# Electrical Safety Authority

# Discussion Paper on Electric Utility Regulations

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# Executive Summary

### *Introduction and the ESA Mandate*

The Electrical Safety Authority ("ESA") is an independent not for profit corporation, and since 1999, has acted as an administrative authority, within the terms of an administrative agreement, on behalf of the provincial Ministry of Commercial and Business Services ("MCBS"). Formerly part of Ontario Hydro and known as Electrical Inspection, the ESA operates across the province fulfilling the role of inspection for customer owned electrical infrastructure. For the participants in that part of the electrical industry in Ontario over which the ESA provides oversight, the ESA is a self-regulating organization, in that it is intended to oversee public electrical safety relative to these industry participants. While ultimately responsible to the MCBS, the ESA's Board of Directors is comprised of industry participants, government, and consumer representatives. The ESA establishes and administers the Ontario Electrical Safety Code ("OESC"), which for certain parties prescribes the minimum electrical safety installation and equipment requirements and the inspection process. In addition, the ESA can advise the MCBS on electrical safety policy.

Section 113(1) of the Electricity Act provides the statutory framework within which the ESA operates. This legislation assigns the ESA authority, with the approval of the Lieutenant Governor in Council, for making regulations for public electrical safety[2] related matters ranging from the design to the use of electricity in each of generation, transmission, distribution and retail use of energy. In essence, this statutory authority assigns to the ESA the responsibility and accountability for ensuring electrical safety in all electrical installations.

### *The Ontario Electricity Market restructuring and the impact on Public Electrical Safety*

The OESC referenced by regulation currently exempts electrical utility functions. This exemption has been in place for many decades. Under the largely publicly owned utility structure that existed in Ontario, individual electric utilities established and maintained their own safety standards for their franchise area.

A number of issues have been identified, as the industry restructures, which raise questions as to whether this current regulatory framework will continue to ensure high levels of electrical safety.

Several anomalous situations involving different compliance regimes applied to different entities, based on ownership, exist today. For example, while customer owned generators are subject to the compliance process under the OESC, Ontario Power Generation ("OPG") is exempt. As ownership of assets is transferred from OPG to other private entities, this

[2] Throughout this report, the term's electrical safety and public electrical safety are synonymous and used interchangeably. In the context of the work that the ESA performs, it defines "public" as including people working on electrical infrastructure as well as members of the general public having contact with electrical infrastructure. It interprets the phrase to mean the requirement to address or recognize all factors impacting upon electrical safety including a safe physical electrical infrastructure; recognizing the linkages between this infrastructure and safe working practices; and public electrical safety education.

raises the question of whether these new entities should also be exempt from the requirements of the OESC. Indeed, the ESA believes that 'non-utility' parties who own generation equipment[3], which is identical to 'utility-owned' equipment, could lobby to be exempt from the requirements of the OESC unless this anomalous situation is addressed. In the newly restructured electrical industry, all generation in Ontario will be considered 'non-utility' generation.

Other examples of areas of specific concern to the ESA include: changes in distribution system and transmission ownership as a result of new entrants coming into the Ontario marketplace; new parties with different approaches to public electrical safety standards; the lack of a proactive compliance framework; the lack of a means to deal with public electrical safety complaints in the utility sector, and; a decrease in focus on public electrical safety in setting and maintaining uniform public electrical safety standards.

The ESA believes that parties might also be more creative in the 'use of the utility exemption' in the future. An example of a situation like this which the ESA has witnessed is one in which a utility has used its 'exemption status' to allow it to compete and win the right to build new facilities, located on customer property, where thereafter ownership will be transferred to the customer. Ultimately, in these kinds of situations, utilities could build equipment to a different 'utility standard' with respect to key safety parameters, yet a customer would ultimately own and operate the equipment.

Although the ESA recognizes these potential electrical safety risks, it currently has no specific regulatory authority to address these risks. Although the Electricity Act and O.Reg. 164/99 gives the ESA statutory authority over all electrical infrastructure - including utility plant - there is presently no mandated code with defined public electrical standards or processes to proactively require compliance, or processes to address specific public electrical safety hazards. In short, therefore, the ESA has no authority to respond to public safety concerns around utility installations.

The ESA believes, that all generation, transmission, and distribution facilities should be subject to the same safety standards and compliance processes, irrespective of ownership.

### *The Role of the ESA in this New Marketplace*

In its first year of operation as an incorporated entity, the ESA has considered it's statutory mandate and considered the potential safety impact brought about because of the restructuring in the utility sector. The ESA has reviewed the regulatory and statutory environment in which utility players are operating; the utility electrical safety record; practices adopted in other restructured industries and jurisdictions; available technical

[3] Throughout this report the terms equipment, installations, plant and infrastructure are often used interchangeably. Typically, "equipment" is used to refer to something that one buys from a manufacturer, installation as something assembled on site from equipment, and "infrastructure" or "plant" is used to refer to groups of interconnected installations needed to operate a distribution, transmission or generation facility.

industry standards and; held discussions with 13 key stakeholders (approximately 42 individuals) to obtain their feedback and input. The important learning acquired through this research is presented in this discussion paper.

### *Regulatory Environment and Industry Impact*

The ESA is sensitive to the fact it is conducting its' regulation review at a time when the industry is under considerable pressure to meet market opening requirements, and in the context of the regulatory framework determined by both the Ontario Energy Board ("OEB") and the Independent Energy Market Operator ("IEMO"). The ESA believes that it should not duplicate the activities of other major governmental / quasi-governmental bodies in the Ontario marketplace, nor add more regulatory/cost burden to industry participants without demonstrating benefit to public electrical safety.

In the past 18 months, the OEB has, for example, issued both the Distribution ("DSC") and Transmission System Codes ("TSC"), and has defined the ratemaking framework for the distribution utilities and for OHNC[4]. All of these documents provide key financial and business parameters which utilities will consider carefully in their operating decisions. The IEMO has modified the Market Rules to accommodate the TSC, and these rules will continue to address the need to maintain a secure and adequate operation of the IEMO-controlled grid within equipment limitations, as specified by other standard authorities. In addition, the OEB provides a critical forum for the economic review of new transmission facilities applications, while the IEMO focuses it's attention on the IEMO Controlled Grid through the Transmission Operating Agreements, emergency preparedness, and restoration plans. Additionally, through review of connection agreements, the IEMO reviews new connections to the IEMO Controlled Grid based on viability and feasibility of the connection through an assessment of impact with respect to system reliability and stability.

While each of the DSC, TSC, and Market Rules provide for compliance to the requirements of the ESA, they have only a few safety and design requirements to address public electrical safety specifically. In summary, no body is evaluating new facilities from a public electrical safety and safe design perspective.

### *Regulatory Practice in Other Jurisdictions*

In it's evaluation of practices in other jurisdictions (New Zealand, California, Alberta and New Jersey) and other industries (i.e. natural gas in Ontario), the ESA has found that, as a matter of public policy, defined safety standards and-in some cases - compliance processes are adopted in regulation.

[4] Specifically, in the OEB's Performance Based Regulation Decision with Reasons (RP-1999-0034) which deals with certain issues raised by parties regarding the draft Rate Handbook to govern Performance Based Regulation for licensed electricity distributors, and; Ontario Hydro Networks Company (Hydro One Networks Inc.) Decision with Reasons for Year 2000 Transmission Cost Allocation and Rate Design dated May 26, 2000 (RP-1999-0044)

### *Technical Standards*

The ESA has determined that CSA International and other accepted standards exist in the areas of design and construction which the ESA initially has identified as the source of greatest electrical safety risk, those being: Clearances (e.g. from overhead lines and underground cable burial depths, working space around equipment); Access by unauthorized personnel to live parts (e.g. standards for fences, warning signs); Grounding; and Mechanical / Structural and Operating Standards (i.e. protection and control)[5].

### *Stakeholder Feedback*

Upon review of the regulatory framework, and following discussions with both the OEB and the IEMO, ESA concludes that each of the OEB license codes or rules, and each of the OEB and IEMO as bodies, rely upon the ESA to fulfill its legislated mandate to address the electrical safety interest of the public.

Some organizations, such as the Ministry of Labour ("MOL"), International Brotherhood of Electrical Workers ("IBEW") and the Power Workers Union ("PWU") are anxious to work with the ESA to recognize safety standards and integrate activities. Utility players, while cautious about any incremental burden (time, money) that new regulations might represent, also recognize the value of safety as “good business practice” and a way to "level the playing field" between themselves and new entrants. All parties warn of duplication in existing regulatory processes, and adding cost with no value.

Evidence collected to date from stakeholder interviews leads the ESA to conclude that the obligation to comply with these standards, by regulation, will not place significant incremental burden on current Ontario utility participants since the majority of them feel they already meet or exceed these standards. Mandatory standards will guard against lowering of the standards in the future, provide a safety focus for progressively eliminating public electrical safety hazards and - over time - encourage greater consistency in the design of utility systems.

### *Conclusions, Recommendations and Next Steps*

The ESA believes it would be prudent to review the regulations that currently apply to the electrical utility sector (i.e. generation, transmission and distribution), present the recommended approach to industry participants, and determine what regulatory changes should be enacted to ensure that electrical safety is maintained and continues to improve as a result of the industry restructuring.

In introducing new regulations, the ESA wants to follow existing processes and adopt existing technical standards to the greatest extent possible to minimize the incremental cost burden of compliance to industry participants.

[5] Note: Definition of these terms, as they are used throughout this discussion paper, can be found in Appendix 1.

Given the high level of expertise in the Ontario electrical industry, the ESA believes that an audit-based compliance system with clear accountabilities is an appropriate starting point.

### *Conclusions*

The ESA statutory mandate, as defined in Bill 35, is to consider all electrical safety accidents occurring in the electricity sector, and to introduce measures which serve to reduce the number of incidents to as low a number as possible. It is clear from interviews with the MOL, IEMO, and OEB that these agencies expect the ESA to address safety related matters with respect to utility infrastructure. It is incumbent upon the ESA to consider what safety standards should be introduced and how compliance might be monitored. Absent the introduction of specific codes, the ESA cannot fulfill its mandate.

In considering the electrical safety record in the electrical industry, the ESA observes that approximately one-half of the electrical fatalities involve workers, and one-half involve the public (either at home or in public places). For many years, the ESA has, as a public service, investigated accidents occurring at home or in a public place, which involve non-utility electrical infrastructure and has used the results of these investigations to continuously improve the OESC and other standards (e.g. CSA equipment standards, Ontario Building Code). The ESA believes that the public interest will be well served by providing it with a regulatory framework to support this activity in both the utility and non-utility sectors[6]

There is a gap in terms of regulatory oversight of public electrical safety around utility installations. There are currently two sets of standards and two compliance regimes used in the Ontario electrical industry. A comprehensive regulatory framework administered by the ESA exists for public electrical safety in customer installations. Legislative oversight, safe work standards and compliance processes exist for utility workplace safety (MOL and EUSA) but do not address public electrical safety around these utility installations.

[6] One of the advantages of having an industry recognized, mandatory code and an associated industry sponsored process to keep the OESC up to date, is that it provides a forum for changes to address new safety risks: new technology, and to incorporate this knowledge to fine tune standards and address problems over time. Some of these changes are detailed below. These changes in the OESC are not mandatory for utilities since the ESA has no jurisdiction over these entities. Therefore, the OESC may be more demanding than utility standards for similar installations.

- 1994 fatality of a young girl in Stratford - There was an insulation failure in an outdoor light fixture which energized the support light standard at an outdoor municipal park. The OESC Rule 30-1028 was changed to require separate conductor bonded to the system ground for this type of installation.
- In 1998, a worker was electrocuted while trying to install a satellite dish on a hydro utility pole carrying a 2400-volt line to a transformer. In support of the coroner's jury recommendations OESC Rule 75-268 was changed to require warning signage on all poles carrying overhead lines (within the scope of the code).
- In 1989, a worker was electrocuted while working on a sign: The OESC contains minimum separations between overhead lines and buildings. The code does not apply (and therefore the ESA has no jurisdiction) over buildings constructed in the presence of utility lines.
- During the 1980's, a worker was killed in a situation where the battery power for the circuit breaker for a line feeding a customer also supplied the emergency lighting for the substation. OESC Rule 14-308 (1) was added in 1990 prohibiting the batteries for circuit breakers from supplying any other loads.

There is potential for conflict over interpretation of some phrases used in the OESC[7] since it may be problematic to identify the point of ownership demarcation in an installation. Specifically, since individual distribution utilities are obligated to define ownership and operational demarcation points in their Conditions of Supply documents (as per the DSC requirements), this may result in different electrical standards for the identical structure based on where that structure is located (i.e. depending on which utility is serving that building, and that utility's defined demarcation point). This point will impact the decision as to which compliance process might apply. Problems may arise when facilities, which have not been built to meet the OESC standards, are transferred from utilities to new owners or former customers. This could expose these asset acquirers to electrical safety risks.

The current regulatory regime defines a financial and operating framework for licensed industry participants. It provides public safeguards against degradation in reliability, customer service and dramatic rate increases. However, there are no public electrical safety performance standards defined and a lack of detail as to how public safety will be protected and ongoing safe practices assured by the regulatory bodies. Yet, certainty of rules may minimize the probability of errors, and / or accidents. Both the OEB and the IEMO have stated that they rely on the ESA to ensure the physical infrastructure remains safeguarded against degradation to protect the public electrical safety.

Other jurisdictions with similar utility structures to Ontario have mandatory codes and compliance processes built into legislation. Both the historical safety statistics and the restructuring processes suggest some type of utility electrical safety code is similarly desirable in Ontario. In Ontario, electrical utilities are familiar with the requirement to follow codes and standards in other areas of their business (e.g. building codes, boiler and pressure vessel codes, etc.). It should not, therefore, be too onerous to follow a code relative to safety standards involving their core business operations. One of the premises of market restructuring has been to introduce competition while driving towards a "level playing field"' as between private and utility market participants. It would seem logical to extend the oversight system in place for private market participants (i.e. the value system, the processes, and the approach behind the OESC and the associated compliance processes), to utilities.

### *Recommendations*

The ESA believes that this is the appropriate time to define and prescribe standards for the utility sector and implement a compliance mechanism through a broad-based public consultation. As a province and as an industry, significant time, money, and effort has already been expended to set high standards. It is prudent to protect this investment. In this way, it is hoped that the current, high level of electrical safety in the province can be maintained.

[7] There is potential for conflict over interpretation of some phrases used in the OESC, such as "exclusively for sale or distribution to the public" and "transmission... intended for sale or distribution to the public", since it may be problematic to identify the point in an installation where the point of sale occurs.

Specifically, the ESA recommendations include:

- Explicit reference to national design standards in legislation would bring Ontario closer to the norm in all of the jurisdictions evaluated. The function of standards is to serve as a floor to protect against degradation in infrastructure design and construction over time and/or the introduction of lower standards by participants seeking a short term cost advantage over the existing asset owners.

- Develop a compliance process based substantially on certification of design, and an audit framework.

- Reinforce the ESA public interest mandate to continue to work to promote and enhance awareness of public electrical safety in the utility and non-utility sectors.[8] Some of the specific manifestations of this mandate include:

    - ESA participation, as an independent safety focused body in standards development;

    - Public education campaigns[9], and;

    - In conjunction with the OEB, work to integrate safety performance within the utility regulatory regime (e.g. licence criterion, public safety performance indicator, facilities application review). [10]

    - Integration of a safety oversight or compliance system, with the work of other safety organizations such as the MOL. This would move Ontario explicitly towards an oversight system that recognizes the critical interrelationship between infrastructure design and work practices.

    - Definition of reporting requirements for utilities and/or integration with existing incident reporting so as to: ensure that the ESA is informed of all electrical contact accidents and incidents. (E.g. integration of reporting with MOL, Coroner's office, Fire Marshall office). Public consultation should be used to define 'reportable incidents' and a mechanism for reporting of all electrical contact accidents and incidents.[11]

[8] Several stakeholders (e.g. EUSA, distribution utilities, IEMO, OEB) recognized and endorsed that the ESA should have a role in promoting public electrical safety. Some utilities feared that their expenditures (i.e. on public safety education, on standards, on maintenance) to support public electrical safety might be compromised over time given the new financial motivators of the restructured environment and suggested that the ESA could provide an alternate mechanism to continue the promotion of public electrical safety.

[9] Some stakeholders (e.g. EUSA, distribution utilities) felt that there would economies of scale realized should the ESA handle some public safety education campaigns;

[10] Some stakeholders (e.g. the OEB, distribution utilities) felt that an ESA approval could provide some positive brand equity to the industry as a whole. In addition, the OEB felt that there would be value in defining 'good utility practice' more specifically as it relates to public electrical safety and as a licensing criterion. The role of the ESA in facilities review is analogous to that played by the TSSA.

[11] Currently statistics are gathered by several organizations and are not always accessible by the ESA. There is no reporting requirement in place now whereby utilities must report safety incidents to the ESA. The ESA believes that information on safety incidents involving

The ESA recognizes that the introduction of a compliance mechanism will represent a cost for utilities, which is obviously a concern for all stakeholders. In an attempt to minimize cost, the ESA recommendations include an audit-based approach, leveraging existing processes, and integration with other agencies. The ESA estimates that participation in the standards development process, the public education campaigns, and a compliance process would be in the order of 0.04 to 0.07% of gross provincial utility electricity sales in the year 1998.

### *Next Steps*

In order to provide for input, and take advantage of stakeholder expertise, the ESA proposes a three-month public consultation to finalize which standards should be referenced in regulation, and the details of the audit-based compliance and verification processes, including its' potential integration with the OEB licensing processes.

The Electrical Safety Authority is prepared to initiate this broader public consultation process and put forward recommendations on revised electrical safety regulations that will address the changes occurring in the generation, transmission and distribution of electricity. With the cooperation and assistance of industry stakeholders, the ESA is hopeful that this consultative process will be completed and the recommended approach put forward to the MCBS within six months of the commencement of the public consultation process.

utility infrastructure, if tabulated and analyzed, would provide powerful information in the development of industry standards as well as in evaluating individual utility safety performance over time.

# REPORT ON ELECTRIC UTILITY REGULATIONS

## 1.0 Background

### 1.1 The Electricity Act and the ESA Mission

The ESA Mission statement reads: “To protect the people of Ontario from electrical hazards". The ESA mission reflects the work carried out in Ontario over eight decades under the auspices of Electrical Inspection and the governance of the former Ontario Hydro organization.

The ESA’s statutory authority, as specified in the Electricity Act 1998, has reiterated the ESA ‘s accountability for public electrical safety. Specifically, the statutory authority provides that the ESA may set regulations, with approval of the Lieutenant Governor in Council, in the following areas[12]:

- Prescribing the design, construction, installation, protection, use, maintenance, repair, extension, alternation, connection and disconnection of all works and matters used or to be used in the generation, transmission, distribution, retail or use of electricity in Ontario;
- Prohibiting the use in Ontario of any such works or matters until they have been inspected and approved;
- Providing for the inspection, test and approval of all such works and matters before being used;
- Adopting by reference, any code or standard and requiring compliance with any code or standard that is so adopted
- Subject to the approval of the Minister, may establish the fees to be paid for permits and for inspection, test and approval of all such works and matters mentioned above and of plans and specifications relating thereto.

Currently, the regulation governing the ESA's activity, as embodied in the OESC[13], provides that every act or omission in connection with the generation, transmission, distribution, retail or use of electricity in Ontario is to be done or made in compliance with the Electrical Safety Code. However, Rule 2-000 (a) of the OESC exempts certain functions performed by electric utilities. Thus, the ESA statutory and regulatory authority to set the safety-related codes for utility infrastructure is presently inconsistent.

[12] Source: Selected excerpts from Section 113, Electricity Act

[13] Ontario regulation 164/99, under the Electricity Act, deems that the Canadian Electrical Code Part I together with some Ontario Hydro Revisions constitute The Ontario Electrical Safety Code.

### *1.1.2 CONCLUSION: ESA AUTHORITY IN THE UTILITY INDUSTRY*

The ESA believes it is their statutory mandate to consider all electrical safety accidents occurring in the utility sector and, to introduce measures which serve to reduce the number of incidents to as low a number as possible. Further, from stakeholder interviews with the OEB, the Ministry of Labour ("MOL"), the Ministry of Energy Science and Technology ("MEST"), the Ministry of Consumer and Business Services ("MCBS") and the Independent Electricity Market Operator ("IEMO"), it is clear that these agencies expect the ESA to address public electrical safety related matters with respect to utility infrastructure. Given this mandate, the ESA must consider what safety standards are in place in the utility industry and how compliance might be assured. Without specific codes, the ESA cannot fulfill its mandate.

## 1.2 Ontario Utility Industry: Public Electrical Safety Record

### *1.2.1 HISTORICAL SAFETY PERFORMANCE IN THE UTILITY ENVIRONMENT: AN ASSESSMENT*

The ESA realized that it must first assess the current state of "public electrical safety" to determine where the majority of safety hazards exist today. This evaluation was done through review and evaluation of reports of accidents and incidents involving electrical infrastructure. [14]

An analysis of available safety statistics[15] over the last several years has led the ESA to draw the following conclusions:

- Ontario has historically performed marginally better than other jurisdictions in North America.
- Ontario's electrical safety performance has leveled off in the last nine years.
- The highest level of work related deaths, from electrical contact, are associated with the electric power supply for power generating plants, distribution and transmission lines.
- The highest level of public electrical fatalities is associated with utility installations.

[14] Electrical safety performance measures can help focus activities on those aspects of the industry where there is the most to gain in public electrical safety. The ESA believes that there would be value in a more integrated and centralized electrical accident reporting system for all electrical fatalities to establish this knowledge base. Over time, therefore, the ESA would like to build upon the Coroner's Office records for all electrical fatalities and the Ministry of Labour's (and associated organization's) safety records relative to occupational safety and workplace accidents to develop a more comprehensive understanding of electrical safety performance in the Ontario utility industry. Currently, data is collected by several parties using several methodologies and is not always shared with all the parties involved in the delivery of safety programs or involved in safety management oversight.

[15] Amongst the statistics collected are:
Coroner's statistics - all electrical fatalities in the province
Electrical Contact Accidents - The Ministry of Labour and the Workers Safety and Insurance Board (WSIB) gathers this information.

Table 1 below provides some statistics gathered over the period 1992 through 1999 from a variety of sources. The table was compiled to attempt to both provide a record of Ontario public electrical safety, and to obtain some indication of safety results in the utility industry.

**Table 1[16]**
**Fatalities from Electrocution 1992 – 1999**

| Cause of Death | Work | Home | Public | Total | Percentage |
|---|---|---|---|---|---|
| Domestic wiring & Appliances | 4 | 16 | - | 20 | 22 |
| *Electric power supply power generating plants, distribution, & transmission lines*[17] | ***27*** | ***6*** | ***19*** | ***52*** | ***56*** |
| Industrial wiring, appliances and Electrical machinery | 15 | - | 2 | 17 | 18 |
| Other farm, outdoors public Buildings, residential institutions And unspecified | 3 | - | 1 | 4 | 4 |
| Total | 47 | 22 | 33 | 93 | |
| Deaths (Percentage) | **52** | 23 | 25 | | |

### *1.2.2 CONCLUSION: HISTORICAL ELECTRICAL SAFETY PERFORMANCE*

In considering the electrical safety record in the electrical industry over the past 7 years, the ESA observes that over one-half of the electrical fatalities involve electrical utility infrastructure. The details reveal that (of those) one-half have occurred at the workplace (the remainder taking place either at the home e.g. a homeowner's ladder going into an electrical line, or in a public space e.g. a kite going into an electrical line). Workplace accidents are subject to the guidelines in the Occupational Health and Safety Act ("OHSA"), and investigation by the MOL. The ESA is often involved in these investigations, and – according to the MOL interview comments - would be accountable for defining the infrastructure safety regulations to which the asset owners would have to comply.

Non-workplace related safety incidents, which involve utility infrastructure, are not monitored, or addressed by the MOL, WSIB, or workplace safety organizations. There is no independent body on which the public can rely to investigate these incidents. The ESA believes that this falls within their mandate. For many years, the ESA has had the responsibility, as a public service, to investigate accidents occurring at home or in a public place, which involve non-utility electrical infrastructure and has used the results of these investigations to continuously improve the OESC. This responsibility has never been explicitly addressed in legislation. The ESA believes that the public interest will be well served by providing it with a regulatory framework to support this activity in both the utility and non-utility sectors.

[16] Based on an analysis of data from the MOL and the Coroner's Office, Province of Ontario

[17] These numbers reflect incidents occurring on lines > 750 V. In some of the coroner's reports, it is unclear where the incident occurred relative to the demarcation point between the customer and utility "plant". Historically, the ESA did not receive, nor become involved, in investigations involving utility infrastructure, so must rely on coroner's reports for these statistics.

To fulfill this responsibility and as part of a sound safety risk management program, the ESA believes that it must have access to statistical records and reports of all electrical incidents/accidents so that it can use data to support standards development (i.e. identify safety hazards) and to monitor individual industry participant performance. In evaluating the historical safety record, for example, it is apparent that reports of electrical contact incidents-especially those occurring in non-workplace settings-do not always contain sufficient information so as to understand cause as it relates to electrical infrastructure, and preventative measures that should therefore be introduced. The ESA therefore recommends that submission of all electrical contact incident reports to the ESA should be mandatory. [18]

## 1.3 Ontario Legislative Environment as it relates to Electrical Utilities and Public Electrical Safety

### *1.3.1 ONTARIO LEGISLATIVE ENVIRONMENT AND RESPONSIBLE GOVERNMENTAL BODIES*

The electrical utility business is in the process of restructuring from primarily publicly owned, vertically integrated generation, transmission, and distribution businesses (including municipally based distribution companies), to a mixture of privately and publicly-owned monopoly and competitive businesses. These businesses will be given authorities and rules of operation through a system of Acts, Regulations, Codes, and Licences, amongst which are:

- The Electricity Act, 1998;
- The IEMO's Market Rules, and;
- Under the auspices of the OEB: The Standard Supply Code; Retail Settlement Code; Performance Based Rates; Distribution and Transmission System Codes ("DSC" and "TSC"); and Generator, Transmitter, and Distributor Licences (including in some cases a complaint resolution system).

The next two sections of this report provide an overview of the relevant safety-oriented components of the existing legislation, and attempts also to summarize the public electrical safety oversight provided by governmental bodies other than the ESA.

[18] The ESA recognizes that this may be more efficiently accomplished by being added to the distribution list to reports which utilities already prepare and submit to other agencies (e.g. Coroners' office, MOL, WSIB, etc.). While there may be some additional information required on the forms specific to the electrical infrastructure, this may still be more cost effective than the creation of a new report/reporting process. This detail should be determined through the public consultation.

### *1.3.2 PUBLIC ELECTRICAL SAFETY: SAFE PHYSICAL INFRASTUCTURE*

For customer owned installations, the OESC provides the minimum standards for design and an ESA compliance framework.

For utility installations, compliance with specific electrical standards is not regulated, except as provided for within the Professional Engineers Act[19]. It is worth noting that utilities are not exempt from standards such as the Ontario Building Code, Pressure Vessel Codes, etc.

### *1.3.3 PUBLIC ELECTRICAL SAFETY: SAFE PHYSICAL INFRASTRUCTURE PUBLIC ELECTRICAL SAFETY: WORKER ELECTRICAL SAFETY THE MO L, THE OHSA, AND THE MINISTRY OF COLLEGES, TRADES AND UNIVERSITIES ("MCTU")*

The OHSA defines the responsibility for ensuring that safe work practices are employed and is administered by the MOL. This Act references the duties of a number of people, including the responsibilities of employers, constructors, licensees, supervisors, workers, owners, project owners, suppliers, architects, engineers, directors and officers of the Corporation for ensuring safe work practices are employed.

The MOL is involved in workplace accident investigations. Together with the Worker Safety Insurance Board (“WSIB”), the MOL relies on the efforts of safe workplace associations, such as the Electrical & Utility Safety Association (“EUSA”), the Industrial Accident Prevention Association (“IAPA”), and the Construction Safety Association of Ontario ("CSAO"), to deliver training and other services to utilities and their contractors, to improve worker safety. (To comply with OEB license specifications, distribution utilities must belong to a safety association, such as EUSA). EUSA is the primary safe workplace association for utilities and has been in existence since 1915. EUSA offers training and certification in a myriad of safety courses for power, communication and water utilities including electrical safety, safe work methods, workplace safety audits and Joint Health and Safety Committees’ roles and responsibilities, etc.. Utilities involved in construction may also be members of the Construction Safety Association of Ontario - an association offering training and other services to construction industry employers. The level of training (or other services, such as safety-audits) which utilities buy from these associations is based on their assessment of need. Obviously the personnel to whom the training is delivered is also determined at the discretion of the managing utilities.

The MCTU sets qualifications for a number of electrical trades and establishes rules for obtaining Certificates of Qualifications (“C of Q”) under the auspices of regulations contained in the Trades Qualification and Apprenticeship Act. The "construction and maintenance" electrician C of Q is the certificate required by regulation under both the TQAA and OHSA for such work as planning, installing, repairing, connecting or testing equipment and wiring

[19] The Professional Engineers Act does define elements within the practice of engineering, which includes the design of generation, transmission and distribution facilities. This work must be done by individuals or organizations licensed by the Association of Professional Engineers of Ontario. As such, this provides some public protection as the engineering profession has both a regulation code of ethics, with a complaint process recognized by statute.

for alarms, communication, light heat or power in buildings or other structures.[20] [21]It is granted based on initial competence.

### *1.3.4 CONCLUSION: PUBLIC ELECTRICAL SAFETY LEGISLATIVE OVERSIGHT*

A comprehensive regulatory framework exists for public electrical safety in customer installations. Legislative oversight standards and compliance processes exist to address utility worker safety (MOL, EUSA), but not to address public electrical safety specific to the design of these utility installations. There are no regulations requiring certification of people working on utility lines, although the ESA recognizes that voluntary certification exists.

## 1.4 Ontario Regulatory Environment as it relates to Electrical Utilities and Public Electrical Safety

### *1.4.1 THE OEB AND THE IEMO*

The Ontario electricity utility industry is in a state of tremendous change. Significant progress has been made in the development of legislation to facilitate the commercial changes to a competitive market for electricity, many of which provide safeguards to protect the public against dramatic rate increases and degradation in customer service quality.

The issuance by the OEB of the ratemaking framework for the distribution utilities and the DSC and TSC, and the establishment of the IEMO Market Rules has provided a framework within which industry players will operate. In the deregulated setting, transmission and distribution utilities' capital expenditures for new facilities will be reviewed under a prescribed rate making regime. Specific transmission expenditures will be subject to separate OEB review.

In the ratemaking regime, no public safety quality indicators have been introduced to date. Further, while public electrical safety has been implicit in many of the codes developed thus far, they regulators are relying on the ESA to address the details for protecting the electrical safety interest of the public.

### *1.4.2 DISTRIBUTION SYSTEM CODE AND TRANSMISSION SYSTEM CODE*

The DSC addresses the minimum obligations that a licensed distributor must meet in carrying out its obligations to distribute electricity within its Service Area under its license and the *Energy Competition Act.*

[20] O.Reg. 1051 as amended by O.Reg.466/91 "Regulations Pertaining to Electrician"

[21] O.Reg. 1051, under the Trades Qualification and Apprenticeship Act, defines Electricians and specifies exclusions for those persons who are permanently employed in an industrial plant at a limited purpose occupation in the electrical trade (i.e. This is interpreted as a permanent employee in an industrial plant and a person employed by an outside contractor in an industrial plant) and line workers. O.Reg. 784/93, under OSHA, is the regulation that makes the trade of Electrician mandatory.

The TSC sets out the transmitter obligations with respect to customers, including performance standards, technical requirements and expansions and connections.

The ESA understands public electrical safety regulations must be written to work within the industry regulatory framework. Thus, as a first step, the ESA reviewed the TSC/DSC in some detail to identify those clauses, which referenced public electrically safety, namely: standards (design, operating, maintenance, verification); "good utility practice"' safety; qualified personnel; (safe) work practices; operational information access, and; connection and disconnection terms and conditions.

#### *1.4.2.1 REGULATORY FRAMEWORK PROVIDED BY THE DSC/TSC AS IT RELATES TO PUBLIC ELECTRICAL SAFETY*

The TSC and the DSC appear to move the industry forward, from a public safety perspective, in that they address the need for standardizing connection agreements; rules around connection/disconnection, and; references to good utility practice, etc. (therefore providing the framework to improve or maintain safety).

The OEB has indicated that both the DSC and TSC had public safety as a guiding, underlying principle. Both were written with the involvement of current parties, including the dominant player(s). They both include conditions of licensing which either directly reference the ESA and/or the Electrical Safety Code, or which indirectly reference the setting of standards or conditions of service which reference public safety as a guiding principle.

The DSC and TSC contain the same approach for facility design. In the TSC, equipment must be in accordance with recognized standards (CSA, IEEE, ANSI, IEC) and good utility practice which is defined, generally speaking, as a practice used by a significant portion of electric utilities in North America. In the DSC, enhancements and removal of defects must be in accordance with good utility practice. However, no specific standards are identified for such safety matters as clearances of overhead lines, depth of underground cables, preventing access by the public to energized equipment, grounding, and signage. In addition, there are no provisions for ensuring compliance with the standards (e.g. audits or certification of compliance). These practices might come under review only when an accident happens (e.g. by the MOL as part of the investigation to establish accountabilities). However, absent any regulation, the ESA would be unable to act upon such investigation (e.g. prescribe changes in equipment or installation). Generation licences do not include any provision for installation or equipment standards related to public electrical safety.

The DSC includes a mandatory inspection cycle, but does not include a penalty structure for "poor performance" related to public electrical safety standards. The OEB can refuse to licence or renew licences but the specific basis for this action, due to safety related issues, is not described.

### *1.4.3 CONCLUSION: PUBLIC ELECTRICAL SAFETY: REGULATORY OVERSIGHT*

The current regulatory regime defines a financial and operating framework for licensed industry participants. It provides public safeguards against degradation in reliability, customer service and against dramatic rate increases. Oversight provided by both the OEB and the IEMO is primarily in place to ensure the cost efficient, secure and reliable supply of electricity in the province. Neither body sees public electrical safety as its primary mandate. There is a lack of detail about how public electrical safety performance standards are defined and how public safety will be protected and ongoing safe practices assured by the regulators.

In short, it is unclear whether this framework provides adequate safeguards for public safety. Since a number of areas of risk to public electrical safety have not been specifically address in these codes, the ESA recommends addressing the following questions through a mandated regulation:

- What constitutes adequate protection of the public safety interest in terms of installation design, equipment maintenance and operating standards?
- What minimum steps should parties be obligated to take, so as to minimize risk to public electrical safety?
- What role should oversight by a third party play in auditing or certifying utility practice as it relates to public electrical safety?
- What processes will ensure that independent electrical safety experts can access equipment and installation details, asset operation records and incident reports necessary to conduct safety investigations or prescribe measures to eliminate safety hazards?
- How to safeguard against a degradation of standards for installation, equipment or operating procedures which could impact on public safety over time as, for example, new players enter the market who may not have an appreciation for the risks associated with utility plant. (What penalties, apart from the removal of a license, might utilities be subjected to, should they not meet the standards that impact upon public electrical safety?)

The ESA believes that there needs to be certainty in the entire institutional framework guiding the distributors, generators and the transmitters operating practices. It will reduce the risk that participants will seek competitive advantage by inappropriately reducing costs associated with public safety. Certainty of rules will minimize the probability of errors, and / or accidents. Both the OEB and the IEMO have stated that they would rely on the ESA to ensure that the physical infrastructure remains safeguarded against degradation in measures to protect public electrical safety.

## 1.5 Existing Technical Standards and the Use of Technical Standards in Codes: An Overview

### *1.5.1 TECHNICAL STANDARDS AND STANDARD ORGANIZATIONS*

There are a large number of technical standards in place in the utility industry today. Most are intended to support the design and construction of utility installations that will operate reliably and safely over a long service life. Some also support the standardization of system components, such as poles, wire, hardware, etc..

There are several organizations establishing standards or guidelines. For the Canadian utility industry, the key standard setting bodies are: CSA International ("CSA"); Canadian Electrical Association ("CEA"); Municipal Electrical Association ("MEA"); Institute of Electrical and Electronics Engineers ("IEEE"); American National Standards Institute ("ANSI"); American Society for the Testing of Materials ("ASTM"), National Fire Protection Association ("NFPA") and the International Electrotechnical Commission ("IEC").

It must be noted that public and worker safety is often the root cause for many aspects of the standards in use today (i.e. systems design is driven by the need to design in a way that the systems can be operated safely, assuming the use of personnel with certain qualifications). However, most of the standards are focused directly on the physical aspects of system design, and not directly on how systems are operated or maintained. For example, while the design of a switch is intended to enable safe operation, the method of operating the same switch safely is not specified in any standard set by the organizations noted above. Hence, the reason why two sets of standards (i.e. design/technical and work practice rules) can and do co-exist in the electrical industry (in the non-utility sector in Ontario and in many other jurisdictions in North America).

In addition to the worker qualification system in place, some safe workplace practices are contained in regulations under the OHSA. Notably, the construction regulations (O.Reg. 213/91) and the industrial regulations (O.Reg. 630/94 and 144/99, s.3), reference the EUSA rulebook.

#### *1.5.1.1 THE USE OF STANDARDS BY ONTARIO UTILITIES*

Utilities in Ontario use technical standards for electrical infrastructure on a *voluntarily* basis. In general, most utilities in Ontario use the same set of standards for a number of reasons, amongst which are the following:

- It is in any utility's interest to be able to establish that it is in compliance with commonly accepted "good utility practice" should equipment fail and/or a customer be harmed;

- Most suppliers build equipment to commonly accepted standards, making it most economic for the utility to accept these standards (e.g. compatible equipment inventory, pool of individuals trained to operate);

- Because these standards are in widespread use, it is easier for a utility to gain benefit from being a member of a large technical community that shares like problems and experiences based on the use of similar equipment (e.g. interface compatibility, operating understanding).

However, utilities adopt different standards on occasion. The exceptions occur for different reasons, some of which follow:[22]

- Occasionally, a utility will adopt what it believes to be a more stringent standard than CSA, if it feels the equipment it may purchase based on a CSA standard is inadequate. This most often happens with underground plant and transformers, where some utilities prefer what they feel are more stringent European standards;

- Economic considerations may drive non-adherence. That is, utilities may prefer to buy material from plants which manufacture to a more relaxed standard.

- There are a few instances where local utility design and operation practices are at variance with standards, while arguably still following sound engineering practice and principles. In these areas, utilities have found it is wiser and/or safer to adopt their own practices (e.g. the use of higher standards for the construction of transmission facilities to maximize reliability in consideration differing terrain, climatic or other operating conditions).

#### *1.5.1.2 CONCLUSION: THE USE OF CSA STANDARDS BY ONTARIO UTILITIES*

In Ontario, the most commonly used technical standards in voluntary use for utility distribution and transmission plant is the CSA 22.3 family of standards and the CSA engineering (e.g. transformer) standards, and the large number of technical standards that they in turn reference. Virtually all utilities in Ontario use this family of standards for the design of their utility plant, and for procuring the component parts from which it is constructed.[23] For generation plant, non-utility generators have historically been obliged to follow the OESC for design and construction. Utility generators have used utility-defined standards for parts of the facility and, to the extent possible, the OESC for the non-power production parts of the facility (e.g. office areas, staff areas, lighting, out buildings, etc.).

[22] Having said this, industry initiatives are underway to achieve common standards under NAFTA and World Trade Organization, and ultimately the need (or indeed the opportunity) for utilities to purchase equipment "below" CSA standards should disappear.

[23] Appendixes 1 provide a summary of various aspects of distribution, transmission, and generation utility standards in place and in common use in Ontario.

There are a small number of gaps in the CSA standards. In these cases, there have been provincial 'modifications' to the C22.3 standards commonly adopted. The next section provides a more detailed discussion of current CSA codes in use in Ontario.

### *1.5.2 OVERVIEW OF EXISTING TECHNICAL STANDARDS REFERENCED IN CODES*

In Canada, there are two complementary standards covering electrical installations. These standards are used extensively (either on a voluntary basis, or as mandated by law) to guide design and construction for utility plant. This section of the report has been written to provide the reader with a summary understanding of the existence of these Canadian codes and the content contained within them.

#### *1.5.2.1 UTILITY INSTALLATIONS: CANADIAN ELECTRICAL CODE PART III ("PART III")*

In Canada, design requirements for electrical utility installations are contained within the Canadian Electrical Code Part III ("Part III"), with two significant portions being CSA Standard C22.3 No 1 Overhead Systems and CSA Standard C22.3 No 7, Underground Systems.

C22.3 No.1 addresses design requirements for structural grades of construction and clearances of lines above ground, from other structures and from communication lines. C22.3 No.7 addresses underground cable depths of burial, mechanical protection of cables, separation from communication cables, and other structures. Use is also made of applicable parts of the OESC on a discretionary basis for such things as wiring, grounding, and space for access to equipment in buildings.

#### *1.5.2.2 CUSTOMER INSTALLATIONS: CANADIAN ELECTRICAL CODE PART I ("PART I") / OESC*

Requirements governing design and construction of customer owned installations are in the Canadian Electrical Code Part I ("Part I"). In Ontario, the same subject matter is covered by the OESC, which uses the Canadian Electrical Code as a foundation, and incorporates revisions after consultation with Ontario stakeholders.

While the OESC is used primarily for customer owned low voltage installations (<750 volts), it is also applicable to customer owned high voltage installations and, to this end, contains extensive requirements which deal with the same subject matter contained in the Canadian Electrical Code Part III. Specifically, it deals with aspects of high voltage installations not covered by Part III (i.e. not covered by C22.3 Nos. 1 and 7), including, grounding, fence design, signage, high voltage cables in structures, clearances in switchyards, transformer placement, disconnecting and isolating means, overcurrent protection and working space around electrical equipment. The requirements of the OESC are very prescriptive and are more demanding than those in Part III. In addition, the OESC has amended Part I by adding a section for customer owned distribution which deals with the subject matter of Part III in a

very prescriptive fashion and with some more demanding requirements (essentially the pre 1999 Ontario Hydro Distribution Standards). The Electrical Safety Code refers to Part III for installations not covered by specific requirements.

Compliance processes applicable to customer owned installations are contained in the OESC[24], and provide for third party oversight of installations and equipment, and removal of hazards. For installations, oversight is achieved by plan review and inspection by ESA (which provides for work audit and rigorous, detailed inspection). Third party approval is required for equipment.

#### *1.5.2.3 THE METHOD BY WHICH THE OESC IS UPDATED*

In Ontario, O.Reg. 164/99 adopts the 1998 Canadian Electrical Code including any Ontario revisions. This 1998 Code contains any exemptions to the code, inspection processes, and the technical revisions mentioned above. The OESC is updated every four years, in step with the Canadian Electrical Code.

Technical revisions of the OESC are made on the advice of the Ontario Provincial Advisory Committee. This committee is modeled, both in composition and operation, on the CSA Committee for the Canadian Electrical Code Part I. That is, the composition of the committee attempts to ensure balanced representation of all key stakeholders (i.e. contractors, engineers, utilities, consumers, certification organizations, government ministries (Labour, Fire Marshall's Office, Housing), inspectors, equipment manufacturers, organized labour). Membership is structured such that no one segment of the industry can dominate the vote. Much of the work is done by correspondence with any negative votes on any change being discussed and voted on at a meeting. Although the committee technically provides only advice, the practice for many years has been to adhere to committee decisions.

Members of the relevant committees are consulted, as appropriate, before making significant interpretations of the code or accepting new technologies between scheduled code revisions.

The electrical industry is consulted on changes to the inspection processes and changes in the code scope using a broad “canvas approach” process and, where necessary, follow up discussions.

#### *1.5.2.4 SCOPE OF THE OESC AS IT RELATES TO UTILITY INFRASTRUCTURE:*

The OESC historically has exempted electrical utility functions from the requirements of the Code - the current wording being in place since 1969. Specifically, it reads that: This code does not apply to: Electrical equipment and electrical installations used exclusively in the

[24] OESC Rules 2004 through 2-0036 (pages 30-34).

generation, transformation, or transmission of electrical power or energy intended for sale or distribution to the public.[25]

### *1.5.3 CONCLUSION: THE ROLE OF CODES IN SAFETY*

There are currently two sets of standards, codes and compliance regimes used in the Ontario electricity industry. Differences are largely based upon infrastructure ownership.

## 1.6 Ontario Electrical Industry Restructuring and Potential Public Electrical Safety Risks

### *1.6.1 POTENTIAL PUBLIC ELECTRICAL SAFETY RISKS*

Amongst the changes which industry restructuring may bring and which could increase the public electrical safety risks are the following:

1. Changes in asset ownership or operation (public to private business ownership) and consequent increased risk, examples of which come from:

- New owners of utility plant may have a different approach towards safety or a different understanding and/or training for personnel working on, or in proximity to, electrical equipment. This will affect both the approach towards the ongoing maintenance of existing plant, and the construction of new plant.

- Transfers of operational responsibility to private owners who lack knowledge of design and installation standards used during construction; and whose workers lack the skills for working in the environment of electrical equipment that was assumed in the original design.

- Transfer of operational responsibility to private owners who have responsibility for electrical equipment which was not built in compliance with the safety features inherent in the OESC; [26]

- Transfers of utility plant assets to new private owners and the identification of severe safety hazards requiring risk mitigation.

[25] Ibid.

[26] A potential 'extension' of this risk may also come, for example, as ownership of assets is transferred from utilities (e.g. OPG) to other private entities, who claim that they should also be exempt from the requirements of the OESC. Indeed, the ESA believes that 'non-utility' parties who own generation equipment, which is identical to 'utility-owned' equipment, could lobby to be exempt from the requirement of being compliant with the OESC unless this anomalous situation is addressed.

2. Regulatory regime and new competitive pressures may introduce new financial motivators.

- These may lead utility management to make certain cost cutting decisions, including to: reduce the quality of work materials; lower public electrical safety campaigns; lower expenditures on safety training and/or audits; introduce lower cost methods to operate and maintain the system; introduce lower design constructs in order to reduce operating costs. Any of these measures could impact upon public electrical safety.

3. Differences in demarcation point between utility/customer plant across the province increases the risk to those working on electrical equipment due to:

- Differences between the equipment configuration, material used, construction and installation between privately owned and publicly owned plant. Customer owned plant installation had to comply with the OESC, while utility plant installation did not.

- The practice of some utilities to competitively bid against independent electrical contractors. Some utilities use their current "OESC exemption" to build what will eventually be customer owned electrical infrastructure to a standard intended to be worked on by utility-trained and qualified personnel. Contractors working across the province will have to be aware of different standards and different demarcation points. The competitive pressures to reduce costs may lead to increased contracting out and contractors working across the province will have to be aware of different standards and different demarcation practices [27].

### *1.6.2 CONCLUSIONS: INDUSTRY RESTRUCTURING MAKES THE CONTINUANCE OF THE UTILITY EXEMPTION QUESTIONABLE*

There are currently two sets of standards and two compliance regimes used in the Ontario electricity industry. It seems prudent to re-address the current utility exemption in the OESC since the underlying assumptions on which the exemption was based (government ownership, high safety focus) are no longer necessarily valid. Moreover, the process of transition to a restructured industry is introducing unique risks, which cannot be easily addressed without some change in the regulatory framework.

[27] Some stakeholders indicated that an additional risk comes from the different business approach and potentially different attention to safety standards between an asset owner who ultimately has to build plant in a way that ensures its' safe and effective long-term operation, and short-term industry players (or contractors) who build assets on behalf of the long-term asset owner. The latter do not have to own and operate the asset over the long term and hence may not be as concerned with the 'safe and effective long-term operation.

In the interests of both:

- protecting purchasers of utility plant by providing a clear descriptions of construction, design, operating procedures and any safety risks inherent in equipment they are buying, leasing, operating, or working on, and

- not undermining the quality of the utility plant in place over time through degradation of standards,

it seems appropriate to re-address the current utility exemption.

It is increasingly important that the scope of the OESC be defined in light of restructuring and the separation of monopoly and competitive components within the utility businesses. The demarcation points between customer, competitive affiliate and regulated utility infrastructure (both ownership and operational demarcation) will become increasingly blurred. Some clarity is needed around the question as to where power ceases to be intended to be for sale at the customer interface, and in stations, what parts of an installation are used exclusively for this stated purpose. The current ambiguity would obviously be problematic where an electrical accident was being investigated, or in defining, a remedy where an electrical safety risk had been identified.

In short, as the industry restructures, it is questionable whether the current regulatory framework and the concept of utility "self-regulation" will continue to ensure the levels of electrical safety that have been a cornerstone of this industry. Since one of the premises of market restructuring has been to introduce competition while driving towards a "level playing field" as between private and utility market participants, it would seem logical to extend both the private oversight system (including the value system, the processes and the approach behind the OESC and the associated compliance processes), to the utility sector.

## 1.7 Safety Oversight Regime in other Restructured Jurisdictions, Including Ontario 's Natural Gas Industry

### *1.7.1 OVERVIEW*

This section provides a summary of the research conducted to evaluate safety management systems used in other jurisdictions in the world. The research considered jurisdictions which, on a continuum, could be considered either "lightly regulated" (e.g. New Zealand) to "more tightly regulated" (e.g. California, Alberta) so as to asses the relative merits of each. In addition, the ESA evaluated the present oversight system in place in the Ontario natural gas industry, overseen by the Technical Standards and Safety Authority ("TSSA") and relied upon by the OEB[28], to assess what could be gleaned from this system.

[28] As an aside, a new Technical Standards and Safety Act received third reading on October 12, 2000. It modernizes and consolidates a number of acts including the Energy Act.

Key characteristics of the jurisdictions studied are:

- All have an element of private ownership in their electricity industry and/or have restructured some element of the electricity industry to introduce increased economic competition.

- In some jurisdictions (i.e. New Zealand), restructuring took place in the early 1990's and they have therefore had some time to introduce, identify problems with, and modify their system.

- Alberta was included since they have recently restructured, have an integrated standards and compliance system, historically had some privately owned utilities, and provide a Canadian example.

- New Jersey has recently restructured, has privately owned utilities, and references comprehensive electrical standards.

In all of the jurisdictions evaluated, the following patterns or similarities in the safety management systems are noted:

- Regulations affecting distribution, transmission and generation specifically address aspects of the electrical safety management system;

- Standards are published with requirements affecting design and are prescribed by regulation (usually national design standards);

- Legislation addresses worker certification in some way.

### *1.7.2 RELATIVE STRENGTHS OF SYSTEMS STUDIED*

Attempts to be conclusive about the effectiveness of one regulatory regime over another are difficult. Ideally, one would like to draw conclusions on effectiveness based on electrical safety records in the utility industry in each jurisdiction. However, it is difficult to compare safety records between jurisdictions since it is difficult to determine the method - if any - used to collect safety statistics, and typically the data simply does not exist. It is, therefore, impossible to conclude if one jurisdiction is superior to another. Instead, the ESA has enumerated the characteristics of the various systems and attempted to draw conclusions, some of which are enumerated below:

- Electrical safety requires the electrical system be constructed, operated, and maintained in accordance with safety standards. A strength of the New Jersey system is reliance on national electrical safety standards, which draw on national expertise on safety, design, operation and maintenance and can draw from a well-

developed national accident statistics database. Similarly, in Alberta the oversight system uses national codes with some provincial revisions;

- Design standards, in isolation; have not been seen as sufficient to ensure that public safety risks are minimized. Public electrical safety is also determined by the methods used to safely maintain and operate the infrastructure. Operational standards are included in the TSSA oversight of the natural gas industry in Ontario;

- Duplication of oversight responsibility has led to confusion in the introduction and management of the safety management system in New Zealand. The key lesson is to ensure that proposed system avoids duplication and has clear accountabilities for safety.

- Specific design standards and compliance processes contribute to a transparent and fair process for safety management and licensing;

- A specific process for investigating accidents and complaints, which includes follow up, contributes to eliminating hazards and improving standards over time.

With respect to the Ontario natural gas industry;

- There is an integrated system of standards for design, operation and maintenance, worker certification, contractor licensing, compliance process and accident investigation under the auspices of the TSSA. The design standards are based on national standards that are adopted by reference. Pipeline standards address operation and maintenance as well as design and construction. Codes comprise a national standard with revisions to address Ontario conditions.

- The TSSA leverages the existing statutory licensing of Professional Engineers, requiring certification of designs and some installations by Professional Engineers.

- Compliance processes are enabled by the TSSA having the right to conduct spot checks as a method of assessing successful compliance to standards.

- The TSSA must be notified of accidents, which facilitates improvements in standards and compliance processes and has the authority to access records.

- The TSSA fulfills a public education role.

### *1.7.3 CONCLUSIONS: SAFETY OVERSIGHT REGIME*

Other jurisdictions with similar utility structures to Ontario have mandatory codes and compliance processes built into legislation. Further, in Ontario, electrical utilities are familiar with the requirement to follow codes and standards in other areas of their business (e.g. building codes, boiler and pressure vessel codes, etc.).

Other regulatory processes, now in place in Ontario, do not deal completely with public electrical safety and assume ESA has the required code in place. Both the historical safety statistics and a change in the provincial utility structure suggest some type of code is desirable since, the ESA has statutory authority over utility installations for public electrical safety, but does not have regulations or a code referenced in a regulation that deals with design, maintenance, operation standards, compliance processes and processes for dealing with imminent hazards.

# 2.0 Recommended Approach, including Implementation Issues (standards, regulations, and compliance assurance process)

## *2.1 KEY PARAMETERS GUIDING THE ESA APPROACH*

The ESA has developed a recommendation for regulations after careful consideration of both the potential increase in public electrical safety risk due to restructuring, and the regulatory approach adopted in other jurisdictions and in other industries.

### *2.1.1 INTEGRATION WITH OTHER OVERSIGHT AGENCIES*

Government/regulatory agency integration avoids duplication, minimizes industry confusion, and avoids the layering of regulatory requirements and reporting. In so doing, cost efficiencies can be realized. The ESA believes it can define a public electrical safety oversight and compliance assurance process which can be integrated with the processes described by the OEB in the DSC and TSC, and which can work in parallel with the Market Rules defined by the IEMO. Indeed, the recommended processes may assist in defining the term "good utility practices" found in both the TSC/DSC as they relate to public electrical safety. Similarly, the ESA is aware of the role with respect to worker safety in the utility environment provided by other bodies (i.e. the MOL, MTCU, WSIB, and safety management organizations, such as EUSA and the IAPA). ESA recognizes workers as an obviously important subset of its public electrical safety mandate and, as such, must work with these agencies to share statistics, programs and resources, wherever possible.

### *2.1.2 LEVERAGE EXISTING PROCESSES*

The ESA believes it is prudent to, adopt and secure as many of the features of current processes and approaches as practical. Therefore, for example, the ESA has tried to incorporate the following thinking in its recommendation:

- The approach adopted in the DSC/TSC with respect to self-inspection, testing and certification, with the addition of ESA audits;
- Adoption of the compliance assurance model which currently exists in the ESA "Authorized Contractor Program". Specifically, a determination of audit frequency and content based on utility performance over time.
- Adoption of the approach used in the Ontario natural gas industry with the TSSA providing regulatory safety support and oversight and public education material, including the requirement for all electrical incidents or accidents to be reported in a timely manner and for the ESA to be given the opportunity to participate in the investigation.
- Use of utility resources to verify that designs meet the specifications of the standards, and that the construction is consistent with the design.
- Use of utility records, as provided to the ESA by the utility, as a means for a utility to "qualify" for a less rigorous oversight compliance process.
- Adoption and/or adaptation of industry CSA design and construction standards;
- Adoption of the existing process for update and maintenance of the OESC as a recommended approach to modify referenced utility standards over time;
- Partnering with the OEB to address licensing criterion as defined in the DSC/TSC for public electrical safety, and remedies within the licensing regime.

### *2.1.3 COST BENEFIT EVALUATION*

The ESA believes that there are societal benefits arising from the ESA recommendation, namely:

- ESA participation in standards development forums - The ESA brings a third party, independent, safety-focused voice to these forums. The ESA would also provide information, based on both its' audits of utilities across the province, and its' access to incident reports, on common operating practices, experience and performance in safety related areas;

- Over time, standards will likely introduce cost efficiencies in the utility business (e.g. increased labour mobility, reduced costs associated with training)[29];

- The adoption by utilities of more consistent equipment standards and specifications may lead to significant savings in manufacturing costs and service vehicle safety costs, and;

- Any reduction in electrical fatalities due to contact with utility infrastructure would obviously be a desirable outcome.

The ESA estimates that participation in the standards development process, the public education campaigns, and a compliance process would be in the order of 0.04 to 0.07% of gross provincial utility electricity sales in the year 1998[30].

The ESA recommends that utilities could be billed periodically based on hours spent on utility-specific audit investigation and review, plus a pro rata share of ESA general costs of activities undertaken on behalf of the utility sector in total (e.g. participation in regulation/standards development, public education, complaints handling infrastructure, etc.). Utilities requiring frequent investigation due to third party complaints/referrals, or based on performance, or a history of non-compliance, would incur higher fees (presumably an incentive to improve performance).

### *2.2 CONCLUSION: ESTABLISHMENT IN REGULATIONS OF MINIMUM DESIGN STANDARDS FOR UTILITY INFRASTRUCTURE (TRANSMISSION, DISTRIBUTION AND GENERATION)*

A code should be developed for the electric utility industry. The Code should provide a minimum standard for ensuring electrical safety of all electrical installations. The function of standards is to serve as a floor to protect against degradation in infrastructure design and construction over time and/or the introduction of lower standards by new participants seeking a short term cost advantage over the existing asset owners. Standards can and should be used as the design basis for all-new electrical installations or modifications.

For generation facilities:

- the standards currently applied to "non-utility generators" should be applied to all generators.

[29] Some stakeholders who have experienced amalgamations (e.g. Toronto Hydro) have indicated that they have had difficulty in using workers from one part of their system to another due to the divergence in standards previously used by the former utilities.

[30] The ESA estimates that participation in the standards development process, the public education campaigns, and a compliance process would be in the order of 0.04 to 0.07% of gross provincial utility electricity sales. 1998 Gross Provincial Electricity Sales were $8,411,153,354 (Source: OEB). These values are considered illustrative in nature.

For distribution and transmission:

- Design and construction standards should be applied to selected aspects of the utility business. Design standards would be introduced, in particular, in those areas where the risk to public electrical safety is determined to be highest, such as clearances, depths of burial, grounding, access by the public, working space around equipment, mechanical /structural, and operating practices. Design standards would address both utility infrastructure and interface infrastructure between utility and customer owned equipment. The OESC would continue to apply to all customer-owned installations.

Existing Canadian standards (CEC Part III, etc.), where available and applicable, would be referenced in the regulations. International standards or the existing OESC, where available and applicable, could also be utilized. If specific provincial operating conditions and/or considerations are deemed to warrant provincial modifications to these national standards, those modifications, which serve to enhance these national standards, could be adopted, provided there is consensus in the public consultation process. The ESA believes it to be more efficient to adopt or adapt existing standards, rather than to produce and maintain a separate Ontario standard. The ESA believes this standard should always set a minimum. There will always be those who choose to exceed this minimum.

The requirement for utilities to comply with these referenced standards would be implemented on a going-forward basis only. That is, utilities would not be expected to change current infrastructure to conform to these standards, except in those circumstances where there are undue safety hazards to persons or property.

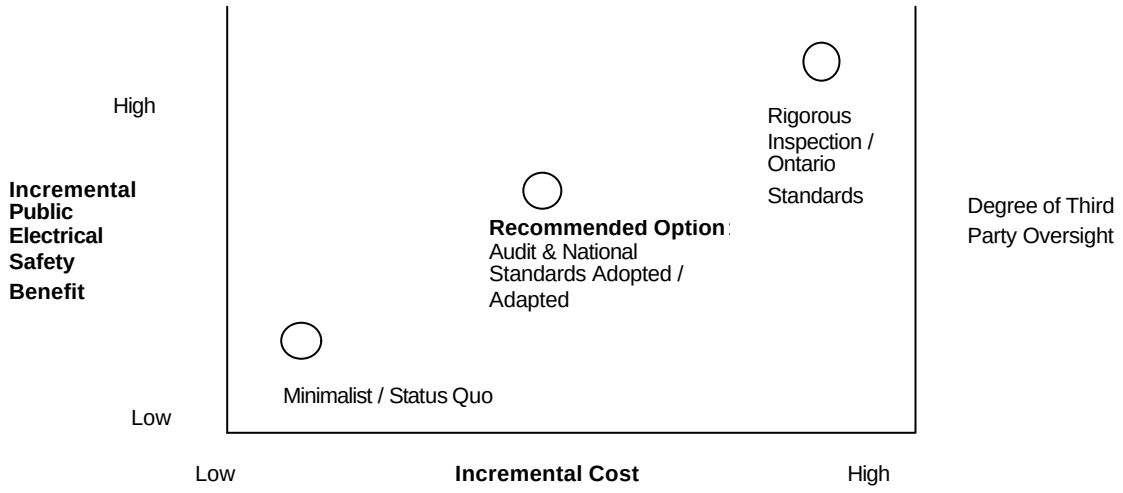
The ESA recognizes that, while the standards will not be applied retroactively to existing infrastructure, there are situations where a transfer of asset responsibility may increase the public electric safety risk. Specifically, utility plant, which was built to be operated and maintained by qualified utility personnel, may not have been designed or constructed in a way, which provides for safe operation, by non-utility personnel. In any situation where a utility is planning to transfer responsibility for, or sell any portion of utility plant to private non-utility owners and/or operators (the 'acquirer'), a disclosure of the details as they relate to the safe connection, disconnection and safety of the plant to be transferred is to be provided to both the acquirer and the ESA. Specific details of what information must be provided, including any types of changes required and inspections required are to be determined through the public consultative process. Such information should include details with respect to clearances, grounding, access, isolation equipment, disconnection/reconnection information, and an assessment of measures necessary to bring the installation to OESC conformance, available fault currents, and safe work methods with respect to such equipment.

### *2.3 CONCLUSION: ESA SUMBITS THE FOLLOWING RECOMMENDATION ON COMPLIANCE PROCESS*

The ESA believes that most parties will comply with standards. The compliance process is a check to guard against gradual or inadvertent slipping. The ESA submits that it may be particularly important for such things as overhead line clearances, depths of burial for underground cables, grounding, mechanical / structural design of lines, access by unauthorized persons, working space for authorized persons, protection and control, equipment and electrical insulation.

Compliance systems can vary from rigorous, intrusive systems requiring third-party inspection of all utility construction to spot inspections of specific geographic or functional areas of construction within particular utilities, to requirements for utilities to develop and maintain a documented safety management system and relying largely on utility self-inspection. Each of these compliance systems has societal benefits (i.e. minimizing public electrical safety risk, saved lives) at significantly different costs (i.e. cost of oversight). The graph below depicts pictorially the various options contemplated by the ESA and their associated benefits and costs. Table 2 below summarizes the criterion used by the ESA to evaluate the options.

**Graph A:** Depiction of various compliance options




The need for third-party oversight is only justified to the extent that safety performance may be compromised, or is at risk of deteriorating. In evaluating which compliance approach to adopt, the ESA carefully considered the Ontario utility safety record (as presented above); the historical approach to system design and construction adopted by significant industry players and, the expertise of the industry personnel. The recommended approach, in light

of the relatively high standards in place today is to rely to a large extent on an audit based compliance approach.

**Table 2: Compliance Options Considered by the ESA**

| Compliance Options | | Criterion Used by ESA to Evaluate the Compliance Options | | | |
|---|---|---|---|---|---|
| | **Description of the compliance option, including the degree of ESA Oversight of Utility** | **Public Electrical Safety (e.g. Support Independent Safety focused (i.e. ESA) Participation in Standards Development, prevent degradation of standards)** | **Level Playing Field (Standards and Compliance processes applied to Private/Utility Players)** | **Support OEB Licensing Process, Other Accident /incident investigations (Complaint follow-up, audit of utility reported inspection, testing, commissioning records)** | **Implementation Cost to Utility** |
| Option 1: Minimalist | Utility self-inspection/ (i.e. Status Quo, no regulations under Section 113 to give ESA any role in requiring utility compliance); Limited follow up of OEB / third party complaints | Low Impact | Low Impact | Low Impact | Low Impact |
| Option 2: Maximum Oversight | Rigorous third party inspection of utility infrastructure, regular audit, follow up of OEB/third party complaints | High Impact | High Impact | High Impact | High Impact |
| Option 3: Recommended Option | Verification that utility T, D, & G infrastructure is designed and constructed to mandatory safety standards by Professional Engineer, or ESA inspection. Establishment of ESA audits. Follow up of OEB/third party complaints. | Medium Impact | Medium –Low Impact | Medium-Low Impact | Medium–Low Impact |

The ESA recommends that it will initially rely largely on industry participants to continue to maintain high safety standards, will rely on an audit process and provide for more intensive oversight where warranted based on hazards found and /or performance. While the

oversight rules will be more clearly developed through the public consultation process, they must include the following:

- Provision for regular ESA audit authority for both planned and 'as built' construction, with the audit process defined for each utility segment;

- Provision for more rigorous/less intensive audit possible given performance over time, based on complaints received, or as directed by a third party regulatory or governmental body.

- Provision requiring utilities to maintain records of work done on utility infrastructure, related to expansions and significant betterments. Provision for the ESA to be given access to utility operating, design verification, construction verification records and performance records or reports, as required for safety related accident investigation or as required for audit/inspection.

- Provision that ESA be notified (or included on report distribution) in a timely manner of all reportable electrical incidents or accidents and provided the opportunity to participate in the investigation.

The ESA believes that a system, which relies on the asset owners to largely carry the responsibility for safe utility infrastructure, is the most sensible. This places the responsibility for optimal operation in the hands of the parties with the greatest incentive to maintain current expertise and it ensures that the responsibility (and cost) for unsafe operations remains in the hands of those responsible for ongoing system operation. The onus for industry participants to regularly examine and ensure that their work practices are consistent with their own definition of "good utility practice" is implicit and consistent with the approach adopted by the OEB in both the DSC and the TSC.

At the same time, the involvement of other interest groups, including consumers, regulators and safety experts in the establishment of the definition of good utility practice, as it relates to public electrical safety, provides independent safety-focused input. Third party oversight does provide both the public and the government with a "safety net", namely; a mechanism to proactively identify and react to safety hazards; a body to enforce remedies in situations where problems are identified; a body to audit utility safe practices as directed by the OEB or other governmental agency, and a participant in standards development which provides public electrical safety focused input.

Explicit reference to national design standards in legislation would bring Ontario closer to the norm in all of the jurisdictions evaluated. Integration of this safety oversight, with the work of other safety organizations such as the MOL, would move Ontario explicitly towards an oversight system that recognizes the critical interrelationship between infrastructure design and work practices.

### *2.4 DESCRIPTION OF ROLE OF THE ESA*

Under the recommended option, the ESA would have the following accountabilities:

- ESA given authority to require verification that designs and construction for distribution, transmission, and generation facilities are in accordance with adopted/modified national public electric safety standards. Such verification must be completed by an Ontario registered Professional Engineer or by the ESA. Such certification could be reported with license application, periodically, or as part of facility commissioning.
- Where a professional engineer is not available to provide this certification, ESA must review design and inspect installations (possible using audits and/or examination of plans, as per processes developed within the OESC).
- ESA given authority to carry out spot inspections, regular audits, review operational, incident and maintenance records as prescribed by regulation to check code compliance.
- If investigation demonstrates that utility design does not conform to standards, the ESA can determine appropriate remedy (e.g. notice of deficiency, issuing an order, referral to Professional Engineers Ontario ("PEO") discipline process, and referral to OEB licensing process).
- For those facilities requiring OEB approval, ESA given the opportunity to review designs prior to construction.
- ESA given authority to investigate third party non-compliance complaints and OEB referrals.
- ESA notified of electrical accidents/incidents. ESA on report distribution list(s) (from Coroners' office, MOL/WSIB, utility, police, for example) or involved in accident/incident investigations.
- Creation of stakeholder advisory body to develop and maintain standards and regulations.

## 3.0 Next Steps

### *3.1 INDUSTRY CONSULTATIVE PROCESS*

The consultative process is intended to involve industry stakeholders, government and regulatory representatives, and other public interest groups.

The focus of this work is on identifying the appropriate electrical safety standards that should apply across the Province for the generation, transmission, and distribution of electricity and to ensure that appropriate compliance assurance mechanisms are in place.

Over the last three months, in preparation for this consultation, the ESA met with 13 key industry stakeholder organizations, involving discussions with approximately 42 individuals, to obtain their input, to better understand which safety standards are used in their businesses, and obtain their views as to the recommended next steps. Table 3 enumerates the stakeholders who met with the ESA. Their views have been considered and incorporated wherever possible. The ESA hopes that this will facilitate the broader public consultation in 2001.

The Electrical Safety Authority is prepared to initiate this review process and put forward recommendations on revised electrical safety regulations that will address the changes occurring in the generation, transmission and distribution of electricity. With the cooperation and assistance of industry stakeholders, the ESA is hopeful that this consultative process will be finished and the recommended approach put forward to the Minister of Consumer and Business Services within six months following the commencement of the public consultation process.

**Table 3: List of Stakeholders contacted during November and December 2000**

| Name | Company |
|---|---|
| Mr. Brian MacEwen<br>Director of Electrical & Gas Standards | CSA International |
| Mr. Eryl Roberts, Executive Vice-President<br>Mr. Earle Goodwin, Manager, Publication Relations & Communications | Electrical Contractors' Association |
| Mr. Ted Vandevis, Chief Executive Officer<br>Mr. Brian A. Weber, President, grimsbypower<br>Mr. Tom Bell, Toronto Hydro<br>Mr. Jim MacKenzie, Guelph Hydro<br>Mr. Colin Saunders, Director Prevention Services, EUSA | Electrical Utility Safety Association |
| Mr. Mike McEwen, President & CEO<br>Mr. Kevin Bell, GLPL<br>Mr. Colin Clark, GLPL<br>Mr. Rob Reid, GLPL | Great Lakes Power Limited |
| Mr. Michael Penstone, Manager Industry Practices & Policies<br>Mr. Mike Della Rossa, Director Safety & Environment<br>Mr. Chris Cooper, Operating Standards and Policies | Hydro One Networks Co., |
| Mr. Larry Lineham, Executive Chairman, Power Council<br>Mr. Ray Wacheski, Business Manager / Financial Secretary Local 636 | International Brotherhood of Electrical Workers |
| Mr. Amir Shalaby, Manager Regulatory Affairs<br>Mr. Stephen Burns, IEMO | Independent Electricity Market Operator |
| Mr. Jake Brooks, Executive Director | Independent Power Producers Society of Ontario |

| Name | Company |
|---|---|
| Mr. Greg Warner, Niagara-on-the-Lake Hydro Inc.<br>Mr. Doug Reeves, Sudbury Hydro Inc.<br>Mr. Ken Quesnelle, Vice President and Assistant General Manager, Woodstock Hydro<br>Mr. Ed Muldoon, Vice President-Network Services, Hydro Ottawa<br>Ms. Gaye-Donna Young, Manager Regulatory Affairs, Markham Hydro Distribution Inc.<br>Mr. Rene Gatien, Vice President, Operations, Guelph Hydro<br>Mr. Rick Archdekin, Midland Power<br>Mr. Don Marsales, Hamilton Hydro Inc.<br>Mr. Ed Gabryl, Engineer Distribution Practices, MEA<br>Mr. Jerry Freeman, Assistant Director Technical Training, MEA | Municipal Electric Association and representative distribution utilities |
| Mr. Gabriel Mansour , Provincial Engineer Professional & Specialized Services<br>Mr. Nax Nagalingam, Provincial Co-ordinator, Professional & Specialized Services<br>Ms. Filomena Savoia, Provincial Co-ordinator, Construction Health and Safety Program<br>Mr.Bernie Deck, Provincial Co-ordinator, Mining, Mining Health and Safety Program<br>Mr. Stephen T. Kwok, A/Provincial Co-ordinator Industrial Health and Safety Program | Ministry of Labour |
| Mr. Brian Hewson, Manager Licensing<br>Mr. Gord Ryckman, Licensing, OEB | Ontario Energy Board |
| Mr. Joel Singer<br>Vice President, Regulatory Affairs | Ontario Power Generation |
| Mr. Mel Hyatt, Vice President<br>Mr. Bob Menard, Staff Officer<br>Mr. Rick Johnson, Chief Steward | Power Workers Union |
| Mr. Tom Bell, Senior Vice President<br>Mr. Joe Bailey, Vice President Infrastructure | Toronto Hydro |

# Appendix 1 (a)

## Summary of Various Aspects of Distribution, Transmission Utility Standards in common use in Ontario[31]

| MAJOR CATEGORY | | DISTRIBUTION LINES | | TRANSMISSION LINES | |
|---|---|---|---|---|---|
| | | Overhead | Under-ground | Overhead | Under-ground |
| **Overhead Line Clearances and depth of burial of underground cables** | Principle recommendation | CSAC22.3 No.1-M85 (R97) | CSAC22.3 No.7-94 (R97) | CSAC22.3 No.1-M85 (R97) | CSAC22.3 No.7-94 (R97) |
| | Supporting Standard | OESC, ANSI / IEEE - 738 | OESC | OESC, ANSI / IEEE –738 | OESC |
| **Mechanical Structural design of lines** | Principle recommendation | CSAC22.3 No.1-M85 | CSAC22.3 No.7-94 (R97) | CSAC22.3 No.1-M85 (R97) | CSAC22.3 No.7-94 (R97) |
| | Supporting Standard | OESC, ASCE-74, IEEE P751/D2, CSAC83-90, CSA-015-90, CSAC49-65 | OESC, CSA C68.1, CSA C68.3-M92, IEEE 404-M92, IEEE 48-96 | OESC ASCE-74, IEEE P751/D2, IEC-826 CSAC83-90, CSA-015-90, CSAC49-65 | OESC, IEEE 404-M92, IEEE 48-96, AEICG1-68, AEIC5-71, IEC-141 |
| **Grounding** | Principle recommendation | OESC*,, CSAC22.2 No.41-M87 (R93) | | OESC*, CSAC22.2 No.41-M87 (R93) | |
| | Supporting Standard | ANSI/IEEE No.80 | | ANSI/IEEE No. 80 | |
| **Access by Unauthorized personnel** | Principle recommendation | OESC* | | OESC* | |

[31] IEEE 404 has been adapted by CSA as "Can CSA-C22.2 No. 241-M91". IEEE 48 has been adapted by CSA as "CAN/CSA-C22.2 No.242-92".

# Notes to Appendix 1(a):

**Clearances** include vertical clearances of live parts above ground (including farmland, parks, driveways, streets, roads railways) and structures (including buildings, signs and swimming pools), and; horizontal clearances of live parts from adjacent structures and separation from communication conductors. Live parts include overhead bare conductors, equipment and transformer terminals.

**Depth of burial** includes such aspects as depth below grade, markers and mechanical protection, and separation from communication and other utilities sharing the same trench.

**Mechanical/Structural** include considerations to ensure conductors and lines are designed to remain standing and include considerations for wind loading, snow loading, methods to allow for the effect of conductor current on strength, foundations, pole strength, structural design safety factors for various locations, pole treatments, mechanical protection.

**Grounding** is ensuring nonenergized conductive parts are at earth potential (or close enough to be non objectionable) under normal and electrical fault conditions - including metal poles, fences, equipment structures and cases, operating handles, nearby building metal parts and cable sheathes, earth surfaces near HV stations.

Guarding against **access by unauthorized personnel** includes such things as minimum elevation distances for energized parts, fences, gates, locks, signs, locked rooms and compartments, "tamperproof" construction

*Although the OESC is shown as being in use, not all the provisions (e.g. that equipment be certified to a standard by a third party) are followed. In addition some utilities may have internal requirements that exceed the minimums in the OESC.

For the same types of facilities under customer control and ownership, the mandatory minimum is the OESC. The vertical clearances and grounding requirements in particular are more demanding.

# Appendix 1 (b)

## Summary of Various Standards for Transformer stations, Substations and Generation Facilities in common use in Ontario

| | Transformer stations, Substations | | | Generating Stations | | |
|---|---|---|---|---|---|---|
| | Utility | | Customer | Utility | | Non Utility |
| | Not part of the "power path" | "Power path" | Power path and non power path | Not part of the "power path" | "Power path" | Power path and non power path |
| Clearances Protection and Control, Grounding, Access | Canadian Electrical Code where possible supplement-ed by appropriate other national and international standards | Canadian and appropriate international standards | OESC | Canadian Electrical Code where possible supplement-ed by appropriate other national and international standards | Appropriate Canadian and international standards | OESC |
| Equipment | Canadian standards and supplement-ed by other recognized standards as appropriate | Canadian and appropriate international stan dards | OESC and appropriate international standards | Canadian standards and supplement-ed by other recognized standards as appropriate | Canadian and appropriate international standards | OESC and appropriate international standards |

## Notes to Appendix 1(b):

For the purposes of this table, the term power path or power production parts of facilities covers equipment used exclusively in the generation, transmission and transformation of power for sale or use by the public. Loosely speaking it refers to the equipment essential to getting the power from the turbine to the customer.

**Protection and control** is the provision of switches and overcurrent devices. In the power path portions of installations, the same functions are accomplished in a greater variety of ways. Greater control over the system and over work methods allows utilities to use different designs of equipment, which may meet the intent but may not meet the detailed requirements of the Canadian Electrical Code in every aspect. In non-utility and customer installations, the same equipment may be used and there may be a requirement for additional equipment to compensate for different work methods. For example, the Canadian Electrical Code requires visible contacts for high voltage switches. Utilities may not require visible isolation on switches at transformers, as they can provide visible isolation further upstream in their system and control the potential hazard at the transformer through work methods.

**Grounding** is preventing non-energized conductive parts from taking on an objectionable or lethal voltage under normal or abnormal conditions. Utility practice may exceed the OESC in some respects and not meet it in others - examples being the number of ground rods for pad mount transformers or the permissible ground voltage rise around stations under fault conditions.

**Access** is keeping unauthorized personnel away from energized parts and ensuring there is adequate working space for authorized personnel. Practices are largely common although they may differ is specific instances - in part because the compliance process in the OESC discourages "marginal" practices.

**Equipment** is that of a type usually supplied by a manufacturer. In the power path, Utilities control the safety of the equipment through purchase specification and utility quality control procedures. For the non-power path portions, equipment may not be third party certified. For non-utilities, under the OESC, the equipment may be the same as used by a utility but it must be approved to for basic safety by an accredited third party. Modifications, which are generally inexpensive, may be required to eliminate or compensate for "marginal" practices (e.g. signage).

# Appendix 2

## Biographical Notes on the Authors

**Mary Ellen Richardson**

Ms. Richardson's seventeen years of corporate energy industry experience include marketing, sales, management, strategic and operational planning at Ontario Hydro, Consumers Gas, TransCanada Gas Services, TransCanada Pipelines, and Petro Canada. In her most recent senior management role, Ms. Richardson was Director of Consumer and Small Business Markets for Ontario Hydro's Retail Company.

Since leaving a corporate environment, Ms. Richardson has been involved in various endeavours, including: as the Corporate Secretary and General Manager for the Ontario Energy Marketers Association, being actively involved with the customer call centre, dispute resolution process, policy development and government/regulatory liaison; as a regulatory consultant, being involved in various OEB task forces and rate hearing proceedings, and; as a management consultant, leading market readiness, market planning and change management projects.

Ms. Richardson's educational background includes an Honours degree in Economics. She is currently involved in the University of Toronto Dispute Resolution program.

**Mary K. Hutchins**

Over the last twenty years, Ms. Hutchins' experience in the electricity industry includes management positions with Ontario Hydro Retail in field operations general management, call centre and customer service management, business planning, process re-engineering and business systems implementation projects.

In her role as an independent consultant, Ms. Hutchins has worked in a variety of activities including: Corporate Secretary of the Ontario Energy Management Association; as a regulatory research consultant on projects related to the electricity industry restructuring such as the development of the OEB's Performance Based Rates Handbook and Distribution System Code, and; as a management consultant with electricity industry clients helping them to prepare for the Ontario market opening.

Ms. Hutchins has a long-standing belief in continuous learning and has led workshops and facilitated discussions on leadership and coaching, technology application and business planning. The National Bank of Canada has recently recognized her with an award for her work in business planning with start up entrepreneurial organizations. She holds a Bachelor of Commerce, Masters in Business Administration, and a Post-Graduate Certificate in Advanced Management.

C.W. (Wayne) Clark

Wayne Clark has been involved with the electric utility industry for twenty-five years, both with the former Ontario Hydro and as a consultant. His experience spans all aspects of the distribution utility business from field operations management through to strategy formulation and business integration. Prior to becoming a consultant, he held senior positions in distribution system planning, design, engineering projects, materials management, business administration, asset management and business systems. Wayne has particular strengths in the management of large transformational IT projects, as well as recent experience in the regulatory area and the development of asset management skills in distribution utilities.

Wayne has an electrical engineering degree from the University of Windsor, is a licensed professional engineer (PEO), and a member of the IEEE.

**Roy Hicks**

Roy Hicks has been involved with the electric utility industry for thirty-five years prior to retirement in 1999. His experienced includes technical research on electromagnetic propagation, design of electronic devices for power system application, testing of electrical equipment and appliances, research strategic planning, development of standards, preparation of codes and regulations and interpretation of codes.

Prior to retirement he assisted in task forces concerned with forming the Electrical Safety Authority, chaired committees concerned with the development of the Ontario Electrical Safety Code, the Canadian Electrical Code and a Bi-National Correlating Committee on Electrical Codes, participated on many CSA equipment standards committees and participated in committees advising several North American equipment certification organizations. He held a senior position in the Ontario Hydro electrical inspection department, which transformed into the Electrical Safety Authority.

He is currently on CSA International and Professional Engineers Ontario committees.

Mr. Hicks is a graduate of Queens University in electrical engineering and a member of Professional Engineers Ontario.

**Yakov Motlis**

Yakov Motlis has been involved with electric utility industry for thirty-seven years including nineteen years with Ontario Hydro. His experience includes all engineering aspects of transmission and distribution systems, overhead and underground, from low distribution voltages up to and including 500 kV systems, development of design methods in standards, evaluation, development and implementation of new technologies.

Mr. Motlis is active in the national and international work on standards for transmission and distribution systems. He is a Senior Member of IEEE, and a voting member of the IEEE Standards Association, Canadian Representative at CICRE SC22/WG12, a member of the Canadian National Delegation at IEC/TC11. During 1995 to 2000, he was a CEA representative CSA Steering Committee on Electrical Code, Part III.

As a Consultant, (since May 1, 2000) he continues in his profession being involved in a diverse range of projects in North America and in international forums.

Mr. Motlis holds a M.Sc. degree in High Voltage Power Systems Electrical Engineering, is a Professional Engineer (PEO) since 1982, and an author of thirty-six technical papers published by CEA, IEEE, IEE, and CIGRE.