newfoundland labrador hydro
a nalcor energy company

Hydro Place. 500 Columbus Drive.
P.O. Box 12400. St. John's. NL
Canada A1B 4K7
t. 709.737.1400 f. 709.737.1800
www.nlh.nl.ca

November 30, 2018

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Holyrood Thermal Generating Station Unit 2 Stack Movement Assessment

On November 15, 2018, during a period of strong winds, Newfoundland and Labrador Hydro informed the Board of Commissioners of Public Utilities of the increased movement of the Unit 2 exhaust stack at the Holyrood Thermal Generating Station. The Board requested that Hydro submit a report no later than November 30, 2018 outlining the various actions undertaken by Hydro to confirm the structural integrity of the Unit 2 exhaust stack. The report must include any engineering analyses/reports carried out during the process.

Enclosed with this letter please find one (1) original plus eight (8) copies of a report entitled "Holyrood Thermal Generating Station Unit 2 Stack Movement Assessment."

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Senior Legal Counsel – Regulatory
SW/kd

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey
Dennis Browne, Q.C. – Brown Fitzgerald Morgan & Avis

ecc: Dean Porter – Poole Althouse
Van Alexopoulos – Iron Ore Company
Senwung Luk – Olthuis Kleer Townshend LLP
Denis J. Fleming – Cox & Palmer
Benoît Pepin – Rio Tinto

Holyrood Thermal Generating Station Unit 2 Stack Movement Assessment

November 30, 2018

A Report to the Board of Commissioners of Public Utilities

newfoundland labrador hydro
a nalcor energy company

Summary

On November 15, 2018, during a high wind event, Newfoundland and Labrador Hydro ("Hydro") observed movement of the Holyrood Thermal Generating Station ("Holyrood") Unit 2 stack, prompting an investigation into the cause of the movement and the structural integrity of the concrete chimney structure.

An immediate visual inspection of the stack by a third-party consultant, Hatch Ltd. ("Hatch"), was completed and revealed that there were no indications of structural failure and it was appropriate for the stack to remain in normal operation. Hatch recommended that further inspection and a structural analysis be completed.

Hydro is awaiting a suitable outage window that aligns with inspection contractor availability to conduct a more thorough inspection of the Unit 2 stack. The targeted date for inspection is December 1, 2018. As identified in the consultant's assessment, the Unit 2 stack inspection does not require emergency action.

Hatch has also been engaged to complete an engineering analysis of the Unit 2 stack movement to identify the cause and determine if any upgrades to the stack or monitoring equipment is required.

The Unit 2 stack will continue to be monitored as recommended and will remain under normal operation.

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List of Appendices

1 Introduction

On November 15, 2018, observation of what was believed to be abnormal movement of Holyrood Unit 2 stack ("Unit 2 stack") during a wind storm prompted an investigation into the structural integrity of the concrete structure and the cause of the observed motion. This report provides a summary of the observation, the action taken to fully assess and de-risk the situation, and the plan to ensure confidence in the safe operation of the Unit 2 stack.

2 Overview

2.1 Holyrood Thermal Generating Station Overview

Holyrood is a thermal generating station consisting of three generating units for a total generating capacity of 490 megawatts ("MW"). The plant was constructed in two stages: Stage 1 entered service in 1971 with generating Units 1 and 2, and Stage 2 came into service in 1979 with generating Unit 3. Each unit has a chimney stack that provides ventilation for hot flue gases from the boilers as depicted in Figure 1.

Figure 1: Holyrood Thermal Generating Station

2.2 Units 1 and 2 Stack Design

Holyrood Units 1 and 2 stacks are duplicate design structures. The stack design is a reinforced circular concrete chimney column that stands at approximately 91.5 metres. The overall stack dimensions are provided in Table 1. A cross-sectional view of the stack is provided in Figure 2. The concrete column is constructed of 40 equal poured concrete sections, with overlapping steel reinforcement between sections. The stacks each have a single 4.1 metre diameter steel liner, constructed of stainless steel at the top 9.1 metres of length and mild carbon steel for the remainder. The liner has two breaching[1] entries located on the east and west sides of the stacks. Figure 3 illustrates the liner to concrete base connection detail and Figure 4 illustrates the liner bumper at the top of the stack. Externally, the concrete column is equipped with a full height access ladder and safety rail and two access platforms. Each stack is outfitted with a lightning protection system and an aircraft warning light system.

Table 1: Holyrood Unit 2 Stack Design Dimensions

Description	Metres (m)
Height	91.5
Exterior Diameter at Base	8.1
Exterior Diameter at Top	5.1
Concrete Thickness (Base to 13.7 m)	0.36
Concrete Thickness (45.7 m to Top)	0.18
Lower Platform Elevation	45.7
Upper Platform Elevation	89.0
Steel Liner Diameter	4.1

[1] Inlets for boiler exhaust gas near the bottom of the stack.

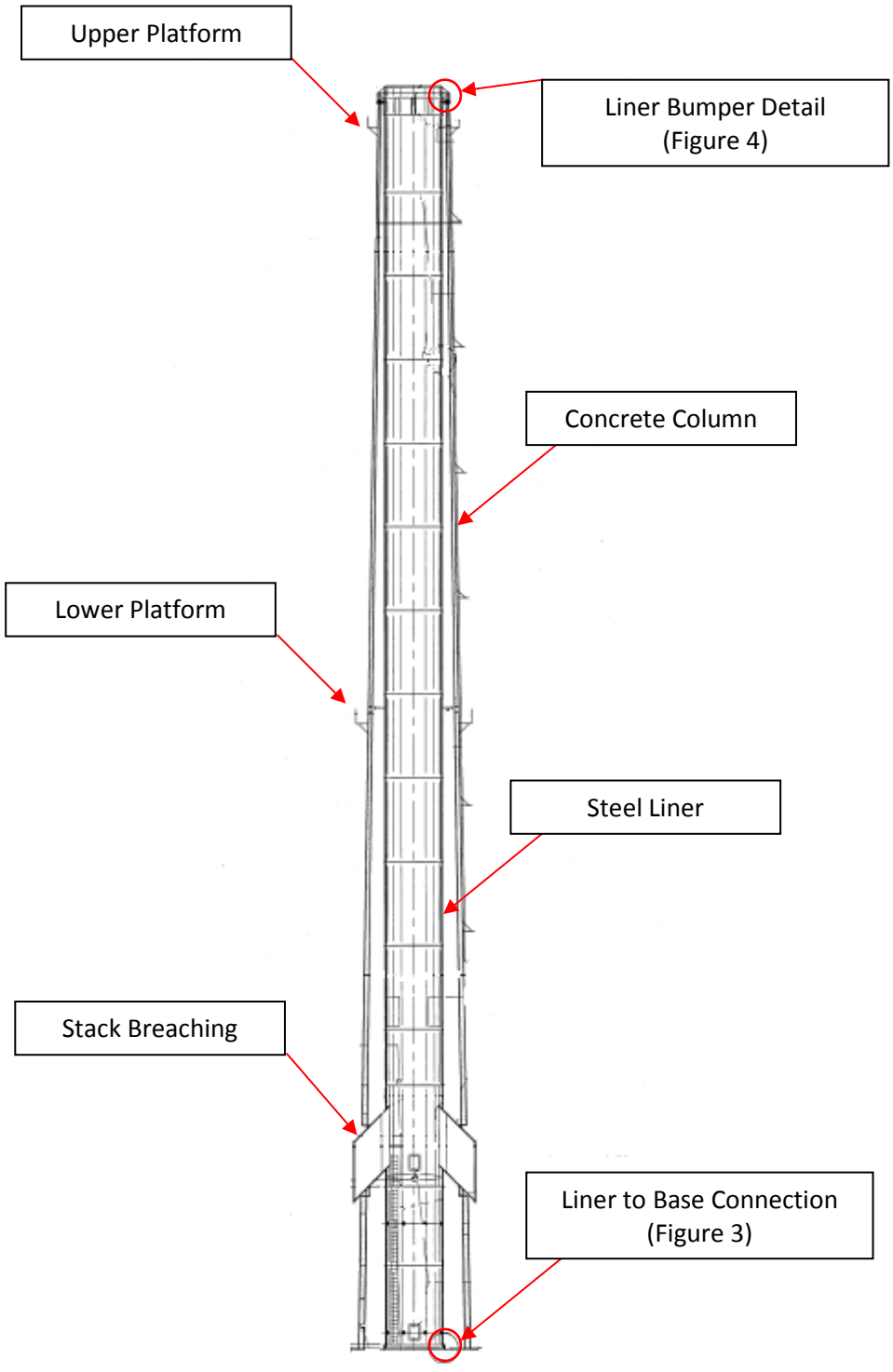

Figure 2: Unit 2 Stack - Cross-Sectional View

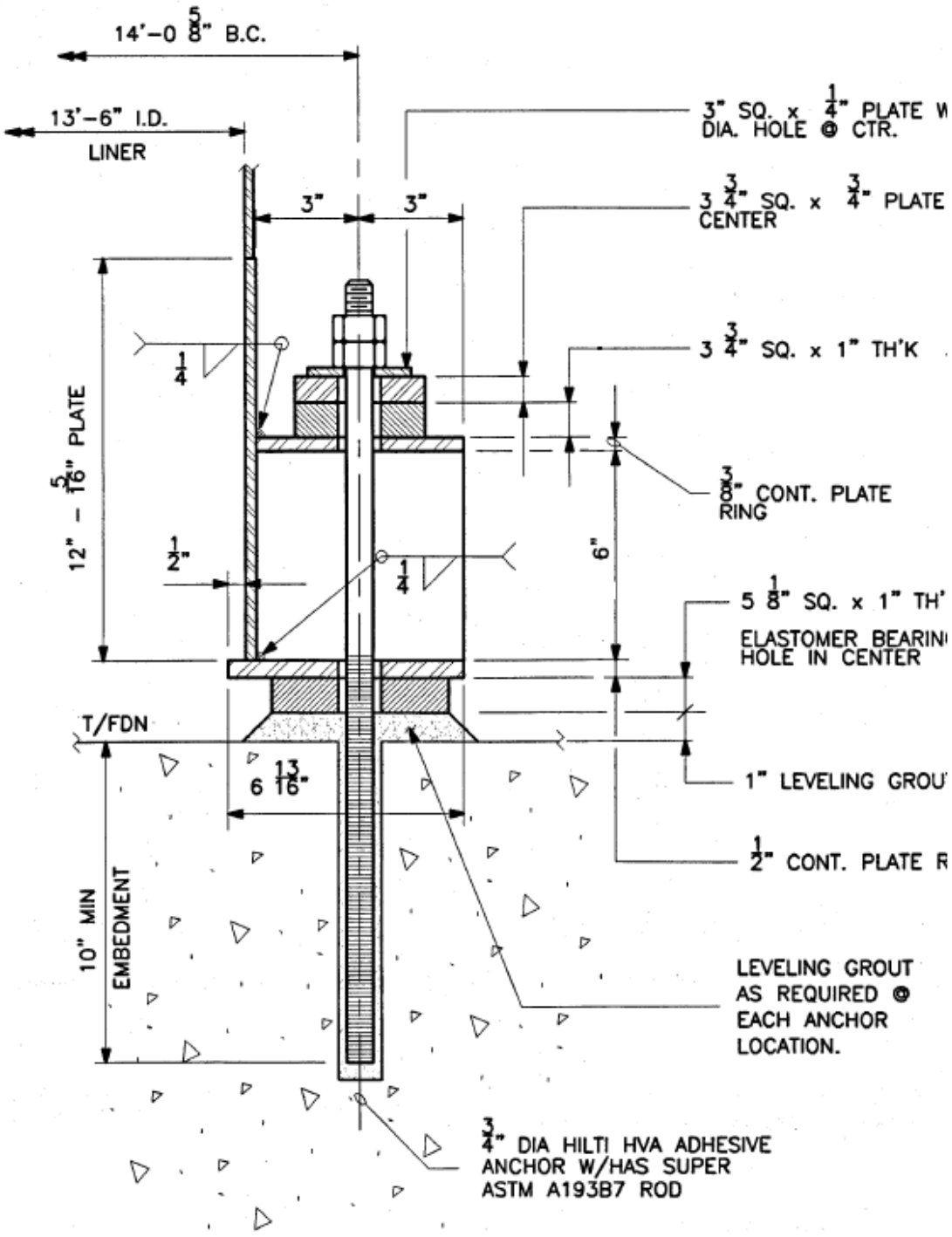

Figure 3: Unit 2 Stack – Steel Liner to Concrete Base Connection Detail

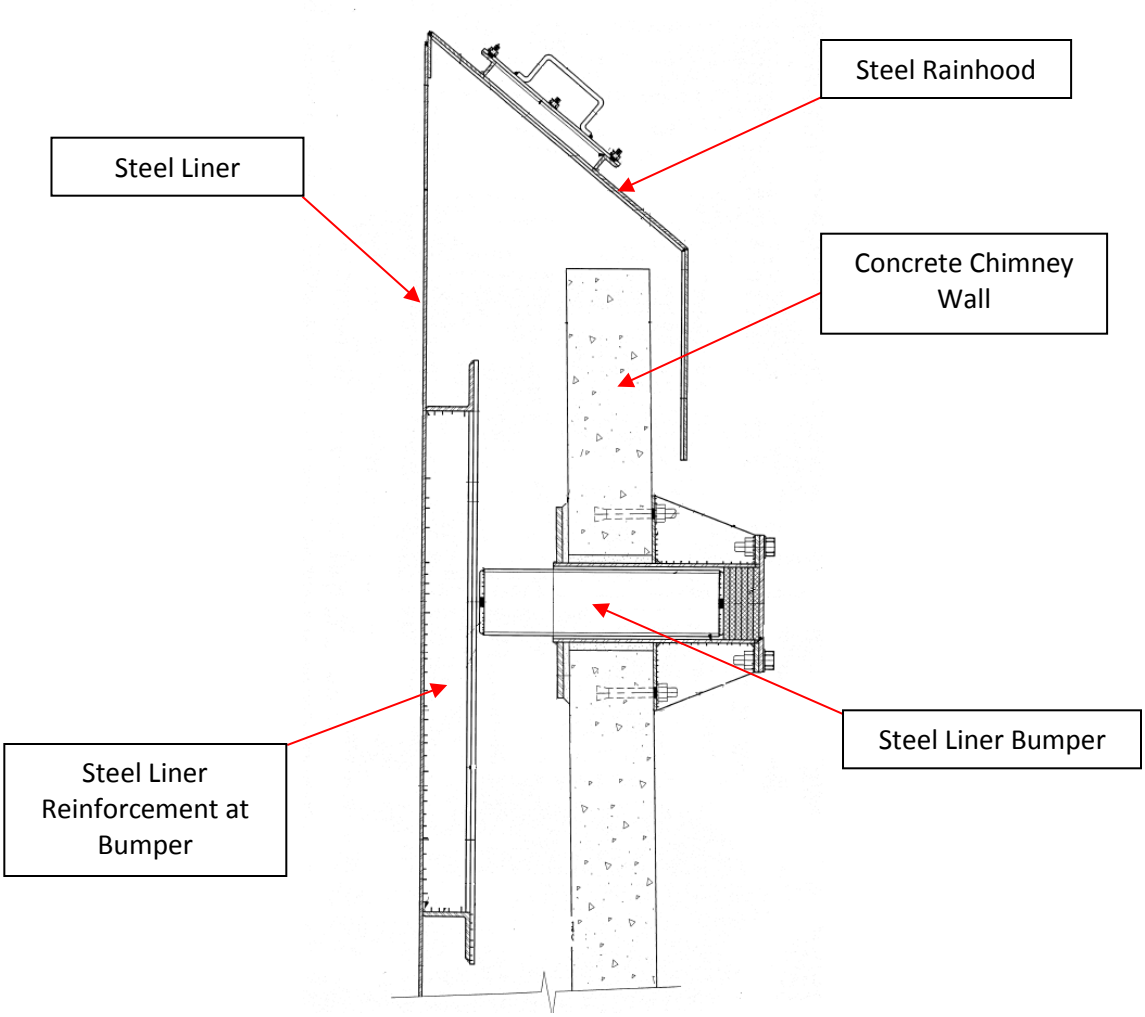

Figure 4: Unit 2 Stack – Steel Liner Bumper at Top of Stack

3 Holyrood Thermal Generating Station Unit 2 Stack Movement

3.1 Event Overview

November 15, 2018

On the morning of November 15, 2018, personnel at Holyrood observed what was considered to be abnormal swaying motion of the Unit 2 stack. The movement was described to be in excess of that observed at the adjacent stacks for Units 1 and 3. An exact measurement of the stack movement could not be obtained due to strong buffeting wind and the inability for the survey equipment to lock on the moving structure. The movement was described by on-site personnel as slow and somewhat elliptical, with the greatest deflection in the direction perpendicular to the wind. Figure 5 indicates the direction of the wind and the motion on the

Unit 2 stack shown in Figure 6. On-site monitoring equipment recorded west-north-west winds with gust speeds of 90 km/h to 95 km/h at the time of the observation. The maximum recorded gust wind speed in the 24-hours leading up to the observation was 119 km/h.

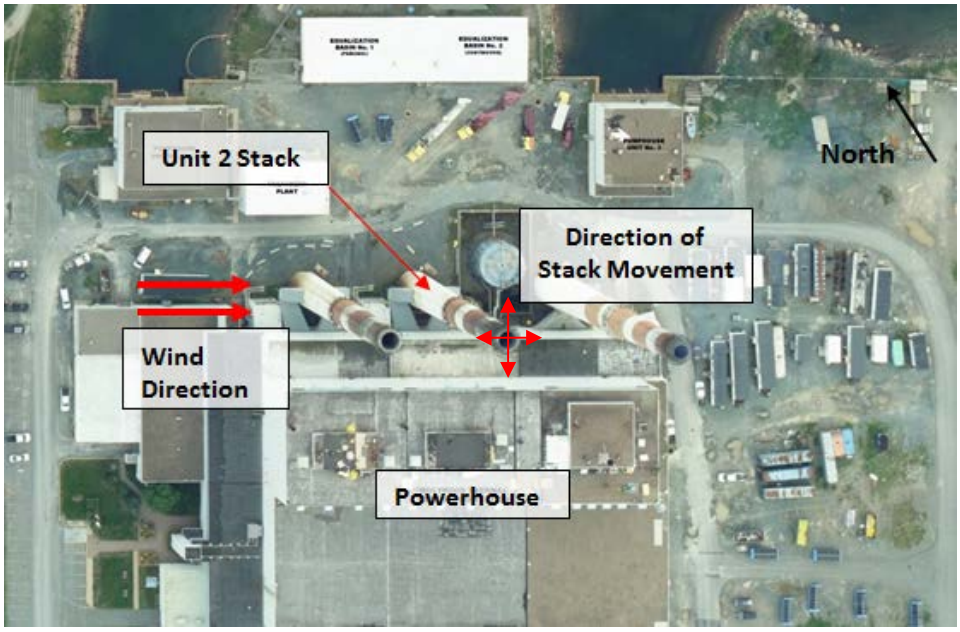

Figure 5: Aerial View – Holyrood Thermal Generating Station

Figure 6: Holyrood Thermal Generating Station Unit 2 Stack

Hydro contacted Hatch, an engineering consulting firm, to assess the stack movement and condition. On-site personnel were instructed to avoid all buildings and grounds north of the powerhouse. Hydro's emergency management response plan was implemented.

The structural/civil engineer from Hatch was on-site by 1030 hours and, as a precautionary measure, the decision to dismiss all non-essential personnel was made at 1100 hours. Personnel safety was the primary concern. Removing personnel from site reduced risk and enabled the remaining essential workers to focus on the stack assessment and continue supporting operations.

The engineering consultant provided a summary of the initial stack condition assessment. The engineer noted there was no visible exterior indication[2] of imminent failure. The assessment was a ground level visual inspection using binoculars from several vantage points. The stack base could not be assessed due to the potential for falling objects while wind speeds were high. It was advised that a base assessment should be completed once wind speeds diminished. A surveyor from EPCO, a survey company brought in by Hatch, attempted to measure the stack movement but was unable to obtain an accurate reading due to strong buffeting wind and the inability for the survey equipment to lock on the moving structure. A routine stack inspection, completed by an external consultant in August 2018, noted that there were no structural concerns at that time. Hydro continued monitoring the stack and wind conditions, and forecasts indicated that the wind speed would continue to diminish over the following 24 hours.

Hatch made the following recommendations during discussions of the initial assessment of the stack condition and the requirement to ensure that safety and reliability would not be compromised as a result of the stack movement.

- Base inspection to be completed once the area was deemed safe to access;
- Monitor wind conditions and stack movement overnight and report any changes;

[2] Indications could include falling debris, cracks and spalling (fragmenting) in the concrete column and/or construction joints, failed or failing connections at the platforms and ladder, and visual deformation of the platforms or ladder.

- Complete internal and external inspection of the stack, liner, platforms, ladders, and any other attachments to the concrete stack. This is to be completed during the next available Unit 2 outage.

Hydro and Hatch agreed that the following steps should also be taken:

- Review the stack inspection/repair history;
- Complete structural analysis of stack design for deflection/motion under wind speeds and directionality observed during stack movement event; and
- Determine if vortex shedding[3] upgrades are necessary for the stacks.

In addition, Hydro committed to completing the following actions:

- Follow up on outage requirements/availability for the Unit 2 stack inspection;
- Investigate upgraded wind/directionality monitoring equipment for the Holyrood stacks;
- Investigate stack inspections via drone as an option for exterior concrete assessment during times when ascending the stacks is not permissible; and
- Determine if the results of Unit 2 stack investigation would trigger similar investigations at other sites (e.g., Bay d'Espoir Surge Tanks).

As vortex shedding was determined to be the potential issue in Holyrood, Hydro also completed a visual assessment of the Bay d'Espoir surge tanks during the wind storm as a precautionary measure. No abnormalities were noted. The designed wind loading of the surge tanks is a minimum of 170 km/h wind speed which is higher than winds experienced during the storm. The tanks are also not located in as close proximity to each other as the Holyrood stacks and may not be subject to the same wind loads from vortex shedding.

November 16, 2018

On November 16, wind speeds were reported to be gusting in the 30-40 km/h range and there was no visible swaying of Unit 2 stack or the adjacent stacks. The consulting engineer returned

[3] Oscillating forces that take place due to wind passage around the Holyrood stacks.

to complete the stack base assessment. Visual inspection at the base revealed no structural defects. The stack was also viewed from the powerhouse roof and no indication of failure was found. A verbal confirmation of the "fit for purpose" condition of the stack was given before the consultant left site to prepare its report. Arrangements commenced to have the stack inspection completed during a Unit 2 outage.

Hydro implemented a plan to monitor and record stack movement if winds were to reach the 70-80 km/h range over the weekend during another forecast storm.

The consulting engineer issued a memo on November 16, 2018 and followed up with a subsequent memo on November 26, 2018. These are provided as Appendix A and Appendix B, respectively. The memos outlined the completed assessment and conclusion that Unit 2 stack could remain in service under recommendation that the outlined actions were taken. A summary of the observations is as follows:

- There were no obvious new cracks or displaced concrete at any of the joints visible from the two vantage points (ground level and powerhouse roof);
- There was no evidence of concrete missing from the surface or large pieces of concrete on the ground at the base of the stack;
- There was no obvious displacement of the vertical ladders, platforms, or electrical cables;
- The interior of the stack was observed from the doorway as confined space entry was required. There was no evidence of fallen concrete or issues with the liner foundation that could be seen;
- Hydro personnel ascended the stack to access the first platform level and found three small pieces of concrete on the platform grating. Upon inspection, it did not appear that these pieces were from new cracks. Photos of the concrete pieces are included in Appendix B;
- Recommendations included:
    - Monitor and record movement of all three stacks during winds gusting in excess of 75 km/h;

- Limit access to the area around the base of the Unit 2 stack until a full inspection can be completed; and
- Perform an internal and external inspection of concrete column, liner, platforms, ladder and any other attachment during the next available Unit 2 outage.

4 Unit 2 Stack Condition Assessment

There were several factors taken into consideration when Hatch determined that the Unit 2 stack was structurally safe and could remain in normal operation. These factors are outlined in the following sections.

4.1 Visual Assessment of Unit 2 Stack

The visual assessment of Unit 2 stack was completed by an engineer from Hatch, who has a history of consulting at Holyrood and has completed projects involving the Units 1 and 2 stacks. The engineer noted that based on what could be seen, the stack did not have any structural failure indicators. Indications of structural failure of a concrete chimney could include:

- Falling debris or debris at the stack base;
- Cracking or spalling (fragmenting) concrete;
- Obvious displacement of attachments (ladders, platforms, cables, etc.);
- Disconnected or falling attachments; and
- Cracked concrete or disturbed ground at stack foundation.

It was recommended that a full inspection of the stack be completed to confirm these findings and ensure there was no damage to the interior concrete or stack liner. In addition to the condition assessment memo in Appendix A, Hatch also provided a more detailed summary of the assessment, which is included in Appendix B.

Hatch noted that the stack movement was observed to be relatively slow and primarily elliptical in shape, with the largest deflection in the direction perpendicular to the wind. This type of movement could have been caused by vortex shedding on the Unit 1 stack, which would create turbulent wind in the vicinity of the Unit 2 stack. This hypothesis will be further investigated in

an engineering analysis being completed by Hatch. Hydro will submit the analysis to the Board by January 31, 2019.

4.2 Stack Inspection History

The Unit 2 stack inspection history is provided in Table 2.

Table 2: Unit 2 Stack Inspection History

Contractor	Inspection Year
Industrial Chimney Maintenance Inc.	1998
Industrial Chimney Maintenance Inc.	1999
McClean Chimney Co. Ltd.	2000
McClean Chimney Co. Ltd.	2001
Industrial Chimney Maintenance Inc.	2004
Industrial Chimney Maintenance Inc.	2006
Remote Access Technology	2014
Industrial Chimney Maintenance Inc.	2018

The inspections consistently report findings of minor concrete cracks and spalling, corrosion at structural steel attachments, and water seepage at construction joints. These are normal for this type of structure and are addressed as part of the standard maintenance process. The stack liner was replaced in 2006 and there were no major issues found during the 2018 inspection.

The 2018 inspection report completed by Industrial Chimney Maintenance ("ICM") was reviewed and there were no structural concerns found during the inspection. With the exception of the stack exterior coating, all documented deficiencies were addressed by ICM at the time of the inspection. The stack exterior coating was not identified as an urgent or immediate requirement and Hydro will continue to monitor annually.

Discussions with ICM on the stack movement supported the working theory that the movement was vortex shedding induced and not uncommon for chimney structures in specific wind speeds and orientations relative to other structures.

5 Recommended Ongoing and Future Actions

The following actions have been identified as part of the Unit 2 stack investigation. A summary of these actions with completion dates is provided in Section 5.4.

5.1 Unit 2 Stack Inspection

Unit 2 is awaiting a suitable outage window that aligns with inspection contractor availability and is targeted for December 1, 2018. The Unit 2 stack inspection is not an emergency as per the Hatch assessment. Hatch will also consult on the inspection findings and make any immediate and future recommendations.

In researching the scope of the inspection, it is expected that that the primary concern and focus will be the condition of the liner, specifically at the bumpers and stack top, and the connections at ladders and platforms. The concrete exterior will be inspected from ground level, on the ladders, and at the platforms. Completing a full exterior inspection is highly dependent on weather conditions and may not be achievable in the Unit 2 outage timeframe.

Any issues found with the concrete or liner will be assessed to determine if immediate repair is necessary or if repair can be made during the planned unit outage in the next maintenance season. An additional outage will only occur if work cannot be completed immediately and if the work is necessary to ensure the safe and reliable operation of the Unit 2 stack. If liner damage has occurred, Hatch can provide recommendation for temporary repair or replacement. The consulting Hatch engineer was involved in the 2005 liner replacement project and is familiar with the liner replacement requirements.

5.2 Engineering Analysis of Stack Movement

Hatch has been engaged to complete an engineering analysis of the Unit 2 stack movement. Hatch is a global engineering consultant with the ability to consult with industry experts from other offices and complete a thorough and accurate analysis of the Unit 2 stack. The analysis will include the following outcomes:

- Determine the likely cause of the Unit 2 stack movement;

- Determine the allowable deflection for the chimney structure and the anticipated wind direction/speeds that could cause maximum deflection;
- Determine if it is likely that the stack movement exceeded the allowable deflection;
- Determine if any stack upgrades are required in order to reduce movement in future wind events;
- Determine if any structural upgrades should be investigated for the stacks; and
- Determine the wind parameters that would trigger stack monitoring or require additional inspections to be completed.

The report will be provided to the Board by January 31, 2019.

5.3 Additional Considerations

Additional actions have been recommended to ensure that events similar to the Unit 2 stack movement can be predicted and monitored more accurately in the future. These actions are not identified as essential to confirming the structural integrity of the Unit 2 stack but will be critical in preparing for and reacting more effectively if a similar event were to occur. These actions are included as the last three items in Table 3.

5.4 Summary

Table 3 outlines Hydro's next steps in its Unit 2 stack investigation as detailed in sections 5.1 to 5.3.

Table 3: Unit 2 Stack Investigation Actions

Action	Completion Date
Interior and Exterior Inspection of Unit 2 Stack	December 1, 2018 - December 5, 2018
Report of Engineering Analysis of Unit 2 Stack Movement	January 31, 2019
Investigate Wind Monitoring Equipment for Holyrood Stacks	March 15, 2019
Investigate Displacement Measuring Equipment for Holyrood Stacks	March 15, 2019
Determine Investigation Requirements for Similar Infrastructure	February 15, 2019

6 Conclusion

The initial condition assessment of the Unit 2 stack indicates that there is no obvious visible damage to the exterior or interior of the stack or any indication of structural defects. A full inspection of the stack exterior and interior is to be completed during an outage on Unit 2, which has been approved for December 1 to 5, 2018. An engineering analysis, including a structural analysis of the observed stack movement and an assessment of necessary upgrades to decrease and/or quantify future movement, will be filed with the Board on January 31, 2019. The Unit 2 stack will continue to be monitored as recommended and will remain under normal operation.

Appendix A

Unit 2 Stack Condition Assessment Memo by Hatch – November 16, 2018

HATCH

Project Memo

HXXXXXX

November 16, 2018

To: To Dana Dalton P.Eng. From: Greg Saunders P.Eng.

cc: Scott Crosbie P.Eng.
Jeff Vincent P.Eng.

NL Hydro
Holyrood Thermal Generating Station

Unit No. 2 Exhaust Stack

1. Introduction/Observations

On the morning of November 15, 2018 Hydro noticed what appeared to be an unusual amount of sway in the exhaust stack due to winds gusting over 100 km/hr. During the same period it was observed that the two adjacent stacks were hardly moving.

Hydro contacted Hatch and Mr. Greg Saunders P.Eng visited the plant and observed the movement of the stack. Hatch also brought survey company EPCO to the site to see if they could measure the amount of displacement the stack was undergoing. Unfortunately the total station instrument was unable to give accurate measurements as it was unable to lock in on the moving object.

Due to safety concerns personnel were restricted to observations from about 30m and greater.

Based on observations from the ground and with the assistance of binoculars there appeared to be no cracking or displacement at any of the circumferential construction joints. There also appeared to be no new vertical cracks formed on the exterior, due to the movement, or patches of missing or spalled concrete.

On the morning of November 16, 2018 the wind speed and gusts had subsided to 30 to 40 km/hr and no visible swaying was noticed in the stack or the adjacent stacks. Mr. Saunders visited the site again and walked around the stack at ground level and at the powerhouse roof level. Photographs were taken and these will be reviewed and forwarded to Hydro for their records.

The following observations were made November 16, 2018.

1 No obvious new cracks or displaced concrete at any of the joints, that could be seen from the two vantage points, were visible.

2 There was no evidence of concrete missing from the surface or large pieces on concrete on the ground at the base of the stack.

HATCH

3 The was no obvious displacement of the vertical ladders, platforms or electrical cables.

4 The interior access at ground level required confined entry. Observations were made from the doorway and there was no evidence of fallen concrete or issues with the liner foundation. We understand Hydro personnel entered this area and walked around the liner and inside diameter of the stack and found no evidence of distress i.e. cracks or fallen concrete.

5 Hydro personnel climbed the ladder to access the first platform level. Three small pieces of concrete were found on the grating. In looking at these pieces they do not appear to be from new cracks. One had a flat face from a concrete saw blade and another contained caulking which likely came from one of the circumferential joints.

2. Recommendations

Based on the observations made today there is no obvious signs of distress showing on the stack. In our opinion the stack can remain in service but we recommend the following actions to take place.

1 Monitor the movement of the three stacks and in particular Stack No. 2 during windy/gusty days. We recommend checking the weather forecast for wind speeds exceeding 75km/hr. We can readjust this number upward based on observed movement.

2 Corden off the area around the base of the stack for nonessential personnel. Hydro to determine the boundary limits.

3 During the November shutdown of Unit No. 2 perform an internal and external inspection of the stack, liner, platforms, ladders and any other attachments to the concrete stack.

Greg Saunders P.Eng.

GDS:gds
Attachment(s)/Enclosure

Appendix B

Unit 2 Stack Condition Assessment Memo by Hatch - November 26, 2018

Project Memo

H358729

November 26, 2018

To: D. Dalton, P.Eng.

From: G. Saunders, P.Eng.

cc: S. Crosbie, P.Eng.
J. Vincent, P.Eng.

Newfoundland and Labrador Hydro
Holyrood Generating Station

Unit No. 2 Exhaust Stack

1. Introduction

On the morning of November 15, 2018, NL Hydro noticed what appeared to be an unusual amount of sway in the exhaust stack due to winds gusting over 100 km/hr. During the same period, it was observed that the two adjacent stacks were hardly moving.

NL Hydro contacted Hatch and Mr. Greg Saunders, P.Eng. visited the plant and observed the movement of the stack. Hatch also brought survey company EPCO to the site in an effort to remotely measure the top displacement of the stack. Unfortunately, the total station survey instrument was unable to give accurate measurements as it was unable to lock onto the moving stack.

2. Observations

Observations were made from four sides approximately 90 degrees apart using binoculars and where possible, due to the wind, the survey instrument lens. The side of the stack closest to the plant had restricted visibility due to the building elevation. Due to safety concerns, personnel were restricted to observations from about 30 m and greater.

Based on the observations from the ground, there appeared to be no cracking or displacement at any of the circumferential construction joints, no new vertical cracks formed on the exterior or significant patches of missing or spalled concrete. The stack movement appeared to start approximately one quarter to one third up from the base. The majority of the movement was perpendicular to the direction of the wind and had a constant period. The sway appeared to be a simple single order fixed cantilever movement similar to a musical metronome.

A meeting was held with senior NL Hydro operations staff regarding safety and operation of the plant. Hatch agreed that although the stack was swaying there were no obvious signs showing on the exterior that would indicate the stack would fail catastrophically. It was decided to continue to closely monitor the stack for any visible signs of concrete failure, new cracks, exposed rebar or spalled concrete, and any increase in the stack movement.

On the morning of November 16, 2018, Hydro contacted Hatch and requested they come back to site and complete a visual inspection of Stack No. 2 as the wind speed had reduced to 30 to 40 km/hr and there was no visible swaying of it or the two adjacent stacks. Mr. Saunders visited the site late that morning and walked around the stack at ground level and viewed it from the adjacent powerhouse roof. A photographic record was made of this inspection and these were reviewed and forwarded to Hydro for their records.

The following observations were made November 16, 2018.

1. No obvious new cracks or displaced concrete at any of the joints, that could be seen from the two vantage points, were visible.
2. There was no evidence of significant concrete missing from the surface or large pieces on concrete on the ground at the base of the stack.
3. The was no obvious displacement of the vertical ladders, platforms or electrical cables.
4. The interior access at ground level required confined entry. Observations were made from the doorway and there was no evidence of fallen concrete or issues with the liner foundation. We understand Hydro personnel entered this area and walked around the liner and inside diameter of the stack and found no evidence of distress i.e. cracks or fallen concrete. Pictures were taken from the ground of the concrete stack to base slab and looking vertically upward from the base slab. One area has an interior profile that is non circular in appearance similar to an inward bulge. This same area on the exterior is close to or opposite a brace from the breaching. Visually from the ground the exterior does not appear to be bulged and there are no visible signs of cracking or concrete failure.
5. Hydro personnel climbed the ladder to access the first platform level. Three small pieces of concrete were found on the grating. In looking at these pieces they do not appear to be from new cracks. One had a flat face from a concrete saw blade and another contained caulking which likely came from one of the circumferential joints.

3. Preliminary Conclusions

At Hatch's request Hydro provided drawings of the site, structural drawings of the stack, the stack liner and environmental data for the days prior to and during the event.

A preliminary review of the environmental data confirms the site observations of Thursday November 15 that the wind was inline with the three stacks at a fairly constant speed.

The likely cause of the stack movement was vortex shedding of the wind passing across Stack No. 1.

The stack swaying appeared to be a first order motion similar to the vibration of a cantilever with a fixed end condition.

4. Recommendations

Based on the exterior observations made during the two inspections, there were no obvious signs of distress or indications the stack would undergo catastrophic failure.

In our opinion, the stack can remain in service but we recommend the following actions to take place.

1. Monitor the movement of the three stacks and in particular Stack No. 2 during windy/gusty days. We recommend checking the weather forecast for wind speeds exceeding 75 km/hr and in particular note the wind direction if parallel with the stack alignment. This wind speed can be adjusted upward based on observed movement.
2. Corden off the area around the base of the stack for nonessential personnel. NL Hydro to determine the practical boundary limits.
3. During the November shutdown of Unit No. 2, perform an internal and external inspection of the stack, liner, platforms, ladders and any other attachments to the concrete stack.
4. Have a structural analysis completed of the stack to determine the effects of wind speed and direction considering the effects of the stack's proximity to each other, stack shape, dimensons and construction.
    - Determine if computer analysis can reproduce a similar oscillation and compare this wind speed to those recorded during the event.
    - Determine if there is a natural frequency problem under these conditions.
    - Calculate the shell stress in the current design.

5. Photographs

(See attached).

G. Saunders, P.Eng.

GDS:smb
Attachment(s)

Photo 1: Stack No. 2 Lower Section

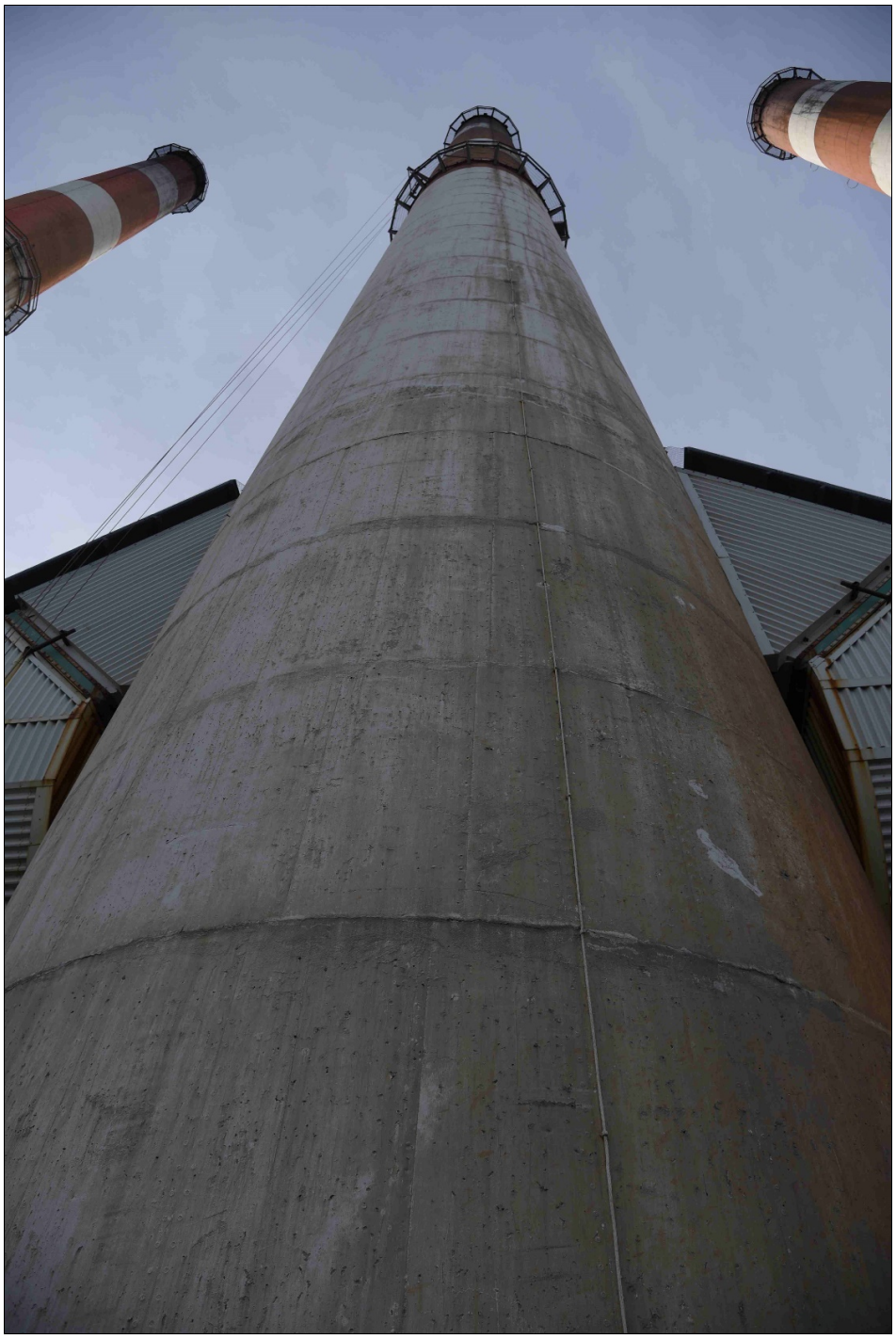

Photo 2: Stack No. 2 Looking Upward from the Ground – View on Opposite Side from Powerhouse

Photo 3: Tank No. 2 Interior View of Base Slab and Stack Interface

Photo 4: Stack No. 2 View from Powerhouse Roof Lower Section

Photo 5: Stack No. 2 View from Powerhouse Roof Lower Section Below Lower Platform

Photo 6: Stack No. 2 View from Powerhouse Roof Lower Section at Lower Platform

Photo 7: Stack No. 2 View from Powerhouse Roof Lower Section Above Lower Platform

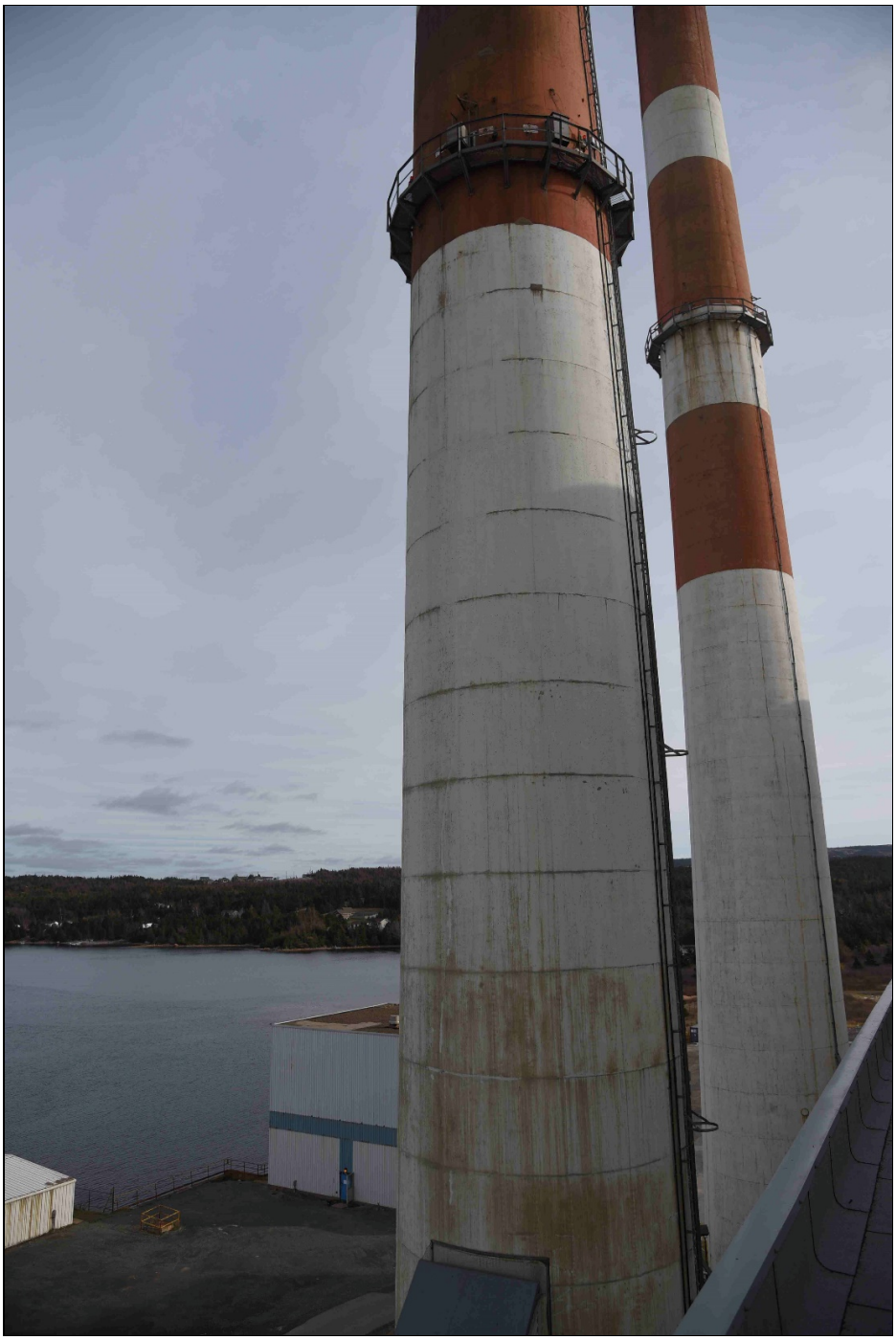

Photo 8: Stack No. 2 View from Powerhouse Roof Lower Elevation above Breaching Connection

Photo 9: Stack No. 2 Small Pieces of Concrete Found on Lower Platform