

**CITY OF HOUSTON**  
INTER OFFICE CORRESPONDENCE

To: City Council Members

From: Annise D. Parker  
City Controller

Date: March 2, 2006

Subject: Automated Meters  
Limited Review and  
Risk Assessment

**INTRODUCTION**

The City Controller's Office Audit Division (Audit Division) has conducted a limited review and risk assessment of the Public Works and Engineering Department's (PW&E) Automated Meter Reading Program (AMR) that is managed by their Utility Customer Services Branch (UCS). Our review included the unlocated water meter situation that exists within the water system. The objectives of our work are as follows:

1. Obtain a general background and understanding of the policies, processes and procedures used in the implementation of the Program as well as its goals and objectives.
2. Determine the concerns and issues of PW&E management particularly as they relate to the unlocated meters.
3. Obtain and review any prior audits that have been performed with respect to the Program.
4. Obtain an overview of the Program's tools and resources.
5. Obtain an overview of system maintenance processes, with particular attention to quality assurance and non-reporting (or unlocated) meters.
6. Determine the number of automated water meters that are "unlocated" and whether there is a plan to identify and locate the meters.
7. Determine if revenues are being lost due to the meters being unlocated.
8. Prepare an overall assessment to identify any high-risk areas.

**EXECUTIVE SUMMARY**

Overall, the UCS is commended for their thorough research, planning and implementation of the AMR Project. The project began in 1999 when the City of Houston's manually read meters began to be exchanged with the new automated readers. Originally, PW&E requested and was authorized the change out of 400,000 meters; now that number has increased to a total of 455,000 meters. Currently, approximately 403,000 meters have been replaced out of the 455,000, resulting in an 88% completion rate. The City of Houston (City) is the first major city to implement this automated system within an in ground application.

Additionally, Itron, Inc. (Itron), the manufacturer of the AMR systems, is also acknowledged for their cooperation in aiding the City in completing this massive undertaking. In several instances, Itron agreed to assist in installing meters and replacing equipment that exceeded their contract terms. During the course of installation, the City has returned 134,000 ERTs, and Itron replaced 105,000 of those at no charge to the City. Of the 105,000 returned ERTs, 89,000 of them were out of warranty, which amounts to a savings of \$5,429,000.

As explained more fully in the details of this correspondence, we have sited two areas of risk that should be noted. The first area is the issue of the approximately 13,000 unlocated meters, representing 3% of the total. Only 34% of these unlocated meters are active and billable, and most are receiving estimated bills. UCS is very aware of the issues involved with the unlocated meters, and they are taking steps to remedy the problem. UCS is budgeting for two important technologies that should aid in the problem of unlocated meters, beginning in fiscal year 2007. The first is a locator device that uses radar technology to detect and locate utilities up to a depth of 30 meters below ground. The second is a GPS system that will map new and existing installations, so that in the future, meters; mains; valves; etc. will be easily located by tagged coordinates.

The second area of risk identified is the issue of Encoder Receiver Transmitters (ERT) failures. ERTs are the radio device that encodes water consumption once it is connected to the meter, and is read by a van-mounted computer. Currently, there are approximately 55,000 ERTs that are not emitting the radio frequency; this results in a meter reader being dispatched to manually read the meter. None of these ERTs are still under warranty and will need to be replaced at the City's expense. If they are replaced with Itron's ERTs, the cost is \$61 each, for a total of \$3,355,000. From the beginning of this Program, UCS projected a 5% failure rate; however, due to the original ERT design, that has not been the case. Approximately 189,000 out of 403,000 ERTs (47%) have been or will be required to be replaced. However, the newer AMR transmitter models have been improved through addition of a second battery and permanent sealing of all potential water intrusion points and are expected to be more reliable than the original ones installed. Therefore, management currently anticipates only a 5% failure rate.

## **BACKGROUND**

Before the advent of the AMR Program, PW&E manually read each of the water service meters spread out over 617 square miles. The AMR Program is equipping each of its meters with an ERT that allow the meters to be read remotely. A van-mounted computer can read the meters from a distance of 300 feet allowing one person to perform the amount of work in a day that had previously taken 62 meter readers to accomplish.

In addition to obtaining an understanding of the AMR system, we also focused on the unlocated meters within the City's water system. In order to review the unlocated meters, we were provided a database that contained a listing of 12,827 meters that could not be located in November 2005. However, review of these meters revealed that 8,171 (64%) of those meters were categorized as "No Customer". This category is determined either by the customer calling in and terminating service or by UCS field investigations. "No Customer" means that the meter is not being used by anyone, and therefore creates no billing or revenue activity. There are several reasons that this can occur but in general they are: 1) the meter is located in a currently vacant lot; or 2) the meter is located at an abandoned or vacant house. Even though UCS records indicate where the meter is located, it does not necessarily mean they can physically

find the meter. The meter could be under cement, covered with landscaping, been arbitrarily moved, or the description of the location of the meter is incorrect in their records.

The remaining 4,656 unlocated meters includes 288 City facility accounts. The following table breaks down the status of the 12,827 unlocated meters.

Column A	Column B	Column C	Column D	Column E
Meter Descriptions	Number of Unlocated Manually Read Meters	Number of Unlocated AMR Meters	Amount Billed to Unlocated Meters in November 2005	Revenue Collected in the First Period after November 2005
Number of "No Customer" Accounts	7,176	995	\$0.00	\$0.00
Number of Customer Accounts	2,585	1,783	\$477,892	\$541,683*
Number of City Facility Accounts	242	46	\$0.00	\$0.00
Total Number of Unlocated Meters	10,003	2,824**	\$477,892	\$541,683

\*It is difficult to tie amounts invoiced in a particular month to the collections received in the following month. Customers do not always pay the exact amount invoiced. For instance, the revenue collected shown in Column E includes \$104,860 in excess of what 1,549 customers were actually invoiced for November 2005.

\*\*Some of these meters include meters that occasionally do not respond to the radio frequency. Several things, including weather conditions, obstructions or a bad ERT can cause this problem.

In order to address each of the eight objectives in greater detail, this correspondence is divided in eight sections.

## Section 1

*Obtain a general background and understanding of the policies, processes and procedures used in the implementation of the Program as well as its goals and objectives.*

As early as 1986, UCS began its research in the field of automated meter reading technology. They began attending related technology conferences in order to keep apprised of current technologies. UCS spent a great deal of time and energy determining if the AMR Program would benefit not only the City, but also its water customers. Finally, a system emerged that fit the City's needs, and in 1998 Houston City Council approved a contract to begin replacing and automating the City's water meters.

From the onset of the Program, it was apparent that the new meters worked well. Revenues increased because many of the old meters had been reading lower levels of water usage than

were actually being used due to their age. This information caused UCS to reassess their installation schedule and opted to begin increasing the installation rate. Additionally, according to a 2002 KPMG review of the AMRs, KPMG agreed with UCS that the change outs should be expedited in order to capitalize on the additional revenue the City was collecting due to the new meters.

Written policies and procedures regarding the installation of the AMRs can be found in the original scope of work within the installation contract with the Texas Institute of the Blind and Handicapped (TIBH), a not for profit organization. The scope of work was modeled after existing policies and procedures utilized by UCS personnel since inception of the project in 1998.

The goals of this Program are to be 95% complete by October 2006. The remaining 5% are the unlocated meters and meters that will require special installation techniques.

## **Section 2**

*Determine the concerns and issues of PW&E management particularly as they relate to the unlocated meters.*

UCS is aware of the unlocated meters and has considered various options to deal with the situation. However, due to the low occurrence of these unlocated meters (3% of total City meters), PW&E is focusing on changing out the locatable manual meters at this time, and will save these unlocated meters until the end of the Project.

UCS is budgeting for two important technologies that should aid in the problem of unlocated meters. The first is "ground penetrating radar" equipment. This equipment uses radar to detect and locate utilities up to a depth of 30 meters below ground. The second is a GPS system that will map where the current meters are being installed, so that in the future the new meters do not also become unlocated meters. If this locating equipment works, then UCS will be able to find the meter and determine what events should occur next. If the homeowner caused the meter to be covered, then UCS will require the homeowner to unearth the meter. If the City caused the meter to be covered, then the City will be responsible for freeing the meter.

## **Section 3**

*Obtain and review any prior audits that have been performed with respect to the Program.*

KPMG performed two separate studies on the AMR Project. The first one in 1999 was done ..."solely to assist you (PW&E) with respect to determining the mathematical accuracy of the calculations of the net present value savings related to your operation analysis of the cost/benefit of purchasing an automated meter reading system." KPMG found no mathematical errors, but it should be noted that KPMG did not review PW&E's methodology or assumptions used in the cost/benefit scenario.

The second KPMG project in 2001 obtained and analyzed data in order to assess the benefits realized through the AMR Project to date, and to assist management in the development and updated implementation plan along with a related cost/benefit analysis. This review ultimately

encouraged PW&E to expedite the change out of the meters within a two year time period, and sited a seven-year annual average return on capital of 54.91%.

## **Section 4**

*Obtain an overview of the Program's tools and resources.*

The Itron System is a complete package that includes both the software and hardware needed to read water meters via radio signals. Once UCS has installed the ERTs, they are able to read the meters by using Itron's computerized system that are loaded onto meter reading vans. The meter reader drives their assigned route, and the ERTs send their signal to the computer on the van.

Once the route is completed, the data is uploaded to a database, and ultimately transferred to the billing section where the invoices are generated and mailed to the customers.

## **Section 5**

*Obtain an overview of system maintenance processes, with particular attention to quality assurance and non-reporting (or unlocated) meters.*

Currently, there are approximately 55,000 installed ERTs incapable of being read by the radio frequency. When this occurs, the van-mounted computer recognizes that the meter was unread. When the meter reader downloads his database after completing his route, the meters that were not read are recognized and a meter reader will be dispatched to the meter so that it may be read manually.

There can be many explanations for the meter not transmitting its radio frequency. According to UCS, through sampling and review of accounts that have been corrected, they have identified causes that include but are not necessarily limited to: material defect, customer tampering, and battery failure. The 55,000 meters are being changed out as new units and the manpower to install them becomes available. None of these ERTs are still under warranty and will need to be replaced at the City's expense. If they are replaced with Itron's ERTs, the cost is \$61 each, for a total of \$3,355,000.

Because the City was the first major city to implement this Program, it was anticipated that there would be a period of transition and unexpected situations would be encountered. From the beginning of this Program, UCS projected a 5% failure rate; however, due to the original ERT design, that has not been the case. Approximately 189,000 out of 403,000 ERTs (47%) have been or will be required to be replaced. However, the newer AMR transmitter models have been improved through addition of a second battery and permanent sealing of all potential water intrusion points and are expected to be more reliable than the original ones installed. Therefore, management currently anticipates only a 5% failure rate.

Additionally, if the meter is an unlocated meter it is billed based on the meters average historical water consumption. Briefly, average consumption is estimated by using the billed meter history to obtain a daily usage. That daily usage is then multiplied by the number of days in the billing cycle. The result will be the amount billed to the customer.

## **Section 6**

*Determine the number of automated water meters that are "unlocated" and whether there is a plan to identify and locate the meters.*

In November 2005, there were 12,827 unlocated meters, and 2,824 of those were the new AMR style meters (22%). PW&E currently utilizes several methods such as metal detectors, thumping device, and heavy equipment to locate meters on an as needed basis. Long term planning also includes implementation of previous discussed technology enhancements. Equally important, it should be noted that there are accounts that have been automated yet have been covered by landscaping, construction, et al. These accounts are also classified as "can't locates" yet, the accounts are billed by average use. To prevent this issue from escalating, UCS is planning to implement a GPS tracking system. This is critical to the AMR Program because it will be able to pinpoint not only the exact location of the new meters, but also their tie-in points into the main line as they are being installed.

## **Section 7**

*Determine if revenues are being lost due to the meters being unlocated.*

The unlocated meters get invoiced based on the meters historical average consumption. However, UCS does not perform any type of unique collections analysis on these accounts; therefore it is difficult to determine what, if any, revenue is being lost due to the unlocated meters. However, the Collections Section does maintain a monthly list of twenty unlocated meters they have determined should be located. This list is forwarded to UCS Field Operations, and as the time and resources become available, the unlocated meters are investigated. The list can change from month to month, but in general, the list includes meters that have not been read for over a year, or the water usage for a particular meter is in question.

## **Section 8**

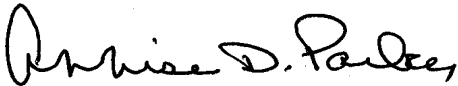
*Prepare an overall assessment to identify any high-risk areas.*

Based on our review, we have sited two areas of risk that should be noted. The first area is the issue of the approximately 13,000 unlocated meters, representing 3% of the total. Only 34% of these unlocated meters are active and billable, and most are receiving estimated bills. UCS is very aware of the issues involved with the unlocated meters, and they are taking steps to remedy the problem. UCS is budgeting for two important technologies that should aid in the problem of unlocated meters, beginning in fiscal year 2007. The first is "ground penetrating radar" equipment. This equipment uses radar to detect and locate utilities up to a depth of 30 meters below ground. The second is a GPS system that will map where the current meters are being installed, so that in the future the new meters do not also become unlocated meters.

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Please call Steve Schoonover at 713-247-2447 if you have any questions regarding this matter.



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