
JSTO – Job Safety Training Outline
LOTO – Lockout/Tagout
Lt Col – Lieutenant Colonel
Maj – Major
MSgt – Master Sergeant
O/L – Online

O&M - Operations and Maintenance
OSC – Office of Special Counsel
RAC – Risk Assessment Code
RPM – Rotations per Minute
SAF/IG – Air Force Inspector General
S/B – Standby
SSgt – Staff Sergeant
TAD – Technical Assessment Directorate
TSgt – Technical Sergeant
USAF – United States Air Force