Community Planning, Regulation and Mobility Committee – Public (September 18, 2023)
Objection Submission: Burlington Nelson (LeFarge) Quarry OP Amendment (PL-51-23)
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Flyrock is the Ultimate Adverse Effect and Most Dangerous and Deadly Consequence of Blasting Rock (Detonation of Explosives) and Can Never Be Mitigated

Flyrock is the dirty little secret of the Aggregate Industry and the explosives engineers acting on their behalf, and they have been remarkably successful in concealing the dangers of flyrock from the public!

- Of 219 flyrock incidents documented, 37 resulted in death from being struck by flyrock debris, reflecting a "kill" rate of 16.9% (37 ÷ 219), and 41 more people were injured in the same 37 flyrock incidents.

The act of blasting (detonation of explosives) to break rock is itself the cause of flyrock, but there are numerous factors that contribute to the generation of flyrock.

Concealing the dangers of flyrock from the public serves the financial interests of the Aggregate Industry at the expense of the environment and its inhabitants, both human and non-human. According to the Ontario Aggregate Resources Act (ARA), O. Reg. 244/97,[1] *flyrock* is not to be launched beyond the boundaries of a quarry site.

> *28. A licensee or permittee shall take all reasonable measures to prevent fly rock from leaving the site during blasting if a sensitive receptor is located within 500 metres of the boundary of the site.*

There are no provisions in the ARA as to how *flyrock debris* is to be prevented from leaving the boundaries of a site, and as to what "reasonable measures" the onsite blaster-in-charge is to take. Since the ARA does not define "flyrock" it remains a mystery as to what constitutes "reasonable measures," i.e., quantifiable measures to protect quarry personnel onsite and the general public offsite from the potentially deadly consequences of *flyrock debris.*

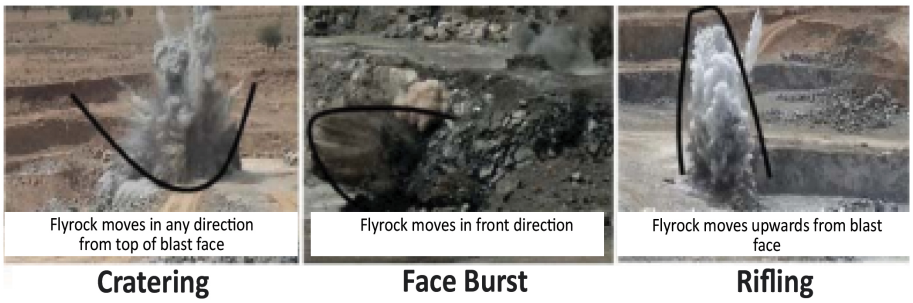
- Based on ARA's illusive premise, the blaster-in-charge is, in effect, given free rein to make up his/her own definition of flyrock and arbitrarily engage in any manner of blasting anywhere onsite within a reckless and inadequate excavation limit (i.e., onsite setback) of only 30 metres under the ARA, which is grossly inadequate from a land use

[1] https://www.ontario.ca/laws/regulation/970244

compatibility perspective, and puts the health, safety and welfare of the public at risk.

- The ARA does not pre-empt the City of Burlington from imposing permanent setbacks greater than 30 metres to prevent *flyrock debris*, *vibration*, *noise* and *toxic fumes* (all four of which are contaminants under the *Ontario* Environmental Protection Act (EPA)), from leaving the boundaries of an existing or proposed quarry site and endangering the health, safety and welfare of the residents living, working, studying and playing in the surrounding communities.
- The Ministry of Natural Resources (MNRF), the agency responsible for overseeing the ARA, has never undertaken an evidence-based quantitative study of *flyrock* incidents, even though *flyrock* is the most dangerous and deadly aspect of blasting rock.
- As to whether *flyrock debris* from blasting is launched offsite, in contravention of the ARA, depends entirely on the distance from the "blast site" to the boundaries of the quarry site.
- It is inconceivable that any provincial statute would permit a private for-profit corporation (i.e., blasting quarry operation) to install testing equipment to measure *noise* and *vibration* levels anywhere other than along the entire perimeter of its own property, as to do otherwise constitutes unlawful trespass.
- Nelson Aggregates' (LeFarge) blasting quarry operation is incapable of containing *noise* and *vibrations* onsite, which is a violation of City of Burlington Noise and Nuisance By-law No. 19-2003,[2] which, in part, states,

> No noise or vibrations shall be made, caused or created so as to be heard or felt or otherwise perceived outside the property and which are, in the view of all the circumstances including the nature of the neighbourhood and the use to which adjoining properties are put and the time of day during which such noise or vibrations are made, caused or created excessive or which are, or may cause a nuisance to the public generally or to others residing or carrying on a manufacture, trade or business in the vicinity. [Vibration levels along the entire perimeter of a blasting quarry site must be kept to a maximum of 2 mm/sec to prevent offsite damage to structures, monuments and unstable or vulnerable landscapes/shorelines, and to prevent anxiety, fear, discomfort and annoyance to humans living, working, studying and playing offsite.][3]



[2] https://www.burlington.ca/en/by-laws-and-animal-services/resources/By-laws/By-law-Search/019-2003-By-law.pdf

[3] "The ANZEC guidelines 1990 state that experience has shown that for almost all sites a ppv [Peak Particle Velocity] of 1mm/sec is generally achieved. It is recognized that it is not practicable to achieve a ppv of this level at all sites and hence a recommended maximum of 2mm/sec (ppv) be considered as the long-term regulatory goal for the control of ground vibration." https://earthresources.vic.gov.au/legislation-and-regulations/guidelines-and-codes-of-practice/ground-vibration-and-airblast-limits

As disclosed by LeFarge on its website,[4] with respect to the operation of the Seebe Quarry in Seebe, Alberta, Lafarge readily admits residents of any development within 500 metres of the Seebe Quarry would experience a number of adverse effects from blasting quarry operations, which effectively constitute nuisance and trespass, and a permanent loss in the value of third-party property. Lafarge expects neighbouring residents to run for cover whenever Lafarge decides to initiate blasting (i.e., detonation of explosives). Lafarge has no legal authority to force residents to evacuate when LeFarge decides to initiate a blast, nor does it have a legal right to prevent and sterilize the use and enjoyment of neighbouring third-party properties.[5] Blasting is an ultrahazardous activity and any damage caused to third-party personal or real property is held to strict liability regardless of whether blasting has been conducted within regulatory limits.

The sandstone and shale quarries are active and have approval to operate with industrial lighting 24 hours a day, seven days a week. Lafarge has no plans to close or reclaim these quarries in the short or medium term and expects to use the quarries beyond 2070 to support Lafarge's modernized, Exshaw Cement Plant.

This means that residents can expect:

- Noise and vibration [and flyrock][6] caused by regular blasting activity
- Noise from breaking material and equipment operations
- Up to 100 trucks a day leaving and then returning to the quarries each day
- Airborne dust from quarry operations.

Evacuation potential during blasting

Evacuation potential during blasting operation. For any blasting that takes place, Lafarge employs a 500m exclusion zone to the front of the blast and 200m zone to the side of the blast. Considering the location of this proposed development, there is the possibility that the area would have to be evacuated for safety during blasting. When evacuation is not required, residents can expect to feel vibration and airblast from the blasting due to the saturated nature of the ground surrounding the bow river.

Fig. 9. The damage to structure (50 cm flyrock fragment at 320 m distance).

[4] Yamnuska and SeeBe Quarries, Active Shale Quarries, Information for potential property owners, Lafarge Exshaw | 2019, https://lafargeexshaw.ca/yamnuska-and-seebe-quarries/ retrieved May 7, 2023.

[5] Sevelka, Tony. 2023. "Sterilization of Homeowners' Land and Loss of Property Value Occasioned by Aggregate Extraction in Ontario: A *De Facto* Taking Without Compensation". *Journal of Policy & Governance,* 03 no. 01: 1-22. https://doi.org/10.33002/jpg030101

[6] Flyrock is an inevitable by-product of blasting rock. According to the application (DP 15/22) for the residential development to which Lafarge objects, "blasting has the potential of launching debris [flyrock] and that is why there is an exclusion zone" and "nuisances are continuing…year-round [p. 13]," https://www.mdbighorn.ca/AgendaCenter/ViewFile/Minutes/_03162022-563. Retrieved September 9, 2022.

Since a Licence to permit aggregate extraction in Ontario has no expiry date and annual production figures for a particular aggregate site are not publicly available, it must be assumed that Nelson Aggregate's (LeFarge) blasting quarry operation will remain operational indefinitely, and that the adverse effects, as similarly defined in the EPA and 2020 Provincial Policy Statement, are permanent, impacting the environment and its inhabitants, human and non-human for 100 years plus, and disrupting long-term planning objectives.

Definition of Flyrock

In other jurisdictions in Canada and worldwide "flyrock" is defined in a number of ways, but the most complete and accurate definitions of "flyrock" are as follows:

> "Flyrock" means rock that is thrown through the air as a result of blasting [i.e., detonation of explosives]... If flyrock is uncontrolled the rocks, which can travel significant distances, pose a risk to persons involved with blasting as well as anyone else in the area of the blast. There is also the potential for damage to nearby property and equipment."[7]
>
> "Flyrock can be gravel, rocks, tree trunks, construction materials, mud – even water."[8]
>
> "Any blasting event in surface mines produces a sudden ejection of rock pieces, called flyrock, which may result in human injuries, fatalities and property damage."[9]

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[7] Nova Scotia, Canada, website: https://novascotia.ca/lae/healthandsafety/flyrock.asp. In Ontario, *flyrock* is an undefined term in the Aggregate Resources Act O. Reg. 244/97, s. 0.13 (1) 28, requires that *reasonable* (undefined) steps to prevent *flyrock* only if there are *sensitive receptors* within 500 metres of the boundary of the site (s. 0.13 (1) 28.

[8] Worker's Hazard Alert issued by the National Institute for Occupational Safety and Health (NIOSH), 2019.

[9] Jamei, M., Hasanipanah, M., Karbasi, M., Ahmadianfar, I. and Taherifar, S. "Prediction of flyrock induced by mine blasting using a novel kernel-based extreme learning machine," *Journal of Rock Mechanics and Geotechnical Engineering*, Vol. 13, Issue t, December 2021: 1438-1451. https://www.sciencedirect.com/science/article/pii/S1674775521001189.

Characteristics and Adverse Effects of Flyrock

- flyrock is uncontrollable and can never be eliminated
- flyrock throw calculations are unreliable and unscientific, and there is no proven and reliable method for predicting flyrock velocity and throw range (van der Walt, 2020,[10] and Szendrei, 2022[11])
- flyrock is a potential hazard throughout the anticipated life of a blasting quarry operation (assuming each blast has an average of 50 blast hole detonations, each detonation produces flyrock)
- flyrock can come at you from any direction. Flyrock can be thrown high like a fly ball, fly straight like a fastball, roll along the ground, or ricochet from any direction. Flyrock can be gravel, rocks, tree trunks, construction materials, mud—even water.
- flyrock comes in all shapes and sizes, and can be as small as marbles or as large as a car. Any size material (flyrock debris) is capable of damaging property or injuring, permanently disabling or killing people, pets, livestock and wildlife.
- flyrock debris can travel 6,000 feet (1,829 metres) or more, reach speeds of 400 miles per hour (644 kilometres per hour), and can penetrate buildings, smash vehicles, and cause great bodily harm or death. (Pits & Quarries, 1991 and Flyrock Hazard Alert, Virginia)
- flyrock has the potential to damage personal and real property onsite and offsite
- flyrock has the potential to disrupt and interfere with the use or enjoyment of public amenity space (parks, trails, bicycle paths) and private amenity space (front and year yards)
- flyrock has the potential to damage infrastructure (e.g., roads, bridges, power transmission lines/towers, telephone lines/cell towers, water towers, propane tanks)
- flyrock has the potential to damage tree stands and other crops
- flyrock is the ultimate adverse effect

Post COVID-19, the potential to be struck by flyrock from the detonation of explosives is expected to increase significantly, as more people are forced or choose to work from home or decide to establish home occupations or businesses.


5/8” thick steel construction

Quantitative Analysis of Flyrock Distances

A non-theoretical quantitative study of actual distances that flyrock has been launched from a blast site was undertaken by Sevelka (2021) 56 in May 2021, and included in that analysis are 92 incidents of flyrock. Since then, more incidents of flyrock have been documented, expanding the data set from 92 to 139 incidents of flyrock (August 2023).

[10] van der Walt, J., ’A critical analysis of recent research into the prediction of flyrock and related issues resulting from surface blasting activities’ (2020) 120 (12) J. S. Afr. Inst. Min. Metall. . <http://dx.doi.org/10.17159/2411-9717/1103/2020>.

[11] Szendrei, T. and Tose, S., ‘Flyrock in surface mining – Limitations of current predictive models and a better alternative through modelling the aerodynamics of flyrock trajectory’ (2022) 122 (12) J. S. Afr. Inst. Min. Metall, <http://dx.doi.org/10.17159/2411-9717/1873/2022>.

Where flyrock debris has been launched over a large area or in more than one direction, only the furthest distance of the flyrock from the blast site is recorded, summarized and arrayed in the following bar chart.

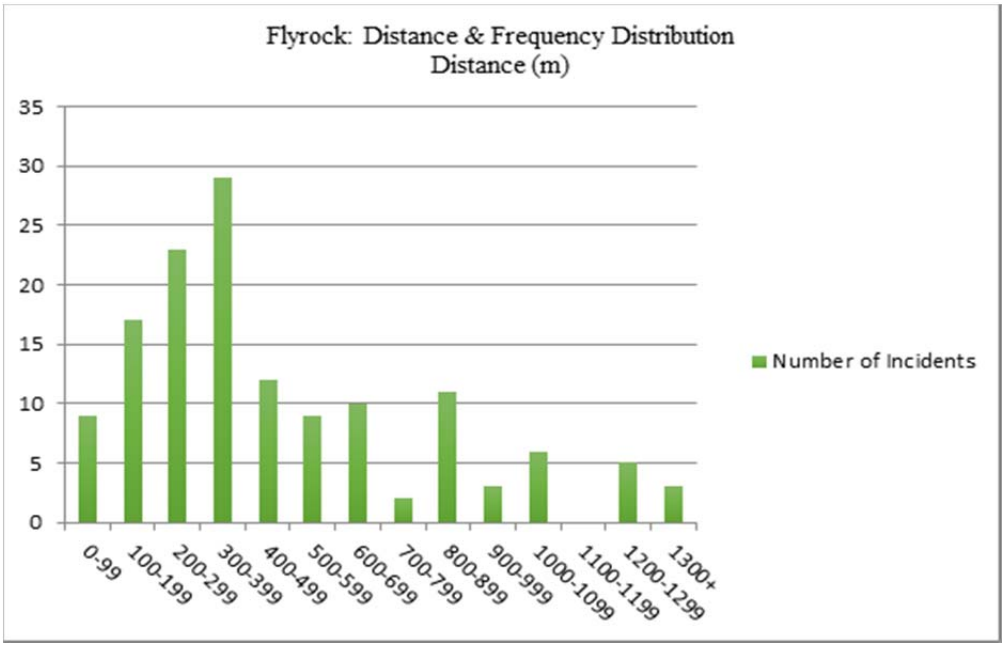

Figure 1: Analysis of Flyrock Travel Distances (May 2021; updated August 2023)

The number of flyrock incidents within each interval, starting at between 0-99 metres, and the average distance travelled within each interval are summarized as follows:

Metres	0-99	100-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999	1000-1099	1100-1199	1200-1299	1300+
Incidents	9	17	23	29	12	9	10	2	11	3	6	0	5	3
Cumulative	-	26	49	78	90	99	109	111	122	125	131	131	136	139
Average (m)	59	148	240	327	440	512	616	701	803	916	1015	-	1225	2307
% of Total	6%	12%	17%	21%	9%	6%	7%	1%	8%	2%	4%	0%	4%	2%
Cumulative %	-	19%	35%	56%	65%	71%	78%	80%	88%	90%	94%	94%	98%	100%

- At 90%, of the 139 flyrock incidents, 125 flyrock incidents in ascending order reached a distance up to the 900 – 999 metre interval, and, at 94%, which accounts for the first 131 flyrock incidents in ascending order, flyrock reached a distance up to the 1000 – 1099 metre interval.
- At 98%, of the 139 flyrock incidents, 136 flyrock incidents in ascending order reached a distance up to the 1200 – 1299 metre interval.
- On the basis of the this updated study of flyrock incidents (August 2023), the designated blast area (onsite safety zone) would have to be approximately 1,000 metres to effectively prevent 94% of flyrock incidents from leaving the boundaries of a blasting quarry site, equivalent to a 1,000-metre setback.

Evidence-based Rationale for Permanent Onsite Setbacks (Extraction Limits) Coupled with Permanent Offsite Separation Distances

The quantitative analysis of the travel distances of 139 flyrock incidents from a blast site presented in this paper provide municipalities and its Land Use Planners with an evidence-based rationale for avoiding land use conflicts, preserving property values, and avoiding the potentially deadly consequences of flyrock (and the other impacts associated with blasting quarry operations) by the enactment of permanent minimum onsite setbacks (extraction limits) combined with offsite permanent minimum separation distances from existing and future sensitive land uses or lands with development potential. The ultimate goal of good land use planning is to create complete, healthy, liveable and sustainable communities, which can only be achieved by preventing anticipated land use conflicts, now and in the future.

Listed below are examples of jurisdictions that have imposed mandatory setbacks, separation distances or buffers on proposed blasting quarry operations:

- 3,000 metres from a residential, commercial or industrial area (Nigeria)
- >1,000 metres from a residential or sensitive land use, boundary of a Settlement Area or Waterfront designation (Algonquin Highlands, Ontario, Canada)
- 1,000 metres minimum buffer distance from existing or proposed residential development where blasting is involved (Newfoundland and Labrador, Canada)
- 1,000 metres from the planned maximum extent of quarry operations to any sensitive use (Tasmania, Australia)
- one-half mile (805 metres) from any residential zone (Palm Springs, California)
- 800 metres separation between blasting and offsite structures (Nova Scotia, Canada)
- 600 metres minimum from residential, commercial and mixed-use (Quebec, Canada)
- 600 metres from any drinking water supply well (New Brunswick, Canada)
- 500 metres minimum separation distance from sensitive land use (Timmins, Ontario, Canada)
- 500-metre radius from blast site treated as onsite danger zone (Dangers due to blasting projectiles) (India)

Canadian Cases Referencing Flyrock

- *Castonguay Blasting Ltd. v. Ontario (Environment)*, 2013 SCC 52 (CanLII), [2013] 3 SCR 323, <https://canlii.ca/t/g1038>
- *Director of Occupational Health and Safety v. Government of Yukon, William R. Cratty and P.S. Sidhu Trucking Ltd.*, 2012 YKSC 47 (CanLII), <https://canlii.ca/t/fs6vt>
- *City Sand and Gravel Limited v. Newfoundland (Municipal and Provincial Affairs)*, 2007 NLCA 51 (CanLII), <https://canlii.ca/t/1sfnv>, (Leave to Appeal to Supreme Court of Canada denied)
- *Miller Paving Ltd. v McNab / Braeside (Township)*, 2015 CanLII 70369 (ON LPAT), <https://canlii.ca/t/glwwn>, (para. 55)
- *James v. Miller Group Inc*, 2013 ONSC 3266 (CanLII), <https://canlii.ca/t/g2f5j>
- *James v. Miller Group Inc.*, 2015 ONSC 3138 (CanLII), <https://canlii.ca/t/gj16p>
- *Dexter Construction Company Limited (Re)*, 2020 NSLB 41 (CanLII), <https://canlii.ca/t/j7xz3>
- *Parker Mountain Aggregates Limited*, 2007 CanLII 91661 (NS OHSAP), <https://canlii.ca/t/j7q8f>
- *R. v. Chenard*, 2005 ONCJ 501 (CanLII), <https://canlii.ca/t/1mfqs>
- *Ontario (Ministry of Labour and Ministry of the Environment) v. Sunrise Propane Energy Group Inc. et al.*, 2013 ONCJ 358 (CanLII), <https://canlii.ca/t/fzhvs>
- *MacMillan Bloedel (Alberni) Ltd. et al. v. British Columbia Hydro & Power Authority et al.*, 1972 CanLII 1042 (BC CA) <https://canlii.ca/t/gwgbw>
- *Roy Judge Co. Ltd. v. Norris et al.*, 1973 CanLII 1236 (NS CA), https://canlii.ca/t/gwgdr
- *WCAT-2009-01297 (Re)*, 2009 CanLII 36791 (BC WCAT), <https://canlii.ca/t/24kng>
- *Jeans v. Carl B. Potter Limited and Lester Archibald Drilling & Blasting Ltd.* 1976 CanLII 2506 (NS SC) <https://canlii.ca/t/jsk1g>
- *R. v. Austin Powder Ltd.*, ONCJ, 2014 (Charges under the Ontario *Environmental Protection Act* LSB File No. 11-8155) (Pakenham Quarry, Arnprior – 2009 unreported flyrock incident damaged a scale house and vehicles)

American Cases Referencing Flyrock

- *Lee Lime Corp. v. Massachusetts Turnpike Authority,* 337 Mass. 433 (1958) 149 N.E.2d 905, https://scholar.google.ca/scholar_case?case=8453729559483718978&q=%22quarry%22+and+%22fly+rock%22&hl=en&as_sdt=2006
- *Crushed Stone Co., Inc.. v. Moore*, 369 P. 2d 811 (1962), https://scholar.google.com/scholar_case?case=12758952683844784344&q=%E2%80%9Cquarry%E2%80%9D+and+%E2%80%9Cflying+rocks%E2%80%9D&hl=en&as_sdt=2006
- Dept. of Energy v. Hobet Min. & Const, . 358 S.E.2d 823 (1987), https://scholar.google.com/scholar_case?case=17148911866299365 66&q=flyrock&hl=en&as_s dt=2006
- Ramsburg v. Target Stores, Inc., 982 F. Supp. 1194 (1987), https://scholar.google.com/scholar_case?case=3137640203151959616&q=flyrock&hl=en&as_s dt=2006
- *Fantasy Valley Resort, Inc. v. Gaylord Fuel Corp.*, 92 Md. App. 267 (1992) 607 A. 2d 584, https://scholar.google.com/scholar_case?case=8781503776859543886&q=flyrock&hl=en&as_sdt=2006
- *Vulcan Materials Co. v. City of Tehuacana*, 369 F.3d 882 (2004), Court of Appeals, 5th Circuit, https://scholar.google.ca/scholar_case?case=13980108463387688348&q=%22quarry%22+and+%22fly+rock%22&hl=en&as_sdt=2006
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- *Amerikohl Mining, Inc. v. Fayette County Zoning Board*, PA Commonwealth Court 2012, https://scholar.google.com/scholar_case?case=4967608865363526286&q=flyrock&hl=en&as_sdt=2006
- *Cheryl Lloyd Humphrey Land v. Resco Prods.*, 858 S.E.2d 795 (2021) 377 N.C. 384, NCSC, https://scholar.google.ca/scholar_case?case=11533840335821535217&q=%22quarry%22+and+%22fly+rock%22&hl=en&as_sdt=2006

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