

**Performance Audit 16-03:  
Fire Equipment Maintenance**

**February 2017**

**City Auditor**

Stan Sewell, CPA, CFE, CGFM

**Internal Auditor**

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# OFFICE OF INTERNAL AUDIT

## Stan Sewell, City Auditor

February 28, 2017

To: Mayor Andy Berke  
City Council Members

Subject: Fire Equipment Maintenance (Report #16-03)

Dear Mayor Berke and City Council Members:

The attached report contains the results of our audit of Fleet Division fire equipment maintenance. Our audit found the Fire Maintenance section of the Fleet Division is well managed and organized. Fire maintenance employees appear to enjoy their jobs, working well together to accomplish their task. Their job is to ensure the fire apparatuses function properly to enhance safety for the public and fire employees while on route, and after arrival at the scene. Chattanooga Fire Department (CFD) management is generally pleased with the maintenance service provided them, as well as the concern Fleet staff show for the safety of CFD personnel. CFD indicated Fleet maintenance often works late and Saturdays to keep their front-line fire apparatuses running and in service.

We found, fire apparatuses are not always replaced within industry standard timeframes. On occasion, preventative maintenance was not conducted, critical tests were not taken and/or results were not received from the vendor. There is also a lack of written policies and procedures. In order to address the noted areas for improvement, we recommended actions to explore purchasing fire apparatuses through the Fleet leasing program, determine and address the reason test results are not received and development of industry compliant written policies and procedures.

We thank the management and staff of the General Services, Finance and Fire Department for their cooperation and assistance during this audit.

Sincerely,

Stan Sewell, CPA, CFE, CGFM  
City Auditor

Attachment

cc: Audit Committee Members  
Stacy Richardson, Chief of Staff  
Maura Sullivan, Chief Operating Officer  
Chris Adams, Fire Chief  
Cary Bohannon, Director, General Services  
Brian Kiesche, Manager, Fleet Division  
Carlos Tibbs, Logistics and Technology Chief, CFD

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## AUDIT PURPOSE

This audit was conducted in accordance with the Office of Internal Audit 2016 Audit Agenda. The objectives of this audit were to determine if:

- The Fleet Division has effective processes to ensure fire apparatuses are maintained in accordance with National Fire Protection Association (NFPA) standards; and
- The Fleet Division has effective controls to ensure outsourced work is completed properly.

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## BACKGROUND

The City of Chattanooga Fire Department (CFD) possesses a diverse vehicle fleet. The fleet includes 38 pieces of front-line fire-fighting apparatuses. There are also 7 units of fire-fighting apparatuses in reserve and 2 additional units for training. The maintenance of front-line apparatuses was the primary focus of this audit.

CFD front line fire-fighting apparatuses range in age from new to 37 years. The average age of front-line fire-fighting apparatuses is 12.4 years. In addition to the above fire apparatuses, CFD also uses 3 quick response vehicles, 3 brush trucks, 1 fire boat, 2 fuel trucks and 1 mass casualty bus. CFD also has autos, small trucks, SUV's, utility terrain vehicles, generators and trailers in their fleet.

Responsibility for maintaining fire-fighting apparatuses lies with the Fleet Division of the General Services Department. The Fleet Division has five maintenance bays dedicated to fire apparatuses. The fire equipment on the boat is serviced by the Fleet Division, while the boat is serviced at a local boat dealer. The SUV's, small trucks and autos are serviced by the regular service area of the Fleet Division.

The Chattanooga Fire Department (CFD) is a member of the National Fire Protection Association (NFPA). NFPA is a trade association that creates and maintains private, copyrighted standards and codes for usage and adoption by local governments. NFPA develops, publishes and disseminates more than 300 codes and standards intended to minimize fire and other risks.

The Fleet Division bases fire apparatuses maintenance policies for the differing apparatuses on NFPA standards, primarily NFPA 1901 – *“Standard for Automotive Fire Apparatuses”*, NFPA 1911: *“Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service*

*Automotive Fire Apparatus” and NFPA 1915: “Standard for Fire Apparatuses Preventive Maintenance Program.”*

Fleet management designs fire apparatuses preventive maintenance (PM) schedules to comply with NPFA standards, along with compliance with manufacturer’s warranty requirements. Several PM schedules are in place to meet the specifications for equipment on the fire apparatuses. Most preventive maintenance is performed under two schedules, at six month or annual intervals. PM testing on items such as pump pressures, aerials (hydraulic ladders) and seldom used equipment are performed annually. Front-line equipment PM services are on a six-month schedule. Maintenance issues related to breakdowns, specific apparatus issues, etc. are corrected as they occur. Maintenance personnel qualifications are also developed with NFPA standards in mind.

Achieving well-maintained apparatuses requires vigilance by both maintenance personnel and the operators of the apparatuses. CFD personnel perform daily and weekly checklist inspections. The maintenance personnel perform periodic maintenance (PM) while being vigilant for any issues they may find outside the requirements of the PM.

The fire maintenance section of the Fleet Division consists of five technicians and a shop supervisor. The length of City employment of employees range from twenty-three years to one year. The average length of employment is 11.5 years. Two employees have been employed one year, one five, one seventeen and two greater than twenty years.

**Financial Information**

Exhibit I: Fire Maintenance Expenditures FY 2011-FY 2016

|      | Parts   | Labor   | Total   | Budget  | Budget Variance |
|------|---------|---------|---------|---------|-----------------|
| 2011 | 546,221 | 369,340 | 915,561 | 796,000 | (119,561)       |
| 2012 | 415,690 | 317,874 | 733,564 | 775,000 | 41,436          |
| 2013 | 512,213 | 338,046 | 850,259 | 770,000 | (80,259)        |
| 2014 | 515,536 | 361,880 | 877,416 | 770,000 | (107,416)       |
| 2015 | 492,610 | 320,204 | 812,814 | 887,000 | 74,186          |
| 2016 | 495,435 | 365,221 | 860,656 | 826,154 | (34,502)        |

Source: Oracle Financial

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## FINDINGS AND RECOMMENDATIONS

### **Fire equipment replacement is driven by Capital Budgeting constraints.**

NFPA standard 1901, Annex D recommends fire apparatuses be upgraded as much as possible to NFPA standards and moved to reserve status after 15 years. The standard further recommends fire apparatuses be replaced after 25 years.

CFD currently has fourteen pieces of front-line apparatuses with 15 years of service or greater, including four in service 25 years or greater. The oldest is a tanker with 37 years of service. In addition, there are six additional units in reserve or training functions with 25 or more years of service.

CFD keeps a detailed fire apparatus replacement schedule considering factors such as apparatuses age, life-to-date maintenance costs and other issues. This schedule is not used to schedule replacements due to inconsistent funding through the capital budgeting process. Therefore, some fire apparatuses remain in service longer than planned, as well as longer than NFPA recommendations. Some new safety standards cannot be integrated onto older apparatuses due to changes in the build, reducing effectiveness and safety.

In a 2002 “*City of Chattanooga Fleet Study*” MTAS recommended all City vehicles be owned by the Fleet Division, and leased to end users. The program has been implemented over most City vehicles. The program allows for organized, regularly scheduled, vehicle replacement. Fire apparatuses is not included in the vehicle lease program. CFD felt this was an option they would like to explore, under the condition they determine the specifications for all apparatuses obtained through the leasing program.

### **Recommendation 1:**

We recommend CFD and Fleet management investigate placing firefighting apparatuses into a leasing program with pre-determined replacement dates.

### ***Auditee Response:***

*We concur with the finding and recommendation.*

### ***Auditee Response (CFD):***

*The Chattanooga Fire Department has many levels of concern when it comes to a leasing program. We have investigated the leasing concept several times in the last ten years. We found departments lost control over specifications as the programs went along. As new mayors are elected, the plans were changed and departments were left with*

*dilapidated apparatus. It also taxed their budgets as new mayors came into office and changed funding streams. Also mileage is a concern if a plan was similar to our present vehicle lease program. Many of our apparatus travel a large distances per shift twenty four seven. Pre-determined replacement dates have been in place for years. As stated above, each administration has its own priorities and is dependent on the economy. Due to these reasons apparatus replacement funding may not be approved. Having stated all that, we should always strive to make the best use of the taxpayer dollar. We must also make certain we keep our firefighters safe by having reliable equipment. In order to investigate a leasing program, we will need to start out working through these concerns.*

**There are issues with oil sample testing.**

Oil tests are scheduled to be pulled from all apparatuses with pumps at each PM and sent to an outside vendor to test for metal shavings, soot, water, etc. There are four levels of comment: normal, caution, abnormal and severe. Abnormal and severe findings result in the apparatuses being brought in to investigate the cause of the issue.

We found documented abnormal and severe readings had been addressed promptly during a two-year period we tested.

We found 5% of oil test kits were not completed with the PM in our testing period.

We found 14% of oil sample test results were not received from the vendor during a two year test period. Missed oil samples may result in an accident and/or serious damage to equipment. Oil sample kits were listed on the work order as performed, but results were not documented. The supervisor indicated there had been trouble for several years getting the samples mailed properly. He stated the testing vendor is located in the vicinity of the Amnicola shop and he is exploring taking the samples directly to that location.

**Recommendation 2:**

We recommend the process and training be updated to ensure an oil sample kit is pulled and mailed as part of each periodic maintenance and a procedure developed to ensure they are delivered to the vendor.

***Auditee Response:***

*We concur with the finding and recommendation.*

**Recommendation 3:**

We recommend a written policy be put in place assigning a position responsibility for recording the date tests are forwarded to the vendor

and the date results are received back, with an appropriate timeframe for results to be received, and follow up procedures developed for sample results not received by that date.

***Auditee Response:***

*We concur with the finding and recommendation.*

**Procedures are needed to ensure equipment is properly maintained.**

A well thought out and implemented preventative maintenance program for fire apparatuses reduces apparatus and fire crew downtime, roadside service calls and apparatus malfunctions on scene. A well maintained fire apparatus provides increased safety for both fire crews and the general public. Regular preventive maintenance reduces overall repair expense while improving safety.

NFPA 1915, “Standard for Fire Apparatuses Preventive Maintenance Program”, Section 2.1.2 states, in part: “ It shall be the responsibility of the authority having jurisdiction to develop and implement a schedule of service and maintenance for the fire apparatus, system, and components, based upon manufacturers’ recommendations, local experience and operating conditions.”

**Periodic maintenance has been missed on some fire apparatuses.**

Unwritten Fleet policy dictates front-line apparatuses receive periodic maintenance each six months. The PM is performed using a checklist based on NFPA standards 1901 and 1915. Missed periodic maintenance may result in an accident, delayed response or damage to equipment.

We found three instances during the periods we tested, (FY15 and FY16) where apparatuses had not received a six month maintenance within the limits of the City’s unwritten requirements. Two were front-line apparatuses. The third was a reserve engine.

Unwritten Fleet policy requires seldom used apparatuses receive a PM at a one year interval. These apparatuses include brush trucks, fuel trucks, Hazmat trucks and urban search and rescue vehicles. Training apparatuses are not in service and are maintained as needed.

We found two seldom used hazardous material trucks had not had a full preventive maintenance service since 2010 and 2011. Also, there were three urban search and rescue trucks that had not received complete preventive maintenance service for several years, and a rarely used mass casualty bus has not had a full PM since 2014. If not fully maintained for extended periods of time, these vehicles may not operate properly when needed.

**Recommendation 4:**

We recommend steps be taken to ensure each apparatus receive a PM at the appropriate time interval for its status, per policy.

***Auditee Response:***

*We concur with the finding and recommendation.*

**Recommendation 5:**

We recommend a written policy be developed and placed in the policies and procedures manual requiring each apparatus receive periodic maintenance at its scheduled timeframe.

***Auditee Response:***

*We concur with the finding and recommendation.*

**Proper training of personnel improves job skills.**

The job description for a Mechanic 1 states they must obtain an ASE Brake certification within one year of hire. A mechanic was hired to a Mechanic 1 position August 2015 and has not been registered for the brake certification class.

**Recommendation 6:**

We recommend Fleet management develop a procedure to ensure all employees have access to required training.

***Auditee Response:***

*We concur with the finding and recommendation.*

**Develop procedures to document testing to confirm successful completion of outsourced repairs.**

The Fire Maintenance section of Fleet Maintenance seldom outsources work, approximately three to five times per year, primarily on a front line apparatus when the shop has a backup for repairs.

A work order is opened when an apparatus is sent for repair at an outsourced vendor. The work order tracks the whereabouts of the apparatus and the associated problem. It also contains an entry noting invoice number and amount charged by the vendor.

When the apparatus is returned from the vendor it is checked to ensure the repair was performed properly. If the repair involves anything that could affect the fire apparatus, the entire system is checked for proper

operation. When testing is completed the apparatus is returned to service and the work order closed. Testing performed when the apparatus is returned from the vendor is not noted on work orders.

No formal procedures or guidelines are in place to guide outsourced work and detail the testing to be performed upon its completion. With a change in management or staff turnover, the informal policy of common sense checks currently in place could be lost.

### **Recommendation 7:**

We recommend Fleet personnel note on the work order any work performed to test outsourced work.

#### ***Auditee Response:***

*We concur with the finding and recommendation.*

### **Recommendation 8:**

We recommend management develop written procedures stating the steps to be taken when an apparatuses is sent to an outside vendor, as well as steps to check out the apparatus when it is returned.

#### ***Auditee Response:***

*We concur with the finding and recommendation.*

## **Lack of written Policy and Procedure Manual.**

Component 1, Control Environment of the *Internal Control and Compliance Manual for Governmental Entities and Other Audited Entities in Tennessee* requires the development of a manual that provides sufficient documentation of internal control to communicate to personnel their responsibilities, as well as to monitor and evaluate the controls.

The Fire Maintenance section performs many tasks related to maintenance of fire apparatuses, and has developed procedures as to how they are to be accomplished over time. However, Management has not formalized these procedures in written form.

With no written policies, current practices could be dropped or performed incorrectly, possibly leading to failure of equipment. This risk would be substantially increased with staff personnel changes. Also, newer employees, as well as employees performing tasks with which they are unfamiliar, cannot access a written source for instruction.

**Recommendation 9:**

We recommend Fleet management develop a comprehensive, NFPA compliant, Fire maintenance Policy and Procedure Manual. **We have recommended the development and issuance of a comprehensive policy and procedure manual for the Fleet Division in multiple previous audits.**

***Auditee Response:***

*We concur with the finding and recommendation.*

**A comprehensive record retention program is needed.**

All service requests in the Fleet Division originate with a handwritten work order. The mechanic assigned the repair details the steps taken to complete the task and makes notes on the work order. This information is entered into Ron Turley Associates software (RTA) which is the Fleet Division book of record. It is used to record maintenance and prepare invoices. Parts used and associated cost are electronically assigned to the work order as parts are received from the parts desk. Predetermined labor rates for each type of work are assigned to the work order by RTA, which produces a final invoice. All information on the work order is recorded in RTA, with the exception of the notes by the mechanic or supervisor. RTA reports are available detailing period or life-to-date costs of repair and maintenance for each piece of fire apparatus.

Original work orders and related backup sheets are stored after being entered into RTA. The original paper work orders for FY 2016 were available through March, 2016. Paper records from April 2016 through October 2016 had been misplaced and could not be located. We also found portions of the prior fiscal year work orders to be missing. The City Record Retention Policy requires fleet records be retained for the life of the apparatuses plus two years.

**Recommendation 10:**

We recommend Fleet management develop a method of records inventory to track when/where records are moved to storage, as well as their location in the storage room. We would also recommend controlled access and a check out system be put in place. **This was previously recommended in Audit 09-12.**

***Auditee Response:***

*We concur with the finding and recommendation.*

**Recommendation 11:**

We recommend Fleet employees receive training on City Records Retention policy.

***Auditee Response:***

*We concur with the finding and recommendation.*

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## APPENDIX A: OBJECTIVES, SCOPE AND METHODOLOGY

Based on the work performed during the preliminary survey and the assessment of risk, the audit covers Fleet Division fire equipment maintenance from July 1, 2014 to June 30, 2016. When appropriate, the scope was expanded to meet the audit objectives. Source documentation was obtained from the Fleet Division and the Finance Department. Original records, as well as copies were used as evidence and verified through physical examination.

To evaluate the efficiency of the fire equipment maintenance, we reviewed MTAS recommendations, NFPA standards, reviewed fire apparatuses maintenance records and vendor records for outsourced repairs.

To develop our recommendations, we reviewed documentation from the National Fire Protection Association standards, as well as MTAS and the *Internal Control and Compliance Manual for Governmental Entities and Other Audited Entities in Tennessee*.

The sample size and selection was based upon 100% of the periodic maintenance performed from July 1, 2014 to June 30, 2016.

Ron Turley Associates computer system (RTA) was utilized to review work orders for this audit.

Reliance was placed on computer processed data taken from the City financial system. The City financial system has previously been subjected to testing and deemed reliable to be used in meeting the audit's objectives.

We conducted this performance audit from August 2016 to December 2016 in accordance with generally accepted government auditing standards. Those standards require we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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