Offsite Emergency Planning at Darlington

Preparing for Re-licensing Interventions
November, 2015

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Presentation made to the Canadian Nuclear Safety Commission, City of Toronto Executive Committee, and the Durham Region Council

About CELA

Canadian Environmental Law Association
EQUITY. JUSTICE. HEALTH.

CELA is a Legal Aid clinic with a mandate to help low-income individuals, community groups, and ENGOs in Ontario.

Our priorities presently focus on:

- Access to environmental justice,
- Pollution and health,
- Green energy,
- Water sustainability,
- Community planning and sustainability, and
- Local to global issues.

Outline

1. Importance of off-site emergency planning
2. Elements of good off-site emergency planning
3. Deficiencies in DNERP
4. Unavailable information
5. Summary of recommendations

1. Importance of Off-site Emergency Planning

- Risk management perspective : not if, but when
- If the offsite emergency plan is triggered, by definition it is the last barrier that might prevent or reduce harm to the health and safety of persons

Importance of Off-site Emergency Planning cont'd

- CNSC passed Regulatory Document 2.10.1 with new offsite emergency planning requirements
- According to its own material, OPG won't be in compliance with RegDoc 2.10.1 until 2018

2. Elements of Good Off-site Emergency Planning

A. Alerting
B. **Evacuation**
C. **Sheltering**
D. **Potassium Iodide (KI) distribution**
E. Control of agricultural products (crops, milk)

"Early" radioactive releases are conceivable.
Accordingly, an important test for the regulator is to ask how fast measures can be implemented to protect people.

3. Deficiencies in DNERP – Evacuation timeliness

Removing people from the area is the only effective way to avoid some doses.

- **2008 Durham Nuclear Emergency Response Plan evacuation scenarios**
  - **range from 4.77 hours to 36.5 hours, several over 20 hours**
- In some scenarios that could mean exposures
- With population and traffic growth in the area of Darlington, this is a major concern

Evacuation must be faster.

Deficiencies in DNERP – Evacuation logistics

Ability of people without cars to evacuate is a significant concern

- DNERP lists for each sector, special care facilities, schools, recreation centres, parks, and locations of emergency services, works, and vital services such as health centres. It also notes motels and hotels when present in the sector.
- However, their specific logistical and needs calculations have not been assessed in the existing Durham Plan. It is thus very difficult for this Panel to assess the reliability of evacuation planning logistics for the Darlington plant.
- The U.S. Nuclear Regulatory Commission provides a good example

More detailed information is needed from OPG

Deficiencies in DNERP – Overreliance on sheltering in place

There is a serious lack of clear information from OPG on merits of sheltering in place

- IAEA Guide GS-G-2.1 :"**typical European and North American homes and their basements may not provide adequate protection**"
- ICRP Publication 109: buildings constructed of wood or metal are "not generally suitable for use as protective shelters against external radiation…"
- Health Canada: sheltering is only effective for some radionuclides, for a few days, and only in concrete buildings
- **OFMEM: evacuation is preferred strategy in PNERP; sheltering in place has limited effectiveness (D. Nodwell, CNSC transcript 1 Oct. 2015, p. 163)**

Regulator should place very low reliance on sheltering. Evacuation must be primary remedy.

Deficiencies in DNERP – Limited planning basis

Planning basis depends on size of accident considered. INES Level 7 Accident not considered

- Commission should require planning basis that contemplates:
  - INES Level 7 accident
  - Early release of radioactive emissions
  - Large source term released to public
  - Widely dispersed radioactive emissions
  - Weather patterns moving emissions over highly populated areas

Darlington Emergency Plan should plan for worst-case scenario

Deficiencies of DNERP – Limited planning basis cont'd

Swiss approach

- Post-Fukushima, Swiss nuclear regulator required:
  - INES Level 7 accident modelling for each nuclear plant
  - Detailed dispersion modelling for each nuclear plant, which has been made publicly available online
  - Detailed emergency planning within 50 to 80km of nuclear plants based on above dispersion modelling, including evacuation and KI distribution

OPG should follow Swiss approach

Deficiencies of DNERP – Limited KI distribution

KI only effective when consumed before or at onset of exposure. Best if pre-distributed.

- OPG pre-distributed KI to homes and businesses in 10km primary zone
- KI will be purchased and pre-stocked in the 50km secondary zone for sensitive populations only (R. Tennant, CNSC transcript 1 Oct. 2015, p. 148)
- Sensitive populations = pregnant & breastfeeding women, children 18 and under
- Radioactive exposures have exceeded 10km in other nuclear accidents worldwide

OPG should pre-distribute KI within entire secondary zone

4. Unavailable information

- Most recent version of Durham Region Evacuation and Sheltering Plan
- DNERP Annex B (evacuation modelling) update not available until December, 2015
- Severe Accident Study modelling an INES Level 7 accident
- Site-wide evaluation of risks
- Input from any revisions to Provincial nuclear response plan made in 2016
- Transparent and inclusive engagement with residents in primary & secondary zones re: emergency planning

Conclusion

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- CNSC should limit OPG to a 1-year license with strict conditions:
  - OPG must comply with RegDoc 2.10.1
  - The CNSC must be satisfied that evacuation would be effective as the primary remedy in an INES level 7 accident
  - The CNSC must be satisfied that it has seen updated, detailed modelling of evacuation timelines and logistics
  - The CNSC should require OPG to demonstrate that offsite planning in the vicinity of the Darlington reactors is based on an expanded planning basis compared to the status qho, i.e. must conduct and share results of Severe Accident Study of an INES Level 7 accident, as well as early release scenarios
  - OPG together with the host municipalities must pre-distribute KI to all homes and businesses in secondary zone
  - The CNSC must be satisfied that it has all of the unavailable information listed in slide 13 before considering the application for a life extension.

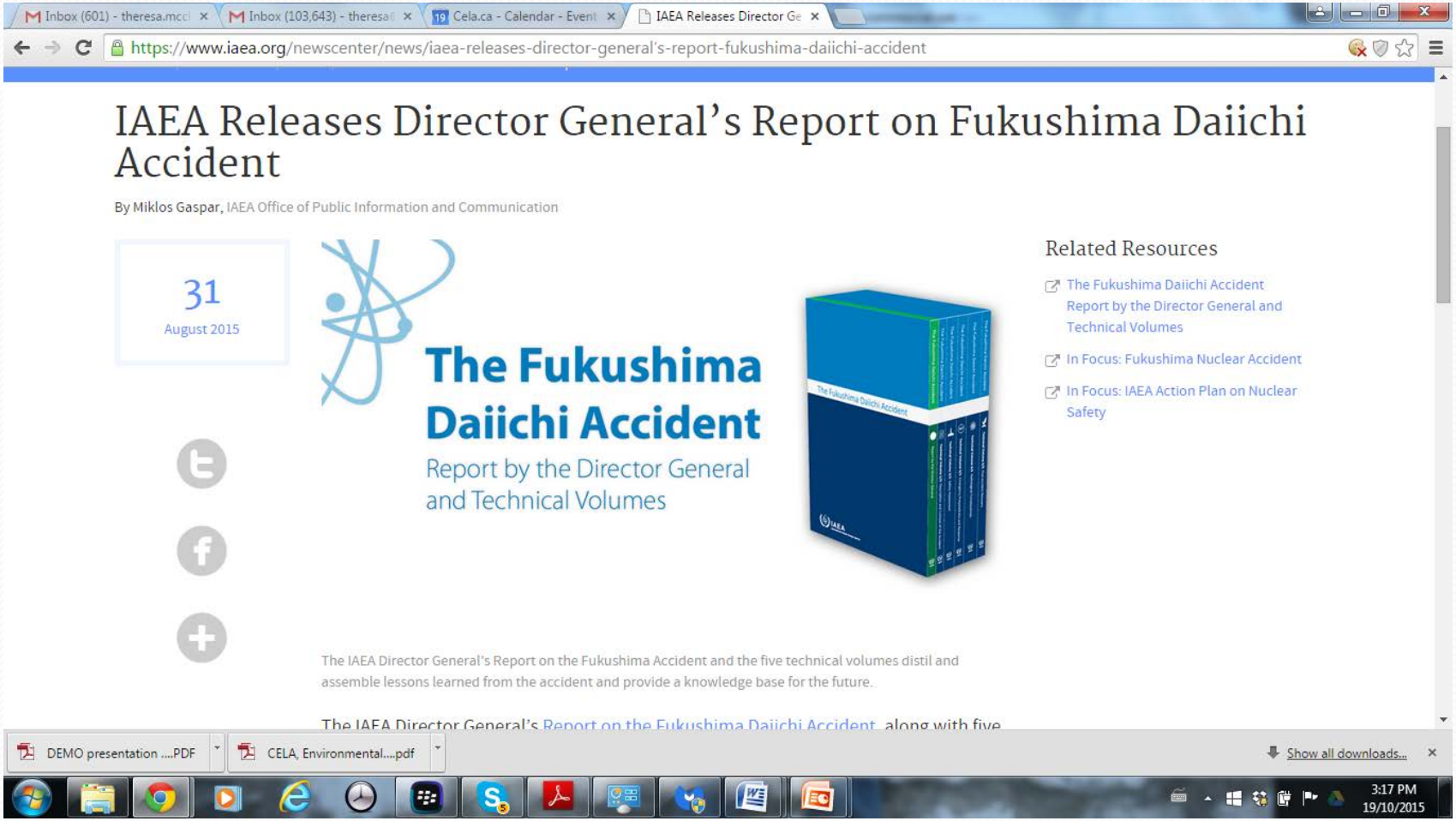
All 16 CELA recommendations are provided in Appendix B

Appendix A

Lessons Learned on Emergency preparedness in Fukushima

- Fukushima Daiichi Accident review by the International Atomic Energy Agency published 2015
- Five technical volumes – one on Emergency Preparedness and Response

IAEA Report 2015



Initial Notification

- The emergency response plan at Fukushima anticipated prompt notification to off-site authorities within 15 minutes
- However, all means of communication to some of the affected towns were out of order
- Staff from the operator travelled personally to some of the affected towns to relay plant conditions; in the case of Namie Town they reached them two days later

Approval for venting

- There were contradictory decisions between the Prime Minister`s office, the operator and the emergency response organization leading to delays in venting
- An order to vent containment was not implemented due to the on-site conditions with lack of lighting, increased radiation and frequent after-shocks
- The Prime Minister therefore visited directly to review the situation since he was not getting consistent information
- Increased hydrogen pressure inside containment before venting led to the hydrogen explosion on March 12

Approval of seawater injection

- The Prime Minister did not approve seawater injection over concerns about criticality
- He was getting fragmentary information
- After an order to suspend seawater injection for cooling was given, it was not followed because the onsite Site Superintendant believed it was vital to continue to prevent accident progression

Evacuation of on-site Personnel

- The operator contacted the regulator about removing non-essential personnel
- The prime minister did not receive clear communication that essential personnel would remain
- He responded that that evacuation of all personnel was unacceptable
- Finally it became evident that an integrated response headquarters including operator, regulator, emergency response and prime minister was necessary (March 14)

Transporting emergency equipment

- Because transportation infrastructure was so heavily damaged, there were severe logistical difficulties getting supplies and equipment to the site even though it was made available.
- On-site emergency workers had difficulty getting through police road blocks, and truck drivers abandoned their loads part way to the site

Declaration of the Emergency

- It took two hours after notification by the operator of a nuclear emergency for the Prime Minister to issue a declaration of a nuclear emergency
- In part this was due to seeking additional information
- At that time no orders for protective action were given

Co-ordination of emergency response

- Not all of the departments who were supposed to be involved in emergency response sent representatives to the emergency response headquarters
- Reasons ranged from being involved with evacuations locally, to damaged transportation infrastructure and communications equipment
- The off-site response centre itself had to be evacuated and re-located on March 15

Public protection response

- It was not possible to calculate estimated `source terms`` from the accident due to loss of power
- Therefore dose projections were not able to be used as the basis for instructions on evacuation and sheltering
- Instead plant conditions formed the basis for instructions given to the public

Evacuation orders

- The national government issued a 3 km evacuation order simultaneously with (and unaware of) the local government`s 2 km evacuation order on March 11
- By March 12 the national government extended those evacuation orders first to 20 and then 30 km of the plant
- However not all of the municipalities in those zones received the orders – seven did not, due to communication infrastructure disruption, resulting in days of delay
- Similarly the evacuation itself was difficult due to transportation infrastructure disruption
- By the time voluntary evacuation of a larger area was issued, most residents had already left

Sheltering

- A sheltering order for 20 to 30 km was issued from March 15 to 25th, but with no information as to how long to shelter, nor how to minimize indoor contamination
- There was inability to buy food supplies in many cases; and government supplied gas, food and medications were insufficient

Hospital facilities

- Most hospitals closed as a result of the evacuation orders; leaving only one 44 km away
- That hospital had severe medical personnel shortages as they left with their families
- Evacuation of all patients from hospitals and nursing homes had not been anticipated and planned; prior drill exercises had not included this element; as a result some patients were abandoned and some died; full evacuation took days once implemented

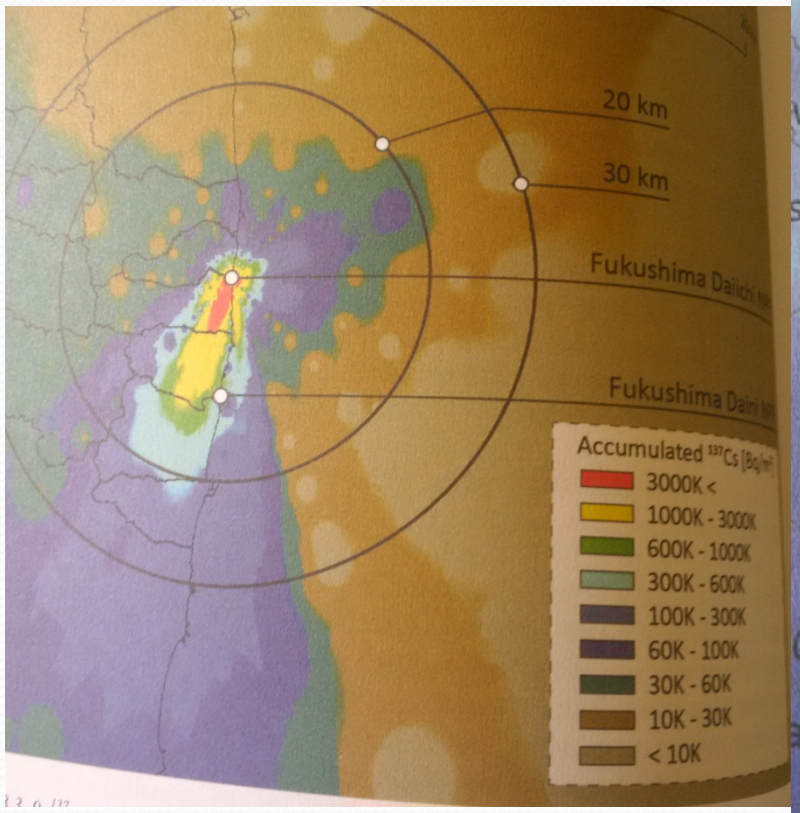
KI – Iodine Thyroid Blocking

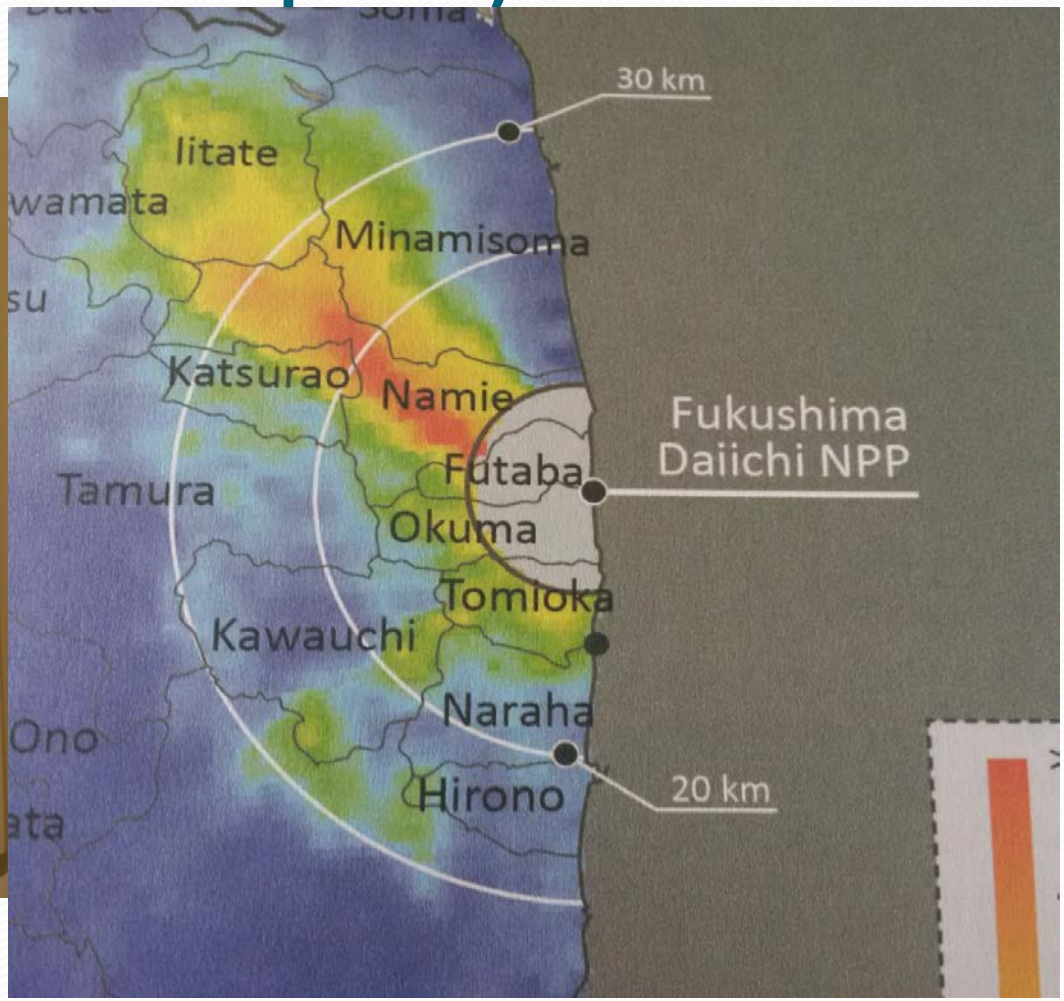
- KI distribution was not ordered until March 16
- It had not been pre-distributed
- The orders were not followed because everyone within 20 km had already been evacuated by then
- After March 14, in the 20 to 40 km zone ITB was distributed but with non-uniform success as sometimes there were no instructions to actually ingest the KI; and other areas were waiting for more information from the national government

Deposition patterns

- The technical report noted the discrepancy between the modelled deposition of cesium following the accident (even with actual weather data) compared to the actual deposition
- The model predicted highest rates of deposition to the southwest; in fact the highest rates of deposition were to the north west, and extended further than predicted; for example including Iitate with 500 to 2000 kBq/m2 located beyond 30 km from the plant
- Some people who had been evacuated to the north-northwest ended up in an area that was “later found to be heavily contaminated”

Modelled versus actual deposition (figures 3.3-9 and 3.3-10 from the IAEA report)





Monitoring difficulties

- Most of the environmental monitoring posts were not functioning following the accident due to the earthquake and tsunami; government monitoring vehicles ran out of fuel and were abandoned along with the monitoring equipment
- No monitoring results were published until March 13
- On March 15 a major release was transmitted by air as plume followed by rain with major depositions beyond the 20 km evacuation zone

Public Information - INES

- Public communications were inconsistent and confusing
- The first INES rating on March 11 assigned level 3; raised on March 12 to level 4 and on March 18 to level 5, and finally on April 12 to Level 7
- Level 3 means “serious incident”; level 4 means “accident with local consequences”; level 5 means “accident with wider consequences” and level 7 means “serious accident”.

Post-accident Urgent Protective Zone

- After the Fukushima Daichii accident, the regulator simulated the spread of radioactive materials around other plants for an emergency corresponding to the one at Fukushima Daichii
- The result was that Urgent Protective Zones need to be expanded beyond the 10 km zone that had been established pre-accident (to approximately 30 km)

Appendix B

Summary of recommendations

1: OPG's operating license should be strictly time-limited to a one year period, until it can return in another public hearing to demonstrate that it is in compliance with RegDoc 2.10.1, and this should be required before the Commission considers the application for a life extension.

2: The Commissioners should require OPG to return to the commission in 1 year with updated evacuation modelling, prior to considering the application for life extension.

3: The Commission should require this additional detailed information to be provided to it within eight months and publicly released, and at a return hearing before the Commission next year, the Commission should evaluate the ability of the public to be protected by evacuation before granting this license to the applicant.

Summary of recommendations

4: The Commissioners should asses and ensure that there are provisions for effective, fast evacuation of all of the potentially affected residents, occupants, and workers in the primary and secondary zones and beyond.

5: The geographic scope of potential evacuation measures and assessment of their adequacy should be based on a large INES 7 scale accident as well as on potential early releases.

6: The CNSC should direct OPG to ensure that KI is pre-distributed to all residents within the secondary zone as a condition of licensing.

7: CELA recommends ingestion control be extended to 100 km around the plant.

Summary of recommendations

8: The Commission must transparently and explicitly review the present and predicted populations surrounding the Darlington NGS in light of IAEA Site Evaluation Safety Standard No. NS-R-3 "Criteria Derived from Considerations of Population and Emergency Planning."

9: CELA submits that prior to considering the application for life extension, the Commissioners must require consideration of a nuclear accident emergency planning basis for Darlington that contemplates the potential for some or all of the following scenarios:

- Early release of radioactive emissions
- Large source term released to the public
- Widely dispersed radioactive emissions
- Weather patterns moving emissions over highly populated areas around the plant

Summary of recommendations

10: A study of the potential consequences of an accident on the scale of Fukushima should be required before the Commission should make a decision on the 30 year life extension requested by OPG, in conjunction with the requirements of the IAEA guidance on siting and in view of the current population and of the population growth expected to 2045.

11: The Commissioners should require a site-wide evaluation of risks prior to consideration of the application for life extension.

Summary of recommendations

12: CELA submits that the panel should not consider this application for life extension until the planning basis has been reviewed, and increased to reflect the actual global nuclear power plant accident experience, namely INES level 7 events, as well as early releases, and multi-unit accident releases, and the items listed in this section have been provided in the nuclear emergency plans relating to Darlington (provincial, regional and local municipal) with sufficient detail and demonstration of practical implementation.

13: The Commissioners should consider the input from any revisions to the provincial nuclear emergency response plan as a critical input to this licensing decision.

Summary of recommendations

14: The Commission should set out timelines relative to the Darlington NGS for the installation of a direct data feed to the CNSC Emergency Operations Centre as recommended by the Independent Evaluator of Exercise Unified Response.

15: CELA submits that the Commission should take up recommendation 13 of the Independent Evaluator, forthwith and then use the insights from that involvement in scrutinizing the adequacy of nuclear emergency response planning and preparedness in all licensing decisions concerning the Darlington NPP (and other class 1A facilities) beginning with the current application for life extension.

Summary of recommendations

16: The Commission should require that its staff, and the licensee, in cooperation with provincial and municipal authorities, should conduct detailed and transparent open public engagement and consultation with residents of Durham Region, the Region of York, the City of Toronto, the County of Peterborough, as to the above noted planning basis implications.