RESPONSE OF
THE CANADIAN ENVIRONMENTAL LAW ASSOCIATION
TO THE REPLY OF THE MINISTRY OF THE ENVIRONMENT
RE: EBR APPLICATION FOR REVIEW OF REGULATION 903 (WELLS)

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EXECUTIVE SUMMARY

CELA applied under the *Environmental Bill of Rights* for a review of Ontario Regulation 903 (Wells), which sets out provincial standards for the construction, maintenance and decommissioning of wells. CELA's application outlined numerous deficiencies within Regulation 903 (as amended by O.Reg.128/03), and raised questions about its effectiveness and enforceability. However, the Ministry of the Environment ("MOE") has refused CELA's application to review Regulation 903. The MOE's reasons for this refusal are unpersuasive and unresponsive to concerns raised by CELA. Accordingly, CELA has requested the Environmental Commissioner of Ontario to investigate and report upon this urgent matter.

PART I – INTRODUCTION

On October 30, 2003, the Canadian Environmental Law Association ("CELA") applied under Part IV of the *Environmental Bill of Rights* ("EBR") for a review of Ontario Regulation 903 (Wells), as amended by O.Reg. 128/03.

CELA's Application for Review[1] identified numerous deficiencies within Regulation 903, and raised serious concerns about the effectiveness and enforceability of Regulation 903. Accordingly, CELA concluded that Regulation 903 was inadequate to protect the environment and public health, and further noted that the amendments to Regulation 903 were inconsistent with recommendations from the Walkerton Inquiry.

On November 3, 2003, the Ministry of the Environment ("MOE") acknowledged receipt of CELA's Application for Review, and advised that the MOE's decision whether to conduct the requested review would be communicated to CELA by January 2, 2004. This 60 day timeframe for the MOE response is imposed by section 70 of the EBR.

Despite this statutory requirement, the MOE failed to respond to CELA by the January 2nd deadline. Therefore, CELA wrote to the MOE on January 15, 2004 to object to the delay and to request an immediate reply to the Application for Review. The MOE failed to respond to CELA's January 15th letter.

However, approximately two months after the January 2nd deadline had expired, CELA received a copy of the MOE's formal reply to the Application for Review. Interestingly, although the MOE's reply was dated January 15, 2004, it was not received at the CELA offices until March 1, 2004.

In essence, the MOE reply advises that the requested review of Regulation 903 will not be undertaken. In refusing CELA's Application for Review, the MOE argues that:

[1] CELA's Application for Review is available at: www.cela.ca.

- the Regulation 903 amendments "reflect extensive consultation with key stakeholders over a two year period",[2] and were based upon a multi-jurisdictional review of "best practices" and "best available science";

- the issues raised by CELA were largely "operational matters best addressed by trained and licenced persons who construct wells"; and

- some of CELA's concerns were based on a misinterpretation of Regulation 903, or involved "highly situational events not common to most well drilling operations across the province".

Not surprisingly, then, the MOE reply asserts that "taken as a whole, the amendments will greatly enhance the safety of groundwater drinking supplies in the province and will therefore not result in harm to the environment or the public".

CELA has carefully considered the MOE reply, which consists of a four-page cover letter signed by Brian Nixon, Director of the MOE Water Policy Branch ("the Nixon letter"), and an unsigned eleven-page document entitled *EBR Application for Review Decision Summary: EBRO File No. 03EBR009.R* ("the EBR Decision Summary"). Assuming that the EBR Decision Summary was also prepared under the auspices of the Water Policy Branch, there appears to be no evidence that Branch staff consulted the Provincial Well Coordinator (the MOE's lead expert in well construction and the Director of well licencing) or any other well experts within the MOE's Operations Division for the purposes of formulating a response to CELA's Application for Review.

It should be noted that this very issue was raised in the Ontario Legislature on May 10, 2004, when the Minister of the Environment was directly asked by the NDP environment critic whether the Provincial Well Coordinator had been consulted regarding this matter. The Minister declined to answer this question, and refused to commit to contacting the Provincial Well Coordinator and reporting back to the Legislature on the Coordinator's views on Regulation 903.[3]

CELA further notes that in her answers, the Minister referred to source protection and the forthcoming reports by the implementation and technical committees on source protection. CELA is a member of the implementation committee, and notes that the MOE's wells management program is more than just "source protection". Instead, this program is intended to protect groundwater and provide standards to ensure drinking water safety for private, public and communal well users across Ontario.

In any event, having reviewed the MOE reply, CELA concludes that the MOE reply is riddled with errors and omissions, and is largely unresponsive to the numerous concerns raised in the Application for Review.

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[2] CELA does not dispute that some stakeholder consultation occurred, but notes that the EBR Registry Notice regarding proposed amendments to Regulation 903 did not provide adequate public notice about some of the highly controversial changes being contemplated by the MOE, such as lowering the chlorination standard from 250 mg/L to "approximately" 50 mg/L. In addition, the Nixon letter (page 2) refers to MOE consultations with the well drilling industry, but does not mention any specific consultation with the well digging industry.

[3] *Hansard* (May 10, 2004).

In particular, the MOE reply (and Regulation 903 itself):

- ignores "best available science" and fails to address the serious health risks created by lowering the chlorination standard from 250 mg/L to "approximately" 50 mg/L;

- fails to ensure "best practices" in relation to:

    (a) removing chlorinated water from wells;

    (b) cleaning, developing and disinfecting of wells;

    (c) preventing unnecessary sedimentation of bedrock wells; and

    (d) using vermin-proof well caps and stainless steel well screens;

- fails to adequately regulate waterline connections;

- fails to require testing for dangerous naturally occuring gases that can be present in wellwater;

- fails to ensure proper regulation of test holes and dewatering wells;

- fails to prohibit or restrict the use of "used materials" in well system components;

- fails to ensure proper completion of pumping tests;

- fails to properly regulate the placement of sealant for both drilled and dug wells;

- fails to ensure effective compliance and enforcement activities; and

- fails to consider or implement the precautionary principle entrenched within the MOE's *Statement of Environmental Values*.

In summary, CELA submits that the MOE refusal to review Regulation 903 is completely unjustified, and that the reasons for the refusal, as set out in the MOE reply, are unpersuasive and unacceptable. CELA concludes that unless and until Regulation 903 is properly revised, public safety and environmental health remain at risk in relation to the construction, maintenance and decommissioning of wells across the province.

It should be noted that Regulation 903, as amended, has been in effect since August 1, 2003. On average, the MOE receives 15,000 water well records per year. Therefore, it appears that some 11,600 new wells have been constructed in Ontario during the past 9 months under the deficient standards contained within Regulation 903. This figure does not include the tens of thousands of pump installations where water well records do not have to be submitted to the MOE and test hole installations.

Accordingly, the purpose of this document is to provide a detailed response to the claims made within the MOE reply. For each concern raised in CELA's Application for Review, this document provides a synopsis of the issue, a description of the MOE reply, and an assessment by CELA of the adequacy of the MOE reply.

After this detailed review, this document concludes that the MOE reply is seriously inadequate if not largely misleading. CELA therefore recommends this matter warrants the immediate intervention of the Environmental Commissioner of Ontario pursuant to Part III of the EBR, as described below.

PART II – REGULATION 903: LEGAL, TECHNICAL AND ADMINISTRATIVE ISSUES

CELA's Application for Review raised 12 legal, technical and administrative issues regarding Regulation 903, as amended. These issues are outlined below, together with a summary of the MOE reply and CELA's response thereto.

1. Rollback of Disinfection Requirements

Issue

The CELA Application for Review raised various objections to the fact that the amendments to Regulation 903 greatly reduce chlorination requirements for new wells from 250 milligrams/litre to "approximately" 50 milligrams/litre. Among other things, CELA expressed concern that this reduction could leave harmful bacteria present in water when the well owner commences to use the well, and may allow such bacteria to migrate from the well into the aquifer and other nearby wells. In addition, CELA noted that the EBR Registry Notice for the amendments provided no advance notice to the public that the MOE was contemplating the reduction of the chlorination standard. CELA also expressed concern that the amendments failed to specify how the chlorine concentration is to be measured in order to determine compliance with the Regulation's reduced chlorination standard.

MOE Reply

The Nixon letter states that:

> One specific concern expressed in your application was the change in the standard for disinfection for new wells. This standard was strengthened by the Ministry because new research into the effectiveness of different doses of chlorine to disinfect wells indicate that optimal disinfection is approximately 50 mg/L of available chlorine. Lowering the chlorine concentration from 250 mg/L to 50 mg/L used to disinfect wells will raise its effectiveness at killing pathogenic microorganisms in new wells and increase public health and safety. This is consistent with the Ministry's *Procedure for Corrective Action for Systems Not Currently Using Chlorine*, PIBS 4441e, released on April 16, 2003 (page 2).

The EBR Decision Summary further states:

> The well must be pumped until no chorine [*sic.*] odour remains according to the regulation…
>
> The word "approximately" was retained in the regulation, because groundwater flows through the well during the disinfection time and maintaining an exact dose is not feasible.
>
> It is intended that the chlorine concentration is to be measured as residual chlorine. The wording remains the same as the old regulation: only the number has changed.
>
> Contractors should know how to calculate the concentration of chlorine in well water: the regulation does not need to specify how to do this.
>
> It is important to remember that the well owner continues to be responsible for the water quality of water from their well. It should be noted that in his second report, Justice O'Connor affirms this position (page 4).

CELA Response

CELA's response to the MOE reply regarding the reduction of the chlorination standard is as follows:

(a) It appears that the MOE reply does not dispute the fact that the EBR Registry Notice did not notify the public that the chlorination standard was going to be reduced to "approximately" 50 mg/L. In our view, it was incumbent upon MOE to provide proper notice about this critical change to a standard that is clearly intended to protect public health and safety. Either the MOE should have specifically flagged this proposed change in the initial EBR Registry Notice, or it should have re-posted the proposal for a further public comment period.

(b) The word "approximately" did <u>not</u> appear in the chlorination standard in Regulation 903 prior to the O.Reg. 128/03 amendments. Instead, section 15(1) simply provided that "the water in the well shall be chlorinated by the creation in the water of 250 milligrams of chlorine per litre of water". Therefore, it is inaccurate if not highly misleading for the MOE reply to suggest that "the wording remains the same as the old regulation".

(c) The MOE reply is unresponsive to CELA's concern that the inherent vagueness of the word "approximately" renders the chlorination standard virtually unforceable. In general, environmental regulations under Ontario law tend to limit the use of "approximately" to describe geographic locations, design specifications, or time intervals (i.e. where exact precision may not be necessary). In other words, Ontario's environmental regulations generally do not insert "approximately" to preface or qualify a prescribed numerical

standard for chemical or contaminant concentrations.[4] With respect to such scientific matters, it is necessary to define or establish accuracy by identifying an acceptable measurement method but leaving the standard as absolute.

(d) CELA disputes the MOE's claim that the word "approximately" is necessary because it is not "feasible" to maintain an exact 50 mg/L concentration while water is flowing through the well during disinfection. It is clear that the chlorination requirement is intended to be a minimum provincial standard. Thus, while it may be open to well contractors to maintain a chlorine concentration that slightly exceeds the prescribed standard, the MOE should not tolerate concentrations that fall below this minimum standard.

(e) Despite the MOE's claim regarding "feasibility", CELA notes that the previous chlorination standard under Regulation 903 was able to operate for many years without inclusion of the word "approximately". We further note that drinking water treatment standards recently promulgated under the *Safe Drinking Water Act* do not contain the word "approximately", even though water is continuously flowing through treatment equipment and distribution systems. For example, paragraph 1-4 of Schedule 1 of O.Reg.170/03 requires owners of municipal drinking water systems to ensure that "at all times and at all locations within the distribution system, the free chlorine residual is never less than 0.05 mg/L" where chlorination is used for secondary disinfection. In CELA's view, if "approximately" has no place in drinking water standards, then it also has no place in wellwater standards.

(f) The MOE reply – and Regulation 903 itself – still uses the inaccurate and outdated term "chlorine" to describe what is to be measured or maintained for disinfection purposes. Unfortunately, the term "chlorine" (or "available chlorine") is a scientific misnomer that should not be used or reflected in Regulation 903. As noted in an authoritative text on disinfection:

> The term "available chlorine" has no place in the field of water and wastewater treatment. In summary, the term "available chlorine" is a misnomer…
>
> The reader is cautioned that this term is not to be confused with "free available chlorine", which is the concentration of hypochlorous acid and hypochlorite ions existing in chlorinated water. To qualify as a *free chlorine* residual, HOCl [hypochlorous acid] must be 85 per cent of the total chlorine residual.[5]

Scientifically speaking, disinfection solutions (i.e. sodium hypochlorite, calcium hypochlorite, lithium hypochlorite, etc.) do not suddenly turn into the element "chlorine" once applied to wellwater. Instead, after reacting with water in the hydrolysis process, these solutions turn into hypochlorous acid (HOCl) and the hypchlorite ion (OCl-). The sum of the hypochlorous acid and hypochlorite ion in chlorinated water is called the

[4] Interestingly, section 18 of Regulation 176 under Ontario's *Consumer Protection Act* provides a definition of "approximately" to describe prescribed time intervals. However, CELA advocates the removal – not definition – of "approximately" in Regulation 903.

[5] G.C. White, *Handbook of Chlorination and Alternative Disinfectants* (4th ed., 1999), pages 221 and 223.

"chlorine residual". Hypochlorous acid kills bacteria more quickly and effectively than the hypochlorite ion, which is why the "free chlorine residual" should be at least 85% per cent hypochlorous acid, as described above. This is also why CELA's Application for Review recommended that Regulation 903 should be amended to require the measurement of "free chlorine residual" (as is found in O.Reg. 170/03), rather than "chlorine".

(g) Using the term "chlorine" (but then not defining "chlorine") in Regulation 903 creates considerable uncertainty as to how to assess chlorination practices for compliance purposes: by the initial solution dose, total chlorine residual, combined chlorine residual, or free chlorine residual? In light of this uncertainty, CELA derives no comfort from the MOE reply that well contractors "should know" what to calculate. In our view, the preferable and far simpler approach is to amend Regulation 903 to specify that "free chlorine residual" – not "chlorine" – is what is to be measured and maintained for disinfection purposes.

(h) The MOE reply concedes that although the term "chlorine" is used in Regulation 903, "it is intended that the chlorine concentration is to be measured as residual chlorine". First, it is unclear whether this MOE reference to "chlorine residual" is intended to actually mean "free chlorine residual" (with 85% hypochlorous acid, as described above). Second, if the MOE reply really does mean "free chlorine residual", then CELA fails to understand why the MOE is refusing to entrench or reflect that "intention" in Regulation 903. "Intentions" are admirable, but unless greater specificity is built into Regulation 903, well contractors and MOE abatement or enforcement personnel have little or no certainty what "chlorine" is supposed to mean for compliance purposes.

(i) In order to rationalize reducing the chlorination standard to 50mg/L, the MOE reply suggests that the MOE's new approach "is consistent" with the MOE's *Procedure for Corrective Action for Systems Not Currently Using Chlorine* (April 16, 2003). We have carefully reviewed this MOE Procedure, and we find that it supports – not subverts – CELA's Application for Review of Regulation 903.

First, we note that in several instances, the MOE Procedure provides for the temporary disinfection of E. coli bacteria (and other bacteria) by using a "free chlorine residual of 50 mg/L".[6] As described above, this terminology means that the chlorinated water must contain at least 85% hypochlorous acid. However, Regulation 903 uses the term "chlorine" rather than "free chlorine residual" (despite the MOE's "intention"), and thus on its face the Regulation permits a chlorination concentration that is different from (and less stringent than) the concentration found in the MOE Procedure.

Second, we note that Appendix C of the MOE Procedure provides a disinfection methodology aimed at achieving the 50 mg/L free chlorine residual (i.e. by adding one millilitre of a solution containing 5% sodium hypochlorite (common bleach) to water).[7]

[6] MOE, *Procedure for Corrective Action for Systems Not Currently Using Chlorine* (April 2003), pages 5, 7, 8, 10, 14 and 18.
[7] *Ibid.*, pages 23 to 24.

As described below, however, the amount of hypochlorous acid and hypochlorite ion resulting from sodium hypochlorite depends on a number of factors and reactions, such as pH (see below) or the presence of suspended solids or total dissolved solids. Based upon the Appendix C methodology (and using common chemistry calculations set out in Attachment 1 below), it appears that 1 millilitre of 5% sodium hypochlorite (i.e. 50 mg/L) only achieves an initial 1.28 milligrams of hypochlorous acid per litre of water, or 2.56 per cent of the 50 mg/L solution dose. The remainder of the chlorinated solution (48.52 mg/L) consists of the weaker and less effective hypochlorite ion. As noted above, free chlorine residual should consist of at least 85 per cent hypochlorous acid, rather than the 2.56 per cent calculated in accordance with the MOE Procedure. In our view, it is highly problematic that the MOE Procedure publishes and relies upon a prescribed concentration of 50 mg/L of free chlorine residual, but then provides disinfection methodology in Appendix C that misses the prescribed concentration by 82.44 per cent.

More alarmingly, if the same calculations are undertaken using the former standard of 250 mg/L under Regulation 903, applying sufficient 5% sodium hypochlorite solution to meet this standard will achieve an initial 2.90 milligrams of hypochlorous acid per litre of water (see Attachment 1). In other words, reducing the chlorination standard from 250 mg/L to 50 mg/L effectively reduces the amount of initial hypochlorous acid – the more powerful bacteria killer -- by approximately 55%. Therefore, lowering the chlorination concentration to 50 mg/L does not "strengthen" the standard, as claimed by the MOE reply. To the contrary, this reduction creates a profound risk to public health and the environment because the 50 mg/L standard generates a smaller amount of initial hypochlorous acid to kill harmful bacteria. Accordingly, CELA submits that Regulation 903 must be amended to restore the previous 250 mg/L standard and define chlorine as "free chlorine residual".

(j) The MOE reply claims that reducing the chlorination standard to 50 mg/L is based on "new research" and "best available science". First, it is noteworthy that the MOE reply fails to provide any actual references or citations for this "new research" or "best available science". Similarly, the MOE reply fails to provide any scientific references or citations to back its apparent belief that the previous 250 mg/L standard performed poorly or was somehow less effective than 50 mg/L for disinfection purposes. Accordingly, CELA concludes that there is a profound lack of "science" that supports the MOE's reduction of the chlorination standard. To the contrary, CELA submits that there is a strong scientific basis for reinstating the 250 mg/L standard, as described below.

(k) CELA is aware that the scientific literature demonstrates that as pH increases, the production of hydrochlorous acid decreases, and the hypochlorite ion increases, during the chlorination process. For example, certain disinfection solutions such as sodium hypochlorite and calcium hypochlorite may raise pH, while chlorine gas may decrease pH.[8] Since sodium hypochlorite and calcium hypochlorite are commonly used to "shock chlorinate" wells in Ontario, we suspect that the MOE's so-called "new research" is, in reality, the well-known and well-documented increase in pH when such solutions are

[8] G.C. White, *supra*, pages 213 to 219.

used. In any event, the effect of pH on chlorination does not justify lowering the chlorination standard to 50 mg/L.

In this regard, the MOE reply appears to overlook the existence of pH adjustment chemicals that make the previous 250 mg/L standard superior to the current 50 mg/L standard. These chemicals have been certified by the National Sanitation Foundation to create more hypochlorous acid in the chlorinated water. For example, Michigan's *Water Well Disinfection Manual* provides for the use of weak acetic acid (i.e. common vinegar) to counteract the high pH created by hypochlorite solutions.[9] Where such chemicals are used in the context of a 250 mg/L standard, it is clear that more initial hypochlorous acid will be produced than under a 50 mg/L standard.

(l) The MOE reply fails to take into account other basic chemistry principles affecting chlorination, such as the "reservoir effect" and "Le Chevalier's principle". These important matters have been described as follows:

> **Reservoir Effect of OCl- Ion:** The notion is valid that at high pH values the distribution of the two species titrable chlorine – HOCl [hypochlorous acid] and OCl- [hypochlorite ion] – is such that dissociation of the OCl- ion and the hydrogen ion provides a reservoir for the formation of HOCl. In accordance with Le Chevalier's principle, as soon as the HOCl in Eq. 6-5 is used up, more HOCl is immediately formed from the OCl- ion and the H+ ion to maintain the chemical equilibrium in Eq. 6-5.[10]

In other words, when the initial hypochlorous acid is used up, some of the hypochlorite ion will redistribute itself, based on the pH of the remaining solution, to form more hypochlorous acid. In effect, there will always be hypochlorous acid. <u>However, a 250 mg/L chlorine residual will always have more hypochlorous acid over a long period than 50 mg/L chlorine residual.</u> Therefore, lowering the chlorination standard from 250 mg/L to 50 mg/L is counterproductive if the regulatory objective is to kill pathogens and to protect public health.

(m) The MOE reply does not take into account the effect of "ionic strength" (or total amount of dissolved solids) when chlorinating wellwater. Simply put, high levels of dissolved solids such as iron (which can be very common in bedrock groundwater in Ontario) will significantly reduce chlorine residual.[11] This is true regardless of whether the chlorination standard is expressed as 250 mg/L or 50 mg/L. However, in areas where groundwater contains high total dissolved solids, it is five times more likely that a solution of the 50 mg/L standard will create significantly less (or no) hypochlorous acid than the 250 mg/L standard. In other words, lowering the standard from 250 mg/L to 50 mg/L significantly reduces the "margin of safety" for dealing with the effect of total dissolved solids.

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[9] Michigan, *Water Well Disinfection Manual*, pages 28 to 29.
[10] G.C. White, *supra*, page 407.
[11] *Ibid.*, page 217.

It should be further noted that chlorination doses larger than 50 mg/L are also important for destroying iron and sulphur reducing bacteria,[12] which are very common in Ontario and can be transferred by machinery used in well construction.

(n) The MOE reply fails to mention that the chlorination standard only applies where new wells are constructed and put into operation. The relevant sections of Regulation 903 provide as follows:

> 15(1). When the construction of a well, other than a flowing well, is completed, the water in the well shall be chlorinated to a concentration of approximately 50 milligrams of chlorine per litre of water and maintained at that concentration for a period of at least 12 hours.
>
> 15(2). If pumping equipment is installed in a well,
>
> (a) the chlorinated water shall be brought into contact and maintained in contact with all areas of the pumping equipment that will come into contact with the water in the well is in use; and
> (b) at the end of the 12-hour period of chlorination, the chlorinated water shall be pumped from the well until no odour of chlorine remains in the well water.
>
> 16. Sections 12 to 15 apply only to the construction and putting into operation of a new well except as otherwise provided therein.

Sections 15(1) and (2) do not "otherwise provide" that its standards apply to situations other than the construction and putting into operation of new wells. In other words, the combined effect of the above-noted sections is that repairs to existing wells and pumps (which are considered to be well construction activities under section 35(2) of the *Ontario Water Resources Act*) do not trigger the duty to chlorinate wellwater after repairs have been completed. Given that there are 750,000 existing wells across Ontario, CELA submits that limiting the chlorination standard only to new wells places public health and safety at risk, and represents a major loophole under Regulation 903 that should be reviewed and revised.

(o) The MOE reply states that well owners continue "to be responsible for the water quality of the water from their well". It should be noted, however, that Regulation 903 is just part of the regulatory framework administered by the MOE to ensure drinking water safety, and it is not restricted solely to private wells owned by individuals. In fact, all public and other communal wells are also subject to Regulation 903, and it is apparent that the MOE has overall responsibility for inspecting communal wells and ensuring that communal well owners meet minimum water quality standards. In addition, section 11 of Regulation 903 makes it abundantly clear that the onus is on well contractors – not well owners – to comply with the construction standards prescribed under the Regulation. Therefore, it is not entirely accurate for the MOE to suggest that ultimately it falls upon the well owner alone to ensure water quality within wells.

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[12] *Ibid.*, page 507

CELA is aware that in the Part II Walkerton Report, Mr. Justice O'Connor indicated that private well owners should remain responsible for the safety of their own water.[13] However, it should be noted that this was a suggestion, rather than a formal recommendation. Moreover, Mr. Justice O'Connor did recommend that the provincial government should prepare and distribute public information about how to supply safe water, "thoroughly apply" the well contractor licencing regime, and ensure easy availability of microbiological testing, including testing for E. coli.[14] He further stated that Regulation 903 should be reviewed and updated if necessary to ensure that it requires best construction practices.[15] Unfortunately, during Part II of the Walkerton Inquiry, Mr. Justice O'Connor did not have an opportunity to review and comment upon the proposed amendments to Regulation 903, nor did he have an opportunity to hear from the MOE's Provincial Well Coordinator regarding necessary improvements to Regulation 903. In fact, Mr. Justice O'Connor wrote that:

> The government has recently proposed changes to the way it regulates wells. I am not in a position to comment on the proposed changes because they have been introduced only recently.[16]

Accordingly, it is misleading for the MOE reply to suggest that its current approach to wellwater chlorination is somehow consistent with, or otherwise sanctioned by, Mr. Justice O'Connor's recommendations.

(p) In summary, Regulation 903, as amended, uses the misnomer "chlorine", reduces the chlorination standard to 50 mg/L without public notice or scientific justification, and inserts the vague term "approximately" to further qualify the reduced chlorination standard. In CELA's view, these regressive "reforms" contravene the precautionary principle reflected in the MOE's *Statement of Environmental Values*, and clearly undermine the MOE's ability to effectively enforce the chlorination standard. The MOE approach is also inconsistent with Recommendation 75 of the Part II Walkerton Report, in which Mr. Justice O'Connor called for "strict enforcement" of all regulations and provisions related to drinking water safety. The net effect is that the reduced chlorination standard jeopardizes the health and safety of the millions of Ontarians who rely upon private or municipal wells for drinking water purposes. Accordingly, the chlorination standard in Regulation 903 must be reviewed and revised forthwith.

2. Removing Chlorinated Water from New Wells

Issue

CELA's Application for Review noted that Regulation 903, as amended, does not require well contractors to remove highly chlorinated wellwater from newly constructed wells unless and

[13] Part II Walkerton Report, page 479.
[14] *Ibid.*, Recommendation 86.
[15] *Ibid.*, page 480.
[16] *Ibid.*, footnote 7.

until the well pumping equipment is installed. Where there is a significant lag time between well construction and pump installation, CELA expressed concern that such delay created the potential for chlorinated wellwater to migrate into groundwater and threaten downgradient wells, particularly in highly fractured bedrock.

MOE Reply

The EBR Decision Summary states that:

> The previous concentration of 250 mg/L in the Regulation was in use for many years and this has not been a reported problem to the Ministry of chlorinated wellwater migrating to other wells. Dilution by groundwater flow removes the likelihood for chlorinated wellwater migrating into other wells, and if concentrations are kept at 50 mg/L, as required by the new Regulation, then the likelihood of human health impacts is negligible (pages 4 to 5).

CELA Response

CELA's response to the MOE reply regarding the removal of chlorinated wellwater is as follows:

(a) Regardless of whether the chlorination standard is 250 mg/L or 50 mg/L, the MOE reply does not adequately address concerns raised by CELA in relation to the potential migration of chlorinated wellwater. Even if true, the MOE suggestion that this problem has not been reported to the MOE is not determinative of the issue. Indeed, since the MOE does not accept that this problem exists, it seems unlikely that MOE staff have been directed to undertake field investigations or inspections in relation to this issue. In any event, it appears that the MOE reply does not dispute CELA's contention that Regulation 903 does not require the removal of chlorinated water from new wells without pumps.

(b) The MOE reply fails to offer any empirical evidence to support its claims that groundwater flow will "dilute" chlorinated wellwater, and that the new 50 mg/L standard will result in "negligible" human health impacts. At best, such claims amount to mere conjecture or sheer speculation by the MOE.

(c) The MOE's "dilution" argument appears premised on the now-discredited theory that "dilution is the solution to pollution", and is clearly inconsistent with section 30(1) of the *Ontario Water Resources Act*, which makes it an offence to discharge any material into water (including groundwater and wellwater) that "may" impair water quality. The "dilution" argument is also inconsistent with the precautionary principle entrenched within the MOE's *Statement of Environmental Values*, and conflicts with the Ontario government's commitment to preventing contaminants from getting into sources of drinking water in the first place.

(d) To address Mr. Justice O'Connor's "best construction practices" approach (Recommendation 86), CELA recommends that instead of relying upon groundwater to attenuate chlorinated wellwater, Regulation 903 should attempt to control such

contamination at source by requiring the expeditious removal of chlorinated wellwater as part of the well cleaning protocol, as described below. For example, Michigan's *Water Well Disinfection Manual* states that:

> Flushing a water supply after treatment with chlorine is required to remove the chlorine residual from the well.[17]

(e) In summary, if it is appropriate for Regulation 903 to require the removal of chlorinated water when pumps are installed on new wells, then a precautionary approach would require the same action for new wells without pumps.

3. Cleaning New Wells

Issue

CELA's Application for Review noted that Regulation 903, as amended, does not require well contractors to properly clean and develop new wells by removing sediment and other foreign materials generated by well construction activities. The presence of such substances in new wells can render wellwater undrinkable, interfere with disinfection, and decrease the service life of pumping equipment.

MOE Reply

The EBR Decision Summary states:

> Sediments, sand and silt will be disinfected when the chlorine is added to wellwater as required by section 15 of the Regulation.
>
> Section 11(6) of the regulation requires a well to be developed. Where the well is not developed to a sand-free state, the person constructing the well must notify the well owner of the condition and make note of the condition on the well record, which is reported to the Ministry of the Environment.
>
> Section 11(4)(a) [of] the regulation also requires that on the day the well is completed, the person constructing the well shall provide the owner of the well with a 1 litre sample from the well for visual inspection.
>
> It would not be in their own interest, for the well contractor to show the well owner a sample of water that is not sand-free and to record it on the well record. As well, leaving sediments in a well produces a lower yield of water.
>
> Furthermore, section 14(4) of the regulation requires the water-producing zone to be filled with clean, washed gravel or sand that is,
>
> (i) deposited after placement of the casing, or

[17] Michigan, *Water Well Disinfection Manual*, page 18.

(ii) developed, after placement of the casing and sealant, by surging water through the intake zone to remove the adjacent fine-grained soils.

This is consistent with other jurisdictions who also do not stipulate the removal of all sediments and foreign material from new private wells (page 5).

CELA Response

CELA's response to the MOE reply regarding well cleaning is as follows:

(a) According to the Nixon letter, the amendments to Regulation 903 were based upon "best practices" used by "leading jurisdictions" (page 1). If this was true, then it is unclear why the MOE reply relies upon jurisdictions that do not require removal of sediment and foreign material from new wells. In our view, if the MOE was genuinely interested in ensuring "best practices" regarding cleaning, then the MOE should have considered and adapted cleaning requirements from progressive jurisdictions such as Michigan and Wisconsin, as described below.

(b) With respect to the reference in the MOE reply to section 15 of Regulation 903, CELA points out that the amendments changed the title of this section from "chlorination" to "disinfection". In our view, this is a subtle but significant change because section 15, as amended, merely requires shock chlorination, not multi-stage disinfection. As noted in the American Water Works Association standards[18] and Michigan's *Water Well Disinfection Manual*, proper "disinfection" means more than simply chlorinating the wellwater with common bleach. This distinction is explained in the Michigan's *Manual* as follows:

> Disinfection is a process that includes the following components:
>
> 1. Proper water supply preparation, including the sanitary completion of the water well through cleaning of existing wells, and the proper development (sediment removal) of new wells.
> 2. Thorough flushing of the water supply.
> 3. Treatment with a properly prepared chlorine solution.
> 4. Collection and analysis.[19]

The Michigan *Manual* further states:

> Well water must be free of turbidity. Suspended particles in turbid water interfere with the chlorine's efforts to make contact with and kill microorganisms (Le Chevalier et al. 1981)…
>
> Dirty surfaces and turbid water cannot be effectively treated with chlorine… thereby decreasing the effectiveness of the chlorination process… [I]nterfering

[18] ANSI/AWWA C654/97 and A100/97.
[19] Michigan, *Water Well Disinfection Manual*, page 5.

> substances include… inorganic matter (sand, silt, clay)… organic matter (synthetic chemicals or biological materials)… drilling mud/additives…dissolved iron and other minerals [and] drill cuttings. Only clean surfaces in a well render themselves to effective disinfection with chlorine (Coombs, 2001). Proper development [and] thorough flushing of a water supply can effectively clean exposed surfaces, remove turbid water, and help remove most interfering substances.[20]

Similarly, Wisconsin's water well regulations require proper well cleaning:

> (1) **Development**. All wells shall be developed until the water is practicably clear and free of sand by one of, or a combination or modification of, the following methods…[21]

Thus, by focusing solely on shock chlorination, section 15 of Regulation 903, as amended, does not require comprehensive disinfection of wells. In other words, the section 15 fixation on shock chlorination leaves out the other critical steps in proper well disinfection: water supply preparation, well development (sediment removal), thorough flushing, and post-treatment water sampling/analysis.

(c) The MOE reply erroneously states that "section 11(6) of the regulation requires wells to be developed". In fact, the actual text of section 11 (6) simply provides as follows:

> Where construction of a well is completed but the well is not developed to a sand-free state, the person constructing the well shall notify the well owner of this condition and shall make note of it on the well record.

In other words, this section does <u>not</u> impose a mandatory duty to develop a new well. Section 11(6) is only operative if the well contractor voluntarily attempts to develop a well, but cannot achieve a sand-free state. Even then, the section only imposes a reporting obligation upon the well contractor. Therefore, it is inaccurate and misleading for the MOE reply to indicate that section 11(6) requires wells to be developed. In fact, there is <u>no</u> section in Regulation 903, as amended, that requires new wells to be thoroughly developed, cleaned and flushed prior to treatment, or that requires proper water sampling and analysis after treatment to ensure that treatment is effective.

(d) The MOE reply further suggests that section 14(4) of the Regulation 903 requires wells to be "developed" by surging water through the water intake zone. It must be pointed out, however, that this standard is only operative in rare situations where an overburden drilled well encounters "fine grained soils" in the water intake zone that must be removed via surging techniques. Accordingly, bedrock wells and wells in which "clean" sand/gravel have been placed are not subject to the section 14(4) surging requirement. It should be further noted that "surging" (i.e. by air or mechanical means) merely pushes

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[20] *Ibid.*, pages 9 and 23.

[21] Wisconsin Department of Natural Resources, Chapter NR 812, Well Construction and Pump Installation, NR812:22 Finishing Operations, NR 812.22(1), Development, page 167.

water back and forth through the material deposit.[22] Therefore, after surging has been completed, a well contractor should still pump and clean out the well, but Regulation 903, as amended, does not require such activity.

(e) There is no scientific basis for the claim in the MOE reply that "sediments, sand and silt in a well will be disinfected when chlorine is added to the water". As noted above in the Michigan *Manual*, it is well-established that sediment will, in fact, use up chlorinated water and decrease the overall effectiveness of the dose. This is precisely why Regulation 903 should require the removal of sediments from new wells prior to treatment.

(f) The MOE reply notes that since section 11(4) of Regulation 903 requires well contractors to show a wellwater sample to the well owner, it would not be in the "interest" of the contractor to show a sample that was not sand-free. CELA submits that this MOE argument carries no weight because the issue is not what is – or is not – in the "interest" of the contractor. Instead, the issue is how to protect societal interests by ensuring the health and safety of well owners and users across Ontario. In our view, this issue is best addressed by requiring the removal of sediment from new wells, rather than leaving this critical matter to the pecuniary interest of well contractors.

(g) In summary, despite changing the title of section 15 from "chlorination" to "disinfection", Regulation 903, as amended, still lags behind regulations in other leading jurisdictions that require proper well development and cleaning as a matter of law, rather than a matter left to well contractors' discretion. Therefore, Regulation 903 should be reviewed and revised accordingly.

4. Introducing Sediment into Bedrock Wells

Issue

The CELA Application for Review stated that Regulation 903, as amended, requires contractors to place "clean, washed" sand or gravel within the water-producing zones of bedrock wells. CELA expressed concern that this practice could impair groundwater flow, decrease well yield, interfere with chlorination, and shorten the service life of pumping equipment.

MOE Reply

The EBR Decision Summary states:

> The statement is incorrect since the clean, washed sand or gravel of section 14(4)1 is the be placed in the annular space only. There is no annular space in an open hole (page 5).

CELA Response

CELA's response to the MOE reply regarding sand/gravel placement is as follows:

[22] Dr. F. Driscoll, *Groundwater and Wells* (2nd ed., 1986), pages 504 to 509.

(a) The MOE reply is unresponsive to the CELA concerns, and fails to consider the following provisions of Regulation 903:

1. "annular space" means an open space between a casing and the side of a well, and includes space between overlapping casings within the well;

"casing" means pipe, tubing or other material installed in a well to support its sides;

14(4) If a well is constructed by a method other than digging or the use of a driven point, the annular space shall be filled from the bottom of the well to the ground surface with suitable sealant in accordance with the following rules:

1. The water-producing zone shall be filled with clean, washed gravel or sand that is,

i. deposited after placement of the casing, or
ii. developed, after placement of the casing and sealant, by surging water through the intake zone to remove the adjacent fine grained soils.

In typical bedrock well construction, the well borehole is open for some distance because the consolidated bedrock itself is strong enough not to collapse in the well bore. Having regard for the above-noted definitions, annular space is only located adjacent to well casing, which is supposed to be continuous and watertight: see subsections 13(5) and 13(18) of Regulation 903. Accordingly, the area <u>below</u> the well casing is the only location that is open in a well to allow flow from the water-producing zones to enter the well. By definition, since annular space only exists alongside the well casing, then no annular space exists in the water-producing zone of a well. Therefore, as currently drafted, section 14(4)1 does, in fact, require contractors to place sand or gravel in the water-producing zone.

(b) CELA's interpretation of the above-noted provisions is supported by the MOE reply in the EBR Decision Summary in relation to well screens:

> The requirement for casing in Regulation 903 does not extend to well screens.
>
> "Intake zone" for for screened overburden wells means the part of the well where water enters the well through the well screen. Intake zone for bedrock wells is either the screened portion of the well if there is a screen or the open bore part of a well (page 9).

(c) CELA notes that the Nixon letter (page 3) describes public meetings involving the well industry that were held in November 2003 to explain the amendments to Regulation 903. It is CELA's understanding that at such meetings, MOE staff presented slides that, in fact, depicted a bedrock well filled with sand/gravel material. Thus, it appears that

CELA's interpretation of section 14(4)1 is supported by the MOE's public outreach program.

(d) In summary, despite the assertions of the MOE reply, section 14(4)1 does require the placement of sand or gravel in the water production zone (i.e. the area below the annular space and well casing). To our knowledge, no other jurisdiction requires this highly unusual well construction. Thus, this requirement is inconsistent with the Part II Walkerton Report recommendation that Regulation 903 should ensure best construction practices. Similarly, this requirement is contrary to the precautionary principle reflected in the MOE's *Statement of Environmental Values*. Therefore, Regulation 903 should be reviewed and revised accordingly.

5. Sealing Waterline Connections

Issue

CELA's Application for Review noted that Regulation 903, as drafted, does not require waterline connections to be watertight while they are above-ground and awaiting burial and final grading. CELA expressed concern that until final grading has been completed, exposed waterlines serve as a potential entry point for contaminants.

MOE Reply

The EBR Decision Summary states:

> Predominantly, connections are made below ground. Given the climate of Ontario, few waterlines are connected to casing above-ground because they would freeze. If the connection is made above-ground, it is only on a temporary basis before the final grading of new well construction. At the time of construction, if the person constructing the well is aware that the connection is intended to be underground, it is the responsibility of the person constructing the well to make the connection watertight as required by section 17(1) of the regulation (page 6).

CELA Response

CELA's response to the MOE reply regarding waterline connections is as follows:

(a) CELA is fully aware that waterlines are generally buried due to Ontario's winter climate. However, the concern raised in the Application for Review was premised, in part, on the fact that there may be extensive delay from the time the waterline connection is first made to the time the waterline is actually buried. For example, where a well is constructed in the spring, the waterline may remain exposed to the elements (and potential contaminants) for several months if final grading does not occur until the summer or fall. Although the MOE reply characterizes this exposure as "temporary", CELA can see no reason why Regulation 903 should not require all waterlines to be watertight, regardless of whether they are above- or below-ground.

(b) The MOE reply does not dispute CELA's interpretation that section 17(1) does not impose a minimum standard for above-ground connections, regardless of whether they are temporary or permanent. Indeed, section 17(1), on its face, only imposes the watertightness standard "if" the waterline connections are below-ground. Thus, Regulation 903 itself contemplates situations where waterline connections may not necessarily be buried. Indeed, the MOE's EBR Decision Summary notes that waterlines are "predominantly" buried, which leaves open the possibility of an above-ground connection (i.e. within a structure or building). In our view, section 17(1) should apply to all waterlines without exception.

(c) Regulation 903 requires the top of wells to have tight connections, such as vermin-proof well caps, in order to keep contaminants I.e. insects) out of the wellwater system and the groundwater resource. In CELA's view, it would be equally prudent for section 17(1) of Regulation 903 to impose a minimum standard to ensure that at all material times, all waterline connections are watertight, regardless of whether they are above- or below-ground.

(d) In summary, Regulation 903, as amended, does not adequately regulate waterline connections, and is not sufficiently protective of public health and the environment. CELA submits that this omission is contrary to the precautionary principle reflected in the MOE's *Statement of Environmental Values*. Therefore, Regulation 903 should be reviewed and revised accordingly.

6. Testing for Explosive/Dangerous Gases

Issue

CELA's Application for Review stated that Regulation 903, as amended, does not adequately address the risks associated with explosive, noxious or radioactive gases (i.e. methane, hydrogen sulphide, and radon) that may be intercepted or exposed by wells in certain areas of Ontario. In particular, CELA expressed concern that Regulation 903 does not properly define such gases, and does not require well contractors to identify, evaluate or quantify such gases if encountered.

MOE Reply

The EBR Decision Summary states:

> Chlorine gas from chlorinated water can only be generated when the pH of the water is below a pH of 5, whereas natural groundwater has a pH well above a pH of 5. In addition, chlorine disinfectants used in wells increase the pH of the well water.
>
> Situations of naturally occuring gas in the province are uncommon. Nothing in the regulation prevents the person constructing the well from using equipment to test for natural gases. It could be onerous to require persons constructing wells to use equipment to test for natural gases in areas where it is known that there is no natural gas occuring….

Section 21(4)(c) and (d) of the regulation requires the well owner to abandon a well that contains natural gas or other gas or produces water that is not potable or permits the movement of natural gas between subsurface formations or between a subsurface formation and the ground surface.

Section 21(1)5 of the regulation also places an obligation on the person who abandons a well to ensure that the well is plugged in order to prevent the movement of water, natural gas or contaminants between subsurface formations or between a subsurface formation and the ground surface

Section 18(1)(e) of the regulation states that if natural gas is present, the air vent must extend to the outside atmosphere to release gases that may accumulate in the well (pages 6 and 7).

CELA Response

CELA's response to the MOE reply regarding natural gases is as follows:

(a) The MOE reply fails to provide any science or statistical information to substantiate its claims regarding chlorine gas or the alleged "uncommon" occurence of natural gases across Ontario. With respect to chlorine gas, CELA agrees that some hypochlorite solutions can, in fact, increase pH. As described above, however, certain acids can be used by well contractors to lower pH in order to create hypochlorous acid. In addition, it is possible to chlorinate water with chlorine gas, which also reduces pH.[23] In any event, the reality is that there is a clear potential for the generation of dangerous chlorine gas emanating from treated water within the well.

(b) The MOE reply claims that since natural gases are "uncommon" in Ontario, it would be "onerous" to impose testing standards under Regulation 903 in relation to such gases. CELA submits that this claim is not supported by the MOE's own data and publications. For example, on the basis of water well records submitted to the MOE, it is CELA's understanding that almost 19,000 water wells have been reported to have naturally occuring methane or hydrogen sulphide gases. From a public health perspective, this number is significant because both methane and hydrogen sulphide are known to be explosive at relatively low concentrations in the air. In addition, at sufficient concentrations within residences and confined locations, methane can displace oxygen in the air (thereby causing suffocation), and hydrogen sulphide can also be poisonous to humans.

(c) Similarly, CELA notes that an MOE publication regarding wells confirms that dangerous gases can be encountered in certain areas of Ontario:

[23] G.C. White, *Handbook of Chlorination and Alternative Disinfectants* (4th ed., 1999), page 213.

> Many water wells, particularly in southwestern Ontario, produce water containing some natural gas. Natural gas escaping into an enclosed well pit or shed has been known to cause explosions and fires (emphasis added).[24]

As noted in CELA's Application for Review, dangerous natural gases are not confined to southwestern Ontario. In fact, such gases are known to be present in bedrock wells central and southeastern Ontario (i.e. the Trenton/Picton area, Lake Scugog area, and the Hawkesbury/Plantagenet area). Thus, the presence of dangerous gases is clearly more widespread across the province than the MOE reply cares to admit.

(d) The MOE reply's claim that testing would be too "onerous" is unjustified and unacceptable, particularly in light of the serious risks posed by such gases if present in wellwater. In our view, protecting the health of well owners, users and drillers takes precedence over the MOE's misplaced concern about inconveniencing well contractors (who may incur slight additional cost) by imposing minimum testing standards.

(e) While Regulation 903 does not prescribe a protocol or methodology for gas testing, CELA notes that well contractors are required to report "natural gas" if encountered: see section 20(2). However, CELA understands that it is common for contractors to become aware of gas by either smelling it or igniting it, rather than using analytical equipment in the field. In CELA's view, this practice makes gas detection too subjective or "hit-or-miss" in nature, and we remain concerned that numerous wells are not being properly tested for dangerous gases, even in areas where such gases are known to exist.

(f) The MOE reply states that where natural gas is present, section 18(1)(e) of Regulation 903 requires the well's air vent to direct the gases to the outside atmosphere for release. This MOE comment is misleading in that section 18 only applies to drilled wells with pumps. In other words, the gas venting requirement does not apply to any other type of well, including wells without pumps. Given the limited application of section 18, the MOE reply does not alleviate CELA's concern about naturally occuring gases in wellwater.

(g) CELA derives no comfort from the MOE's assurance that well owners are supposed to abandon and plug wells containing natural gas or other gas in accordance with section 21(4) of Regulation 903. This duty will only be triggered if the well owner is advised by the well contractor that such gases are present. However, Regulation 903 does not require contractors to actually undertake gas testing, as described above. Moreover, Regulation 903 does not even define "natural gas" or "other gas",[25] and thus provides no specificity as to what well owners or contractors should be looking for in terms of dangerous gases. Therefore, the mere existence of abandonment procedures under Regulation 903 does not adequately respond to CELA's concerns regarding naturally occuring gases in wellwater.

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[24] MOE, *Water Wells and Groundwater Supplies in Ontario* (1980), page 61.

[25] We presume that "other gas" does not mean the ambient air in the upper column of the well. However, by using this open-ended (and undefined) term "other gas", Regulation 903 remains highly ambiguous and virtually unenforceable in relation to this issue.

(h) CELA notes that section 21(5) of Regulation 903 allows well owners to avoid well abandonment if they obtain the written consent of the Director. This exemption opportunity exists not only where the well contains natural gas or other gas, but also where the well does not produce potable water.[26] To our knowledge, the MOE has not yet developed or publicized a well exemption process. In the absence of such a process, it is unclear to CELA whether the MOE can actually apply or enforce the well abandonment/exemption provisions of Regulation 903.

(i) In summary, the MOE reply is unresponsive to CELA's concerns regarding naturally occurring gases. While the MOE claims such gases are "uncommon", the MOE's own records and publications suggest otherwise. Given the precautionary approach entrenched in the MOE's *Statement of Environmental Values*, and given the serious health risks posed by such gases, it is readily apparent that Regulation 903 should specifically define these gases and should impose minimum gas testing standards. Therefore, Regulation 903 must be reviewed and revised accordingly.

7. Construction Standards for Test Holes

Issue

CELA's Application for Review states that Regulation 903, as amended, exempts test holes from many important standards prescribed by the Regulation. CELA expressed concern that unless test holes are properly constructed, maintained and decommissioned, they can create pathways for surface contaminants to reach groundwater resources.

MOE Reply

The EBR Decision Summary states:

> The Regulation for the first time has many specific requirements for test holes and dewatering wells, including licencing, tagging, record-keeping and decommissioning requirements. Furthermore, test holes and dewatering wells are required to prevent any movement of water, natural gas, contaminants or other material between subsurface formations or between [a] subsurface formation and the ground surface.
>
> The majority of the test wells and dewatering wells are in the ground for a short period of time only (within 30 days of construction). Proper abandonment of these wells is the primary objective. All test holes and dewatering wells must be abandoned properly according to the provisions of Reg. 903. All test holes and dewatering wells over 30 days must be tagged and reported to the Ministry. For wells open more than 180 days, there are applicable requirements in most sections…

[26] "Potability" is now defined as meaning that the water must meet Ontario Drinking-Water Quality Standards (O.Reg.169/03): see section 10 of the *Safe Drinking Water Act, 2002*.

> Also, test holes or dewatering wells that are made to a depth of not more than 3.0 below the ground surface (a "shallow work") are **not exempt** from the requirements of the regulation if they are constructed in a contaminated area, or if they penetrate an aquitard, or if they are construction in an area with conditions to likely result in flowing wells (original emphasis, pages 7 to 8).

CELA Response

CELA's response to the MOE reply regarding test holes/dewatering wells is as follows:

(a) CELA's Application for Review listed 15 examples of exemptions that exist under Regulation 903 in relation to test holes and dewatering wells. The MOE reply does not dispute the existence of such exemptions, but suggests the exemptions are appropriate given the short-term nature of test holes and dewatering wells. It should be noted, however, the MOE reply provides no statistical evidence to substantiate its claim that "the majority" of test holes and dewatering last less than 30 days. In fact, the MOE reply itself concedes there are instances where test holes and dewatering wells can be operated for periods of time in excess of 180 days. Given that tens of thousands of test holes and dewatering wells are established in Ontario each year, CELA derives no comfort from the MOE reply.

(b) With respect to test holes and dewatering wells less than 3 metres in depth (i.e. shallow works), there are a number of interpretive questions arising under Regulation 903. For example, section 1.1(1) generally exempts all such holes and wells from Regulation 903, unless they are constructed in a "contaminated area", "penetrate a formation that is not an aquifer", or may "result in flowing wells". While the term "flowing well" is defined, the term "contaminated area" is not defined in Regulation 903, which creates uncertainty as to what this provision actually means (i.e. "brownfield" sites? waste disposal fill areas? contaminant attenuation zones? some other type of area where "contaminants" are known or suspected to be present?). Similarly, does a "formation that is not an aquifer" mean an aquitard, as suggested by the MOE reply? If so, "aquitard" is not defined in the Regulation, and, in any event, it is unclear how MOE officials will be able to prove that water entering a test hole is not coming from an "aquifer" (i.e. pumping tests? water analysis?).

(c) Section 1.1(2) also requires the separation and storage of the major soil horizons that are excavated to construct test holes or dewatering wells. Thus, this provision does not appear to address common instances where test holes are drilled into bedrock but little or no soils exist, or where dewatering wells are established via point wells that are driven or jetted into the ground with little or no soil excavation. In addition, section 1.1(2) requires excavated areas to be backfilled, but imposes no timeframe or deadline for backfilling to be undertaken or completed. Similarly, this section does not specify what should happen if there is insufficient excavated soil to fill the hole, nor does it specify that contractors must use impermeable materials to fill the opening. CELA's concern is that as long as the hole or pit remains open (or if it is not properly backfilled), it creates both a physical safety hazard as well as a potential pathway for contaminants.

(d) CELA further notes that boreholes constructed for highway and foundation work are considered to be test holes under Regulation 903. In general, these boreholes are constructed under the supervision of a professional engineer or geoscientist in order to obtain soils or groundwater information rather than to draw water for drinking purposes. Such boreholes are usually left open to conduct short-term field observations or measurements, and are presumably plugged with material that will prevent downward migration of contaminants. Significantly, section 11(1) of Regulation 903 prescribes that persons constructing wells (which include test holes: see section 1) must comply with sections 12 to 15, 17 and 18. Among other things, this means that well casing must be installed, but the above-noted boreholes are not constructed with casing since they are usually plugged quickly. Indeed, section 11(5.3) exempts certain types of uncased test holes from water well record requirements. In our view, this is but one example of where there is internal inconsistency within Regulation 903 when well standards are applied to test holes.

(e) In summary, many types of test holes and dewatering wells appear to be subject to more exemptions than standards under Regulation 903, as amended. In our view, this relaxed approach is inconsistent with the "multi-barrier approach" recommended by Mr. Justice O'Connor, and contravenes the precautionary principle entrenched within the MOE's *Statement of Environmental Values*. In addition, there are serious difficulties in interpreting, applying and enforcing Regulation 903 in relation to test holes. CELA submits that instead of imposing "one-size-fits-all" well standards for test holes (but then establishing numerous exemptions for test holes), it would make far more sense to amend Regulation 903 to include a new part that imposes appropriate standards for various types of test holes. Alternatively, the MOE could develop a new regulation with standards specifically aimed at test holes. In either case, Regulation 903 should be reviewed and revised accordingly.

8. Using "Used Materials" for New Wells

Issue

The CELA Application for Review states that aside from well casing (which must be "new material": see section 13(1)), Regulation 903, as amended, does not prohibit the use of "used materials" in new well systems, and does not set out minimum standards regarding the utilization of "used materials". CELA expressed concern that used materials (i.e. well caps, vents, foot valves, pumps, waterlines, injectors, pitless adapter connnections, etc.) may be weathered, expire prematurely, contain latent defects, or contain foreign substances from previous uses or applications.

MOE Reply

The EBR Decision Summary states:

Some of the main components of a new well is [*sic*.] its casing, the sealant around the outside of the casing, and the well cap. The regulation requires that new casing be used in the construction of a well, and also has specifications for the well cap and for sealants that must be complied with. The well owner has the right to decide whether the pump installed to provide water from the well is new or used. However, after every well construction or repair, the regulation also specifies that the well must be disinfected for a minimum of 12 hours thereby eliminating any bacterial contamination that might have been introduced during the work (page 8).

CELA Response

The CELA response to the MOE reply regarding used materials is as follows:

(a) The MOE reply does not dispute CELA's statement that Regulation 903 permits the utilization of used materials for every well component except casing. However, the MOE claims that any bacterial contamination caused or permitted by well construction or repair will be eliminated by the 12 hours of disinfection required by Regulation 903. This MOE claim is erroneous and misleading for several reasons. First, the "disinfection" required by the Regulation is, in reality, "chlorination", and there is scientific reason for believing that lowering the chlorination standard from 250 mg/L to "approximately" 50 mg/L greatly impairs the efficacy of treatment (i.e. less hypochlorous acid), as discussed above. Second, the chlorination standard generally applies only to new wells or to the putting into operation of new wells (i.e. new pump installation in new wells): see section 16. In other words, contrary to the MOE claim, the chlorination standard does <u>not</u> apply when there has been a well "repair" (i.e. fixing the casing or removing the pumping equipment). Third, disinfection will not remedy latent defects within used materials. Thus, there is no basis for the MOE suggestion that bacterial risks posed by used materials will be ultimately addressed by the initial chlorination of wellwater.

(b) The MOE reply indicates that it is up to the well owner to decide whether new or used materials are utilized within the well system. It must be noted, however, that Regulation 903 applies not only to private individual wells, but also to all public and communal wells in Ontario. In our view, it is inconceivable that owners of public or communal wells have the "right" to insist upon used materials for virtually all well components except casing. CELA submits that such an approach contravenes the precautionary principle as reflected in the MOE's *Statement of Environmental Values*, and it is inconsistent with Mr. Justice O'Connor's endorsement of "multi-barrier protection" and "best construction practices".

(c) In summary, the MOE reply is unresponsive to the CELA concerns regarding used materials in well systems. In our view, if Regulation 903 does not prohibit used materials, then, at the very least, the Regulation should prescribe minimum standards for the use of such materials in order to protect public health and safety. In this regard, CELA notes that the Ontario Building Code (O.Reg. 403/97) prescribes standards for, and regulates the use of, "used materials" for building construction purposes. In fact, Part 7 (Plumbing) of the Building Code restricts the use of "used materials and equipment, including fixtures" unless they meet "requirements of this Part for new materials and

equipment and are otherwise satisfactory for their intended use". Moreover, with respect to potable water systems, Part 7 expressly prohibits the re-use of "materials and equipment that have been used for a purpose other than the distribution of potable water". If the Building Code can address "used materials" to ensure water potability, then surely Regulation 903 can prescribe standards and regulate the use of "used materials" for well construction purposes, not only to ensure water potability at the individual residence but also to protect the aquifer and other downgradient wells. Therefore, Regulation 903 should be reviewed and revised accordingly.

9. Elimination of Pumping Tests

Issue

The CELA Application for Review stated that Regulation 903, as amended, allows well drillers to discontinue pumping tests for virtually any reason, and the Regulation does not require re-testing if the initial pumping tests were discontinued. CELA expressed concern that failure to complete pumping tests deprives well owners of important yield data to determine if there will be sufficient water for the owner's intended use, and to assess wellwater interference problems that may occur in the future.

MOE Reply

The EBR Decision Summary states:

> The only acceptable reason for discontinuing the pumping test is when the well does not have a good enough yield of water; for example, pumping from low permeability aquifers. Such well records are reviewed when submitted to the Ministry.
>
> In addition, if an invalid reason for discontinuing pumping is provided by the well driller, the water well well record may be viewed by the Ministry as 'incomplete' and returned to the driller for correction (page 8).

CELA Response

The CELA response to the MOE reply regarding pumping tests is as follows:

(a) Section 19(2) of Regulation 903 does not support the MOE reply. Section 19(2) merely requires that a reason be provided for discontinuing the pumping test, but does not specify what is – or is not – an acceptable reason. Section 19(2) provides as follows:

> 19(2) If water cannot be pumped from the well continuously for one hour in accordance with clause 1(c), no further measurements are required under clause (1)(a) and there shall be noted on the well record,
>
> (a) the reason pumping was discontinued….

On its face, section 19(2)(a) does not provide that "the only acceptable reason" is a low yield well. Accordingly, it would be open to a driller to cite any reason (i.e. electrical, mechanical, hydrogeological or other reasons), and it is unclear what regulatory basis the MOE could rely upon in order to reject the reason. Therefore, CELA is not assured by the suggestion that the MOE "may" review the record and send it back for "correction".

(b) In summary, the MOE Reply is unresponsive to the CELA concern regarding pumping tests. Section 19(2) does not prescribe what are acceptable reasons for discontinuing pumping tests, and, more importantly, does not require re-testing if or when conditions permit. Therefore, Regulation 903 should be reviewed and revised accordingly.

10. Exclusion of Certain Well Caps and Well Screens

Issue

The CELA Application for Review stated that Regulation 903, as amended, effectively excludes two useful products from being installed in Ontario wells: vermin-proof well caps and stainless steel well screens.

MOE Reply

The EBR Decision Summary states:

> The requirement for casing in Reg. 903 does not extend to well screens.
>
> The Ministry will clarify the design requirements for vermin-proof caps (page 9).

CELA Response

CELA's response to the MOE reply regarding well caps/screens is as follows:

(a) It appears that the MOE recognizes that the current wording of section 18(1)(c) of Regulation 903 causes difficulty with respect to the use of vermin-proof well caps. However, the MOE reply vaguely states that the "design requirements" will be "clarified", and does not commit to a corresponding amendment to Regulation 903. Thus, the issue of whether vermin-proof well caps can be lawfully used in Ontario remains unresolved by the MOE reply.

(b) With respect to well screens, the basis of MOE reply is somewhat unclear but it seems that the MOE does not accept that well screens are "casing" for the purposes of Regulation 903. It should be noted that section 1 of the Regulation defines casing as any "pipe, tubing or other material installed in a well to support its sides". Well screens are clearly caught by this definition because they perform this side support function, especially when placed at the bottom of overburden wells. The difficulty is that section 13(5) of Regulation prescribes that all casing shall be watertight. Since well screens are specifically designed to let water into the well, they clearly cannot be watertight, and

therefore appear to be excluded by Regulation 903. Other jurisdictions permit the use of well screens, and CELA submits that this interpretive issue in Ontario can be easily resolved by finetuning Regulation 903. The MOE's refusal to do so is puzzling, to say the least.

(c) In summary, Regulation 903 should be reviewed and revised so as to permit the use of vermin-proof well caps and stainless steel well screens

11. Sealant Requirements

Issue

The CELA Application for Review states that Regulation 903, as amended, has serious interpretive difficulties regarding the placement of sealant around the outside of well casing to prevent downward migration of contaminants or upward movement of natural gases. CELA expressed concern that the Regulation only specified minimum sealant thickness for the upper 6 metres of wells, rather than the entire depth of wells. CELA also noted that critical definitions regarding this matter (i.e. "proposed diameter of the finished well", "water producing zone", "intake zone", and "fine grained soils") were absent from Regulation 903.

MOE Reply

The EBR Decision Summary states:

> The regulation clearly requires that all annular space that is created around the well casing be sealed from the bottom up to prevent gaps where contaminants could enter the well.
>
> Reg. 903 states that at a minimum, sealant must be placed at the top of the clean washed sand and gravel referred to in subsection 14(4), and upwards so that it completely fills the annular space. The person who constructs a well shall ensure that the annular space is sealed to prevent any movement of water, natural gas, contaminants or other material between subsurface formations or between [a] subsurface formation and the ground surface by means of the annular space. The Regulation requires that there be annular space to a depth of at least 6 metres. Deeper than that, annular space is not required but if you do create annular space it must be filled.
>
> An overburden well must be cased all the way down to the water producing zone, and the entire annular space form [*sic*.] the top of the well screen to the surface should be filled with suitable sealant.
>
> "Intake zone" for screened overburden wells means the part of the well where water enters the well through the well screen. Intake zone for bedrock wells is either the screened portion of the well if there is a screen or the open bore part of the well.

"Fine grained soils" refers to the soil material that would normally be removed during development of the well. Development of the well consists of surging water through a well screen or pumping at a high rate.

To ensure that the required minimum width of annular space is obtained when constructing a well, the "proposed diameter of the finished well" must be the actual outer diameter of the well casing of the finished well. Section 14(3) requires that the hole that is constructed for the well be at least 7.6 cm greater in diameter than the outside diameter of the well casing that is installed in the hole.

Section 14(5)(b) requires that the hole that is constructed for the well must be at least 5.1 cm greater in diameter than the outside diameter of the well casing that is installed in the hole, if certain provisions are met such as mechanisms for ensuring the casing is centred in the hole.

The MOE is finalizing a "Guide to 903" which explains the requirement for the placement of seal in and around well casings in plain language (pages 9 to 10).

CELA Response

CELA's response to the MOE reply regarding sealant is as follows:

(a) The MOE reply does not dispute CELA's statement that important definitions are absent from Regulation 903, but then goes on to provide examples of the very definitions that should actually be in the Regulation for compliance and enforcement purposes. CELA's concerns are not alleviated by the reference in the MOE reply to the unfinished "Guide to 903" for well contractors that is supposed to provide guidance or information about sealant requirements. Some nine months have now elapsed since Regulation 903 went into effect, and approximately 11,600 wells of been constructed during that timeframe, as discussed above. However, it appears that official technical guidance documentation from the MOE regarding sealant has not been available to well contractors during this entire period of time. It should be further noted that pursuant to section 16 of Regulation 903, the sealant standards do not apply to casings in existing wells, except if the wells are being deepened: see section 14(14).

(b) Regulation 903, as interpreted by the MOE reply, only requires contractors to create a borehole larger than the well casing for the upper 6 metres of a well, but it is open to contractors to create deeper annular space in their discretion. Regardless of whether the annular space is limited to the upper 6 metres or extends to the bottom of the well, it is critically important to ensure that the entire annular space is completely and properly filled with suitable sealant. However, Regulation 903 fails to specify that well contractors must keep the annular space open or intact after constructing the borehole and installing the casing, but prior to the placement of the sealant. CELA's concern is that there is potential for materials from the well wall (i.e. overburden, rock, etc.) to fall into and fill up the lower portion of the annular space prior to placement of sealant. In addition, 14(3) and (5) of Regulation 903 do not adequately address the issue of boreholes that are not

vertically aligned properly, or casings that are not centred properly. Such practices can constrict annular space and interfere with the placement of sealant (especially in deep drilled wells), resulting in well casings that are not properly sealed. This problem existed under the previous version of Regulation 903, and has not been remedied by the amendments to Regulation 903.

(c) The MOE reply overlooks the internal inconsistency within Regulation 903 regarding the placement of sealant in wells deeper than 6 metres. According to the MOE reply, if a contractor installs well casing to 100 metres depth, the contractor is only obliged to create and seal annular space within the upper 6 metres. At the same time, however, paragraph 2 of section 14(4) requires contractors to fill the annular space "from the top of the water producing zone" (i.e. the area <u>below</u> well casing, as described above). In light of this apparent contradiction, it is clear that current sealant standards within Regulation 903 have created considerable uncertainty among well contractors and regulatory officials about complying with and enforcing such standards. The continuing absence of the long-promised MOE technical guidance document only exacerbates this problem.

(d) CELA is also concerned that paragraph 2 of section 14(4) only allows two ways to deposit sealant: (i) force it through the bottom end of the casing; or (ii) force it through a tremie pipe in the annular space. No other method of applying sealant is prescribed under section 14(4). Unfortunately, this seems to preclude the use of superior techniques for depositing sealant, such as the "displacement method" (i.e. depositing a calculated amount of sealant into the bore hole, and then installing a plugged casing to displace the sealant upwards into the annular space). CELA submits that such methods should not be precluded by Regulation 903.

(e) The MOE reply does not adequately address the issue of depositing sealant for dug wells. Section 14(10) of Regulation 903 requires the lowest annular space at the bottom of dug wells to be filled with "clean, washed and disinfected gravel or sand", while the upper 2.5 metres of annular space is to be filled with "suitable sealant". Section 1 of Regulation 903 defines "sealant", *inter alia*, as "a slurry of clean water and at least 20 per cent bentonite solids". "Bentonite" is further defined as commercially produced sealing material that, *inter alia*, consists of more than 50 per cent sodium montmorillonite by weight. In effect, these definitions would allow the use of a slurry mixture consisting of 80% water, 10 per cent sodium bentonite, and 10 per cent sand. However, this slurry has little strength in the ground for dug well applications, and thus creates physical safety risks (for persons walking in the vicinity of the well) and potential contaminant pathways if used to fill the large excavated annular space associated with dug wells.

(f) CELA is similarly concerned about the requirement in Regulation 903 to place sand/gravel in the lower annular space of dug wells. Typically, sand or gravel should be placed <u>below</u> the casing of a dug well (not within the annular space) in order to filter out organics or fine materials that may be present in groundwater entering the well. Accordingly, section 14(10), as drafted, allows the construction of dug wells that may be plagued by sediment problems that are easily avoidable. With respect to treating sand/ gravel to kill pathogens, CELA notes that section 14(10) specifically requires

"disinfection". However, we assume what is really intended by MOE is that contractors should pour a chlorinated solution on the installed sand or gravel. If so, then CELA notes that merely pouring chlorinated solution on sand/gravel is not "disinfection" (as described above) and, in fact, could be creating a health hazard by generating chlorine gas in the area of application.

(g) Regulation 903 also fails to set proper standards in relation to annular space associated with well pits (i.e. drilled wells whose casing top is below ground). Well pits are commonly less than 4 metres deep, and they may not necessarily extend downward into the underlying bedrock. Where a diamond drilled well is constructed with a well pit (or where an existing well with a well pit is deepened via regular drilling), section 13(14) of Regulation 903 only requires casing to the bottom of the well pit. In other words, the casing does not have to extend below the well pit into the water producing zone in bedrock or overburden. Not even the upper 6 metres of such wells need to be cased, as prescribed by section 13(15). In our view, this approach creates the potential for contaminants to enter the well beneath the well pit, and for overburden materials to collapse into the open hole beneath the well pit. It should be further noted that since there is no requirement to install casing to depth, there is no annular space beneath the well pit, and therefore sealant standards do not apply.

(h) In summary, Regulation 903, as amended, gives rise to numerous questions about the interpretation, application and enforcement of sealant standards. The MOE reply does not adequately respond to CELA's sealant concerns, only some of which are set out above. Therefore, Regulation 903 should be reviewed and revised accordingly.

12. Compliance and Enforcement

Issue

The CELA Application for Review states that the various deficiencies within Regulation 903, as amended, are compounded by the apparent MOE inability to adequately enforce the Regulation. CELA expressed concern that specialized full-time well inspectors no longer exist within the MOE, and that unscheduled well inspections are no longer conducted in Ontario. CELA also noted that the MOE had failed to prepare or disseminate detailed technical packages to the well industry in order to explain the new requirements under Regulation 903.

MOE Reply

The EBR Decision Summary states that:

> The Ministry will continue to respond to complaints and take enforcement actions involving water wells where non-compliance by a well contractor may have caused human health or environmental impacts or, where there are allegations the environmental legislation has not been complied with (page 10).

The EBR Decision Summary also provides details regarding a well training/education program that is being offered at Sir Sandford Fleming College, and refers to various general publications, fact sheets and videotapes that are available to well owners and contractors (pages 10 to 11).

CELA Response

CELA's response to the MOE reply regarding compliance/enforcement is as follows:

(a) The MOE reply focuses largely on training/information developments, and does not dispute CELA's statement that full-time well inspectors no longer exist within the MOE. In our view, the continuing absence of specialized full-time well inspectors, and the ongoing failure to proactively conduct unscheduled well inspections, significantly compromises the MOE ability to effectively enforce the provisions of Regulation 903, as described below. As noted by Mr. Justice O'Connor, unscheduled inspections are invaluable for assessing compliance with regulatory requirements:

> It is self-evident that the enforcement of legislation and government guidelines is enhanced by visits that are made without advance notice. Unannounced inspections enable an assessment to be done under normal working conditions rather than a situation possibly structured to accommodate the inspection.[27]

(b) The MOE's Operations Division is generally responsible for inspection and abatement activities to enforce the *Ontario Water Resources Act* and regulations thereunder, including Regulation 903.[28] With respect to public complaints regarding wells, the groundwater program chapter of the Division's "Delivery Strategy" specifies that MOE staff shall only respond where the complaint involves harm to public health or the environment, or where repeated complaints are received in relation to the same person. In this regard, it appears that the MOE reply is, in part, merely reiterating the inspection policy found within the Delivery Strategy.

(c) Significantly, however, adherence to the Delivery Strategy means, in effect, that MOE staff are not obliged to respond to complaints regarding serious well construction defects that are not causing actual health or environmental impacts at the present time. This is also true in relation to "paper offences" (i.e. failure to undertake prescribed monitoring or reporting) under Regulation 903. Accordingly, it is misleading for the MOE reply to claim that it will "take enforcement action" where there is alleged non-compliance with "the environmental legislation" (i.e. Regulation 903), particularly since the Operations Division's own Delivery Strategy does not require such action.

(d) CELA further notes that this Delivery Strategy was originally developed in the 1990s to deal with reduced MOE staffing levels, including the five full-time well inspector positions that were eliminated. More importantly, the Delivery Strategy has not been revoked or revised in relation to water well construction, and the full-time well inspectors have not been reinstated, despite the fact the Ontario government has adopted Mr. Justice

[27] Part I Walkerton Report, page 320.
[28] Part II Walkerton Report, page 412.

O'Connor's recommendations that the province must "adequately fund" all programs and "strictly enforce" all regulations related to drinking water safety.[29] Clearly, Regulation 903 is directly related to drinking water safety, but the Delivery Strategy remains unchanged and, to our knowledge, there has been no public governmental discussion of properly funding the wells program. In our view, if the Ontario government is serious about "adequate funding" and "strict enforcement" regarding wells, then, at a minimum, the MOE must renew unscheduled inspections of well construction operations. Similarly, the MOE must begin enforcing all provisions of Regulation 903 in accordance with Mr. Justice O'Connor's recommendation that the MOE increase its commitment to the use of mandatory abatement.[30]

(e) The need for scheduled and unscheduled well inspections (and the corresponding need for qualified, full-time well inspectors to carry out this task) directly flows from Mr. Justice O'Connor's recommendation that the MOE maintain its system for licencing well drillers.[31] In addition, Mr. Justice O'Connor concluded that "the proper construction of water wells is best accomplished by thoroughly applying existing licencing systems" (emphasis added).[32] The existing licencing system includes statutory provisions that empower the Director to refuse to issue (or to revoke or suspend) well contractor and well technician licences where the applicants have contravened the *Ontario Water Resources Act* or regulations thereunder (i.e. Regulation 903).[33] In order to "thoroughly apply" the existing licencing system as endorsed by Mr. Justice O'Connor, the MOE must, at a minimum, re-establish and fully fund a dedicated team of full-time well inspectors to properly respond to complaints, conduct unscheduled inspections, enforce all aspects of Regulation 903, and otherwise gather information that assists the Director in well licencing decisions prescribed in the *Ontario Water Resources Act*.

(f) As described above, Regulation 903 establishes a new mandatory abatement procedure regarding well owners faced with wells that contain natural gas, cannot produce potable water, or contravene Regulation 903 construction standards. In essence, well owners must either abandon the wells or obtain written exemptions from the Director. This is true even in situations where, through no fault of the well owner, the wellwater problem is attributable to other off-site sources of contamination. In such circumstances, CELA submits that it would be more equitable and efficient for the MOE to pursue the persons responsible for the off-site source of contamination, rather than force the well owner to abandon the well or apply for an exemption. In any event, to our knowledge, this new exemption process has not been established to date, nor has the Delivery Strategy been revised in relation to well exemptions. In addition, it does not appear that the MOE has increased its staffing to deal with this new abatement approach. Given that tens of thousands of adverse well reports are issued yearly by local health units, and given the large number of wellwater quality complaints received by the MOE, CELA submits that

[29] *Ibid.*, Recommendations 75 and 78.
[30] *Ibid.*, Recommendation 74.
[31] *Ibid.*, Recommendation 86.
[32] *Ibid.*, page 480.
[33] *Ontario Water Resources Act*, sections 41, 42 , 45 and 46.

it would be prudent to at least hire back the five full-time well inspectors to deal with exemption requests and other well-related matters (especially inspections).

(g) The reference in the MOE reply to training opportunities and MOE publications does not satisfactorily answer CELA's concerns regarding compliance and enforcement. First, some nine months after Regulation 903 came into force, CELA understands from well industry members that the continuing training course at Sir Sandford Fleming College has only addressed the use of global position system (GPS) receivers. Second, existing well technicians do not have to take any training for approximately three years. Third, the "technical information" touted by the MOE reply is, in fact, merely four "green fact sheets", three of which do not even address well construction standards. The remaining fact sheet provides questionable advice, such as suggesting that wells should be chlorinated with a chlorine residual of 50 mg/L, which, in our view, is inadequate for the reasons discussed above. Fourth, the well tag booklet now available to the public shows five out of six scenarios where the tag is not affixed to the casing, contrary to section 11(3.1) of Regulation 903. Fifth, at the present time, the homeowners' guide is not complete, and, more importantly, the well constructors' guide is not complete. Sixth, the videotape referenced by the MOE reply only deals with drilled wells, and does not address dug, bored or point wells. Seventh, the MOE reply refers to public meetings scheduled for March and April 2004; however, it turns out that these meetings were never held. Finally, it appears to CELA that well owners and local health units remain unaware of the new mandatory well abandonment/exemption requirements under Regulation 903. For these reasons, CELA submits that the training/education component of the MOE's well program remains woefully inadequate, and it does nothing to dispel CELA's concerns regarding compliance and enforcement.

(h) In summary, the provisions of Regulation 903 are undoubtedly intended to serve as a critical upfront safeguard in Ontario's wells management program and the "multi-barrier approach" to ensuring drinking water safety. In other words, the minimum standards set out in the Regulation are intended to prevent health or environmental risks from materializing in the first place. This is why the MOE must be proactive – not reactive -- in its inspection policies and procedures, and must be adquately funded to carry out this important task. Thus, it is unacceptable for the MOE reply (and the Operations Division Delivery Strategy) to restrict inspection activities to public complaints involving actual health or environmental impacts. Similarly, the MOE reply places undue reliance upon the sparse training courses and publications currently available. Therefore, Regulation 903 must be reviewed and revised accordingly.

PART III – CONCLUSIONS AND RECOMMENDATIONS

For the foregoing reasons, it is readily apparent that the MOE reply is seriously flawed and remarkably unresponsive to the concerns raised by CELA's Application for Review.

In particular, the MOE reply (and Regulation 903 itself):

- ignores "best available science" and fails to address the serious health risks created by lowering the chlorination standard from 250 mg/L to "approximately" 50 mg/L;

- fails to ensure "best practices" in relation to:

    (a) removing chlorinated water from wells;

    (b) cleaning, developing and disinfecting of wells;

    (c) preventing unnecessary sedimentation of bedrock wells; and

    (d) using vermin-proof well caps and stainless steel well screens;

- fails to adequately regulate waterline connections;

- fails to require testing for dangerous naturally occuring gases that can be present in wellwater;

- fails to ensure proper regulation of test holes and dewatering wells;

- fails to prohibit or restrict the use of "used materials" in well system components;

- fails to ensure proper completion of pumping tests;

- fails to properly regulate the placement of sealant for both drilled and dug wells;

- fails to ensure effective compliance and enforcement activities; and

- fails to consider or implement the precautionary principle entrenched within the MOE's *Statement of Environmental Values*.

In light of the substantive inadequacy (and misleading nature) of the MOE reply, CELA therefore recommends that the Environmental Commissioner of Ontario intervene in this matter pursuant to Part III of the EBR. Indeed, given the importance and urgency of ensuring wellwater safety, CELA submits that this matter should not be deferred by the Environmental Commissioner to the Annual Report for 2004.

Instead, CELA recommends that the Environmental Commissioner should immediately exercise his authority under section 58(4) of the EBR to research, prepare and file a special report on wellwater safety in Ontario. In our view, a special report is urgently required in the circumstances surrounding the questionable amendments to Regulation 903, and is consistent with the Environmental Commissioner's previous reports regarding groundwater protection, drinking water and public health.

In addition, CELA recommends that while preparing this special report, the Environmental Commissioner should broadly utilize his powers under section 60 of the EBR to question the relevant MOE officials and to compel the production of MOE documents regarding the amendments to Regulation 903. On this latter point, it should be noted that CELA has been

unable to access the relevant documentation through provincial freedom-of-information legislation due to the excessive fees and numerous exemptions claimed by MOE.

If such steps are undertaken by the Environmental Commissioner, CELA anticipates that he will reach the same conclusion as CELA regarding Regulation 903, *viz.* that it is substantially deficient and remains virtually enforceable despite the recent amendments. Accordingly, Regulation 903 must be reviewed and revised forthwith in order to protect the environment and public safety.

ATTACHMENT 1

CALCULATION OF FREE CHLORINE RESIDUAL

NOTE: (a) The following examples assume that there are no total dissolved solids or suspended solids in the water.

(b) Sodium hypochlorite consists of sodium (Na), oxygen (O) and chlorine (Cl), whose total atomic mass is 74.442 grams per mole: see Periodic Table of the Elements.

(c) The following resources were considered for these calculations:

G.C. White, *Handbook of Chlorination and Alternative Disinfectants* (4th ed., 1999), pages 213 to 223

http://www.chem.purdue.edu/gchelp/howtosolveit/

http://www.chem.purdue.edu/gchelp/howtosolveit/Equilibrium/Salt_Solutions.htm

http://www.chem.umb.edu/chemistry/CH311/exam1.pdf

EXAMPLE 1: 50 mg/L Concentration

The MOE Procedure recommends adding 1 millitre of 5% sodium hypochlorite solution. This means that there is 0.05 grams of sodium hypochlorite per litre of solution.

To achieve the MOE's desired chlorination concentration, take the 0.05 grams of NaOCl per litre of water, and divide it by the total atomic mass of NaOcl (74.422 grams per mol). This calculation reveals that the number of moles of NaOCl in solution is 0.00067 moles per litre (M).

To determine the amount of hydrochlorous acid produced when the solution is added to water, the following equations must be recalled:

$NaOCl + H_2O \rightarrow HOCl + NaOH$

$HOCl = OCl^- + H^+$

The hydronium ionization constant (Ka) must be calculated for hypochlorous acid. Groundwater commonly has a temperature of 12.7 degrees Celsius. Applying this value in J.C. Morris's "best fit" formula,[34] the following calculations are made:

$pKa = 3000/T - 10.0686 + 0.0253T$

[34] G.C. White, *Handbook of Chlorination and Alternative Disinfectants* (4th ed., 1999), page 217.

Where T = 273 + groundwater temperature (12.57 degrees C) = 285.778 degrees C

pKa = 7.66

Ka = antilog [- pKa] = antilog [7.66] = 2.188×10^{-8}

Given that OCl^- is a weak base, it associates with water, and thus the hydroxide ionization constant (Kb) is calculated from the Ka as follows:

Kw = 1×10^{-14} (given)

Kb = Ka/Kw = $2.188 \times 10^{-8} / 1 \times 10^{-14} = 4.57 \times 10^{-7}$

With the ionization constant and ICE formula, the concentration of the hydronium ion (x) can be calculated as follows:

Kb = x^2 / moles of NaOCl

$x^2 = 4.57 \times 10^{-7} \times 0.00067$ M

$x = 1.752 \times 10^{-5}$ M

p[OH] = -log [1.752×10^{-5}] = 4.7565

Given 14 = p[H] + p[OH]

then

p[H] = 14 – 4.765 = 9.24

Concentration of hydronium ion is H (or H_30^+) = antilog [9.24] = 5.7544×10^{-10}

The percentage of HOCl is calculated as follows:[35]

100 x [1 / (1 + ($2.188 \times 10^{-8} / 5.7544 \times 10^{-10}$))] = **2.56 per cent**

Therefore, 2.56 per cent of 50 milligrams is 1.28 milligrams of hydrochlorous acid in the solution.

[35] *Ibid.*, page 219.

EXAMPLE 2: 250 mg/L Concentration

Take the 0.25 grams of NaOCl per litre of water, and divide by the total atomic mass of NaOCl (74.442 grams per mol), which reveals that the number of moles of NaOCl in solution equals 0.0033581 M.

$Ka = \text{antilog} [- pKa] = \text{antilog} [- 7.66] = 2.188 \times 10^{-8}$

Given that OCl^- is weak base, it associates with water, and thus the hydroxide ionization constant (Kb) is calculated from the Ka as follows:

$Kw = 1 \times 10^{-4}$

$Kb = Ka/Kw = 2.188 \times 10^{-8} / 1 \times 10^{-14} = 4.57 \times 10^{-7}$

With the ionization constant and ICE formula, the concentration of hydronium ion (x) can be calculated as follows:

$Kb = x^2 / \text{moles of NaOCl}$

$x^2 = 4.57 \times 10^{-7} \times 0.0033581 \text{ M}$

$x = 3.9175 \times 10^{-5} \text{ M}$

$p[OH] = - \log [3.9175 \times 10^{-5}] = 4.407$

Given $14 = p[H] + p[OH]$

Then

$p[H] = 14 – 4.407 = 9.59$

Concentration of hydronium ion is H (or H_3O^+) = $\text{antilog} [- 9.24] = 2.570 \times 10^{-10}$

The percentage of HOCl is as follows:[36]

$100 \times [1 / (1 + (2.188 \times 10^{-8} / 2.570 \times 10))^{-10}] =$ **1.161 percent**

Therefore, 1.161 per cent of 250 milligrams is 2.90 of hypochlorous acid in the solution.

CONCLUSION:

When comparing the results of Example 1 (50 mg/L) with Example 2 (250 mg/L), it is noted that Example 2 produces a smaller percentage of hypochlorous acid in solution. Significantly, however, Example 2 produces a much larger amount of hypochlorous acid for killing bacteria.

[36] *Ibid.*