



## REPORT

Report Date: January 13, 2022  
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Meeting Date: January 26, 2022  
[Submit comments to Council](#)

TO: Standing Committee on Policy and Strategic Priorities

FROM: General Manager of Development, Buildings, and Licensing, and the Chief Building Official

SUBJECT: Electrification of Space Heating and Domestic Hot Water: Mechanical Permit, and Various Housekeeping and Miscellaneous Amendments.

### **RECOMMENDATION**

- A. THAT Council approve, in principle, the amendments to the Building By-law generally in the form attached as Appendix A, implementing improvements and regulations to various building mechanical systems, including a mechanical permit.
- B. THAT Council approve, in principle, various housekeeping and miscellaneous amendments to the Building By-law as generally described in this report and as set out in Appendix A.
- C. THAT Council instruct the Director of Legal Services to bring forward for enactment amendments to the Building By-law as set out in Appendix A, to implement Recommendations A and B, with certain provisions to come into force and take effect on July 1, 2022.

### **REPORT SUMMARY**

This report recommends amendments to the Building By-law in response to Council's direction to reduce emissions and to improve the city's resiliency. The key feature of these proposals is a new mechanical permit, modelled on neighbouring jurisdictions, and a professional certification program for installers.

The recommendations:

- Centre on the City's zero emissions space and water heating targets defined in Vancouver's Climate Emergency Action Plan — Zero Emissions Buildings initiative (Big Move 4);
- Elevate standards for the design and installation of heating and cooling systems; and
- Help to ensure that operating costs for building owners with zero emissions heating and cooling systems are comparable to building owners with natural gas fuelled systems.

The recommendations were developed in collaboration with local industry and were refined in consultation with professional associations, consultants, contractors and building owners (Appendix C). Local manufacturers and industry associations support these proposals.

Lastly, housekeeping amendments are also being proposed to rectify administrative errors in the integration of recent amending by-laws, remove redundancies and, responding to public feedback, clarify the meanings of existing requirements through improved wording and new Notes. Miscellaneous amendments to the operating permit fees in the Schedule of Fees are also being proposed, for the purposes of administrative cost-recovery.

### ***COUNCIL AUTHORITY/PREVIOUS DECISIONS***

In July 2016, Council approved the Zero Emissions Building Plan to achieve zero emissions for all newly permitted buildings by 2030 that included intermediary, time stepped GHG emission and energy efficiency limits in the Building By-law for each building type.

In April 2019, Council approved the Climate Emergency Response report, which established a 'Big Move' target for all new and replacement heating and hot water systems to be zero emissions by 2025. Further, 'Accelerated Action' 5a directed staff to "Explore opportunities to set lower carbon emissions limits for new construction faster than laid out in the Zero Emissions Building Plan."

In November 2020, Council adopted the Climate Emergency Action Plan, which includes "Big Move 4 – Zero Emissions Space + Water heating," putting Vancouver on target to reduce its carbon pollution by 50% by 2030.

### ***CITY MANAGER'S/GENERAL MANAGER'S COMMENTS***

The City Manager recommends approval of the foregoing.

### ***REPORT***

#### ***Background/Context***

The recommended By-law amendments align with Big Move 4 of the Climate Emergency Action Plan, transitioning space heating and domestic hot water in new construction from natural gas combustion systems (furnaces, boilers) to an electric source in most cases. Electric source space heating and domestic hot water systems include heat pumps and electric resistance options (electric boilers, electric baseboards).

A heat pump is a mechanical heating and cooling system that utilizes refrigerant to move heat energy from one location to another. A heat pump can warm a building in the winter and cool a building in the summer, or can provide hot water throughout the year. Electric heat pumps require appropriate design and installation to be effective. Currently, all types of heating systems in Vancouver are unregulated and are not reviewed or inspected by City staff.

This report proposes a new mechanical permit for heating and cooling systems. The objective is to ensure that all heating systems are designed, sized, installed and commissioned correctly, by qualified professionals. Specifically, a mechanical permit will provide a regulatory mechanism to help ensure that:

- building occupants have a reliable and professionally installed heating and cooling system;
- the heating and cooling system operates efficiently; and
- the direct financial costs of operating a zero emissions heating system are comparable to a natural gas heating system.

Presently, the City of Vancouver regulates plumbing, gas, electric and fire sprinkler systems and ensures those systems are designed, sized and installed to the relevant codes. Adding a mechanical permit for space heating and hot water systems is congruent with existing processes and enhances public safety and confidence.

The proposed mechanical permit mimics regulations in neighbouring municipalities, such as the District of North Vancouver, District of West Vancouver, City of Burnaby, City of Port Coquitlam and the City of New Westminster.

This report seeks to create a mechanical permit to regulate the installation of space heating and domestic hot water systems for all building types. Permitting and inspecting of these systems will assist in a successful transition to electrification.

A Municipal Heat Pump Certification has been developed by the Thermal Environmental Comfort Association (TECA) in collaboration with the City of Vancouver (Appendix B). This is a new minimum professional standard proposed for installers, and would be a requirement for a mechanical permit that included the installation of a heat pump.

The additional cost implications for a single family dwelling for a mechanical permit would range from \$109 - \$303 dependant on the complexity of the system. This is comparable to neighbouring jurisdictions.<sup>1</sup> Currently there is already a fee of \$218 for a stand alone natural gas boiler or furnace. For a multi-unit residential building, four stories and above, the cost would be approximately \$800.

This report also proposes various housekeeping and miscellaneous amendments to the by-law.

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<sup>1</sup> Mechanical permit fees (as of 2021) in neighbouring municipalities for a typical single family dwelling:

District of North Vancouver	\$166 - \$263
District of West Vancouver	\$450 - \$515
City of Burnaby	\$335 - \$402
City of Port Coquitlam	\$270 - \$324
City of New Westminster	\$411

## **Strategic Analysis**

Unregulated installations of heating systems, including heat pumps, can have negative outcomes<sup>2</sup>. Poorly performing systems can result in premature failure, high operating and maintenance costs, adverse impacts to building integrity, and detrimental health effects (such as from mould). A new mechanical permit would be an effective regulatory tool to help protect building owners and occupants with a minimum standard for equipment design, installation and commissioning.

## **Housekeeping and Miscellaneous Amendments**

The recommended housekeeping amendments are intended to rectify administrative errors in the integration of recent amending by-laws, remove redundancies and, responding to public feedback, clarify the meanings of existing requirements through improved wording and new Notes.

For the existing Operating Permit program, three new fees are proposed for administrative cost-recovery. Two of the proposed fees are solely for situations where mechanical equipment owners are not in compliance with regulatory requirements, and reflect the effort of Clerks and Plumbing Inspectors to follow-up and help establish regulatory compliance. More serious matters are referred to prosecution under existing processes. The third proposed fee addresses the administrative effort of staff when a permit holder formally requests to transfer their Operating Permit to another entity.

## **Industry readiness**

The proper sizing, design and installation of heat pumps is critical to the success of the City's transition to electricity. This requires professional designers and a skilled local installer base.

Local plumbers and gas fitters are “upskilling” through the new Municipal Heat Pump Certification, developed by the Thermal Environmental Comfort Association (TECA) in collaboration with the City of Vancouver. Additional heat pump installation capacity will likely come from those installing traditional heating systems. Upskilling and certifying installers will ensure that the end user has a zero-emissions system designed and installed for comfort and longevity.

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<sup>2</sup> “Numerous studies and surveys indicate that typically-installed [heating, ventilation and air conditioning] equipment operate[s] inefficiently and waste[s] considerable energy due to different installation errors (faults) such as improper refrigerant charge, incorrect airflow, oversized equipment, leaky ducts.” (Domanski *et al.* (2014) “Sensitivity Analysis of Installation Faults on Heat Pump Performance,” NIST Technical Note 1848, [nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1848.pdf](http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1848.pdf)).

“...there is still a need for field verification of system performance. This field verification cannot be limited to evaluation of charge and airflow, as it has been in the past, but must be extended to system controls. Field verification cannot be limited to the installer’s report but must include an additional layer of quality assurance. This is both to ensure the performance of the system and to maintain currency with the more advanced systems...” (Baylon *et al.* (2005) “Analysis of Heat Pump Installation Practices and Performance,” [library.cee1.org/system/files/library/1938/1123.pdf](http://library.cee1.org/system/files/library/1938/1123.pdf)).

### ***Public/Civic Agency Input***

See Appendix C. The proposed mechanical permit has strong support from industry, trade organizations and licensed contractors. Ensuring compliance to minimum standards creates an even “playing field” for industry and enhances public confidence.

### ***Implications/Related Issues/Risk***

There is a minimal up-front permit cost for new installations of heating systems.

### ***Financial***

The mechanical permit fee will cover the additional inspections and administrative staff required for successful program delivery.

The program will be integrated into the City of Vancouver’s existing, web-enabled POSSE inspection platform, and all permit application requirements will be managed through a customer’s online account. The customer experience will mirror the success of the department’s Operating Permit program for water systems, which has issued over 1,200 permits through an entirely on-line process.

### ***Human Resources/Labour Relations***

Administrative and technical staff support will be required to audit mechanical permit applications, verify requirements and conduct inspections, on a cost-recovery basis.

### ***Environmental***

Within the City’s context of projected population growth, economic development and climate change, these proposals will help to safeguard resources and infrastructure, and improve the City’s long-term resilience while meeting the City’s commitment to reduce emissions through the electrification of space heating and hot water as outlined in “Big Move 4” of the Climate Emergency Action Plan.

### ***Legal***

Council has the authority from the *Vancouver Charter* to make by-laws for regulating building efficiency and green house gas emissions under section 306(1)(a) Sentence V and VI and regulating the installation of or alteration of plumbing and heating facilities in and about buildings, including the materials to be used as well as connections under section 306(1)(l) Sentence I.

### ***CONCLUSION***

The recommended Building By-law amendments will help to protect building owners and occupants as the City of Vancouver transitions to electrification, and aide in meeting Council’s resilience objectives.

The housekeeping and miscellaneous amendments will address errors and add clarity to the by-law, and will ensure that the costs of the Operating Permit program are appropriately covered through the imposition of certain fees.

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## **Appendices**

Appendix A.....DRAFT By-law to amend Building By-law No.12511  
Appendix B..... Municipal Heat Pump Certification – Course Outline  
Appendix C..... Public Consultation Process, Summary and letters of support

**DRAFT**

*Note: A By-law will be prepared generally in accordance with the provisions listed below, subject to change and refinement prior to posting.*

**A By-law to amend Building By-law No. 12511  
Regarding the Addition of a Mechanical Permit  
and Various Housekeeping and Miscellaneous Amendments**

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

1. This By-law amends the indicated provisions of Building By-law No. 12511.
2. In the definition of “Appliance” in Sentence 1.4.1.2.(1) of Book I, Division A, Council adds “, including electricity,” after “a device to convert fuel”.
3. In Sentence 1.4.1.2.(1) of Book I, Division A, Council:
  - (a) strikes out the definition of “Constructor” and substitutes:

“**Constructor** or **Contractor** means a person who contracts with an *owner* or an authorized agent of an *owner* to undertake a *project*, and includes an *owner* who contracts with more than one person for the work on a *project* or undertakes the work on a *project* or any part thereof.”; and
  - (b) strikes out the definition of “Contractor” and substitutes:

“**Contractor** (see *constructor*).”.
4. In the definition of “Plumbing contractor” in Sentence 1.4.1.2.(1) of Book I, Division A, Council strikes out “either a plumber or a person who employs a plumber on a full time basis” and substitutes “either a *journeyperson plumber* or a person who employs a *journeyperson plumber* on a full time basis”.
5. In the definition of “Space-heating appliance” in Sentence 1.4.1.2.(1) of Book I, Division A, Council strikes out “such as a central *furnace* or *boiler*”.
6. In Sentence 1.4.1.2.(1) of Book I, Division A, Council adds the following new definitions in the correct alphabetical order:
  - (a) “**Gas contractor** means a person licensed as a *gas contractor* pursuant to the License By-law, and who is either a gas fitter or a person who employs a gas fitter on a full time basis.”;

- (b) “**Heat loss calculation** means a calculation according to the methodology of CSA F280-12, “Determining the required capacity of residential space heating and cooling appliances”.”;
- (c) “**Mechanical system** means a heating or cooling system and includes all components, controls, wiring and any piping associated with the system.”; and
- (d) “**Municipal Heat Pump Certification** means a certification issued to a person who has completed the Municipal Heat Pump Certification training.”.

7. In Table 1.3.1.2. of Book I, Division B, Council:

(a) adds, in correct alphabetical order, the following new row:

“

CSA	F280-12	Determining the required capacity of residential space heating and cooling appliances	1.4.1.2.(1) of Division A
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” and,

(b) adds, in correct alphabetical order, the following new row:

“

ASSE/IAPMO/ ANSI	12080-2020	Professional Qualifications Standard for <i>Legionella</i> Water Safety and Management Personnel	A-1.6.9.4.(1) of Division C
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”

8. In Section 9.33. of Book I, Division B, in the title of the Section, Council strikes out “**Heating and Air-conditioning**” and substitutes “**Mechanical Systems**”.

9. In Article 10.2.2.14. of Book I, Division B, Council adds the following new Sentences in the correct numerical order:

“**6)** Heat pumps used to provide space heating shall be of the variable or multi stage compressor type.

**7)** Heat pumps providing space heating shall not provide for domestic hot water production, except where the heat pump only provides pre-heated water to a separate and independent electric domestic hot water system.”.

10. In Article 10.2.2.15. of Book I, Division B, Council adds the following new Sentence in the correct numerical order:

“6) In a *building* required to comply with this Article, gas-fired fireplaces are not permitted as the primary heating *appliance*.”.

11. In Sentence 1.4.1.2.(1) of Book II, Division A, Council:

(a) strikes out the definition of “Constructor\*” and substitutes:

“**Constructor\*** or **Contractor\*** means a person who contracts with an *owner* or an authorized agent of an *owner* to undertake a *project*, and includes an *owner* who contracts with more than one person for the work on a *project* or undertakes the work on a *project* or any part thereof.”; and

(b) adds the following new definition in the correct alphabetical order:

“**Contractor\*** (see *constructor\**).”.

12. In Sentence 1.4.1.2.(1) of Book II, Division A, Council adds the following new definitions in the correct alphabetical order:

- (a) “**Appliance\*** means a device to convert fuel, including electricity, into energy and includes all components, controls, wiring and piping required to be part of the device by the applicable standard referred to in this By-law.”;
- (b) “**Gas contractor\*** means a person licensed as a gas *contractor* pursuant to the License By-law, and who is either a gas fitter or a person who employs a gas fitter on a full time basis.”;
- (c) “**GMAW** means gas metal arc welding.”;
- (d) “**GTAW** means gas tungsten arc welding.”;
- (e) “**Heat loss calculation\*** means a calculation according to the methodology of CSA F280-12, “Determining the required capacity of residential space heating and cooling appliances”.”;
- (f) “**Mechanical system\*** means a heating or cooling system and includes all components, controls, wiring and any piping associated with the system.”;
- (g) “**Municipal Heat Pump Certification\*** means a certification issued to a person who has completed the Municipal Heat Pump Certification training.”;
- (h) “**Space-heating appliance\*** means an *appliance* intended for the supplying of heat to a room or space directly, such as a *space heater*, fireplace or *unit heater*, or to rooms or spaces of a *building* through a heating system.”;
- (i) “**Space heater\*** means a *space-heating appliance* for heating the room or space within which it is located, without the use of ducts.”; and
- (j) “**Unit heater\*** means a suspended *space heater* with an integral air-circulating fan.”.

13. In the definition of “Cooling tower” in Sentence 1.4.1.2.(1) of Book II, Division A, Council adds “(See Note A-1.4.1.2.(1).)” to the end of the definition.

14. In Note A-1.4.1.2.(1) in the Notes to Part 1 of Book II, Division A, Council adds the following in the correct alphabetical order:

“**Cooling Tower**

From a Legionnaires' disease prevention perspective, the fluid flow of interest is the water sprayed, evaporated, collected and recirculated within a *cooling tower* (the so-called "external circuit"). It is this water that requires appropriate treatment to keep *Legionella pneumophila* levels controlled.

For a *cooling tower* with multiple cells, if all of the cells share the same recirculated water, the whole unit can be considered one *cooling tower*. However, as a cautionary note for large systems, even with the same water flowing to all parts, it has been found by New York City's Department of Health and Mental Hygiene that different locations within the same *cooling tower* can test positive and others can test negative for *Legionella pneumophila*.

For buildings with multiple cooling tower structures, in certain, rare configurations, and at the sole discretion of the *Chief Building Official*, it may be determined that the multiple cooling tower structures can be considered as one *cooling tower* for the purpose of this defined term. To be considered as one *cooling tower*, the recirculating water loops of the multiple cooling tower structures must share the same recirculated water and treatment and the recirculating loops must always operate together. The *Chief Building Official* must be satisfied with the equipment owner's reasoning and supporting evidence that there is a reasonable basis to presume that the water quality should be identical at all times across the multiple cooling tower structures. This assessment would consider the location, size, condition and mechanical configuration of the cooling towers, including valves and pipes; differences in exposure to sunshine, heat sources, neighbouring buildings, potential pollution sources, and mechanical equipment, such as exhaust fans; the control system and operational philosophy for the cooling towers; water quality data and compliance history; and maintenance records."

15. In Sentence 1.4.2.1.(1) of Book II, Division A, Council adds the following to the list of symbols and other abbreviations in the correct alphabetical order:

"**kW** ..... kilowatt(s)".

16. In Table 1.3.1.2. of Book II, Division B, Council:

- (a) in the By-law Reference column for CSA - CAN/CSA-B128.1-06 - Design and Installation of Non-Potable Water Systems:
- (i) strikes out "2.7.2.1.(2)" and substitutes "2.7.2.1.(1)", and
  - (ii) adds "2.7.5.2.(1)(c)" in the correct numerical order;
- (b) in the By-law Reference column for NSF/ANSI - 14-2017 - Plastics Piping System Components and Related Materials, strikes out "2.7.2.1.(1)" and substitutes "2.7.2.1.(2)";

- (c) in the By-law Reference column for PSPC – MD 15161-2013 - Control of Legionella in Mechanical Systems, strikes out “A-2.2.11.6.(7)” and substitutes “A-2.2.11.6.(8), A-2.2.11.6.(9)”;
- (d) in the By-law Reference column for BC - B.C. Reg. 296/2010 – Pool Regulation, adds “of Division A” under “1.4.1.2.(1)”;
- (e) in the By-law Reference column for NSF/ANSI 61 – 2016 Drinking Water System Components – Health Effects, strikes out “2.2.6.11.(1)” and substitutes: “2.2.6.11.(1), 2.2.6.12.(1), 2.2.6.13.(1), 2.2.6.14.(1), 2.2.6.15.(1), 2.2.6.17.(1)”;
- (f) strikes out the row for NSF/ANSI 372 – 2016 Drinking Water System Components – Lead Content;
- (g) adds, in correct alphabetical order, the following new row:

“

CSA	F280-12	Determining the required capacity of residential space heating and cooling appliances	1.4.1.2.(1) of Division A
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”;

- (h) adds, in correct alphabetical order, the following new row:

“

CSA	CAN/CSA-Z317.13-17	Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities	A-2.2.11.6.(9)
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”; and

- (i) adds, in correct alphabetical order, the following new row:

“

ASSE/IAPMO/ANSI	12080-2020	Professional Qualifications Standard for <i>Legionella</i> Water Safety and Management Personnel	A-1.6.9.4.(1) of Division C
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”

17. In Clause 2.2.6.12.(1)(c), Clause 2.2.6.13.(1)(b), and Sentence 2.2.6.14.(1) of Book II, Division B, Council strikes out “NSF/ANSI 372, “Drinking Water System Components – Lead Content”” and substitutes “NSF/ANSI 61, “Drinking Water System Components – Health Effects.””.

18. In Sentence 2.2.6.15.(1) of Book II, Division B, Council:
- (a) strikes out “and” in Clause (a);
  - (b) strikes out “Service.” and replaces it with “Service;” and” in Clause (b); and
  - (c) adds a new Clause (c) as follows:  
  
“c) NSF/ANSI 61, “Drinking Water System Components – Health Effects.””.

19. In Subsection 2.2.6. of Book II, Division B, Council adds a new Article in the correct numerical order as follows:

**“2.2.6.17. Welded Stainless Steel**

**1)** Welded stainless steel shall conform to NSF/ANSI 61, “Drinking Water System Components – Health Effects.”

**2)** Welding of stainless steel pipe for *potable plumbing systems* shall use a *GTAW* or *GMAW* process.”.

20. Council strikes out Sentences 2.2.11.6.(6) and 2.2.11.6.(7) of Book II, Division B and substitutes:

**“6) Deleted.**

**7)** *Legionella pneumophila* testing shall be conducted

a) in accordance with Article 2.2.1.7.,

b) on water samples collected at a point in the recirculation loop just prior to the point where treatment chemicals are injected, or where this is not feasible, from a location representative of water in the system,

c) no less than 48 hours and no more than 5 days after completion of system start-up and disinfection,

d) at minimum, while the *cooling tower* is in operation, each calendar month of operation, with not more than 33 days between samples, and

e) as required by Sentence (8).”.

21. In Sentence 2.2.11.6.(9) of Book II, Division B, Council adds “(See Note A-2.2.11.6.(9))” to the end of the Sentence.

22. In Clause 2.2.11.7.(2)(b) of Book II, Division B, Council adds “(See Note A-2.2.11.7.(2)(b))” to the end of the Clause.

23. In Sentence 2.2.11.7.(7) of Book II, Division B, Council:

- (a) in Clause (b) strikes out “and” at the end of the Clause;
- (b) renumbers Clause (c) as Clause (d); and
- (c) inserts a new Clause (c) as follows:

“c) at minimum, while the *decorative water feature* is in operation, every 2 calendar months of operation, with not more than 63 days between samples, and”.

24. In Table 2.2.11.6. of Book II, Division B, Council strikes out footnote (4) and substitutes:

“(4) For the person giving the immediate notice to the *Chief Building Official*, the *owner*, and the owner of the equipment, the person shall take all reasonable steps to give notice by speaking directly to or by telephone with each person required to be notified, a person designated for this purpose by the person required to be notified, or a person answering the telephone number designated for this purpose by the person required to be notified, and follow with notice in writing to each person within 24 hours. For the person giving immediate notice to the medical health officer, the person shall provide notice in writing immediately.”.

25. In Table 2.2.11.7. of Book II, Division B, Council strikes out footnote (3) and substitutes:

“(3) For the person giving the immediate notice to the *Chief Building Official*, the *owner*, and the owner of the equipment, the person shall take all reasonable steps to give notice by speaking directly to or by telephone with each person required to be notified, a person designated for this purpose by the person required to be notified, or a person answering the telephone number designated for this purpose by the person required to be notified, and follow with notice in writing to each person within 24 hours. For the person giving immediate notice to the medical health officer, the person shall provide notice in writing immediately.”.

26. Council strikes out Sentence 2.4.6.3.(1) of Book II, Division B and substitutes:

“(1) Piping that is too low to drain into a *building sewer* by gravity shall be drained to a sump or receiving tank provided that

- a) *fixtures* located above the *public sewer connection* shall drain by gravity, and
- b) any overflow piping shall drain to the *public sewer connection* by gravity except overflow piping from an *alternate water source system*.”.

27. In Sentence 2.4.6.3.(5) of Book II, Division B, Council adds “and *backwater valve*” after “of the *trap*”.

28. In Sentence 2.4.6.4.(3) of Book II, Division B, Council strikes out “Except as provided in Sentences (4) and (5)” and substitutes “Except as provided in Sentence (5)”.

29. Council strikes out Sentence 2.6.1.12.(1) of Book II, Division B and substitutes:

“(1) *Storage-type service water heaters* shall operate at a temperature not lower than 60°C. (See Note A-2.6.1.12.(1).)”.

30. In Column B of Table 2.7.1.3. of Book II, Division B, Council adds “adiabatic cooling

systems,” after “make-up water for *cooling towers*,”.

31. In Article 2.7.2.1. of Book II, Division B, Council:

(a) strikes out Sentences (1) and (2) and substitutes:

**“1)** Except as required by Sentence (2), all non-*potable* water pipes shall be identified and marked in accordance with CAN/CSA-B128.1, “Design and Installation of Non-Potable Water Systems.”

**2)** All non-*potable* water distribution pipes of 2 inch *size* and smaller shall be purple in colour and conform to the requirements of NSF-rw and NSF/ANSI 14, “Plastics Piping System Components and Related Materials.”; and

(b) in Sentence (3), adds “(See Note A-2.7.2.1.(3))” to the end of the Sentence.

32. In Sentence 2.7.5.1.(1) of Book II, Division B, Council adds “within 8 weeks of *occupancy*” after “shall be commissioned”.

33. In Subclause 2.7.5.2.(1)(a)(i) of Book II, Division B, Council strikes out “Article 2.2.7.1.” and substitutes “Article 2.2.1.7.”.

34. In Book II, Division B, Council strikes out Clause 2.7.5.2.(1)(c) and substitutes:

“c) a cross connection control test shall be performed as required by CAN/CSA-B128.1, “Design and Installation of Non-Potable Water Systems” and witnessed by the *Chief Building Official*.”.

35. Council strikes out Sentence 2.7.5.2.(2) of Book II, Division B, and substitutes:

**“2)** Except as required by Sentence (3), if a water sample required by this Article fails to meet any of the standards set out in Table 2.7.7.1., an additional water sample for *E. coli* shall be collected no less than 48 hours and not more than 5 days after any cleaning or disinfection, tested, and reported.

**3)** If a *Legionella pneumophila* sample required by this Article fails to meet the standard set out in Table 2.7.7.1., an additional water sample for *Legionella pneumophila* and *E. coli* shall be collected no less than 48 hours and not more than 5 days after any cleaning or disinfection, tested, and reported.”.

36. In Column 4 of Table 2.7.7.1. of Book II, Division B, Council strikes out “every 2 months” wherever it appears and substitutes “every 2 calendar months”.

37. In Sentence 2.7.7.2.(1) of Book II, Division B, Council strikes out “every 2 months” and substitutes “every 2 calendar months”.

38. In Table 2.8.1.1. of Book II, Division B, Council adds the following new rows in correct

numerical order:

**“2.2.6.17. Welded Stainless Steel**

(1) [F80-OH2.1, OH2.2, OH2.3]

(2) [F80-OH2.1, OH2.2, OH2.3]”.

39. In the Notes to Part 2 of Book II, Division B, Council adds, in correct numerical order, the following new Notes:

- (a) **“A-2.7.2.1.(3) Non-potable water outlet identification.** An example of an acceptable graphical symbol is:



It is suggested that public education material also be posted to assist with risk perception and acceptance of treated non-potable water use.”;

- (b) **“A-2.2.11.7.(2)(b) Health Advisory.** Examples of acceptable graphical symbols include



”; and

- (c) **“A-2.2.11.6.(9) Offline Cleaning and Disinfection.**

The terms “cleaning” and “disinfection” have the meanings defined by Public Services and Procurement Canada’s standard MD 15161 “Control of *Legionella* in Mechanical Systems.”

More frequent *cooling tower* cleaning and disinfection may be necessary, especially for buildings with or near vulnerable populations. For health care facilities, refer to CAN/CSA-Z317.13 “Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities” Clause 6.4.2.”.

40. In Article 1.5.2.10. of Books I and II, Division C, Council:

- (a) in the title of the Article, adds “, **Mechanical**” after “**Plumbing**”; and
- (b) in Sentence (1), adds “, *mechanical system*” after “plumbing system”.

41. In Article 1.5.3.4. of Books I and II, Division C, Council:

- (a) in the title of the Article, adds “**or Mechanical**” after “**Plumbing**”; and
- (b) adds the following new Sentence in the correct numerical order:

“**3)** The *Chief Building Official*, if of the opinion that the *mechanical system*, or any part of it, in any *building* is defective or inadequate, may notify the *owner* or occupant thereof of such condition and may order such *mechanical system*, or part thereof, be placed in a proper, safe and working condition.”.

42. In Subsection 1.6.3. of Books I and II, Division C, Council:

- (a) in the title of the Subsection, adds “, **Mechanical**” after “**Plumbing**”;
- (b) in Sentence 1.6.3.1.(1), adds “, *mechanical system*” after “*plumbing system*”;
- (c) renumbers Articles 1.6.3.3. through 1.6.3.7. as Articles 1.6.3.4. through 1.6.3.8. respectively;
- (d) adds a new Article 1.6.3.3. as follows:

**“1.6.3.3. Permit for Mechanical System**

**1)** The *Chief Building Official* shall only issue a *permit* to construct, extend, alter, renew or repair a *mechanical system* to a *plumbing contractor*, licensed electrical *contractor* or a *gas contractor*.

**2)** The *Chief Building Official* shall only issue a *permit* to install a *mechanical system* that includes a heat pump to a *plumbing contractor*, a licensed electrical *contractor* or a *gas contractor* who holds a *Municipal Heat Pump Certification*.”;

- (e) in the title of Article 1.6.3.7., adds “**or Mechanical**” after “**Plumbing**”; and
- (f) strikes out Article 1.6.3.8. and substitutes:  
“**1.6.3.8. Requirement for Inspection**

1) A *plumbing system, mechanical system or sprinkler system* shall be inspected by the *Chief Building Official*, unless the *Chief Building Official* determines that an inspection is not necessary.”.

43. In Sentence 1.6.3.2.(1) of Book II, Division C, Council italicises “plumbing contractor”.

44. In Article 1.6.8.1. of Books I and II, Division C, Council strikes out Sentence (1) and substitutes the following:

“1) In this Subsection, “temporary” means for a time period not exceeding 12 consecutive months or a fixed term of occupancy not to exceed 3 years where *acceptable*.”.

45. In Subsection 1.6.9. of Book I, Division C, Council strikes out Articles 1.6.9.3., 1.6.9.4., and 1.6.9.5., and substitutes:

**“1.6.9.3. Application Requirements for New Operating Permits and Renewals**

1) To obtain or renew an *operating permit*, the owner of the equipment, device, apparatus, or system, or their authorized representative, shall file an application in writing in the form prescribed by the *Chief Building Official*.

2) The application for a new *operating permit* or the renewal of an *operating permit* shall be accompanied by the *operating permit* fees and any documentation required by the *Chief Building Official* to verify that the requirements of this By-law are being met.

3) Except as provided in Sentence (4), *operating permits* are valid for a one year period, and shall be renewed on an annual basis.

4) *Operating permits* for *once through cooling equipment* will be valid for a period deemed appropriate by the *Chief Building Official* or *City Engineer*, and if valid for a one year period, shall be renewed on an annual basis.

**1.6.9.4. Owner Must be Certified**

1) The owner of the equipment, device, apparatus, or system, or their authorized representative, must be certified under the Environmental Operators Certification Program, except that this requirement does not apply to *once through cooling equipment*. (See Note A-1.6.9.4.(1).)

**1.6.9.5. Conditions on Operating Permits**

1) The *Chief Building Official* may impose conditions on *operating permits* including, but not limited to, conditions regarding

- a) notifications and notices,
- b) safety,
- c) health,
- d) design requirements,

- e) *construction* requirements,
- f) timing of *construction*,
- g) deadlines for completion of *construction*,
- h) reviews and inspections,
- i) responsibilities of the owner of the equipment, device, apparatus, or system, the *constructor*, the *registered professional* and the *certified professional*,
- j) compliance with this By-law and other enactments,
- k) use and *occupancy*, and
- l) temporary *buildings* and *occupancies*.

#### **1.6.9.6. Operating Permit Fees**

1) *Operating permit* fees are as set out in the Schedule of Fees at the end of this Part.”.

46. In Article 1.6.9.3. of Book II, Division C, Council adds the following sentences in the correct numerical order:

“2) The application for a new *operating permit* or the renewal of an *operating permit* shall be accompanied by the *operating permit* fees and any documentation required by the *Chief Building Official* to verify that the requirements of this By-law are being met.

3) Except as provided in Sentence (4), *operating permits* are valid for a one year period, and shall be renewed on an annual basis.

4) *Operating permits* for *once through cooling equipment* will be valid for a period deemed appropriate by the *Chief Building Official* or *City Engineer*, and if valid for a one year period, shall be renewed on an annual basis.”.

47. In Sentence 1.6.9.4.(1) of Book II, Division C, Council adds “(See Note A-1.6.9.4.(1).)” to the end of the Sentence.

48. In Subsection 2.2.3. of Books I and II, Division C, Council:

- (a) in the title of the Subsection, adds “, **Mechanical**” after “**Fire Protection**”; and
- (b) adds the following new Article in the correct numerical order:

#### **“2.2.3.4. Information Required on Mechanical Drawings and Related Documents**

1) If the *Chief Building Official* requires an application for a *permit* in respect of a *mechanical system*, mechanical drawings and related documents submitted with the application shall show

- a) the location and size of all mechanical *appliances*,
- b) the size of all major pipes and components,
- c) the *heat loss calculation*, and

- d) the full *mechanical system* being installed, drawn to an indicated scale.”.
49. In the Notes to Part 1 of Books I and II, Division C, Council adds, in correct numerical order, the following new Note:
- “A-1.6.9.4.(1) Owner Must be Certified.** The Environmental Operators Certification Program (EOCP) Building Water Systems (BWS) certification is the required minimum certification level, except that for non-*potable* water systems accepted by the *Chief Building Official* as an alternative solution, a more advanced water or wastewater certification may be required. Certification under the ASSE/IAPMO/ANSI 12080 Standard “Professional Qualifications Standard for *Legionella* Water Safety and Management Personnel” is an acceptable equivalent to the EOCP Building Water Systems certification.”.
50. In Note A-2.2.6.2.(1) of the Notes to Part 2 of Books I and II, Division C, Council:
- (a) in subsection (m), strikes out “, and” and substitutes “,”;
  - (b) in subsection (n), strikes out “.” and substitutes “,”; and
  - (c) adds the following new subsection in correct alphabetical order:
    - “(o) the heat loss calculations for heating and cooling of the building.”.
51. In “Part C – Operating Permits” of the Schedule of Fees in Books I and II, Council:
- (a) strikes out “pay to the City the fee set out hereunder:” and substitutes “pay to the City the fees set out hereunder:”; and
  - (b) adds the following to the end of the part:

“For not renewing an OPERATING PERMIT on or before  
the renewal date ..... The OPERATING  
PERMIT renewal fee plus \$100.00

For each reinspection made necessary due to non-compliance with this  
By-law .....\$218.00

For each change of permit holder on an OPERATING PERMIT...\$100.00”
52. In the Schedule of Fees in Books I and II, Council adds a new Part D – as follows:
- “PART D – MECHANICAL PERMITS**
- For a MECHANICAL PERMIT in a 1-3 storey BUILDING..... \$350 + \$12.00 per 1kW
- For a MECHANICAL PERMIT in a BUILDING of 4 stories and above.....\$800
- + \$100 for each electric heat pump installation above 6 total heat pump units”.
53. A decision by a court that any part of this By-law is illegal, void, or unenforceable severs that part from this By-law, and is not to affect the balance of this By-law.
54. This By-law is to come into force and take effect on the date of its enactment, except that



## Municipal Heat Pump Certification – Course Outline

The following course outline lists topics related to the Municipal Heat Pump Certification:

### Contents

1. An Overview of Heat Pumps
2. Principles of Heat Pumps
  - 1) Heat naturally travels from high temperature to low temperature
  - 2) How does it work?
3. The Compression Refrigeration Cycle
  - 1) Reversible heat pumps
4. Categories of Heat Pumps
  - 1) Air source heat pumps
  - 2) Water source heat pumps
  - 3) Air-to-water heat pumps
    - i. Monobloc configuration
    - ii. Split configuration
    - iii. Split heat pump outdoor compressor
    - iv. Split heat pump indoor compressor
  - 4) Water-to-water heat pumps
  - 5) Geo-exchange (An example of a water-to-water heat pump application)
5. Refrigerants in Heat Pumps
  - 1) Problems with conventional refrigerants
  - 2) Natural refrigerant
  - 3) Why CO<sub>2</sub>?
  - 4) CO<sub>2</sub> air-to-water heat pump and water heater
  - 5) CO<sub>2</sub> heat pump's efficiency, pressure, and temperature
6. High Temperature Heat Pumps
  - 1) Product design optimized for specific refrigerants
  - 2) Application of natural refrigerants
  - 3) Cascaded systems
  - 4) Enhanced vapor injection (EVI)
  - 5) Pre-heated incoming liquid (2 Stage Process)
7. Thermal Performance of Hydronic Heat Pumps
  - 1) Coefficient of performance (COP)
  - 2) Heating seasonal performance factor (HSPF)
  - 3) Canadian standards for heat pumps
8. Simultaneous Heating and Cooling (Heat Recovery Systems)
9. Variable and Fixed Capacity Hydronic Heat Pump
  - 1) Basics of single stage heat pumps
  - 2) Basics of multi-stage heat pumps
  - 3) Basics of variable speed heat pumps
  - 4) Heat pumps with inverter driven compressors
  - 5) More efficiency
  - 6) More life span and less electrical problems
  - 7) More savings
10. Flow Requirements

- 1) Glycol (anti-freeze)
11. Circulator Sizing and Selection
  - 1) Calculate the required circulator pump's flow rate in gallons per minute (GPM)
  - 2) Calculate the head loss, or pressure drop in the system
  - 3) Circulator pump curve chart
  - 4) Heat pump flow requirements
12. Hydronic Heat Pump Selection
  - 1) Determine heat pump capacity for design conditions
    - i. Heat loss and heat gain calculation
  - 2) Selection procedure primarily based on the cooling load
  - 3) Selection procedure primarily based on the heating load
13. Determine Heat Emitter Temperature Requirement
  - 1) Heat emitter characteristics
  - 2) Water temperature requirements for heat emitters
14. Variable or Fixed Capacity Heat Pumps
  - 1) Fixed capacity
  - 2) Variable capacity (inverter)
15. Buffer Tanks
  - 1) To use a buffer tank – or not?
  - 2) Buffer tank function
  - 3) Buffer tank sizing
  - 4) Buffer piping configuration methods
  - 5) Buffer tank configuration details
16. Hydronic Heat Pump Piping Configuration without Buffer Tank
  - 1) Closed spaced tees
  - 2) Parallel secondary piping
  - 3) Hydraulic separator
    - i. Hydraulic separators sizing and application
17. Back-up Systems
  - 1) Electric element
  - 2) Gas boiler
18. Domestic Water Heating
  - 1) Heat pump domestic water heaters
  - 2) Desuperheater
  - 3) Domestic water heating using indirect water heater
  - 4) Supplementary domestic boost/ preheat
19. Swimming Pool and Spa Heaters
20. Radiant Heating and Fan Coil Cooling
  - 1) Heating and cooling with the same single buffer tank
    - i. Simple heat/ cool tank piping
    - ii. 3-way diverting valve piping
    - iii. 4-way diverting valve piping
    - iv. Heating with buffer tank and cooling without buffer tank
21. Heating and Cooling with Two Buffer Tanks
22. Cooling with Hydronic Heating Pumps
  - 1) Cooling capacity and unit of measurement
  - 2) Nominal and rated cooling capacity

23. Heat Pump Cooling and Hydronic Piping System
  - 1) Chilled water velocity and nominal pipe sizing
  - 2) Cooling water temperatures and ranges
  - 3) Cooling water temperature range (delta T)
    - i. Chilled water delta temp range
    - ii. Suggested supply water temperature
  - 4) Chilled water terminal units
24. Chilled Water Piping Insulation
  - 1) But what is condensation and why does it occur?
  - 2) Chilled water piping insulation considerations
25. How much insulation does it take to prevent condensation?
  - 1) Hangers and fasteners
26. Balancing, Testing and Commissioning
  - 1) The heat pump
    - i. Check flow
    - ii. Check temperature rise/ drop
  - 2) Balancing heat emitters
    - i. Fan coils
    - ii. Radiant floors
    - iii. Hydronic piping
  - 3) Automatic air vents
27. Controls
  - 1) Control philosophy
  - 2) Sequence of operation
  - 3) Safety shut downs and limiting devices
  - 4) Skill sets

## Public Consultation Process & Summary

Stakeholder consultation was completed in the fall and winter of 2021 and included discussions with manufacturers, wholesalers, designers, installers, engineers, gas fitters, plumbers, energy advisors, and architects as well as personnel from various departments within the City of Vancouver.

Multiple presentations and engagement events were hosted by the City of Vancouver during this time that were open to the public. Trade and technical organizations, such as HRAI, TECA and CIPH, circulated invitations to these events directly to their members. In addition, the City of Vancouver hosted a booth to provide information and discussion opportunities regarding the proposed amendments during the CIPH trade event (CIPHEX West) in early November 2021.

A public engagement letter was distributed to industry members on November 30, 2021. Final discussion sessions, open to the public, were hosted by the City of Vancouver on January 10 and 14, 2022. Feedback from stakeholders was incorporated into the proposed amendments.

Recipients of the November 30, 2021 public engagement letter and attendees to various workshops and presentations in 2021 are included in the below lists. Those entities prefixed with an asterisk provided comments to the City of Vancouver.

Letters of Support from industry members are at the end of this appendix. Industry members who have provided a Letter of Support are **bolded** within the following lists:

### a) Professional and Industry Associations & Utilities

- Architectural Institute of British Columbia (AIBC)
- \*Canadian Association of Consulting Energy Advisors (CACEA)
- \*Canadian Institute of Plumbing & Heating (CIPH)
- \***Engineers & Geoscientists of British Columbia (EGBC)**
- \*Homebuilders Association Vancouver (HAVAN)
- Home Performance Stakeholder Council (HPSC)
- \*The Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI)
- \***Thermal Environmental Comfort Association (TECA)**

### b) Consultants, Contractors, Manufacturers, Wholesalers & Suppliers

- \*Allied Engineering
- \*Bartle & Gibson
- \*BC Plumbing
- Bradford White
- CleanBC
- \*ECCO Supply
- Ecolighten
- \***Electro Industries**
- \*Emco
- Giant Factories Inc.
- \*IBC Boiler
- Integral Group

- Navien Inc.
- Noritz
- Ouellet
- Rheem
- Rinnai
- Thermo 2000 Inc.
- \*Universal Supply
- \*Uponor
- \*Viessman
- \*Wolseley



**THERMAL ENVIRONMENTAL COMFORT ASSOCIATION**

Thermal Environmental Comfort Association  
BC Toll Free Phone: 1-888-577-3818 Fax: 1-888-577-3137 E-mail: training@teca.ca  
Mail: PO Box 73105, Evergreen RO, Surrey, BC, V3R 0J2 Website: www.teca.ca

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December 14, 2021

Brandon Clevenger, P.Eng.  
Climate and Emissions Inspector  
Development, Building and Licensing  
The City of Vancouver  
453 West 12<sup>th</sup> Avenue  
Vancouver, BC V5Y 1V4

**Subject: Draft By-law to amend Building By-law No. 10908  
Development of a new Mechanical System Permit**

Dear Brandon,

It is our pleasure to confirm the Thermal Environmental Comfort Associations' (TECA) support of the proposed amendment to the City of Vancouver Building By-law No. 10908 with respect to the development of a new Mechanical System Permit.

TECA's mandate is to offer the residential heating, cooling and ventilation industry up-to-date training courses and our mission is to see safe, efficient and comfortable heating, cooling and ventilation systems installed in dwellings in British Columbia. We believe that only through the establishment of proper training programs and enforcement of minimum standards will the public be assured that such systems are indeed installed.

TECA supports the City of Vancouver's goals and objectives outlined in the Draft By-law to amend Building By-law No. 10908 and believe that this will create a stronger industry overall.

We wish you all the best in this procurement process and are looking forward to working with the City of Vancouver in support of its initiatives to reduce greenhouse gas emissions.

Sincerely,

**THERMAL ENVIRONMENTAL COMFORT ASSOCIATION (TECA)**

Gary Milligan, President

Cc: TECA Board of Directors



2150 West River Street · PO Box 538 · Monticello, MN 55362 · 763.295.4138 · Fax 763.295.4434 · [www.electromn.com](http://www.electromn.com) · [sales@electromn.com](mailto:sales@electromn.com)

July 23, 2021

Branson Clevenger  
Climate and Emissions Inspector  
City of Vancouver

Subject: Letter of Support for Vancouver Building By Law (VBBL)

Dear Mr. Clevenger,

My name is Dennis Schramel, National Sales Manager for Electro Industries located in Monticello, MN.

On behalf of Electro Industries we offer our full support of the Vancouver Building By Law and its initiatives to update the mechanical system permit to utilize electric resistance and heat pumps to help reduce energy use and greenhouse gas emissions as well as lower heatloss for new and existing buildings.

As a leader in electric heating technology, we see firsthand the positive impact electric heating systems have in buildings. From providing unsurpassed comfort and safety to a new building to offering future flexibility to couple with PV solar and or wind power to offset heating costs that further reduce GHG emissions. Electric resistance and heat pump technology is the future of heating that will continually get greener as we move towards initiatives such as VBBL.

Sincerely,

A handwritten signature in black ink, appearing to read 'Dennis Schramel', is written over a light blue horizontal line.

Dennis Schramel  
National Sales Manager  
\* [dschramel@electromn.com](mailto:dschramel@electromn.com)  
: [www.electromn.com](http://www.electromn.com)

Cc:  
John Seefeldt  
Deb Heinen

---

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January 12, 2022

Sent Via: [Contact City Council Webpage](#)

Mr. Brandon O. Clevenger, P.Eng.  
Climate and Emissions Inspector  
Development, Building and Licensing  
City of Vancouver  
453 W 12<sup>th</sup> Avenue  
Vancouver BC V5Y 1V4

Dear Mr. Clevenger:

**Re: Engineers and Geoscientists BC's Letter of Support for the Mechanical System Permit Requirement Under the Vancouver Building By-law (VBBL)**

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Engineers and Geoscientists of BC is the regulatory body established under the *Engineers and Geoscientists Act* and now governed under the *Professional Governance Act* (the "Act") to regulate the practice of professional engineering and geoscience in the Province of British Columbia. The primary duty of Engineers and Geoscientists BC is to protect the public interest respecting the practice of professional engineering and practice of professional geoscience. The main means by which the regulatory body delivers on this duty is defined in the following object of the organization as identified in the Act "to establish, monitor, and enforce standards of practice".

Engineers and Geoscientists BC has a Council approved [Climate Change Action Plan](#) and an evolving portfolio of practice guidelines on the topic of climate change and a dedicated [Climate Change Information Portal](#) with tools and resources to support its registrants. With respect to the energy efficiency and greenhouse gas emissions reduction in the buildings sector, Architectural Institute of BC and Engineers and Geoscientists BC have developed joint [Professional Practice Guidelines on Whole Building Energy Modelling Services](#). These professional practice guidelines outline the standard of practice to be followed by engineers and architects in providing energy modelling services that meet the energy performance requirements and are applicable also to Part 9 buildings.

Engineers and Geoscientists BC has been well engaged in the discussions on Part 9 VBBL amendments and has previously issued a letter in support of climate-related requirements for New Housing 3-Storeys and Under RTS 13606. We understand that the proposed updates to the VBBL for a 'mechanical system permit' is to capture the installation of electric space heating and hot water systems covered under the bylaw amendment. Staff from the City of Vancouver engaged with Engineers and Geoscientists BC's Building Code Advisory Group to provide an overview of the changes to Energy Compliance Paths for new construction of single-family and multi-family residential buildings under 3-storeys. Webinars relating to Part 9 by-law implementation and mechanical permits were promoted by Engineers and Geoscientists BC including through its "External Events Page" on our website.

On this basis, Engineers and Geoscientists BC supports the proposed amendments regarding the development of a new 'mechanical system permit' aimed at implementing greenhouse gas reduction measures in the Part 9 buildings across the City of Vancouver.

**Mr. Brandon O. Clevenger, P.Eng.**  
**January 12, 2022**  
**Page 2 of 2**

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We commend the City of Vancouver's leadership on climate change action which is demonstrated through these policies and bylaws.

Should you have any comments or queries, please do not hesitate to contact Harshan Radhakrishnan, P.Eng., M.A.Sc., Manager, Climate Change and Sustainability Initiatives, directly at 604-412-6054 or via email at [hrad@egbc.ca](mailto:hrad@egbc.ca).

Yours truly,



for:

Peter R. Mitchell, P.Eng.  
Director, Professional Practice, Standards and Development

/lb