BALTIMORE CITY COUNCIL
PUBLIC SAFETY COMMITTEE

Mission Statement

On behalf of the Citizens of Baltimore City, the Public Safety Committee will be responsible for matters concerning public safety, including, but not limited to, emergency preparedness, police services, fire/EMS, & their administrative functions.

The Honorable Mark Conway

CHAIR

PUBLIC HEARING

3/3/2026

1:00PM
CLARENCE "DU" BURNS COUNCIL CHAMBERS

LO25-0025

Underground Infrastructure Safety

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Brandon M. Scott – Mayor
Zeke Cohen – Council President

Office of Council Services
Nancy Mead – Director
100 Holliday Street, Room 415
Baltimore, MD 21202

PUBLIC SAFETY COMMITTEE

The Honorable Mark Conway
CHAIR

Legislative Oversight Hearing

LO25-0025
Legislative Oversight – Underground Infrastructure Safety

For the purpose of inviting relevant city agencies & utility providers including but not limited to the Baltimore City Fire Department, Department of Public Works, Department of Transportation, Office of Emergency Management, Baltimore Gas and Electric, Comcast, Verizon, and Vicinity Energy to discuss the safety of Baltimore's underground conduit system in response to ongoing underground fires.

REPORTING AGENCIES

- Baltimore City Fire Department
- Department of Public Works
- Vicinity Energy
- Department of Transportation
- Baltimore Gas and Electric

BACKGROUND

Primarily overseen, maintained, and managed by the Department of Transportation (DOT), Baltimore City's Municipal Conduit system has existed for over 115 years and, today, is comprised of approximately 700 miles of underground channeling, spanning between over 12,000 manholes, filled with critical power and networking cables.

Found directly below city streets, ducts made of plastic, fiber, or terracotta encased in concrete stretch between manhole access points to allow for minimally invasive installation, maintenance, and/or replacement of cables from service providers including Baltimore Gas and Electric (BGE), Comcast, and Verizon to local buildings, businesses, and homes.

As the sole owner of the Conduit, the City charges fees on service providers to support the conduit's upkeep. As of September 2015, following an increase from $.98 approved by the City's Board of Estimates, service providers are assessed a fee of $3.33 per foot annually to use the system; however, BGE, the system's largest user, objected to this increase and joined a lawsuit to prevent the city from implementing the rate increase. In the lawsuit, BGE alleged the City was violating state law by using the rate increase to generate revenue. Subsequently, in 2016, BGE and the City agreed to a settlement wherein BGE would pay $2.00 per foot for three years and $2.20 per foot each year after. More recently, in 2023, BGE entered into an updated agreement with the City wherein it agreed to contribute $120 million in capital improvements to the conduit over the initial contract term, ending December

31, 2026. In addition, BGE agreed to pay the City $14 million for maintenance to the conduit by December 31, 2023, and $1.5 million for each of the remaining years of the agreement. The agreement also allows for one automatic three-year renewal, which could result in additional capital improvement expenditures by BGE.

In addition to the Conduit system, Baltimore's streets also sit atop several other major pipelines including water and sanitary main systems, which together are administered by the Baltimore City Department of Public Works and comprised of approximately 2,900 miles of piping within City limits; nearly 28 miles of pipeline administered by Vicinity Energy to deliver chilled water, hot water, and steam; and, extensive underground natural gas lines maintained by BGE.

Over the past several years, the safety of Baltimore's extensive underground infrastructure system has become a cause of concern for many city residents on account of underground explosions and fires. The following table details a non-exhaustive sample of those incidents over the past several years:

Date	Approximate Location	Incident
June 28, 2025	Intersection of East Baltimore Street and Guilford Avenue	Underground fire
September 29, 2024	300 block of North Charles Street	Underground fire causing manhole explosions
January 25, 2024	300 block of North Charles Street	Underground fire causing manhole explosions
May 16, 2023	400 block of West Pratt Street near Eutaw Street	Excavation activity caused ruptured steam line resulting in explosion

During the Committee's July 22nd hearing, the Department of Transportation (DOT) indicated it engaged in monthly meetings with BGE to discuss necessary maintenance and problem areas. Additionally, the administration reported that it was bringing in outside experts, forensic consultant RTI Group LLC, to conduct a review of the Charles St. incident. DOT also indicated it expected that report by "mid-to-late fall."

On December 20, 2025, the administration published RTI's report. In relevant part, the report concludes the September 29, 2024, fire was caused by a buildup of combustible gases, which likely generated from deteriorating cable insulation, and connected duct work. The report also identified that Baltimore's conduit (and underground infrastructure, broadly) is overcrowded. The report does not identify a specific ignition source for the fire.

FISCAL NOTE

The City's 2023 agreement with BGE has led to a significant reduction in the annual revenue coming into the City's Conduit Fund. In fiscal year (FY) 2023, the City accrued over $41 million in revenues from rents, fees, and other income assessed on Conduit service providers, including BGE. The following year, FY 2024, the City took in just over $17 million. However, this marked change in revenues does not account for the $120 million in capital improvements BGE is required to make under the terms of the 2023 agreement. In addition, Conduit system operating expenses, which

account for contractual services required to maintain the Conduit, fell slightly from FY2023 to FY 2024 – from $12.4 million to just under $10.2 million.

In FY 2025, City conduit revenues did increase to just under $23.5 million with operating expenses returning to a level comparable to FY 2023 at about $12 million.

Analysis by: Ethan Navarre
Direct Inquiries to: Ethan.Navarre@baltimorecity.gov
Analysis Date: 7/15/2025
Revision Date: 2/24/2026

BALTIMORE CITY COUNCIL

PUBLIC SAFETY COMMITTEE

LO25-0025
Underground Infrastructure Safety

Agency Reports

Public Safety Committee Underground Infrastructure Safety

March 3, 2026

Brandon M. Scott
Mayor

BRIEFING PURPOSE

Today's briefing will:

- Highlight the outcome of the December 30, 2025, Report.
- Discuss implementation of Report recommendations.
- Identify Conduit system issues and implementation challenges.

REPORT FINDINGS

The City's report, prepared by RTI Consulting Group, determined the following:

- The fire on September 29, 2024, was likely started by combustible gases.
- Underground infrastructure is overcrowded with multiple utilities.
- Due to the age and complexity of the Conduit system outdated equipment installation practices are present throughout the system.

This presentation will discuss the Report's recommendations.

SUMMARY OF RECOMMENDATIONS

a. Cable separation
b. Manhole remediation
c. Enhanced monitoring
d. High-risk locations
e. System mapping
f. Emergency plan
g. CO2 truck
h. Safety committee
i. Manhole covers
j. Housing actions
k. CitiWatch footage
l. Evidence preservation
m. Laboratory testing
n. Manhole chambers

(a) CABLE SEPARATION

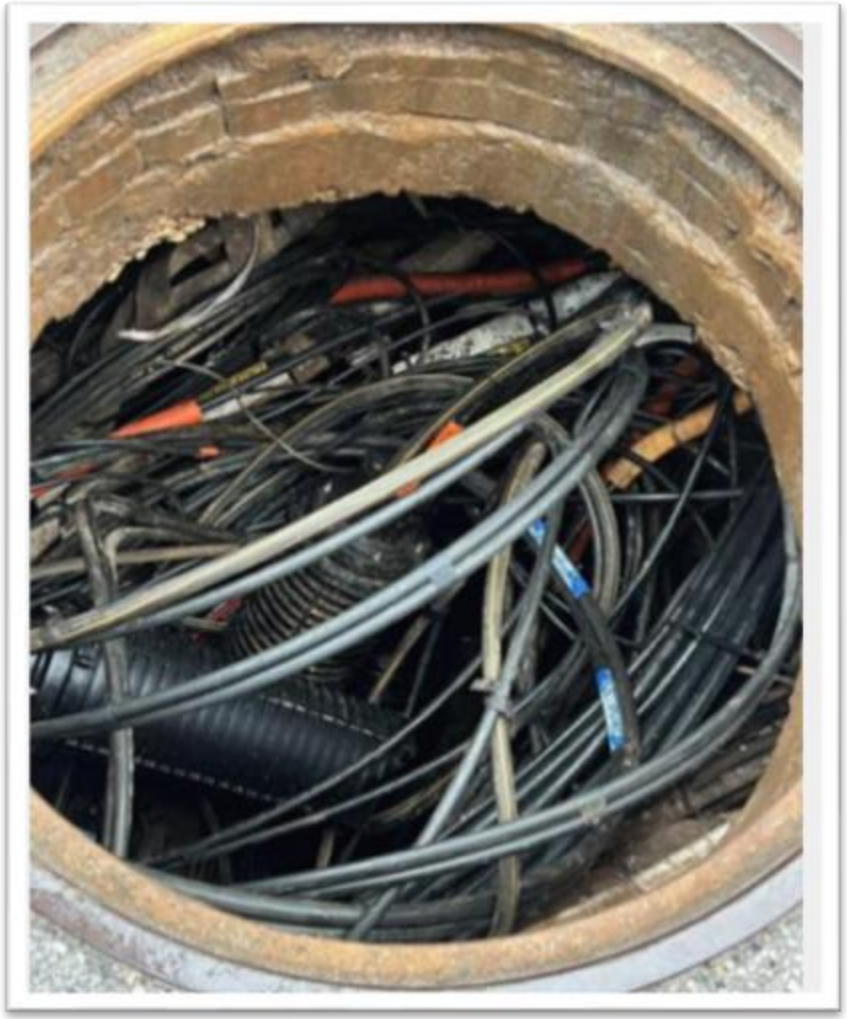
(a.) Ensure that all fiber cable coils and splice boxes are separated from all power cables in the manhole by at least 12 inches. Congestion of fiber optic cables in manhole A1- 116-087, as shown in Figure 1, should be avoided.

System crowding is concentrated primarily Downtown.

- Underground space is limited.
- Working with lessees to reduce manhole crowding.

DOT prohibits the installation of fiber optic and electric cables on the same ducts, reducing the risk of electrical fires.

(a) CABLE SEPARATION (cont.)



December Report, 'Figure 1'. Manhole 087.

Ongoing reconstruction of Manhole 087.

(b) MANHOLE REMEDIATION

(b.) Develop a priority enlargement program for the most congested manholes to achieve proper space for maintenance and inspection.

Conduit Division is prioritizing which segments of the system should be enlarged to reduce system crowding.

- New and reconstructed manholes are built to modern specs.
- This is standard Conduit practice where underground space is available.

(c) ENHANCED MONITORING

(c.) Enhance monitoring practices beyond periodic thermal inspections i.e., temperature and smoke detectors, combustible gas sensors, water level sensors, and potential electric discharge sensors.

In consultation with peer agencies, we have determined the Conduit system needs the following:

- Sensors (heat, gas, humidity, water detection)
- Network connectivity
- Centralized analytics platform

(d) HIGH-RISK LOCATIONS

(d.) Develop a city-wide conduit system utility risk map to determine the most critical and vulnerable cables services for loss prevention and most effective emergency response.

DOT has identified critical and high-risk parts of the Conduit system.

- As is the case for most utilities, vulnerable asset locations are kept confidential to reduce the risk of intentional tampering.
- Conduit division is aware of system-wide areas of concern.

(e) SYSTEM MAPPING

(e.) Create a city-wide utility scaled drawing database to enable all underground utility installations to be accurately located for inspection and or excavation as well as isolation controls.

DOT maintains a database of all underground utility installations.

- Conduit division maintains a robust GIS system to identify utility locations.

(f) EMERGENCY PLAN

(f.) First responders to manhole fires, in particular BCFD and BGE, should devise an emergency plan and training for prompt extinguishment of manhole events including timely isolation of power and best means of suppression.

Fire and OEM have developed emergency response plans in place for fires in the Conduit system.

(g) CARBON DIOXIDE TRUCK

(g.) Provide access to a Carbon Dioxide Tank Truck (CARDOX) for the BCFD to share with adjacent Counties to aid in control electrical fires.

Baltimore City Fire Department is exploring the potential acquisition of a carbon dioxide tank truck.

(h) UNDERGROUND SAFETY COMMITTEE

(h.) Establish an ad-hoc safety committee for all city utilities, to meet on a regular basis to reduce the risk of undesirable conditions in the conduit system and surrounding underground utility installations.

Underground safety is now discussed at DOT's monthly utility coordination meeting.

- Conduit division holds a separately monthly meeting with BGE.

DOT is working with OEM on emergency documentation standards.

- These will speed up responses and clarify accountability during emergencies.

(i) MANHOLE COVERS

(i.) Explore established manhole cover tethering and venting options.

Manhole cover venting was tested and is not recommended.

- Venting would introduce more stormwater, road debris, and salt/brine into the system.

DOT Conduit is exploring the potential tethering of manholes.

(j) HOUSING ACTIONS

(j.) Baltimore Housing Community Development (BHCD) should inspect and enforce fire stop installations at all street ducts into housing.

DOT Conduit is working with DHCD to understand inspection standards and inspection protocols.

(k) CITIWATCH FOOTAGE

(k.) Obtain CitiWatch relevant footage of entire event and other security camera footage available from nearby structures within 24 hours of an event.

DOT will request CitiWatch camera footage surrounding incident locations when available and keep it in records.

(I) EVIDENCE PRESERVATION

I. Continue to preserve all physical evidence from manhole fires based on the guidelines utilized in forensic engineering investigations.

Pieces of infrastructure evidence will continue to be preserved and examined.

(m) LABORATORY TESTING

(m.) Conduct laboratory testing on evidence from the September 29, 2024 event that was secured by BGE to enable further recommendations. These tests include Energy Dispersive X-Ray Spectrometry (EDX) of the materials on power and fiber cables, optical and microscopic examinations, CT scans of internal structures of cable connections, compression testing on different types of conduits that were used, as well as physical examination of fiber splice boxes.

Laboratory testing may be conducted to gain further insight into the causes of the fire, if necessary.

(n) MANHOLE CHAMBERS

(n.) A new design needs to be developed to store fiber optic splice boxes and coils in separate underground telecom manhole chambers.

The Report recommends the design of separate manhole chambers for splice boxes and electrical infrastructure.

- The design and installation of new manhole chambers is contingent on the availability of underground space, which is limited in Downtown.
- DOT is working to increase separation between electric and fiber cables.

MEMORANDUM

To: The Honorable President and Members of the City Council
c/o Natawna Austin, Executive Secretary
From: J Hardy, Community & Legislative Affairs Coordinator
Date: March 2nd, 2026
Re: LO25-0025 - Underground Infrastructure Safety

The Office of the Comptroller is responding to Chair Conway's request for testimony regarding Legislative Oversight 25-0025, specifically as it relates to the history of the amendment to the settlement agreement with BGE, which restructured how BGE and the City make capital investments and maintenance payments, and this office's role in scrutinizing that amendment.

Timeline

Baltimore City's conduit system is a publicly owned asset that generates revenue used for its maintenance and long-term capital needs. In 2015, the City increased conduit fees based on a consultant's report identifying necessary infrastructure investments. Following litigation, the City entered into a settlement agreement that required all collected conduit fees to be spent exclusively on conduit upkeep or returned to BGE. That agreement expired in 2022.

In 2023, rather than renewing the prior agreement under similar terms, the Administration negotiated a revised structure in which BGE would make capital improvements directly instead of continuing to pay usage fees. This deal was made public in late January 2023. On February 14th, the Administration rejected a vote deferral request from the Chair of the Board of Estimates, Council President Mosby. On February 15th, the Mayor and his appointees to the Board of Estimates voted to approve the amended agreement with myself and Council Present absent.

Background

In the three weeks between the amendment becoming public and the Board's action, neither the Comptroller's Office nor the City Council, despite repeated requests, was provided with updated, comprehensive data demonstrating that the proposed capital commitment is sufficient to meet the current and long-term needs of the conduit system. When the deal went to the Board, nearly every other conduit user sent in letters of opposition. It is not an overstatement to say that there was simply no understanding of the financial implications or logistics from any party, outside of the Mayor's office.

Subsequent developments further underscored our concerns. In December 2023, the Maryland Public Service Commission approved a $400 million multiyear rate increase for BGE to fund

infrastructure improvements. Though BGE is not allowed to use a higher franchise fee as a justification to the Public Service Commission to charge higher rates, by spending the same amount of money as direct improvements to the conduit, that counts as a capital expenditure allowing them to pass the cost onto ratepayers. The Mayor's office argued that this scheme would help BGE realize savings. Instead, we've seen prices increase and costs put on the shoulders of our residents.

Crucially, the City is nine months away from the conclusion of the initial term of BGE's CIP obligation; this contract automatically renews for three succeeding years. The Comptroller's Office is committed to working with the Council to provide oversight and scrutiny as we look for solutions to this issue. We need to examine this entire process, so our residents aren't carrying the burden of bad past decisions.

CC:

Celeste Amato, Chief of Staff, Comptroller's Office
KC Kelleher, Deputy Chief of Staff, Comptroller's Office

BALTIMORE CITY COUNCIL

PUBLIC SAFETY COMMITTEE

LO25-0025
Underground Infrastructure Safety

Additional Materials

CITY OF BALTIMORE
BRANDON M. SCOTT, MAYOR
100 N. Holliday Street
Baltimore, Maryland 21202

DEPARTMENT OF TRANSPORTATION
Veronica P. McBeth, Director
417 E. Fayette Street, 5th Floor
Baltimore, Maryland 21202

Date: **December 30, 2025**
To: **Mayor Brandon M. Scott**
From: **Veronica P. McBeth, Director, Department of Transportation**
Subject: **Re: Review of 2024 Underground Fire**

Prior to my tenure as Director of the Baltimore City Department of Transportation, a fire occurred on September 29, 2024, following a manhole explosion at the intersection of Charles Street and Pleasant Street. The fire resulted in damage to a number of nearby businesses and caused power to be shut down in the downtown area for several hours. While this fire was particularly dangerous and disruptive, it was the latest in a series of many fires that have occurred in the City's underground conduit system dating back many years.

To address this, at your direction, the relevant agencies participated in a review of the cause of the underground fires and developed a series of recommendations to prevent their future recurrence. This began with the convening of a multi-entity stakeholder group in October 2024. In the spring of 2025, the City began working with forensic consultant RTI Group LLC, an engineering firm with experience in investigating fires, to develop a scope for an investigation into the underground fires. This work was expedited following another incident in June 2025 at the intersection of Guilford Avenue and Baltimore Street. RTI was formally engaged and began their investigation in the beginning of July 2025.

RTI's investigation to date has primarily focused on the 2024 Charles Street fire due to the heavy commercial presence in the area and major disruption to City residents. That review is complete, and their findings and recommendations are being released, as was assured to the City Council following a Council hearing last July. Their investigation spanned several months, and included multiple site visits to the underground conduit, meetings with City officials from the Department of Transportation, Fire Department and Department of Public Works, as well as discussions with BGE and Vicinity. RTI's findings provide the most in-depth chronology of events around the Charles Street Fire, and have identified a number of risks that the appropriate agencies have already begun addressing.

In relevant part, RTI determined that the Charles Street Fire was caused by a combination of combustible gases that had been generating in the A1-116-087 manhole (087 manhole) and connecting duct work for some time prior to their detonation at 4:10 am on September 29, 2024. The resulting fire that occurred after the explosion then spread to the surrounding businesses. RTI identified a number of risk factors, including overcrowding of the underground infrastructure with equipment and cables from multiple utility companies. RTI recommended that the City develop a program for ensuring separation of the underground fiber cables and enhanced monitoring of the City's underground infrastructure.

The City, led by the Department of Transportation, is in the process of developing a plan to implement the recommendations provided by RTI. To begin, DOT has already significantly increased the number of inspections of the manholes in the area. Additionally, the City is piloting a monitoring system developed by RTI to detect gas and high temperatures in the underground conduit on Charles Street.

Moving forward, the responding agencies will continue to work with key utility partners to enhance the safety of the city's underground infrastructure to ensure safety for all residents.

Regards,

Veronica P. McBeth, MSL
Director
Department of Transportation

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PJLA Testing
Accreditation
#128874

Survey of Baltimore City Manhole Explosions and Fires
North Charles and Pleasant Streets, September 29, 2024

Executive Summary and Recommendations
December 30, 2025

Prepared and Submitted By:
Joseph R. Reynolds, PE
Principal Electrical Engineer

Reviewed By:
Joshua Rochon, EIT
Electrical Engineer

RTI Matter No. 50244UT002

ABSTRACT

On September 29, 2024, Baltimore City Maryland experienced a major manhole explosion and fire in the 300 block of North Charles Street. The resulting fire damaged numerous businesses in the area and required a significant response from the Baltimore City Fire Department ("BCFD"). The City convened a meeting with the affected businesses in October 2024 to discuss a response to the underground fires. In 2025, the City contacted forensic consultants at RTI Group LLC (RTI), a local professional engineering firm highly experienced in such matters, to determine a scope of an investigation into the causes and contributing factors of the Charles Street fire as well as to develop recommendations for the city to mitigate the threat of future fires. The City formally engaged RTI following an additional manhole fire that occurred in June 2025, and their investigation began in July of 2025.

RTI's investigation lasted approximately five months and included 41 virtual meetings and one live mid-way presentation to City officials, as well as numerous meetings with the City's Department of Transportation, three field visits to the City's underground conduit system, and four inspections of BGE physical evidence at BGE's Riverside location. BGE provided access to their photo-video documentation and the physical remains saved from the A1-116-087 (087) manhole of the September 29, 2024 event at North Charles and Pleasant Streets. The report that follows includes the findings and recommendations to date of RTI's investigation.

RTI interviewed Baltimore City personnel, including but not limited to the Fire Department, Department of Law, Fire Prevention Bureau, DOT, and Conduit System Consultants. In addition, conversations were held with the BGE Claims manager during multiple inspections of all physical manhole evidence stored at the Riverside Plant. Introductory virtual meetings were held with representatives of Vicinity Energy, who own and operate the underground steam system in the Charles Street corridor.

RTI also reflected on its own experience from past investigations of manhole fires and explosions on behalf of other power utilities in the U.S. and overseas; from London to Chicago, Indianapolis, Boston, New York and Washington D.C. The power industry has been dealing with manhole fires for decades and RTI has been involved with leading institutions such as the Electric Power Research Institute (EPRI), in this work as consultants. The conclusions and recommendations presented in this report reflect that experience to provide the most practical and effective solutions for the Baltimore City Mayor's Office.

Table of Contents

I. Introduction

Underground utilities in the City of Baltimore have existed for more than one hundred years. Conduits for electric power cables in the beginning were made of wood, then advanced to terracotta. Today, most electrical conduits are made of various plastics or fiberglass. Aging of the conduit system and its installed equipment has created an environment with numerous risk factors that can result in unexpected explosions and fires, at times ejecting heavy cast iron covers from the manholes that provide access to these underground utilities. In a similar fashion as in numerous aging metropolitan cities worldwide Baltimore City has experienced a series of manhole explosions and fires over the past several years.. The resulting impact usually involves electric power outages, communications outages, disruption of street traffic, business interruptions, and risks of injuries and property damages.

Although explosive gases may be the result of several processes, the most frequent events are due to overheating of the cable insulation during the pre-explosion phase. The nature and composition of gases evolved from degradation and overheating of cable insulation installed in underground systems includes hydrogen, carbon monoxide, methane, ethylene, and the presence of arcing can produce acetylene. Prior to a manhole explosion and fire, gases can accumulate and produce a potentially explosive atmosphere in an underground system of duct work and manholes. These events have prompted numerous research studies to understand the science behind their causation. Although each event is unique, RTI's analysis has identified with a high level of confidence the cause of such explosions and the resulting fires.

II. Investigation Findings

RTI conducted a comprehensive factual investigation of the recorded data and evidence available from several sources. Those sources included but are not limited to City of Baltimore records; BGE reports, records, and photographs; the BCFD radio logs, reports, and photographs as well as other utilities sharing the Charles Street corridor. As in any forensic investigation of this type, visual inspections of the scene and detailed documentation of the physical evidence have been conducted to assist in reconstructing the event, which took place over four hours, from just before 4 AM to 8 AM on September 29, 2024.

During the investigation, it was discovered that a previous manhole fire had occurred on January 25, 2024 in the underground conduit locations near 340 and 342 North Charles Street, Baltimore, Maryland. According to BGE records, their secondary cables may have been damaged by trenching in the area in late 2023 or other underground repair and construction activities. It was noted in BGE's report that a steam leak in the basement of 340 N. Charles Street was directly adjacent to the manhole fire that may have contributed to the event. The photograph shown in Figure 1 was taken on March 6, 2024, six weeks after the January 25, 2024 event. The unacceptable overcrowded conditions, proximity, location and time since repairs in the January event constitute a contributing factor in the September event.

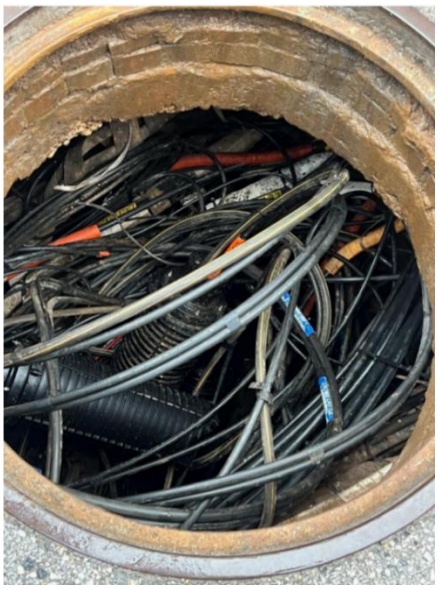

Figure 1: Manhole A1-116-087 SE Charles and Pleasant Streets as "restored" from the January 25, 2024 fire on March 6, 2024 prior to the September 29, 2024 fire and explosion.

Figure 2: Fiber splice box and coils of fiber optics cable thrown outside of manhole due to the explosion.

Evidence shows that on September 29, 2024, a detonation of combustible gases occurred in manhole A1-116-087 (087) was first reported by a 911 call at 4:10am and as a "Big Bang" by a resident at a distance of about 1000 feet north from Pleasant Street. Figure 2 shows the fiber cable and splice box ejected from the manhole at that time. As a particular note of this photograph, the splice box is mainly intact while the fiber cable coverings have been destroyed. The burning flame seen in the cable debris continued to burn indicating the presence of combustible materials.

By 6:30am, a fire broke out in the bookstore of Brown's Arcade building due to the lack of fire stop plugs in the duct. Three additional manhole covers, two on North Charles and one on Saint Paul Place, had blown and were showing smoke. Electric power to these manholes and the bookstore had not been isolated at this time. The fire was finally brought under control at 8:23am after the power in the area was isolated at 7:01am.

Figure 3: Photograph taken approximately 6:30am at the bookstore on Charles Street. It was reported that the fire was coming up from the basement.

As a result of the manhole explosion, the cover was found to be shattered into five pieces. Figure 4 shows the relative position of those pieces, which separated at the thin wall portion of the rim, due to a sudden over pressurization in the manhole caused by a high energy or detonation of combustible gases. This particular condition was aggravated by a slightly oversized cover causing it to shatter rather than simply blowing off. This indicates that the mixture of gases with oxygen was well within the explosive limits at the time of ignition.

Figure 4: Shattered Manhole cover from A1-116-087.

a. Research

The areas of Baltimore involved in the entire September 29, 2024 incident extended from Mulberry Street to the North, Saratoga Street to the South, between Cathedral Street to the West, and St. Paul Place to the East (See Figure 5). An accurate timeline was constructed from the BCFD dispatch radio transcript to reconstruct the sequence of events, which involved two 911 calls from concerned citizens when the first manhole explosion was heard and the timing of subsequent manhole events (See Figure 6 and Figure 7). It was important to also understand the source and timing of a coincident fire development in the Brown's Arcade building.

Figure 5:Is a scaled image of the common point at manhole 087 (1) with orange conduit involved in the January 25, 2024 incident to the north and the yellow conduit going to the south involved in the September 29, 2024 incident.

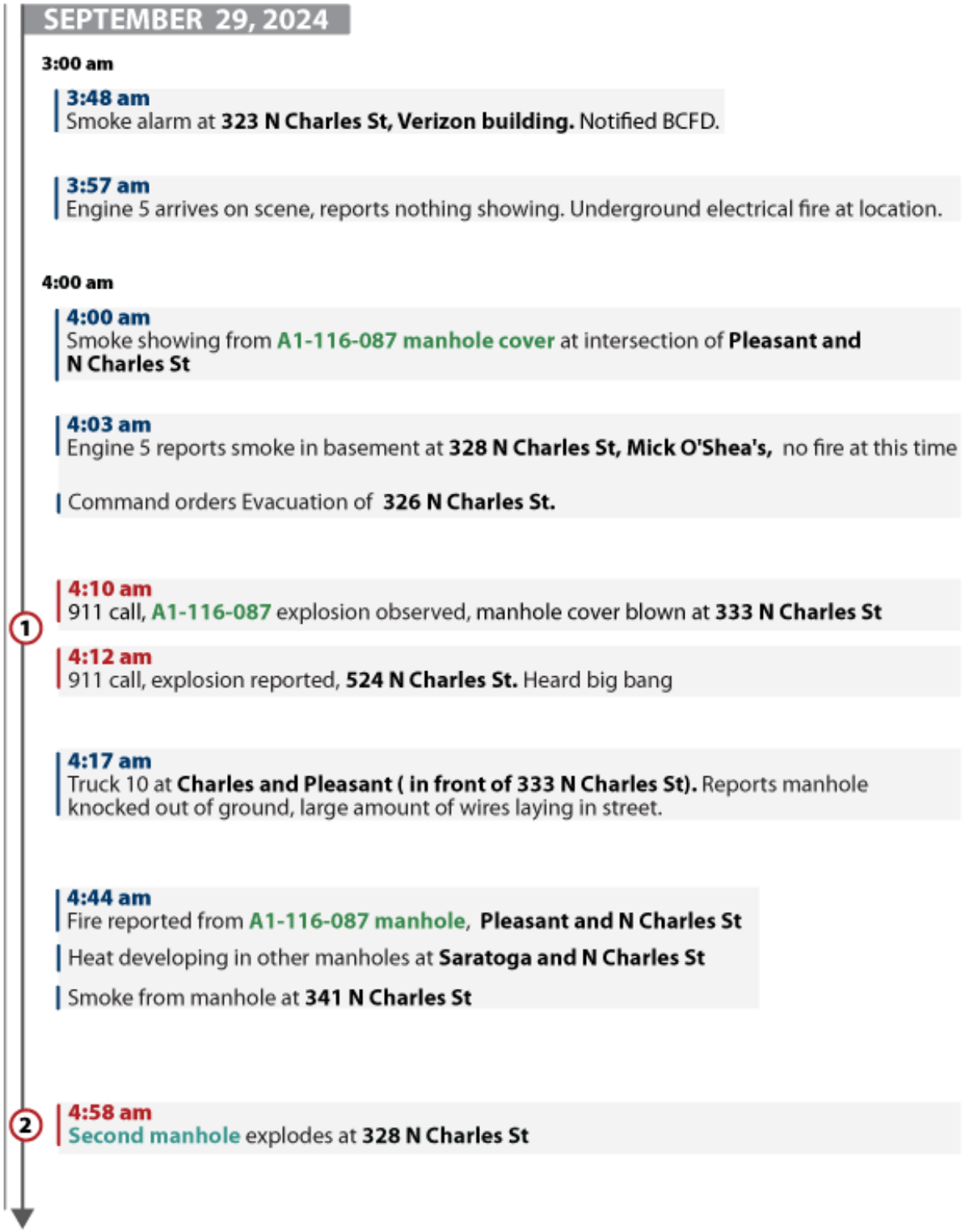

Figure 6: Timeline of key events.

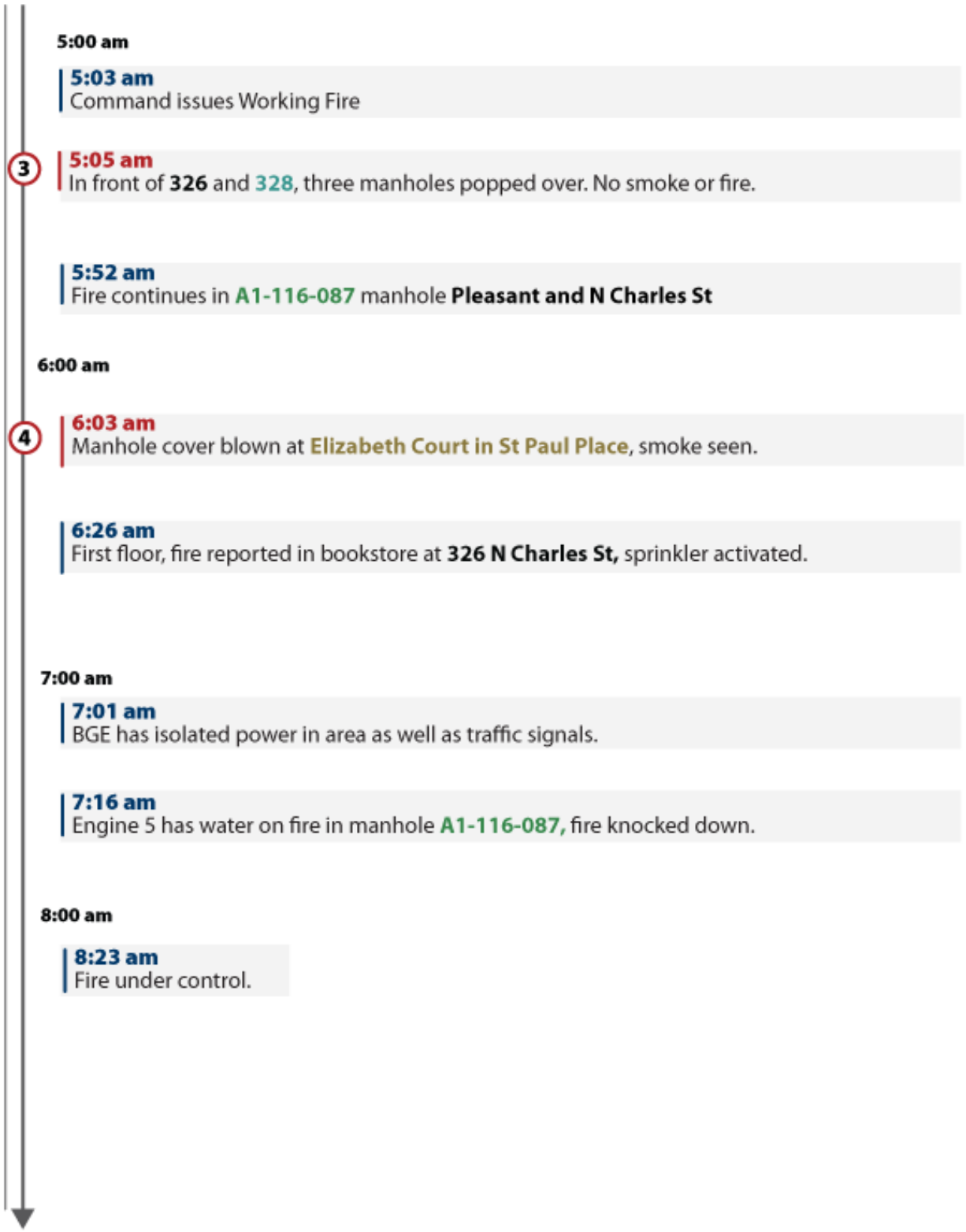

Figure 7: Timeline of key events continued.

The underground region of North Charles Steet contains public works utilities buried with electric power and fiber optics communication cables, installed in a variety of ductwork under individual Conduit Lease Agreements with the City for each operator in Baltimore City Department of Transportation (BCDOT) conduit.

Previous research has shown that the majority of manhole fires and explosions are caused by combustible gases. Only a small number are caused by electrical arcing alone. Generation of explosive gases most often occurs in manholes when cable insulation is decomposed due to overheating at incipient electrical failures. The process is normally slow to release a mixture of combustible gases initially but can become rapid as the fault and overheated area expands. Once the explosive gases mix in the correct proportion with air (O_2) and a sufficient ignition source is present, the explosion will be released in the ductwork and/or manhole.

Combustible gas detectors can warn operators of these gases and provide a timely means to monitor underground utilities for serious risks. Local underground conditions that also lead to cable insulation degradation can be monitored for ambient temperature, moisture, and ice control chemicals. In addition, infrared imaging can detect overloaded power cables and connectors that can lead to arcing faults. While several major US cities are using innovative manhole monitoring and alarm systems, the ideal standard system is developing with advances in detectors and computer controls. Other underground services including fiber optics cable, copper telephone, natural gas, and steam may also be involved.

b. Site Inspection

On July 21, 2025, the manhole 087 at Charles and Pleasant streets was entered and examined. The slightly oversized cover was noted to be very difficult to remove, although ladder access was possible, approximately 18 inches of water was pumped from the sump before entering. The conditions found were an improvement over the March 6th, 2024 photo (Figure 1) by fiber optics equipment not being literally thrown into the manhole, but rather hung on supports for the existing power cables.

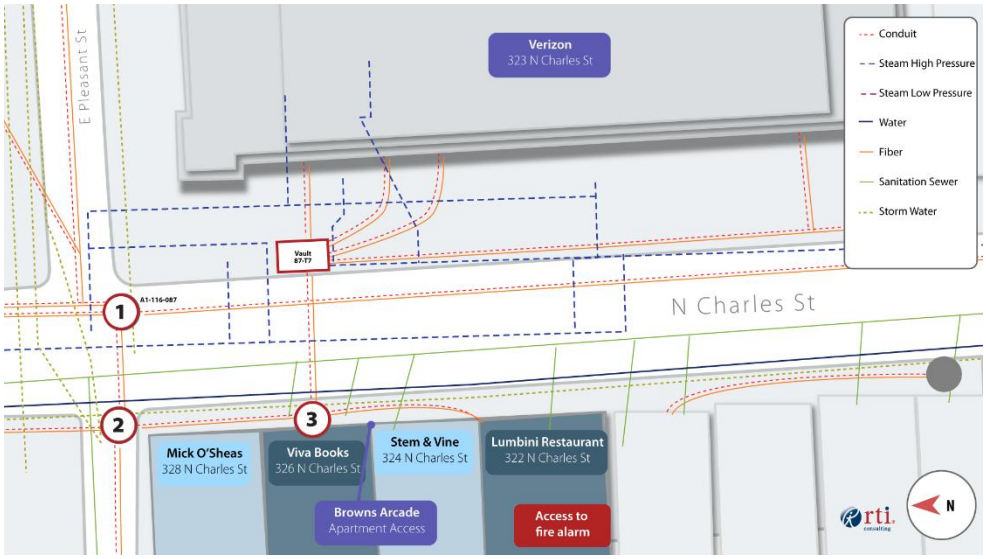

Figure 8: Known underground utilities sharing the 300 block of North Charles Street.

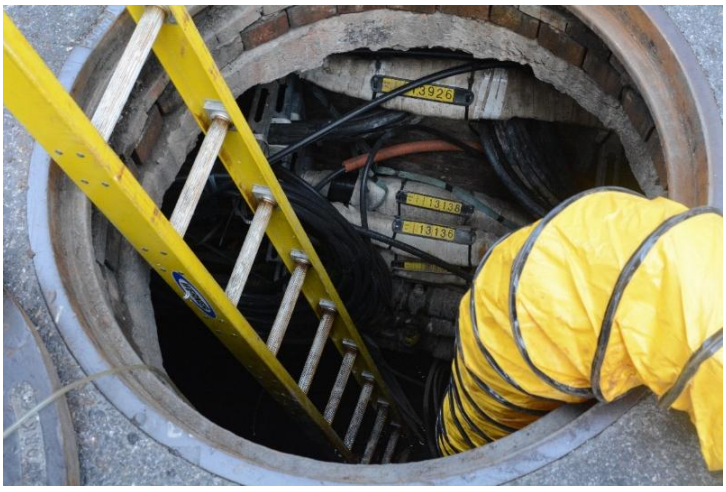

Figure 9: Photograph taken on July 21, 2025 during RTI's site visit to manhole 087.

Access has been greatly improved for manhole 087, as seen in Figure 10, with the ladder and air supply duct in place. While access has been improved, placement of fiber cable coils remains a problem inside the manhole 087. Contact between armored fiber cables and electric power cables, as seen on the right side of Figure 10, is undesirable and may lead to electrical failures.

Figure 10: Photograph taken on July 21, 2025 during RTI's site visit to manhole 087.

On October 9, 2025, the reconstruction of manhole 087 at North Charles and Pleasant Streets was visited and found to be slightly enlarged and being constructed to BGE specifications. Fiber cable coils can be seen hanging from temporary pole supports separated from power cables as seen in Figure 11. A return visit is planned upon completion of this investigation.

Figure 11: Photograph taken on October 09, 2025 during RTI's site visit to manhole 087.

c. Evidence Inspection

On September 9, 2025, the first inspection of BGE evidence, stored in sling bag tarps at their Riverside plant storage facility, provided an overview of the condition and variety of cables and connectors removed from the 087 manhole and adjacent areas. Plans were made for a more detailed inspection and a selection of items to be examined in the laboratory.

Figure 12: Photograph taken on September 9, 2025, of the first inspection of BGE evidence at their Riverside plant storage facility

A second visit with the evidence occurred on September 15, 2025, where individual items were examined and documented. Selecting items of interest began and small parts were placed in green bins. Larger evidence was placed on a blue tarp A third visit to Riverside was planned for the purpose of examining the contents of a large cardboard box that had remained untouched in the dumpster since it had arrived to the Riverside facility.

Figure 13: Photograph taken on September 15, 2025, of the second inspection of BGE evidence at their Riverside plant storage facility

A third visit to the Riverside evidence storage was made on September 29, 2025, to select items to be examined and to initially review materials that had been stored in a large cardboard box that was in a covered roll-off dumpster. All selected evidence and materials were protected from the elements with tarps and placed inside the covered dumpster.

Figure 14: Photograph taken on September 29, 2025, of the third inspection of BGE evidence at their Riverside plant storage facility

III. Conclusions

Based on multiple site inspections, detailed evidence examinations, and review of all available information, RTI provides the following conclusions, to a high degree of engineering certainty:

a. The Charles Street September 29, 2024, event was caused by a combination of combustible gases that had been generating in the A1-116-087 manhole (087 manhole) and connecting duct work for some time prior to their detonation at 4:10am.

b. Underground infrastructure is overcrowded with multiple utilities (fiber optics, steam, potable water, electric, natural gas, sewer, and storm water piping).

c. The need for underground utility maintenance on Charles Street presents the opportunity for inadvertent contact with neighboring systems where such contact with cables could damage their insulation.

d. The recent addition of fiber optic cables in the existing manholes exceeds the original design for their intended use.

e. There was little to no separation of fiber optic cables from power cables inside of the 087 manhole. While inspecting a nearby vault 087-T2, it was observed that there was one case where fiber optic cable as well as power cables were sharing the same conduit duct, shown in Figure 15.

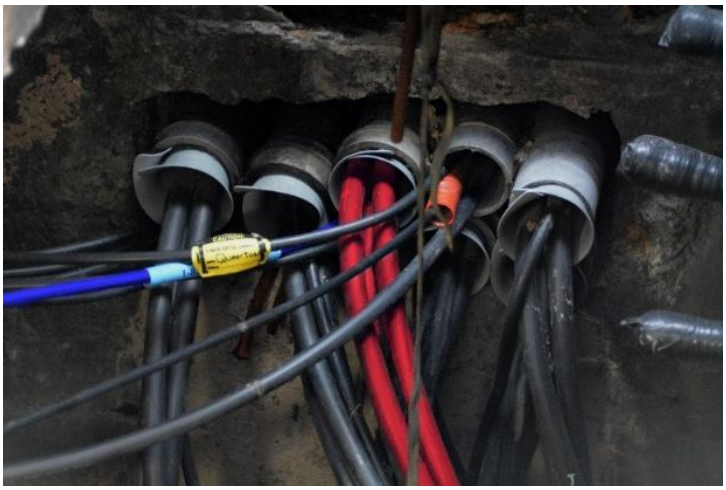

Figure 15: The photo above shows a blue fiber optic cable with the blue Crown Castle label leading to the same conduit duct as multiple red power cables. Note: Coloring for illustration only.

f. The overlapping location and time since repairs of manhole 087 after the January 25, 2024, event qualify these circumstances to be considered a contributing factor in the September 29, 2024 event.

g. The physical evidence salvaged from the manhole by BGE contains equipment spanning approximately 100 years. Laboratory testing will enable a determination of individual power and fiber cable components potential for failure.

h. It is well documented that aging utilities are demanding more frequent inspections and increased maintenance in order to prevent failures. Modernization and or replacement programs are critical to establish a base for conditional assessments.

i. The lack of fire stop plugs in entering duct work allowed the manhole fire to enter the basement of the bookstore, that set fire to its interior.

j. The physical evidence of cable connectors contained a variety of installation techniques, some may present serious risks.

k. The investigation was aided by the numerous photos and videos provided by BGE and BCFD. RTI encourages the institution of a mutual training program for first responders to enable an organized documentation and collection of evidence in the future.

IV. Recommendations

Based on the conclusions and RTI's experience in manhole fires and explosions, RTI provides the following recommendations:

a. Ensure that all fiber cable coils and splice boxes are separated from all power cables in the manhole by at least 12 inches. Congestion of fiber optic cables in manhole A1-116-087, as shown in Figure 1, should be avoided.

b. Develop a priority enlargement program for the most congested manholes to achieve proper space for maintenance and inspection.

c. Enhance monitoring practices beyond periodic thermal inspections i.e., temperature and smoke detectors, combustible gas sensors, water level sensors, and potential electric discharge sensors.

d. Develop a city-wide conduit system utility risk map to determine the most critical and vulnerable cables services for loss prevention and most effective emergency response.

e. Create a city-wide utility scaled drawing database to enable all underground utility installations to be accurately located for inspection and or excavation as well as isolation controls.

f. First responders to manhole fires, in particular BCFD and BGE, should devise an emergency plan and training for prompt extinguishment of manhole events including timely isolation of power and best means of suppression.

g. Provide access to a Carbon Dioxide Tank Truck (CARDOX) for the BCFD to share with adjacent Counties to aid in control electrical fires.

h. Establish an ad-hoc safety committee for all city utilities, to meet on a regular basis to reduce the risk of undesirable conditions in the conduit system and surrounding underground utility installations.

i. Explore established manhole cover tethering and venting options.

j. Baltimore Housing Community Development (BHCD) should inspect and enforce fire stop installations at all street ducts into housing.

k. Obtain Citi Watch[1] relevant footage of entire event and other security camera footage available from nearby structures within 24 hours of an event.

l. Continue to preserve all physical evidence from manhole fires based on the guidelines utilized in forensic engineering investigations.

[1] "The CitiWatch Community Partnership is a voluntary registry containing the location and owner information of privately owned cameras. This information can be helpful if there's a crime in the area. Sharing this information helps to deter crime and assist law enforcement with investigations."

m. Conduct laboratory testing on evidence from the September 29, 2024 event that was secured by BGE to enable further recommendations. These tests include Energy Dispersive X-Ray Spectrometry (EDX) of the materials on power and fiber cables, optical and microscopic examinations, CT scans of internal structures of cable connections, compression testing on different types of conduits that were used, as well as physical examination of fiber splice boxes.

n. A new design needs to be developed to store fiber optic splice boxes and coils in separate underground telecom manhole chambers.

RTI reserves the right to amend and/or supplement this report should additional information become available.

---------- End Report ----------