



2020

COMPLIANCE AUDIT REPORT

ENVIRONMENTAL MANAGEMENT ACT

Concrete and Concrete Products Industry



EXECUTIVE SUMMARY

In 2020, the Compliance and Environmental Enforcement Team of the B.C. Ministry of Environment and Climate Change Strategy (ENV) conducted a sector-wide compliance audit of concrete and concrete product facilities within the province of British Columbia. The concrete and concrete products industry was selected for audit as it is a prescribed industry under the *Environmental Management Act* Waste Discharge Regulation (WDR), and this industry had not previously been audited by ENV. In the concrete industry, 60 percent of authorized facilities are registered under the Code of Practice for the Concrete and Concrete Products Industry (Concrete CoP) to discharge effluent, air, and waste concrete from their facilities, and the remaining 40 percent of authorized facilities hold waste discharge permits which authorize the discharge of air, effluent, and refuse. These permitted facilities discharge under their active permits, as they were not required to switch over to the Concrete CoP when it was introduced in 2008.

The objectives of this audit were to:

- Determine overall compliance rates with the Concrete CoP requirements and concrete industry permit requirements.
- Obtain a snapshot of compliance within this industry for all relevant requirements, to evaluate any areas of risk to human health or the environment.
- Improve compliance within the sector through inspection and feedback to facility operators.
- Provide recommendations for improving future compliance for the Concrete industry, and recommendations for improving enforceability of environmental protection provisions in the Concrete CoP.

Inspections were conducted on a total of 83 facilities, with 18 inspections of waste discharge permits and 65 inspections of Concrete CoP registrations. ENV inspectors conducted on-site inspections and reviews of records on file for all authorizations.

Across all facilities inspected, 14% of facilities were fully compliant with their authorization. The audit resulted in the issuance of 10 notices of compliance, 51 advisories of non-compliance, 12 warnings of non-compliance, and one administrative monetary penalty referral (Figure 1). In addition, 9 inspection reports resulted in recommendations to cancel the corresponding authorizations as they were found to no longer be required.

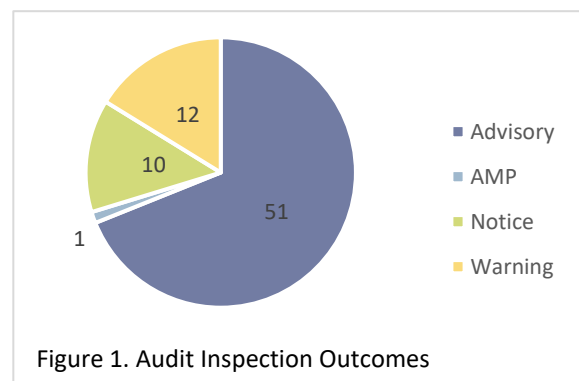


Figure 1. Audit Inspection Outcomes

The audit found that the areas with the highest levels of non-compliance were effluent discharge monitoring, operations and maintenance, record keeping, and reporting. These are all requirement types that involve collecting and recording data to inform on how the facility is functioning, and if discharges are within required limits. Despite a low overall compliance rate, across all inspections

conducted, non-compliances were determined to have, at most, a minor or temporary impact or threat to the environment or human health. This supports the notion that the industry generally poses a lower risk to the environment, human health, and safety.

In the future, compliance promotion from ENV, improvements in the enforceability of some authorization requirements, as well as better practices to review authorization requirements regularly by concrete facilities could help to improve compliance rates in this industry.

From the audit results, the Compliance and Environmental Enforcement Team is recommending that:

- Facility operators regularly review all Concrete CoP/permit requirements, ensure monitoring of discharges is conducted as required by the applicable authorizations, and that records are maintained as required.
- Facility operators ensure all required monitoring is conducted as described in the permit and in the B.C. Field Sampling Manual found here:
<https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>.
- Facility operators ensure authorized discharges are within permit/Concrete CoP requirements for discharge quality and quantity, and that timely notification of any incidents, emergencies, bypasses, process changes, and administrative details are provided to ENV as required.
- ENV consider making future amendments to the Concrete CoP when possible to:
 - Provide a clear and verifiable metric to determine if air discharges are harming the environment or causing pollution.
 - Provide a clear and verifiable metric to determine if effluent discharges to ground are causing pollution of the groundwater, or provide effluent quality limits that apply to ground discharges.
 - Allow for escalated enforcement on effluent quality related sections of the CoP in the Administrative Penalties Regulation (EMA).
 - Update the hydrocarbon testing procedure required in the Concrete CoP.
 - Improve clarity regarding which parameters must be sampled and analyzed for, and at what frequency, in section 8 (4)(f) of the CoP.
- ENV improve compliance promotion in the industry with increased communication. This is especially true for lower risk industry facilities where inspections may be less frequent.
- ENV continue to prioritize inspections for facilities that have not been inspected in a long time, or never inspected, as compliance rates were found to be low for facilities that had not been inspected in many years.
- ENV prioritize a follow up inspection for the audited facilities that received warnings or an Administrative Monetary Penalty.
- For facilities authorized under permits, ENV prioritize the sector for permit refresh to ensure implementation of updated enforceable clauses.

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LIST OF ABBREVIATIONS USED

Acronym	Definition
EMA	<i>Environmental Management Act</i>
ENV	B.C. Ministry of Environment and Climate Change Strategy
WDR	Waste Discharge Regulation
Concrete Audit	Concrete and Concrete Products Industry Audit
CoP	Code of Practice
Concrete CoP	Code of Practice for the Concrete and Concrete Products Industry
TSS	Total Suspended Solids
QP	Qualified Professional
TEH	total extractable hydrocarbons
BOD5	Biochemical oxygen demand
PM	Particulate matter
ND	Not Determined
NA	Not Applicable

INTRODUCTION

PURPOSE OF THIS REPORT

This report presents the findings of a sector-wide compliance audit conducted between June 5, 2020, and November 5, 2020 of concrete and concrete product facilities within the province of British Columbia (B.C.) to determine their level of compliance with the *Environmental Management Act* (EMA), administered by the Ministry of Environment and Climate Change Strategy (ENV).

The objectives of this audit were to:

- Complete inspections for 88 active concrete and concrete products authorizations, representing 43 percent of active industry authorizations.
- Determine overall compliance rates with the Code of Practice for the Concrete and Concrete Products Industry (Concrete CoP) requirements for 66 registered sites (53 percent of the active registrations)
- Determine overall compliance rates with permit requirements for 22 permitted sites (27 percent of the active industry permits)
- Determine if the Concrete CoP contains enforceable environmental protection provisions and clauses from a compliance perspective.
- Determine if current permits contain consistent enforceable environmental protection provisions (e.g. discharge limits, monitoring and reporting requirements) from a compliance perspective.
- Determine similarities and differences in the environmental protection provisions of the Concrete CoP and the industry permits.
- Improve compliance within the sector by identifying opportunities for compliance promotion initiatives.
- Provide internal recommendations to improve Concrete CoP and permit enforceability and environmental protection where applicable.

ABOUT THE INDUSTRY SECTOR

SELECTION

Industry sectors targeted by the ENV's annual audit program are selected based on their inclusion in the Waste Discharge Regulation (WDR), as well as existing policy and direction such as Environmental Protection Division's Inspection Policy and the 2020 B.C. Service Plan. The concrete and concrete products industry (hereafter referred to as the "concrete industry") was selected for audit because it is listed as a prescribed industry in WDR, and had a number of authorizations that had not been inspected in at least five years. Additionally, it is beneficial to inspect industries as a whole over a short period of time to ensure fairness for the businesses and inform the industry as a whole on improvements that could be made to achieve compliance.

DESCRIPTION

Concrete is the second most consumed material in the world after water, and is used twice as much as all other construction materials combined.¹ With its wide variety of uses, from skyscrapers and bridges to pipes and pavement, the concrete industry is important to the growth and maintenance of infrastructure in B.C. In Canada, the concrete industry generated approximately 7 billion dollars in sales in 2020², even with construction projects slowed due to the pandemic.

Concrete is made by combining coarse and fine aggregates, cement, and water.

Different types of concrete can be made by varying the ratios of the four ingredients.

Admixtures are also sometimes added to the concrete to modify specific properties of the material.³ Aggregates consist of

mostly sand, gravel, and crushed stone, and sometimes recycled materials like demolition waste. The most common cement used for concrete is Portland cement, which reacts with water to

become adhesive, holding the concrete

together.⁴ The main chemical components of cement are calcium, silicon, aluminum, and iron, and the most common materials used to make the cement are limestone, shale, clay, aluminosilicate minerals, and iron ore.⁵



Photo of aggregate piles at a concrete facility.

As of April 2020, there were 204 active authorized facilities in the concrete industry in B.C. Of those authorizations, 123 were registrations under the Concrete CoP. The remaining 81 authorizations were waste discharge permits for the discharge of waste as follows:

- 35 permits for the discharge of effluent;
- 41 for the discharge of air;
- 2 for the discharge of refuse; and,
- 3 of the permits authorized the discharge of both air and effluent under one authorization.

¹ Gagg C.R. (2014) Cement and Concrete as an Engineering Material: An Historic Appraisal and Case Study Analysis. *Engineering Failure Analysis*, volume 40, pages 114-140.

² Statistics Canada. Table 16-10-0047-01 Manufacturers' sales, inventories, orders and inventory to sales ratios, by industry (dollars unless otherwise noted) (x 1,000). Available here: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610004701&pickMembers%5B0%5D=4.185&cubeTimeFrame.startMonth=01&cubeTimeFrame.startYear=2020&cubeTimeFrame.endMonth=12&cubeTimeFrame.endYear=2020&referencePeriods=20200101%2C20201201>

³ National Highway Institute. Portland Cement Concrete Materials. Available here: <https://www.fhwa.dot.gov/pavement/pubs/013683.pdf>

⁴ U.S. Environmental Protection Agency (2006) Emission Factor Documentation for AP-42 Section 11.12 Concrete Batching. Available here: https://www.epa.gov/sites/production/files/2020-10/documents/b11s12_0.pdf

⁵ Biernacki, J.J., Bullard, J.W., Gaurav Sant, G., Brown, K., Glasser, F.P., Jones, S., Ley, T., Livingston, R., Nicoleau, L., Olek, J., Sanchez, F., Shahsavari, R., Stutzman, P.E., Sobolev, K., Prater, T. (2017). Cements in the 21st century: Challenges, perspectives, and opportunities. *Journal of the American Ceramic Society*, 100, 2746–2773.

REGULATORY OVERSIGHT

The EMA and the WDR are the principal pieces of legislation that protect soil, air and water quality in B.C. Under this legislation, the introduction of waste into the environment from identified “prescribed” industries, trades, businesses, operations, and activities requires authorization from ENV.

The Concrete and Concrete Products Industry is a prescribed activity/operation listed under Schedule 2 of the WDR and included in section 6 (2) of EMA. Therefore, concrete facilities require an authorization to discharge waste into the environment.

The concrete industry as defined under WDR means:

“establishments, except home-based businesses, educational facilities and establishments of hobbyists or artisans, engaged in manufacturing ready-mix concrete or concrete products;”

Examples include operations that:

- use Portland cement powder either in bags or bulk mixed with water, sand, gravel and other additives to produce a concrete slurry in truck-load batches
- manufacture solid concrete products such as concrete blocks, septic tanks, and pre-cast concrete products such as concrete pipe and pre-stressed beams

Examples do not include artisans, home-based businesses, educational facilities and hobbyists.

Home-based business, educational facilities, hobbyists, or artisans are defined in the Waste Discharge Regulation Implementation Guide (Version Date: September 10, 2007) as follows:

Artisan	a trained or skilled person who creates an object or performs a task that has aesthetic value and who, generally in a small business, produces arts and crafts for retail or wholesale trade
Home-based Business	a small business that operates from a (residential) home base including a family farm
Hobbyist	a person who conducts a pursuit outside of their regular occupation for recreation without expectation of commercial benefit
Educational Facility	a facility where teachers provide academic or practical education to students

REGULATORY INSTRUMENTS

Concrete facilities are authorized to discharge to the environment either under the Concrete CoP or via site specific permits.

Under section 14 of EMA, ENV can issue permits authorizing the introduction of waste into the environment subject to requirements for the protection of the environment that the ENV considers advisable. These permits have site specific requirements with respect to discharges (including limits on

quantity and quality, and treatment works), operations, monitoring, and reporting. Air, effluent, and refuse discharge permits were used for the concrete industry prior to the introduction of the Concrete CoP, which came into effect on March 1, 2008. Many of these permitted facilities are still in operation and discharge under their active permits as ENV did not require authorized facilities to switch over when the Concrete CoP was introduced.

Most facilities authorized after March 1, 2008, are registered under the Concrete CoP, and if permitted facilities require a major permit amendment they are often moved to the CoP as well. To view the Concrete CoP in full visit this page:

https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/329_2007

POTENTIAL ENVIRONMENTAL ISSUES AND KEY METHODS OF POLLUTION CONTROL

Concrete facilities create waste in the forms of effluent, air, and refuse. Each of these discharge types have their own concerns with regards to the environment, human health and safety, as well as their own pollution control methods.



Photo of silo with air pollution control works on top (baghouse filter)

Air

Particulate matter (PM) emissions are the primary air discharge of concern from concrete operations. PM from concrete facilities can be cement and pozzolan dust as well as aggregate, sand, and metals dust emissions.⁶ The PM emission sources at concrete facilities are typically split into fugitive dust emissions and point source emissions.

Fugitive dust at concrete facilities can occur from the transportation of aggregate, the loading of ready-mix trucks, the loading of on-site mixers, wind erosion from sand and aggregate storage piles, and vehicle traffic. Dust issues from traffic will be exacerbated if the facility is unpaved and/or roads leading to the facility are unpaved. Controls for fugitive dust may include spraying water on aggregate piles, keeping facility equipment clean and free of dust, growing vegetation around the facility, using enclosures, hoods, curtains, shrouds, movable and telescoping chutes, and central duct collection systems in areas where mixing, loading and transportation occurs.

Wetting road surfaces and using chemical dust suppressants are also methods used to control fugitive dust.

⁶ U.S. Environmental Protection Agency (2006) Emission Factor Documentation for AP-42 Section 11.12 Concrete Batching. Available here: https://www.epa.gov/sites/production/files/2020-10/documents/b11s12_0.pdf

The most common point source of emissions from concrete facilities occurs when cement and other concrete additives are loaded into silos. The silos must vent air when they are filled and if no pollution control is in place this would discharge cement powder or other additives to the air.⁶ The Concrete CoP requires that all silos have particulate control systems to control and suppress emissions. The most common systems used are baghouses, which are fabric filters that silo emissions are vented through before discharge to the environment.

Another point source of PM emissions comes from concrete processing equipment like sanders or etchers. Some facilities in the concrete industry make products that require altering after the concrete has hardened. These alteration processes create dust which must be managed. Pollution control works vary depending on the equipment and setup, however often a combination of dust collectors and enclosures are used.

There are environmental and human health protection concerns associated with PM emissions from concrete facilities. PM exposure has been linked to a number of health problems such as asthma, lung disease, heart disease, decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.⁷ Cement is a fine powder with a grain size generally ranging from 7 to 200 μm ⁸, and it has been found that the finer particles can be inhaled deeper into the respiratory system, increasing the risk of lung and cardiovascular diseases. PM from concrete facilities can also cause harm to the environment by entering aquatic and marine habitats and increasing suspended solids concentration in the water. Additionally, cement is very basic, with a pH of 12.5 which is caustic and can cause burns to skin.⁹ Cement dust pollution is known to cause alkalization of the ecosystems. Studies have found that soil properties can be affected by cement dust emissions. In one study, soil pH was found to increase significantly with sampling proximity to a cement plant.¹⁰

Refuse

Solid waste from concrete facilities is mainly waste concrete and sludge from any on-site ponds or effluent treatment systems. Although fresh concrete has a high pH, as the concrete hardens, the pH decreases and becoming almost neutral over time¹¹. The Concrete CoP requires that establishments must not dispose of their waste concrete in a manner that causes pollution. As waste concrete can be used to make blocks or recycled, there should not be a large amount of waste concrete discharged to the environment from concrete manufacturing. When waste concrete or sludge is disposed of as refuse, it is often sent to quarries, other larger concrete facilities, or to waste management companies.

⁷ Health and Environmental Effects of Particulate Matter (PM) Available here: <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm#:~:text=Health%20Effects&text=Numerous%20scientific%20studies%20have%20linked,irregular%20heartbeats>

⁸ Zhang, H. (2011) *Building Materials in Civil Engineering*. Woodhead Publishing.

⁹ Carl M. (2005) Wet Concrete, wet cement. *Pit & Quarry*, 48.

¹⁰ Bilen, S., Bilen, M., Turan, V. (2019) Relationships between Cement Dust Emissions and Soil Properties. *Polish Journal of Environmental Studies*, 28(5), 3089-3098. DOI: 10.15244/pjoes/92521

¹¹ Müllera, B., Grenggb, C., Schallerta, V., Sakoparnigc, M., Staudingera, C., Breiningera, J., Mittermayrc, F., Ungerböcka, B., Borisova, S.M., Dietzelb, M., and Mayr, T. (2018) Wide-Range Optical pH Imaging of Cementitious Materials Exposed to Chemically Corrosive Environments. *RILEM Technical Letters* 3, 39-45. DOI: <http://dx.doi.org/10.21809/rilemtechlett.2018.72>.

Effluent

Effluent from concrete facilities is divided into the two categories in the Concrete CoP which provides the following definitions:

Process water means, in relation to an establishment, any water-based discharge produced in the course of manufacturing concrete products or ready-mix concrete at establishment premises, including such discharge resulting from the use of water in (a) dust suppression at establishment premises, or (b) cleaning establishment premises or any vehicle or other facility of the establishment, but does not include domestic sewage, as defined in the Sewerage System Regulation

Establishment runoff means runoff, whether from rainfall, snow or snowmelt, at or from establishment premises.



Photo of effluent settling pond at concrete facility

There are both environmental and human health protection concerns associated with effluent discharges from concrete operations. The main contaminants of concern for concrete effluent listed in the Concrete CoP are pH, total suspended solids (TSS), and hydrocarbons. Monitoring of Biochemical oxygen demand (BOD5) was also required in some concrete effluent permits. Toxicity of effluent is a concern for this industry as pH, TSS, and oil and grease are known toxic stressors for aquatic and marine habitats.¹² There is also potential for groundwater contamination from high pH effluent discharges. The contamination of drinking water supplies may have an impact on human health or food sources.



Photo of infiltration pond at concrete facility

Pollution control methods for effluent include settling ponds, infiltration basins, screens and filters, sand/grit separators, pH treatment works such as Carbon Dioxide injection or hydrochloric acid injection, and oil/water separators. Many concrete facilities also have reclaiming systems in place to treat their effluent so that it could be recycled into the concrete making process and thus not discharged to the environment.

¹² Nguyen, N.T.T., Marteen Sevando, M. (2019) Assessing Coastal Water Quality through an Overall Index. *Polish Journal of Environmental Studies*, 28(4), 2321-2330. DOI: 10.15244/pjoes/90836

METHODS

INSPECTIONS

DESCRIPTION OF THE AUDITED PREMISES

As of May 2020, there were 204 active authorizations in the concrete industry in B.C. This project aimed to audit facilities operating in the industry with an active authorization that had not been inspected in the past four years, or facilities which had received a Warning or referral for Administrative Monetary Penalty in the last year. As per this objective, the audit targeted 43 percent of active authorized concrete and concrete product facilities in the province (88 out of 204 authorizations). The target included an audit of 27 percent of the active industry permits (22 out of 81 permits) and 53 percent of the active registrations under the Concrete CoP (66 out of 123 registrations).

Due to some travel restrictions related to the COVID-19 pandemic, only 83 of the 88 planned inspections were conducted. For the full list of concrete authorizations included in this audit, their inspection record numbers, and their locations, see Appendix 1.

OFFICE REVIEW / DESKTOP INSPECTIONS

ENV reviewed office records required for each facility that was inspected in the Concrete Audit. The office reviews included authorization information within ENV's Authorization Management System (AMS) database and any other documents, reports, or data submissions required under their authorizations between January 2018 and the date of inspection in 2020. The office review also may have included direct communication with the authorization holder to ask questions as needed to gather additional information necessary to complete the inspection.

ON-SITE INSPECTIONS



Photo of silos and air pollution control works taken during on-site inspection

ENV conducted on-site inspections on all facilities inspected in the Concrete Audit. During each on-site inspection, ENV conducted a walkthrough of the site to verify facility and operational details and review monitoring records and maintenance logs. Site personnel were questioned on site history and operation details as necessary in order to verify permit or CoP compliance. Photographs of the authorized works and discharges were taken as necessary.

COMPLIANCE DETERMINATIONS AND RESPONSES

Inspections consisted of evaluating whether the authorization holder was compliant, on a clause-by-clause basis, with their discharge permit, or Concrete CoP registration. Compliance findings for each section were one of four outcomes:

In	ENV determined that the authorization holder is in compliance with the regulatory requirement at the time of the inspection
Out	ENV determined that the authorization holder is out of compliance with the regulatory requirement at the time of the inspection
Not determined	There was not enough information for ENV to determine whether the authorization holder is in compliance with the regulatory requirement at the time of the inspection
Not applicable	Compliance with the regulatory requirement did not apply to the authorization holder at the time of the inspection

ENV determined the appropriate administrative response based on the compliance verification findings of the inspection using the non-compliance decision matrix contained in ENV's Compliance and Enforcement Policy and Procedure¹³ (see Appendix 2). This matrix uses the levels of impact on environmental or human health or safety, and the categories of the likelihood of compliance to determine available enforcement responses. Levels range from a 1 where non-compliances are unlikely to have an impact or where minor administrative non-compliances are observed to a 5 where non-compliances have a severe impact on the environment or human health. Categories range from "A" for a high likelihood of ongoing compliance to "E" for obstruction of a ministry official or refusing to provide

¹³ B.C. Ministry of Environment and Climate Change Strategy. May 2014. Compliance and Enforcement Policy and Procedure, Version 3. Accessed at <https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/reporting/reporting-documents/environmental-enforcement-docs/ce_policy_and_procedure_2018.pdf>.

required information. Both the level and category determine which administrative response will be issued as a result of the inspection. A detailed description of some common administrative responses is included below:

Notice	A notice of compliance is a written confirmation that ENV determined that the authorization holder is in compliance with all of the regulatory requirements evaluated at the time of the inspection
Advisory	An advisory notifies the non-compliant party in writing that they are not in compliance with a specific regulatory requirement and often recommends a course of action that is expected to achieve compliance. An advisory is often the first enforcement response taken in cases of minor to moderate non-compliance when there is a high likelihood of achieving compliance.
Warning	Similar to an advisory, a warning notifies the non-compliant party in writing that they are not in compliance with a specific regulatory requirement; however, the warning differs from an advisory in that it warns of the possibility of an escalating response should non-compliance continue. Warnings are generally used when it is determined that an exchange of information alone would not be sufficient in achieving compliance.
Administrative Monetary Penalty	An administrative monetary penalty is a financial penalty up to \$40,000 imposed by a ministry Statutory Decision Maker on a non-compliant party in accordance with legislation.

The response of a notice of compliance is only issued if none of the assessed sections are found to be out of compliance. If a single non-compliance was found during an inspection, the minimum compliance response is an advisory, regardless of how many sections were compliant or how minor the non-compliance.

All administrative responses to non-compliances serve as a formal record of the alleged non-compliance and form an important element of the compliance history of the party in question. Other responses such as orders, administrative sanctions, etc., within ENV's enforcement toolkit can be found in ENV's Compliance and Enforcement Policy and Procedure.

The results of each inspection, along with the administrative responses, were summarized in an inspection record, a copy of which was provided to the authorization holder.

DATA ANALYSIS

ENV compiled the results of the 83 inspections for the concrete facilities included in the Concrete Audit to determine overall compliance rates. In addition, for facilities authorized under the CoP, compliance findings for each Concrete CoP clause were tallied and aggregated to obtain data on sector performance in different clause categories such as compliance with discharge quantity and quality requirements, compliance with maintaining authorized works, etc. A similar analysis was conducted for permitted facilities.

The tallied clause category data was then further analysed to answer the following question: What percent of facilities were in compliance with each category of requirement? In this analysis each facility

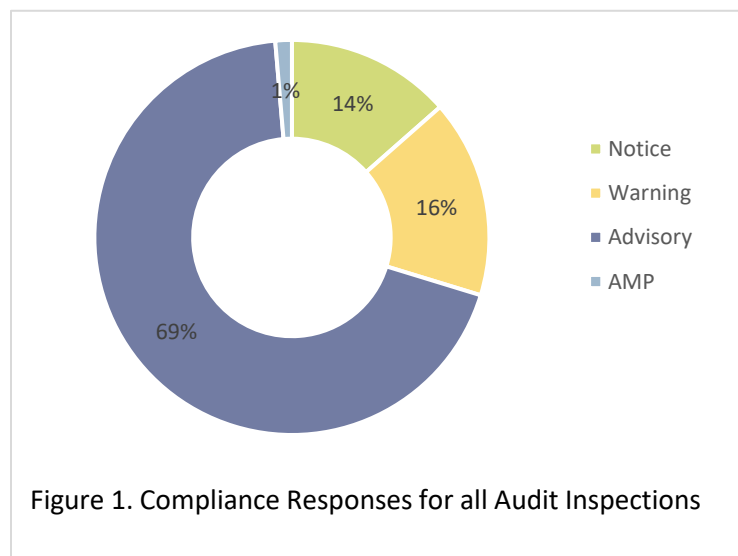
was given equal weight when tallying sector performance results for a compliance category; therefore, if more than one clause evaluation for a compliance category was conducted for a facility, the weights given to each of those facility's multiple evaluations summed up to one for that compliance category. This is to ensure that the sector performance is reflective of all facilities and not disproportionately impacted by facilities with multiple requirements.

RESULTS

INSPECTION OUTCOMES – ALL AUTHORIZATIONS

The audit resulted in 83 inspection records, with 18 inspections of waste discharge permits and 65 inspections of Concrete CoP registrations. Nine of the total 83 inspections were cancellation recommendations due to facility closure, change in ownership, or facilities being double authorized under both a permit and the Concrete CoP. These cancellation recommendations were issued as eight Notices and one Advisory, and as these inspections did not include compliance verification with the full authorization, they were removed from the results below, unless specifically mentioned.

Two of the inspections were for unauthorized discharges, as the two facilities had undergone changes in ownership without applying for the required change in registration under the Concrete CoP. Both inspections resulted in Warnings being issued.



14 percent of inspection reports issued determined that the facilities were in compliance with their authorizations and notices of compliance were issued. 86 percent of inspections determined that there was at least one non-compliance, resulting in an outcome of Advisory, Warning, or Administrative Monetary Penalty (AMP; Figure 1).

The Advisories were issued as a result of non-compliances that were either administrative deficiencies or other deficiencies considered to pose, at most,

minor temporary impacts to environment, human health, or safety. These corresponded to an impact rating of either a Level 1 or 2 on ENV's Compliance Decision Matrix (See Appendix 2). These inspections determined that the likelihood of future compliance was at a Category A or B, meaning facilities had a history of few or no past non-compliances, good or questionable awareness of and/or capacity to meet regulatory requirements, and, for a Category A, a reasonable and cooperative attitude.

The Warnings were also all issued for non-compliances assessed at a Level 1 or 2 on the non-compliance decision matrix, however some facilities were found to have a lower likelihood of compliance at a

Category C. Category C indicates that facilities had numerous past non-compliances and/or little or no awareness of and/or capacity to meet regulatory requirements.

The audit resulted in the issuance of one AMP. This facility was assessed as a Level 1, Category C on the non-compliance decision matrix. This facility had a compliance history of receiving two warnings in 2016, an AMP in 2017, and then a warning in 2019. The inspection conducted during the audit determined that facility to be out of compliance with effluent monitoring and record keeping requirements, and the issuance of the AMP follows ENV's policy of escalating enforcement action for repeated non-compliance. A tally of all compliance outcomes by authorization type (i.e. permit vs. CoP) is presented in Table 1.

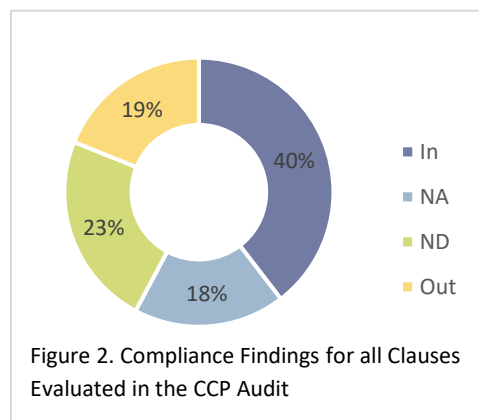
Table 1. Tally of Compliance Outcomes for Audit Inspections separated by authorization type (i.e. Permit vs. CoP)

Compliance Responses	Number of Responses Issued for Inspections Against Concrete CoP	Percentage of Responses Issued for Inspections Against Concrete CoP	Number of Responses Issued for Inspections Against Permits	Percentage of Responses Issued for Inspections Against Permits	Total	Percentage of Total
Notice	6	9%	4	22%	10	12%
Advisory	47	72%	4	22%	51	61%
Warnings	9	14%	3	17%	12	14%
AMP	1	2%	0	0%	1	1%
Cancelation	2	3%	7	39%	9	11%
Recommendation						
Grand Total	65		18		83	

COMPLIANCE WITH AUTHORIZATION REQUIREMENTS – ALL AUTHORIZATIONS

The Concrete Audit involved compliance verification of 1718 discharge permit clauses and Concrete CoP clauses. Across all clauses verified, 40% of clauses were found to be in compliance (Figure 2).

Table 2. Compliance Findings for Clauses by Authorization type



Compliance findings	Tally of Compliance Findings for Concrete CoP	% Concrete CoP findings	Tally of Compliance finding for Permits	% of Permit findings	Grand Total
In	617	39%	63	43%	680
Out	308	20%	16	11%	325
ND	368	23%	32	22%	400
NA	276	18%	37	25%	313
Grand Total	1569		148		1718

The percentage of clauses determined to be in compliance between the Concrete CoP and Concrete Permits are very similar at 39 percent and 43 percent respectively. However, the Concrete Permits had a higher percentage of not applicable clauses, whereas the Concrete CoP had a higher rate of non-compliance clauses (Table 2).

Table 3 presents the compliance determinations separated into similar clause categories for all facilities inspected.

Table 3. Tally of Compliance Determinations per Clause Category for all facilities inspected

Clause Categories	In		Out		Not Determined		Not Applicable		Total Count
	Tally	% of category	Tally	% of category	Tally	% of category	Tally	% of category	
Air Authorized Works	72	89%	3	4%	2	2%	4	5%	81
Air Discharge Monitoring	1	20%	0	0%	0	0%	4	80%	5
Air Discharge Quality	14	12%	0	0%	103	87%	2	2%	119
Air Discharge Rate	1	13%	0	0%	7	88%	0	0%	8
Bypasses	1	11%	1	11%	0	0%	7	78%	9
Discharge Location Confirmation	10	100%	0	0%	0	0%	0	0%	10
Disposal of Waste Concrete	47	77%	0	0%	11	18%	3	5%	61
Dust Control and Ambient Air Quality	74	63%	1	1%	42	36%	1	1%	118
Effluent Discharge Rate	0	0%	0	0%	5	83%	1	17%	6
Effluent Authorized Works	15	58%	5	19%	3	12%	3	12%	26
Effluent Discharge Monitoring	21	12%	49	27%	44	24%	68	37%	182
Effluent Discharge Quality	22	9%	50	21%	107	45%	58	24%	237
Emergencies - Procedures and Reporting	13	11%	4	3%	7	6%	97	80%	121
Miscellaneous	1	33%	0	0%	1	33%	1	33%	3
Notification of Changes	1	11%	2	22%	1	11%	5	56%	9
Operations and Maintenance	44	47%	24	26%	19	20%	6	6%	93
Provisional		0%	0	0%	0	0%	6	100%	6
Record Keeping	283	51%	182	33%	47	8%	47	8%	559
Registration	60	97%	1	2%	1	2%	0	0%	62
Reporting	0	0%	2	100%	0	0%	0	0%	2
Grand Total	680	40%	325	19%	400	23%	313	18%	1718

Across all authorizations inspected, certain clause categories had higher levels of compliance than others. For example, clauses related to effluent and air authorized works, disposal of waste concrete, dust control and ambient air quality, and discharge location confirmation had relatively high levels of compliance. Conversely, clauses related to effluent discharge quality, effluent discharge monitoring,

notification of changes, operations and maintenance, recording keeping and reporting had relatively high levels of non-compliance (Table 3).

CONCRETE COP REQUIREMENTS

Overall COP Compliance Findings

This section of the report highlights the results of the Concrete CoP audit inspections, excluding data from the permit inspections. Below is a tally of all compliance findings for each clause of the Concrete CoP (Table 4).

Table 4. Compliance Findings for Concrete CoP Clauses

Concrete CoP Clauses	Clause Category	In		Out		Not Determined		Not Applicable		Total Count
		Count	%	Count	%	Count	%	Count	%	
2	Registration	60	94%	1	2%	1	2%	2	3%	64
3 (a)	Dust Control and Ambient Air Quality	59	95%	1	2%	1	2%	1	2%	62
3 (b)	Dust Control and Ambient Air Quality	11	22%	0	0%	39	78%	0	0%	50
4 (1)(a)	Air Authorized works	57	92%	1	2%	1	2%	3	5%	62
4 (1)(b)	Air Discharge Quality	10	20%	0	0%	40	78%	1	2%	51
4 (2)	Air Discharge Quality	0	0%	0	0%	55	98%	1	2%	56
4 (3)	Operations and Maintenance	27	46%	17	29%	14	24%	1	2%	59
5	Disposal of Waste Concrete	46	77%	0	0%	11	18%	3	5%	60
6 (1)	Effluent Discharge Quality	4	11%	8	22%	20	56%	4	11%	36
6 (2)	Effluent Discharge Quality	3	5%	8	14%	40	68%	8	14%	59
7 (1)	Effluent Discharge Quality	2	3%	9	16%	3	5%	44	76%	58
7 (2)(a)	Effluent Authorized Works	9	53%	4	24%	2	12%	2	12%	17
7 (2)(b)(i)	Effluent Discharge Quality	4	22%	6	33%	8	44%	0	0%	18
7 (2)(b)(ii)	Effluent Discharge Quality	4	21%	6	32%	9	47%	0	0%	19
7 (2)(b)(iii)	Effluent Discharge Quality	1	6%	2	12%	14	82%	0	0%	17
7 (2)(b)(iv)	Effluent Discharge Quality	3	18%	1	6%	12	71%	1	6%	17
7 (3)	Operations and Maintenance	5	31%	4	25%	3	19%	4	25%	16
8 (1)	Effluent Discharge Monitoring	5	8%	44	71%	4	6%	9	15%	62
8 (2)(a)	Effluent Discharge Monitoring	3	7%	2	5%	22	52%	15	36%	42
8 (2)(b)	Effluent Discharge Monitoring	0	0%	0	0%	0	0%	17	100%	17
8 (3)(a)	Effluent Discharge Monitoring	9	25%	1	3%	16	44%	10	28%	36

8 (3)(b)	Effluent Discharge Monitoring	0	0%	0	0%	0	0%	16	100%	16
8 (4)(a)	Record Keeping	7	19%	16	43%	6	16%	8	22%	37
8 (4)(b)	Record Keeping	11	46%	10	42%	1	4%	2	8%	24
8 (4)(c)	Record Keeping	16	67%	4	17%	2	8%	2	8%	24
8 (4)(d)	Record Keeping	12	50%	7	29%	3	13%	2	8%	24
8 (4)(e)	Record Keeping	7	29%	14	58%	1	4%	2	8%	24
8 (4)(f)	Record Keeping	8	33%	11	46%	3	13%	2	8%	24
9 (1)	Record Keeping	31	51%	24	39%	2	3%	4	7%	61
9 (2)(a)	Record Keeping	30	57%	13	25%	4	8%	6	11%	53
9 (2)(b)	Record Keeping	35	81%	5	12%	1	2%	2	5%	43
9 (2)(c)	Record Keeping	15	35%	18	42%	7	16%	3	7%	43
9 (2)(d)	Record Keeping	18	42%	22	51%	1	2%	2	5%	43
9 (2)(e)	Record Keeping	29	67%	10	23%	2	5%	2	5%	43
10 (1)(a)	Emergencies - Procedures and Reporting	5	9%	0	0%	6	10%	47	81%	58
10 (1)(b)	Emergencies - Procedures and Reporting	2	11%	4	21%	0	0%	13	68%	19
10 (1)(c)	Emergencies - Procedures and Reporting	1	6%	0	0%	0	0%	16	94%	17
10 (1)(d)	Emergencies - Procedures and Reporting	5	28%	0	0%	0	0%	13	72%	18
11 (1)	Record Keeping	22	37%	17	29%	14	24%	6	10%	59
11 (2)	Record Keeping	41	73%	11	20%		0%	4	7%	56
Grand Total		617	39%	301	19%	368	24%	278	18%	1564

Effluent Discharge Quality

The Concrete CoP has separate requirements for effluent discharges to ground versus surface waters and/or marine waters. Section 6 regulates effluent quality for **ground discharges** and no other effluent quality limits are set for discharges to ground. Section 6 reads:

6 (1) Process water of an establishment must not be discharged to the ground except in accordance with subsection (2).

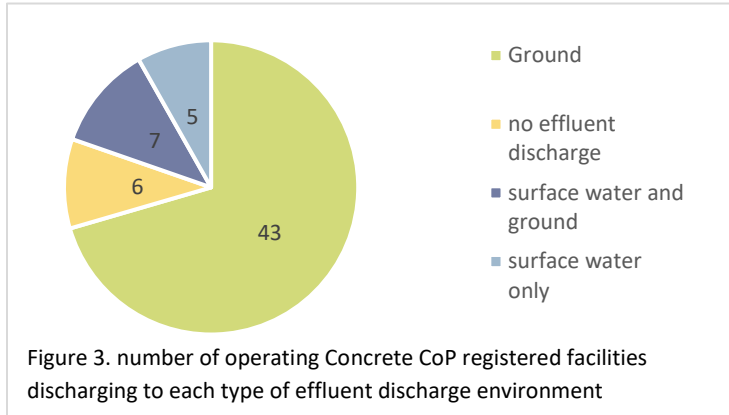
6 (2) A person operating an establishment must ensure that its process water and establishment runoff do not cause pollution of any groundwater.

Section 7 of the CoP regulates effluent discharges **to surface waters and/or marine waters**. Section 7 reads:

7 (1) Process water of an establishment must not be discharged into surface water or marine water except in accordance with this section.

*7 (2) A person operating an establishment
(b) must ensure that such process water or establishment runoff*

- (i) has a pH level of no less than 6.5 and no more than 9,
(ii) contains no more than 75 mg/L total suspended solids,
(iii) contains no more than 15 mg/L total extractable hydrocarbons, and
(iv) is not acutely lethal to fish.



Effluent discharges to surface waters and marine waters were found to be less common than discharges to ground. Twenty percent of facilities were found to be discharging some effluent to surface waters and marine waters, and of those facilities, more than half were found to also have some discharge to ground (Figure 3.).

Table 5. Compliance Findings for Concrete CoP Effluent Discharge Quality Clauses (ground discharge clauses in green, surface water and marine in blue)

Concrete CoP Clauses	Tally	In % of row total	Tally	Out % of row total	Not Determined Tally	Not Determined % of row total	Not Applicable Tally	Not Applicable % of row total	Total
6 (1)	4	11%	10	22%	20	56%	4	11%	36
6 (2)	3	5%	10	14%	40	68%	8	13%	59
7 (1)	2	4%	9	16%	3	5%	43	75%	57
7 (2)(b)(i)	4	22%	6	33%	8	44%	0	0%	18
7 (2)(b)(ii)	4	21%	6	32%	9	47%	0	0%	19
7 (2)(b)(iii)	1	6%	2	12%	14	82%	0	0%	17
7 (2)(b)(iv)	3	18%	1	6%	12	71%	1	6%	17
Grand Total	21	9%	40	18%	106	48%	56	25%	223

In the majority of inspections conducted, Officers used section 6(2) to verify compliance for ground discharges. Section 6(2) was found to be applicable in 87 percent of inspections (51 out of 59), meaning a discharge to ground was occurring (Table 5). However, compliance could not be determined for 40 of the 51 applicable ground discharges inspected under section 6(2).

Section 7 (1) was found to be not applicable in 75 percent of inspections because there were no discharges to surface waters or marine waters at these facilities. Of the 25 percent of facilities where discharge to surface water or marine water was occurring, 64 percent were found to be out of compliance, 14 percent were found to be in compliance, and in 21 percent of these inspections, compliance could not be determined.

It should be noted that at the time of this audit the TEH testing methodology listed in the BC Field Sampling Manual is no longer valid, and therefore compliance with TEH limits in section 7 (2)(b)(iii) could not be determined during the audit.

Effluent Discharge Monitoring

The Concrete CoP requires that both ground and surface water and/or marine water dischargers monitor their discharge by requiring process water and establishment runoff be sampled and analyzed once a month. This is required under section 8 (1), and it was determined that 71 percent of registrations under the Concrete CoP were out of compliance with this requirement (Table 4). Section 8 (2)(a) and 8 (3)(a) require dischargers to follow procedures in the B.C. Field Sampling Manual and B.C. Environmental Laboratory Manual respectively. The results show both these sections had high findings of not applicable and not determined, frequently because no samples were being collected. Sections 8 (2)(a) and 8 (3)(a) are provisional allowing alternate procedure for sampling and analysis to be used with approval from a director.

Air Discharge Quality and Dust Control

Air discharges under the Concrete CoP are regulated by sections 3 and 4. Section 3 regulates dust control and section 4 regulates silo emissions. These sections state:

3 A person operating an establishment

(a) must take measures to control dust produced in the operation of the establishment, including any dust produced at the establishment premises by traffic, storage activities or the handling of materials, and

(b) must ensure that such dust does not cause pollution.

4 (1) If there is a silo at or on establishment premises, a person operating the establishment

(b) must ensure that those silo emissions do not cause pollution.

4 (2) The opacity of silo emissions discharged to the air must not exceed 10% averaged over 6 consecutive minutes.

Table 6. Compliance Findings for Air Discharge Quality Requirements

	Clause Category	In		Out		Not Determined		Not Applicable		Total Count
		Count	%	Count	%	Count	%	Count	%	
3 (a)	Dust Control and Ambient Air Quality	59	95%	1	2%	1	2%	1	2%	62
3 (b)	Dust Control and Ambient Air Quality	11	22%	0	0%	39	78%	0	0%	50
4 (1)(b)	Air Discharge Quality	10	20%	0	0%	40	78%	1	2%	51
4 (2)	Air Discharge Quality	0	0%	0	0%	55	98%	1	2%	56
Grand Total		80	37%	1	0%	135	62%	3	1%	219

It was determined that 95 percent of requirements to take measures to control dust produced in the operation of the establishment were found to be in compliance (Table 6). Compliance with sections 3 (b) and 4 (1)(b) could not be determined 78 percent of the time for both sections, meaning ENV officers could not determine if the dust caused pollution. Section 4 (2) sets opacity limits, but the Concrete CoP does not require the facility to monitor opacity, therefore facilities had no data for this requirement to support a compliance finding.

Authorized Works and Operations and Maintenance

Air pollution control works are required under section 4 (1)(a) for all silos, and they are required to be inspected monthly under 4 (3) to verify they are in good working condition. Effluent pollution control works are only required for surface water and marine water discharges as per section 7 (2)(a) of the Concrete CoP. Compliance rates with air authorized works clauses were determined to be higher than for effluent authorized works (Table 4).

CONCRETE PERMIT REQUIREMENTS

The results for compliance findings for permit clause categories only are given in Table 7. These results show compliance with air authorized works, discharge location confirmation, dust control and ambient air, effluent authorized works, operations and maintenance, record keeping, and waste concrete disposal clauses to be high (more than 66 percent in compliance). Conversely, effluent discharge quality and reporting clauses were found to have high rates of non-compliance (50% and above). As expected, the provisional clause types (e.g. bypasses, emergencies, notification of changes) were determined to be not applicable most often. Clause types where the most common outcome was “not determined” were air discharge quality, air discharge rate, and effluent discharge rate. ENV officers were most often unable to determine compliance with these clauses types because there was no data available to determine compliance with, and this was due to a lack of requirements to monitor discharges in these permits.

Table 7. Tally of Compliance Findings for Permit Clause Categories

Row Labels	In	Out	ND	NA	Grand Total
Air Authorized Works	16	2	1	1	20
Air Discharge Monitoring	1	0	0	4	5
Air Discharge Quality	3	0	8	0	11
Air Discharge Rate	1	0	7	0	8
Bypasses	1	1	0	7	9
Discharge Location Confirmation	10	0	0	0	10
Dust Control and Ambient Air	4	0	2	0	6
Effluent Authorized Works	6	1	1	1	9
Effluent Discharge Monitoring	4	2	2	1	9
Effluent Discharge Quality	1	3	1	1	6
Effluent Discharge Rate	0	0	5	1	6

Emergencies	0	0	1	8	9
Miscellaneous	1	0	1	1	3
Notification of Changes	1	2	1	5	9
Operations and Maintenance	12	3	2	1	18
Provisional	0	0	0	6	6
Record Keeping	1	0	0	0	1
Reporting	0	2	0	0	2
Waste Concrete Disposal	1	0	0	0	1
Grand Total	63	16	32	37	148

DISCUSSION AND RECOMMENDATIONS

OVERALL COMPLIANCE RESULTS

Across all facilities inspected, including both permitted facilities and registrations under the Concrete CoP, 40 percent of clauses were found to be in compliance. The next most common compliance finding was “not determined” for 23 percent of all clauses included in the audit. Eighteen percent of clauses were determined to be not applicable at the time of inspection and 19 percent of clauses were found to be out of compliance. Eighty-six percent of facilities were issued an Advisory, Warning, or referral to AMP, with the majority receiving Advisories. This means that most audited facilities had at least one non-compliance with either the Concrete CoP or their respective Permit. Despite a relatively low overall compliance rate, across all inspections conducted, non-compliances were determined to have, at most, a minor or temporary impact or threat to the environment or human health. This overall finding supports the notion that the industry generally poses a lower risk to the environment, human health, and safety.

The results of the tallied compliance findings per clause category for all authorizations show that compliance with authorized works and discharge location categories was high, indicating that authorized works were in place and had not been moved most of the time. Disposal of waste concrete clauses had high compliance, which is likely because much of the waste concrete can be recycled.

Some of the categories with the highest non-compliance rates (above 25 percent) were effluent discharge monitoring and operations and maintenance. Effluent discharge monitoring had higher non-compliance rates due to some facilities not monitoring their discharges at the required frequency, or at all. Operations and Maintenance requirements include requirements to inspect the authorized works and maintain them in good working order. Most of the non-compliances with these requirements were due to lack of inspection of the authorized works. These are important requirements that provide ENV and facility operators with information on the discharges and on how the authorized works are functioning.

Compliance could not be determined with 23 percent of clauses in the audit. Clause categories with the highest rates of “not determined” findings were air discharge quality, air discharge rate, effluent discharge quality and effluent discharge rate. A review of inspection reports shows the lack of

compliance determinations for discharge quality and quantity requirements is due to a combination of factors. In some cases, discharge monitoring was not being conducted as required, resulting in a lack of data to determine compliance. In other instances, the authorizations lacked requirements for discharge monitoring to be conducted, also resulting in a lack of data. Finally, some quality and quantity requirements were found to be unverifiable due to a lack of measurable limits in the authorizations.

The two categories relating to discharge rate were only found in permits, and the high percentage of not determined findings was mostly due to there being no requirements to monitor the discharge rate in all the air permits and one of four active effluent permits. The other not determined findings were due to facilities missing data or not monitoring even though they were required to do so.

Air discharge quality is regulated in the Concrete CoP, however there are no specific monitoring requirements for air discharge quality. This resulted in a lack of data, and a challenge for ENV to verify compliance. Effluent discharge quality is regulated differently depending on the type (process water or establishment runoff) and the discharge receiving environment (ground or surface water/marine). Discharges to ground are more common, but the only discharge quality requirement is that is the discharge does not cause pollution of the groundwater. With no requirement to monitor groundwater discharge quality, there is a lack of data and compliance was difficult to determine. This is an area of the Concrete CoP where enforceability could be improved.

Compliance with 18 percent of all clauses was assessed to be not applicable; however, for many of these clauses this result is not unexpected, as they relate to provisional clauses such as bypasses, notifications of changes, and emergencies that only apply if those events occur.

CONCRETE COP FINDINGS

Air

The audit found high compliance rates with section 3 (a) of the Concrete CoP, which requires facilities to take measures to control dust produced in the operation of the establishment. This indicates that most facilities are taking some kind of action to control dust. Air and authorized works clauses also had high rates of compliance, meaning that pollution control works were in place most of the time.

However, other air discharge quality requirements (sections 3 (b), 4 (1)(b) and 4 (2)) had high rates of Not Determined findings. Air discharge quality from silos and from fugitive dust must not cause pollution, and ENV officers were unable to determine compliance with the majority of these requirements. While section 4 (2) provides an opacity limit, there is no requirement for facilities to assess opacity and record results, so no data was available from facilities for this compliance point.

Refuse

The disposal of waste concrete requirement in the Concrete CoP had a high compliance rate. Inspections also found that many facilities recycle their excess concrete, making less waste. Any other waste

concrete was often disposed of in a quarry or another concrete facility with technology to recycle it into the process again, leading to high compliance rates.

Effluent

Effluent authorized works clauses had high rates of compliance, meaning that pollution control works were in place more often than not.

Compliance with effluent discharge quality requirements for discharges to ground (ie. Sections 6 (1) and 6 (2) of the CoP) were assessed as Not Determined in the majority of inspections. 6 (1) requires that process water be discharged to the ground only in accordance with 6 (2), and 6 (2) requires that process water and establishment runoff do not cause pollution of any groundwater. However, ENV officers were most often unable to determine compliance with these clauses types as there are no requirements in the CoP to monitor ground water, and therefore no data available to determine compliance with. The results of this audit found that compliance with the requirement for the discharge to not cause pollution to ground water could not be determined for 89 percent of the 53 ground discharges inspected under section 6 (2). The Concrete CoP provides more specific requirements for effluent discharge quality to surface water and marine environments in section 7 (2), however compliance with these requirements was also found to be not determined the majority of the time. In general, this indicates that there was a lack of data available for inspectors to assess.

Sections 7 (2)(b)(iii) and 7 (2)(b)(iv) had particularly high rates of “Not Determined” at over 70%. Section 7 (2)(b)(iii) provides maximum limits of 15 mg/L for total extractable hydrocarbons for effluent discharged to surface water and marine. Due to changes made to the B.C. Environmental Laboratory Manual testing methods, TEH tests can no longer be used for concrete effluent discharges while following the methods in the manual. In addition, section 8 (3)(a) requires that sample analysis be performed using the procedures described in the British Columbia Environmental Laboratory Manual. This means that even if facilities did sample data for TEH ENV could not use it to determine compliance. Therefore, compliance was not determined for the majority of inspection where this clause applied. Part (iv) requires that process water or establishment runoff is not acutely lethal to fish. High rates of “Not Determined” compliance findings for this section were due to facilities not having toxicity data, as there is no clear monitoring requirement to conduct toxicity tests.

7 (2)(b)(i) is the requirement that effluent have a pH level of no less than 6.5 and no more than 9, and 7 (2)(b)(ii) is the requirement that effluent contain a maximum of 75mg/L total suspended solids. These two requirements had high rates of ND findings; however, when compliance was able to be determined, there was a high rate of non-compliance. This indicates that effluent quality for surface water and marine discharges could be improved upon for the industry.

Section 8 (1) requires that all Concrete facilities sample and analyze their process water and establishment runoff at least once a month. A non-compliance rate of 71% indicated that the majority of facilities are not consistently sampling and analyzing both process water and establishment runoff. A review of audit inspection records determined that there were more non-compliances relating to

establishment runoff sampling than process water. This is likely due to the fact that process water may be more easily contained, and was being recycled and not discharged at a number of facilities.

Records

Record keeping clauses made up the largest category of clauses assessed in the Concrete CoP, with a 558 included out of a total of 1569 concrete CoP Clauses in the audit. Each record keeping clause requires that a different, specific piece of information be recorded. The compliance rate overall for record keeping clauses was found to be high. However, some individual record keeping clauses had very low rates of compliance. For example, Section 8 (4)(f) is an important clause, as it requires the results of the sample data analysis to be recorded with reference to the standards described in section 7 (2)(b)(i) to (iii). Low compliance rates with this section show some data was not being recorded or collected, which adversely affects ENV's ability to assess compliance for the important characteristics of process water and establishment runoff.

CONCLUSIONS

Do current authorizations contain consistently enforceable environmental protection provisions (eg. discharge limits, monitoring and reporting requirements)?

The Concrete CoP includes discharge quality requirements, monitoring requirements and record keeping requirements. As discussed above, although discharge limits are included in the Concrete CoP, requirements for effluent discharges to ground and for air discharges are difficult to verify compliance with. Discharge limits for effluent discharges to surface water and marine water, as they are currently written in the Concrete CoP, also create challenges with respect to enforceability.

The Concrete CoP has no regular reporting requirements; however, records are required to be kept for five years and facilities must report if a particulate control system or effluent treatment system has a failure. The Concrete CoP does not include a non-compliance reporting clause. This means compliance issues that are not related to a failure of a particulate control system or effluent treatment system may not be known to ENV until an inspection of that facility is conducted.

With regards to permits, a number of the discharge permits inspected do not contain certain foundational environmental protection provisions such as discharge monitoring, discharge quality limits, and record keeping or reporting requirements. Only five of 11 active permits contain discharge monitoring requirements, and only three contain reporting or record keeping requirements (Table 8).

Table 8. Number of Permits Containing Clauses from each Clause Category

Clause Categories	Number of Permits containing the clause category
Air Authorized Works	7
Air Discharge Monitoring	2
Air Discharge Quality	7
Air Discharge Rate	7
Bypasses	9
Discharge Location Confirmation	5
Dust Control and Ambient Air	5
Effluent Authorized Works	4
Effluent Discharge Monitoring	3
Effluent Discharge Quality	4
Effluent Discharge Rate	4
Emergencies	5
Miscellaneous	3
Notification of Changes	8
Operations and Maintenance	11
Provisional	4
Record Keeping	1
Reporting	2
Waste Concrete Disposal	1

Four of the 11 permits regulate only effluent discharges and seven regulate only air discharges. Air permits were found to have clear air discharge limits provided as maximum PM concentrations. However, none of these permits required the measurement of PM concentrations, making these limits unenforceable. Half of the effluent discharge quality limits set in the permits only required the discharge to be some kind of “typical” concrete wastewater, making enforceability a challenge.

Overall, the results show that not all permits were consistent in having enforceable environmental protection provisions, and the Concrete CoP could be clearer and more enforceable in some areas.

Finally, it should also be noted that the majority of active concrete permits were issued before the Concrete CoP came into effect in 2008, and may be missing requirements that are now standard to all permits issued currently. All of the 18 permits included in the audit were from 1999 or older, except for one issued in 2013 and one in 2017. Prioritizing the sector for permit refresh to ensure implementation of updated enforceable clauses would likely be a benefit for this industry.

What is the likelihood of improved compliance in the future?

As this is the first audit of the concrete industry, future compliance may be improved as a result. Almost all audited facilities had not been inspected in 4 years (except for 8 facilities which had received a Warning or referral for Administrative Monetary Penalty in the last year), and 58 of the audited facilities had no previous inspections on record in ENV’s electronic system. The audit increased ENV’s

communication and on-site presence in the concrete industry greatly in 2020. ENV staff reminded operators of the regulatory requirements and helped to clarify any points of confusion for operators. ENV prioritizes conducting follow up inspections when warnings or AMP referrals are issued; therefore, 15% of facilities will be prioritized for inspection in the near future. This process of conducting a follow up inspection may improve the likelihood of future compliance.

Is the Environment Protected?

None of the audited facilities were assessed using the Non-Compliance Decision Matrix at a level higher than a 2, meaning that all the non-compliances were determined to have, at most, a minor temporary impact on the environment (Appendix 1). However, clause categories with high rates where compliance could not be determined included air discharge quality, effluent discharge quality to ground, and effluent discharge quality to surface water and marine water. These are all clause categories that provide ENV with information on the quality and quantity of discharges to the environment, which is valuable information when determining compliance. Overall, ENV considers the concrete industry to be a lower risk industry as it is listed in schedule 2 of the WDR and regulated under a CoP rather than a Regulation. Regardless, discharge authorizations are issued to protect the environment and human health, so it is important that compliance can be clearly determined.

RECOMMENDATIONS

Findings from the 2020 Concrete audit have highlighted opportunities for improvement within the concrete sector and ENV.

Recommendations for Facility owners/operators:

- Ensure that facility owners, operators, and staff are aware of and comply with all Concrete CoP/permit requirements.
- Ensure monitoring of discharges is conducted as required by the applicable authorizations.
- Ensure that routine inspections and maintenance of authorized works is conducted as required.
- Ensure records are maintained as required.
- Ensure that required authorized works are complete and fully operational during discharge.
- Ensure that bypasses of authorized works are prohibited unless prior approval from ENV is obtained.
- Ensure all required monitoring is conducted as described in the permit and in the B.C. Field Sampling Manual found here: <https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>.
- Ensure authorized discharges are within permit/Concrete CoP requirements for discharge quality and quantity.
- Ensure that timely notification of any incidents, emergencies, bypasses, process changes, and administrative details are provided to ENV as required.
- Ensure Concrete CoP/permit requirements are reviewed regularly.

Recommendations for ENV:

- For facilities authorized under permits, prioritizing the sector for permit refresh to ensure implementation of updated enforceable clauses.
- ENV should improve compliance promotion in the industry with increased communication. This is especially true for a lower risk industry facilities where inspections may be less frequent.
- ENV should continue to prioritize inspections for facilities that have not been inspected in a long time, or never inspected. More than half of the audited facilities had never been inspected by ENV and compliance rates were found to be low overall. This indicates the importance of targeting these types of authorizations.
- ENV should inspect facilities with new authorizations in the concrete industry soon after authorizations are issued. This would be beneficial to help the industry understand their authorization requirements and allow them put procedures in place to comply with their authorizations from the start.
- It is recommended that the audited facilities that received warnings or an AMP receive a follow up inspection.
- The Compliance and Environmental Enforcement Team be consulted for recommendations identified in this audit to increase clarity and enforceability of specific sections of the Code.

APPENDIX 1 – LIST OF INSPECTED PARTIES

Authorization Number	Regulated Party	Region	Requirement Source	NCD Matrix Level	NCD Matrix Category	Response	Inspection Number
2976	Armtex GP Inc	South Coast	Permit	2	A	Warning 120(6)	151133
4517	Lehigh Hanson Materials Limited Doing Business As Ok Ready Mix, A Division Of Lehigh Hanson Materials Limited	Thompson- Okanagan	Permit	0	0	Notice	155115
4853	Island Concrete Finishing Ltd.	West Coast	Permit	2	A	Advisory	157483
5500	Rempel Bros. Concrete Ltd.	South Coast	Permit	2	A	Warning 120(6)	159828
5601	Lehigh Northwest Cement Limited	West Coast	Permit	2	A	Warning Unauthorized 6(2)	160026
5730	Oliver Read-Mix Limited	Thompson- Okanagan	Permit	0	0	Notice	158449
6100	Lehigh Hanson Materials Limited Doing Business As Ok Ready Mix, A Division Of Lehigh Hanson Materials Limited	Thompson- Okanagan	Permit	0	0	Notice	158741
6137	Lehigh Hanson Materials Limited Doing Business As Ok Ready Mix, A Division Of Lehigh Hanson Materials Limited	Thompson- Okanagan	Permit	0	0	Notice	158740
7081	Ever Redi Concrete Products Ltd.	Cariboo	Permit	0	0	Notice	160660
11370	Remple Bros. Concrete Ltd.	South Coast	Permit	1	A	Advisory	159845
12261	Omineca Redi-Mix Ltd.	Omineca- Peace	Permit	0	0	Notice	158762
12262	Omineca Redi-Mix Ltd.	Omineca- Peace	Permit	0	0	Notice	158788
13823	Randy D.B.A. Cameron'S Concrete Redi Mix Cameron	Kootenay- Boundary	Permit	0	0	Notice	151666
13849	Randy D.B.A. Cameron'S Concrete Redi Mix Cameron	Kootenay- Boundary	Permit	0	0	Notice	151669
15995	Lehigh Hanson Materials Limited Dba Lehigh Northwest Cement Limited	Omineca- Peace	Permit	1	B	Advisory	158893
16122	Lafarge Canada Inc.	Kootenay- Boundary	Permit	0	0	Notice	153161
100364	Interoute Construction Ltd. Doing Business As B.A. Blacktop Cranbrook	Kootenay- Boundary	Concrete CoP	1	A	Advisory	159160
100367	Surespan Ready Mix	West Coast	Concrete CoP	2	A	Advisory	159470
100376	Interoute Construction Ltd.	Northeast	Concrete CoP	1	A	Advisory	155225
100377	Gravel Hill Supplies Ltd.	West Coast	Concrete CoP	2	A	Advisory	160027
100387	Brownsey Block (1985) Ltd. - Duncan	West Coast	Concrete CoP	1	A	Advisory	159455
100405	Interoute Construction Ltd. Doing Business As Selkirk Paving	Kootenay- Boundary	Concrete CoP	0	0	Notice	152758
100406	Interoute Construction Ltd. Doing Business As Selkirk Paving	Kootenay- Boundary	Concrete CoP	0	0	Notice	153191
100407	YCS Holdings Ltd. Doing Business As Sonic Concrete & Aggregate	Omineca- Peace	Concrete CoP	1	A	Advisory	158891
100472	Burnco Rock Products (B.C.) Ltd.	South Coast	Concrete CoP	2	A	Warning Codes and Regs	151308
100476	Port McNeill Enterprises Ltd.	West Coast	Concrete CoP	1	B	Advisory	158135

100483	Burnco Rock Products (B.C.) Ltd. West Kelowna Facility Inspection 2012	Thompson- Okanagan	Concrete CoP	1	A	Advisory	153776
100538	Western Concrete Ltd. Doing Business As Ready Mix Concrete	South Coast	Concrete CoP	1	A	Advisory	159614
100566	Moby Concrete Ltd.	Omineca- Peace	Concrete CoP	1	B	Advisory	160640
103027	Parksville Redi-Mix Ltd.	West Coast	Concrete CoP	2	A	Advisory	157485
103083	Basalite Concrete Products - Vancouver, Ulc Doing Business As Basalite Concrete Products	South Coast	Concrete CoP	2	A	Advisory	159116
103127	Interoute Construction Ltd. Doing Business As Fernie Ready-Mix	Kootenay- Boundary	Concrete CoP	1	A	Advisory	151768
103132	Rolling Mix Concrete (B.C.) Ltd.	Omineca- Peace	Concrete CoP	0	0	Notice	153980
103287	Interoute Construction Ltd. Doing Business As Garrett Ready Mix	Kootenay- Boundary	Concrete CoP	1	A	Advisory	151789
103337	Salvador Ready Mix Concrete Limited Partnership	Kootenay- Boundary	Concrete CoP	2	A	Advisory	158715
103338	Tri-Kon Precast Products Ltd.	Kootenay- Boundary	Concrete CoP	1	A	Advisory	159248
103442	Interoute Construction Ltd. Doing Business As Golden Concrete	Kootenay- Boundary	Concrete CoP	1	A	Advisory	160023
103880	Interoute Construction Ltd.	Northeast	Concrete CoP	0	0	Notice	155230
103986	Coyote Concrete Ltd.	Kootenay- Boundary	Concrete CoP	1	C	Warning Codes and Regs	158728
104043	Interoute Construction Ltd. Doing Business As H & J Ready Mix	Kootenay- Boundary	Concrete CoP	1	A	Advisory	162063
104070	Burnco Rock Products (B.C.) Ltd.	Thompson- Okanagan	Concrete CoP	1	A	Advisory	153865
104113	Rempel Bros. Concrete Ltd.	South Coast	Concrete CoP	1	A	Advisory	159134
104517	Dolan's Concrete Ltd.	West Coast	Concrete CoP	1	B	Advisory	158127
104532	Dolans Concrete Ltd	West Coast	Concrete CoP	1	A	Advisory	158131
104719	Uplands Ready-Mix Ltd	West Coast	Concrete CoP	1	A	Advisory	154354
105062	Lombard Precast Limited Partnership	West Coast	Concrete CoP	1	B	Advisory	156895
105084	Dan's Precast Ltd.	West Coast	Concrete CoP	1	A	Advisory	154226
105175	Becker Creek Enterprises Ltd. Doing Business As Rocky Mountain Concrete	Thompson- Okanagan	Concrete CoP	2	A	Advisory	154155
105791	Agassiz Ready Mix Concrete & Gravel Ltd.	South Coast	Concrete CoP	2	A	Advisory	153283
106164	Lang Bay Aggregate Ltd.	South Coast	Concrete CoP	2	B	Warning Codes and Regs	159241
106448	YCS Holdings Ltd. Doing Business As Kentron Construction	Skeena	Concrete CoP	2	B	Warning Codes and Regs	162152
106480	United Concrete & Gravel Ltd.	Cariboo	Concrete CoP	1	C	Warning Codes and Regs	161315
106526	Lehigh Hanson Materials Limited Doing Business As Inland Concrete	Omineca- Peace	Concrete CoP	2	A	Advisory	159865
106562	United Concrete & Gravel Ltd.	Cariboo	Concrete CoP	1	C	AMP	160364
106563	United Concrete & Gravel Ltd.	Cariboo	Permit	1	A	Advisory	161148
106665	Princeton Redi-Mix (1993) Ltd.	Thompson- Okanagan	Concrete CoP	1	A	Advisory	153542
106800	West Fraser Concrete Ltd.	Skeena	Concrete CoP	0	0	Notice	162120
107213	Pacific Site Constructors Inc.	South Coast	Concrete CoP	0	0	Notice	159129
108114	Gulf Coast Materials Ltd.	South Coast	Concrete CoP	2	C	Warning Codes and Regs	159350

108836	Lehigh Hanson Materials Limited Doing Business As Lehigh Inland Cement	Omineca- Peace	Permit	1	A	Advisory	160311
109128	Magnum Concrete Inc.	South Coast	Concrete CoP	2	A	Advisory	158801
109149	Interoute Construction Ltd. Doing Business As H & J Ready Mix	Kootenay- Boundary	Concrete CoP	0	0	Notice	162062
109464	CIF Construction Ltd.	Kootenay- Boundary	Concrete CoP	1	A	Advisory	151804
109534	Kelowna Ready-Mix Inc.	Thompson- Okanagan	Concrete CoP	1	A	Advisory	153919
109566	RMC Construction Materials Ltd.	Omineca- Peace	Concrete CoP	1	A	Advisory	160920
109616	Vossloh Tie Technologies Canada Ulc	Thompson- Okanagan	Concrete CoP	2	A	Advisory	153155
109625	Lehigh Hanson Materials Limited Doing Business As Ocean Pipe	South Coast	Concrete CoP	2	B	Warning Codes and Regs	151095
109854	Swanson'S Ready-Mix Ltd.	South Coast	Concrete CoP	2	A	Advisory	159132
109957	Abbotsford Concrete Products Ltd. Doing Business As Abbotsford Concrete Products	South Coast	Concrete CoP	1	A	Advisory	152658
109974	Lafarge Canada Inc.	South Coast	Concrete CoP	1	A	Advisory	159125
109996	Moby Concrete Ltd.	Omineca- Peace	Concrete CoP	2	A	Advisory	158808
110082	Coast Range Concrete Ltd.	Thompson- Okanagan	Concrete CoP	1	A	Advisory	156430
110083	Coast Range Concrete Ltd.	Thompson- Okanagan	Concrete CoP	1	A	Advisory	156637
110127	Salmon Arm Ready Mix Ltd.	Thompson- Okanagan	Concrete CoP	2	A	Advisory	154545
110128	Lock-Block Ltd	South Coast	Concrete CoP	2	A	Advisory	151143
110142	Magnum Concrete Inc.	South Coast	Concrete CoP	1	A	Advisory	152659
110182	Lehigh Hanson Materials Limited Doing Business As Ok Ready Mix	West Coast	Concrete CoP	1	A	Advisory	157440
110183	Lehigh Hanson Materials Limited Doing Business As Ok Ready Mix	Thompson- Okanagan	Concrete CoP	0	0	Notice	155742
110212	RMC Ready-Mix Ltd.	South Coast	Concrete CoP	2	A	Advisory	151307
110213	RMC Ready-Mix Ltd.	South Coast	Concrete CoP	1	A	Advisory	158899
110232	Lafarge Canada Inc.	South Coast	Concrete CoP	1	A	Advisory	159127
UA159873	Pacific Ready Mix Co. Ltd.	West Coast	Concrete CoP	1	B	Warning Unauthorized 6(2)	159873
UA161111	Bedrock Redi-Mix A Division Of M&K Redi-Mix Inc.	West Coast	Concrete CoP	2	A	Warning Unauthorized 6(2)	161111

APPENDIX 2 – ENV’S NON-COMPLIANCE DECISION MATRIX

ESCALATING ENVIRONMENTAL, HUMAN HEALTH OR SAFETY IMPACTS (ACTUAL OR POTENTIAL)						
		LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
DIMINISHING LIKELIHOOD OF COMPLIANCE (COMPLIANCE HISTORY/ WILLINGNESS AND CAPACITY TO COMPLY)	CATEGORY A (high)	ADVISORY	ADVISORY - WARNING	WARNING - ADMIN PENALTY	ADMIN PENALTY	INVESTIGATION
	CATEGORY B	ADVISORY - WARNING	WARNING - ADMIN PENALTY	WARNING - ADMIN PENALTY	ADMIN PENALTY - CONSULT	
	CATEGORY C	WARNING - ADMIN PENALTY	WARNING - ADMIN PENALTY - ADMIN SANCTION	ADMIN PENALTY - ADMIN SANCTION - CONSULT	CONSULT	
	CATEGORY D	WARNING - ADMIN PENALTY - ADMIN SANCTION	ADMIN PENALTY - ADMIN SANCTION - CONSULT	ADMIN PENALTY - CONSULT	CONSULT	
	CATEGORY E (low)	CONSULT	INVESTIGATION			

Levels of Escalating Environmental, Human Health or Safety Impacts
(Actual or Potential)

LEVEL 1

- Non-compliance that does not result or is unlikely to result in any environmental, human health or safety impact; or
- Minor administrative non-compliance.

LEVEL 2

- Non-compliance resulting in a minor, temporary impact to the environment or minor, temporary threat to human health or safety; or
- Significant administrative non-compliance.

LEVEL 3

- Non-compliance resulting in a moderate, temporary impact to the environment or moderate, temporary threat to human health or safety.

LEVEL 4

- Non-compliance resulting in a significant impact to the environment or significant threat to human health or safety (may be temporary or permanent).

LEVEL 5

- Known or likely human health impact that is severe in effect, i.e. resulting in hospitalization and/or long term human health consequences.

Categories of Likelihood of Compliance

(Compliance History/Willingness and Capacity to Comply)

CATEGORY A - Indications of future and ongoing compliance are very high

- No previous occurrences of non-compliance;
- Good demonstrated awareness of and/or capacity to meet regulatory requirement; and/or
- Offender has a reasonable and cooperative attitude.

CATEGORY B - Indications of future and ongoing compliance are uncertain

- Few previous occurrences of non-compliance; and/or
- Questionable awareness of and/or capacity to meet regulatory requirement.

CATEGORY C - Indications of future and ongoing compliance are unlikely

- Numerous previous occurrences of non-compliance; and/or
- Little or no awareness of and/or capacity to meet regulatory requirement.

CATEGORY D - No indication of future and ongoing compliance

- Wilful violation of ministry regulatory requirement; and/or
- Little or no demonstrated willingness or capacity to meet regulatory requirement.

CATEGORY E - Indications of obstruction and ongoing or future non-compliance

- Hindering or obstructing a ministry official;
- Refusing to furnish required information; and/or
- Intentionally including false or misleading information in any required document.