PHASE 2 INITIAL BOREHOLE DRILLING AND TESTING, IGNACE AREA

Site Commissioning Technical Report IG_BH04

APM-REP-01332-0341

November 2021

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Wood.



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Site Commissioning Technical Report – IG_BH04

Phase 2 Initial Borehole Drilling and Testing, Ignace Area Project Number: SCB1912026 Document Number: SCB1912026-REP-006 R3

Prepared for:

Nuclear Waste Management Organization

6th Floor, 22 St. Clair Avenue East, Toronto, Ontario, M4T 2S3

November 2021



Wood Environment & Infrastructure Solutions a Division of Wood Canada Limited

www.woodplc.com

Site Commissioning Technical Report – IG_BH04

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1.0 Background

The Initial Borehole Drilling and Testing project at Ignace, Ontario is part of Phase 2 Geoscientific Preliminary Field Investigations of the Nuclear Waste Management Organization's (NWMO's) Adaptive Phased Management (APM) Site Selection Phase. This project involved the drilling and testing of up to three deep boreholes in the Ignace area within identified Potential Repository Areas (PRAs).

The project was carried out by a team led by Wood Environment & Infrastructure Solutions, a Division of Wood Canada Ltd. ("Wood") on behalf of the NWMO. All work associated with the Drilling Pad for Borehole IG_BH04 has been completed and the pad is ready for use. The location of Borehole IG_BH04 is shown in Appendix A: Site Layout & Location Plan.

2.0 Purpose

This report intends to provide the necessary details for the successful commissioning of Borehole IG_BH04. With the completion of the drilling pad for Borehole IG_BH04, the drilling and coring activities pertaining to WP02 may begin. Site infrastructure details including site layout, facilities, drill pad characteristics, general site services and electrical connections are provided to ensure a seamless transition for the drilling and testing phase.

As stated in WP01 Test Plan - Site Infrastructure and Access Road Construction (Document No. SCB1912026-PLN-005), a technical report is to be submitted for each of the drill sites to document the construction and preparation of the drill sites, and the site infrastructure. Details regarding the access road, drill pad & site preparation, site services, electrical configuration, and as-built data will be provided within this report.

3.0 Site Access and Egress

The access road for Borehole IG_BH04 is pictured in Figure 2: Site Layout As-Built in Appendix A. Borehole IG_BH04 is located at 556957N, 5486488E (Datum: NAD83 Projection: UTM Zone 17). Access to the site is by traveling on Hwy 17 approximately 42 km ENE of Ignace, ON to the Tower Road turnoff. Follow Tower Road south for 2.2 km and turn west onto Dyment Road and follow for 4 km. The access road for IG_BH04 runs north for roughly 900m before reaching the drill pad. Construction of the access road was not a contractual requirement as there was already a pre-existing road providing access to the site. Therefore, only minor clear-cutting/grubbing was necessary for this drill pad site. All vehicular traffic will continue through the access road from the main roads as seen in Figure 2: Site Layout As-Built in Appendix A.



4.0 Site Setup and Preparation

4.1 Initial Conditions

On October 16th, 2019, Wood field staff visited the site to assess the site initial conditions and determine the necessary construction activities. The initial site conditions were determined as the following:

- Very soft topsoil along the south side of the site (Figure 3: Initial Ground Conditions at BH-04, Appendix B);
- A layer of wood chips on the along north side of the site (Figure 4: Soft Wood Chips Observed on Site Initially, Appendix B);
- Minor tree clearing required in various spots to widen some areas (Figure 5: Clearing and Grubbing, Appendix C);
- Exposed bedrock in various spots and major exposure of the bedrock-oriented East-West (Figure 6: Exposed Bedrock at Final Design Elevation, Appendix C);
- The presence of the public access road that intersects the pad diagonally;

4.2 **Construction Activities**

Construction of the pad at IG-BH04 included the following activities:

- Environmental Baseline Assessment;
- Clearing and Grubbing Areas (Figure 5: Clearing and Grubbing, Appendix C);
- Placing and compacting gravel (Figure 7: Dumping First Lift of Granular, Appendix C);
- Site Infrastructure Setup;

4.2.1 Environmental Baseline Assessment

As planned and before starting any clearing and grubbing activities, the baseline environmental assessment was conducted with the presence of Wood and NWMO field personnel. The baseline environmental assessment is detailed in the Environmental Baseline Sampling Report (Controlled Document No. SCB1912026-REP-003).

The site and immediate vicinity of the IG_BH04 pad was logged historically. In order to assess the existing surficial soil conditions of the proposed pad area for possible environmental impacts at a preconstruction state, Wood completed a Baseline Environmental Soils Investigation on October 19, 2019. The information provided below is a brief summary of the investigation. The complete report is filed under SCB1912026-REP-003 (Wood, 2019). The purpose of the study was to establish the preconstruction concentrations for the contaminants of potential concern (COPCs) including petroleum products. The results of the study were used to compare with post-construction concentrations to assess the impact from Wood's drilling operations.

During the investigation, twenty hand auger holes were completed on the pad and planned parking areas. Sample depths ranged from 0.15 to 0.75 metres below ground surface (mbgs). Soil samples were inspected



in the field for gross evidence of negative environmental impact, including staining and odours. Soil samples were collected for headspace screening including Combustible Organic Vapour (COV) and Total Organic Vapour (TOV) concentrations to facilitate sample selection for laboratory analysis and provide an assessment of potential vertical contaminant distribution at each location. Laboratory samples were also collected using laboratory provided glass jars with no preservative, and glass soil vials including methanol preservative.

The sample results indicated exceedances of the Table 1 Site Condition Standard (SCS) for Agricultural properties in 10 of the 20 test holes for parameters including acetone, benzene, ethylbenzene, toluence, PHC F1 and PHC F4 (related to petroleum products), prior to the start of site commissioning activities. This may indicate that a potentially contaminating activity may have impacted the Site historically.

4.2.2 Clearing and Grubbing

An area of approximately 3300 m² was cleared to accommodate the pad, which involved minor tree clearing, and grubbing (Figure 3: Clearing and Grubbing, Appendix B) of the soft topsoil and wood chips. This was followed by compacting the subgrade to ensure stability prior to the placement of granular material. The subgrade was then inspected by Wood personnel, and it was determined to be stable ground supported by the exposed/shallow bedrock.

Following grubbing and clearing, 255 linear meters of temporary sediment control "silt fence" was then installed around the site perimeter to prevent soils from washing away into the surrounded environment and nearby water streams.

4.2.3 Placement and Compaction of Granular Material

The granular material used was classified as Granular 'A' Type 1 that was outsourced from "Broda Quarry" which is a local supplier nearby to the Ignace Township. A sieve analysis is provided in Appendix F: Sieve Analysis. The granular material was visually inspected by Wood field personnel upon arrival at the site and it was determined to be clean fill.

A total of 1915 m³ of Granular 'A' Type 1 was brought to site using tri-axle dump trucks. The drilling pad was constructed in 300 mm lifts. Each lift was compacted with 6 passes using a Hamm H20i 20 tonne vibratory smooth drum roller.

As per design and upon reaching the pad's final grade at 443.0 meters above sea level (mASL), an additional 700 m³ of granular material was added to bury the exposed bedrock which was at 443.8 mASL at its peak to reach a new pad final grade of 444.0 mASL (Figure 6: Exposed Bedrock at Final Design Elevation, Appendix C). As per the original design, the drill pad area from fence to fence was supposed to be 1623m², however, it was extended to the North side of the pad to approximately 1800m² in order to ensure an adequate storage area.

For the final as-built survey, please refer to Appendix E: As-Built Figure (Controlled Document No. *SCB1912026- FIG -003-* R02).



4.2.4 Site Setup

For a plan view of the site layout with a description of the site infrastructure and facilities, please refer to Figure 2: Site Layout As-Built in Appendix A.

4.2.4.1 Site Security

The site was secured on November 19, 2019 by MCL with 190 linear meters of temporary 1.83 meter construction fence and it was replaced on November 30, 2019 with a 2.44 meter fence and gate that was kept closed at all times.

4.2.4.2 Site Facilities

As per the original design of the site, there were to be two 20' x 10' site office trailers (for NWMO and Wood), however the site was supplied with a 26' x 10' Wood site office trailer and a 16' x 8' NWMO/WLON office trailer. Additionally, the site was equipped with four 20' x 8' x 8' heated storage sea cans, one 10,000L heated wastewater tank, one 30,000L heated freshwater tank, one 4,500L fuel tank, two Wacker Neuson generators (G70), one Wacker Neuson (G25), four light towers, one wash room facility, and garbage and recycling bins.

4.2.4.3 Major Drilling Facilities

The site was supplied with the drilling rig, drilling deck, core shack #1 for infield chemical analyses and core extraction, an STS unit, an AMC unit, one 4,500L fuel tank, two rods sloops, two storage trailers, skid steer on site at all times, and core shack #2 for core logging and sampling activities.

4.2.4.4 Site Communication

The site was equipped with two wireless internet networks (5G) through Bell Canada. The signal strength was determined to be strong as the service/communication tower was located 4.8 kilometers East of the site. The speed test conducted determined the internet speed on site to be 7.9 megabytes per second (Mbps).

The core logging shack was equipped with one wireless internet network (5G) through with Rogers Communications. Speed test was conducted to be 16.1 Mbps. The core shack internet network was dedicated to the core logging activities.

4.2.4.5 Secondary Containment

Flexible Spill Containment L-Bracket Berms were installed under all Wood and subcontractor facilities and equipment which posed any potential for hazardous substance spillage or leakage to act as a secondary containment system. These containment units were set up to extend at least 0.5 m from each edge of the associated equipment and raised 0.3 meters above ground surface (mags) around the outside to provide proper containment. This included all the generators and light towers, drilling rig, drilling cuttings, AMC and STS units. Flexible Spill Containment L-Bracket Berms. All secondary containment berms and devices were inspected at least once per day and maintained to ensure they were in good working condition during drilling and testing activities. Further detail is provided in Section 3.6.4 of the Site Infrastructure and Access

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Road Construction Test Plan (Controlled Document No. SCB1912026-PLN-005). Spill response reports were created for spills and were recorded in the spill report form (Controlled Document No. SCB1912026-FOR-058).

4.2.4.6 HSE Equipment

The site is equipped with safety equipment stationed at locations throughout the work area and the site and were labelled with signage. The site's main hard case First Aid Kit (50-60 workers) and eye wash station are located in the Wood office trailer. Additional smaller first aid kits and eye wash stations were placed in various locations on site including the drill rig, core shack #1, core shack #2, and seacan #6. Eyewash stations were placed in the drill shack, core shack #1, core shack #2, seacan #6, the AMC Unit, the STS Unit, and the Wood office trailer, with additional eye wash fluid bottles being kept on site in the Wood office trailer with the main hard case First Aid Kit.

Fire extinguishers were located in the Wood office trailer, the NWMO office trailer, the portable washroom facility, coreshack #1, coreshack #2, seacan #6, the drill rig, the AMC Unit, the STS Unit, each light tower, and each generator, with additional fire extinguishers being stored in seacan #2.

In case of emergencies where cell phone service was not available; the site was equipped with SPOT Satellite Communicator. The nearest hospital in Dryden is informed that there is an operational site in the area and the exact site location was been provided to emergency services in case of emergency.

The site was provided with hearing protection, safety glasses, face shields, goggles, hard hats, high visibility vests and blankets for site personnel and visitors use. All site workers were fully trained on the emergency response plan. All the safety equipment on site was in compliance with Wood's HSEP (SCB1912026-PLN-002).

5.0 Site Services

A plan view of the site layout, with a description of the site infrastructure and all facilities/equipment can be found in Figure 2: Site Layout As-Built and Table 2: Site Overview Legend in Appendix A. The following is a summary of the materials and equipment that will remain mobilized for the duration of the borehole drilling and coring process:

- Silt Fencing
- Security Fencing
- Site Trailer #1 (WOOD)
- Site Trailer #2 (NWMO)
- Site Trailer #3 (Major Drilling Storage)
- Portable Washroom Facility
- Seacan #1 (DGI/Solexperts)
- Seacan #2 (Westbay)
- Seacan #3 (WOOD Storage)
- Seacan #4 (Core Storage)
- Seacan #5 (Solexperts)
- Generator #1 (G70)

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- Generator #2 (G70 Backup)
- Generator #3 (G25)
- Generator #4 (25kW)
- Core Shack #1
- Core Shack #2
- AMC Unit
- Heated Waste Water Tank
- Heated Fresh Water Trailer
- Drill Rig
- STS Unit
- Fuel Storage Tank
- Garbage Disposal Bins
- Light Towers x4

6.0 Electrical Connection

6.1 General Overview of Electrical Configuration

The site is predominantly powered by two generators, a Wacker Neuson G70 and another Wacker Neuson G25 generator. The main generator, a G70 was the primary feed supplying power to most of the site equipment and facilities. The G70 generator supplies 46KW at 240V, single phase (1PH) feeding the 200 Amp main breaker on the distribution panel. The panel is mounted on the side of storage sea can #4 the location of which is shown in Figure 9: SCB1912026-SKT-004 Electrical Connection Diagram, Appendix D. A second, identical G70 generator is connected in parallel to the same distribution panel as a backup power feed in case of any unexpected break down of, or scheduled maintenance to the main generator. Figure 10: Electrical Connection Panel Schedule in Appendix D shows the Electrical Panel Schedule.

The G25 generator, rated at 25kW was solely dedicated to power the SolExperts packer equipment and supporting devices used for WP06: Hydraulic Testing and WP07 Opportunistic Groundwater Sampling and Testing, which were designed and built to European electrical standards requiring a dedicated power supply. The SolExperts motor name plate shows that the motor runs on 460V, 60 HZ. It was decided that the G25 with output of 480V 3PH would be suitable to feed the motor. The motor was tested by a certified Wood electrician and certified for use by the ESA inspector (Figure 11: ESA Inspection Sticker Example, Appendix D).

6.2 Site Conditions and Risk Assessment

Initially, from November through December 2019 the G70 was used to power the complete site including Major's site equipment and facilities such as the STS unit and heaters. An electrical load analysis was conducted, and it was determined that the main G70 was running at almost 93% of its rated capacity. It was noted that this did not allow for any additional loads that would be required to power up portable heaters that would be needed during times of extremely low temperatures to maintain a suitable temperature in the sea cans for sensitive equipment and stored samples and core.

.

A risk assessment was performed by Wood site personnel on the electrical load analysis reports provided by the subcontractor's certified electrician (Justin Fediuk, Master Electrician License #6002843) as well as an electrician from the Wood electrical department. It was determined that an additional power source would be required to avoid overloading the G70 generator, which would likely cause power outages, especially during the periods of extreme low temperatures. As such, a second generator, rated at 25KW was brought to site to supply power to some of Major's site equipment and facilities, effectively lowering the possibility of any power outages.

6.3 Site Illumination

Lighting at site was supplied by 4 self-contained light towers. Each tower consisted of 4 multi-directional lights powered by its own generator.

Lighting Tower Descriptions									
Name	Description	Serial	Unit	Power	Fuel Type	Date Installed*			
20499 WACKER NEUSON LTW8K- VS – LIGHT TOWER	8 kW Light Tower Towable (2" BALL)	24248164	9715	8 kW	Diesel	11/17/2019			
20500 WACKER NEUSON LTW8K- VS – LIGHT TOWER	8 kW Light Tower Towable (2" BALL)	24248165	9716	8 kW	Diesel	11/17/2019			
20495 WACKER NEUSON LTW8K- VS – LIGHT TOWER	8 kW Light Tower Towable (2" BALL)	24243847	9711	8 kW	Diesel	11/17/2019			
20501 WACKER NEUSON LTW8K- VS – LIGHT TOWER	8 kW Light Tower Towable (2" BALL)	24251263	9717	8 kW	Diesel	11/17/2019			

Table 1 - Lighting Tower Descriptions

*The lighting towers were inspected and made operational on November 17, 2019 but were received earlier.

It was recognized that each of these generators could be used to power smaller electrical items further lessening the load on the main G70. The power distribution network was reworked to include these generators. The 4 light tower generators were used to power the NWMO office trailer, the site washrooms, the freshwater tank trailer and the heaters in core (dry) shack. The site electrical configuration is shown in Figure 9: SCB1912026-SKT-004 Electrical Connection Diagram in Appendix D. Once the power was redistributed, a further electrical load analysis was conducted which showed the main G70 and the 4 light

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tower generators were operating at an average of 76% and 86.5% capacity respectively at peak demand with a 20% contingency factor.

6.4 ESA Inspection and Approval

The Electrical Safety Authority (ESA) states that any power connections or equipment purchased or utilized in a project or job site should be approved by an ESA inspector and subsequently bear a ESA sticker indicating that the equipment complies with ESA (Ontario) regulations and is therefore in accordance with Wood HSEP and protocols. ESA inspections were conducted on site twice. Minor modifications to the electrical circuitry and connections were requested to be made in order to comply with ESA regulations in the first inspection. The final inspection was conducted on the whole site, and it was found to be in full compliance and approved to be an operational site. A copy of the inspection letter is included in Appendix G: ESA Inspection Letter.

7.0 References

- SCB1912026-PLN-005 WP01 Test Plan Site Infrastructure and Access Road Construction
- SCB1912026-REP-003 Baseline Environmental Soils Investigation
- SCB1912026-FIG-003-R02 As-Built
- SCB1912026-PLN-002 HSEP



Appendix A Site Layout & Location Plan

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Figure 1 - Site Location Plan

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Figure 2 - Site Layout As-Built

	Site Overview Legend									
1	1 Site Trailer #1 (MOOD) 11 Seasan #E (Selevinerte)									
	Site Trailer #1 (WOOD)	11	Seacan #5 (Solexperts)							
2	Site Trailer #2 (NWMO)	12	Core Shack #1							
3	Portable Washroom Facility	13	Core Shack #2							
4	Seacan #1 (DGI/Solexperts)	14	AMC Unit							
5	Seacan #2 (Westbay)	15	Heated Waste Water Tank							
6	Seacan #3 (WOOD Storage)	16	Heated Fresh Water Trailer							
7	Light Towers	17	Drilling Rig							
8	Seacan #4 (Core Storage)	18	STS Unit							
9	Generators	19	Seacan #6 (Major Drilling Storage)							
10	Fuel Storage Tank	20	Garbage Disposal Bins							
		21	Glycol Unit							

Table 2 - Site Overview Legend



Appendix B Initial Site Conditions Photographs

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Figure 3 - Initial Ground Conditions at BH-04



Figure 4 - Soft Wood Chips Observed on Site Initially

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Appendix C Construction Activity Photographs

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wood.



Figure 5 - Clearing and Grubbing



Figure 6 - Exposed Bedrock at Final Design Elevation

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Figure 7 - Dumping First Lift of Granular



Figure 8 - IG_BH04 Pad after completion



Appendix D Electrical Connection Details

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Figure 9 - SCB1912026-SKT-004 (Electrical Connection Diagram)



						P/	NE	L	SC	HE	DU	LE							
PANEL NO. : Main				CLIEN	TNAN	E: NW	MO-E	81					Doc. No.: XXXXXXX-0000-DF00-SCH-0001						
PROJECT NO. : XXXXX				PROJ	ECT N	AME: B	H4 &	BH5					Date: Jan 30, 2020						
PANEL BOARD TYPE:				SC R/	ATING:	10kA S	Symm	etrica	al		6	VOLT/	OLTAGE: 240/120/3W						
MAINS:	200A			LOCA	OCATION: Electrical Room MOUN						IOUNTING: Surface								
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												28.3	28.3	56.6	TOTA	L PAN	IEL LC	AND TOTAL (KW) AD - ALL PHASES (KW)	
NOTES: Grand Total Load applying 0.8 de	mand	factor	will be	45 KW	/ inclu	ding 0.9	95 CO	ncid	ence	fact	tor lo	ad will	be 42.7	5KW					
REV	DESCRIPTION											APP							
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Figure 10 - Electrical Connection Panel Schedule





Figure 11 - ESA Inspection Sticker Example

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Appendix E As-Built Figure (Controlled Document No. SCB1912026- FIG -003- R02)

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N 5486448.659 E 556957.703 EL=443.360

N 5486442.540 E 556978.890 EL=440.948

LEGEND

TOPOGRAPHIC SURVEY OF

(IGNACE AREA) SCALE: 1 : 500 10 20

30

DENOTES SITE CONTROL MONUMENT
DENOTES FENCE
DENOTES FENCE
DENOTES EDCE OF SHOULDER
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444
DENOTES EDCE OF VEGETATION

ELEVATION

ELEVATIONS SHOWN HEREON ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVDING BY 0.3048. ELEVATIONS ARE REFERED TO VERTICAL CONTROL MONUMENT 0011993U067 HAVING A PUBLISHED ELEVATION OF 419.358m CGV028-78.



ACAD FILE SEL \2018\0



Appendix F Sieve Analysis

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Appendix G ESA Inspection Letter

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400 Sheldon Dr, Unit 1, Cambridge, ON, N1T 2H9 FOR BILLING INQUIRIES Toll Free Tel: 1-877-372-7233 Toll Free Fax: 1-800-667-4278

www.esasafe.com

INVOICE

(This is also your Notificatio	on Confirmation)	1 of 1
그는 영화 물로 가장 같은 문양한 방문을 가격할다.	INVOICE NUMBER:	97996591
FEDIUK ELECTRIC INC	DATE:	November 18, 2019
SITE 124 BOX 6 RR4	DUE DATE:	SEE TERMS
DRYDEN ON P8N 0A2	ACCOUNT NUMBER:	105525
ATTN: LINDSEY-ANN EJ FEDIUK	ACP NUMBER:	NCR1458
	NOTIFICATION NO:	16522675
이 물 수 있는 것을 수 없는 것이 같이 많이 많이 많이 많이 많이 없다. 것을 것을 수 있다. 것을 것을 수 없는 것을 것을 수 없다. 것을 것을 수 있는 것을 것을 수 있다. 가지 않는 것을 수 없다. 나는 것을 것을 것을 수 없다. 이렇게 있는 것을	LICENCE NUMBER:	0007013430
집중 전화 관계적 것은 것은 것을 알아야 한다. 것은 것이 모양을 했다.	요즘 다 전에서 집 중에서 걸 것을 했다.	

NOTE: It is the responsibility of property owners to ensure the safety of workers on their property including that of Inspectors. This responsibility includes determining whether asbestos dust 'a major safety risk' is present and taking required mitigation actions. To learn about your legal obligations, contact the Ministry of Labour at <u>1-877-202-0008</u> or visit their web site at

https://www.labour.gov.on.ca/english/hs/faqs/asbestos.php. You may be required to do a designated substance survey and those results need to be available to ESA upon request or you may experience delays to your inspection.

The minimum fee for wiring inspection services is \$79.00 (plus HST).

HST#: 87391-1424-RT-0001

Terms: Net 30 days from STATEMENT date.

Overdue amounts will be subject to a late payment charge of 1.5% per month which equals an effective annual rate of 19.56%.

Inspector: Kuzemchuk, Donald (SITE:	Cell: (807)221-8260 D	ays of Inspection	: M-WK 1	
WOOD INCORPORATED TOWER RD KENORA UNORGANIZED ON Description	Quantity	Amount	HST	TOTAL
LV ICIA MISCELLANEOUS EQUIPMENT	3.0	\$170.00	\$22.10	\$192.10
LV ICIA DISTRIBUTION EQUIPMENT 0-225	2.0	\$76.00	\$9.88	\$85.88
CONSTRUCTION TRAILER	12.0	\$1,488.00	\$193.44	\$1,681.44
Total Amount of Invoice	가 관련되었는 것 가 가 있는 것 같이 같은 것은 것 같은 것 같은 것 같이 있다. 것 같은 것 같은 것 같은 것 같은 것 같이 있다.	\$1,734.00	\$225.42	\$1,959.42

Days of inspection listed above are valid as of the date on the document and are subject to change at any time.

Please tear along dotted line and return with payment

REMIT BY:

CHEQUE (Payable to Electrical Safety Authority) Please write account number and invoice number on cheque.

CREDIT CARD For payment by credit card, please call 1-877-372-7233.

INVOICE NUMBER:	97996591
DUE DATE:	SEE TERMS
ACCOUNT NUMBER:	105525
TOTAL AMOUNT DUE:	1,959.42 CAD