



# City of Richmond

## Report to Committee

**To:** General Purposes Committee  
**From:** Phyllis L. Carlyle  
 General Manager, Law & Community Safety  
**Re:** Noise and Sound Regulation

**Date:** February 2, 2011  
**File:**

### Staff Recommendation:

1. The proposed Noise Regulation Bylaw public participation program described in this report be endorsed.

Phyllis L. Carlyle  
 General Manager, Law & Community Safety  
 (604.276.4104)

Att: 3

| FOR ORIGINATING DEPARTMENT USE ONLY |   |                             |   |
|-------------------------------------|---|-----------------------------|---|
| ROUTED TO:                          | CONCURRENCE                             |                             | CONCURRENCE OF GENERAL MANAGER                                      |
| Budgets                             | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Building Approvals                  | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Communications                      | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Development Applications            | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Engineering                         | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Enterprise Services                 | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Fire Rescue                         | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Law                                 | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Parks Maintenance & Operations      | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Parks Programs                      | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Policy Planning                     | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| RCMP                                | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Roads & Construction                | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| Transportation                      | Y <input checked="" type="checkbox"/>   | N <input type="checkbox"/>  |   |
| <b>REVIEWED BY TAG</b>              | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> | <b>REVIEWED BY CAO</b>  |
|                                     |   |                             | YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> |

## Staff Report

### Origin

At the Community Safety Committee meeting of November 10, 2009, the following motion was carried:

*That staff investigate and assess the Measurable Noise Limits (Section 3.2) of the Public Health and Protection Bylaw 6989 in view of the increase in multi-family residences being in close proximity to industrial developments.*

At the Council meeting of Monday March 22<sup>nd</sup>, 2010, the following motion was carried in response to a public delegation:

*(1) That staff be directed to prepare a report and appropriate amendments to the Public Health Protection Bylaw 6989, Noise Control section to:*

*(a) amend the bylaw to include maximum interior sound levels on both the dBC and dBA scale to address the issue of the bass component of amplified sound originating from commercial and industrial establishments that impact on residential premises;*

*(b) define the point of reception for sound readings as the property line of a residential dwelling;*

*(c) revise the allowable dBA and dBC sound levels so that they are based on the recommendations from the World Health Organization;*

*(d) amend the bylaw to include mitigating measures for low level continuous noise;*

*(2) That the report and bylaw amendments be brought forward to the General Purposes Committee by May 17, 2010.*

*(3) That staff meet with MB Tarr and Associates Consulting Ltd. and True World Foods to assess the effectiveness of the baffling around the compressors on the roof of True World Foods to ascertain if improvements can be made to the baffling to considerably reduce the noise and vibration, and report back.*

At the Council meeting of May 25, 2010, the following motion was carried in response to the staff report dated May 6, 2010:

*That staff retain the necessary expertise to update and redraft, in consultation with the Richmond Medical Health Officer, the City's Public Health Protection Bylaw No. 6989 to address further advances in sound technology; assessment of ambient noise impact; inventory of potential noise conflict boundaries; impact of any changes in objective measurement; successful enforcement models and collaborative neighbourhood impact models.*

### Background

The City's present Public Health Protection Bylaw No 6989, Subdivision Three – "Noise Regulation" (the "Current Bylaw") has not been amended since 2000. During this time, significant changes have occurred in sound measurement technology, methodology and standards.

Neighbourhood issues related to noise are becoming more frequent due to the City's urbanization. The most recent report from Vancouver Coastal Health for the 6 months ending December 31, 2010 shows a total of 349 enquiries or complaints for the period. Additional analysis shows the following changes when compared to the same period in 2009:

- construction noise + 25%
- noise from residential neighbours + 33%
- industrial noise + 100%
- special events + 29%

In addition to these inquiries, the Engineering Division processes approximately 50 bylaw variance requests annually for construction outside of permitted hours.

Some of these complaints have gained a higher profile through the local media and communications with Council by residents and businesses. Staff has also met with members of the Richmond Economic Advisory Committee which resulted in the following motion from the Committee in 2010:

*"The Economic Advisory Committee recommends that Council consider other alternatives to deal with industrial noise, other than a change to its Noise Bylaw that would differentiate it from other municipalities (i.e. facilitate discussions between the business and residents)."*

As a result of the above-mentioned Council resolutions, the age of the Current Bylaw, changes in sound, technology, measurement standards and methodology and the increase in noise related complaints, staff are of the view that significant changes are required to the Current Bylaw. However, while significant changes may be required, the science, technology and methodology of sound and sound measurement is difficult and complex. Given the same, so that the public and the applicable stake-holders are all fully informed as to the changes in the proposed draft Noise Regulation Bylaw (the "Proposed Bylaw" – Attachment 1), a recommended public participation approach is set-out in this report.

To assist Council in the analysis of the very complex technical and legal issues surrounding the types of sound, the various methods of sound measurement and the production of an effective regulatory bylaw and enforcement strategy, the following external consultants were engaged:

- Don Howieson, Young Anderson, Barristers & Solicitors
- Mark Bliss, Acoustics Consultant, BKL Consultants Ltd.

## **Analysis**

### **Current and Proposed Bylaws**

Attachment 2 to this Report is the "Noise Regulation Bylaw Overview". This Overview reviews and explains the critical sections and concepts of the Proposed Bylaw.

In preparing the Proposed Bylaw, the consultants considered a number of factors including the following:

- changes in sound science, measurement and methodology in the 11 years since adoption of the Current Bylaw;
- World Health Organization (WHO) standards;
- success and challenges of other municipalities in addressing noise;
- both general and specific deficiencies or problems with Current Bylaw (including enforcement challenges) and proposed remedies; and
- impact of Proposed Bylaw on local residents, businesses, and institutions (including the City).

A comprehensive report addressing the issues set-out above together with other matters relating to the Current Bylaw and the Proposed Bylaw, prepared by BKL Consultants is Attachment 3 to this Report. The following table is a summary of BKL's report.

| Issue                 | Current Bylaw  | Proposed Bylaw   |
|-----------------------|--|--|
| 1999 WHO Guidelines   | N/A  | 1999 WHO Guidelines have not been adopted for the Proposed Bylaw because the primary purpose of the Guidelines is long-term transportation and noise planning  |
| Continuous Sound      | If the sound level in question is in excess of that permitted for 3 minutes in a 15 minute period. Continuous sound must be calculated and cannot be measured directly | Replaced by the $L_{eq}$ metric which is the most common metric used in the world to address human annoyance and can be directly measured and therefore eases enforcement                            |
| Point of Reception    | Definition lacks specificity for this key concept  | Specifies that usually measured outdoors and a prescribed distance from reflecting surfaces and at a place that best represents, in the inspector's determination, where the disturbance is received |
| Low Frequency Sound   | No objective measurement   | dBC scale added. dBC scale measures low frequency or bass sound  |
| Sound Characteristics | N/A  | Penalties for tones and impulsiveness added to account for increased annoyance   |

| Issue   | Current Bylaw   | Proposed Bylaw  |
|---|---|---|
| Objective Criteria (determining violation by sound measurement)                                   | Contains objective criteria measured only in dBA (which better measures higher frequency sound) | Contains objective criteria measured in dBA and dBC   |
| Subjective Criteria (determining violation without measurement but based on objectionable sounds) | Subjective criteria is alternative method for determining bylaw breach                          | Subjective criteria used only when it is impractical to measure the impugned sound  |
| Ambient noise   | Not addressed   | Includes a methodology for predicting the specific sound when the ambient noise background prevents accurate sound measurements |

As for the practical application of the limits in the Proposed Bylaw, Appendices A and B of the attached report from BKL Consultants Ltd. give some examples of various scenarios, measurement processes and the results. As stated on page 6 of the same report, in some cases the Proposed Bylaw will be stricter, but it will also replace some of the cases, where the subjective criteria might establish an infraction due to personal sensitivity, with an objective limit that is met.

### **Public Participation**

In respect to the Proposed Bylaw, there has been regular consultation with Richmond Health, the City's contractor for enforcement of the Current Bylaw. Richmond Health has provided input as to the challenges in enforcement of the Current Bylaw and the potential operational and cost impacts of enforcing the Proposed Bylaw including new equipment, training and increased complaint levels.

Consultation also took place with the RCMP, the City's contracted prosecutor and various City departments.

As to public participation, Community Bylaws staff will be working with Corporate Communications to conduct a thorough public notice, education and input assessment including the following components:

- published notices in the local media;
- an educational open house and on-line reference resources to ensure that changes in technology, generally accepted community standards, amendments in the Proposed Bylaw and challenges in enforcement are outlined;

- a workshop with key business stakeholders in the community, including the Richmond Economic Advisory Committee, Richmond Chamber of Commerce, etc. to investigate impacts of the Proposed Bylaw; and
- in order to expand the scope of the education and to gauge the public's sensitivity and opinions, an on-line survey through the City's web site.

Based on this public participation program, a full report would be provided to Council with recommendations and any further amendments to the Proposed Bylaw, impact on the City's enforcement program agreements and any cost implications.

### **Financial Impact**

Initial assessment indicates that implementation of the Proposed Bylaw, in its present form, will require new sound measuring equipment, additional training and documentation for City staff at an initial cost of \$30,000, with an annual operating budget impact of \$4,000.

Given the present enforcement agreement with Vancouver Coastal Health, any costs associated with new sound measuring equipment, additional training and documentation will have a resulting impact on the annual contract fees of \$209,000 paid to Vancouver Coastal Health. This cannot be fully calculated until the impact of the final bylaw is established, at which time, a formal contract estimate will be presented to Council.

The Proposed Bylaw, may result in increased prosecutions at an average cost of \$15,000 to \$20,000 per prosecution.

### **Conclusion**

Methods of sound measurement and practices have changed dramatically since the Current Bylaw was adopted. This, combined with difficulties in enforcement and measurement under the Current Bylaw, result in the need for a new sound bylaw. Acoustic measurement is complex and therefore, in order for the public and local businesses to fully understand the proposed amendments and provide their input, staff recommends a rigorous public participation program.



Wayne G. Mercer  
Manager, Community Bylaws  
(604.247.4601)

WGM:wgm



## NOISE REGULATION BYLAW

### PART ONE: INTRODUCTION

#### 1.1 Title

1.1.1 This Bylaw may be cited as the "NOISE REGULATION BYLAW".

#### 1.1.2 Definitions

In this Bylaw,

**"Activity Zone"** means those areas so described in this Bylaw and so indicated on the Noise Zone Map;

**"approved sound meter"** means an acoustic instrumentation system which

- (a) is comprised of a microphone, wind screen and recorder which conforms to class 1 or class 2 requirements for an integrating sound level meter as defined by IEC 61672-1 [2002];
- (b) has been field calibrated before and after each sound measurement using a class 1 or class 2 field calibrator as defined by IEC 60942 [2003]; and
- (c) has been calibrated, along with the field calibrator, within the past two years by an accredited lab to a traceable national institute standard;

**"City"** means the City of Richmond;

**"commercial occupancy"** in respect of a premises, means a self-contained area of a building used to sell, or offer for sale, goods or services;

**"construction"** includes:

- (a) the erection, alteration, repair, relocation, dismantling, demolition and removal of a building;
- (b) structural maintenance, power-washing, painting, land clearing, earth moving, grading, excavating, the laying of pipe and conduit (whether above or below ground), street or road building and repair, concrete placement, and the installation, or removal of **construction** equipment, components and materials in any form or for any purpose; or

- (c) any work or activities being done or conducted in connection with any of the work listed in paragraphs (a) or (b);

“**Council**” means the City Council of Richmond;

“**daytime**” means

- (a) from 7:00 a.m. to 10:00 p.m. Monday through Saturday;
- (b) from 10:00 a.m. to 10:00 p.m. on a Sunday or holiday;

“**dB<sub>A</sub>**”, or A-weighted decibel, means the unit used to measure the sound pressure level using the “A” weighting network setting on an **approved sound meter**;

“**dB<sub>C</sub>**”, or C-weighted decibel, means the unit used to measure the sound pressure level using the “C” weighting network setting on an **approved sound meter**;

“**holiday**” means:

- (a) New Years’ Day, Good Friday, Easter Monday, Victoria Day, Canada Day, British Columbia Day, Labour Day, Thanksgiving Day, Remembrance Day, Christmas Day and Boxing Day; and
- (b) the day named in lieu a day that is named in paragraph (a) and that falls on a Saturday, Sunday or the following Monday;

“**IEC**” means the International Electro-Technical Commission;

“**impulsive sound**” means **specific sound** that is characterized by brief bursts of **sound** pressure, with the duration of each impulse usually less than 1 second, including without limitation **specific sound** containing “bangs”, “clicks”, “clatters” or “thumps” from hammering, banging of doors and metal impacts;

“**impulsive sound adjustment**” means a 5 **dB<sub>A</sub>** increase applied to **specific sound** classified as **impulsive sound** and a 0 **dB<sub>A</sub>** increase applied to **specific sound** that is not classified as **impulsive sound**;

“**inspector**” includes the **Medical Health Officer**, the Chief Public Health Inspector, the General Manager of Engineering and Public Works, a Bylaw Enforcement Officer employed by the **City**, a Peace Officer, and any employee acting under the supervision of any of them.

“**Intermediate Zone**” means those areas so described in this Bylaw and so indicated on the **Noise Zone Map**;

“**ISO**” means the International Organization for Standardization;

“**L<sub>eq</sub>**”, or equivalent continuous sound pressure level, means that constant or steady **sound** level, rounded to the nearest decibel, which, in a specified time period, conveys the same **sound** energy as does the actual time-varying sound level;

“**measurement time interval**” means the total time over which **sound** measurements are taken, and

- (a) is chosen to best represent the situation causing disturbance;
- (b) is between 1 minute and 30 minutes;
- (c) is chosen to avoid influence from the **residual sound** where possible; and
- (d) may consist of a number of non-contiguous, short term measurement time intervals that add up to 1 to 30 minutes;

“**Medical Health Officer**” means the Medical Health Officer appointed under the *Health Authorities Act*, RSBC 1996, c. 180 or his/her designate, to act within the limits of the jurisdiction of any local board, or within any health district.

“**nighttime**” means:

- (a) from 10:00 p.m. to 7:00 a.m. Monday through Saturday;
- (b) from 10:00 p.m. to 10:00 a.m. on a Sunday or holiday;

“**Noise Zone Map**” means the map attached as Schedule “A” to this Bylaw;

“**point of reception**” means a position within the property line of the real property occupied by the recipient of a **sound** that best represents the location at which that **specific sound**, emanating from another property, is received and the resulting disturbance experienced and is:

- (a) at least 1.2 m above the surface of the ground;
- (b) at least 3 m from any reflecting surface other than the ground where possible, or, where it is necessary to make measurements above the ground floor level, at least 1 m from the façade of the relevant floor of the building; and
- (c) outdoors, unless there is no **point of reception** outdoors because the **specific sound** is within the same building or the wall of one **premises** is flush against another, in which case the **point of reception** shall be within the building where the **specific sound** is received and the resulting disturbance experienced;

“**power equipment**” means any equipment or machinery used in lawn and garden care, including leaf blowers, edge trimmers, rototillers and lawn mowers;

**“premises”** means:

- (a) the area contained within the boundaries of a legal parcel of land and any building situated within those boundaries; and
- (b) each unit, the common areas of the building, and the land within the apparent boundaries of the legal parcel of land are each separate **premises** where a building contains more than one unit of commercial, industrial or **residential occupancy**;

**“Quiet Zone”** means those areas so described in this Bylaw and so indicated on the **Noise Zone Map**;

**“rating level”** means the **specific sound level** plus the **impulsive sound adjustment** and **tonal sound adjustment**;

**“residential occupancy”** in respect of **premises**, means a dwelling unit located within a building, and includes a room for rent in a hotel or motel;

**“residual sound”** means the sound remaining at a given location in a given situation when the **specific sound** source is suppressed to a degree such that it does not contribute to the **total sound**;

**“sound”** means an oscillation in pressure in air which can produce the sensation of hearing when incident upon the ear;

**“specific sound”** means the **sound** under investigation;

**“specific sound level”** means the equivalent continuous **sound** pressure level or  $L_{eq}$  at the point of reception produced by the **specific sound** over the **measurement time interval**;

**“tonal sound”** means **specific sound** which contains one or more distinguishable, discrete, continuous tones or notes including, without limitation, **specific sound** characterized by a “whine”, “hiss”, “screech” or “hum”;

**“tonal sound adjustment”** means a 5 dBA increase applied to **specific sound** classified as **tonal sound** and a 0 dBA increase applied to **specific sound** that is not classified as **tonal sound**, or, if there is uncertainty whether a **specific sound** is tonal, a 0-6 dBA increase as determined using the fast Fourier transform (FFT) analysis approach described in ISO.1996-2 [2007] Annex C;

**“total sound”** means the totally encompassing **sound** in a given situation at a given time, usually composed of **sound** from many sources near and far;

**“total sound level”** means the equivalent continuous **sound** pressure level or  $L_{eq}$  at the point of reception produced by the **total sound** over the **measurement time interval**; and

“**vehicle**” means a device in, on or by which a person or thing is or may be transported or drawn along a highway, but does not include a device designed to be moved by human power, a device used exclusively on stationary rails or tracks or a motor assisted cycle.

## **PART TWO: SOUND LEVELS**

### **2.1 Quiet Zone Permitted Sound Levels**

2.1.1 In a **Quiet Zone** a person must not make, cause or permit to be made or caused, any **sound** that has a **rating level** which:

- (a) during the **daytime** exceeds:
  - (i) **55 dBA** or **70 dBC** when received at a **point of reception** in a **Quiet Zone**;
  - (ii) **55 dBA** or **70 dBC** when received at a **point of reception** in an **Intermediate Zone**;
  - (iii) **60 dBA** when received at a **point of reception** in an **Activity Zone**,  
or
- (b) during the **nighttime** exceeds:
  - (i) **45 dBA** or **65 dBC** when the prescribed **point of reception** is outdoors or **55 dBC** when the prescribed **point of reception** is indoors in a **Quiet Zone**;
  - (ii) **50 dBA** or **65 dBC** when received at a **point of reception** in an **Intermediate Zone**;
  - (iii) **60 dBA** when received at a **point of reception** in an **Activity Zone**.

### **2.2 Intermediate Zone Permitted Sound Levels**

2.2.1 In an **Intermediate Zone** a person must not make, cause or permit to be made or caused, any **sound** that has a **rating level** which:

- (a) during the **daytime** exceeds:
  - (i) **60 dBA** or **70 dBC** when received at a **point of reception** in a **Quiet Zone**;
  - (ii) **60 dBA** or **70 dBC** when received at a **point of reception** in an **Intermediate Zone**;

- (iii) 65 dBA when received at a **point of reception** in an **Activity Zone**,  
or
- (b) during the **nighttime** exceeds:
  - (i) 50 dBA or 65 dBC when received at a **point of reception** in a **Quiet Zone**;
  - (ii) 55 dBA or 65 dBC when the prescribed **point of reception** is outdoors or 55 dBC when the prescribed **point of reception** is indoors in an **Intermediate Zone**;
  - (iii) 65 dBA when received at a **point of reception** in an **Activity Zone**.

### 2.3 Activity Zone Permitted Sound levels

2.3.1 In an **Activity Zone** a person must not make, cause or permit to be made or caused, any **sound** that has a **rating level** which:

- (a) during the **daytime** exceeds:
  - (i) 60 dBA when received at a **point of reception** in a **Quiet Zone**;
  - (ii) 65 dBA when received at a **point of reception** in an **Intermediate Zone**;
  - (iii) 70 dBA when received at a **point of reception** in an **Activity Zone**,  
or
- (b) during the **nighttime** exceeds:
  - (i) 55 dBA when received at a **point of reception** in a **Quiet Zone**;
  - (ii) 60 dBA when received at a **point of reception** in an **Intermediate Zone**;
  - (iii) 70 dBA when received at a **point of reception** in an **Activity Zone**.

### 2.4 Summary of Permitted Sound Levels by Zone

2.4.1 For convenience, the **sound** level limits set out in sections 2.1 to 2.3 are summarized in the table in Schedule "B".

## 2.5 Assessment at Locations Affected by Residual Sound

2.5.1 Where the **total sound level** exceeds all of the prescribed **sound** limits identified in sections 2.1 to 2.3 and is influenced by the **residual sound** at the **point of reception**, such that the **specific sound** cannot be accurately measured, the **specific sound** should be measured at close distances and then predicted at the **point of reception** using an international calculation standard such as ISO 9613-2.

## 2.6 Role of Inspector

2.6.1 Any **inspector** may measure **sound** levels with an **approved sound meter**, and may enter at all reasonable times upon any real property, to determine compliance with the provisions of Part Two of this Bylaw.

## PART THREE: PROHIBITED TYPES OF NOISE

### 3.1 Noise Disturbing Neighbourhood

3.1.1 Where it is impractical to perform a **sound** level measurement according to Part Two of this Bylaw:

- (a) a person must not make or cause a **sound** in a street, park, plaza or similar public place which disturbs or tends to disturb the quiet, peace, rest, enjoyment, comfort or convenience of persons in the neighbourhood or vicinity;
- (b) a person who is the owner or occupier of, or is in possession or control of, real property must not make, suffer, or permit any other person to make, a **sound**, on that real property, which can be easily heard by a person not on the same **premises** and which disturbs or tends to disturb the quiet, peace, rest, enjoyment, comfort or convenience of persons in the neighbourhood or vicinity.

### 3.2 Prohibited Types of Noise

3.2.1 Without limiting the generality of section 3.1.1, the following conduct is specifically prohibited:

- (a) the **sound** made by a dog barking, howling or creating any kind of **sound** continually or sporadically or erratically for any period in excess of one-half hour of time;
- (b) the **sound** made by a combustion engine that is operated without using an effective exhaust muffling system in good working order whenever such engine is in operation;

- (c) the **sound** made by a **vehicle** or a **vehicle** with a trailer resulting in banging, clanking, squealing or other like **sounds** due to an improperly secured load or improperly secured equipment, or due to inadequate maintenance;
- (d) the **sound** made by a **vehicle** horn or other warning device used except under circumstances required or authorized by law;
- (e) the **sound** made by amplified music, whether pre-recorded or live, after 2:00 a.m. and before 8:00 a.m. on any day; and
- (f) **sound** produced by audio advertising which
  - (i) is directed at pedestrians or motorists on any street or sidewalk;  
or
  - (ii) can be heard on any street or sidewalk.

## **PART FOUR: EXEMPTIONS**

### **4.1 Specific Exemptions**

4.1.1 This Bylaw does not apply to **sound** made by:

- (a) a police, fire, ambulance or other emergency vehicle;
- (b) a horn or other signalling device on any **vehicle**, boat or train where such sounding is properly and necessarily used as a danger or warning signal;
- (c) the use, in a reasonable manner, of an apparatus or mechanism for the amplification of the human voice or music in a public park, public facility or square in connection with a public meeting, public celebration, athletic or sports event or other public gathering, if:
  - (i) that gathering is held under a City issued permit or license or similar agreement; or
  - (ii) that gathering has received prior approval under section 4.2.1;
- (d) bells, gongs or chimes by religious institutions, or the use of carillons, where such bells, gongs, chimes or carillons have been lawfully erected;
- (e) works and activities of, British Columbia School Board 38 (Richmond), its employees, agents and contractors;
- (f) a parade, procession, performance, concert, ceremony, event, gathering or meeting in or on a street or public space, provided that an exemption has been granted for the event;

- (g) outdoor athletic activity that takes place between 8 a.m. and 10:30 p.m.;
- (h) the use, in a reasonable manner, of the **premises** of a Community Care Facility duly licensed under the *Community Care and Assisted Living Act*, SBC, 2002, Chapter. 75, or from the use of a similar institution;
- (i) works and activities of the **City**, its employees, agents and contractors;
- (j) a garbage collection service:
  - (i) between 7:00 a.m. and 8:00 p.m. Monday through Saturday in all Zones; and
  - (ii) between 9:00 a.m. and 6:00 p.m. on a Sunday or holiday in all Zones;
- (k) despite the exemption in subsection (m) below, municipal works including, but not limited to, the construction and repair of streets, sewers lighting and other municipal services, whether carried out by, or on behalf of the City or the Greater Vancouver Regional District or any other public authority, but, unless the General Manager of Engineering and Public Works approves otherwise, does not include **construction** carried out under and agreement to install City works as described in section 940 of the *Local Government Act*;
- (l) **power equipment**, provided that the use of the **power equipment** takes place:
  - (i) between 7:00 a.m. and 8:00 p.m. Monday through Friday; or
  - (ii) between 8:00 a.m. and 6:00 p.m. on a Saturday, Sunday and holiday;
- (m) **construction**, provided that it has a rating level which does not exceed 85 dBA when measured at a distance of 15.2m (50 feet) from that source of sound, and only:
  - (i) between 7:00 a.m. and 7:00 p.m. Monday through Saturday; and
  - (ii) between 10:00 a.m. and 7:00 p.m. on a Sunday and holiday;
- (n) the nightly cleaning of streets and sidewalks and the collection of garbage from sidewalk refuse bins by or on behalf of the City;
- (o) public transit or aeronautics;
- (p) normal farm practices on a farm operation as defined by and protected by the Farm Practices Protection (Right to Farm) Act; and

- (q) an occupant of a strata unit or a rental unit where the **point of reception** is within the same building.

## **4.2 Exemptions by Approval**

- 4.2.1 A person may submit an application for an exemption from the provisions of this Bylaw to the General Manager of Engineering and Public Works or his or her designate.
- 4.2.2 A person who has been refused an exemption by a decision of the General Manager of Engineering and Public Works or his or her designate may apply to have Council reconsider that decision in accordance with the following procedures:
  - (a) the person may apply by notice to the City Clerk within 14 days of the decision;
  - (b) the person may address Council in writing or in person concerning the request for the exemption;
  - (c) the Council may allow or refuse the exemption.

## **PART FIVE: GENERAL**

### **5.1 Severability**

- 5.1.1 No provision of this Bylaw depends for its validity on the validity of any other provision

### **5.2 Repeal**

- 5.2.1 Part 3. of the Public Health Protection Bylaw No. 6989 (adopted June 12, 2000) is hereby repealed.

### **5.3 Offences and Penalties**

- 5.3.1 Any person who violates, or who causes or allows any of the provisions of this Bylaw to be violated is guilty of an offence and liable upon summary conviction to a penalty of not more than \$10,000 in addition to the costs of the prosecution, and each day that the violation is caused or allowed to continue constitutes a separate offence.

5.3.2 The minimum penalty for a contravention of a provision of this Bylaw is a fine of \$200.

FIRST READING

SECOND READING

THIRD READING

ADOPTED

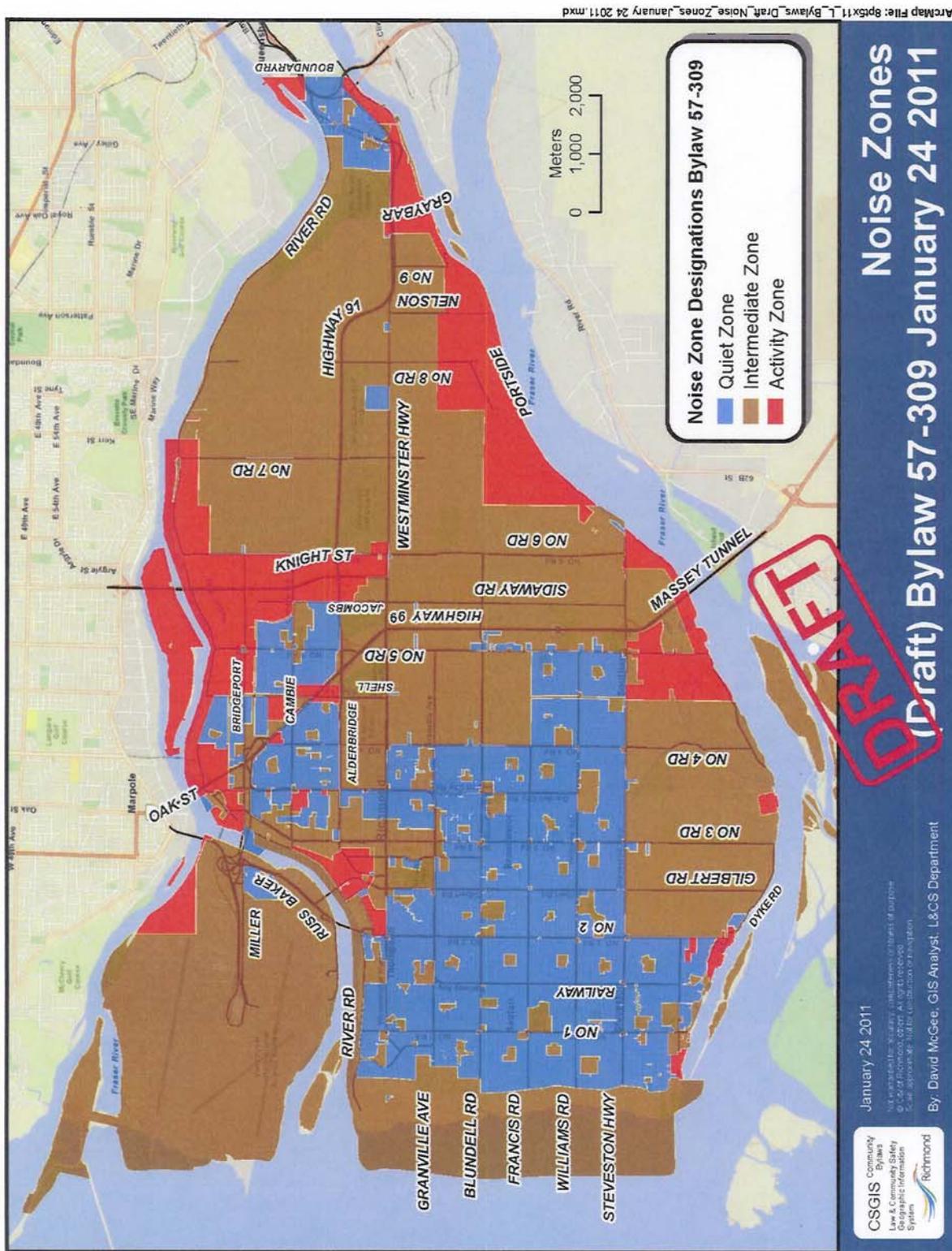
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MAYOR

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CITY CLERK

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| CITY OF RICHMOND                          |
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Schedule "A" – Noise Zone Map



ArchMap File: 8p15x11\_L\_Bylaws\_Draft\_Noise\_Zones\_January 24 2011.mxd

**Schedule B**

**Summary of Permitted Sound Levels by Zone**

|                          |                           | Sound Receiver Zone |   |                   |   |          |        |
|--------------------------|---------------------------|---------------------|---|-------------------|---|----------|--------|
|                          |                           | Quiet               |   | Intermediate      |   | Activity |        |
|                          |                           | Day                 | Night   | Day               | Night   | Day      | Night  |
| <b>Sound Source Zone</b> | <b>Quiet</b>              | 55 dBA,<br>70 dBC   | 45 dBA,<br>65 dBC<br>outside,<br>55 dBC<br>inside | 55 dBA,<br>70 dBC | 50 dBA,<br>65 dBC                                 | 60 dBA   | 60 dBA |
|                          | <b>Inter-<br/>mediate</b> | 60 dBA,<br>70 dBC   | 50 dBA,<br>65 dBC                                 | 60 dBA,<br>70 dBC | 55 dBA,<br>65 dBC<br>outside,<br>55 dBC<br>inside | 65 dBA   | 65 dBA |
|                          | <b>Activity</b>           | 60 dBA              | 55 dBA  | 65 dBA            | 60 dBA  | 70 dBA   | 70 dBA |

## NOISE REGULATION BYLAW OVERVIEW

Overview and explanation of the principal sections of the proposed bylaw is set-out below. Words in "bold" indicated definitions in the proposed bylaw

| SECTION   | CONCEPT  | EXPLANATION  |
|-----------|--|--|
| 1.1.2     | "Activity Zone"<br>"Intermediate Zone"<br>"Noise Zone Map"<br>"Quiet Zone" | Attached to the bylaw is a " <b>Noise Zone Map</b> ". The <b>Noise Zone Map</b> divides Richmond into the following three zones: <ol style="list-style-type: none"> <li>1. "<b>Activity Zone</b>:" predominantly industrial use. Greatest amount of <b>sound</b> is permitted.</li> <li>2. "<b>Intermediate Zone</b>": predominantly commercial use. Moderate amount of <b>sound</b> permitted.</li> <li>3. "<b>Quiet Zone</b>": predominantly residential use. Least amount of <b>sound</b> permitted.</li> </ol> |
| 1.1.2     | "dBA"  | Most commonly used measurement of sound – the sole measurement of sound in the current bylaw.  |
| 1.1.2     | "dBC"  | Measurement of sound more sensitive at lower decibels than <b>dBA</b> to low frequency / bass sound.   |
| 1.1.2     | "L <sub>eq</sub> "   | In measuring sound, replaces the concept of "continuous sound" and "non-continuous sound." in existing bylaw. Can be more easily and directly measured and most common metric used globally  |
| 1.1.2     | "Point of Reception"   | Subject to the criteria in the definition, the <b>inspector</b> determines the position within the property (usually outdoors) that best represents where the disturbance is received.   |
| Part Two: | Objective Criteria   | Part Two sets-out objectively (measured by an <b>approved sound meter</b> ) day and night sound maximums within each of the three zones and between the three zones. <b>Quiet Zones</b> and <b>Intermediate Zones</b> use both the <b>dBA</b> and <b>dBC</b> scales. <b>Activity Zones</b> do not include the dBC scale since these occupants are considered not to be low frequency/bass noise sensitive.   |
| 2.5.1     | High Residual Sound Levels   | This section is added to address the scenario in which the <b>residual sound</b> (for example the background sound from a highway or other constant source) results in a " <b>total sound level</b> " that exceeds the objective sound levels set-out in Part Two. The methodology described is to permit the <b>specific sound</b> to be calculated in this scenario.   |

## NOISE REGULATION BYLAW OVERVIEW

| SECTION           | CONCEPT                              | EXPLANATION  |
|-------------------|--------------------------------------|--|
| Part Three        | Subjective Criteria                  | Subjective criteria are included for scenarios in which it is impractical to take a <b>sound</b> measurement. Taking a sound measurement would be impractical if, for example, the responder to the complaint was a police officer (who typically would not have an <b>approved sound meter</b> ) or because of the type of disturbance (parties, loud exhaust on <b>vehicles</b> etc.). |
| Section 3.2.1     | Specific Types of Sound (Subjective) | This section is descriptive (and does not limit the general subjective section 3.1.1) of certain common types of noise or disturbing <b>sound</b> . Many of these identified disturbances (barking dogs, combustion engines etc.) are found in the existing bylaw.   |
| Section 4.1       | Exemptions                           | This section sets-out and describes the specific permitted exemptions to the objective <b>sound</b> limits in Part Two and the subjective noise prohibitions in Part Three.  |
| Section 4.1.1(e)  | "School Board"                       | This exemption exempts School Board works and activities.  |
| Section 4.1.1(g)  | "Outdoor Athletic"                   | This exemption exempts outdoor athletic activities conducted between 8:00 am and 10:30 pm.   |
| Section 4.1.1(i)  | the "City"                           | This exemption exempts the works and activities of the City, its employees, agents and contractors.  |
| Section 4.1.1(k). | "Municipal Works" Exemption          | This exemption permits the City and other public authorities to conduct municipal works without being caught by the bylaw – there are similar exemptions in the existing bylaw.  |
| Section 3.2.1(l)  | "Power Equipment" Exemption          | This exemption permits essentially lawn and garden equipment to be used within certain times periods. There is a similar exemption in the existing bylaw.  |
| Section 3.2.1(m)  | "Construction" Exemption             | This exemption permits <b>construction</b> provided that it is within certain <b>dba</b> limits and certain times of day and days of week. Construction in respect to municipal works is governed by the "City exemption" and "municipal exemption" and is therefore not limited by these time frames.   |
| Section 3.2.1(o)  | "Public Transit" Exemption           | This exemption exempts buses, Canada Line and other form of public transit from the proposed bylaw.  |
| Section 3.2.1(o)  | "Aeronautics" Exemption              | Aeronautics is a federal jurisdiction. There is a similar exemption in the current bylaw.  |
| Section 3.2.1(p)  | "Farm Operations" Exemption          | Limited to farm operations described in the <i>Farm Practices Protection Act</i> . There is a similar exemption in the current bylaw   |

## NOISE REGULATION BYLAW OVERVIEW

| <b>SECTION</b>   | <b>CONCEPT</b>                       | <b>EXPLANATION</b>  |
|------------------|--------------------------------------|---|
| Section 3.2.1(q) | "Strata Lot / Rental Unit" Exemption | Exemption places burden of regulating sound / noise within a strata corporation or rental building on the strata corporation or landlord, as the case may be  |
| Section 3.2.2    | Other Exemptions                     | This section permits a person to, for a specific activity (that would otherwise not be exempt), submit a request to the City's General Manager of Engineer and Public Works or his or her designate for an exemption from the bylaw. The current bylaw includes a similar section |
| Section 3.2.2.3  | Appeal to Council                    | If the GM refuses the request for an exemption, appeal is to Council  |
| Section 3.5      | Offences and Penalties               | Maximum fine (\$10,000) is same as existing bylaw. New minimum fine of \$200 included.  |



January 27, 2011

File: 3135-10A

City of Richmond  
6911 No. 3 Road  
Richmond, BC  
V6Y 2C1

Attention: Wayne Mercer, Manager, Community Bylaws - Law & Community Safety

Dear Mr. Mercer:

**Re: New Richmond Noise Regulation Bylaw**

Further to our submission of a new draft noise regulation bylaw, BKL Consultants Ltd., together with Don Howieson of Young, Anderson Barristers & Solicitors, have prepared the following rationale regarding the proposed changes.

Noise is unwanted sound. Since one person's noise is another person's music, the scope of a noise control bylaw cannot adequately assess all possible noise impact situations, nor does it need to. Noise complaints could be related to annoyance, activity interference or health effects such as sleep disturbance. All of these are relevant concerns that a noise control bylaw should address to the extent possible.

**General Overview of Changes in Assessment of Health Effects due to Noise since the Adoption of the Noise Regulations in Public Health Protection Bylaw 6989**

Throughout the past three decades, there have been numerous psycho-acoustic studies related to community annoyance and health effects of noise, primarily in the area of long-term transportation noise exposure such as road, rail and air traffic noise. Key guidelines and standards include the 1999 World Health Organization (WHO) Guidelines for Community Noise (WHO 1999) and the 2003 International Organization for Standardization (ISO) 1996-1 standard (ISO 2003).

Council has suggested that the noise control bylaw be revised to adopt guidance contained in the 2009 World Health Organization's (WHO) Night Noise Guidelines for Europe (WHO 2009). However, it is our opinion that this guide is more useful as a planning document and not for noise control because:

1. the studies cited in this guideline are also mostly related to long-term transportation noise exposure which is land use planning related and outside the jurisdiction of the noise control bylaw;
2. based on BKL's experience, in most disturbance cases, residual sound levels (i.e. sound levels in the absence of the specific sound source under investigation) in Richmond will exceed the WHO 2009 criteria due to road traffic, aircraft noise, etc., which means that the specific source will not be comparable with the criteria, and that an objective assessment will not be possible; and
3. from BKL's limited communications with UK acoustical consultants, it is their understanding that this new guideline has not been well received, and is therefore rarely used.

In other words, public health cannot be adequately addressed within the scope of a noise control bylaw.

One main difference between typical noise control bylaws and psycho-acoustic guidelines is that noise control bylaws tend to regulate noise taking into account adjacencies, i.e. they allow for more noise in the case of an industrial zone next to a residential zone, than two adjacent residential zones. If different types of adjacency were not taken into consideration, noise bylaw exceedances would result more frequently in the former case, which would reflect poorly on the City's land use planning department. This is usually not a City's desired effect.

The 1999 WHO Guidelines for Community Noise has achieved industry acceptance in many parts of the world. It contains guidelines for both daytime and nighttime noise. However, its primary purpose also relates to long-term transportation noise and land use planning.

### **General Overview of Changes in Measurement of Sound since the Adoption of the Noise Regulations in Public Health Protection Bylaw 6989**

The "continuous sound" metric in the current noise control bylaw, that is, the sound level exceeded for 3 minutes in a 15 minute period, cannot be measured directly by sound level meters and is therefore difficult to assess and defend. In practice, the operator must estimate the level, or must log sound levels and analyze them in the office to determine the level exceeded for 3 minutes in any 15 minute period. The equivalent continuous sound level, or  $L_{eq}$ , is the most common metric used around the world to assess human annoyance and health effects with noise and can be directly measured using an integrating sound level meter. The attached Appendix A illustrates the difference between these metrics.

It is well documented (ISO 2003, BSI 1997), that to best assess annoyance, adjustments to the  $L_{eq}$  are necessary to account for sound that is more annoying, such as tonal or impulsive sounds. Furthermore, sound at night is more annoying than daytime sound. Low frequency noise impacts, such as music bass noise impacts, are also being measured and assessed in various ways throughout the world. A different weighting scale, called the C-weighting, is often used as opposed to the generally used A-weighting scale so that low frequency noise becomes more prominent in the sound measurement. The attached Appendix A illustrates the difference between the A- and C-weighting functions.

In general, outdoor measurements are preferred even though the point of reception is often indoors (ISO 2007). Outdoor measurements are more precise, as long as measurements aren't performed too close to building facades and other sound reflecting surfaces, because an indoor measurement result can vary greatly depending on the position of the microphone within a room. However, indoor measurements must be used in situations of sound transmission within a building through a common wall or floor.

In the context of legal proceedings where objective sound measurements are introduced into evidence, instrumentation is one of the first items that is challenged when a case goes to court. Evidence of field and lab calibrations must be provided to meet potential instrumentation accuracy challenges.

### **Approaches Taken Locally**

Most noise control bylaws in British Columbia use purely subjective criteria in their prohibition sections. The criteria has been the subject of a number of a number of legal challenges in our courts, with the most common argument being that the provisions are vague and uncertain. In *Dhillon v. Municipality of Richmond and Attorney General of B.C.* (1987) 16 B.C.L.R. (2d) 80, 37 M.P.L.R. 243 (S.C.) Mr. Justice Oppal, as he then was, found that although there are were subjective elements in the prohibition sections of the City's bylaw at that time, the subjective elements caused no actual problems in interpretation and their infringement could be determined through consideration of the evidence in each case.

Subjective criteria do present problems for both the courts and the bylaw enforcement officer. It is often difficult to determine if the complainant is overly sensitive, having expectations with respect to noise levels that are perhaps unreasonable in a vibrant urban community. The introduction of objective criteria, setting standards that address the realities of the urban environment while at the same time respecting the health and lifestyle concerns of the community, have been introduced in communities that have access to the technology and educational opportunities to implement such criteria.

Most Lower Mainland municipal noise control bylaws that contain objective criteria, such as Vancouver and Burnaby's noise control bylaws, use the "continuous" and "non-continuous" sound level metrics that are in the current Richmond bylaw. However, these bylaws, like Richmond's, also contain subjective criteria.

The City of Vancouver has been heavily involved in the control of entertainment noise over the past ten years. Section 11 from the Vancouver Noise Control Bylaw No. 6555 contains numerous requirements relating to low frequency noise limits.

The City of Victoria revised their noise control bylaw from a "subjective criteria only" to an "objective criteria only" bylaw in 2004, and amended it in 2008 to reintroduce subjective criteria during nighttime hours for noise complaint situations where noise measurements were deemed impractical. It is the only recently revised noise control bylaw in the area and only bylaw using the  $L_{eq}$  as the noise measurement metric. It also includes penalties for tonality, impulsiveness and intermittency.

### **General Approach and Rationale When Drafting the New Richmond Bylaw**

The direction received from City staff was to revise the bylaw so that it would use objective criteria only where practical, to improve certainty for noise makers, the City and complaints and to reduce costs. The new bylaw was also to consider:

1. the use of appropriate current guideline references;
2. measurement precision, for example, clarity on point of reception location;
3. the assessment of the most common types of noise complaints, namely:
  - a. construction noise;
  - b. fixed mechanical equipment noise from e.g. roof-top units, heat pumps, etc.; and
  - c. human generated noise from parties, daycares, etc.;
4. the assessment of entertainment noise; and
5. whether to use subjective criteria;

while maintaining:

1. conciseness;
2. clarity of language for public interpretation;
3. clarity of interpretation of language for use in court of law; and
4. consideration of fairness and compatibility with existing noise makers such as those represented by the Richmond Business Advisory Committee.

After taking these considerations into account and reviewing the options, the new bylaw has used the City of Victoria's bylaw as a general template, with consideration of the previously referenced 1999 WHO Community Noise Guidelines, ISO 1996-1, ISO 1996-2 and British Standard BS 4142. In particular, the  $L_{eq}$  noise metric has been new instead of "continuous" and "non-continuous" sound levels to provide a critical improvement in measurement confidence. Penalties for tonality and impulsiveness have been included. In addition, provisions directed at entertainment related noise taken from the City of Vancouver's bylaw have been revised and added, based on our experience using the Vancouver bylaw with entertainment noise scenarios. The list of prohibited sound sources from the current City of Richmond bylaw has been retained.

Since the intent of the new bylaw is to assess the most common types of complaints, and not every type of complaint, some complexity and therefore confusing language for special cases can be avoided. However, because of this approach, it must be emphasized that the bylaw may not provide an appropriate assessment of special noise impact cases. Section 2.5 in the new bylaw adds flexibility to use sound predictions according to recognized standards such as ISO 9613-2 (ISO 1996) while still using the objective targets for cases where accurate measurements cannot be made but where the City doesn't want to use subjective criteria.

It is clear that objective criteria need to be specified. However, subjective criteria have also been included for cases where noise measurement may be impractical. For example, in order for police officers to respond to noise problems at parties or loud exhausts on vehicles or motorcycles without

taking noise measurements, they need subjective criteria to refer to in order to write a ticket citing the noise bylaw.

Areas of the City are divided into three "noise" zones, which depend on land use. Quiet zones are found in predominantly residential areas, Intermediate zones in commercial areas and Activity zones in industrial areas. The new bylaw levels agree with the 1999 WHO recommendations, but only for the case of Quiet zones adjacent to Quiet zone limits. Permitted noise is increased for cases where the City has permitted Intermediate or Activity zones next to Quiet zones or where the receiver is not in a Quiet zone.

Instrumentation requirements were updated to current International Electro-Technical Commission (IEC) standards (IEC 2002, IEC 2003) and field and lab calibration requirements were introduced.

Terms for specific sound (the sound of interest), residual sound (other sound) and total sound (specific plus residual sound) were introduced to provide distinctions between different types of measured sound, consistent with international standard terms.

It is difficult to define the necessary measurement duration in the context of a bylaw, since it depends on the variability of the source, the variability of the residual sound and the variability in sound propagation from the source to the receiver due to factors such as meteorological conditions. The new bylaw allows for judgement in this regard, with a guideline range of 1 to 30 minutes, with the intent that the chosen duration would have to be defended in a court of law.

Appendix B illustrates four example noise complaint scenarios and how they could be addressed using the new bylaw.

### **General and Specific Deficiencies and Problems with Current Noise Bylaw and Remedy in New Bylaw**

As discussed above, the City faces difficulties in using subjective criteria to address specific complaints. While many of these complaints are legitimate and the loss of enjoyment for and disturbance to the complainant may be very real, given the realities of life in a large urban communities and the limitations presented by land use regulation, some of these problems are inevitable.

The objective standards have been set having regard to these realities. The new draft bylaw makes it clear that the subjective criteria are only applicable where it is impractical to implement accurate noise measurements to determine if the objective standards have been contravened. It is hoped that the City will then be able to "weed out" the complaints that it simply has no ability to address. In these limited situations, where efforts at mitigation by the noise maker have failed and the application of the objective standard makes it virtually impossible for the City to pursue enforcement, it will be left to the complainant to pursue the matter as a common law nuisance.

In terms of enforcement of the objective criteria, as discussed above, the move to outdoor measurements and the use of the  $L_{eq}$  noise metric in place of "continuous" and "non-continuous" sound levels, should make enforcement easier and more accurate.

### **Real World Impact of New Bylaw**

In general, the new bylaw is not expected to increase the number of bylaw infractions compared to the current bylaw. In some cases the new bylaw will be stricter, but it will also replace some of the cases where the subjective criteria might establish an infraction due to personal sensitivity with an objective limit that is met. The example measurement in Appendix A shows how the current and new bylaw criteria would compare for one particular case.

### **Anticipated Cost Associated With New Bylaw**

Implementation of the new approach will require the purchase of new equipment by Vancouver Coastal Health in the form of sound level meters designed to take  $L_{eq}$  measurements using both dBA and dBC weightings. It will also require lab calibration of the equipment, training and documentation.

We estimate that the cost of each sound level meter will be approximately \$2,000.00 to \$3,000.00. Accessories, such as field calibrators, tripods and cases, could increase the cost of each sound level meter by up to \$1,000.00, mostly due to the cost of a field calibrator. There should be one field calibrator per sound level meter so that field calibration can be performed immediately before and after each measurement.

Lab calibration, to be conducted once every two years, could cost approximately \$500 for one sound level meter plus field calibrator.

The City of Victoria indicated that they spent \$4,500.00 on a two day training course for their bylaw officers in 2003 or 2004 and that they were thinking about having another training course in the near future. Ongoing training every few years and equipment upkeep will be additional costs. There are local acoustical consulting firms, such as ourselves, that offer training.

Another cost will be providing a reference manual that enforcement officers (EHO, Bylaws, RCMP) can refer to for guidance. This will help improve consistency in addressing different complaint cases and ensure that adequate documentation of each case is made. There are local acoustical consulting firms, such as ours, that could undertake this. However, we have not yet determined the cost of providing this manual.

We trust this letter provides the technical backing necessary to accompany the new bylaw.

Sincerely,

**BKL Consultants Ltd.**

per:



Mark Bliss, P.Eng.

Attachments:      Attachment 1 - References  
                         Attachment 2 - Explanation of Frequency Weightings and Sound Metrics  
                         Attachment 3 - Example Measurement Scenarios using the New Bylaw

## References

British Standards Institute (BSI). 1997. Method for Rating industrial noise affecting mixed use residential and industrial areas. Reference No. BS 4142:1997. London, British Standards Institute.

International Electrotechnical Commission (IEC). 2002. Electroacoustics - Sound level meters - Part 1: Specifications. Reference No. IEC 61672-1:2002. Geneva, International Electrotechnical Commission.

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International Organisation for Standardization (ISO). 1996. Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation. Reference No. ISO 9613-2:1996. Geneva, International Organisation for Standardization.

International Organization for Standardization (ISO). 2003. Acoustics - Description, measurement and assessment of environmental noise - Part 1: Basic quantities and assessment procedures. Reference No. ISO 1996-1:2003. Geneva, International Organization for Standardization.

International Organization for Standardization (ISO). 2007. Acoustics - Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels. Reference No. ISO 1996-2:2007. Geneva, International Organization for Standardization.

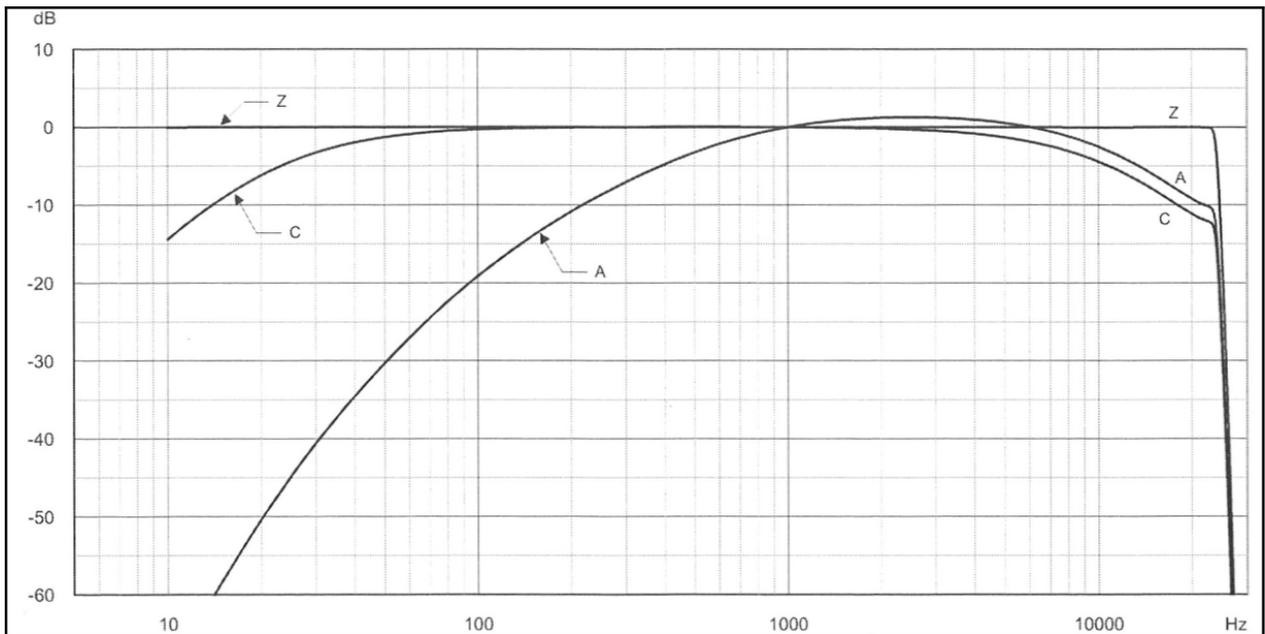
World Health Organisation (WHO). 1999. Guidelines for Community Noise. Geneva, World Health Organization.

World Health Organization (WHO). 2009. Night Noise Guidelines for Europe. Copenhagen, World Health Organization.

## Appendix A

### Explanation of Frequency Weightings and Sound Metrics

Frequency weightings are applied to sound pressure measurements to better reflect how humans subjectively respond to sound. The most common weighting used is the A-weighting. A-weighted sound levels are designated dBA. Another frequency weighting in common usage where low frequency sound, or bass sound, is known to be dominant is the C-weighting. C-weighting applies less of a penalty against low frequencies when compared to A-weighting. Figure 1 shows how no weighting (or Z-weighting), compares to the A- and C-weighting functions. There is a large difference in the attenuation applied in the low frequency range (200 Hz and below).

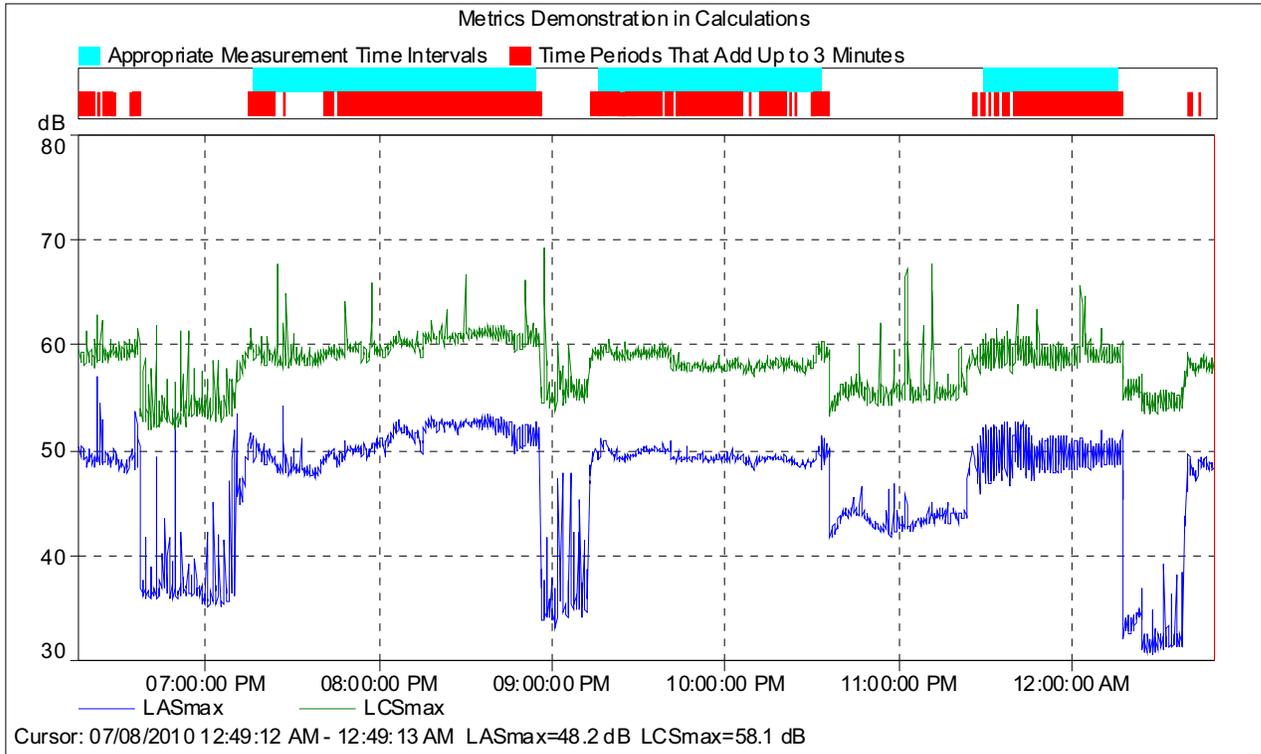


**Figure 1:** Frequency Weighting Functions

The continuous and non-continuous sound level metrics used in the current bylaw are different from the proposed dBA  $L_{eq}$  metric, even though all three use the A-weighting. If a measurement is made of a constant sound source, such as a fan, then the three metrics will be approximately equal. However, in more typical cases, the sound level fluctuates with respect to time due to variations in the sound source level and variations due to meteorological effects. The equivalent continuous sound level, or  $L_{eq}$ , is the steady sound level that would contain the same amount of energy as the actual time-varying level. Although it is an average, it is strongly influenced by the loudest events because they contain the majority of the energy.

Figure 2 shows an example of how the three metrics differ in a particular measurement situation. The C-weighted (green curve) level has been added to the A-weighted (blue curve) level to also show the difference between dBA and dBC in this example. In this 6.5 minute sound measurement, a piece of mechanical equipment was cycling on and off. According to the current bylaw, the continuous sound level over the whole period (the level exceeded for the loudest 3 minutes is shown by the red zones) was 49 dBA, and the non-continuous sound level over the whole period was 57 dBA. In the new bylaw, the proposed measurement time interval would be chosen to be 1 minute during one of the

"on" periods (the cyan zones). The  $L_{eq}$  over each of these three one minute "on" time intervals would be 51 dBA / 60 dBC for the 1<sup>st</sup> interval, 49 dBA / 58 dBC for the 2<sup>nd</sup> interval and 50 dBA / 59 dBC for the 3<sup>rd</sup> interval. If the three intervals are included together as three parts of one total measurement, the resulting  $L_{eq}$  would be 50 dBA / 59 dBC.



**Figure 2:** Example Measurement Time History

Since there is no particular low frequency concern with the fan noise, the dBC levels would not be used, but this provides an example comparison. Assuming that the sound source was located in a Quiet Zone and that the measurement was taken at a point of reception outdoors during the nighttime:

For the current bylaw:

- The sound would not meet the 45 dBA continuous limit in a Quiet Zone;
- The sound would meet the 60 dBA continuous limit outside a Quiet Zone;
- The sound would meet the 75 dBA non-continuous limit, and

For the new bylaw:

- The sound would not meet the 45 dBA limit in a Quiet Zone;
- The 1<sup>st</sup> interval would exceed the 50 dBA limit in an Intermediate Zone, but averaging subsequent intervals would increase confidence, providing a truer average of the noise in question, and in this case would result in meeting the limit;
- The sound would meet the 60 dBA limit in an Activity Zone; and
- The sound would meet the 65 dBC limit.

## Appendix B

### Example Measurement Scenarios using the New Bylaw

#### *Example 1: Daytime Construction Compressor Noise*

A compressor is cycling on and off on a construction site during daytime hours. The distance from the compressor to the property line is 6m. As per section 2.6, a sound measurement should be made at 15m to determine if the rating level meets or exceeds 85 dBA.

The chosen measurement time interval would be while the compressor is on. Since the sound level would be steady while the compressor is running, the duration of the measurement could be short, e.g. 1 minute. Since the compressor is clearly the dominant sound source, the measured total sound level can be assumed to equal the specific sound level. Since there is a clear tone while the compressor is on, a 5 dBA penalty should be applied.

The measured 1 minute  $L_{eq}$  is 67 dBA. The rating level is  $67 + 5 = 72$  dBA. Since this is below the 85 dBA limit, the compressor meets the prescribed bylaw limit.

#### *Example 2: Roof-Top Unit (RTU) Mechanical Noise*

Six RTU units sit on the roof of a 2 storey commercial building with a complainant in an adjacent condominium tower. The commercial property is in an Intermediate Zone and the residential property is in a Quiet Zone. During the daytime, nearby road traffic is the dominant sound source. However, during the nighttime, the traffic dies down and complaints have been submitted regarding nighttime disturbance. The prescribed sound limits, from section 2.2.1, are 60 dBA during the daytime and 50 dBA during the nighttime.

Since the sound is steady when the units are on, the measurement time interval only needs to be 1 minute. The point of reception should be on the complainant's balcony with the microphone 1m away from the building façade.

During the daytime, the 1 minute  $L_{eq}$  is typically 53 dBA or higher. However, at 11:00 pm the 1 minute  $L_{eq}$  is measured to be 49 dBA when the RTU's are on and 45 dBA when the RTU's are off. The specific sound can be estimated by logarithmically subtracting 45 dBA from 49 dBA to result in 48 dBA. Since there are no tones or impulses, the rating level would also be 48 dBA. Since the prescribed limit is 50 dBA, the noise from the RTU's do not exceed the bylaw limits.

#### *Example 3: Loud Party*

In this scenario, nearby residents are complaining about an excessively noise party. If an RCMP officer responded to the complaint and was unable to take a sound measurement, the officer could still issue a ticket citing the noise bylaw according to section 3.1.

*Example 4: Entertainment Noise*

Residents in a Quiet Zone are complaining about noise from a pub in an Intermediate Zone. The prescribed sound limits, from section 2.2.1, are 50 dBA or 65 dBC during the nighttime.

Upon visiting the site at night, the bylaw officer finds that the pub noise at the nearest point of reception cannot be measured. The pub sound varies, so a measurement time interval of 15 minutes is chosen, but the measured 15 minute  $L_{eq}$  of 58 dBA and 68 dBC included both road traffic noise and pub noise as dominant sources.

As per section 2.5, the City asks the pub to retain an acoustical consultant to predict the pub levels at the nearest points of reception. Measurements were then performed near the pub, on the ground and on its roof, during the daytime to calibrate a 3D computer noise model of the scenario in order to predict the pub sound level at the condominium building. In this case, the predicted pub sound level is 49 dBA and 67 dBC which is above the dBC limit.