

# National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



PLD23LR002

## **PHOTOGRAPH STUDY**

Specialist's Study

September 19, 2024

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## **A. ACCIDENT**

Location: West Reading, Pennsylvania  
Date: March 24, 2023  
Time: 4:55 p.m. Eastern Standard Time (EST)  
Type of accident: Leak/ Explosion/Fire  
Operator: UGI Corporation /UGI Utilities, Inc.

## **B. PHOTOGRAPH STUDY SPECIALIST**

Specialist Shane K. Lack  
NTSB  
Washington, DC

## **C. SUMMARY**

Please refer to the *Accident Summary* which is available in the docket for this accident.

## **D. DETAILS OF THE INVESTIGATION**

### **1.0 Overview**

On March 24, 2023, a natural-gas-fueled explosion severely damaged the R.M. Palmer Company candy factory located at the corner of Cherry Street and Second Avenue in West Reading, PA. An excavation of Cherry Street after the explosion found a crack in a 3" steam pipe running north-south across Cherry Street. The location of the steam pipe and the location of the crack in the steam pipe are shown in the survey in Figure 1. The natural gas pipe service riser, the pipe fusion and the active service tee shown in Figure 1 were installed during a previous excavation which was performed on February 16, 2021 (almost two years prior to the explosion). Figure 2 shows a photograph that was taken by an R.M. Palmer employee of the excavation of Cherry Street performed on February 16, 2021. The issue addressed in this study is- Does the area being excavated in the photograph in Figure 2 include the location where the crack in the 3" steam pipe occurred?

## **2.0 Camera/Photo Information**

According to information received from the R.M. Palmer Company, the photograph in Figure 2 was taken with a Samsung Galaxy Note 8 cellphone camera. The aspect ratio of the photograph is 4032 x 1960 which is consistent with the "Full" image setting on the Note 8. (Based on the EXIF information, the photo has been previously rotated 90 degrees from its original orientation using Microsoft Windows Photo Viewer 6.1.7600.16385 so that its aspect ratio is now 1960 x 4032. The date of the photo listed in the EXIF information is 2023:04:20 18:23:17. There is no camera information available in the EXIF information.) Since the original camera was not available, an exemplar Note 8 camera was obtained, and the camera properties measured using two different sets of calibration targets. These measurements indicated the horizontal field of view was approximately 66 degrees, which is consistent with published information. The results of the camera calibration indicated that the distortion was minimal, which is consistent with lines in the brick wall being approximately straight in the photograph. The Note 8 camera is equipped with a zoom function. Evaluation of the zoom features determined that no zoom was used in taking the photograph.

## **3.0 Photographs and Measurements used in the Study**

This section describes the photographs and measurements used in the study.

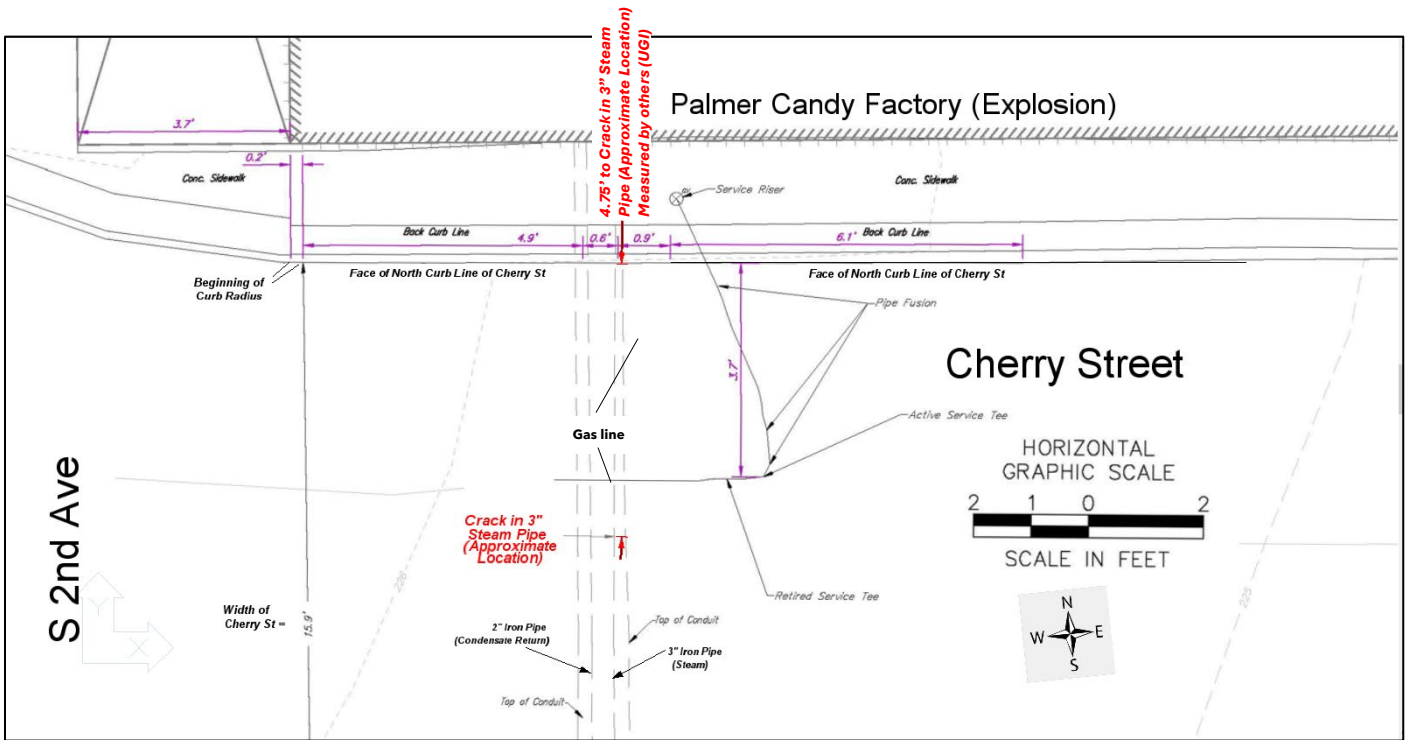


Figure 1. Diagram of Cherry Street showing location of the 3" steam pipe and the crack. (Source UGI)



Figure 2. UGI Crew working on Cherry Street outside the Palmer Candy Factory on February 16, 2021. (Source: Palmer)

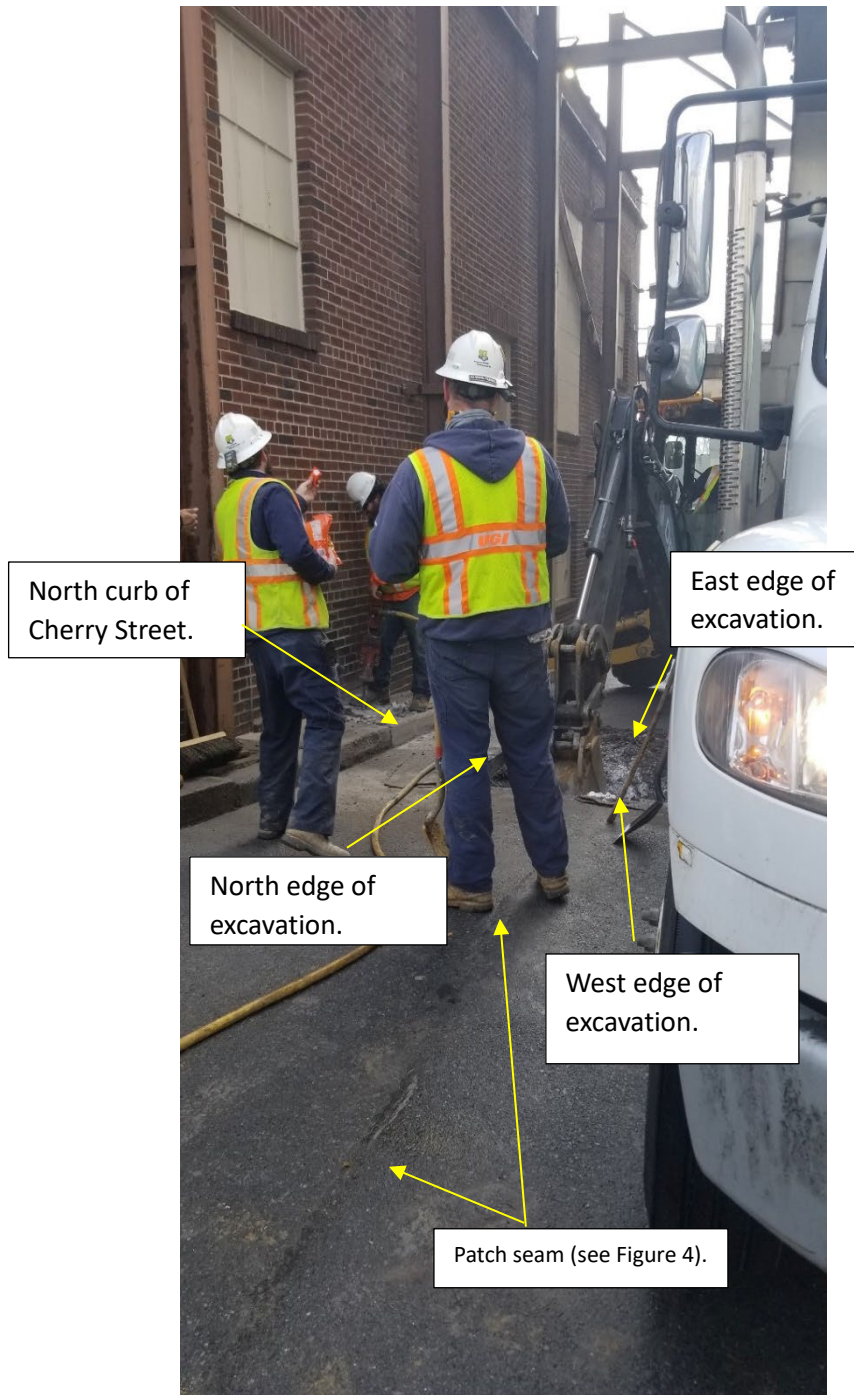


Figure 3. UGI Crew working on Cherry Street outside the Palmer Candy Factory on February 16, 2021. (Source: Palmer)



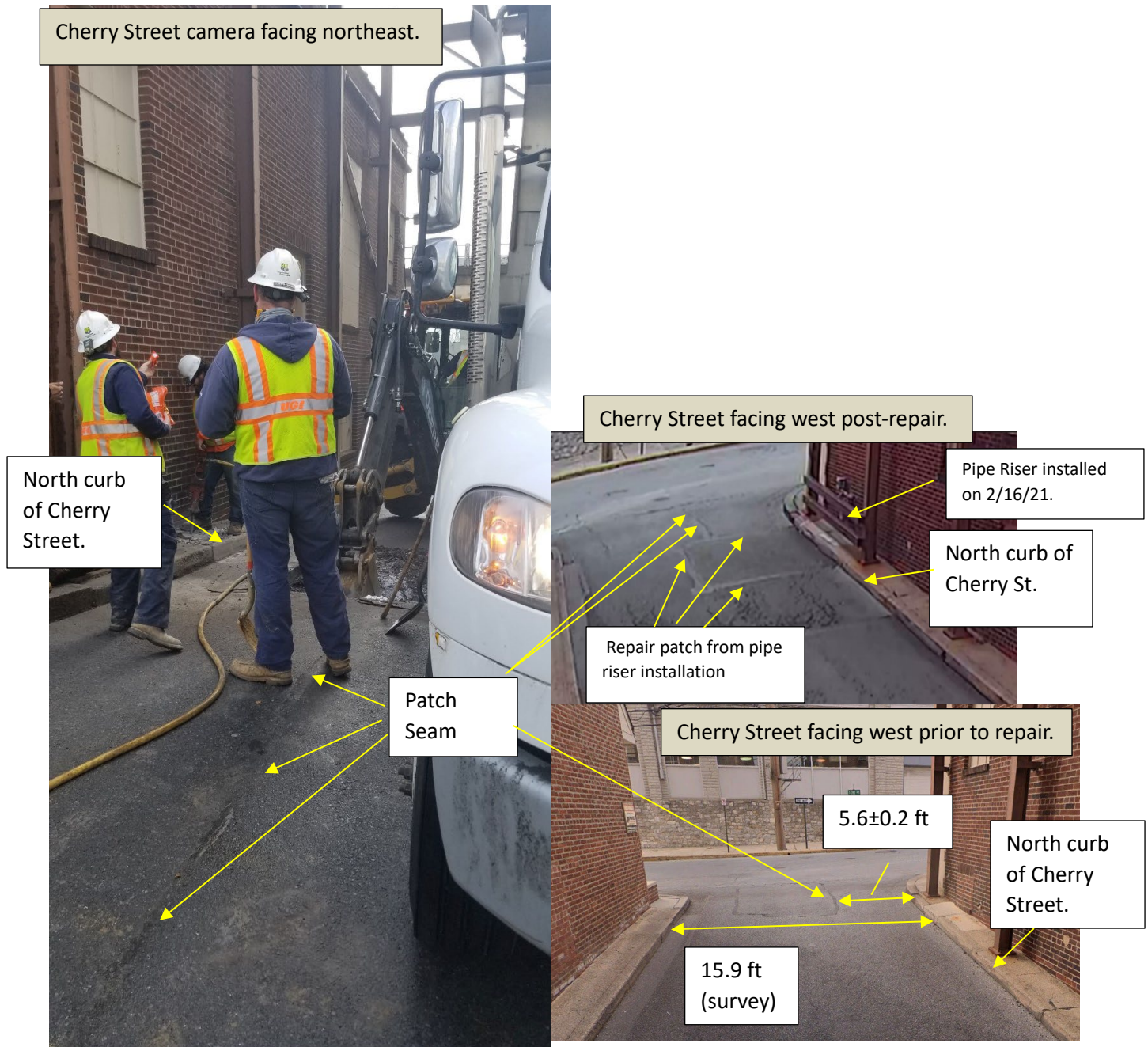


Figure 4. The photograph on the left shows the work crew on February 16, 2021. The figures on the right show the location before and after the maintenance performed on February 16, 2021. The location of the patch seam relative to the north curb of Cherry Street was estimated using the photo and road width and measurements taken by West Reading Borough Police Department after the event (Figure 5).





Approximate Location of the base of post A. (see Figure 6)

North curb of Cherry Street.

Approximate location of the base of post B. (see Figure 6)

Patch seam located  $5.6 \pm 0.2$  ft from north curb of Cherry Street

Figure 5. Cherry Street September 2024. Camera view is facing east. (Source of photo and measurements: West Reading Borough Police Department)



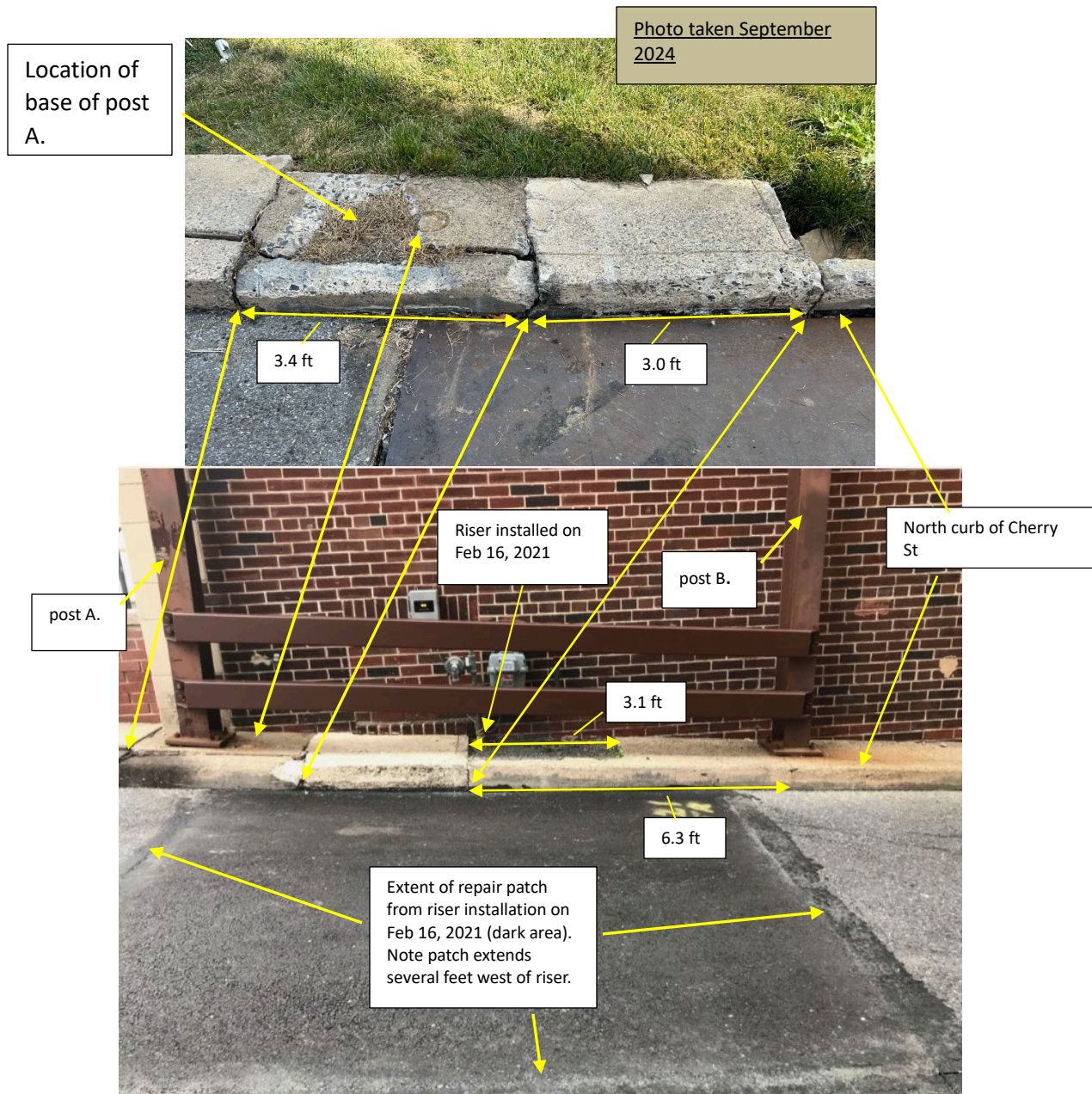


Figure 6. The top photo shows an image of a section of the north curb of Cherry Street photographed September 2024. The image at the bottom shows the riser after the maintenance performed on February 16, 2021. All measurements are post-explosion. (Source of top photo and measurements: West Reading Borough Police Department)



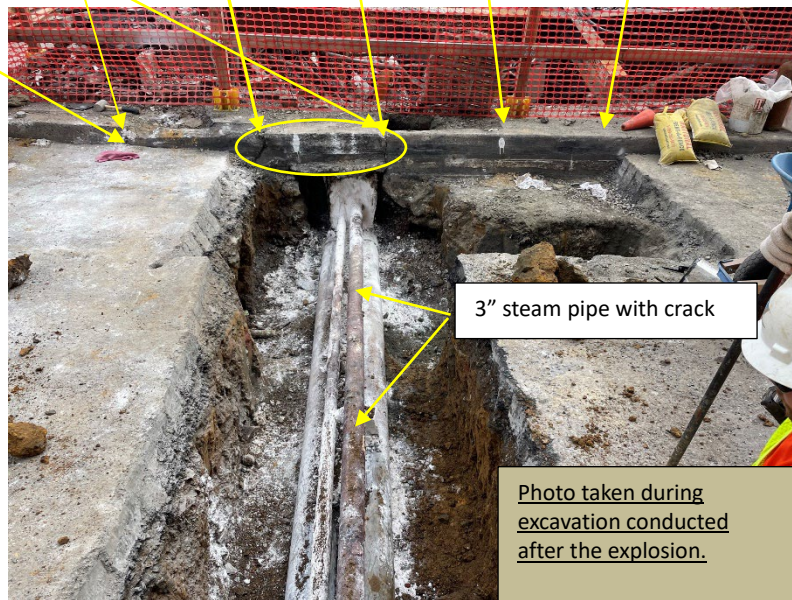
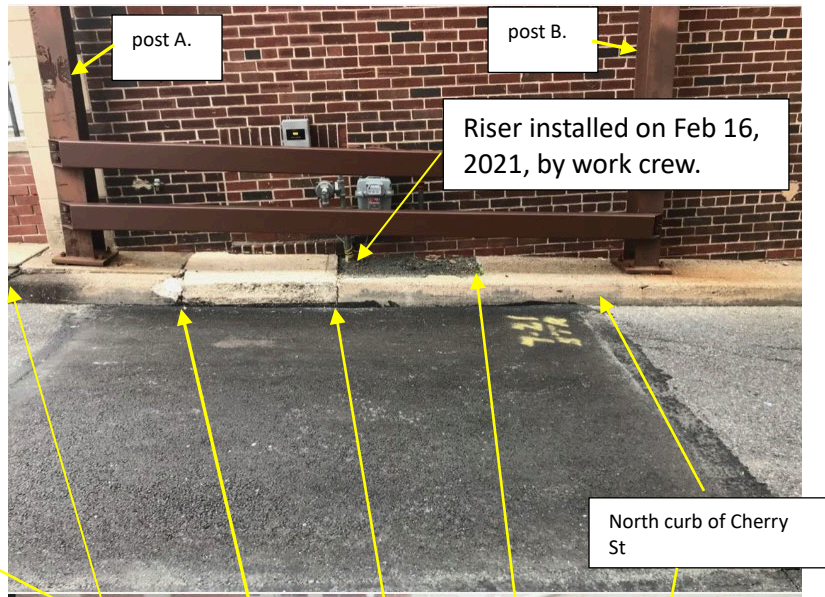
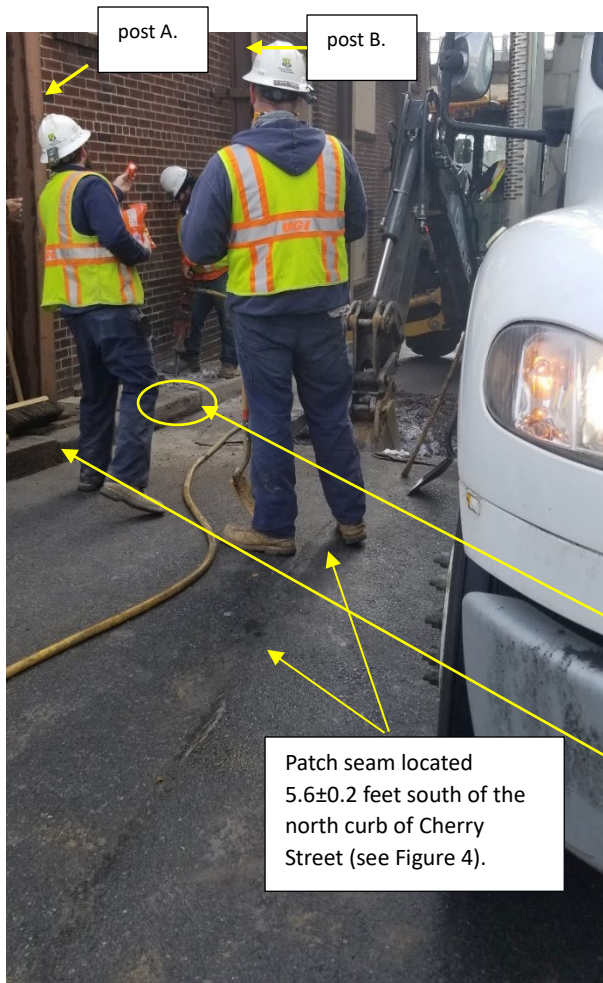


Figure 7. The photograph on the left shows the work crew on February 16, 2021 (Figure 2). The photograph on the upper right shows the location after the maintenance was performed on February 16, 2021 (prior to the explosion). The photograph on the lower right was taken during an excavation conducted after the explosion. Yellow arrows show corresponding features in the photographs.



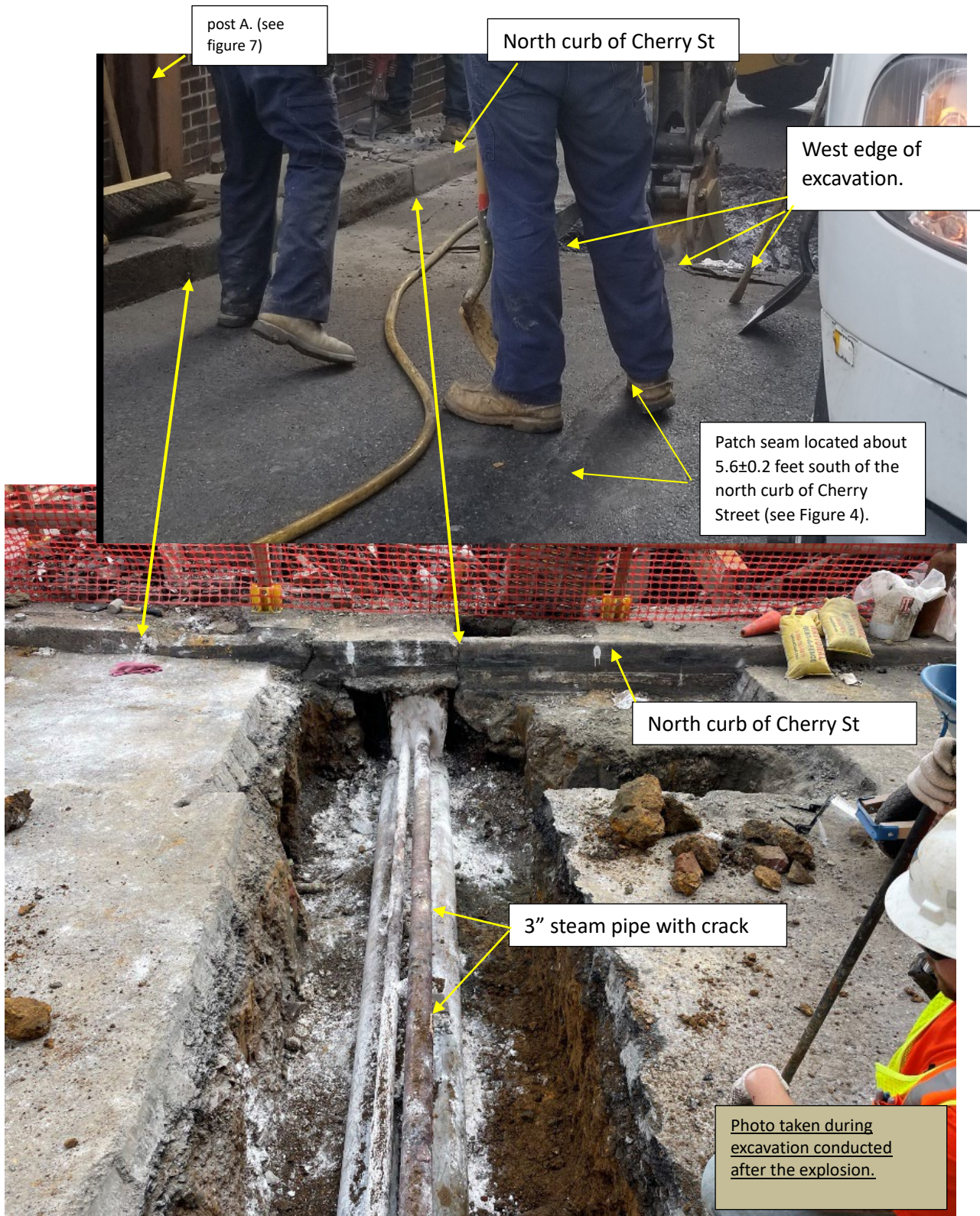


Figure 8. The top image shows the work crew and excavation in the photograph taken on February 16, 2021(Figure 2, zoomed). The bottom image was taken during the excavation conducted after the explosion.





Figure 9. The upper image shows the work crew and excavation in the photograph taken on February 16, 2021 (Figure 2, zoomed). The bottom image was taken during the excavation conducted after the explosion. The broken yellow line shows the alignment of the west edge of the excavation with the north curb of Cherry Street. As indicated by the diagram the south edge of the excavation (hidden behind the truck) is located south of the pavement seam which is located  $5.6 \pm 0.2$  ft south of the north curb of Cherry Street (see also figures 3, 4 and 7).

## **4.0 Discussion and Results**

As indicated by the survey data shown in Figure 1, the steam pipe ran north and south across Cherry Street and was located about 0.9 feet west of the natural gas riser pipe (the east-west zero point for this discussion). The crack in the steam pipe was located approximately 4.75 feet from the edge of the north curb line of Cherry Street.

Based on the measurements and photographs in the previous section, the western edge of the excavation (in Figure 2) was located within 2 feet to the west of the riser pipe (see figure 9) and the southern edge of the excavation was located more than 5.6 feet south of the north curb of Cherry Street (as indicated by the alignment of the pavement seam with the excavation in the photographs).

An attempt was made to accurately locate features in the photograph of the excavation using photogrammetry. There were not enough features in the photograph that could be accurately surveyed to permit a unique solution to the problem of calculating the intrinsic and extrinsic parameters of the camera that define the mapping of the physical space to the image space. As a result, photogrammetry could not be used to accurately locate features in the image and provide quantifiable uncertainties of those locations.

Examination of the images in Figure 9 make it clear that the position of the steam pipe was very close to the west edge of the excavation. Foreshortening of the curb blocks caused by the camera perspective and the obscuration caused by the workers next to the excavation make precise measurements difficult, but it appears that the west edge of the excavation was within about 1 foot of the location of the steam pipe. The crack in the pipe at 4.75 feet from the curb was north of the south edge of the excavation (hidden by the truck), which is at least 5.6 feet south of the curb.

## **E. SUMMARY OF FINDINGS**

The results of the study support that the west edge of the excavation shown in the photograph taken on February 16, 2021, was within about 1 foot of the location of the steam pipe, and the excavation extended south of the location of the crack in the steam pipe. The depth of the excavation could not be determined from the photograph. The steam pipe itself (or any pipe) was not visible in the photograph. A white substance was visible in and around the excavation in the photograph.



Submitted by:

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