

**Review of
Allegheny County's
Emergency Services
911 Division's
System Malfunction that
Occurred on October 25, 2006**

May 22, 2007

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February 26, 2007

Mr. Robert Full
Chief of Emergency Services
400 North Lexington Street
Pittsburgh, PA 15208

Subject: Review of Allegheny County's
Emergency Services 911 Division's
System Malfunction that Occurred on October 25, 2006

Dear Chief Full:

The Controller's Office reviewed the operations of Allegheny County's Emergency Services 911 Division to identify the contributing factors that led to the 911 system malfunction on October 25, 2006 and to provide recommendations concerning the procedures, processes, design, and management of the system. Combest, Inc. was engaged to supplement our own staff review and provide outside expertise to the study. The recommendations in this review are based on the combined knowledge and expertise of Combest, Inc. and the Allegheny County Controller's Office.

Our review revealed that the current 911 telecommunications network is of logical design, using industry-standard technologies. However, the implementation, management, and support of the 911 network are inadequate. Kimball and Associates have failed to provide sufficient contractual negotiation services, project management skills or operational guidance and the County has been left with an insufficiently managed and poorly supported 911 system. Additionally, Kimball and Associates have not created and implemented processes within the 911 environment. Additionally, the services being provided by Embarq are inadequate, their pricing is not competitive, and their ability to operationally maintain the County 911 system after the successful completion of Phase II is in doubt.

Chief Robert Full
February 26, 2007

The 911 team, including the County, Kimball and Associates, and Embarq has allowed the 911 system to operate without effective processes or controls. There is no central day-to-day control of the Embarq contract, and as such there is no reporting available on the service provided from that contract.

Proper planning and preparation could have avoided the incident on October 25, 2006 from occurring. Kimball and Associates and Embarq should be considered deficient in their duties, failing to deliver to the agreed contractual terms of the work and overcharging the County for services rendered. These vendors should not be viewed as delivering a high value service to the County, but as vendors that are not adequately managing a critical service for County constituents.

We recommend that all contracts with Kimball and Associates and Embarq be carefully reviewed and a review be conducted of the services delivered to date. The Controller's Office in conducting this review intend to ensure the efficiencies of any operational or project based tasks within the 911 team and ultimately to improve the service to the County's constituents. The results of our findings and recommendations are detailed in the report.

Very truly yours,

Lori A. Churilla
Assistant Deputy Controller, Auditing

MARK PATRICK FLAHERTY
Controller

cc: Honorable Richard Fitzgerald, President of Allegheny County Council
Honorable William Russell Robinson, Allegheny County Council
Honorable Dan Onorato, Chief Executive
Mr. James Flynn, Jr., Allegheny County Manager
Ms. Amy Griser, Budget Director
Mr. Joseph Cantanese, Council's Chief of Staff, Allegheny County
Ms. Jennifer Liptak, Budget Officer, Allegheny County Council
Mr. Guy A. Tumolo, Deputy Controller, Controller's Office
Mr. Robert J. Lentz, Assistant Deputy, Accounting, Controller's Office
Ms. Pamela Goldsmith, Communications Director, Controller's Office

EXECUTIVE SUMMARY

Purpose:

The Controller's Office in conjunction with its consultant Combest, Inc. reviewed Allegheny County's Emergency Services 911 Division relating to the 911 system malfunction that occurred on October 25, 2006. The purpose of our review was to identify the contributing factors that led to the malfunction and to provide recommendations on the 911 processes, procedures, and network design as it pertains to Allegheny County.

Background:

In July 2006, after testing the new inter-location trunks, the Embarq technician left "temporary" emergency sequence number 0002 instructions on the selective router with no valid Public Safety Answering Point destination defined. These instructions remained on the router for three months. On October 25, 2006, the 911 Center experienced a system malfunction. At approximately 1:14 p.m. a call from a wire line telephone was received by the Allegheny County 911 network. This specific call entered the system with an invalid number and was assigned Emergency Sequence Number (ESN) 0002. This resulted in a single call occupying all inter-selective router trunks. Any further wire line calls to the Strip District location were queued waiting to seize a free channel to be routed to the Point Breeze location and passed to a workstation manned by a dispatcher. Wireless calls in both locations were not impacted and were completed normally. The equipment processed the calls as per the programming and therefore functioned correctly. Equipment failure was not responsible for the system's malfunction. The system malfunction was the result of human error. By approximately 1:18 p.m., the call with the invalid number occupied all inter-selective router trunks and the 911 service degraded. The County contacted an Embarq technician at approximately 6:25 p.m. regarding the problem. This specific 911 call had triggered a continuous loop which resulted in approximately 217, 911 calls being blocked until 8:08 p.m.

As part of the Controller' Office review, a Communication Consultant was hired to identify the contributing factors which led to the 911 malfunction and to provide recommendations on the 911 processes, procedures and network design as it pertains to Allegheny County. Additionally, the Consultant reviewed the accuracy of the report issued by the Allegheny County Emergency Service 911 Division, conducted by Kimball and Associates.

EXECUTIVE SUMMARY

Results in Brief:

Our testing in conjunction with the Consultant from Combest disclosed:

- The implementation, management and support of the 911 system are inadequate.
- The 911 team has allowed the operation of the 911 system without any clearly defined processes or controls.
- Proper planning and preparation could have avoided the incident on October 25, 2006 from occurring.
- 911 failed to identify human error as the root cause of several factors that culminated into the incident on October 25, 2006, and then failed to subsequently recommend service management as a key element of improving the quality of the 911 service.
- Change management was not implemented for any changes to the 911 system. As a result human error allowed changes to the 911 system that were directly responsible for the October 25, 2006 incident.
- Adequate controls and procedural controls were not implemented. A technician was allowed to make a change to the routing of thousands of unassigned numbers for the purpose of testing and did not remove the routing when the testing was completed.
- The incident caused all inter-Selective Router trunks to be full and no “All Trunks Busy Alarm” was generated. This led to approximately 7 hours of degraded service, which for 217 users meant little or no service.
- There is no threshold warning for any call that is in queue and unanswered for a pre-determined amount of time.
- There is no threshold warning for any call that is answered and not cleared down for a predetermined amount of time. The rogue call that caused the incident on October 25, 2006 remained in the Selective Router for almost 7 hours.
- 911 has not implemented a Business Continuity Disaster Recovery Plan to ensure that 911 service would not be impacted by a disaster.
- No backups are stored off-site in the event of a total system failure at one location.

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- The County, while under state law to answer ninety percent of all 911 calls in 10 seconds, has no vendor agreements supporting this state mandate.
- The Data Base Management System (DBMS) is a single point of failure since it only exists at the Point Breeze location. The failure of this system will result in mismatches of Automatic Number Identification and Automatic Location Identification information in a matter of hours. The DBMS has fault-tolerant hardware inherent in the server, but the Data Base Management System itself is not redundant.
- Kimball and Associates have failed to provide sufficient contractual negotiation services, project management skills, or operational guidance.
- The service being provided by Embarq is inadequate and their pricing is not competitive.
- The 911 team is procuring consulting services that does not require the contractor to bill hourly or upon completion of the project.

Recommendations:

In summary, the Consultant's general recommendations include:

- A formal management team should be created to implement root cause analysis and proactively reduce errors. This team should also analyze incidents when they do occur and form a plan to mitigate any future problems arising from the incident.
- Implement a formal, written change management process for all 911 system changes. For each hardware or software change, a process of documenting the change, date, time and duration of the change, impact to users, operational risk, the test plan, back-out plan, and contingency plan should be implemented, as well as approval of the change.
- Implement a Release Management policy that clearly defines the changes to be made and gathers relevant resources to discuss the impacts and potential risks of any such work.
- Review all current alarm thresholds in the 911 system and present to the County for review.
- Implement any software changes to ensure that alarms generated by the system meet County expectations.

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- Simulate a Business Continuity Disaster Recovery scenario twice a year to ensure that 911 service is not impacted.
- Ensure that all backups are stored off-site. Off-site secure backups are a standard part of any IT service organization and require little investment of time and resources.
- Negotiate and enforce a contract between the County and Embarq to ensure Embarq's responses allow the County to meet state law.
- Implement a backup Data Base Management System at the Strip District site.
- Appoint a County employee to be responsible for the negotiation, delivery and performance of the Embarq contract.
- Document County's expectations for work performed by Embarq that includes responsibilities, activities, resources, on-site maintenance and operational tasks, etc.
- Implement an agreed upon hardware and software discount structure for Embarq.
- Terminate the current Embarq support contract and re-negotiate terms based on the outcome of the above recommendation.
- Review the Kimball and Associates contract and work performed.

I. Introduction

Background:

The Allegheny County 911 Division of Emergency Services began operations in 1997. The primary 911 site is located in the Point Breeze area of Pittsburgh. This site contains one-half of the phone and computer equipment and houses all of the 911 employees. The second site is an unmanned center located in the Strip District and houses the other half of the phone and computer equipment. This center is the back-up 911 center which could become staffed and operational if the Point Breeze site became inoperable.

Currently the Allegheny County 911 Center processes approximately 3,700 requests for emergency service per day from the Point Breeze location. On average this represents:

- 1,670 conventional 10 digit emergency numbers for alarm services
- 1,400 requests received via a conventional wire line telephone
- 630 wireless calls

The County 911 Center maintains address records for over 1,300,000 phone lines. These address records enable the County 911 dispatchers to dispatch emergency responders to locations in the County, based on the Automatic Number Identification (ANI) information, similar to caller ID, that is forwarded to the dispatchers with the call. Within the County's equipment, there is a routing database that directs these calls to call-taking groups and designated dispatch zones within the 911 Center (see Figure 1 on page 15). The County Public Safety Answering Point (PSAP) is operationally divided into four PSAP zones within the call center, with each zone being primarily responsible for a designated region within Allegheny County. The four PSAP zones are all physically located at the Point Breeze site and are known as the Central, North, East and South zones. The 911 dispatcher workstations that respond to the East and South zones are primarily supported by the Point Breeze automatic number identification (ANI) and the automatic location identification (ALI) Controller. The Strip District ANI/ALI Controller primarily supports the Central and North zones.

In July 2006, after testing the new inter-location trunks, the Embarq technician left "temporary" emergency sequence number 0002 instructions on the selective router with no valid Public Safety Answering Point destination

I. Introduction

defined. These instructions remained on the router for three months. On October 25, 2006 the 911 Center experienced a system malfunction. At approximately 1:14 p.m. a call from a wire line telephone was received by the Allegheny County 911 network. This specific call entered the system with an invalid number and was assigned Emergency Sequence Number (ESN) 0002. This resulted in a single call occupying all inter-selective router trunks. Any further wire line calls to the Strip District location were queued waiting to seize a free channel to be routed to the Point Breeze location and passed to a workstation manned by a dispatcher. Wireless calls in both locations were not impacted and were completed normally. The equipment processed the calls as per the programming and therefore functioned correctly. Equipment failure was not responsible for the system's malfunction. The system malfunction was the result of human error. At approximately 1:18 p.m. the call occupied all inter-selective router trunks and the 911 service degraded. The County contacted an Embarq technician at approximately 6:25 p.m. regarding the problem. This specific 911 call had triggered a continuous loop sequence of reactions due to programming which resulted in approximately 217, 911 calls being blocked until 8:08 p.m.

The Controller's Office immediately called for an investigation into the malfunction of the 911 system. As part of the Controller's Office review, a Communication Consultant was hired to identify the contributing factors which led to the 911 malfunction and to provide recommendations on the 911 processes, procedures and network design as it pertains to Allegheny County. Additionally, we had the Consultant review the accuracy of the report issued by the Allegheny County Emergency Service 911 Division, conducted by Kimball and Associates.

The County's report, prepared by Kimball and Associates on the 911 system identified four contributing factors which lead to the 911 system malfunction. The contributing factors included:

- Invalid telephone number presented to the 911 system. This specific telephone number was within a pool of numbers controlled by MCI that had not been assigned to any customer. This call did not follow the default Emergency Services Number instructions. Instead, the call resulted in a continuous loop condition.

I. Introduction

- There was no validation or reconciliation between 911's master street address guide and its selective router database. Therefore, the unassigned telephone call did not follow the default emergency sequence number instructions due to no outbound trunk route assigned.
- After testing the new inter-location trunks, the Embarq technician left "temporary" emergency sequence number 0002 instructions on the selective router with no valid Public Safety Answering Point destination defined.
- The selective router does not release a 911 call until it has been answered by the Public Safety Answering Point 911 personnel. This system feature caused the call to loop within the system and "busy" the inter-location trunks. The condition persisted until the Embarq service technician identified the problem and modified the call sending instruction with a valid destination.

The report prepared by Kimball and Associates begins to address the technical aspects of the design, and recommends changes to the software and infrastructure to prevent the issues from reoccurring. However, the report makes little, if any attempt to resolve the underlying problem or root cause of all the related incidents that led to October 25, 2006, which include human interaction and human error. Human error is inevitable, and the best-designed 911 systems can still be impacted by an inadvertent change to the operation of the system. As with the Kimball and Associates report, the organization attempts to resolve the incidents and not address the underlying problem, or worse believe they have remedied the problem when in fact the root cause has been misdiagnosed.

Additionally, the report does not address that Kimball and Associates and Embarq have failed to provide operational guidance which has resulted in a mismanaged and poorly supported 911 system. The 911 team has allowed the operation of the 911 system without effective processes or controls. See Schedule I for Comparison of the Kimball and Associates Report and the Combest Report.

I. Introduction

The 911 Event report prepared by Kimball and Associates and the report prepared by Combest Inc. can be obtained through a written request to the Controller's Office.

II. Scope and Methodology

This review was conducted in conjunction with a Communication Consultant from Combest Inc. Our review focused on the 911 system malfunction that occurred on October 25, 2006. Specifically, we performed the following:

- Interviewed County 911 personnel, Kimball and Associates personnel and Embarras personnel involved in the operations of the 911 system to gain an understanding of the contributing factors that lead to the 911 malfunction on October 25, 2006.
- Reviewed laws and regulations relating to the operations of the 911 call center.
- Reviewed the network design and policies and procedures surrounding the operation of the 911 system.
- Reviewed prior audit reports to identify revenue, expenditures, and other financial data as well as concerns associated with the 911 operations and the status of any recommendations to correct them.
- Toured both the Point Breeze call center and the Strip District call center.
- Conducted a physical inventory of a sample of 911's equipment.
- Reviewed the emergency plan for switch interruptions for both call centers and relocation procedures due to urgent and catastrophic shutdowns of the Point Breeze site.
- Due to the technological nature of the incident, the Controller's Office hired a Communications Consultant from Combest to perform the following:
 - Review 911 emergency management work papers developed by the Controller's Office.
 - Review 911 maintenance agreements and system topology.

II. Scope and Methodology

- Review 911 networks, configurations, network diagrams, back up plans and disaster recovery plans.
- Interview 911 personnel, Robert Kimball and Associates personnel, and Embarq personnel.
- Evaluate the reported cause of the 911 malfunction.
- Identify any significant network security and security policy issues.
- Identify any redundancy issues.
- Identify any backup system deficiencies and other related issued.

We conducted this review November 2006 through February 2007. We provided a draft copy of this report for comment to the Emergency Service's 911 Division. Their response is on page 45.

III. Findings and Recommendations

Finding #1

911 System Malfunction Due to Lack of Controls and Human Error

October 25, 2006 Incident

In July 2006, after testing the new inter-location trunks, the Embarq technician left “temporary” emergency sequence number 0002 instructions on the selective router with no valid Public Safety Answering Point destination defined. These instructions remained on the router for three months. On October 25, 2006 the Allegheny County 911 Center experienced a system malfunction. Due to a lack of controls and human error, this malfunction resulted in approximately 217, 911 calls being blocked from 1:14 pm until 8:08 pm.

The incident began at approximately 1:14 p.m. when a call from a wire line telephone was received by the Allegheny County 911 network. This specific call entered the system with an invalid number and was assigned Emergency Sequence Number (ESN) 0002. (see Figure 2 on page 16). This resulted in a single call occupying all inter-selective router trunks. Any further wire line calls to the Strip District location were queued waiting to seize a free channel to be routed to the Point Breeze location and passed to a workstation manned by a dispatcher. Wireless calls in both locations were not impacted and were completed normally. Wire line calls passed directly to the Point Breeze site by the competitive Local Exchange Carrier were completed normally. The equipment processed the calls per the programming and therefore functioned correctly. Equipment failure was not responsible for the system’s malfunction. The system malfunction was the result of human error. At approximately 1:18 p.m., less than 4 minutes after the call was processed, the call occupied all inter-selective router trunks and the 911 service degraded. The County contacted an Embarq technician at approximately 6:25 p.m. regarding the problem. This specific 911 call had triggered a continuous loop sequence which resulted in approximately 217, 911 calls being blocked until 8:08 p.m. The time to resolution from the point when the incident was first identified by County personnel was approximately 1 hour and 45 minutes.

III. Findings and Recommendations

A timeline of events for October 25, 2006 is detailed below:

Time	Event
1:00 p.m.	Normal operation
1:14 p.m.	Call processed by Selective Router
1:18 p.m.	All Trunks Busy between Selective Router
6:25 p.m.	Embarq technician contacted
6:28 p.m.(approx.)	Ticket raised with Verizon
6:34 p.m.	County escalation
6:40 p.m.	Ticket raised with Embarq
7:10 p.m.	Embarq personnel contacted
8:08 p.m.	Embarq personnel remove loop

To summarize, a series of errors led to the incident. The error that contributed most to the incident was the error by the Embarq technician, who did not remove the test programming in July 2006, as well as lack of controls. Proper planning and preparation could have avoided the October 25, 2006 incident.

Consultant's Finding # 1

The process employed by the County to report troubles is satisfactory. However there are process improvements that could be implemented.

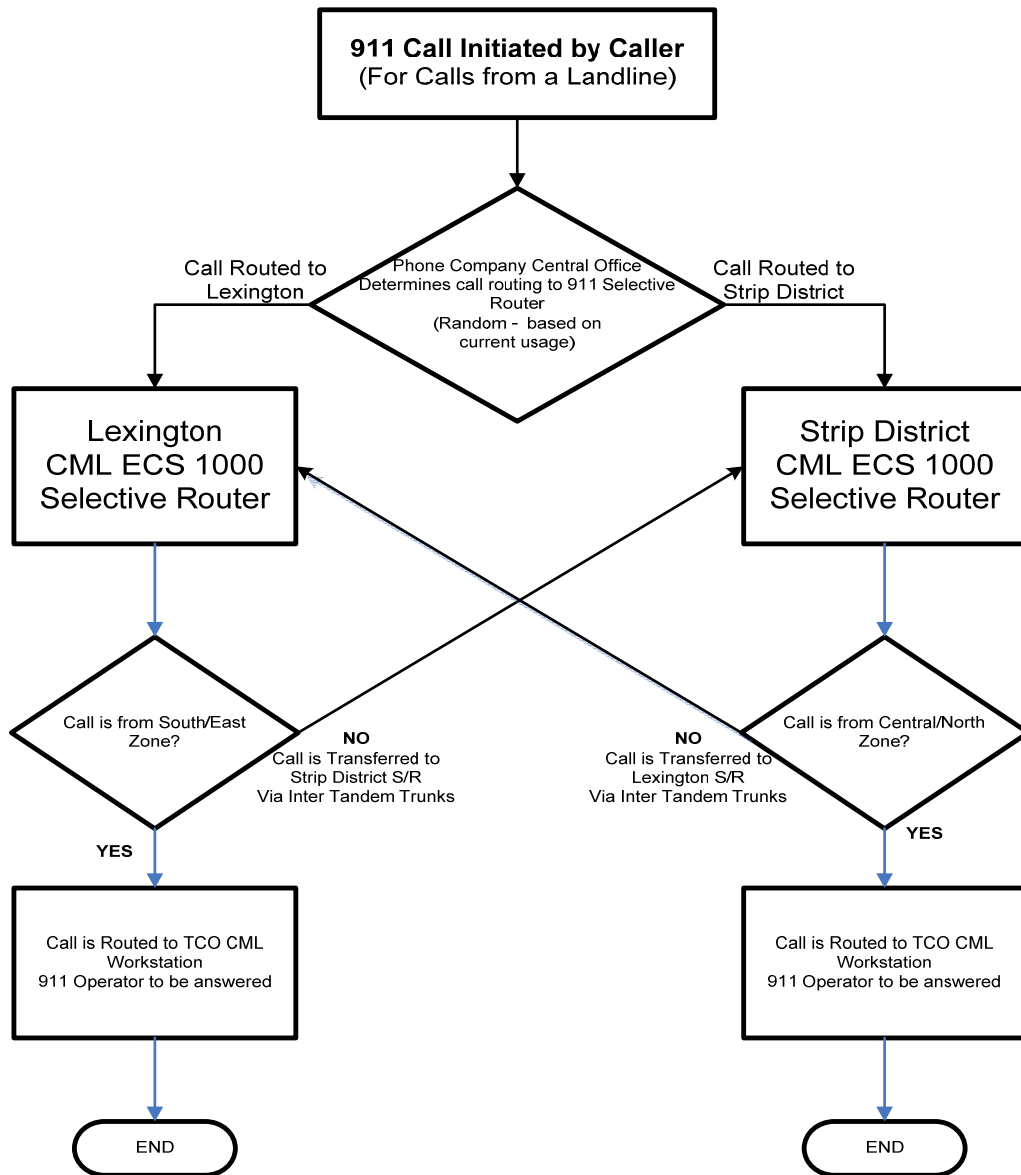
The October 25th incident occurred due to the lack of processes and procedures, improvements needed to the network design and insufficient fulfillment of contractual obligations. All of these issues were contributing factors which led to the 911 malfunction. Additional findings and recommendations can be found on pages 16 to 34.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should implement a process of raising an Embarq ticket under any anomalous situation. The County is paying for a 24x7 support contract and should not hesitate to contact the vendors in the event of a situation. This action could have possibly reduced the time to resolution to less than one hour.

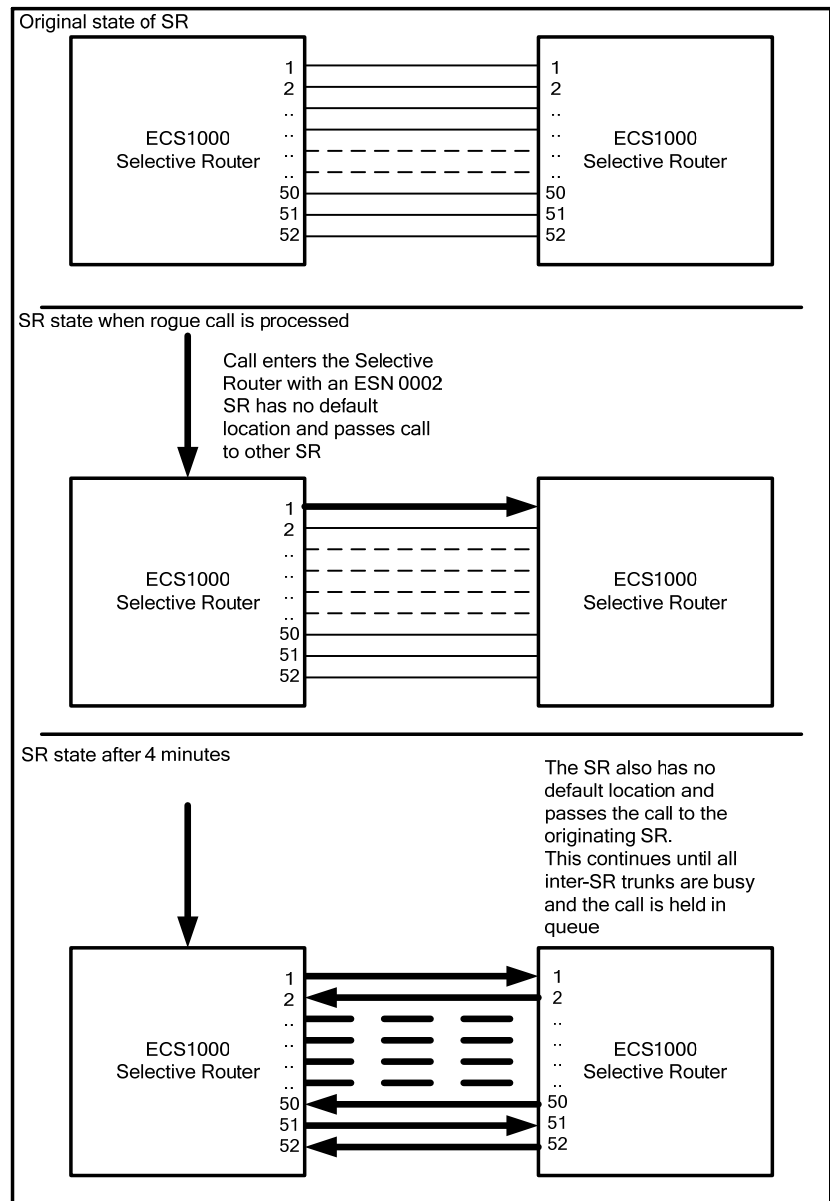
III. Findings and Recommendations

Figure 1: 911 Call Flow Initiated by Caller



III. Findings and Recommendations

Figure 2: Continuous Loop



Source: Combest, Inc.

Management's Response

The report acknowledges that the process employed by County 9-1-1 to report trouble is satisfactory but process improvements could be implemented. We are in agreement of improving the processes of defining the anomalies that are "critical" to the 9-1-1 operations and in improving the processes of tracking the anomalies.

III. Findings and Recommendations

Finding #2

911 Needs to Document Processes and Procedures

Processes and Procedures

Processes and procedures are a valuable element of any service organization, and especially for an organization that provides emergency public services. Information Technology Service Management is the foundation on which the Information Technology Infrastructure Library (ITIL) is built. ITIL was formed in the late 1980's by the British government and has been adopted as one of a few global standards for Information Technology Service Management. IBM has fully embraced ITIL, adopting it in its own internal procedures and using it as a strategy and framework for its clients. Regardless of the body defining the standards, the value and relevance of standards are immense.

Roles and Responsibilities

It is evident that within the County there is confusion as to what role Kimball and Associates plays; whether this is limited purely to a design and project-only function or whether they are to assist in operational activities. It is also clear that the Embarq contract is not managed by anyone on the 911 team - though ultimately Chief Full bears this responsibility. The management of this contract should not fall directly with Chief Full, but instead should be handled by a member of the 911 team, or a Senior Manager of the County.

Consultant's Finding # 2

Kimball and Associates' role in the day-to-day 911 operations is not clear, nor communicated throughout the team. Kimball believes they are not responsible for process development for operational activities, the 911 team does.

Embarq's contractual obligation and the County's expectations of Embarq's responsibilities are vastly different.

III. Findings and Recommendations

Consultant's Recommendation The Allegheny County 911 Division of Emergency Services should write and distribute a clear set of roles and responsibilities for all key personnel, including those at Embarq and Kimball and Associates. This is the responsibility of County management or a party assigned by the County, and may require contract re-negotiation.

Management's Response Job descriptions do exist outlining the responsibility of all personnel within the Department. We believe that within the "Scope of Work" provided under the existing contracts this was sufficient since the contract was approved and fully executed within the given system. We will review the current contract based on this recommendation. We would appreciate any guidance from the Controller's Office as to specific language that they would like to see addressed in future contracts under the "Scope of Work" as to roles and responsibilities of contracting parties

Consultant's Finding # 3 There is no management by the County of the Embarq contract or personnel.

Consultant's Recommendation The Allegheny County 911 Division of Emergency Services should immediately assign responsibility to monitor the terms of the Embarq contract to a County employee with proven technical contract management experience, or a designee of the County.

Management's Response The County 9-1-1 team does have employees that monitor the work flow of technical contracts. All calls for service are logged to a Trouble/Service Report (TSR), response times are routinely monitored. Follow ups are required on all TSRs and there is regular interaction with technicians. The 9-1-1 Assistant Manager's primary role is to address all technological needs for the 9-1-1 division and daily interacts with the contractors. However we recognize that a greater need for documentation of these interactions is necessary.

Consultant's Finding # 4 County management plays little if any role to assist the 911 team in the decision making process. As such the relationship between the two teams is not as strong as it could be.

Consultant's Recommendation The Allegheny County 911 Division of Emergency Services management should play an active role in pre-contract activities for any large 911 center projects.

III. Findings and Recommendations

Management's Response

We agree and up to this point have participated. Coordination of all contracts is in conjunction with the County Law Department. All request for proposals are developed in conjunction with the County's Purchasing Department. We follow the established County guidelines from the approval process of the County Manager's Office through the contract execution stage in the County Controller's Office. We will be glad to sit down with the Controller to see if there is a need for a change in the language of the contracts.

Problem Management

Problem management is based on root cause analysis, which involves the gathering of information of a series of incidents or a single high-impact incident. Its goal is to proactively reduce errors and incidents and when they do occur form a plan to mitigate any future problems arising from the incident. Problem management has occurred for the incident, but it has not correctly identified the underlying root cause. It has however made good progress on eliminating technology errors in the infrastructure.

Consultant's Finding # 5

The team failed to identify human error as the root cause of several incidents that culminated in the incident on October 25, 2006, and then failed to subsequently recommend service management as a key element of improving the quality of the 911 service.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should create a formal Problem Management team and should include Kimball and Associates, Embarq and County employees as its members. The system administrator, Embarq should provide significant resources to support this team.

Management's Response

We agree and we do support the Problem Management Team concept. Weekly meetings were conducted during the time period covered by this report. Actions were recorded by Kimball. Although not formally assembled by the definition of the recommendation, members of County 9-1-1 team, Kimball and Associates, and Embarq met consistently on the project development in developing strategies and identifying issues and resolutions.

III. Findings and Recommendations

Change Management

There are no suitable Change Management processes in place for any aspect of the network design. The goal of Change Management is to ensure that standardized methods and procedures are used for efficient and prompt handling of all changes in order to minimize impact upon service.

For each change, hardware or software, a strict change management process must be used. This includes documenting the change, date, time and duration for the change, impact to users, the test plan, back-out plan and contingency plan. The County, Embarq and possibly Kimball and Associates must approve the change if the change impacts the design. The Embarq technician informed Combest that changes were made on a verbal basis with the County; the exposure and risk of failure using this relaxed method is very high.

A change management process would have identified the requirement to remove any pre-existing programming when the system was brought in to service in 1998. It would have also identified the need to remove ESN 0002 a Call Routing Sending Instruction. Furthermore, the findings from the Event report (prepared by Kimball and Associates for the County) also indicated that trunks provided by AT&T are not operating as desired by the County. A correct change management process would have highlighted the need to test this as part of the turn-up service of the circuit, and would have minimized the impact of the incident on October 25, 2006.

Consultant's Finding # 6

Change Management was not implemented for any changes to the 911 system. As a result, human error allowed changes to the 911 system that were directly responsible for the incident of October 25th 2006.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should implement a Change Management process and create a Change Management Board. The County is the overriding authority for the Change Management Board, although the approving Change Manager could be a County employee or a designee of the County.

III. Findings and Recommendations

Management's Response

We agree that changes going to be made on a non-emergency basis to the system should go through an implemented change processes to ensure that standardized methods and procedures are used to handle all changes to minimize the impact upon service. This has been occurring informally at the weekly "Wireless Phase II" implementation meetings. The County 9-1-1 team agrees in theory with the concept of change management. The County 9-1-1 team is very cautious with systemic change. Again, the County 9-1-1 team will reinforce to Embarq that no software or system changes are to be made without the direct authorization of the County 9-1-1 team and without the appropriate documentation.

Release Management

Release management is concerned with implementing approved changes to the infrastructure and ensuring that all aspects of the change, both technical and non-technical are considered.

Release management would have ensured that the change implemented in July 2006 for testing was completed correctly. Additionally, it would have verified that the change was to be removed in order to return the selective router back to its original state. Release management would have also considered the condition of the selective router in 1998, and would have identified the need to 'scrub' any pre-existing data as part of the change.

Consultant's Finding # 7

There was inadequate controls during testing that allowed a technician to make a change to the routing of thousands of unassigned numbers and did not remove the routing when the testing was completed.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should implement a Release Management policy that clearly defines the changes to be made and gathers relevant resources to discuss the impacts and potential risks of any such work. Release Management should also independently verify (specifically not by the technician completing the change order) that the work is complete and accurate as per the request.

Management's Response

We agree with the concept of Release Management in that formalized documentation of approved sign offs and

III. Findings and Recommendations

check lists of testing being done to the system should be adopted. We have provided guidance and feedback to the contractor on an informal basis but as per the recommendation we will formalize this process and develop policies that articulate that all discussions on issues, actions taken, and outcomes during testing periods will be reported in written format.

Availability Management

The County 911 system has two selective routers with trunking capacity in both that allows each SR to handle 100% of the traffic load. This allows for the total failure of one selective router with minimal disruption to the 911 services. Availability management is the process related to ensuring the service is optimized and is made available to the County and its constituents, cost effectively. Availability management is concerned with reporting information such as component failures, system alarms and reports on the availability of the system using information that makes sense to the County. Such items would include Mean Time Between Failures, Mean Time To Repair, Component Failure Analysis, etc. The solution provided to the County does not provide any availability information or trend analysis.

Consultant's Finding # 8

The incident caused all inter-selective router trunks to be full; no All Trunks Busy alarm was generated. This led to approximately 7 hours of degraded service, which for 217 users meant little or no service.

Consultant's Recommendations

The Allegheny County 911 Division of Emergency Services should conduct a review of all desired thresholds to ensure that events that the County would deem service impacting are configured within the system to generate alarms. A major alarm value is assigned to any All Trunks Busy condition. A minor alarm value is assigned to any trunk group that exceeds 75% capacity.

Management's Response

We agree with the assumption that we should have as many system alarms/alerts that is technologically available for the security and safety of system. We recognize that there are several systems critical to our operation that should have this technology incorporated into the product but it just does not exist. All trunks busy alarms would have

III. Findings and Recommendations

been helpful in this scenario if available. This technology was not available at the time of the incident. Since the incident the vendor has developed and installed software that provides an alarm safe guard.

Consultant's Finding # 9

There is no reporting provided to the County regarding availability of the system. As such, no trend analysis of failures or any preventative maintenance can be usefully performed, since there is no historical data to review.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should instruct Embarq to provide, at a minimum, on a quarterly basis, a report containing information regarding availability. Typically these reports include major and minor alarms received in the reporting period; any scheduled changes or outages; Mean Time Between Failures and Mean Time To Repair calculations; trend analysis and so on. These reports can be designed by a third party and agreed upon by Embarq.

Management's Response

We agree with the finding. This is being done but needs to be more formalized. The County 9-1-1 team documents calls for service via a TSR. Trends and repeat scenarios have been identified through follow up. There is consistent interaction between Embarq and the County 9-1-1 teams with regard to all upgrades, releases, fixes and bugs with the technician. There are also standing orders refusing all release upgrades until fully tested and proven that our systems will handle these changes.

Service Continuity Management

Service continuity management ensures that all business continuity measures are fully supported by the technology. It should be noted that fully demonstrating Business Continuity/Disaster Recovery (BCDR) in a 911 environment is not feasible, but this should not mean that scenarios are not tested and enacted. Service Continuity Management is concerned with two elements. The first element is minimizing the risk of failure through coordinated backups and testing and hardening of services. The second element is preparing the personnel for a Business Continuity/Disaster Recovery incident. There is a tangible cost associated with service continuity, however it

III. Findings and Recommendations

must be realized that technology alone is not a continuity plan in and of itself.

The portable workstations at Lexington St. (Point Breeze) and the secondary Public Safety Answering Point at Railroad St. (Strip District) facility do provide for continuation of service in a BCDR situation. BCDR testing does require additional cost and resources to implement but it is proactive in nature since personnel are trained to deal with a 911 failure, and processes can be refined so that in the event of an actual BCDR incident the response of the 911 team is coordinated and efficient.

Consultant's Finding # 10

A regular Business Continuity Disaster Recovery plan should be implemented to test 911 personnel in their readiness for an event. Though it requires additional staffing, to provide quality 911 service and simulate an emergency situation, it is feasible to conduct these simulations on a bi-annual basis.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should simulate a Business Continuity Disaster Recovery incident at least once a year and preferably twice a year. The event must be coordinated to ensure that 911 service is not impacted but does require the relocation of some 911 personnel.

Management's Response

The Allegheny County 9-1-1 Division does have a Continuity Disaster Recovery Plan. We agree that the Plan needs to be exercised and we are working towards that goal.

Consultant's Finding # 11

No backups are stored off-site in the event of a total system failure at one of the locations.

Consultant's Recommendation

Should complete failure of a device in the system occur, the redundancy should allow service to resume with little or minimal impact. However, to restore the failed system a full configuration reload may be needed. Depending on the type of failure it may not be possible to retrieve the configuration from the failed device. Off-site secure backups are a standard part of any IT service organization and require little investment of time and resources.

Management's Response

Off -site redundancy is in place at Railroad Street as per the Continuity Disaster Recovery Plan. The County 9-1-1

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Team agrees that a secure backup is a “must” in an IT environment. We will consult with the Department the Computer Services to explore if additional backup systems need to be employed.

Consultant’s Finding # 12

In agreement with the Event Report issued by Kimball and Associates, a preventative maintenance plan should be implemented. This involves checking all aspects of the technical system which consider testing items such as power, grounding, cabling, documentation, backups on a defined schedule, and at least once a year.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should define a maintenance plan for all areas of the system and testing these as fully as possible. The Embarq contract has a clause providing the County with one preventative maintenance visit per year, for the duration of the contract. The County should carefully develop a testing plan and issue this to Embarq to be completed within the scope of the maintenance.

Management’s Response

Testing and diagnostics are preformed almost daily on the system by the Embarq Technicians. Embarq frequently consults with Plant/CML who does assist remotely when needed. We will reinforce to Embarq that a written scheduled Plan needs to be identified and written documentation provided to the County 9-1-1 team on all maintenance testing. We will create a system of check lists to ensure that these activities are done per the maintenance contracts.

Service Level Management

The County, while under state law to answer ninety percent of all 911 calls in 10 seconds, has no vendor agreements supporting this state mandate. All vendor contracts should require vendor performance sufficient to meet the County’s required service level agreement.

Consultant’s Finding # 13

No contract exists between the County and Embarq to ensure that the state law of answering 90% of calls in ten seconds is met or exceeded. An amendment to the contract can be drafted and presented to Embarq.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should enforce a contract between the County and

III. Findings and Recommendations

Embarq to ensure Embarq's response times are in compliance with state law. This is defined as an underpinning contract.

Management's Response

The County 9-1-1 team assures that we are in compliance with the requirement of the State Law governing 9-1-1. The law that is referenced in this recommendation applies to the training of TCOs and staffing levels. The network design does meet legislative standards.

Consultant's Finding # 14

Currently Kimball and Associates charges a lump sum fee for consultancy and project management. There is no time-related incentive for Kimball and Associates to close out any projects. Additional charges may be accessed if a delay occurs in which additional resources are required to complete the project.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should engage Kimball and Associates on a fixed-fee basis with time-based penalties for missing milestones.

Management's Response

This contract was entered into on a "Task Based/ Lump Sum" format due to the complexity of the Wireless Implementation Plan and uncharted documentation as to knowing the extent of time, effort, and resources needed during the implementation process. By consulting with and having the Law Department draft the contract this contract method was used and went through the County approval and execution process of all contracts. Because of the special nature of this project we feel we followed the appropriate decision making process in identify that a Lump Sum Task Base contract was the most cost effective way to implement 9-1-1 wireless.

Consultant's Finding # 15

There is no threshold warning for any call that is in queue and unanswered for a pre-defined amount of time.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should implement controls that when a call is in queue for more than 5 minutes without being answered, an audible/visual warning is provided to the Shift Commander.

Management's Response

The County 9-1-1 team agrees with early warning signals. A number of systems in the 9-1-1 center did not have this technology available from the company at the time of the incident. Based on this incident and working with the County 9-1-1 team the company has developed a software package that now provides early warning notifications. We

III. Findings and Recommendations

are examining the availability of early warning signal technology for other existing systems in 9-1-1.

Consultant's Finding # 16

There is no threshold warning for any call that is answered and not cleared for a pre-defined amount of time. The rogue call that caused the incident on October 25, 2006 remained in the Selective Routers for almost 7 hours.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should develop a threshold warning that allows PSAP personnel to determine if a call has been answered but not cleared or disconnected after a pre-defined amount of time. There may be a logical reason why a call can be left open for more than 60 minutes. However a notification to the Shift Commander would allow that call to be reviewed and a decision made on whether the call is legitimate or invalid and can be disconnected.

Management's Response

The County 9-1-1 team agrees with early warning signals. A number of systems in the 9-1-1 center did not have this technology available from the company at the time of the incident. Based on this incident and working with the County 9-1-1 team the company has developed a software package that now provides early warning notifications. We are examining the availability of early warning signal technology for other existing systems in 9-1-1.

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Finding #3

911 Network Design Needs To Be Improved

Network Design

The logical design of two selective routers and inter-SR trunking is a standard design and while it is unusual for the County to own the equipment, it is not unique in the industry. The Plant/CML technology is well rooted in the industry and is found in many Public Safety Answering Points in and out of the State of Pennsylvania.

The methods Kimball and Associates demonstrated on evaluating technologies for each client are consistent with standard techniques and represent a solid decision making process based on the client requirements and the functionality of each technology. It should be noted that Kimball and Associates did not provide the evaluation for the County design, however it is the understanding of this report that the evaluation was carried out correctly.

Data Base Management System

The Data Base Management System is an administration point used to do two daily uploads of Master Street Address Guide information to the Automatic Location Identification database. There is only one such system, which is located at Lexington Street. This system can upload thousands of database corrections each day and as such is a critical piece of the logical design and should be replicated in both locations. The system should be configured such that only one Data Base Management System would be able to upload data to avoid the County uploading multiple sets of the same data.

Consultant's Finding # 17

Kimball and Associates has stated in the County's Event Report that the design is mirrored between Lexington Street (Point Breeze) and Railroad Street (Strip District). This statement is misleading. The Data Base Management System is a single point of failure since it exists only at Lexington Street; the failure of which will result in mismatches of Automatic Number Identification and Automatic Location Identification information in a matter

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of hours. It should be noted that the Data Base Management System has fault-tolerant hardware inherent in the server, but the Data Base Management System is not redundant.

Consultant's Recommendation The Allegheny County 911 Division of Emergency Services should develop a budget for the procurement and implementation of a backup Data Base Management System to be placed in Railroad Street (Strip District).

Management's Response The Team believes that backup of the database is sufficient to meet the needs of redundancy. The ALI Database service is duplicated at RR St. We will analyze the possibility and need for any other duplication component of the system with the Department of Computer Services.

Physical Implementation

The physical layout of Lexington Avenue (Point Breeze) was reviewed and it can be confirmed that items such as power and trunking are diverse, meaning that a single point of failure is not present. The system is suitably protected by an Uninterruptible Power Supply system, with generator backup.

Consultant's Finding # 18 Items such as power cords, power circuits, cables, and etc. are not marked consistently. As such a technician with no or little familiarity with the system would need to spend time becoming accustomed with the physical configuration. In an outage or troubleshooting event, the layout must be simple to follow to ensure speed and accuracy of any fault-finding. The technician sits in the room, amidst cabling and equipment. This room should not be used as general office space.

Consultant's Recommendation The Allegheny County 911 Division of Emergency Services should relocate the Embarq technician to another location. Access to the room must be restricted to be used only when working on the equipment in the room.

Management's Response We disagree with this finding. This room is not used as "general office" space. This is the technician's work environment from which he accesses the system and conducts his business. Access is controlled based on security swipe cards with limited access to this area.

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Standard Conformity

The National Emergency Number Association (NENA) has produced a number of standards, operational guidelines and recommendation documents relating to 911 systems.

This section identifies areas where the 911 solution could be defined as non-compliant with the standards set forth by NENA. The document refers to the '*NENA Recommended Generic Standards for E911 PSAP Equipment*' and is fully referenced at the end of this document.

Consultant's Finding # 19

In Section 5.14 PSAP Status Indicators, NENA requires the Public Safety Answering Points supports both audio and visual indicators for trunk status. This is not present for the inter-selective router tandem trunks.

Additionally, Section 8.2 covers the requirement for periodic maintenance, and the requirement for an established maintenance program. Kimball and Associates confirmed this has not been provided by Embarq.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should comply with Section 5.14 and Section 8.2 of the standards set forth by the National Emergency Number Association.

Management's Response

The above mentioned NENA standards do not apply to the inter-selective router tandem trunks (equipment behind the scene). The standards are applicable to the equipment for the TCO Call Taking position. Therefore, we do comply with these NENA standards. We do agree that indicators and standards should be established for the inter-selective router tandem.

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Finding #4

911 Contracts Are Inadequate

Embarq Pricing

Combest has had the opportunity to review the ‘Allegheny County Wireless Upgrade Pricing Summary’ presented to the County by Embarq. Based on the amount of purchases, the pricing does not reflect competitive discounting and Combest has not been able to verify Plant/CML list prices to those offered to the County by Embarq. However, there are several serious concerns over the pricing offered by Embarq, each of which is noted below. An immediate review of the competitive value Embarq is delivering to the County is recommended. It is not expected that a re-design of the network is required should Embarq be removed as the incumbent.

Consultant’s Finding # 20

Embarq has offered a 25% discount on the Cisco equipment provided; this is not a competitive discount when considering the Cisco equipment alone and is certainly not competitive when considering the whole project value is \$2.9M.

The County is also being charged maintenance by Embarq on spares that the County procured to ensure rapid replacement in the event of failure. This annual cost of maintenance represents 19% of the value of procuring the equipment. In essence, over the 5-year period, the County would have spent close to \$140,000 on maintaining equipment that may not be used in the production environment. This equates to almost 100% of the value of the equipment in maintenance charges. It is an inappropriate practice to extend maintenance to equipment that is procured for the purpose of providing on-site spares.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should require Embarq to re-price the existing maintenance contract to exclude maintenance of critical spares. This represents a cost savings of \$140,000 over 5 years.

Management’s Response

The County 9-1-1 team is willing to discuss and review with the Controller’s Office and the County Purchasing

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Department on how to accomplish this recommendation under the existing contract.

Consultant's Finding # 21

The County is paying \$89,489 to procure surveillance equipment to allow monitoring of the 911 system, a further \$32,035 in maintenance of that surveillance equipment over the 5 year period, and then almost \$1.3M in maintenance charges over the 5 year period. In essence, the County is paying for the equipment to allow Embarq to monitor the 911 system; the County is paying maintenance on the equipment that allows the monitoring of the 911 system and then pays Embarq for maintenance of the 911 system. This is an exceptionally poor practice, and in simple terms can be defined as double-dipping.

Additionally, Embarq has extended to the County a 'Customer Appreciation Discount' on its annual maintenance price. This equates to 3%. Coupled with the value of the projects previously completed by Embarq and previous maintenance contracts, this is an exceptionally poor value to the County and its constituents.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should require Embarq to sign a master agreement stating in writing the value of any service, product or maintenance discounts to be used over a pre-defined period of time. It should be accepted that any purchase of services, product or maintenance is offered to the County at the set, agreed discounts. These discounts must be agreed upon by the County and Embarq and reflect the level of expenditure during past years and expected over the coming years of the contract.

Management's Response

The County 9-1-1 team is willing to discuss and review with the Controller's Office and the Law Department on how to accomplish this recommendation.

Consultant's Finding # 22

The pricing for ECS summarizes a gross discount of \$534,578. However closer review of this quote reveals that \$273,097 is for trade-in value; this is not a discount provided by Embarq. It appears that Embarq has incorrectly represented the discount value of the ECS quote. The Special Incentive Discount represents \$261,481 of the ECS quote, an 18% discount from the ECS unit pricing, or a mere 9% of the project total.

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Embarq is billing the County 260 days of service for the wireless project, at a cost of \$362,666. Transportation and living expenses for those services totals \$239,050. This represents nearly \$1,000 per day for services completed. If Embarq is unable to staff this project with local resources, serious concern exists about their ability to maintain this project. This issue should have been reviewed during contract negotiations and highlighted by Kimball and Associates.

The County is also being charged \$1,684 for a Windows 2000 5-client license. While it was not possible to verify the pricing of this based on 2005 prices, the current retail price for this product is \$999. Embarq has not discounted this product for the County. It is also not leveraging volume discounts that the County should have in place.

Embarq is charging \$446.18 for an off the shelf modem. The County purchased 16 modems; these are freely available at much lower prices.

Embarq has quoted Cisco equipment with only 1 year of SMARTNet – Cisco’s support offering – and on an 8-5 Next Business Day model; Embarq has not provided an adequate design and may not be able to fulfill its obligation of replacement Cisco parts should the need arise.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should purchase products through a centralized point of contact, or at a minimum have interaction with a centralized procurement team to ensure the best possible price is being offered and the best value is driven from agreements the County already has in place.

Management’s Response

The 9-1-1 team adheres to County standards and policies and works with the Purchasing Department and Law Department on all our contracts/purchases. This contract did go through the negotiating process for this amendment. The original proposal from Embarq was for 3.9 million. Through negotiated discounts we received the system upgrade at a cost of 2.9 million. We made a recommendation and worked with the Law Department to amend the existing contract with Embarq that was then approved and fully executed through the County system.

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Embarq Maintenance Agreement #104818v3

Consultant’s Finding #23

The maintenance agreement provided by Embarq – entitled “Sprint Centurion Service Product Annex” is a standard template for Sprint services and support and in general is not well suited to the support and maintenance that should be provided to the County.

The expectation of the County is that all work related to the ECS-1000 including new trunk turn up, configuration changes for CAD workstations, etc. is included within the scope and cost of the contract. This is not reflected in any contract that was provided to Combest during this review.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should review the responsibilities and activities it expects Embarq to complete on a daily basis and provide this assessment to Embarq to quote against.

Management’s Response

The Centurion standard maintenance agreement was reviewed and modified by the Law Department in the existing addendum. We will review this with the Law Department and Controller’s office for any additional modification that would need to be included in any renegotiated or future agreements.

Consultant’s Finding #24

The maintenance agreement does not include a provision for on-site personnel during core operating hours. Embarq is currently providing this service “without charge” – though this makes the current maintenance agreement very expensive. Embarq is not contractually obliged to provide this service and may stop at any time. The contract has verbiage for only 24x7 remote support. The busy hours for 911 are between 3 p.m. and 7 p.m. on any day of the week. The ‘without charge’ technician when on-site leaves at 5 p.m.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should review the value that the Embarq on-site personnel adds to the maintenance agreement and arrange a contract addendum formalizing Embarq’s placing personnel on-site, defining their hours, roles and responsibilities.

Management’s Response

We will explore the possibility of this option under the current agreement. We will perform a cost benefit analysis to see if this option should be renegotiated.

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Consultant's Finding #25

Section 6.3 of the Sprint Centurion Service Product Annex specifically denotes that should the County procure monitoring equipment, Embarq will maintain the monitoring equipment at no additional cost to the County. Embarq is charging the County \$6,407 per year for maintaining the monitoring equipment. This is a direct conflict to the stated and agreed terms between Embarq and the County.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should seek reimbursement for all maintenance fees associated with monitoring equipment. This represents a cost saving of \$32,035 over 5 years.

Management's Response

The County 9-1-1 team will review the language of the contract referenced by the consultant and take appropriate action with the recommendation of the Law Department and Controller's Office.

Consultant's Finding #26

The agreement contains a termination clause only for Embarq, not for the County. The County is entitled to termination under the Standard Terms and Conditions (#193876v2) based on material failure. This will only occur thirty days after Embarq receives a termination notification from the County.

Consultant's Recommendation

Since Embarq has failed to provide a quality service, the Allegheny County 911 Division of Emergency Services should terminate the current support agreement. Additionally, it should negotiate more stringent and favorable contract terms to include on-site personnel during core operating hours (or busy hours) and a maintenance agreement tailored to the 911 services. It should not procure a generic maintenance agreement used by Embarq. The contract should include renewed pricing which reflects the levels of service required by the County, including the purchase of critical spares to assist in maintenance of the 911 services.

Management's Response

The agreement does include a termination clause for the County. This recommendation will be taken under consideration and addressed after further discussions with the Law Department and the Controller's Office.

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Embarq Quotation 5001-02

Consultant's Finding #27

From the documentation provided to Combest, it is not clear whether the County has approved quotation 5001-02. However, this quote has been reviewed and observations are detailed below.

Embarq quotes \$581,559 of installation services, travel and living expenses. On the summary lines of the quote, Embarq charges an additional \$53,334 of labor without explanation. This appears to be a major discrepancy. Contract labor is normally defined in detail.

Consultant's Recommendation

The Allegheny County 911 Division of Emergency Services should review the quote in detail and make the appropriate changes before final approval.

Management's Response

The County 9-1-1 team researched the quotation number referred to as Embarq's quote number 5001-02. We found that this quote did not belong to Allegheny County 911 Division and was never executed by the department. This quote was for equipment being bought from CLM by Sprint. The quote of 5001-02 which was never acted upon was for \$2,247,891. After revising and negotiating pricing the executed quote for the CLM equipment was for \$1,442,000 under quote number 5001-07. The amount referred to by the consultant for \$581,559 was not for Embarq installation but for CLM installation. The \$53,334 was Embarq's labor expenses.

Kimball and Associates Wireless and Wire line Contract #7617

Consultant's Finding #28

Combest has reviewed the Request for Executive Action number 1181-05, concerning Contract #7617. This request awards Kimball and Associates approximately \$1.25M in services for the period October 3, 2005 to December 31, 2006. Using the fee schedule, and Kimball and Associates' most expensive rate of \$190.00/hr for a Principal resource, this equates to 6,578 hours of manpower, or 822 days of resources, more than 2 resources dedicated to the County for each calendar day for the term of the contract. In the explanation provided by the Chief of the Department of Emergency Services it describes Kimball and Associates' scope of work as the '*continued development of...the operations of...wire line 911.*' Since so many issues have

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gone unnoticed it is difficult to understand how these resources were being applied to improve the operation of the wire line 911. Though not in the scope of this report, it is of grave concern that the County is paying \$1.25M for Kimball and Associates' service, which delivers inadequate operational value, and also that the financial value of the contract would suggest Kimball and Associates should have at least two dedicated staff working full-time for the County. It is very important for the County to review this issue with much greater scrutiny.

The wireless project, serviced by Kimball and Associates utilizes the data network to transport voice calls to answering locations. The term for this is Voice over Internet Protocol or VoIP. There are inherent service issues with VoIP if it is not properly implemented. It requires thorough monitoring and management to ensure that the service provided by the County is at the desired level. At the time this report was written and published, Embarq confirmed that there were quality of service issues and could not provide Cisco running configurations.

Kimball and Associates' scope is described by the 911 team to include development of the operations of wire line 911. It took a malfunction of the 911 system for Kimball and Associates to recognize that there were issues in the technology that they had recommended. Additionally, Embarq failed in their delivery of services and the 911 operation does not have any service management practices. This does not represent a reasonable standard of care nor value to the County.

Consultant's Recommendation

Kimball and Associates provides many municipalities in the State of Pennsylvania with 911 services and as such should reach some economies of scale for all its clients. Reducing the cost of services to all, as a result of the services performed by Kimball and Associates should be under direct scrutiny. Kimball and Associates should explain the resource allocation for the Wireless Phase II project and define how they delivered \$1.25M of services during a 14-month engagement. Kimball and Associates should also define how they delivered each of the tasks in their defined scope.

Management's Response

Kimball and Associates are in the process of providing cost analysis information to the Controller's Office on their fee and time based rates. This contract was entered into on

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a “Task Based/ Lump Sum” format due to the complexity of the Wireless Implementation Plan and uncharted documentation as to knowing the extent of time, effort, and resources needed during the Wireless implementation process.

Consultant’s Finding #29

The scope of work provided by Kimball and Associates is loose, vague and does not include any tasks to ensure that operational standards are discussed, reviewed or implemented.

Consultant’s Recommendation

The Allegheny County 911 Division of Emergency Services should conduct an immediate review of all current operational standards.

Management’s Response

Kimball and Associates have had a Project Manager on location at the Allegheny County 911 Division of Emergency Service for the last three years. This Project Manager has been a part of the 9-1-1 Team and interactions take place daily. Discussions, problem solving, reviews and recommendations occur regularly over the course of this period addressing operational standards of the 9-1-1 center. Although most of the time in an informal environment we will ensure that these are formalize as written documentation.

Consultant’s Finding #30

The Scope of Work for Kimball and Associates specifically includes the task (Task 3.1.1) to work with the County and Sprint/CML in the functional, reliability and acceptance testing of the solution. A suitable testing plan would have tested the failure of trunking, both external and internal to the 911 system and would have noted that an All Trunks Busy alarm was not generated. Suitable testing would have indicated that AT&T trunks were not correctly configured. Kimball and Associates has failed to deliver the agreed scope of work, and as a result 217 callers could not access 911 services on October 25, 2006.

Kimball and Associates, while providing design and project management services for this project has offered no management of contracts or scopes. This is specifically defined in Task 2.1.6.8 of the Kimball and Associates Scope of Work for the Wireless project. The contracts presented by Embarq are generic contracts that need a great deal of work to be seen as favorable to the County. The

III. Findings and Recommendations

scopes presented by Embarq are poor and offer no detail about deliverables, responsibilities or success factors.

Consultant's Recommendation

The wireless project should be stopped pending a complete review of the design and implementation. It should include a review of how the system will be operated and maintained. A review of the wireless project is recommended and an amendment to the scope of work for Kimball and Associates' is required to include operational processes. Testing procedures provided by Kimball and Associates should also be reviewed and once completed it should be issued to the County to be scrutinized.

Management's Response

The County 9-1-1 strongly disagrees with this recommendation. We have a valid implementation plan. The Phase I implementation was completed on time and within budget. Phase II implementation is too important of a public safety need to stop. We see no reason to put the implementation of Phase II on hold midstream however we will continue to review each process prior to implementation.

Embarq wireless Scope of Work

The Scope of Work presented to the County by Embarq entitled 'Wireless Phase I-II Upgrade' does not sufficiently detail the scope of what work Embarq will perform. A suitable scope of work at a minimum contains a summary of the project; a list of deliverables, assumptions, constraints; identifies project roles and responsibilities; identifies project success factors, time lines and much more. It is a necessity to have this Scope of Work drafted in the pre-sales cycle and signed in conjunction with issuing a Purchase Order or Acquisition Request.

Consultant's Finding # 31

The Embarq Scope of Work document needs to be enhanced to ensure the County can clearly identify that the deliverables and agreed upon success criteria are measurable and can be achieved.

The Embarq Scope of Work presented by the County states in the Section titled 'Section H – Project Acceptance Criteria' that the project will be considered accepted when all equipment and applications are working as per vendor and industry standards. In short, the County has zero involvement contractually in the acceptance of this project.

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Consultant's Recommendation The Allegheny County 911 Division of Emergency Services should redefine the current Embarq Scope of Work to include tangible deliverables and clear success criteria. A County representative should be assigned to monitor the project and ensure successful completion.

On-site Embarq personnel should be trained in Cisco routing and switching, quality of service and data communications concepts.

On-site monitoring tools should allow the County to verify at any time the quality of service of the call being delivered to the answering point. It should also allow a call to be broken down to the granularity of each segment traverse so complete analysis is possible in a troubleshooting scenario.

Embarq must have all configurations reviewed by certified Cisco technicians and invite another company to review the Cisco configuration for testing.

Management's Response The County 9-1-1 team agrees to review and work with the Law Department and Controller's Office to seek guidance on how to accomplish this.

Consultant's Finding # 32 The Wireless Phase II project is being deployed by Plant/CML. It is of the opinion of Kimball and Associates that since the merger of CML to form Plant/CML, some key technical individuals have left and as such have hampered progress on this project.

Consultant's Recommendation The Allegheny County 911 Division of Emergency Services should generate a specific issue log, carefully record all outstanding activities and issue a milestone schedule. This log should be developed with Plant/CML, Embarq, Kimball and Associates and the County.

Management's Response The County 9-1-1 team is in agreement with this recommendation. We intend to implement a formalized project/program management monitoring component to our processes. We will be holding all employees and contractors to higher standards in requiring documentation of their activities.

**Comparison of
Kimball and Associates Report to Combest Report
on 9-1-1 Malfunction**

<u>Concerns</u>	<u>Allegheny County's Report Kimball Report</u>	<u>Controller's Office Report Combest Report</u>
Invalid telephone number presented to the 9-1-1 System.	Report states that a call from an invalid telephone number started the continuous loop condition.	Report agrees with the statement contained in the Kimball report.
Obsolete telephone number records in the selective router database.	Report states that an Emergency Sequence Number group of numbers designated as 0002 was present within the data tables on the Selective Router and that this contributed to the incident.	Report agrees with the statement contained in the Kimball report.
ESN 0002 call route sending instructions changed for testing.	An Embarq technician changed a delivery route of an ESN 0002 group of numbers, in order to test 96 new trunks, prior to directing "live" 9-1-1 traffic to these new call paths. The default delivery route was never restored by the technician.	Report agrees with the statement of fact contained in the Kimball report.
Selective router "abandoned call" handling	The report states that the Selective Routers will not release a 9-1-1 call until it has been answered by PSAP personnel, and that this was another contributing factor.	Report agrees with the statement contained in the Kimball report.

**Comparison of
Kimball and Associates Report to Combest Report
on 9-1-1 Malfunction**

<u>Concerns</u>	<u>Allegheny County's Report</u> Kimball Report	<u>Controller's Office Report</u> Combest Report
Database Management System	Report states that the DBMS design is mirrored between the two 9-1-1 sites.	Report states that this statement is misleading. The DBMS exists only at the Point Breeze location and it is not redundant.
Physical Implementation: Refers to the physical layout of the 9-1-1 facility	Report does not comment on this issue.	Report states that items such as power circuits, cables, etc. are not marked consistently. No one should have access to this room unless working on the equipment in the room. This review states that the Embarq technician was working on the equipment.
Standard Conformity: The National Emergency Number Association has produced a number of standards, operational guidelines and recommendation documents relating to 9-1-1 systems.	Report does not comment on this issue.	Report states that the County 9-1-1 system is not compliant with standards set forth by the National Emergency Number Association relative to indicators for trunk status and periodic maintenance.
Roles and Responsibilities: Refers to the roles and responsibilities of the two vendors that provide services to the 9-1-1 agency	Report does not comment on this issue.	Report states that Kimball and Associates believes that they are not responsible for process development for operational activities, the 9-1-1 personnel does. Embarq's contractual obligation and the 911 expectations of Embarq's responsibilities are vastly different.

**Comparison of
Kimball and Associates Report to Combest Report
on 9-1-1 Malfunction**

<u>Concerns</u>	<u>Allegheny County's Report Kimball Report</u>	<u>Controller's Office Report Combest Report</u>
<p>Problem Management: The goal is to proactively reduce errors and when they do occur, form a plan to mitigate any future problems arising from the incident.</p>	<p>Report does not comment on this issue.</p>	<p>Report identifies human error as the root cause of several incidents that culminated in the malfunction of the 9-1-1 system on October 25, 2006.</p>
<p>Change Management: The goal of change management is to ensure that standardized methods and procedures are used for efficient and prompt handling of all changes in order to minimize impact upon service.</p>	<p>Report does not comment on this issue.</p>	<p>Report states that a change management process was not implemented for any changes to the 9-1-1 system. As a result, human error allowed changes to the 9-1-1 system that were directly responsible for the malfunction on October 25, 2006.</p>
<p>Release Management: Concerned with implementing approved changes to the infrastructure, ensuring that all aspects of the change, both technical and non-technical are considered.</p>	<p>Report does not comment on this issue.</p>	<p>Report states that inadequate controls were present that allowed a technician to make a change to the routing of thousands of unassigned numbers for the purposes of testing and did not remove the routing when the testing was completed.</p>
<p>Availability Management: The process related to ensuring the service is optimized and is made available to the County and its constituents, cost effectively.</p>	<p>Report does not comment on this issue.</p>	<p>Report states that the looping of the unassigned number caused all inter-SR trunks to be full, and that no all-trunks-busy alarm existed. This led to approximately 7 hours of degraded service.</p>

**Comparison of
Kimball and Associates Report to Combest Report
on 9-1-1 Malfunction**

<u>Concerns</u>	<u>Allegheny County's Report Kimball Report</u>	<u>Controller's Office Report Combest Report</u>
Service Continuity Management: Ensures that all business continuity measures are fully supported by the technology.	Report states that a preventative maintenance plan should be implemented.	Report agrees with Kimball report, but also makes other recommendations. It recommends a Business Continuity Disaster Recovery test and off-site storage of back-ups, in case of a total system malfunction.
Service Level Management: Monitoring levels of service to ensure that the service level is in compliance with laws and regulations.	Report does not comment on this issue.	Report states that, while the County is required by State law to answer 90% of all 9-1-1 calls within 10 seconds, it has no vendor agreements enforcing this requirement.