Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

UNPROTECTED/NON PROTÉGÉ

ORIGINAL/ORIGINAL

CMD: 22-M6

Date signed/Signé le : 10 JANUARY 2022

Technical Briefing

Exposé technique

Potassium Iodide Pill Working Group – Phase I Report

Groupe de travail sur la pilule d'iodure de potassium – Rapport de phase I

Public Meeting

Réunion publique

Scheduled for:

January 26, 2022

Prévue pour :

26 janvier 2022

Submitted by:

CNSC Staff

Soumise par :

Le personnel de la CCSN

e-Doc 6691683 (WORD)
e-Doc 6714752 (PDF)

Canada

Summary

- This CMD will provide an update on the Potassium Iodide (KI) Pill Working Group Phase I Report. The mandate of Phase I is to fulfill the commitment made to the Commission which is to provide clarity on the existing plans and associated responsible authorities for distributing KI pills in the Ingestion Planning Zone (50 km) in the event of an emergency at the Pickering Nuclear Generating Station.
- The Working Group includes members from the Canadian Nuclear Safety Commission, Ontario Office of the Fire Marshal and Emergency Management, Ontario Ministry of Health, Ontario Power Generation, Health Canada, and municipal Public Health Units and Emergency Management Coordinators.
- The Working Group held a 2-day workshop on November 4-5, 2019 to gather the information needed to meet the mandate of Phase I. Following the workshop, CNSC staff took the lead in preparing the draft Phase I Report.
- The Phase I Report underwent a 90-day public review period (April 6-July 5, 2021), and was revised by the Working Group based on comments received.

Résumé

- Le présent CMD fournit une mise à jour sur le rapport de la Phase I du Groupe de travail sur les comprimés d'iodure de potassium (KI). Le mandat de la Phase I est de tenir l'engagement envers la Commission, qui consiste à clarifier les plans existants et les autorités responsables de la distribution de comprimés de KI dans la zone de planification du contrôle de l'ingestion (rayon de 50 km) en cas d'urgence à la centrale nucléaire de Pickering.
- Le Groupe de travail comprend des membres de la Commission canadienne de sûreté nucléaire, du Bureau du commissaire des incendies et de la gestion des situations d'urgence de l'Ontario, du ministère de la Santé de l'Ontario, d'Ontario Power Generation, de Santé Canada, des services de santé publique municipaux et des coordonnateurs de la gestion des urgences.
- Le Groupe de travail a organisé un atelier de 2 jours les 4 et 5 novembre 2019 afin de recueillir les renseignements requis pour respecter le mandat de la Phase I. Après l'atelier, le personnel de la CCSN s'est chargé de préparer l'ébauche du rapport de la Phase I.
- Le rapport de la Phase I a été soumis à l'examen du public pour une période de 90 jours (du 6 avril au 5 juillet 2021) et a été revu par le Groupe de travail en fonction des commentaires reçus.

- The Phase I Report is being presented to the Commission (CMD 22-M6) in this Public Meeting for information prior to being finalized and published on the CNSC website.

There are no actions requested of the Commission. This CMD is for information only.

The following items are attached:

- KI Pill Working Group Phase I Report

- Le rapport de la Phase I est présenté à la Commission (CMD 22-M6) pendant cette réunion publique à titre d'information. Il sera ensuite finalisé et publié sur le site Web de la CCSN.

Aucune mesure n'est requise de la Commission. Ce CMD est fourni à titre d'information seulement.

Les pièces suivantes sont jointes :

- Groupe de travail sur la pilule d'iodure de potassium – Rapport de phase I

Signed/signé le

January 10, 2022 / 10 janvier 2022

Kathleen Heppell-Masys

Director General

Directorate of Security and Safeguards

Directrice générale

Direction de la sécurité et des garanties

Signed/signé le

January 10, 2022 / 10 janvier 2022

Recoverable Signature

X

Signed by: Viktorov, Alexandre

Alexandre Viktorov, PhD

Director General

Directorate of Power Reactor Regulation

Directeur général / Directrice générale

Direction de la réglementation des centrales nucléaire

This page was intentionally left blank.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

1 OVERVIEW 3
1.1 Background 3
1.2 Overall Conclusions 4

2 WORKING GROUP 5
2.1 Membership 5
2.2 Phase I 5
2.3 Phase II 6

3 ADVISORY COMMITTEE 7

4 PHASE I REPORT 8
4.1 Advisory Committee Workshop 8

5 INDIGENOUS AND PUBLIC ENGAGEMENT 9
5.1 Indigenous Engagement 9
5.2 Public Review Periods 11
5.2.1 Terms of Reference 11
5.2.2 Phase I Report 12

6 NEXT STEPS 12

7 OVERALL CONSLUSIONS 13

REFERENCES 14

APPENDIX A. COMMENT DISPOSITION CONCERNING PUBLIC REVIEW OF PHASE I REPORT 15

APPENDIX B. MEETING MINUTES FROM THE ADVISORY COMMITTEE WORKSHOP ON THE PHASE I REPORT 23

APPENDIX C. COMMENT DISPOSITION CONCERNING CURVE LAKE FIRST NATION REVIEW OF PHASE I REPORT 28

ATTACHMENT 1. PHASE I REPORT 32

This page was intentionally left blank.

EXECUTIVE SUMMARY

During the Pickering licence renewal Commission Hearing in June 2018 (CMD 17-H6), a commitment was made by Canadian Nuclear Safety Commission (CNSC) staff to form a working group to provide clarity on the existing plans and associated responsible authorities to distribute Potassium Iodide (KI) pills (in the Ingestion Planning Zone (IPZ), within a 50-km radius) in the event of an emergency at the Pickering Nuclear Generating Station [1].

Terms of Reference (TOR) for the KI Pill Working Group (hereafter referred to as the Working Group) were developed by the CNSC, the Ontario Office of the Fire Marshal and Emergency Management (OFMEM), the Ontario Ministry of Health (MOH) and Ontario Power Generation (OPG). The TOR define the mandate, membership, deliverables and conduct of the Working Group. Following a 48-day public review period, the TOR were revised and signed in May 2019, enacting the Working Group.

The TOR identify the CNSC as chair, with co-chair responsibilities shared by OFMEM, MOH and OPG. In addition, the members of the Working Group include representatives from Health Canada; and Public Health Units and Emergency Management Coordinators from municipalities located within the IPZ and/or designated in the Ontario Provincial Nuclear Emergency Response Plan.

The TOR established a two-phase approach for the Working Group, that includes drafting and a public review of both the Phase I and II reports. In addition, the CNSC established an Advisory Committee to provide additional input and review on the TOR, and the Phase I and II reports. This Commission Member Document will focus on the Phase I deliverables of the Working Group.

The Working Group held a 2-day workshop on November 4-5, 2019 to gather and discuss the information needed to meet the mandate of Phase I – to provide clarity on the existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ. Following the workshop, CNSC staff took the lead in preparing the draft Phase I Report. The report was reviewed by all members of the Working Group, and all comments were incorporated into the draft report.

Due to the Covid-19 pandemic, final concurrence on the report by all members was delayed from March 2020 to December 2020. With concurrence achieved in December 2020, the report was translated in both official languages and posted on the CNSC website for a 90-day public review period (April 6-July 5, 2021). Following the public review period, CNSC staff held a workshop with the Advisory Committee to seek feedback on the Phase I Report and share the comments received during the public review. The Advisory Committee members confirmed that the report meets the mandate of Phase I, and provided input that will be considered for Phase II.

As concluded by the Working Group, the Phase I Report meets the mandate of Phase I by providing clarity on the existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ.

The purpose of this Commission Meeting is to present the Phase I Report to the Commission for information. Following the Commission Meeting, the report will be published and posted on the CNSC website.

Referenced documents in this CMD are available to the public upon request.

1 OVERVIEW

1.1 Background

The Canadian Nuclear Safety Commission (CNSC) held a public hearing from June 25–29, 2018 to consider the licence renewal application submitted by Ontario Power Generation (OPG) for the Pickering Nuclear Generating Station (NGS). A number of intervenors raised concerns about the distribution of potassium iodide (KI) pills in the event of an emergency, and more specifically, how the vulnerable population (children under 18, pregnant and breastfeeding persons) would obtain these pills.

At the hearing, the CNSC Executive Vice-President and Chief Regulatory Operations Officer made a commitment to the Commission to form a working group to provide clarity on the existing plans and associated responsible authorities to distribute KI pills (in the Ingestion Planning Zone (IPZ), within a 50-km radius) in the event of an emergency at the Pickering NGS [1]. To fulfill the commitment made to the Commission, and the direction provided by the Commission in the Record of Decision for the Pickering licence renewal [2], a two-phased approach to the Working Group was established.

The two phases are outlined in the Terms of Reference (TOR) that were signed in May 2019 by the CNSC, OPG, Ontario Office of the Fire Marshal and Emergency Management (OFMEM) and Ontario Ministry of Health (MOH), enacting the Working Group.

The objective of Phase I is to meet the commitment made to the Commission, and focused on providing clarity in the following areas:

- Existing provincial and federal plans for the distribution of KI pills
- Considerations and education concerning KI pill emergency distribution in the IPZ
- Means of KI pill distribution in relation to other factors associated with a nuclear emergency response
- Availability and scope of public emergency preparedness information

The objective of Phase II is to address the Commission's direction in the Record of Decision for the Pickering licence renewal, which includes the following:

- Determining the feasibility of pre-distribution of KI pills to all schools within the IPZ
- Establishing clear and detailed plans for the distribution of KI pills throughout the IPZ

This Commission Member Document (CMD) focuses on Phase I deliverables of the Working Group. The purpose of this Commission Meeting is to present the Phase I Report (Attachment 1) to the Commission for information.

1.2 Overall Conclusions

The Working Group concluded that the Phase I Report meets the mandate of Phase I as described in the Terms of Reference; to provide clarity on the existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ. Furthermore, the Working Group is poised to undertake the work associated with Phase II.

2 WORKING GROUP

2.1 Membership

The Working Group is chaired by the CNSC, and co-chaired by the Office of the Fire Marshal and Emergency Management (OFMEM), the Ontario Ministry of Health (MOH) and Ontario Power Generation (OPG). The Working Group also includes members from Health Canada; and Public Health Units and Emergency Management Coordinators from the following municipalities:

- Peel Region
- York Region
- City of Toronto
- Durham Region
- Simcoe County
- City of Kawartha Lakes
- Peterborough County

The Public Health Agency of Canada (PHAC) contacted the CNSC requesting to attend the Phase I workshop but not become a formal member of the Working Group. The CNSC supported this request, and PHAC was included in the Phase I workshop.

2.2 Phase I

The mandate of Phase I was to provide clarity on the existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ. To meet the mandate, the Working Group is responsible to write a Phase I Report to provide the necessary clarity. The Working Group conducted meetings and a 2-day workshop to gather and discuss the information needed for the Phase I Report. In accordance with the TOR, all meeting minutes are publicly available on the Working Group webpage following concurrence of the minutes by the members. Overall, the Working Group members worked cooperatively and constructively to carry out the activities necessary for Phase I.

The Working Group held its first meeting on August 15, 2019 to introduce the members, discuss the mandate, and identify topics for the Phase I workshop. Topics identified for the Phase I workshop included, but were not limited to, accident progression and emergency response actions; availability of information and KI pills in the IPZ; municipal level plans for distribution; and international and national best practices. Meeting Minutes from the first meeting are available on the webpage.

The Phase I workshop was held from November 4-5, 2019 in Pickering, Ontario, with all Working Group members present. The workshop was successful in gathering the information needed to draft the Phase I Report. Meeting Minutes are available on the Working Group webpage. The minutes provide detailed information on the presentations

and discussions from the workshop related to emergency distribution of KI pills, roles and responsibilities, and available public information on KI pills.

Following the workshop, CNSC staff took the lead in drafting the Phase I Report. The draft Phase I Report was circulated on January 7, 2020 to all Working Group members for review. In February 2020, the Working Group held a teleconference to discuss comments submitted by the members and revisions to the report. The revised Phase I Report was to be sent to all members for concurrence in March 2020, prior to its release for public review.

In March 2020, the onset of the COVID-19 pandemic caused the majority of Working Group members (Public Health Unit representatives and municipal Emergency Management Coordinators) to focus on supporting Ontario's pandemic response. As a result, the CNSC decided to postpone seeking concurrence on the draft report, delaying the public review period.

In August 2020, all Working Group members indicated availability to resume Working Group activities. A meeting was held on September 2, 2020 to discuss the next steps and path forward on seeking concurrence on the draft Phase I Report before moving to the public review phase. Taking into consideration member's continued involvement in the COVID-19 response, members' agreed to a 60-day final review period for additional comments and concurrence on the draft Phase I Report.

In December 2020, the Working Group achieved concurrence on the draft Phase I Report. Following French translation of the report, it was posted on the CNSC e-consultation platform (www.letstalknuclearsafety.ca) in April 2020 initiating the 90-day public review period. The public review was advertised through the CNSC subscription list and social media accounts (e.g., Facebook, Twitter, LinkedIn, YouTube). Further information on the public review is provided in Section 5.2.2. The Phase I Report was also sent to Indigenous communities with potential treaty rights and title, described further in Section 5.1.

The Working Group held a meeting in September 2021 to discuss the comments received during the public review period and associated revisions to the Phase I Report. An additional meeting was held on December 9, 2021 to seek concurrence on the revisions, inform the Working Group of comments received on the report from the CNSC Advisory Committee (discussed further in Section 4.1), and provide information on the upcoming Commission Meeting to present the report. The Working Group members concurred with the revisions to the Phase I Report.

2.3 Phase II

The Working Group is planning to meet in January 2022 to continue discussions and planning for the Phase II workshop. The Phase II workshop is anticipated to be held in the Spring of 2022. A Phase II report will be drafted following the workshop, and will undergo a public review period prior to being presented to the Commission (anticipated for early 2023). Further information on the scope of Phase II is provided in Section 6 of this CMD. CNSC staff will continue to update the Commission on Working Group activities through the Status Report on Nuclear Power Plants.

3 ADVISORY COMMITTEE

In November 2018, at the Commission Meeting on the Regulatory Oversight Report for Canadian Nuclear Generating Sites, the CNSC Executive Vice-President and Chief Regulatory Operations Officer committed to establishing an Advisory Committee [3]. The Advisory Committee was established in 2019 with the following membership:

- Canadian Environmental Law Association
- Toronto District School Board
- Toronto Catholic District School Board
- Municipality of Kincardine
- Bruce Power
- Academia (Professor from McMaster University, Dr. Novog)

An operating procedure was developed to establish the framework and guiding principles for the Advisory Committee's role with respect to the Working Group. As described in the operating procedures, the committee does not provide advice to the Working Group but to the CNSC. The CNSC as chair of the Working Group, brings advice from the Advisory Committee to the Working Group for further consideration. The Advisory Committee was provided opportunities to give advice on the draft TOR, the topics to be considered during the Phase I Working Group workshop, and the draft Phase I Report. The modus operando of the Advisory Committee was cooperative and constructive, and provided valuable input for the Working Group that was welcomed by CNSC staff.

The first Advisory Committee meeting was held on February 26, 2019 to discuss the operating procedure, and solicit feedback on the TOR for the Working Group and comments received during the public review period. The committee members requested additional clarification at the meeting from CNSC staff with regards to the membership, mandate and transparency of the Working Group.

Based on the comments received from the Advisory Committee and public review period, the TOR for the Working Group were revised (as outlined in Section 5.2.1). Meeting minutes are available on the Working Group webpage.

A second Advisory Committee meeting was held on August 29, 2019 to provide the committee with an update on Working Group activities and seek input on topics to be included in the Phase I workshop. Tentative topics identified by the Working Group for the Phase I workshop were shared by CNSC staff with the committee. Committee members sought clarification from CNSC staff on some topics, and provided comments on the tentative topics, including the scope of existing plans being considered in Phase I (e.g., municipal, provincial, federal) and their availability to the public. CNSC staff raised the committee's comments with the Working Group, and workshop topics were revised, as appropriate. Meeting minutes are available on the Working Group webpage.

4 PHASE I REPORT

The Phase I Report, included as Attachment 1 to this CMD, was developed based on existing information and information accumulated during the Phase I workshop. The report is organized into the following sections:

1. Introduction – introduces the purpose of the document, defines key terminology, and provides information regarding the use of KI and nuclear emergency management.
2. Planning for KI Emergency Distribution – identifies current plans and details the current roles and responsibilities.
3. Public Resources Relating to KI – highlights the public information currently available from various stakeholders.
4. Concept of Operations – highlights how emergency distribution of KI would be implemented based on the plans identified in Section 1.
5. Conclusion and Next Steps – summarizes Sections 1 through 4 of the report, and defines the next steps intended for Phase II of the Working Group.
6. References – lists the references to the various sources of information and documents discussed in the report.

The Phase I Report also includes appendices that contain excerpts from various municipal, provincial and federal emergency plans and supporting documents, as well as OPG's emergency management program. CNSC regulatory requirements related to the distribution of KI pills are also included in the appendices, and a comparison of international practices for the distribution of KI pills.

The Phase I Report underwent a 90-day public review period as outlined in Section 5.2.2, and a focused workshop with the Advisory Committee as discussed in Section 4.1. The Phase I Report was revised based on comments received during the public review period. The purpose of this CMD is to present the Commission with the Phase I Report prior to it being finalized and published on the CNSC website.

4.1 Advisory Committee Workshop

The CNSC held a workshop with the Advisory Committee on November 19, 2021 to solicit comments on the Phase I Report and discuss comments received from the public review period. Meeting minutes are included as Appendix B of this CMD and are posted on the Working Group webpage. The Advisory Committee members did not propose any specific changes to the report, but did propose additional considerations for Phase II. The following summarizes the additional considerations proposed for Phase II:

- Information on the actions taken by municipalities in support of emergency distribution of KI pills (to be considered as part of the detailed distribution strategy)
- Need for additional information and medical advice during an emergency for individuals who cannot take KI pills or may have concerns with taking KI pills

- Impact on timelines and capabilities for KI pill distribution from a severe beyond design basis accident and severe weather

Members of the Advisory Committee present at the workshop concluded that the Phase I Report meets the mandate of Phase I.

Due to the evolving covid response in schools, the representatives from the Toronto District School Board and Toronto Catholic District School Board indicated they were unable to participate in the workshop. CNSC staff remain in contact with both representatives, and continue to keep them informed of all Advisory Committee activities.

5 INDIGENOUS AND PUBLIC ENGAGEMENT

The CNSC committed in the TOR to conduct Indigenous and public engagement activities as they are an important consideration in CNSC activities, and ensures opportunities for input are provided.

The draft TOR for the Working Group underwent a 48-day public review period as outlined in Section 5.2.1. In addition, the TOR committed to conducting public review periods for the Phase I and II reports. Additional information on the public review period for the Phase I Report is provided in Section 5.2.2.

A dedicated webpage[1] [1] for the Working Group was launched in June 2019 on the CNSC website. The webpage currently provides general background information on the Working Group, project milestones, the TOR, information on the CNSC Advisory Committee, meeting minutes, and quick facts on KI pills. This webpage will be used as a repository for information on the Working Group and will continue to be updated with information and documentation related to the Working Group. In accordance with the TOR, this will include the Working Group deliverables such as the Phase I and II reports, and meeting minutes of the Working Group and CNSC Advisory Committee.

5.1 Indigenous Engagement

A notification letter was sent by CNSC staff to Indigenous Nations and communities on August 27, 2019 with potential interest in this initiative, informing them of the Working Group and committing to providing the Phase I and Phase II reports for comment. The CNSC also indicated that it was available to discuss this initiative and associated deliverables, or answer any question, upon request. The following Indigenous Nations and communities were sent the notification letter:

- The Métis Nation of Ontario
- Mississaugas of the Credit First Nation
- Alderville First Nation
- Curve Lake First Nation

[1] URL: http://nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/potassium-iodide-pill-working-group.cfm

- Hiawatha First Nation
- Mississaugas of Scugog Island First Nation
- Chippewas of Beausoleil First Nation
- Chippewas of Georgina Island First Nation
- Chippewas of Rama First Nation (Mnjikaning)
- Mohawks of the Bay of Quinte

The Chippewas of Rama First Nation expressed interest in the Working Group following receipt of the notification letter, and CNSC staff provided additional information at a meeting held in January 2020.

The Alderville First Nation also expressed interest in receiving the Phase I Report following receipt of the notification letter, but no request to meet was made at that time.

On April 15, 2021, CNSC staff sent the draft Phase I Report to the identified Indigenous Nations and communities, informing them of the public review period, and offering to meet to discuss the report further. CNSC staff conducted follow-up communications with each identified Indigenous Nation and community.

Following receipt of the draft Phase I Report, Curve Lake First Nation expressed interest to learn more about the Working Group. CNSC staff leading the Working Group attended a regularly scheduled meeting between the CNSC and Curve Lake First Nation in May 2021, and provided a presentation on the Working Group and the Phase I Report; and answered associated questions.

In July 2021, with funding support through the CNSC's Participant Funding Program, Curve Lake First Nation submitted comments on the draft Phase I Report (Appendix C). CNSC staff met with Curve Lake First Nation to discuss each comment in more detail and provide additional information. CNSC staff will continue to engage with Curve Lake First Nation to provide information and address their comments. CNSC staff shared the comments received with the Working Group members, and proposed the following topics to be considered further during Phase II:

- The need for and scope of communications to Indigenous Nations and communities during an emergency
- Information, awareness and education related to KI pills for Indigenous Nations and communities

In addition, the Mohawks of the Bay of Quinte (MBQ) expressed an interest in the Working Group and this initiative, however, due to competing priorities MBQ ultimately decided not to participate in the public review process of the Phase I Report.

While Curve Lake First Nation was the only Indigenous Nation and community engaged on this initiative that submitted comments as part of the public review, in consideration of the comments received from Curve Lake First Nation, the Working Group is discussing further opportunities to engage with the identified Indigenous Nations and communities while planning and conducting Phase II. These opportunities will be in addition to the commitment in the TOR to notify all identified Indigenous Nations and communities of

the public review period for the Phase II Report. CNSC staff will continue to engage with any Indigenous Nation or community that requests additional information on the Working Group and this initiative.

5.2 Public Review Periods

5.2.1 Terms of Reference

The draft TOR underwent a 48-day public review period from December 24, 2018 to February 14, 2019. Seventeen submissions were received during the public review period. The following summarizes the key changes to the TOR following closure of the public review period:

- Mandate – Comments were received indicating that the TOR did not match the direction of the Commission in the Record of Decision for the Pickering licence renewal. As the TOR underwent a public review period prior to the issuance of the Record of Decision, the TOR were revised to include two phases. Phase I includes the commitment made by CNSC executive management to the Commission, and Phase II includes the direction from the Commission in the Record of Decision.
- Membership – Non-governmental organizations (NGOs) wanted to be on the Working Group and requested the criteria for how members were determined. NGOs will be engaged through the public comment periods and CELA is a member of the CNSC Advisory Committee and may solicit input to bring to the Advisory Committee from other NGOs. A statement was added to the TOR to clarify that all members of the Working Group are either located in the IPZ or have assigned roles and responsibilities in the event of a nuclear emergency at Pickering.
- Transparency – NGOs requested that the Working Group post meeting minutes and supporting references from the Phase I and II Reports. The TOR were revised to include a commitment that meeting minutes would be posted, and the CNSC created a dedicated webpage for the Working Group where minutes and references could be made publicly available.
- Deliverables – As the TOR were revised to include two phases, the deliverables were also revised for the Working Group to draft reports for both Phase I and II, and to clarify a public review period would be conducted for both reports. The TOR were also revised to indicate that the CNSC was responsible for notifying Indigenous groups, with potential or asserted treaty rights and title, of the public review periods and coordinate any meetings with interested Indigenous groups.

The draft TOR required revisions to address comments from the public review period and from a meeting held with the CNSC Advisory Committee in February 2019. Furthermore, in the detailed Record of Decision on the Pickering licence renewal that was released in January 2019, the Commission provided additional direction to the Working Group which was captured in the TOR for Phase II. Consensus by the signatories on the revised TOR and comment disposition was reached in April 2019. The TOR were signed in May 2019, and are available on the Working Group webpage.

5.2.2 Phase I Report

The Phase I Report underwent a 90-day public review period from April 6, 2020, to July 5, 2020. Sixteen comments were received during the public review period. The following summarizes the key changes to the Phase I Report based on the comments received:

- Addition of information on KI mail outs to new homeowners within 10 km of Pickering NGS
- Clarification concerning some definitions and terminology
- Revision to OPG responsibilities in Table 2 of the report to indicate the program established and maintained by OPG and the designated municipalities, ensures continued availability of KI pills to residents within the Detailed Planning Zone and Ingestion Planning Zone
- Additional clarification on information campaigns held to increase awareness of KI pills
- Addition of an acknowledgement of the Treaty Lands the Pickering NGS resides on

All comments received and their disposition are found in Appendix A of this CMD. The Working Group agreed with the changes made to the Phase I Report (Attachment 1).

6 NEXT STEPS

Following the presentation of the Phase I Report to the Commission, the report will be finalized and published on the CNSC website.

The Working Group began initial discussions of timelines associated with Phase II in November 2021. The Working Group anticipates the Phase II workshop to be held virtually in Spring 2022. As described in the TOR, Phase II will focus on the following:

- Determining the feasibility of pre-distribution of KI pills to all schools within the IPZ
- Establishing clear and detailed plans for the distribution of KI pills throughout the IPZ

The following topics were also raised during the Phase I workshop and during development of the Phase I Report to be considered during Phase II:

- Public awareness and education in designated and non-designated municipalities
- Pre-staging of the centralized stockpile to municipalities in the IPZ
- Development of a pre-existing emergency communications strategy for use by municipalities and Public Health Units within the IPZ during an event

A Phase II Report will be drafted by CNSC staff with support from all Working Group members, and will undergo a public review period in accordance with the commitments made in the TOR. Indigenous communities and the CNSC Advisory Committee will also be engaged to participate in the review of the draft Phase II Report. The Phase II Report will then be presented to the Commission in a Public Meeting anticipated for early 2023.

7 OVERALL CONSLUSIONS

The Working Group concluded that the Phase I Report meets the mandate of Phase I as described in the Terms of Reference; to provide clarity on the existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ. Furthermore, the Working Group is poised to undertake the work associated with Phase II.

REFERENCES

1. CNSC Transcript of OPG Pickering Public Hearing. Page 316-317, June 28, 2018, e-Doc 5583210.
2. CNSC Record of Decision – Ontario Power Generation – Application to Renew the Nuclear Power Operating Licence for the Pickering Nuclear Generating Station. December 20, 2018, e-Doc 5718117.
3. CNSC Transcript of Public Meeting on the Regulatory Oversight Report for Canadian Nuclear Generating Sites. Page 131-132. November 8, 2019, e-Doc 5714022.

APPENDIX A. COMMENT DISPOSITION CONCERNING PUBLIC REVIEW OF PHASE I REPORT

KI Pill Working Group: Draft Report / Projet de rapport - Groupe de travail sur les comprimés de KI

Comments received from public consultation / Commentaires reçus dans le cadre du processus de consultation

Comments received:

- during public review period (April 6 to July 5, 2021): sixteen comments from four (4) reviewers

Commentaires reçus :

- lors de la première période (du 6 avril au 5 juillet 2021) : seize commentaires reçus de quatre (4) examinateurs

	Section	Organization	Comment	DRAFT CNSC Response
1	Does the draft report provide clarity on KI pill distribution?	Gord Weir Clarington Emergency and Fire Services Fire Chief/CEMC	https://www.clarington.net/en/town-hall/resources/Emergency-and-Fire-Services/Emergency-Plan-AODA.pdf. Just a couple of comments. Attached is a hyperlink for our most current Emergency Plan in Clarington. The document highlighted 2016 Only other comment as Fire Chief and CEMC there does not appear to be any clarification on how residents will be provided or notified on KI distribution. By this I mean there are many residents who move out of Clarington yearly. How does the new Home owner get advised about obtaining KI Pills. Possibly a yearly mail out would suffice to all residents along with utilizing social media with in each municipality maybe? This was just not clear from what I read.	Clarington Plan: • Updated citation/source reference to Clarington Emergency Plan • Updated text from Section B.5.2.4. New home owners: This paragraph is included in Appendix C.1: The New Neighbors program provides KI Pills for residences and businesses in the DPZ which have new area codes or changed addresses (i.e. mail forwarding) that are registered through Canada Post. From 2015 through 2019 KI Pills were distributed to these addresses three times a year. Starting in 2020, KI Pills are distributed to these addresses on a monthly basis. This text has been added to section 3.2.1 KI Pre-distribution packages [Section 3 Public Resources relating to KI].

	Section	Organization	Comment	DRAFT CNSC Response
			Thanks	
2	Comment on specific content of this draft report	Kathy.Bleyer Office of the Fire Marshal and Emergency Management (OFMEM) Planning & Exercise Officer	Please delete the following and, until further notice, please make all references in this and future reports to OFMEM.: "As of June 2020, the Office of the Fire Marshal and Emergency Management (OFMEM) is now Emergency Management Ontario	EMO definition deleted and all references to EMO changed to OFMEM.
3	General	Ontario Power Generation (OPG)	The document does not mention Indigenous communities at all. If the document is public this may arose concern should any First Nation would be within the distribution zone. The closest communities to Pickering and Darlington are Scugog Island (Port Perry), Curve Lake, Hiawatha (both near Peterborough) and Alderville (north of Cobourg). Please check zones to see if any would be inside the distribution zone. Proposed change: Include reference to the Treaty Lands the PNGS and DNGS reside on. Insert 'Designated First Nations as a table at the end of Section 2 and make mention at the end of Section.	An acknowledgment of the Indigenous Nations and communities whose traditional and/or treaty territories are in the proximity to the Pickering Nuclear Generating Station (NGS) will be added to the Phase I Report. The only Indigenous Nation and community located within the Ingestion Planning Zone is Scugog Island located 46 km from the Pickering NGS. However, it is recognized that there are a number of interested Indigenous Nations and communities (see section 5.1) regardless of their distance from the Pickering site. As such, the Working Group is currently discussing additional opportunities for Indigenous Nation and community involvement while planning and conducting Phase II.
4	General	OPG	Details on the central stockpile does not seem to be included, where it is kept, who supplies/maintains. Proposed change: Suggest	The details of the location and contents of the stockpile are confidential.

	Section	Organization	Comment	DRAFT CNSC Response
			including a note on the central stockpile (e.g. in Table 3 roles and responsibilities)	The following text has been added to **Table 3: Roles and Responsibilities** for the Province of Ontario (MOH, OFMEM): • Manages KI central stockpile*
5	Section 1.2, Definitions	OPG	EMO "As of June 2020, the Office of the Fire Marshal and Emergency Management (OFMEM) is now Emergency Management Ontario (EMO). …." Please confirm the above, and if OFMEM name has been changed. Proposed change: Please update the acronym/definition accordingly.	See Kathy's comment above (comment 2)
6	Section 1.2, Definitions	OPG	Vulnerable Population Vulnerable Population definition does not align with CSA N1600:21. Proposed change: Consider adding the "most" to align with CSA N1600:21. Are members of the public that are most vulnerable to radiation exposure (i.e., pregnant women and children).	The definition for vulnerable population is different from CSA N1600, however it indicates that the definition used in this document is with respect to exposure to radioiodine and the use of KI pills, while the CSA definition is more generic. The definition from the MOH for a vulnerable group is the following: A group which, because it is more vulnerable to radiation, may require protective measures not considered necessary for the general population, such as pregnant women and, in some cases, children. Accepted proposed change to add "most" to align with MOH definition.

	Section	Organization	Comment	DRAFT CNSC Response
7	Section 1.4.2/1.4.5, Page 6-7	OPG	1.4.2 Target Population says "elderly people are at a lower risk of developing radiation induced thyroid cancer, and also may be at higher risk of experiencing adverse effects from KI ingestion" but then in section 1.4.5 says "The risk of side effects from taking a dose of KI is extremely low for all age groups, and the overall benefit of KI outweighs the risk of side effects." These statements seems to contradict each other. Proposed change: Suggest reviewing and revising the contradictory statements	These two sentences are both in the KI guidelines by MOH. The second sentence has the following footnote in the guidelines, which will be added to the Phase I Report: *[15]During the Chernobyl accident, the incidence of severe side effects from a single dose of stable iodine was less than 1 in 10 million in children and less than 1 in a million in adults. WHO, 1999.* Although elderly people may be at higher risk of experiencing adverse effects from KI ingestion, the overall risk is still extremely low.
8	Section 1.4.6, Page 7	OPG	"KI is pre-distributed within the detailed planning zone (DPZ), available at reception centers, and stockpiled for the IPZ of Canadian Nuclear Power Plants by the host province, as required by CNSC REGDOC 2.10.1 [3]" REGDOC 2.10.1 doesn't specify about KI being available at reception centers. Proposed change: Suggest the wording of Section 1.4.6 align with REGDOC 2.10.1: "1. ensure that a sufficient quantity of iodine thyroid-blocking (ITB) agents is pre-distributed, to all residences, businesses and institutions within the designated plume exposure planning	The following revision (underlined) was made to align with section 5.3.3 of PNERP Implementing Plan for Pickering: KI is pre-distributed within the detailed planning zone (DPZ), <u>available at DPZ institutions and emergency centres (emergency worker centre, reception centres, evacuation centres)</u>, and stockpiled for the IPZ of Canadian Nuclear Power Plants by the host province [8].

	Section	Organization	Comment	DRAFT CNSC Response
			zone, together with instructions on their proper administration 2. ensure that a sufficient quantity of ITB agent is pre-stocked and available within the designated ingestion control planning zone; this inventory of ITB agents shall be located so that it can be efficiently obtained by, or provided to, members of the public when required…"	
9	Section 2.1, Page 10		"…documents listed are those currently available as of June 2020." The draft report was published in 2021, and the latest Consolidated Nuclear Emergency Plan was published in November 2020. Proposed change: Consider updating the date to 2021.	Sentence revised to December 2020 (when concurrence was received on draft report).
10	Table 3, OPG, Page 11, 1st bullet	OPG	OPG Responsibilities – "The OPG Consolidated Emergency Plan [17] – considers KI pre-distribution. " R017 of CNEP included pre-distribution as well as stock piling: "The program established and maintained by OPG and the designated municipalities, ensures continued availability to residents of the DPZ and Ingestion Planning Zone (IPZ), and that	Table 3 text for OPG linkages revised (as underlined) to: The *OPG Consolidated Emergency Plan* [17] – considers KI pre-distribution <u>(to DPZ) and continued availability to residents (of the IPZ)</u>.

	Section	Organization	Comment	DRAFT CNSC Response
			information is available to the general public, including online" Proposed change: Suggest revising to align with the CNEP "… pre-distribution and continued availability to residents of the DPZ and IPZ."	
11	Table 3,OPG, Page 11, 1st bullet	OPG	OPG Responsibilities – "…and have KI stockpiled and ready for prompt emergency distribution in the IPZ [3, 7]." Is this stockpile referring to the Reception Centres? The current wordings could imply OPG stockpiles which is not the case. Proposed change: Suggest rewording	Removed the first two bullets and revised with this text with reference to CNEP and PNERP Master Plan: • Procure adequate quantities of stable iodine tablets in the DPZ (including residences, businesses, institutions, and emergency centres) [2, 17] • Procure KI within the expiry date in the DPZ [2, 17]
12	Table 3, Page 11, 2nd bullet	OPG	OPG Responsibilities – "Procure KI for institutions and first responders [3, 7]." Should the distance be specified? KI isn't procured for ALL institutions in the IPZ Proposed change: Suggest including the distance that applies here (e.g. within the IPZ).	Addressed in comment 11.
13	Table 3, Page 11, 5th bullet	OPG	OPG Responsibilities – "Conduct robust, cyclical, and ongoing public education and awareness campaigns with the involvement of designated municipalities and the province [3, 7, 2, 8]" Suggest rewording.	Proposed change accepted. There was discussions with the Working Group members to expand on who leads public education. This is captured in the last bullet of Table 3 for the Province of Ontario responsibilities.

	Section	Organization	Comment	DRAFT CNSC Response
			Proposed change: Minor, editorial (e.g. … campaigns in coordination of designated...)	
14	Section 3.2.1, Page 20	OPG	• "…members of the public living within 50 km (IPZ) …" The KI Pre-distribution applies to those both living and working (as per Section 3.1.1). Proposed change: Suggest updating to include those working.	Proposed change accepted.
15	Section 4.2, Page 28	OPG	"….Chief Medical Officer of Health (CMOH) that logistical requirements are being arranged for the transportation of KI pills to certain locations within the IPZ." CMOH acronym has already been spelled out Proposed change: Minor, editorial Use acronym CMOH	Proposed change accepted.
16	Section 5.1.2, Page 30	OPG	"Information campaigns are held periodically by OPG and the designated municipalities, particularly Durham Region, to point members of the public to reliable sources and increase awareness of KI." Toronto is also involved in coordination of the campaigns. Proposed change: Suggested adding wording to include Toronto.	Proposed change accepted.

Additional Feedback form WG: As a public facing document there are too many acronyms, if possible, we should be spelling out the acronyms. The report has been reviewed and the use of acronyms was minimized as practicable.

APPENDIX B. MEETING MINUTES FROM THE ADVISORY COMMITTEE WORKSHOP ON THE PHASE I REPORT

Subject	Meeting Minutes: CNSC Advisory Committee Workshop		
Participants	T. McClenaghan **(Canadian Environmental Law Association)** B. Lemaich, S. Watson **(Municipality of Kincardine)** M. Burton **(Bruce Power)** Dr. Novog **(McMaster University)** K. Heppell-Masys, K. Hazleton, E. Kanasewich, L. Casterton, A. Bellingham, C. MacDonald **(CNSC)**		
Agenda	1. Opening remarks/ Roundtable Introductions 2. Discussion on Draft Phase I Report 3. Closing Remarks		
Teleconference	Microsoft Teams		
Date	November 19, 2021		
Time	10:30 AM – 12:30 PM	**Duration**	2 hours

1. Opening Remarks / Roundtable Introductions

   K. Heppell-Masys, Director General (DG) for the Directorate of Security and Safeguards (DSS) welcomed participants to the CNSC Advisory Committee Workshop for the Potassium Iodide (KI) Pill Working Group.

   Roundtable introductions of all members was conducted.

   K. Heppell-Masys explained to the members that the intent of the workshop is to go through the draft Phase I report and discuss any comments, questions or feedback that the members have on the document. Comments received from the 90-day public review period were also presented to the members for feedback.

   L. Casterton provided background information on the work done by the KI Pill Working Group between 2020 and 2021, and reiterated the role of the Advisory Committee.

Action 1: L. Casterton to share the Advisory Committee's Operating Procedures.

L. Casterton highlighted the following timelines and milestones of the KI Pill Working Group:

- All comments received during the public review period and during the Advisory Committee Workshop will be included in the Commission Member Document (CMD) submission.
- The Draft Phase I report will be presented to the Commission during the January 26 – 27, 2022 Commission proceeding.
- Following the Commission Proceeding, the KI Pill Working Group will commence Phase II as described in the Terms of Reference.
- Phase II is targeted to be complete by early 2023.

2. Discussion on Draft Phase I Report

A. Bellingham and L. Casterton presented the comments received during the public review period on the Draft Phase I Report.

The Draft Phase I Report and the comments received during the public review period are found at the following link: https://www.letstalknuclearsafety.ca/completed_consults/news_feed/ki-pill-working-group-draft-report

Advisory Committee members were asked to provide comments and feedback on the Draft Phase I Report. The following comments were received:

	Section	Member	Comment/Discussion
1.	General	D. Novog	Commended the efforts by the Working Group on the Phase I report, and appreciated the concept of operations presented in Section 4. The Working Group offered a valuable opportunity for Public Health Units (PHUs) and Emergency Management Coordinators (EMCs) to provide input into the concept of operations.
2.	General	T. McClenaghan	The report adds value by having all the information in one place. Understanding that the working group activities have two phases, is there an opportunity during or after Phase II to revisit the Phase I report and update as required, i.e. is this report an evergreen document? **CNSC:** Once Phase I is complete the Working Group will not revise or update the Phase I report itself, however since Phase II is an extension of Phase I, there will be opportunities in Phase II to capture those items as required.
3.	Section 1	T. McClenaghan	The Phase I report describes the current plans in place, but what about the do-ability/adequacy/effectiveness of the distribution of KI in the event of an accident/emergency and the

			appropriateness of planning zones; will Phase II address address this? **CNSC:** Phase II will look at the feasibility of these plans. In addition, other ways that this could be addressed include the IAEA EPREV follow-up mission (anticipated to take place in 2023), as well CNSC's engagement with OFMEM on the revision of the PNERP.
	Section 1	D. Novog	For emergency distribution, the municipalities will be actioned to support the emergency distribution of KI pills, can this report elaborate on what needs to be done at the municipal level to ensure they have the appropriate capabilities/resources? **S. Watson**: Agreed. At the municipal level, ensuring sufficient resources and staffing to carry out these actions needs to be discussed. This is something that Kincardine and other municipalities are looking at as the Bruce County area builds up. **CNSC:** During the KI Pill Working Group workshop when discussing emergency distribution of KI pills, PHUs/EMCs referred to the strategies and response actions that took place during H1N1 in 2009. In present day, the response required by municipalities during the COVID-19 pandemic will provide additional information and insights to support the concept of operations for the emergency distribution of KI. This will be considered for Phase II.
4.	Section 2	T. McClenaghan	There is a need to ensure all information is available for anyone who requires it before an event happens. For example, we need to reinforce guidance and specific medical advice for those who can and cannot take KI pills, and how that differs for populations such as pregnant women or those with thyroid issues. Timeliness to disseminate information and coordinate response actions is a reoccurring concern. For the COVID-19 and H1N1 response the timeframes are within days/weeks/months, however for a nuclear event the timeframes are within hours; there is going to be a lot of coordination required in a short amount of time. There is a need to address any coordination, cooperation, and public information matters in advance.
5.	Section 3	T. McClenaghan	See comment 4, same comment referring to the timeliness of public information/medical advice being prepared in advance of an event. Public communications relating to emergency preparedness has come a long way, but it is still complex. Should also consider impacts of misinformation.

6.	Section 3	T. McClenaghan	Figure 11, bullet 2 under Quick Facts: "*In the highly unlikely event of a nuclear emergency, potassium iodide (KI) pills are key to keeping you safe*". Suggest reviewing this public information product to ensure KI pills are not presented as a "magic pill" during a nuclear event. Phase II should provide more information on the efficacy of the KI pills.
7.	Section 4	D. Novog	Section 4 indicates that the concept of operations was "confirmed" during the KI Pill Working Group Phase I Workshop, could it be elaborated on how this was confirmed? In addition, what was the tabletop scenario conducted during this workshop? **CNSC:** The tabletop scenario did not refer to a specific on-site scenario at a nuclear power plant, it was focussed around an anticipated release occurring within a certain timeframe and the actions required by offsite response authorities. The meeting minutes from the Workshop are available through the KI Pill Working Group webpage: https://nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/potassium-iodide-pill-working-group.cfm **Action 2:** L. Casterton to share the meeting minutes from the KI Pill Working Group Workshop.
8.	Section 4	T. McClenaghan	Page 27, in terms of public alerting, the Working Group should consider the lessons learned from the Pickering false alert.
9.	Section 4	T. McClenaghan	Initial staging of KI pills was based on a Design Basis Accident (DBA) and can be expanded for a Beyond DBA (BDBA), but what about a Severe BDBA? Phase II will need to look at the timeliness of emergency distribution for a Severe BDBA, and if the timeliness cannot be achieved then pre-distribution needs to be considered. Impacts to each planning zone should be considered by applying a risk based approach to the level of detail needed.
10.	Section 4	D. Novog	Phase II should consider the impacts of a severe weather event on emergency response. Actions taken in response to a nuclear emergency may be part of a larger response to a severe weather event. **M. Burton:** Provided an explanation that KI pills were pre-distributed to schools, towns, and villages within the IPZ for Bruce Nuclear Generating Site in case of extreme weather that is experienced in the area.

11.	Section 4	B. Lemaich	For the concept of operations, realistic expectations need to be considered. For example, during Fukushima the response was superimposed with a severe weather event. For Phase II, other factors need to be considered in the concept of operations when it comes to capabilities such as staffing, resources, support from neighbouring municipalities/ offsite authorities, etc. There can be all the plans in place, but if communities get overwhelmed or there is a lack of support, those plans can fall apart.

The Advisory Committee members did not propose any specific changes to the report, but the comments provided above will be brought to the Working Group for further considerations to be included in Phase II.

Members of the Advisory Committee present at the workshop concluded that the Phase I Report meets the mandate of Phase I.

3. Closing Remarks

CNSC emphasized the importance of public engagement for this working group process and thanked all the Advisory Committee members for their participation in providing comments on the Draft Phase I Report.

L. Casterton reiterated the following milestones going forward:

- January 2022, Commission Proceeding to present the Phase I report and the comments received
- Spring 2022, Advisory Committee Meeting to discuss the commencement of Phase II and receive their input on the Phase II Workshop Agenda topics
- Spring/Summer 2022, Phase II Workshop with the KI Pill working Group
- January 2023, Outputs of Phase II outputs presented to the Commission

The following actions were identified for CNSC:

Action 1: L. Casterton to share the Advisory Committee's Operating Procedures.

Action 2: L. Casterton to share the meeting minutes from the KI Pill Working Group Workshop.

APPENDIX C. COMMENT DISPOSITION CONCERNING CURVE LAKE FIRST NATION REVIEW OF PHASE I REPORT

The following comments were submitted by Curve Lake First Nation on the Phase I Report:

Section	Comment	DRAFT CNSC Response
General	Part of our Indigenous way of thinking involves the mindset of All of our Relations. Which means to always identify our interconnectedness to the earth, including all living beings, not just humans. This leads to the question: If the KI pills are protecting humans, what about the safety of the plants and animals within the 50km range and if they were to be consumed by humans? As well, is there a risk of I-131 in our drinking water? Can KI pills protect us from such contaminated water and not just air exposure to I-131? We suggest exploring education, awareness, and clarification on this issue, on the impacts beyond the human species and the different pathways of exposure to I-131. What are the key tangible actions that need to be taken – do we stop hunting and harvesting for a certain period? If we don't stop, what are the risks?	Section 1.3 of the Phase I Report discusses Health Canada's *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response*. This document provides guidelines to inform decisions on what measures are necessary to protect human health during a nuclear emergency, such as restrictions on contaminated water and foodstuffs. The focus of the Working Group for Phase I was to provide clarity on existing plans and associated roles and responsibilities for KI pill distribution in an emergency at Pickering Nuclear Generating Station. Although the impacts to non-human biota and potential longer term exposure pathways are not within the scope of Phase I, CNSC staff will bring these topics forward for further discussion as part of Phase II. Additionally, CNSC staff is committed to providing this information to Curve Lake First Nation during regularly scheduled meetings as part of the CNSC-Curve Lake First Nation Terms of Reference for long-term engagement. The Working Group is discussing additional opportunities for engagement and the CNSC looks forward to working with Curve Lake First Nation on having

Section	Comment	DRAFT CNSC Response
		additional discussions and engagement regarding their feedback, question and comments throughout Phase II.
General	Clarification is needed on what is defined as a nuclear emergency/nuclear disaster event, would this be a controlled release event or an uncontrolled event (such as an explosion). What type of event would lead to exposure of radioactive Iodine within the 50km zone? In our meeting, CNSC described the extensive consideration of accident modelling that has been done, and seemingly is the basis of the emergency response plan for KI pill distribution, this could be clarified in communications. We would like to review the Provincial Nuclear Emergency Response Plan (PNERP) Technical Study to gain a better understanding of the inherent risk and likelihood of an event/disaster that would need the distribution of KI pills and how CLFN would fit into this plan. For example, what is the current program for CLFN in terms of pre-distribution of KI pills and replenishment? Including information, awareness, education tools that would go along with the KI pills. What is the current program or plan for CLFN in terms of an emergency situation? What are the notification and alert systems in place for CLFN? How would we ensure that our community members living on and off reserve are safe and aware of the evolving situation?	CNSC staff will provide the PNERP Technical Study to Curve Lake First Nation. In addition, CNSC staff are committed to providing Curve Lake First Nation with additional information on nuclear events and accident modelling. Pre-distribution is required within the 10km zone (the Detailed Planning Zone) of Pickering Nuclear Generating Station (NGS). KI pills are also available to any resident or individual working in the 50 km zone (the Ingestion Planning Zone) upon request, through the www.preparetobesafe.com webpage. CNSC staff have raised Curve Lake First Nation's comments with the Working Group for further consideration during Phase II. CNSC staff acknowledge the importance of providing information on the areas identified by Curve Lake First Nation, as currently the information in these areas is not specific to Indigenous Nations and communities. Furthermore, the Working Group is discussing how to increase engagement directly with Indigenous Nations and communities throughout Phase II.

Section	Comment	DRAFT CNSC Response
General	How are these predetermined zones, that are noted to be the zones of at-risk exposure, designated and the decision made on how far the zone reaches? More information on how this decision is made will be helpful. How do we know that there isn't a risk of exposure further than these zones?	The emergency planning zones for Ontario are identified in the Provincial Nuclear Emergency Response Plan published by the Ontario Office of the Fire Marshal and Emergency Management. The Ontario planning zones are based on national and international guidance referenced in section 1.5 of the report. The PNERP Technical Study is an important input in determining potential risk and exposure. CNSC staff is committed to meeting with Curve Lake First Nation to provide additional information on planning zones and the potential risks associated with a nuclear emergency in relation to the distance from a NGS.
General	Roles and responsibilities at all levels need to be decided and communicated now, prior to an emergency event due to time-sensitivity of KI pills (communication between municipalities, province, and OPG, CNSC). Perhaps this can be done in Phase 2, but a broad discussion of plans can be mentioned in Phase 1. Furthermore, as rights holders to the land, Indigenous communities should be meaningfully consulted and engaged in the decision making process and distribution of KI pills. We believe this discussion should be included in the first phase of the KI Working Group report to allow feedback and dialogue between Indigenous communities and CNSC to help improve on for the second phase of this work.	The Phase I Report describes the current plans in place for KI pill distribution in an emergency. Phase II provides an opportunity for the Working Group to develop more detailed plans, as well as associate education and awareness information. Acknowledging the need for meaningful engagement with Indigenous communities, CNSC staff have raised Curve Lake First Nation's comments with the Working Group for further consideration during Phase II. The Working Group does not make any decisions related to emergency planning; however, it does provide an opportunity for feedback and dialogue between Indigenous communities and the CNSC. CNSC staff are committed to meeting with Curve Lake First Nation to

Section	Comment	DRAFT CNSC Response
		discuss this comment and help inform Phase II activities.
General	How would Small Modular Reactors change the risk profile or perhaps introduce factors that would result in similar concerns?	As part of the CNSC licensing expectations and requirements, an applicant would need to demonstrate the safety of the SMR during normal and emergency scenarios. Indigenous consultation and engagement will be part of the CNSC licensing process for an application to operate a SMR.

ATTACHMENT 1. PHASE I REPORT

Canada's Nuclear Regulator

Phase I Report – Emergency Distribution of Potassium Iodide Within the Ingestion Planning Zone of Pickering Nuclear Generating Station

KI Pill Working Group

E-DOC # 6055615

December 2020

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

Acknowledgment

The land on which the Pickering Nuclear Generating Station is located is within the traditional and treaty territory of the Chippewa and the Michi Saagiig Nations, collectively known as the Williams Treaties First Nations.

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 PURPOSE AND SCOPE 2
1.2 DEFINITIONS 3
1.3 OVERVIEW OF CANADA'S NUCLEAR EMERGENCY MANAGEMENT FRAMEWORK 5
1.4 KI BACKGROUND 6
1.4.1 What is KI? 6
1.4.2 Target Population 6
1.4.3 The Decision to Administer KI 6
1.4.4 KI Ingestion Timing Considerations 7
1.4.5 Risks and Other Concerns of KI 7
1.4.6 Pre-distribution in Detailed Planning Zone 7
1.5 EMERGENCY PLANNING ZONE TERMINOLOGY 8
1.6 INTERNATIONAL GUIDANCE 9

2. PLANNING FOR KI EMERGENCY DISTRIBUTION 10

2.1 OVERVIEW OF ROLES, RESPONSIBILITIES, AND DOCUMENT HIERARCHY 10
2.2 DISCUSSION ON THE EXISTING ARRANGEMENTS FOR KI EMERGENCY DISTRIBUTION IN THE IPZ 15
2.2.1 Documentation 15
2.2.2 Responsible Authorities 15

3. PUBLIC RESOURCES RELATING TO KI 16

3.1 PUBLIC WEBSITES 16
3.1.1 Prepare to Be Safe Website 16
3.1.2 Durham Region 19
3.1.3 City of Toronto 20
3.1.4 MOH 20
3.2 COMMUNITY INFORMATION AND PUBLIC EDUCATION 20
3.2.1 KI Pre-Distribution Packages 20
3.2.2 Public Education and Awareness 22

4. CONCEPT OF OPERATIONS FOR KI EMERGENCY DISTRIBUTION 25

4.1 INITIATING EVENT – NOTIFICATION AND PREPARATION 27
4.1.1 Emergency Public Alerting System 27
4.2 STAGING OF KI 29
4.3 EMERGENCY DISTRIBUTION OF KI 29
4.4 INGESTION OF KI 30
4.5 END OF RELEASE EVENT 30

5. CONCLUSION 31

5.1 KI EMERGENCY DISTRIBUTION IN THE IPZ 31
5.1.1 Role and responsibilities 31
5.1.2 Public information and communications 31
5.1.3 Concept of Operations 31
5.2 NEXT STEPS 32

6. REFERENCES 33

APPENDIX A KI PILL WORKING GROUP TERMS OF REFERENCE I

APPENDIX B DOCUMENT EXCERPTS VI

B.1 CNSC VI
B.1.1 REGDOC-2.10.1: Nuclear Emergency Preparedness and Response, Version 2 vi
B.2 HEALTH CANADA VIII
B.3 ONTARIO POWER GENERATION XI
B.3.1 OPG Consolidated Nuclear Emergency Plan xi
B.4 PROVINCE OF ONTARIO XII
B.4.1 OFMEM xii
B.4.2 MOH xvii
B.5 MUNICIPALITIES XXIV
B.5.1 The Emergency Management and Civil Protection Act xxiv
B.5.2 Durham Region xxv
B.5.3 City of Toronto xxx
B.5.4 The Regional Municipality of York xxxii
B.5.5 Peel Region xxxii
B.5.6 Kawartha Lakes xxxii
B.5.7 Simcoe County xxxii

APPENDIX C PRE-DISTRIBUTION OF KI PILLS IN THE PICKERING NGS IPZ XXXIII

C.1 KI PILL ORDER STATISTICS XXXIII
C.2 KI PILL ORDER GEOGRAPHY XXXVII

APPENDIX D CURRENT NATIONAL AND INTERNATIONAL PRACTICES XLIV

D.1 CANADA XLIV
D.1.1 Ontario xliv
D.1.2 New Brunswick xlv
D.2 EUROPE XLV
D.2.1 France xlv
D.2.2 Switzerland xlv
D.2.3 United Kingdom xlv
D.2.4 Finland xlvi
D.3 UNITED STATES OF AMERICA XLVI
D.3.1 Illinois xlvi
D.3.2 California xlvi
D.3.3 Florida xlvi
D.4 JAPAN XLVI

Table 1 – Acronyms

Acronym	Definition
AAZ	Automatic Action Zone
CEMC	Community Emergency Management Centre
CMOH	Chief Medical Officer of Health
CNSC	Canadian Nuclear Safety Commission
CPZ	Contingency Planning Zone
DNERP	Durham Nuclear Emergency Response Plan
DPZ	Detailed Planning Zone
EMCPA	Emergency Management and Civil Protection Act
EOC	Emergency Operations Centre
EPZ	Emergency Planning Zones
FERP	Federal Emergency Response Plan
FNEP	Federal Nuclear Emergency Plan
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IPZ	Ingestion Planning Zone
ITB	Iodine Thyroid Blocking
KI	Chemical formula of potassium iodide
MOH	Ministry of Health
MOHLTC	Ministry of Health and Long-Term Care
NGS	Nuclear Generating Station
NPP	Nuclear Power Plant (found only in document excerpts)
OFMEM	Office of the Fire Marshal and Emergency Management
OPG	Ontario Power Generation
PEOC	Provincial Emergency Operations Centre
PHU	Public Health Unit
PNERP	Ontario's Provincial Nuclear Emergency Response Plan
TNERP	Toronto Nuclear Emergency Response Plan
WHO	World Health Organization

1. Introduction

The Canadian Nuclear Safety Commission (CNSC) held a public hearing from June 25-29, 2018, to consider the licence renewal application from Ontario Power Generation (OPG) for the Pickering Nuclear Generating Station (NGS). A number of intervenors raised concerns about the distribution of potassium iodide (KI) pills in the event of an emergency, and more specifically, how the vulnerable population (children under 18, pregnant women, and breastfeeding women) in the Ingestion Planning Zone (IPZ) would obtain KI.

At the hearing, the CNSC Executive Vice-President and Chief Regulatory Operations Officer made a commitment to the Commission to form a working group with Office of the Fire Marshal and Emergency Management (OFMEM), Ontario Ministry of Health (MOH), and OPG.

On May 14, 2019, the Terms of Reference (Appendix A) enacting the Working Group were signed by the CNSC, OFMEM, MOH, and OPG. Formal invitations to join the Working Group were sent on June 7, 2019 to Health Canada, Public Health Units, and Community Emergency Management Coordinators for the municipalities within the IPZ. The municipalities within the IPZ include York Region, City of Kawartha Lakes, Simcoe County, Peel Region, City of Toronto, and Durham Region. The City of Peterborough was also invited to join the Working Group as they are a designated host community. All invitations were accepted.

A dedicated webpage[1] [1] for the Working Group was launched in June 2019 on the CNSC website. The webpage currently provides general background information on the Working Group, project milestones, the Terms of Reference, information on the Advisory Committee, meeting minutes, and quick facts on KI pills. This webpage will be used as a repository of information for the Working Group and will continue to be populated with information and documentation related to the Working Group. In accordance with the Terms of Reference, this will include the Working Group deliverables such as the Phase I and II reports, and meeting minutes of the Working Group and Advisory Committee.

This document was written to meet the objectives and mandate of Phase I of the Working Group:

> *"To fulfill the commitment to the Commission to provide clarity on the existing plans and associated responsible authorities for distributing KI pills in the IPZ in the event of an emergency at the Pickering NGS."*

[1] URL: http://nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/potassium-iodide-pill-working-group.cfm

1.1 Purpose and Scope

This report meets the mandate of Phase I of the CNSC KI Pill Working Group by detailing existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ (depicted in Figure 1). The mandate of Phase I is described in the Terms of Reference (Appendix A)

The report is organized into the following sections:

1. **Introduction** – introduces the purpose of this document, defines key terminology, and provides relevant background information regarding the use of KI and nuclear emergency management.
2. **Planning for KI Emergency Distribution** – identifies current plans and details the current roles and responsibilities. (Appendix B contains specific plan excerpts and discussion of documents referenced in this report)
3. **Public Resources Relating to KI** – highlights the public information currently available by various stakeholders.
4. **Concept of Operations for KI Emergency Distribution** – highlights how emergency distribution of KI would be implemented based on the plans identified in Section 2.
5. **Conclusion** – summarizes sections 2 through 4 and defines the next steps intended for Phase II of the KI Pill Working Group.
6. **References** – lists the references to the various sources of information and documents discussed.

1.2 Definitions

The following terms used in this report are defined below. Unless otherwise stated, the definitions in this section are consistent with Ontario's Provincial Nuclear Emergency Response Plan (PNERP) [2].

Automatic Action Zone (AAZ)	A pre-designated area immediately surrounding a reactor facility where pre planned protective actions would be implemented by default. This zone has a 3 km radius.
Contingency Planning Zone (CPZ)	An area surrounding a reactor facility, beyond the DPZ, where contingency planning and arrangements are made in advance. This zone is within a 10 km to 20 km radius.
Designated Host Municipalities	Municipalities designated in the PNERP that must address hosting an evacuating population in their municipal emergency plans. Relevant to Pickering is City of Peterborough.
Designated Municipalities	Municipalities designated in the PNERP that must address protecting their citizens from the hazard of a nuclear emergency in their municipal emergency plans. Relevant to Pickering are Durham Region and City of Toronto.
Detailed Planning Zone (DPZ)	A pre-designated area surrounding a reactor facility, incorporating the AAZ, where pre-planned protective actions are implemented. This zone has a 10 km radius.
Emergency Distribution	For the purposes of this document all distribution of KI to the general public during a nuclear emergency, as part of emergency response, shall be referred to as emergency distribution.
Emergency Planning Zones (EPZ)	Planning zones define the areas beyond the boundary of a reactor facility, in which implementation of operational and protective actions are or might be required.
Ingestion Planning Zone (IPZ)	A pre-designated area surrounding a reactor facility where plans or arrangements are made to protect the food chain and drinking water supplies. This zone has a 50 km radius. For the purposes of this document, IPZ shall refer to the area between a radius of 10 km and 50 km, or the entirety of the CPZ and IPZ.
Iodine Thyroid Blocking (ITB)	ITB is a general term to refer to any form of stable iodine thyroid protection, including KI. For the purposes of this document, KI can be considered to refer to any form of ITB.
Ministry of Health (MOH)	As of June 2019, the Ministry of Health and Long-Term Care (MOHLTC) is now the Ministry of Health (MOH). Documents published prior to June 2019 will refer to the ministry under its previous name. This document will refer to the organization with the current name.

Municipalities	The Municipalities referred to in this document are those with borders within the IPZ of Pickering Nuclear Generating Station. They are: City of Toronto, Durham Region, Kawartha Lakes, Peel Region, Simcoe County, the Regional Municipality of York, and associated lower-tier municipalities.
Potassium Iodide (KI)	KI can take many forms such as pills/tablets, liquid, etc. For the purposes of this document KI will be used to refer to any preparation generically.
Pre-distribution	For the purposes of this document all distribution of KI in advance of an event, as part of emergency preparedness, shall be referred to as pre-distribution.
REGDOC 2.10.1[2] *Requirements* [3]	For the purposes of this document, as 2.10.1 is part of Pickering NGS's licensing basis, items denoted with the word "shall" in the CNSC regulatory document are considered requirements.
Staging	For the purposes of this document, moving KI from the central stockpile to local storage locations in advance of possible emergency distribution shall be referred to as staging.
Vulnerable Population	During a nuclear emergency the most vulnerable population, with respect to exposure to radioiodine and the use of KI, is considered children under 18, pregnant women, and breastfeeding women.

[2] URL: https://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/regdoc2-10-1/index.cfm

1.3 Overview of Canada's Nuclear Emergency Management Framework

The arrangements for KI pre-distribution and emergency distribution are relevant to the preparedness and response phases of emergency management for nuclear emergencies.

Preparedness relates to actions taken before a nuclear emergency in order to be ready to respond and manage its consequences, and includes the development of response plans and procedures, training of workers, maintaining emergency facilities, conducting exercises, pre-distribution of KI, and fostering public awareness.

Response refers to those actions taken during a nuclear emergency, both onsite and offsite, to reduce the magnitude of the hazard and manage its consequences on health, safety, and the environment. Response actions include supporting onsite accident management activities, protecting the public and emergency workers, emergency public communication, emergency medical assistance, and public protective actions (e.g. shelter-in-place, evacuation, KI pills).

In Canada, the respective roles of the various levels of government in nuclear emergency preparedness and response are derived from legislated responsibilities. Provincial and territorial governments bear the primary responsibility for protecting public health and safety, property, and the environment within their borders. The federal government regulates the peaceful use of nuclear energy in Canada, manages nuclear liability, and supports the nuclear emergency response of provinces within their boundaries.

The administrative framework of the Federal Emergency Response Plan (FERP) [4] and the Federal Nuclear Emergency Plan (FNEP) [5] bring together the resources and expertise available across the federal government to respond to nuclear emergencies in federal jurisdiction or support provinces in their response. In general, different levels of government, along with various agencies and organizations, have responsibilities for developing and implementing emergency plans to address nuclear emergencies with offsite impacts (i.e. outside the boundaries of CNSC-licensed nuclear facilities).

Guidelines for protective actions, such as Health Canada's *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response* [6], are intended to assist federal and provincial emergency response authorities on choosing appropriate protective actions to protect public health and safety. Intervention levels in such guidelines are used to inform decisions on what measures are necessary to protect the public during a nuclear emergency. These guidelines are based, in part, on advice from international organizations such as the International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP) and are found on the Government of Canada's publications website.

Regulatory requirements for licensees relevant to KI are established in CNSC REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response* [3] and Ontario Power Generation (OPG) must meet these requirements in accordance with the Pickering NGS *Licence Condition Handbook* [7].

As the offsite authority, the Province of Ontario maintains nuclear emergency response plans, which include provisions for KI pre-distribution and emergency distribution. The plans relevant to this document are Ontario's *Provincial Nuclear Emergency Response Plan (PNERP) – Master Plan* [2] and *Provincial Nuclear Emergency Response Plan (PNERP) – Implementing Plan for the Pickering Nuclear Generating Station (PNGS)* [8].

1.4 KI Background

The information included in this section is derived from a variety of sources, most predominantly the MOH's *Potassium Iodide (KI) Guidelines* [9]. Excerpts of the pertinent sections can be found in Appendix B.4.2.2. Further information can also be found in Health Canada's Guidance. [6] (Appendix B.2).

1.4.1 What is KI?

KI pills or tablets are made of potassium iodide salts. KI contains stable non-radioactive iodine. Iodine is an essential element for human life. The thyroid gland uses iodine to produce the hormones thyroxine (T4) and triiodothyronine (T3). Nearly all of the iodine in the body is absorbed by the thyroid gland.

Because of iodine's role in human physiology, the thyroid gland is specifically vulnerable to radioactive iodine (e.g. I-131), also known as radioiodine. Uptake of radioiodine, such as that released in the very unlikely event of a nuclear emergency, is linked with increased risk of thyroid cancer.

KI provides a plentiful source of iodine, which saturates the thyroid gland with safe, stable iodine the human body needs. If taken shortly before or immediately after radioiodine exposure, KI reduces the uptake of radioiodine by the thyroid, greatly reducing the absorbed dose to the thyroid [10]. In this way, KI provides a valuable emergency protective action to guard against the risks of thyroid cancer.

The use of KI is well established as a supplemental emergency protective action when applied together with other protective actions such as sheltering-in-place and evacuation. KI is not capable of providing protection against any other forms of radiation (e.g. radioactive caesium) and does not protect against external radiation such as radiation deposited on the ground or surfaces. While KI does not prevent radioactive iodine from entering the body through ingestion or inhalation, it reduces the time it remains in the body. KI provides a valuable extra layer of protection during the very unlikely event of radioiodine release during a nuclear emergency.

1.4.2 Target Population

The risks and benefits of taking KI should be considered on an age-specific basis. Newborns and children are especially vulnerable to radioiodine, while members of the public over 40 years of age are unlikely to require KI. It is also important to note that elderly people are at a lower risk of developing radiation-induced thyroid cancer, and although the risk is still extremely low may be at higher risk of experiencing adverse effects from KI ingestion[3].

Children (<1 month – 18 years), pregnant women, women who are breastfeeding, and workers responding within the zone where public evacuation, sheltering, or KI is considered are at highest risk for negative health effects to the thyroid from radioiodine, and therefore will benefit the most from ITB.

1.4.3 The Decision to Administer KI

In Ontario, the decision to instruct the public to consume KI is made by the Chief Medical Officer of Health (CMOH) in coordination with the Provincial Emergency Operations Centre (PEOC) and the local medical officers of health. Communication will be coordinated with local medical officers of health, the PEOC, and community emergency management centres (CEMC) to ensure consistency in messaging.

[3] During the Chernobyl accident, the incidence of severe side effects from a single dose of stable iodine was less than 1 in 10 million in children and less than 1 in a million in adults. WHO, 1999.

The communication of the CMOH decision to administer KI will include information about when, how, and by whom KI should be taken. It will also include incident-specific information such as: a rationale for the recommendation, risks and benefits of taking KI, where to obtain KI, dosage recommendations, and any other pertinent information deemed necessary at the time.

1.4.4 KI Ingestion Timing Considerations

The benefits of KI are greatly dependant on their timely ingestion. Maximum protection comes if KI is taken less than 24 hours before radioiodine exposure [10], with rapidly reducing protection after exposure [11].

Ideally, KI ingestion should commence before exposure to radioiodine. The optimum time is two to six hours before a release occurs [9]. However, if that is not possible, it should commence as soon after first exposure as possible. After four hours, effectiveness is reduced by half, while no benefit is gained after a delay of 24 hours.

A single dose of KI protects the thyroid gland for 24 hours. The MOH may recommend taking a dose of KI every 24 hours if the potential dose to the thyroid is still high and evacuation is not feasible (excluding some at risk groups, see Section 1.4.5).

1.4.5 Risks and Other Concerns of KI

Individuals intolerant of KI at protective doses (i.e. individuals in whom repeat administration of KI raises safety issues) must be given priority with regard to other protective measures.

The risk of side effects from taking a dose of KI is extremely low for all age groups, and the overall benefit of KI outweighs the risk of side effects. Nevertheless, the possibility of such effects, though rare, requires that KI be:

- Reserved only for situations where it is absolutely necessary
- Only be taken when directed by the Province
- Be taken for a short time frame, i.e., one or two doses.

There is an increased risk of side effects for people with thyroid disorders. Such disorders are more commonly seen in adults and the elderly and are rare in children.

Thyroidal side effects may result from KI administration, especially in people with iodine deficiency. Further information regarding the risks of KI, including conditions that contraindicate administration of KI, can be found in the MOH guidelines [9].

1.4.6 Pre-distribution in Detailed Planning Zone

KI is pre-distributed within the detailed planning zone (DPZ), available at DPZ institutions and emergency centres (emergency worker centres, reception centres, and evacuation centres), and stockpiled for the IPZ of Canadian Nuclear Power Plants by the host province [8]. Pre-distribution ensures that KI is available quickly for residents within 10 km of a Canadian NPP.

KI is also available for pre-distribution in the IPZ of Pickering and Darlington NPPs to those residents who request it, through a program coordinated between the designated municipalities and OPG (see Section 3.1.1). Details on the status of this voluntary pre-distribution are available in Appendix C.

1.5 Emergency Planning Zone Terminology

Figure 1 depicts the Pickering NGS emergency planning zones (EPZs) as described in the PNERP [2].The boundaries of these EPZs may be defined by natural or infrastructure separation, resulting in nominally larger 3 km and 10 km zones.

Table 2 shows the various radii of Ontario EPZs as well as the related terminology used by different documents and organizations.

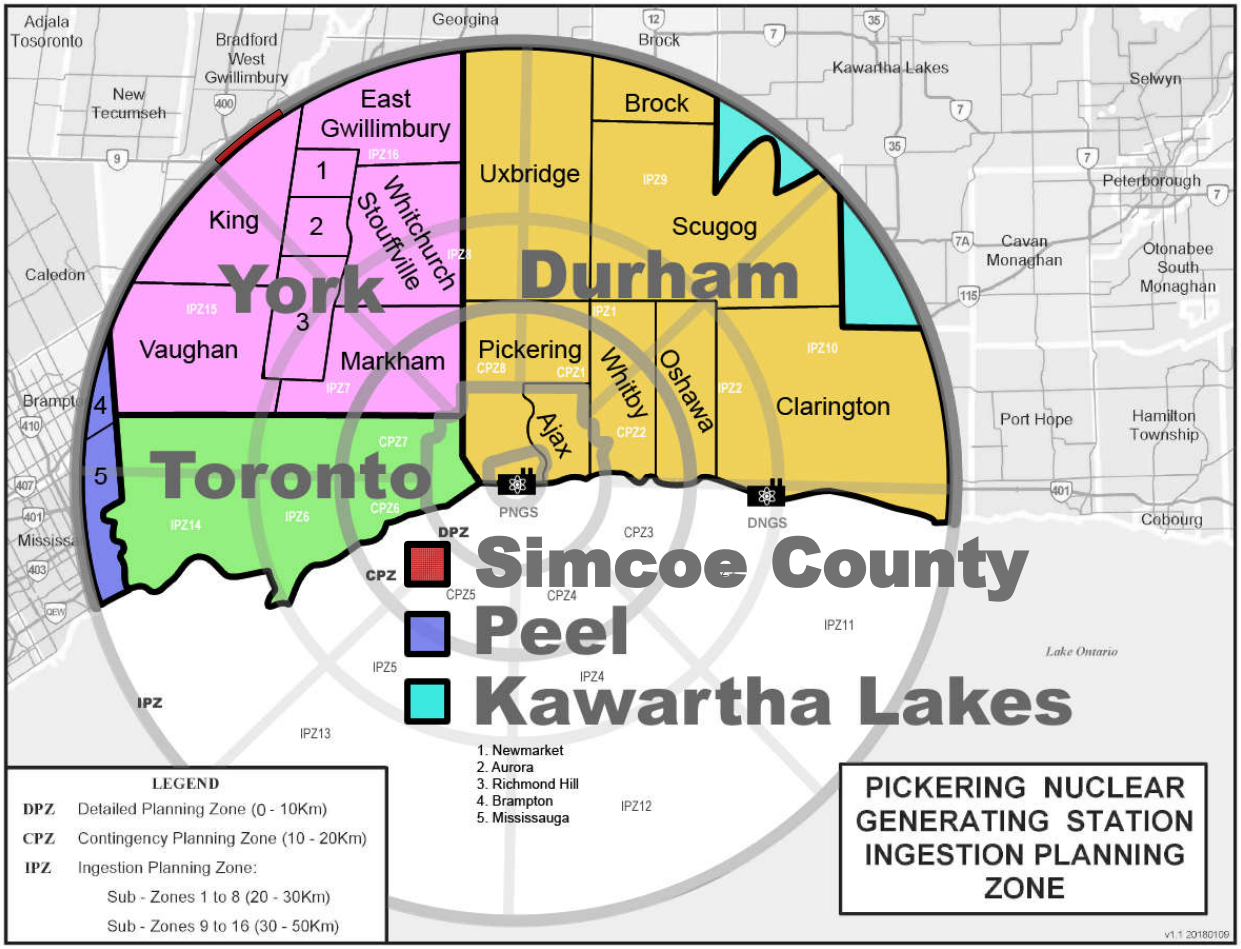

Figure 1 – Pickering NGS Planning Zones Map

Table 2 – Emergency Planning Zone Terminology

2017 PNERP (CSA N1600-16 [12]**)**	**IAEA***	**CNSC REGDOC 2.10.1**	**Province of Ontario Historical Nomenclature**
Automatic Action Zone (AAZ, 3 km)	Precautionary Action Zone (PAZ)	–	Contiguous Zone (3 km)
Detailed Planning Zone (DPZ, 10 km)	**Urgent Protective Action Zone (UPZ)**	**Plume exposure planning zone**	**Primary Zone (10 km)**
Contingency Planning Zone (CPZ, 20 km)	Extended Planning Distance	–	–
Ingestion Planning Zone (IPZ, 50 km)	**Ingestion and Commodities Planning Distance**	**Ingestion control planning zone**	**Secondary Zone (50 km)**

* The suggested radius of IAEA EPZs are found in *Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor* [13] and *GS-G-2.1* [14]. The UPZ radius is defined as out to 15-30 km based on the former [13] and out to 5-30 km as defined by the latter [14] (depending on site specific characteristics such as reactor power), which overlaps the DPZ and CPZ. The IAEA also defines and Extended Planning Distance out to 100 km and an Ingestion and Commodities Planning Distance out to 300 km.

1.6 International Guidance

The World Health Organization (WHO) has published guidelines on ITB [15]. These guidelines emphasize the importance of quick availability due to the time-limited effectiveness of ITB. Pre-distribution is recommended close to a reactor site. Farther from the site, where more time for decision-making is likely, stockpiling is suggested if pre-distribution is not feasible.

The IAEA also points to the necessity of pre-distribution within the precautionary action zone (PAZ, equivalent to AAZ) and urgent protective action planning zone (UPZ, equivalent to DPZ) due to the time dependant efficacy of ITB in GS-G-2.1 [14]. Canada's emergency preparedness review (EPREV) mission, detailed in the IAEA's *Peer Appraisal of the Arrangements in Canada Regarding Preparedness and Response for A Nuclear or Radiological Emergency* [16]*,* identified KI pre-distribution as a good practice:

> *"Good Practice 2 – The implementation of the arrangements for pre-distribution of KI pills maximizes the public awareness and the effectiveness of the protective action."*

International guidance is used in the creation of national guidance documents such as Health Canada's *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response* [6], CNSC REGDOC-2.10.1 [3], and CSA Standard N1600 [12].

Some highlights of domestic and international KI distribution practices can be found in Appendix D.

2. Planning for KI Emergency Distribution

This section contains an overview and discussion of the current roles, responsibilities, plans, and documentation related to KI distribution within the IPZ of Pickering NGS. All documents relevant to the Pickering IPZ's KI distribution (pre-distribution and emergency distribution) were considered.

2.1 Overview of Roles, Responsibilities, and Document Hierarchy

The roles and responsibilities of the various stakeholders, along with their relevant documentation, are summarized in Table 3. Requirements defining these roles & responsibilities are established in section 2.3.4 of the CNSC's REGDOC 2.10.1 [3] and confirmed in Ontario's PNERP [2, 8] and OPG's *Consolidated Nuclear Emergency Plan* [17]. For detailed excerpts from these plans and documents relevant to KI distribution, refer to Appendix B. The documents listed are those currently available as of December 2020.

Figure 2 shows the relative relationship of the documents listed in Appendix B. Arrows show linkages between the various plans (e.g. sources of information, declarations of responsibilities, overlapping plans). Generally, document linkages are structured in the same manner as the governmental hierarchy.

Table 3 – Roles & Responsibilities

Roles & Responsibilities	Relevant Documentation Highlights and Linkages
CNSC	
• Define requirements in regulatory documents and ensure compliance with the *Nuclear Safety and Control Act* [18].	• REGDOC 2.10.1 [3] – defines requirements related to KI and is included in the Pickering NGS Licence Condition Handbook [7].
Health Canada	
• Provide recommendations on protective actions in accordance with responsibilities outlined in the FNEP [5].	• *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Preparedness and Response* [6] includes dose-based criteria for the administration of KI as well as general guidance and advice related to its use.
OPG	
• Procure adequate quantities of stable iodine tablets in the DPZ (including residences, businesses, institutions, and emergency centres) [2, 17] • Procure KI within the expiry date in the DPZ [2, 17] • Procure additional KI as required under the PNERP Implementing Plan [8]. • Work with designated municipalities to pre-distribute KI to the DPZ [3, 7]. • Ensure information pertaining to KI is publicly available [3, 7]. • Conduct robust, cyclical, and ongoing public education and awareness campaigns in coordination with designated municipalities and the province [3, 7, 2, 8]	• The *OPG Consolidated Emergency Plan* [17] – considers KI pre-distribution (for the DPZ) and continued availability to residents (of the IPZ).

<table>
<tr><th colspan="2">Province of Ontario (MOH, OFMEM)</th></tr>
<tr><td>

The province is the offsite authority in the event of a nuclear emergency [2].
The province provides assistance, coordination, and guidance to municipalities [2, 8].
The CMOH shall direct the use of KI [2, 19].
OFMEM and MOH are to maintain a strategy for the emergency distribution of KI within the IPZ [2].
Manages KI central stockpile
The province leads emergency communications strategies related to KI [7, 8].
Public education and awareness programs are co-ordinated by OFMEM in close cooperation with OPG and Designated Municipalities. [3, 2, 8].

</td><td>
OFMEM:

The PNERP and Pickering Implementing Plan [2, 8] – consider KI pre-distribution and emergency distribution.

The PNERP references an IPZ KI emergency distribution strategy that is the responsibility of MOH and OFMEM. This strategy is not a document and is expanded on through Section 4.
Working level plans for the pre-distribution of KI are delegated to the designated municipalities.

MOH

Radiation Health Response Plan and Potassium Iodide (KI) Guidelines [19, 9] – Provide details about KI use.

</td></tr>
<tr><th colspan="2">Designated Municipalities of Pickering NGS (Durham Region & City of Toronto)</th></tr>
<tr><td>

Designated municipalities work with OPG to pre-distribute KI in the DPZ [2, 8, 20, 21, 22].
Designated municipalities must detail in their plans how KI will be made available to the public in the DPZ and IPZ [3, 2, 8].
The designated municipalities participate in emergency communications strategies to meet KI related objectives [3, 2, 8].
With the assistance of OPG and the province, the designated municipalities conduct public education and awareness campaigns with respect to KI [2, 8].

</td><td>
Durham Region

The Durham Nuclear Emergency Response Plan (DNERP) [23] – considers KI pre-distribution.

The DNERP refers to the Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution [20] for KI specific details.

The NESF – considers pre-distribution (including voluntarily in the IPZ).

Emergency distribution in the IPZ is noted as the responsibility of MOH and OFMEM.

City of Toronto

The Toronto Nuclear Emergency Response Plan (TNERP) [21] – considers KI pre-distribution to workers and staff.

</td></tr>
</table>

Other governments within designated Municipalities (Ajax, Clarington, Oshawa, Pickering, Brock, Scugog, Uxbridge, Whitby)	
• Lower-tier municipalities assist the designated municipality in their response [22]. • There is no specific role defined for the lower tier municipalities.	• The Town of Ajax's all-hazard plan [24] – refers to the DNERP as the specific nuclear plan. • The Municipality of Clarington's all-hazard plan [25] – refers to KI pre-distribution and provides wording identical to the DNERP. • The City of Oshawa's all-hazard plan [26] – refers to a specific nuclear plan [27] which is not available to the public. • The City of Pickering's all hazard plan [28] – refers to the DNERP as the specific nuclear plan • The Townships of Brock [29], Scugog [30], Uxbridge [31], and the Town of Whitby [32] all hazard plans – Nuclear emergencies are not explicitly distinguished in these all-hazard plans.
Other Municipalities within IPZ (York, Peel, Kawartha Lakes, Simcoe County)	
• Municipal governments make arrangements to cooperate with and/or support OPG, designated municipalities, and Ontario in the response to a nuclear emergency [2].	• The Regional Municipality of York, Region of Peel, Kawartha Lakes, and Bradford West Gwillimbury (Simcoe County) all-hazard emergency response plans [33] [34] [35] [36] – Nuclear emergencies are not explicitly differentiated.

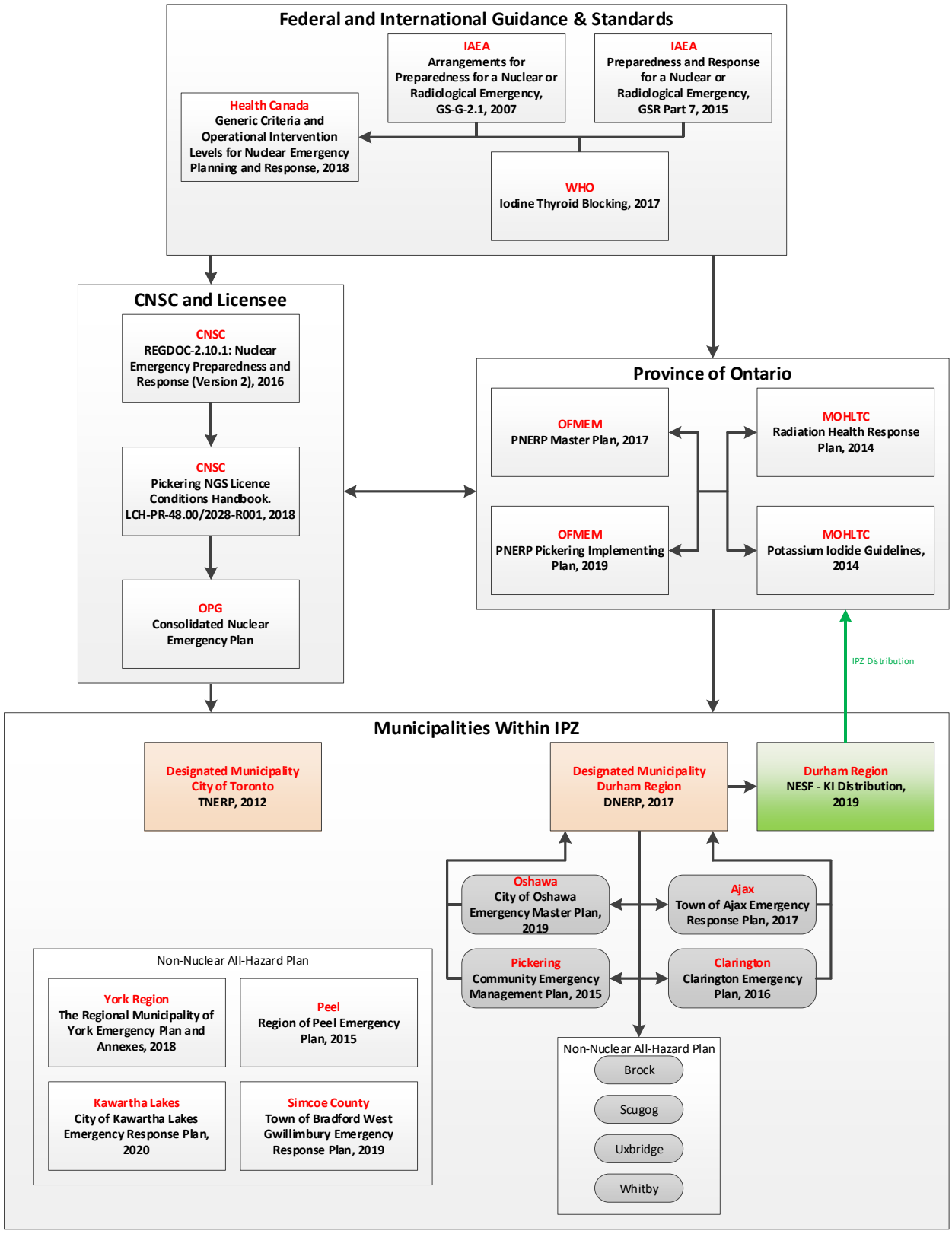

Figure 2 – KI document Map

2.2 Discussion on the Existing Arrangements for KI Emergency Distribution in the IPZ

This section will provide a discussion on the current status of KI emergency distribution planning for the Pickering NGS.

2.2.1 Documentation

The general hierarchy of the plans is well established and KI is clearly defined as a priority in most municipal, provincial, and federal plans. While DPZ pre-distribution is well documented in publicly available plans, specific plans for KI emergency distribution are not. The lack of specific plans for emergency distribution has led to increased requests for information from the public on how to obtain KI during an emergency.

Additionally, some municipalities do not mention KI or nuclear risks in their publicly available all-hazards emergency response plans. While cities and municipalities within Durham Region do not all explicitly state that they fall under the DNERP in their own plans, this is addressed through the *Emergency Management and Civil Protection Act* (EMCPA) [37]. The act states that lower-tier municipalities shall conform to the emergency plans of the upper-tier municipalities. As such, municipalities within Durham Region would conform to the DNERP during an emergency.

Durham Region's KI related NESF [20] is the sole KI specific document available at the municipal level and provides detailed information regarding how KI is pre-distributed in the DPZ. However, this document does not detail IPZ distribution or accessing stockpiles during an emergency, which is noted as the responsibility of the province in the PNERP [2].

In general, the IPZ and KI emergency distribution are often lacking consideration in publicly available plans, which are focused on pre-distribution activities in the DPZ. This report is intended to provide information to the public on KI emergency distribution (Section 4) and identify areas for the KI Pill Working Group to consider further in Phase II such as the establishment of detailed plans for KI distribution during an emergency (Section 5.2).

2.2.2 Responsible Authorities

The requirements of KI distribution are clearly defined by the CNSC and OFMEM (PNERP) and include requirements for both pre-distribution in the DPZ and availability in the IPZ. As the offsite authority, the province of Ontario is responsible for defining further requirements in its PNERP and works with OPG and the designated municipalities to ensure these requirements are met.

The PNERP defines that only designated municipalities are responsible for detailing in their plans the means by which the availability of KI pills is facilitated for any resident of the DPZ and the IPZ (PNERP Master Plan 6.5.2 (b) (vi)). This has been facilitated through large scale pre-distribution campaigns in the DPZ and public awareness in the IPZ. Through partnerships with OPG and the municipalities, KI is available to all residents of the IPZ upon request. This includes residents of non-designated municipalities. Details pertaining to the voluntary pre-distribution of KI in the IPZ can be found in Appendix C.

The province is responsible for KI emergency distribution. IPZ municipalities who are not categorized as designated municipalities, and have not identified radiological emergencies within their Hazard Identification and Risk Assessment, have no obligation to have prepared plans related to nuclear emergencies or KI. The province has sole responsibility for emergency distribution in these regions of

the IPZ. However, the PNERP (Section 1.10) does define that cooperation and support of these municipalities may be ordered during an emergency. This relationship, and the expectations of municipalities during an emergency, is expanded upon in Section 4.

Distribution of KI entails a comprehensive emergency communication and public awareness and education strategy. This strategy includes a coordinated effort between OPG, designated municipalities, and the province. Various communication products are expanded upon in Section 3.

3. Public Resources Relating to KI

Part of the requirements outlined in REGDOC 2.10.1 [3] is that information pertaining to KI be disseminated to the public by a robust, ongoing, and cyclical public education program. This section outlines websites and information packages that have been made available to the public.

3.1 Public Websites

This section includes a discussion on some of the larger publicly available websites created to disseminate information to the public regarding KI. While awareness of, and the content posted on, these websites may be geographically targeted, any member of the public is freely able to access this information.

3.1.1 Prepare to Be Safe Website

The *Prepare to Be Safe* [38] website is a joint project between Durham Region, City of Toronto, and OPG. The website contains pertinent information on KI, offered in ten[4] different languages, and an online form for businesses and households to order KI (provided they are within the eligible zone). Members of the public are responsible for maintaining their personal supply of KI ordered through this website within the expiration date themselves. KI supplied through *Prepare to Be Safe* is not automatically renewed upon expiration.

The welcome page is shown in Figure 3. The site includes several sections with relevant information to the public, which can be accessed through the menu shown in Figure 4.

[4] *Prepare to Be Safe* is available in Arabic, Chinese, English, Farsi, French, Hindi, Spanish, Tagalog, Tamil, and Urdu.

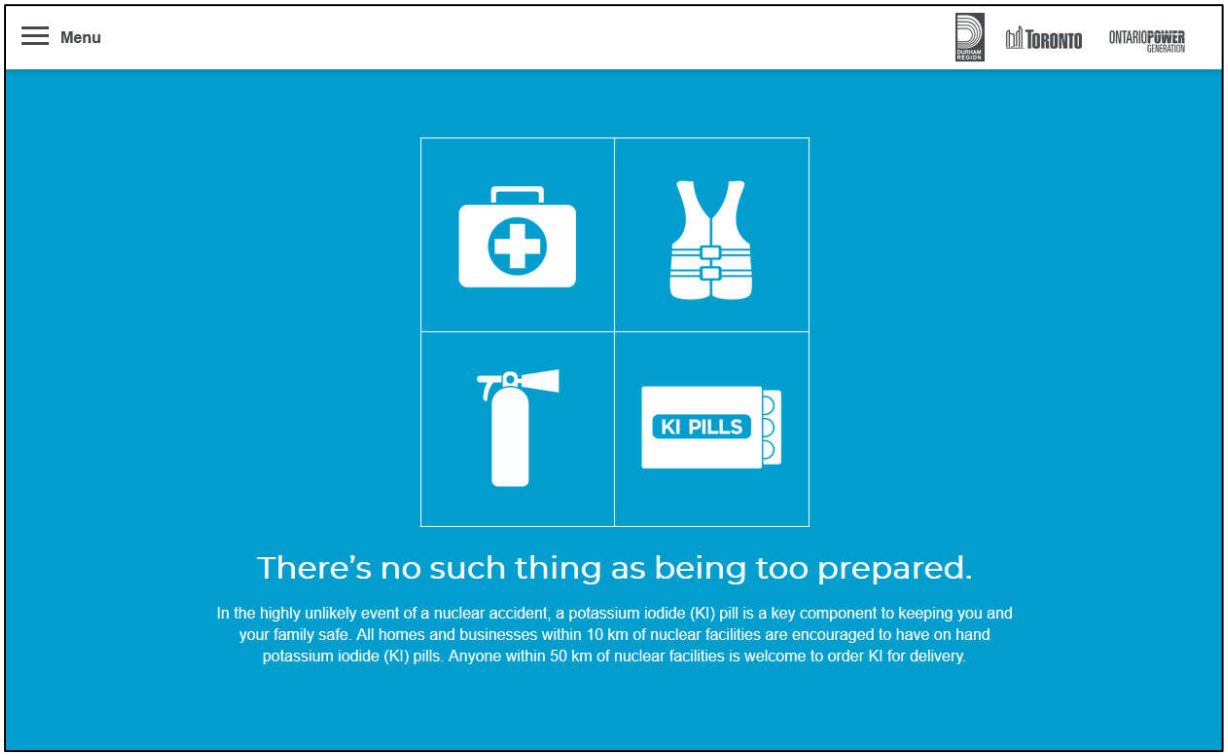

Figure 3 – Prepare To Be Safe: Welcome Page

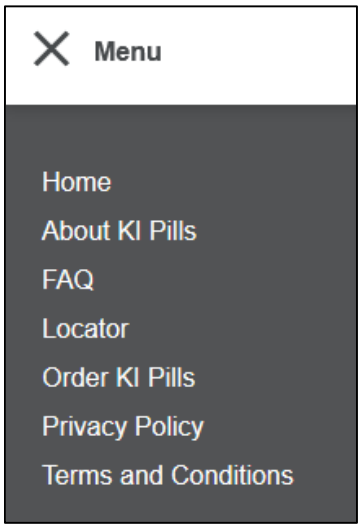

Figure 4 – Prepare To Be Safe: Menu

The Frequently Asked Questions, listed in Figure 5, provide information to most questions the public would have. This FAQ is downloadable in a variety of languages as a PDF [39].

Figure 6 shows the locator tool, which allows members of the public to determine if their address (postal code) is within the IPZ of Pickering or Darlington NGS to qualify for free distribution of KI pills. All businesses and households within the IPZ are eligible to receive a supply of KI, should they request it. Individuals living outside but working within the IPZ may order a personal supply to be delivered to their working address.

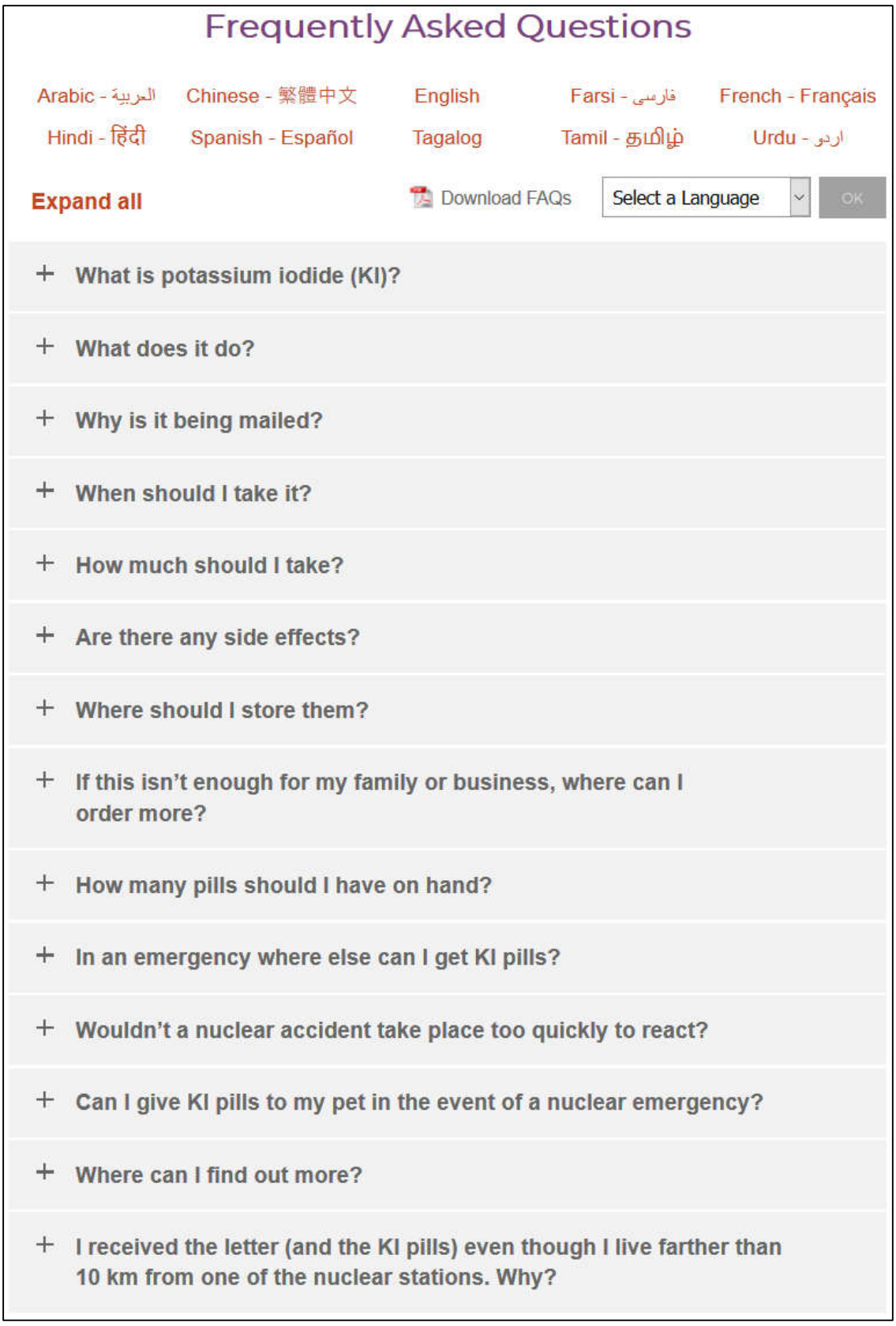

Figure 5 – Prepare To Be Safe: FAQ

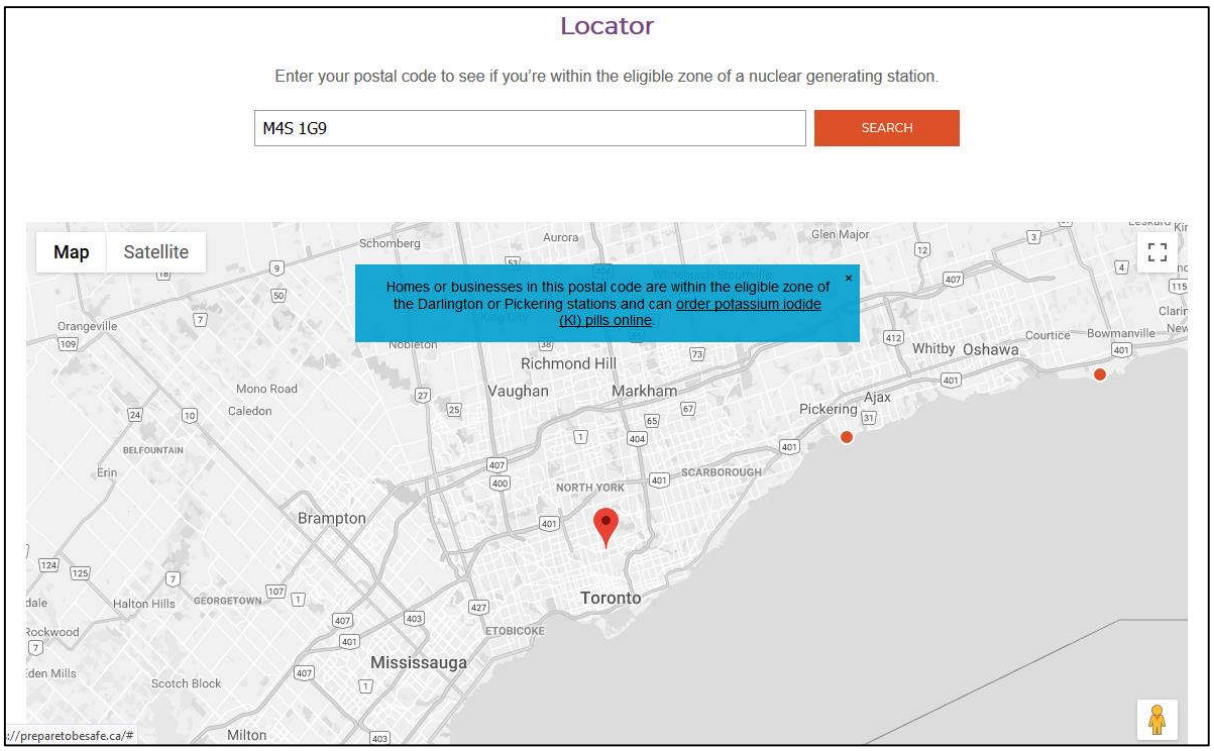

Figure 6 – Prepare To Be Safe: Locater Tool with Ordering Link

3.1.2 Durham Region

The Durham Region website contains a page dedicated to nuclear awareness [40]. The section dealing with KI can be seen in Figure 7.

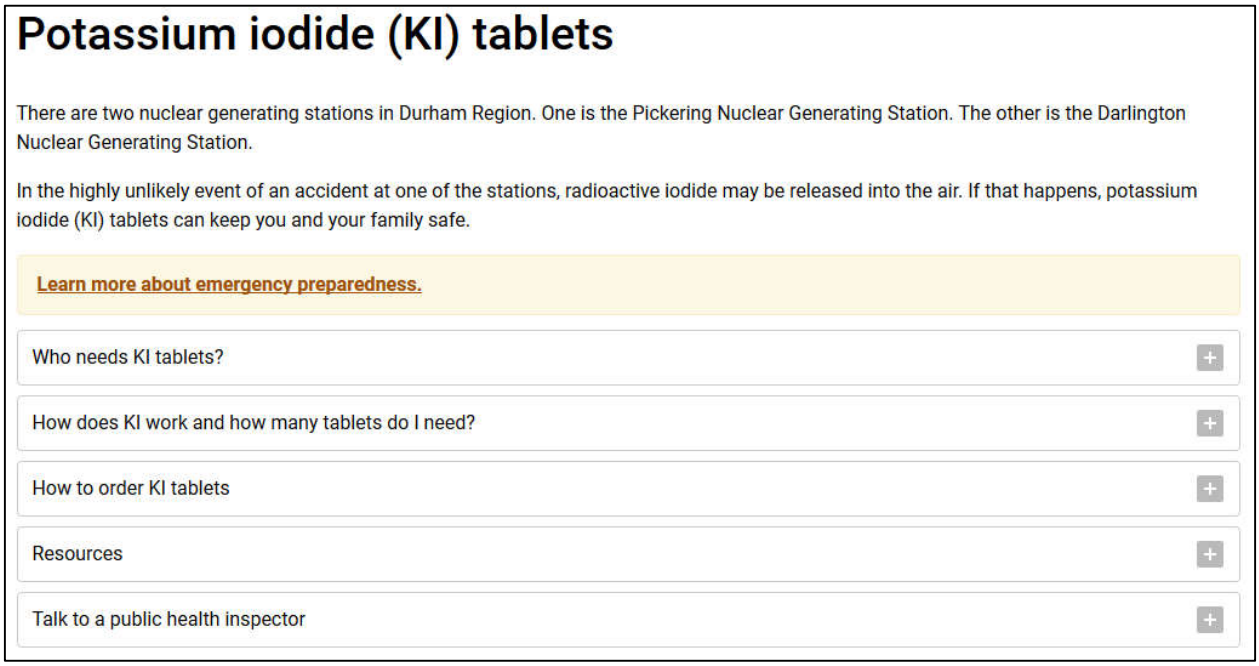

Figure 7 – Durham Region Nuclear Awareness - KI

The menus shown in Figure 7 contain information about KI, how to order it, and links to the MOH, *Prepare to Be Safe*, and OFMEM websites.

3.1.3 City of Toronto

The *Types of Emergencies* [41] webpage, accessed through the main city of Toronto page, has a section on protective measures. This section is shown in Figure 8 and includes some information on the EPZs, sheltering, and KI use. The webpage refers to *Prepare to be Safe* [38] for more information.

Protective Measures

The specific steps people can take to protect themselves from radioactive materials will be determined at the time of the emergency. They would be announced over television, radio and the internet by the Province of Ontario and implemented with the help of the City of Toronto, Region of Durham and other communities as required.
Protective measures may be needed for people who live, study or work within 10 km of the nuclear station. In the City of Toronto, this means locations east of Morningside Avenue to the border with the City of Pickering, Steeles Avenue to Lake Ontario. This area is called the Primary Zone, and includes the City of Pickering and Town of Ajax.

Protective measures that may be directed by the Province include:

- Leaving the areas within the Primary Zone
- Staying indoors
- Taking a dose of Potassium Iodide but only when directed by the Province

When taken at the right time, Potassium Iodide pills prevent or reduce the absorption of radioactive Iodine into the thyroid gland.

Potassium Iodide pills *do not protect* other parts of the body from any other radiation.

Special care is required if Potassium Iodide pills are given to young children. Please consult your family doctor for more information.

During a nuclear emergency, Potassium Iodide pills will be available at Reception-Evacuee Centres that will be set up at various locations in the Greater Toronto Area.

If you are outside the 10km zone, but within 50km of a nuclear station, you are eligible for free KI pills. Although you will not be receiving KI Pills as part of the eligible zone mailout, you can **order the pills on-line**.

More information is available at **www.preparetobesafe.ca** or by contacting Telehealth Ontario at 1-866-797-0000.

Figure 8 – City of Toronto Types of Emergencies: Protective Measures

3.1.4 MOH

The MOH website hosts the *Potassium Iodide Tablets (KI) Fact Sheet* [42]. This document contains information useful to the public about what KI is for and how it should be used. The fact sheet includes instructions on dosage, where to acquire a supply, and preparing liquid solutions (for those unable to swallow a tablet). The scope of this document is for the EPZs of Bruce NGS, Pickering NGS, Darlington NGS, Chalk River Laboratories, and Fermi 2.

3.2 Community Information and Public Education

Information package and KI pre-distribution kits are made available to the public in all emergency planning zones of Pickering NGS. Additionally, public education campaigns are conducted within designated municipalities to spread awareness of KI.

3.2.1 KI Pre-Distribution Packages

KI is pre-distributed to members of the public living within 10 km (DPZ) of the Pickering NGS in kits that contain information on their use. The New Neighbours program provides KI Pills for residences and businesses in the DPZ which have new or changed addresses (i.e., mail forwarding) that are registered

through Canada Post. From 2015 through 2019 KI Pills were distributed to these addresses three times a year. Starting in 2020, KI Pills are distributed to these addresses on a monthly basis.

Similar packages are also available for order from *Prepare to be Safe* [38] to members of the public living and working within 50 km (IPZ) of the Pickering NGS or Darlington NGS. In addition to a supply of KI, the kits contain information brochures. The kit shown in Figure 9 contains KI with a shelf life of approximately 12 years (from manufacturer).

Figure 9 – Prepare to be Safe KI Kit

The kit shown in Figure 9 matches the branding of Prepare to be Safe, and contains KI tablets and an information brochure built into the cover.

3.2.2 Public Education and Awareness

Various levels of government and OPG take part in public awareness and education campaigns that target areas of Pickering NGS's EPZs with information relevant to KI. Community information packages, such as the example in Figure 10, are given to members of the public.

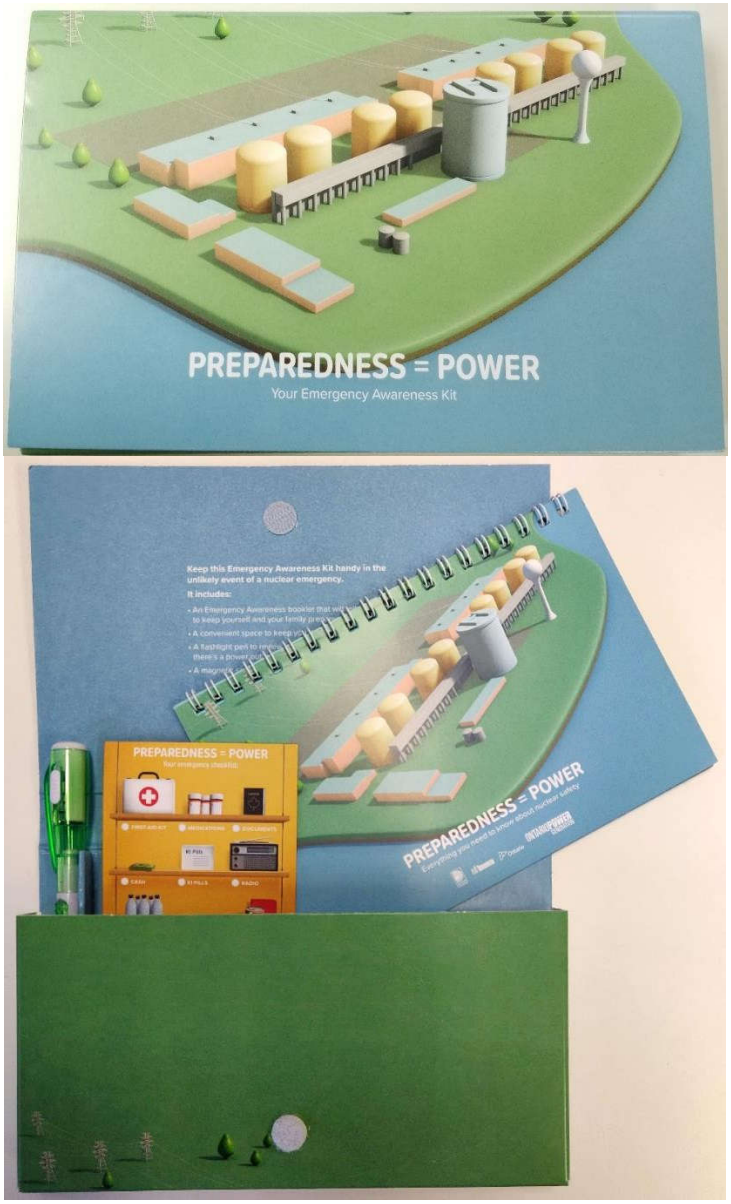

Figure 10 – "Preparedness = Power" Emergency Awareness Kit

The kit shown in Figure 10 includes an information booklet, a box (suitable for holding a supply of KI), and other branded material.

As the host municipality to two nuclear power plants, Durham Region has a detailed public outreach program. A KI tri-fold pamphlet and KI poster (Figure 11) are provided at all 8 municipal offices in the Region, the Ajax and Pickering Welcome Centres, all main libraries, and community centres in the DPZ. Three annual KI public awareness campaigns are held, focussed on the DPZ but extending into the IPZ, through various media (e.g. news releases, print ads, train ads, bus interior ads, social media, and digital

display boards). Durham Region has also produced three YouTube videos to raise general awareness about KI – one of which focussed on the availability of KI to the IPZ.

Figure 11 – "New to Durham Region" Poster

The poster shown in Figure 11 includes information suitable for residents of the IPZ interested in ordering their own supply of KI.

4. Concept of Operations for KI Emergency Distribution

This section highlights the existing concept of operations for emergency distribution of KI in the IPZ during a nuclear accident. It does not address other protective actions. Given that such a response is highly dependant on the multiple variables associated with a severe accident, detailed plans are forgone in lieu of a concept of operations strategy – flexibility for a wide variety of possibilities is paramount.

The concept of operations, depicted in Figure 12, was confirmed through detailed discussions with all relevant stakeholders at the KI Pill Working Group workshop, which is summarized in publicly available meeting minutes [43]. The focus is on the offsite response undertaken by the province and the municipalities, however, actions related to KI which are undertaken by other stakeholders are also included.

The four overarching phases shown in Figure 12 are initiating event, staging of KI, emergency distribution of KI, and ingestion of KI. These are expanded on in sections 4.1 through 4.5.

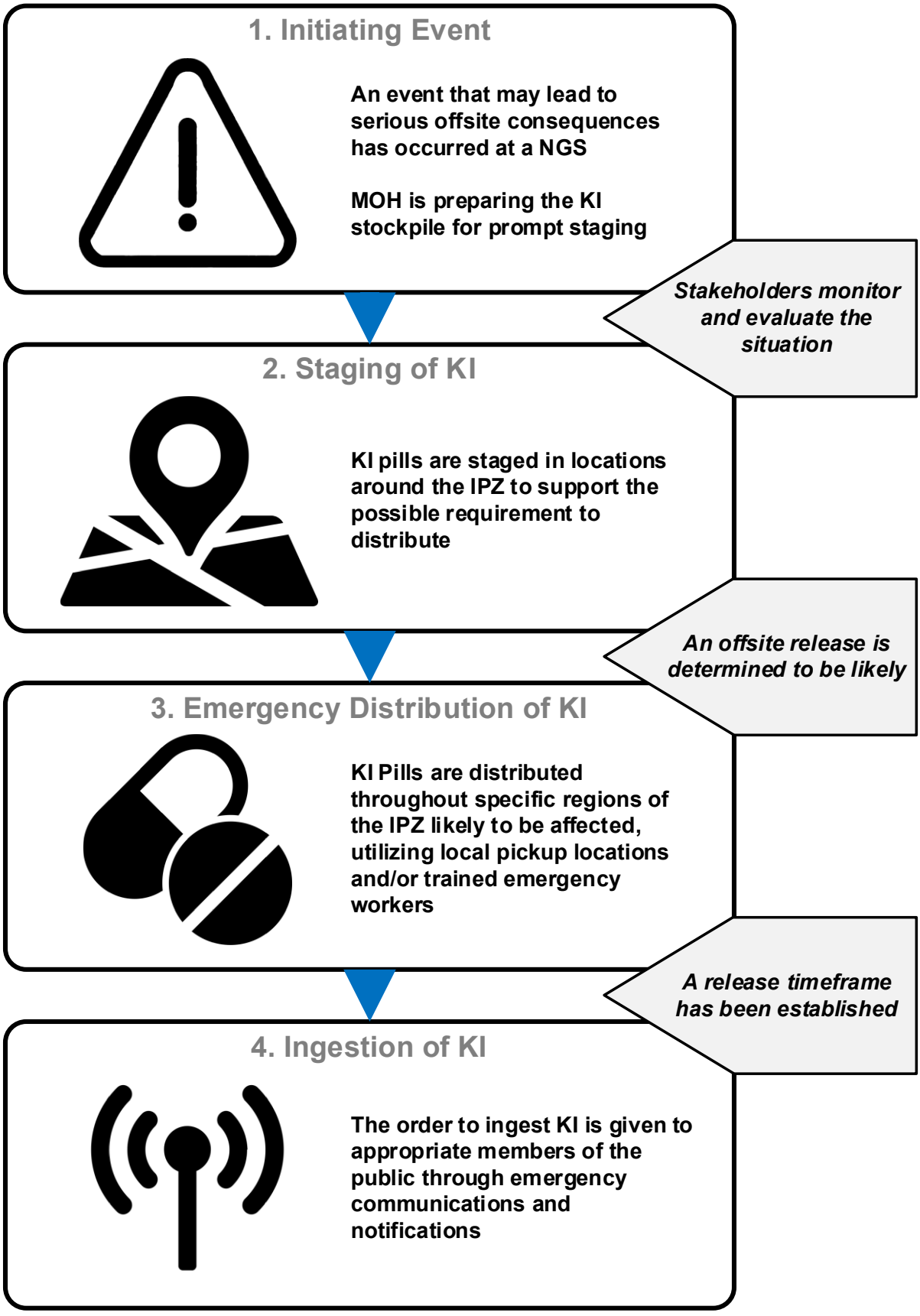

Figure 12 – High Level Concept of Operations for KI Emergency Distribution

4.1 Initiating Event – Notification and Preparation

At the onset of an event, OPG is required to notify the province, through the PEOC, within 15 minutes of initial categorization of an event at the Pickering NGS. Notification will be received by the PEOC via transmittal of an OPG notification form, followed by verbal confirmation. OPG must also notify the CNSC within 15 minutes of Emergency Response Organization (ERO) activation [3].

Based on the event categorization [2, 8] the PEOC will determine the Provincial Response Level and will notify the entire emergency response organization (federal departments, provincial ministries, nuclear facility, and designated municipalities for notification categories above *Reportable Event)*. There is a 15 minute requirement for the Province, through the PEOC, to notify the designated municipalities (i.e. Durham Region and the City of Toronto), of the Provincial Response Level that has been adopted. The MOH will follow up the PEOC notification with its own pre-established communications to relay this notification to Public Health Units (PHU). Upper-tier municipalities (PHUs/CEMCs) will notify lower tier municipalities, according to their notification protocols.

Similarly, depending on the event categorization, the CNSC may send notifications to partners such as Health Canada, Public Safety Canada, and the IAEA.

Offsite organizations will begin to activate their own Emergency Operation Centres (EOCs) commensurate with the provincial response level adopted by the PEOC. Through these EOCs, the organizations will observe and evaluate the situation, following plans highlighted in Section 2. The PEOC will evaluate the offsite consequences as they relate to required protective actions such as KI. An event where protective actions may be required, whether as a result of accident progression or severe initiating event, will result in the adoption of the Full Activation Provincial Response Level.

Public communications will also be categorization dependant. For example, in a reportable event resulting in a Routine Monitoring provincial response level, there may be little to no information released to the public given there are no offsite safety concerns. If appropriate, the response organization communication teams may begin monitoring social media and news releases upon initial notification to address any public inquiries that may arise. In the higher response levels, teams will begin developing communication strategies to assist in coordinating messages with other municipal, provincial, and federal communication teams and disseminating information to the public. Further, the province has the responsibility for disseminating geo-targeted emergency bulletins to notify the affected public of the situation and to instruct them to monitor media for protective actions they may need to take.

Scientific analysis is undertaken by the Scientific Section at the PEOC to determine possible offsite consequences. Based on their determinations, processes to ensure access to KI pills will be undertaken (see section 4.2).

In order to maintain as much timely readiness as possible, the MOH and OFMEM would begin preparing KI stored at the central stockpile for shipment. This ensures KI is promptly ready, should staging be required.

4.1.1 Emergency Public Alerting System

As required by the PNERP, OPG assists the designated municipalities in the establishment and maintenance of a public alerting system within the AAZ and DPZ.

Alerting within the AAZ is designed to warn practically 100% of the population, whether indoors or outdoors, and irrespective of the time of day or year. “Practically 100%” means that the Public Alert can

be heard by nearly everyone in the 3 km AAZ unless exceptional circumstances provide an impediment (e.g. hearing impairment). DPZ alerting is on an "area-wide basis", which does not presume that 100% of the population in the 10 km DPZ will necessarily receive the alert.

Public alerting takes the form of outdoor alerting by means of sirens for the AAZ and indoor alerting through mass telephone dialing systems for the DPZ (including the AAZ). This mass telephone dialing system is targeted only at land line phones and is not related to the cellular/radio/television linked Alert Ready system.

The public alerting system is not intended to instruct the population to evacuate, only to notify them of an ongoing event. In addition to the alert, the PNERP requires the province to release a simultaneous emergency bulletin utilizing such means as social media, broadcast media, and the Alert Ready system. Emergency bulletins contain specific instructions on what actions the public should take and where to get more information. The information included in an emergency bulletin is detailed in the PNERP and can be found in Table 4. Broadcast of the emergency bulletins should be continuously repeated.

Geographically targeted provincial emergency bulletins will be used to inform the public of actions they must take. The order to ingest KI, as approved by the CMOH, will be sent through these means.

Table 4 – PEOC Emergency Bulletin Contents

Partial PEOC Activation	Full PEOC Activation an emission expected within 36 hours
• Date and time of expected emission • Sectors (by geographical description) which may be affected • Applicable precautionary and protective measures for the affected sectors or area and applicable timings (in the case of a delayed emission it may be appropriate to delay the application of some of them) • Public inquiry phone number(s) and websites	• Date and time of expected emission • Precautionary measures directed in the applicable zone(s) • Protective measures and the affected sectors or zones • Reception Centres which can receive evacuees without accommodation • KI pill ingestion details and availability information, as applicable • Public inquiry phone number(s) and websites

4.2 Staging of KI

Plant conditions and meteorological data are used to determine, in advance, when a release may occur and the direction it may travel. This allows for time to inform and implement protective actions. Specifically, response authorities such as the province, OPG, CNSC, and Health Canada will conduct assessments within their areas of responsibility, including dispersion and dose modelling. Response authorities will share and coordinate these results to inform situational awareness and protective action decision making.

Forecasting and modeling of an anticipated release will be used to determine which areas of the planning zones might be affected. This will be shared among the various response authorities. The PEOC will continue to provide updates and information to PHUs and CEMCs.

In the event that a release is anticipated or likely, and meteorological conditions are such that areas of the IPZ could be affected, staging of KI pills will be initiated by MOH to ensure KI pills are available for emergency distribution if required.

Logistical and planning considerations for staging KI in the IPZ will be discussed between OFMEM, MOH, and other relevant response authorities to facilitate timely emergency distribution. The basic concept for the process would involve:

- The MOH informing the CMOH that logistical requirements are being arranged for the transportation of KI pills to certain locations within the IPZ.
- The province recommending the IPZ area(s) within which KI pills will be required for potential ingestion purposes. It is expected that distribution of KI pills to the entire IPZ will not be required.
- The province liaising with the municipalities identified as possibly being affected (i.e. within the path of weather patterns) in order to advise of the required staging of KI pills to locations within the municipality.

Public emergency communications will continue to play a key role in the response to an event. Each response authority will have activated their communication teams to respond to public inquiries and disseminate information to the public. Stakeholders are required to communicate information based on their jurisdictional responsibilities and continue to reinforce information disseminated by the province and OPG. In all stages of the response, clear, consistent, and coordinated messaging is a priority for communicating with the public.

Specific protective action information that is directed by the PEOC will be issued through emergency bulletins disseminated to the potentially affected public through provincial alerting mechanisms (see Section 4.1.1)

It is important to highlight that staging will occur before any need to distribute KI pills and that staging of KI does not indicate in any way that ingestion of KI will be required. Staging would be conducted as a precaution and to ensure distribution can occur in a timely manner, if required.

4.3 Emergency Distribution of KI

As the event progresses, the analyses considered in section 4.2 may indicate an anticipated release could occur with offsite consequences for specific areas of the IPZ. This information will be used to determine areas that may require protective actions and which actions might be required.

Distribution of KI pills in the IPZ will begin when an anticipated release is conservatively predicted by the PEOC Scientific Section to result in offsite consequences in the IPZ.

The province will ensure that staged KI pills are distributed to specific areas of the IPZ where the release is anticipated to travel. The distribution includes the entire population of these specific areas, which captures the vulnerable population (children under 18, pregnant women, and breastfeeding women). Additional distribution arrangements may be in place for facilities that require assistance during an emergency (e.g. long-term health care and hospitals).

The precise means of emergency distribution will depend on event specific factors, and will utilize all available resources. Residents of the IPZ will be provided with the required information on how to retrieve/receive KI pills and information for ingestion through emergency bulletins.

KI emergency distribution in the DPZ will proceed in a similar manner as the IPZ for members of the public who lost, misplaced, or otherwise do not possess a pre-distributed supply.

4.4 Ingestion of KI

The decision-making process that will lead to an order to ingest KI will occur simultaneously with the emergency distribution of KI pills (Section 4.3).

The order to take KI pills will be a recommendation from the PEOC Command Section to the CMOH, based on Scientific Section advice. Ultimately, the CMOH has the authority, in consultation with the PEOC and the appropriate local Medical Officers of Health, to order the ingestion of KI pills.

This order will be broadcast to the affected areas through existing emergency bulletin systems, beginning roughly 6 hours before anticipated exposure. The information provided will include information on the use of KI pills, dosage, and the required timing. As KI efficacy is time sensitive, the order will be given in advance of the ingestion time. Generally, ingestion will be instructed 2 hours before exposure (i.e. release).

4.5 End of Release Event

After a release event has concluded an order will be given to the affected residents that no further KI dose would be required and to stop ingestion. Communications will focus on stopping KI use and further protective actions unrelated to KI.

5. Conclusion

5.1 KI Emergency Distribution in the IPZ

This document provides clarity on the existing plans and associated responsible authorities for the emergency distribution of KI in the Pickering NGS IPZ.

5.1.1 Role and responsibilities

The roles and responsibilities of each organization are clarified in Section 2, sourced from the various documents and plans of the involved stakeholders. Pre-distribution of KI within the DPZ is well established as the responsibility of the designated municipalities, with the assistance of OPG. Emergency distribution in the IPZ is the responsibility of the province, as outlined in the current documentation.

While the responsible authority is defined clearly in the documentation and plans, the roles and details of implementing this responsibility are not currently fully defined with regard to KI emergency distribution in the IPZ. This is instead expanded on through the high-level concept of operations in Section 4.

5.1.2 Public information and communications

The various responsible stakeholders have public awareness and education information systems in place, and the province maintains a strategy for emergency communications during an event. Section 3 details some of the available information the public can turn to for information on KI. Information campaigns are held periodically by OPG and the designated municipalities, particularly Durham Region and Toronto, to point members of the public to reliable sources and increase awareness of KI.

Information is available on municipal, provincial, and federal websites and documents referenced in this report. Community mailers, advertisements, and other communications campaigns are used to reach members of the public who reside in the DPZ and the IPZ.

5.1.3 Concept of Operations

The concept of operations for the unlikely emergency distribution of KI to locations in the IPZ is outlined in Section 4.

This concept of operations was confirmed through detailed discussions with the relevant stakeholders. It is intended to be as flexible as possible to reflect the wide variety of possible scenarios an unlikely event would include. As such, detailed procedures are not available.

The concept of operations deals with four overarching phases relevant to KI emergency distribution in the IPZ. These phases are initiating event, staging of KI within the IPZ, emergency distribution of KI within the IPZ, and ingestion of KI. Each phase includes actions the offsite authorities will need to undertake in order to move KI to the residents of the IPZ.

5.2 Next Steps

This document will serve as the summary of work completed for Phase I of the KI Pill Working Group. Subsequent to this, the KI Pill Working Group will proceed to Phase II. As described in the Terms of Reference (Appendix A), Phase II will focus on:

- Feasibility of pre-distribution of KI pills to all schools within the IPZ
- Establishing clear and detailed plans for the distribution of KI pills throughout the IPZ, if necessary.

The following topics were also raised during the Phase I workshop and during development of this Phase I report for consideration during Phase II:

- Public awareness and education in designated and non-designated municipalities
- Pre-staging of the centralized stockpile to municipalities in the IPZ
- Development of a pre existing emergency communications strategy for use by Municipalities and PHUs within the IPZ during an event.

Phase II will proceed at the completion of Phase I, signified by the publication and presentation of this report to the Commission.

6. References

[1] CNSC, "KI Pill Working Group Webpage," 2019. [Online]. Available: http://nuclearsafety.gc.ca/eng/resources/emergency-management-and-safety/potassium-iodide-pill-working-group.cfm. [Accessed 2019].

[2] OFMEM, "PROVINCIAL NUCLEAR EMERGENCY RESPONSE PLAN (PNERP) - MASTER PLAN," 2017.

[3] CNSC, "REGDOC-2.10.1: Nuclear Emergency Preparedness and Response, Version 2," 2016.

[4] Public Safety Canada, "Federal Emergency Response Plan," 2011.

[5] Health Canada, "Federal Nuclear Emergency Plan," 2014.

[6] Health Canada, "GENERIC CRITERIA AND OPERATIONAL INTERVENTION LEVELS FOR NUCLEAR EMERGENCY PLANNING AND RESPONSE," 2018.

[7] CNSC, "Licence Conditions Handbook, LCH-PR-48.00/2028-R003," 2020.

[8] OFMEM, "PROVINCIAL NUCLEAR EMERGENCY RESPONSE PLAN - Implementing Plan for the Pickering Nuclear Generating Station (PNGS)," 2018.

[9] MOHLTC, "Potassium Iodide (KI) Guidelines," 2014.

[10] WHO, "Use of potassium iodide for thyroid protection during nuclear or radiological emergencies," vol. Technical Brief, 2011.

[11] P. B. Z. a. D. V. Becker, "Effects of time of administration and dietary iodine levels on potassium iodide (KI) blockade of thyroid irradiation by 131I from radioactive fallout.," 2000.

[12] CSA, "N1600-16 General requirements for nuclear emergency management programs," 2016.

[13] IAEA, Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor, 2013.

[14] IAEA, "Arrangements for Preparedness for a Nuclear or Radiological Emergency - Safety Guide No. GS-G-2.1," 2007.

[15] WHO, "Iodine Thyroid Blocking - Guidelines for use in planning for and responding to radiological and nuclear emergencies," 2017.

[16] IAEA, "Peer Appraisal of the Arrangements in Canada Regarding Preparedness and Response for A Nuclear or Radiological Emergency," 2020.

[17] OPG, "Consolidated Nuclear Emergency Plan," 2018.

[18] Minister of Justice - ministre de la Justice , "Nuclear Safety and Control Act - Loi sur la sûreté et la réglementation nucléaires," 2017.

[19] MOHLTC, "Radiation Health Response Plan," 2014.

[20] Durham Region, "Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution," 2017.

[21] City of Toronto, "TORONTO NUCLEAR EMERGENCY RESPONSE PLAN (TNERP)," 2012.

[22] Durham Region, "Durham Region Emergency Master Plan," 2018.

[23] Durham Region, "The Durham Region Risk-Specific Plan – Durham Nuclear Emergency Response Plan (DNERP)," 2017.

[24] Town of Ajax, "Town of Ajax Emergency Response Plan," 2017.

[25] Municipality of Clarington, "Clarington Emergency Plan," 2020.

[26] City of Oshawa, "City of Oshawa Emergency Master Plan," 2019.

[27] City of Oshawa, "City of Oshawa Nuclear Emergency Response Plan," Not Online.

[28] City of Pickering, "Community Emergency Management Plan," 2015.

[29] The Township of Brock, "Township of Brock Emergency Plan," 2016.

[30] Township of Scugog, "Township of Scugog Emergency Plan," 2004.

[31] The Township of Uxbridge, "Town of Uxbridge Emergency Plan," 2018.

[32] Town of Whitby, "Whitby Emergency Plan," Not Online.

[33] York Region, "The Regional Municipality of York Emergency Plan and Annexes," 2018.

[34] Peel - Regional Emergency Management, "REGION OF PEEL EMERGENCY PLAN," 2015.

[35] City of Kawartha Lakes, "City of Kawartha Lakes Emergency Response Plan," 2020.

[36] Town of Bradford West Gwillimbury, "Emergency Response Plan," 2019.

[37] The Solicitor General of Ontario, Emergency Management and Civil Protection Act, 1990.

[38] OPG; Durham Region; City of Toronto, "Prepare To Be Safe," [Online]. Available: https://preparetobesafe.ca/. [Accessed 2019].

[39] OPG; Durham Region; City of Toronto, "Prepare To Be Safe FAQ," [Online].

[40] Durham Region, "Nuclear Awareness," 2017. [Online]. Available: https://www.durham.ca/en/health-and-wellness/nuclear-awareness.aspx. [Accessed 2019].

[41] City of Toronto, "Types of Emergencies," [Online]. Available: https://www.toronto.ca/community-people/public-safety-alerts/emergency-preparedness/types-of-emergencies/. [Accessed 2019].

[42] MOHLTC, "Potassium Iodide Tablets (KI) Fact Sheet," 2014.

[43] KI Pill Working Group, KI Pill Working Group Workshop Meeting Minutes, 2019.

[44] Office of the Provincial Security Advisor, Ministry of the Solicitor Genera, "Investigation into the emergency alerts sent on January 12, 2020," 2020.

[45] IAEA, "Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards - Safety Standards Series No. GSR Part 3," 2014.

[46] Bruce Power, "Emergency Preparedness at Bruce Power," [Online]. Available: https://www.brucepower.com/in-the-community/programs/emergency-preparedness/. [Accessed 2020].

[47] Chatham-Kent Public Health, "Potassium Iodide (KI) Tablets," [Online]. Available: https://ckphu.com/kitablets/. [Accessed 2020].

[48] Windsor-Essex County Health Unit, "Potassium Iodide (KI) Distribution," [Online]. Available: https://www.wechu.org/nuclear/potassium-iodide-ki-distribution. [Accessed 2020].

[49] New Brunswick Emergency Measures Organization, "Nuclear Emergency Program," [Online]. Available: https://www2.gnb.ca/content/gnb/en/departments/emo/NuclearEmergencyProgram.html. [Accessed 2020].

[50] France, "Distribution Iode," [Online]. Available: http://www.distribution-iode.com/. [Accessed 2020].

[51] Switzerland, "Verteilung von Jodtabletten: eine vorsorgliche Schutzmassnahme," [Online]. Available: http://www.jodtabletten.ch/. [Accessed 2020].

[52] HM Government (UK), "National Nuclear Emergency Planning and Response Guidance," 2015.

[53] NHS - Ayrshire & Arran, "Potassium Iodide Tablets - In an emergecny at Hunderston B Power Station; Information for people receiving Potassium Iodide tablets," 2017.

[54] East Lothian Council, "Torness Nuclear Power Station Off-Site Emergecny Plan," 2019.

[55] STUK - Finland, "Emergency arrangements of a nuclear power plant," 2013. [Online]. Available: https://www.stuklex.fi/en/ohje/YVLC-5. [Accessed 2020].

[56] U.S.NRC, "Consideration of Potassium Iodide in Emergency Planning," [Online]. Available: https://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/potassium-iodide.html. [Accessed 2020].

[57] IEMA, "About the IEMA KI Program," [Online]. Available: https://public.iema.state.il.us/KiProcessing/Home/About. [Accessed 2020].

[58] Health Agency | Public Health, County of San Luis Obispo, "Potassium Iodide (KI) Pre-Distribution," [Online]. Available: https://www.slocounty.ca.gov/Departments/Health-Agency/Public-Health/All-Public-Health-Services/Potassium-Iodide-(KI)-Pre-Distribution.aspx. [Accessed 2020].

[59] Florida Health, "Bureau of Radiation Control Fact Sheet Potassium Iodide (KI)," 2013.

[60] Nuclear Regulation Authority Japan, "A manual for distribution and administration of iodine tablets," 2013.

Appendix A KI Pill Working Group Terms of Reference

Canadian Nuclear Safety Commission Potassium Iodide (KI) Pill Working Group

TERMS OF REFERENCE

May 2019

Summary

The Canadian Nuclear Safety Commission (CNSC) held a public hearing from June 25–29, 2018 to consider the licence renewal application from Ontario Power Generation for the Pickering Nuclear Generating Station (NGS). A number of intervenors raised concerns about the distribution of potassium iodide (KI) pills in the event of an emergency, and more specifically, how the vulnerable population (children under 18, pregnant women and breastfeeding women) would obtain these pills.

At the hearing, the CNSC Executive Vice-President and Chief Regulatory Operations Officer made a commitment to the Commission to form a working group to provide clarity on the existing plans and associated responsible authorities to distribute KI pills (in the Ingestion Planning Zone (IPZ), within a 50-km radius) in the event of an emergency at the Pickering NGS. Responsibilities and guidance for planning, preparedness and response regarding iodine thyroid blocking are detailed in the Provincial Nuclear Emergency Response Plan (Master Plan and Implementing Plans).

On January 3, 2019, the Commission made publicly available its detailed Record of Decision for the renewal of Ontario Power Generation's Power Reactor Operating Licence for the Pickering NGS. In the detailed Record of Decision the Commission provides support and direction to the CNSC KI Pill Working Group. The Terms of Reference have been developed in support of fulfilling commitments made to the Commission and direction received from the Commission.

This document details the Terms of Reference for this working group.

1. Mandate

1.1 The mandate of the CNSC KI Pill Working Group (the Working Group) is the following:

- Fulfill the commitment to the Commission to provide clarity on the existing plans and associated responsible authorities for distributing KI pills in the IPZ in the event of an emergency at the Pickering NGS (Phase I); and,
- Fulfill the direction from the Commission in the detailed Record of Decision (Phase II).

The Working Group will work cooperatively and proactively to fulfill its mandate in a timely manner. Upon completion of Phase I, the Working Group will proceed to Phase II. The Working Group will cease to operate following the completion of Phase II.

Strategy to meet mandate

1.2 The strategy for Phase I of the Working Group is to focus on the following:

- Current provincial and federal requirements for the distribution of KI pills;

- Considerations and education concerning KI pill emergency distribution in the IPZ;
- Means of KI pill distribution in relation to other factors associated with a nuclear emergency response; and,
- Availability and scope of public emergency preparedness information related to KI pills.

1.3 The strategy for Phase II of the Working Group is to focus on the following:

- Feasibility of pre-distribution of KI pills to all schools within the IPZ; and,
- Establishing clear and detailed plans for the distribution of KI pills throughout the IPZ, if necessary, following the completion of Phase I.

2. Membership

2.1 The Working Group is composed of representatives from the CNSC, the Office of the Fire Marshal and Emergency Management (OFMEM), the Ontario Ministry of Health and Long-Term Care (MOHLTC) and Ontario Power Generation (OPG), and each organization is a signatory to these terms of reference. The CNSC representatives are from the Directorate of Power Reactor Regulation and the Directorate of Security and Safeguards. The OFMEM, MOHLTC and OPG may select up to two permanent representatives each for the Working Group.

2.2 The Public Health Units from Peel Region, York Region, City of Toronto, Durham Region, Simcoe Muskoka District, Haliburton-Kawartha-Pine Ridge District, and Peterborough County may also select one permanent representative each for the Working Group. These Public Health Units are either located in the IPZ or have assigned roles and responsibilities (i.e., Peterborough) in a nuclear emergency at the Pickering NGS.

2.3 The Emergency Management Coordinators (EMCs) from the Region of Peel, Regional Municipality of York, City of Toronto, Regional Municipality of Durham, City of Kawartha Lakes, and City of Peterborough may also select one permanent representative each for the Working Group. These EMCs are either located in the IPZ or have assigned roles and responsibilities (i.e., City of Peterborough) in a nuclear emergency at the Pickering NGS.

2.4 The OFMEM, MOHLTC, EMCs and Public Health Units will liaise, as necessary, with other EMCs and Public Health Units that fall within the IPZ or have assigned roles and responsibilities in a nuclear emergency at Pickering. The CNSC and OPG will provide support, as needed.

2.5 Health Canada may also select one permanent representative for the Working Group.

2.6 The chairperson is selected from among the CNSC representatives by CNSC senior management. The chairperson's role is to prepare the agenda for Working Group meetings, chair the Working Group meetings, and take responsibility for all organizational and communication issues. The chairperson can delegate their duties to the other CNSC representative at any time.

2.7 Three co-chairs are selected, one each from the OFMEM, MOHLTC and OPG, to serve as the primary contact for organizational issues and communication purposes. Co-chairs can delegate their duties to the other OFMEM, MOHLTC or OPG representatives at any time.

2.8 The chairperson and co-chairs are responsible for inviting any person(s) to participate in or observe meetings of the Working Group.

2.9 A representative of the CNSC serves as secretary for the Working Group. The secretary is responsible for the recording and distribution of meeting minutes, the distribution of all documents related to Working Group meetings, and any communications required in support of the Working Group.

2.10 Each member is responsible for meeting the timelines and objectives agreed to by the Working Group. All members are accountable for their area of responsibility. Members have the authority to negotiate and enlist the help of other staff, as needed. Because good communication is fundamental for success, members must inform the chairperson and co-chairs that a commitment cannot be met as soon as they know or suspect this to be so, and they must negotiate an alternate date or make alternate arrangements. Members are responsible for bringing any risk issues to the attention of the chairperson and co-chairs in a timely manner.

3.0 Meetings

3.1 The Working Group will meet a minimum of once every six weeks. Additional meetings can be held with the consensus of the Working Group. The preferred method for Working Group meetings is face to face, but video and teleconferencing are also options.

3.2 Barring unforeseen circumstances, Working Group members who are unable to attend must notify the chairperson or the co-chair of their absence at least three working days before the meeting. Members have the option to participate by video or teleconferencing.

3.3 The chairperson is responsible for determining the time and place of the meetings. All members of the Working Group assume responsibility for their personal costs to attend.

3.4 The CNSC is responsible for the costs associated with the meeting, such as room rental and any associated hospitality. The Working Group members assume responsibility for the cost of their meals and transportation.

3.5 The objective is to send the agenda to the Working Group members one week before a meeting. Any documents required will be distributed at least three days before the meeting. The secretary of the Working Group will distribute a draft copy of the minutes no later than two weeks after each meeting. Members will have 10 working days to provide comments to the secretary so that the minutes can be prepared for approval at the next meeting. Meeting minutes of the Working Group will be made publicly available following concurrence of the minutes by all working group members.

4.0 Deliverables

4.1 The Working Group is responsible for the following deliverables cooperatively:

- Develop draft terms of reference
- Finalize the terms of reference and distribute them to the responsible authorities of the CNSC, OFMEM, MOHLTC and OPG identified in section 6 for signature
- Prepare the Phase I and II reports to meet the mandate and respective focus, as described in section 1

4.2 CNSC staff are responsible for the following deliverables:

- Post the draft terms of reference on the CNSC website for a 30-day public comment period
- Post the Phase I and II draft reports on the CNSC website for a 30-day public comment period
- Send a letter with the Phase I and II reports notifying Indigenous communities with potential or asserted treaty rights and title of the public review period; and coordinate any meetings with interested communities and working group members
- Produce and present the appropriate Commission member documents in support of the Commission's public meetings on Phase I and II (separate proceedings). Meeting materials will be made publicly available in accordance with the *Canadian Nuclear Safety Commission Rules of Procedure*.

4.3 CNSC staff will establish a special committee for the purpose of advising CNSC staff. Composition of the committee will be established by the CNSC. Operating Procedures will be developed by CNSC staff and circulated to members of the special committee for review and concurrence. The Operating Procedures and Meeting Minutes from all meetings will be made publicly available.

4.4 The Working Group will develop a project plan, outlining the deliverables and anticipated timelines.

4.5 CNSC staff will provide progress updates on the completion of all deliverables identified in point 4.1 and 4.2 to the Commission through the status report on power reactors.

4.6 The OFMEM and MOHLTC will provide progress updates on all deliverables identified in point 4.1 and 4.2 to the Ontario Nuclear Emergency Management Coordinating Committee.

5.0 Review of the terms of reference

5.1 The terms of reference are intended to support the effectiveness of the team by providing direction on team organization and work processes. This document can be reviewed and amended as needed with the agreement of all Working Group members. All amendments must be approved by the signatories to these terms of reference.

6. Management oversight

6.1 CNSC senior management will provide high-level strategic direction on systemic opportunities for improvement relating to the Working Group terms of reference, roles and responsibilities, and critical issues.

6.2 The Working Group members are responsible for disseminating any information from their respective senior management to the Working Group and ensuring any issues brought to the Working Group are raised with their senior management.

6.3 The senior management of all signatory parties may also engage directly, as needed.

7. Management approval

I concur with these terms of reference and support the Working Group members and associated responsibilities.

Once these terms of reference have been signed, the Working Group will be enacted.

Ramzi Jammal
Executive Vice-President and Chief Regulatory Operations Officer Canadian Nuclear Safety Commission

Scott Burns
Vice President Security and Emergency Services
Ontario Power Generation

Jon Pegg
Chief of Emergency Management
Office of the Fire Marshal and Emergency Management, Ministry of Community Safety and Correctional Services

Dr. David Williams
Chief Medical Officer of Health
Ministry of Health and Long-Term Care

Appendix B Document Excerpts

B.1 CNSC

The CNSC publishes regulatory documents to clarify expectations defined under the Nuclear Safety and Control Act [18] (NSCA) and define requirements that are included in a Licence Conditions Handbook. These regulatory documents cover the entire spectrum of the CNSC's activities.

B.1.1 REGDOC-2.10.1: Nuclear Emergency Preparedness and Response, Version 2

REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response V2* [3] is part of the CNSC's Emergency Management and Fire Protection series of regulatory documents.

REGDOC-2.10.1 sets out the emergency preparedness requirements and guidance of the CNSC related to the development of emergency measures for licensees and licence applicants of Class I nuclear facilities and uranium mines and mills to satisfy:

- the requirements of subsection 24(4) of the *Nuclear Safety and Control Act*, by demonstrating that the applicant will, in carrying on the proposed activity, make provision for the protection of the environment, the health and safety of persons, and the maintenance of national security and measures required to implement international obligations to which Canada has agreed

- paragraph 6(*k*) of the *Class I Nuclear Facilities Regulations* and subparagraph 3(*c*)(*x*) of the *Uranium Mines and Mills Regulations*

Section 2.3.4 of REGDOC 2.10.1 Version 2 defines requirements related to ITB. These requirements are presented in Table 1.

Table 5 – REGDOC 2.10.1 V2, Section 2.3.4

Additional requirements for licensees of reactor facilities with a thermal capacity greater than 10 MW and with designated offsite emergency planning zones. **These licensees shall provide the necessary resources and support to provincial and municipal authorities in implementing the provincial and municipal plans to do the following, or shall do the following:** 1. ensure that a sufficient quantity of iodine thyroid-blocking (ITB) agents is pre-distributed, to all residences, businesses and institutions within the designated plume exposure planning zone, together with instructions on their proper administration 2. ensure that a sufficient quantity of ITB agent is pre-stocked and available within the designated ingestion control planning zone; this inventory of ITB agents shall be located so that it can be efficiently obtained by, or provided to, members of the public when required 3. ensure that ITB agents can be obtained by residents of the designated ingestion control planning zone at any time 4. ensure that particular consideration is given to sensitive populations such as children and pregnant women within the designated ingestion control planning zone 5. ensure that the pre-distributed and pre-stocked ITB agents are maintained within expiry date

6. ensure that the pre-distribution plans are supported by a robust, ongoing, and cyclical public education program

7. ensure that all residences, businesses and institutions within the designated plume exposure planning zone are provided with public emergency preparedness information detailing how they should prepare for a nuclear emergency and what they should do or expect during a nuclear emergency; this information will reinforce the public education program designed to support the pre-distribution of ITB agents

8. ensure that this public emergency preparedness information is readily available to the general public, including online

Guidance

Guidance for all licensees

Licensees may, where possible, leverage existing communication channels (such as those used by local municipalities or those identified in their public information program as per RD/GD-99.3, Public Information and Disclosure).

Licensees should periodically assess the adequacy of public emergency preparedness information.

Additional guidance for licensees of reactor facilities with a thermal capacity greater than 10 MW

For reactor facilities with a thermal capacity greater than 10 MW and with designated offsite emergency planning zones:

The term ITB agent is used generically and includes potassium iodide (KI) tablets.

The pre-distribution of ITB agents should be undertaken by representatives of the health and/or emergency management authorities of the province or region/municipality, with support from the licensee. The pre-distribution of ITB agents should be done in a carefully planned and coordinated manner, to ensure that the public receives the appropriate information and education related to the benefits, risks and usage instructions of ITB agents.

Pre-stocked ITB agents for the designated ingestion control planning zone should be located to facilitate prompt and efficient distribution during an emergency. Recognizable locations with credible persons within the community (such as fire stations, police stations and pharmacies) should be considered in the selection of pre-stocking locations.

The requirements of particular relevance in Table 5 are that ITB agents be pre-distributed in the DPZ, ITB agents are pre-stocked in sufficient quantity in IPZ, and information be readily available to the general public. ITB agent is used generically, but KI tablets are defined as being included as an ITB agent. These requirements would fall to the licensee, as part of their license, and would require coordination with the offsite authority.

B.2 Health Canada

Health Canada, as the organization responsible for maintaining the *Federal Nuclear Emergency Plan* [5], produces guidance relevant to nuclear emergency response. *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response* [6] contains details related to the suggested use of KI in Canada. Table 6 provides an excerpt of Section 5, Generic Criteria, including those for KI (Stable iodine thyroid blocking). Table 7 provides an excerpt of Section 7.1, which details KI use and recommended dosages.

Table 6 – Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response, Section 5

5 GENERIC CRITERIA

The bases for implementing protective actions are the generic criteria. If the generic criterion for an action is exceeded, implementation of that action should be considered a priority. Table 2 identifies the generic criteria recommended by Health Canada. Doses include exposure from all pathways (e.g., external irradiation, ingestion, inhalation).

TABLE 2. *Generic criteria. E is effective dose, H thyroid is equivalent dose to the thyroid; H_{fetus} is equivalent dose to the fetus, and $H_p(10)$ is personal dose equivalent at 10mm.*

STRATEGY NAME	PROTECTIVE ACTIONS	GENERIC CRITERIA
Exposure Control	Stable iodine thyroid blocking	50 mSv in the first 7 days ($H_{thyroid}$)
	Evacuation	100 mSv in the first 7 days (E or H_{fetus})
	Sheltering	10 mSv in 2 days (E) (averted dose)
	Temporary relocation	100 mSv in the first year[7] (*E*) or 100 mSv for the full period of in utero development (H_{fetus})
Ingestion Control	Restriction of distribution and ingestion of potentially contaminated drinking water, milk and other foods	3 mSv/y (1 mSv/year for each of the following categories: drinking water, milk and other foods and beverages) (*E*)
Population Monitoring and Medical Management	Population monitoring, internal assessment, and medical follow-up	100 mSv in a month (*E*) or 100 mSv for the full period of in utero development (H_{fetus})
Off-Site Emergency Workers	Restriction of activities for individual workers	50 mSv[8] over the duration of the response ($H_p(10)$ or *E*)

The generic criteria in Table 2 have been largely adopted from the generic criteria recommended by the IAEA (IAEA 2015a).

…

7 This is an initial value. As the response progresses, this generic criterion should be reduced. See sections 5.1.1 and 7.4.

8 This value may be exceeded under some circumstances, as discussed later in this section.

Table 7 – Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response, Section 7.1

7.1 Stable Iodine Thyroid Blocking

Iodine Thyroid Blocking (ITB) works by saturating the thyroid with stable iodine, thus reducing the uptake of radioactive iodine (radioiodine) and subsequent risk of radiation-induced thyroid cancer. Studies of populations affected by the nuclear accident at Chernobyl indicate that increased incidence of thyroid cancer, especially in children, is the predominant health impact directly attributable to radiation exposure (UNSCEAR 2012). Therefore, ensuring that ITB agents (usually potassium iodide (KI) pills) are readily available to those who might need them is an essential component of an effective protection strategy for scenarios involving radioiodine.

ITB agents are only effective at reducing internal exposure to radioiodine; they offer no protection against external radiation or internal exposure to other radionuclides (ICRP 2009). ITB is most effective when used in conjunction with other protective actions such as sheltering or evacuation

7.1.1 Implementation

ITB agents are used primarily to protect people who are at risk of inhaling airborne radioiodine during or immediately following a release.

The effectiveness of KI in limiting the uptake of radioiodine depends greatly on timing. KI administered immediately before or during a release is approximately 100% effective at blocking uptake of radioiodine by the thyroid. Administration of KI in the first few hours can still be 80% effective at blocking the uptake of radioiodine by the thyroid. The effectiveness of KI continues to decrease with time to about 20% after 24 hours (WHO 1999; NAP 2004).

Radioiodine may also enter the body through ingestion of contaminated food and drinking water, especially milk; however, preventing consumption of contaminated foodstuffs offers more protection (from all radionuclides) and is therefore considered the more appropriate action for limiting radioiodine exposure from ingestion. In situations where uncontaminated substitutes for essential foodstuffs, such as milk for children, are not available, it may be necessary to order extended administration of ITB agents while arrangements are made for alternate food and/or water supplies.

Because of the importance of timing in the effectiveness of ITB, protection strategies must include arrangements for ensuring that individuals have access to KI prior to or within the first few hours of an emergency involving radioiodine. This requires pre-distribution within communities that are most at risk of exceeding the generic criteria for ITB, as determined by the planning basis for the emergency scenario. It is the responsibility of the emergency response authority to decide on the manner and extent of KI pre-distribution, in consideration of site-specific factors, implementation plans for other urgent protective actions and/or regulatory requirements, such as those specified in CNSC REGDOC 2.10.1 Emergency Management and Fire Protection: Nuclear Emergency Preparedness and Response (CNSC, 2016).

Emergency response authorities should ensure that KI tablets are readily available for off-site emergency workers responding to an event involving radioiodine.

7.1.2 Risk/benefit considerations

Health risks from consuming KI at the recommended dosages and in accordance with instructions provided by public health or emergency management officials are low for most people.

KI is not recommended for people with some pre-existing conditions, such as autoimmune diseases affecting the thyroid. The prevalence of these types of health conditions increases with age. Due to this increased risk of adverse effects coupled with the extremely low risk of developing thyroid cancer after 40 years of age, administration of KI may not be beneficial for this age group (WHO, 1999).

Tincture of iodine is not an alternative to KI. Tincture of iodine is poisonous, and there are significant health risks associated with its consumption. Messaging about stable ITB should clearly differentiate between safe and unsafe sources of stable iodine, and should include warnings against self-medicating.

The pre-distribution of KI also carries both benefits and risks. Benefits include immediate access to tablets in the event of an emergency requiring their use. People do not have to leave their homes or workplaces to receive them, which may place them in a situation of potential exposure or interfere with the implementation of other protective actions. However, people may lose or misplace their tablets and not have them available at the time of the emergency, or they may take them at inappropriate times.

7.1.3 Dosages

KI should be administered at the dosage levels specified by the World Health Organization (WHO, 1999). Public health authorities should ensure that instructions on how KI must be taken are clear and easily understood, as the correct dose of KI will differ according to age. Recommended age-specific dosages are given in Table 5. Administration of KI may be repeated in the event of prolonged or repeated exposure, however, newborns (less than 1 month) and pregnant and breastfeeding women should only receive 1 dose.

Recommended single dosage of KI according to age group

AGE GROUP	RECOMMENDED QUANTITY OF ELEMENTAL IODINE (mg)12	CORRESPONDING DOSAGE OF POTASSIUM IODIDE (KI) (mg)
Adults and adolescents (over 12 years), including pregnant and breastfeeding women	100	130
Children (3–12 years)	50	65
Infants (1 month–3 years)	25	32
Newborns (< 1 month)	12.5	16

B.3 Ontario Power Generation

As the licensee responsible for Pickering NGS, Ontario Power Generation (OPG) must meet its licence requirements to the CNSC. OPG must maintain fully developed emergency preparedness plans to meet the requirements of REGDOC 2.10.1 [3], including consideration to ITB agents such as KI (Table 5).

B.3.1 OPG Consolidated Nuclear Emergency Plan

The OPG *Consolidated Nuclear Emergency Plan* [17] is not a public document. This plan includes a section on ITB (KI specifically). Table 8 is an excerpt of section 1.3.4 which outlines the protective actions put in place by OPG.

Table 8 – OPG CONSOLIDATED NUCLEAR EMERGENCY PLAN, Section 1.3.4

1.3.4 Thyroid Blocking Agent [B-2] The PNERP requires designated reactor facilities (Pickering and Darlington) procure adequate quantities of stable iodine tablets for their DPZ population. Other operational responsibilities regarding Thyroid Blocking are prescribed in the MOHLTC's Radiation Health Response Plan. In consultation with the designated municipalities, OPG shall procure stable iodine tablets and maintain them within expiry dates. Durham Region and City of Toronto shall detail in their plans how they will facilitate the availability of KI pills, with the support of OPG. Initial distribution of stable iodine tablets to residences, businesses and institutions within the Pickering and Darlington DPZ's was completed in 2015. KI pills continue to be stocked in DPZ institutions and emergency centres. The program established and maintained by OPG and the designated municipalities ensures continued availability to residents of the DPZ and Ingestion Planning Zone (IPZ) and that information is available to the general public, including online. [B-2] [B-4]

Section 1.3.4 primarily outlines how OPG meets the requirements set out in REGDOC 2.10.1 [3]. This includes stockpiling of KI, pre-distribution in the DPZ within expire dates, and availability. OPG reports that pre-distribution was completed in 2015. The plan further points to meeting the requirements and responsibilities of the PNERP [2] and the Radiation Health Response Plan [19].

Relevant to the roles and responsibilities of KI distribution, the OPG nuclear emergency plan states that Durham Region and City of Toronto shall detail in their respective plans how KI availability will be facilitated.

B.4 Province of Ontario

The Province of Ontario, as the offsite authority during a nuclear emergency in their jurisdiction, has the ultimate responsibility of ITB protective actions. The two provincial organizations relevant to KI distribution are the Emergency Management Ontario (OFMEM) and the Ministry of Health (MOH).

B.4.1 OFMEM

OFMEM is responsible for the province of Ontario's Emergency response plans.

B.4.1.1 PNERP Master Plan

Ontario's *Provincial Nuclear Emergency Response Plan (PNERP) – Master plan* [2] contains detailed information on the responsibilities and expectations of stakeholders related to Emergency Preparedness and response, including KI. Table 9 and Table 10 contain excerpts of the PNERP – Master plan.

Table 9 – PNERP – Master Plan, Section 5.5

5.5 Activation of Emergency Plans

5.5.1 This PNERP shall be activated for a nuclear or radiological emergency when required by the Fire Marshal and Chief of Emergency Management or designate on behalf of the Minister of Community Safety and Correctional Services.

5.5.2 The emergency response plans of all other organizations (see Annex I) should be immediately activated as soon as they receive notification that the PNERP has been activated. Their level of activation (see below) should also align with that of the PNERP unless specified otherwise.

5.5.3 To enable an appropriately graduated response to a nuclear emergency, the activation response level shall provide for either partial or full activation, as outlined below.

5.5.4 Partial Activation

This level of activation is unique to a nuclear emergency and is appropriate to the situation where protective and operational measures are not immediately required, but may become necessary if the situation deteriorates. Partial activation of emergency response plans should permit detailed monitoring and assessment of the situation, as well as the ability to quickly go to full activation. As such, partial activation shall include the following:

a) Provincial and Municipal EOCs to be fully staffed;

b) Ministry Emergency Operations Centres and the Unified Transportation Coordination Centre to be staffed to the level appropriate for the situation, in order to monitor and assess the situation on a continuous basis and to implement associated plans as considered appropriate;

c) The local Emergency Information Centre to function on a continuous basis with an appropriate staffing level;

d) Other emergency centres to be readied to a level where they can become fully operational without undue delay when required and all other emergency response personnel to be placed on standby.

5.5.5 Full Activation

Full activation is appropriate when it is expected that protective and operational measures to mitigate the emergency are necessary immediately or, may be necessary in the near future. Full activation requires:

a) all emergency centres to be fully staffed and operational, unless specifically exempted by the appropriate jurisdiction authority

b) all members of the Emergency Response Organization to immediately report to their places of duty, unless specifically exempted by the appropriate jurisdiction authority

5.5.6 The detailed actions for, and response to the activation response level can be found in the following chapters and shall be further detailed in the relevant Implementing Plans as well as the emergency response plans and procedures of those organizations required to respond to a nuclear or radiological emergency.

Table 9 defines the activation levels of the POEOC in the event of a nuclear emergency. This is relevant to the Concept of operations defined in Section 4.

Table 10 – PNERP – Master Plan, Section 6.5.2

6.5.2 Iodine Thyroid Blocking

a) General

i. Iodine Thyroid Blocking involves the ingestion of potassium iodide (KI) pills to prevent the uptake of radioactive iodine by the thyroid gland during a radioactive release.

ii. Iodine Thyroid Blocking shall be directed by the CMOH as appropriate in coordination with the PEOC and the local Medical Officer of Health and is normally undertaken during the early or intermediate phase.

iii. Iodine Thyroid Blocking provides protection against just one radioisotope present in a radioactive release, radioiodine. As a result, this measure is optimally used in combination with other protective measures, such as sheltering-in-place or evacuation, in order to protect the whole body from all radioisotopes.

iv. KI pills should be ingested 2-6 hours prior to or just after exposure to radioiodine in order to optimize protection from radioiodine.

v. A single KI dose lasts approximately 24 hours and should be taken daily until the risk of significant exposure to radioiodine no longer exists. Note: certain populations i.e., pregnant or breastfeeding women, and infants <1-month-old should only take one dose of KI.

vi. KI pill ingestion should be replaced, as a protective measure against radioiodine, by the implementation of ingestion control measures once the radioactive release has ceased.

vii. Iodine Thyroid Blocking should not normally be necessary in a radiological event involving detonation of a Radioactive Dispersal Device (RDD) due to the expected absence of radioiodine.

b) Responsibility

i. The CMOH, in coordination with the PEOC and the local Medical Officer of Health shall direct the use of KI as described in the RHRP's Potassium Iodide Guidelines Annex.

ii. Reactor facilities (except Fermi 2), pursuant to their responsibilities to assist off-site authorities under the Regulations of Class I Facilities (Nuclear Safety and Control Act) and operating licence requirements, shall provide the necessary resources and support to provincial and municipal

authorities to ensure that the ITB related requirements of the PNERP and municipal plans are completed.

iii. The MOHLTC shall procure, in advance, adequate quantities of Potassium Iodide (KI) pill, for use by local authorities of the Fermi 2 Detailed Planning Zone and Ingestion Planning Zone populations during a nuclear emergency.

iv. The MOHLTC shall provide support to local authorities for the Fermi 2 Detailed Planning Zone and Ingestion Planning Zone populations to ensure that the ITB related requirements of the PNERP and municipal plans are completed.

v. Designated Municipalities and local authorities for the Fermi 2 Detailed Planning and Ingestion Planning Zones should perform periodic reviews of the local populations to assess the adequacy of their ITB distribution programs.

vi. Designated Municipalities for the Pickering, Darlington, Bruce and CRL reactor facilities, and local authorities for the Fermi 2 Detailed Planning and Ingestion Planning Zones, shall detail in their plans the means by which the availability of KI pills is facilitated for any resident of the Detailed Planning and Ingestion Planning Zones, including sensitive populations who may wish to possess a supply in advance of an emergency. This shall include:

- The pre-distribution of KI pills together with instructions on KI administration to Detailed Planning Zone residences, businesses, institutions and for emergency centres (Emergency Worker, Reception and Evacuation Centres).

- The appropriate information and education related to the benefits, risks and usage instructions of KI pills.

vii. vii. Other matters related to Iodine Thyroid Blocking (ITB) with stable iodine (KI), including the provision of guidance and advice to health stakeholders and local organizations, are detailed in the RHRP's Potassium Iodide Guidelines Annex.

Appendix 4

1.0 The Office of the Fire Marshal and Emergency Management (OFMEM) shall:

1.1 Preparedness

g) Liaise with MOHLTC to develop and maintain a strategy for the distribution of KI pills within the IPZ as necessary during an emergency.

Responsibility "vi" [2] (Table 10) specifically points to the designated municipalities as being responsible for detailing in their plans the means by which KI availability is facilitated to the DPZ and IPZ. The designated municipalities for Pickering NGS are Durham Region and City of Toronto, as previously noted in section B.3.1.

Appendix 4 [2] (Table 10) further states that OFMEM will liaise with MOH to maintain a strategy for the distribution of KI in the IPZ.

B.4.1.2 PNERP Implementing Plan

The *Provincial Nuclear Emergency Response Plan (PNERP) – Implementing Plan for the Pickering Nuclear Generating Station (PNGS)* [8] details how the province of Ontario will implement the master plan and contains specific responsibilities related to ITB. Table 11 is an excerpt of the initial provincial and municipal response and activation levels. Table 12 is an excerpt of the default protective measures which contain consideration for ITB. Table 13 is an excerpt of section 5.3.3 of the PNERP – Implementing Plan.

Table 11 – PNERP – Implementing Plan, Table 4.2: Initial Provincial and Municipal Response.

INITIAL NOTIFICATION	INITIAL PROVINCIAL RESPONSE	INITIAL MUNICIPAL RESPONSE
REPORTABLE EVENT	ROUTINE MONITORING 1. Provincial Emergency Operations Centre (PEOC) shall notify the municipal contact point(s), reactor facility operator, and others as appropriate, and shall monitor the situation. 2. PEOC Scientific staff is consulted, if appropriate. 3. If and when appropriate, Emergency Information Section (EIS) staff issues news release(s)	Emergency response staff remain in contact with the PEOC, and monitor event.
ABNORMAL INCIDENT	ENHANCED MONITORING 1. PEOC should adopt Enhanced Monitoring and shall inform the municipal contact point(s), reactor facility operator, and any other organizations affected. 2. External notifications to Michigan, New York, Ohio and Quebec are made. 3. PEOC to set up a duty team consisting of operations staff, scientific staff, reactor facility operator representative(s), EIS staff, and others as required. 4. If and when appropriate, EIS staff shall issue news release(s). 5. Provincial staff are notified to remain available to report in for duty.	Emergency response staff monitor event, preferably from Municipal Emergency Operations Centres (EOCs).
ON-SITE EMERGENCY (No emission occurring)	PARTIAL ACTIVATION 1. PEOC should adopt partial activation response (for details, see **Section 4.6.3**), and shall initiate the appropriate internal and external notifications (**Section 4.3** and **Section 4.4** respectively), including the municipal contact points and the host communities. 2. If a reactor emission is expected to occur in 36 hours or less, PEOC should consider adopting full activation response and consider the need to implement the immediate measures per General Emergency below.	1. Issue notification placing municipal Emergency Response Organization on standby. 2. Municipal EOCs fully staffed. 3. Emergency Information Centres (EICs) to be established. 4. Other emergency centres readied to become operational without undue delay.

	3. PEOC shall be fully staffed. Consideration shall be given to issuing an emergency bulletin (**Section 6.4**), news release or both. 4. Ministry EOCs and Unified Transportation Coordination Centre (UTCC) to be established and appropriately staffed	
ON-SITE EMERGENCY (Emission Ongoing or expected within 12 hours)	FULL ACTIVATION 1. PEOC should notify and require the municipal contacts to activate the public alerting system (**Section 6.2**). 2. PEOC should adopt full activation (**Section 4.6.4**), and shall initiate the appropriate internal and external notifications (**Section 4.3** and **Section 4.4** respectively), including the host community. 3. PEOC shall issue the appropriate emergency bulletin (**Section 6.4**). 4. PEOC shall issue operational directives implementing the following operational measures, unless there are good reasons for modifying this response, for: a) Sheltering (**Section 5.3.4**) in the Automatic Action Zone. b) Suspension of road and rail traffic through the Automatic Action Zone. c) Clearance of all boaters in Lake Sector P23. 5. PEOC shall assess the situation for further action. 6. PEOC shall issue further emergency bulletins, as appropriate (**Section 6.4**). 7. EIS staff shall issue news releases, as appropriate. 8. UTCC and Ministry EOCs shall be established.	1. Initiate public alerting. 2. Issue notification activating municipal Emergency Response Organization. 3. Municipal EOCs, EICs and other centres to be activated and operational. 4. Implement operational directives, as issued by the PEOC.

Table 12 – PNERP – Implementing Plan, Table 4.3: Default Protective Measures.

CONDITION OF STATION SYSTEMS	EXAMPLES	Issue Immediate Operational Directives DEFAULT PROTECTIVE MEASURES
A. Intermediate to severe core damage with an accompanying loss of the *containment* function.	*Either*: 1. Failure of reactor shutdown, or 2. LOCA and failure of ECI, or 3. LOCA causing early flow stagnation in a core pass. *Combined with either:* a) Large hole in the containment envelope (e.g., airlock doors open, multiple airlock seal failures), or b) An	1. **Evacuation** of the *Automatic Action Zone*, all other *Detailed Planning Zone* sectors likely to be affected by the emission, and the area beyond the *Detailed Planning Zone* likely to be affected by the emission up to a distance of 20 km from the reactor. 2. **Iodine Thyroid Blocking**: All evacuees from the *Detailed Planning Zone* to ingest a KI dose. 3. **Personal Monitoring**: All evacuees from the *Detailed Planning Zone* to proceed to a facility for *personal monitoring* or to self-decontaminate at destination.

	emission pathway bypassing containment.	4. **Sheltering**: All sectors likely to be affected by the emission, which are not immediately evacuating, to shelter. Also, all sectors and areas adjacent (in the same ring) to sectors and areas being evacuated *should shelter-in-place*.
B. Intermediate level of core damage and a loss of the filtered pathway.	*Either*: 1. LOCA and failure of ECI, or 2. LOCA and failure of emergency coolant recovery. *Combined with either:* a) Containment envelope impairment resulting in loss of pressure control, or b) Impairment of the FADS, including a reduction in filter efficiency.	1. **Evacuation** of the *Automatic Action Zone* and all other *Detailed Planning Zone* sectors likely to be affected by the emission. 2. **Iodine Thyroid Blocking**: All evacuees to ingest a KI dose. 3. **Personal Monitoring**: All evacuees to proceed to a facility for *personal monitoring* (ongoing emission only) or to self-decontaminate at destination. 4. **Sheltering**: All sectors likely to be affected by the emission, which are not immediately evacuating, to shelter. Also, all sectors adjacent (in the same ring) to those being evacuated *should shelter-in-place*.

Table 13 – PNERP – Implementing Plan, Section 5.3.3

5.3.3 Iodine Thyroid Blocking

a) It is the responsibility of the PNGS operator to procure adequate quantities of KI pills for the Detailed Planning Zone population (PNERP Master Plan, Section 6.5.2).

b) Designated Municipalities shall detail in their plans the means by which they facilitate:

i. Availability of KI pills for Detailed Planning Zone institutions and for emergency centres (Emergency Worker, Reception and Evacuation Centres and MDUs).

ii. Availability of KI pills for any members of the Detailed Planning Zone population who may wish to possess a supply.

c) Other operational responsibilities regarding iodine thyroid blocking (stocking, distribution and administration) are described in the Radiation Health Response Plan, as prepared by MOHLTC.

d) The Chief Medical Officer of Health shall decide when to administer KI in consultation with the PEOC Commander.

Section 5.3.3 (Table 13) details requirements for procurement and distribution of KI in the DPZ. Item d) details the responsibility of the CMOH to decide when to administer KI. The implementing plan points to the Radiation Health Response Plan [19] for further operational responsibilities.

The designated municipalities are referenced as requiring details in their plans to facilitate KI availability.

B.4.2 MOH

The Ministry of Health administers documents related to the health of Ontario residents such as response plans to various events relevant to health.

B.4.2.1 Radiation Health Response Plan

The *Radiation Health Response Plan (RHRP)* [19] provides guidance to the health sector at provincial and local levels across Ontario. The plan refers to ITB and KI in general terms. Excerpts of this plan are shown in Table 14, Table 15, and Table 16.

Table 14 – RHRP, Section 3.3.2

3.3.2 Ministry of Health and Long-Term Care (MOHLTC)
The MOHLTC is responsible for leading and coordinating the health response, and maintaining health services during an RN incident.[9] Preparedness tasks performed by the MOHLTC to maintain the response capability in normal times include: … • Providing guidance and coordination to designated municipalities on stocking, distribution, and administration of potassium iodide (KI).

Section 3.3.2 [19] (Table 14) outlines that the role of the MOHLTC with respect to KI distribution is to provide guidance and coordination to designated municipalities.

Table 15 – RHRP, Section 5.1.2

5.1.2 MOHLTC Emergency Management Response Structure
… The PEOC is responsible for decisions regarding the implementation of precautionary and protective actions. The MOHLTC will provide advice and guidance to PEOC on those decisions. The MOHLTC will provide advice and guidance to PEOC on those decisions. The MOHLTC is responsible for deciding when to administer potassium iodide for iodine thyroid blocking (ITB). Guidance on precautionary and protective actions, protective action levels (PALs) and the way they are applied is provided in Appendix C. Guidelines on the use of potassium iodide (KI) for ITB are provided in Annex 1.

Section 5.1.2 [19] (Table 15) outlines the structure and role of the MOH. The MOH provides advice and guidance to the Provincial Emergency Operations Centre (PEOC) on decisions related to protective actions (the PEOC's responsibility). However, the MOH is responsible for deciding when to administer KI.

Table 16 – RHRP, Section 5.2.8

5.2.8 Iodine Thyroid Blocking
Iodine thyroid blocking is the method by which the thyroid gland's ability to absorb radioiodine is prevented or reduced through the ingestion of the stable iodine compound, potassium iodide (KI), before or shortly after exposure to radioiodine. Iodine thyroid blocking is one of a number of protective measures available to deal with the effects of an emergency at a nuclear facility involving radioiodine. This measure will always be implemented in conjunction with either evacuation or sheltering for the public; with restrictions on entering affected areas; and for emergency workers entering affected areas. NOTE: Iodine thyroid blocking using KI is only effective against radioiodine, which is only one of the many potential radionuclides that may be released in an accident at a nuclear facility or a nuclear blast. Iodine thyroid blocking is not effective against other radionuclides, and would not be advised for radiological incidents where radioactive iodine is not detected. Evacuation before emissions have started is the most effective protective

measure in the event of a nuclear emergency because it protects the whole body from all radionuclides and all exposure pathways.

For more information on iodine thyroid blocking during a nuclear facility incident, please refer to the KI Guidelines in Annex 1.

Section 5.2.8 [19] (Table 16) deals specifically with ITB and KI. There are no responsibilities specified. *Potassium Iodide (KI) Guidelines* [9] is referred to as a source of additional information.

B.4.2.2 Potassium Iodide (KI) Guidelines

The *Potassium Iodide (KI) Guidelines* [9] provides more detail on the use of KI and ITB for health providers and local organizations within the planning zone of a NGS. Pertinent excerpts are shown in Table 17, Table 18, and Table 19; which includes the roles and responsibilities, and details on procurement, stocking, and distribution. Details on the target populations and considerations for the use of KI are included in Table 20 and Table 21

Table 17 – Potassium Iodide (KI) Guidelines, Section 3

3. Roles and Responsibilities for Administering KI

Section 5.11 of the Provincial Nuclear Emergency Response Plan, Master Plan 2009 (PNERP) outlines the responsibilities related to KI:

- Pursuant to nuclear installation responsibilities to assist offsite authorities under the Regulation of Class I Facilities (Nuclear Safety and Control Act), nuclear installations (except Fermi 2) shall procure, in advance, adequate quantities of KI pills, for the Primary Zone population for use during a nuclear emergency.
- Designated municipalities[5] shall detail in their plans the means by which they will facilitate the availability of KI pills for Primary Zone institutions and for emergency centres (Emergency Worker, Reception and Evacuee Centres).
- Designated municipalities for the Pickering, Darlington, and Bruce Power nuclear facilities shall detail in their plans the means by which they will facilitate the availability of KI pills for any member of the Primary Zone population who may wish to possess a supply.
- The MOHLTC will ensure that KI is available for the Town of Amherstburg, should there be an event at the Fermi 2 facility in Michigan.
- Other operational responsibilities regarding ITB (stocking, distribution, and administration) are prescribed in the Radiation Health Response Plan (RHRP), as prepared by the MOHLTC.
- The decision to administer KI will be taken by the Chief Medical Officer of Health for Ontario (CMOH).

Section 3 [9] (Table 17) refers to the responsibilities defined in the PNERP [2] which can be found in section B.4.1.1 of this document. The DPZ is equivalently referred to as the Primary Zone, and responsibilities for the Secondary Zone (IPZ) are not considered. This document predates the current PNERP. Responsibility, as per the PNERP, falls to the designated municipalities for the distribution of KI.

Table 18 – Potassium Iodide (KI) Guidelines, Section 4 (4.1-4.2)

4. Procurement, Stocking, and Distribution

4.1 Procurement

As noted in section 3, nuclear installations (except Fermi 2) are responsible for procuring adequate quantities of KI for the Primary Zone population. The MOHLTC ensures KI availability for Amherstburg in case of an

emergency at Fermi 2. In both cases, the procurement is done in consultation with the municipality to ensure adequate numbers for the Primary Zone population.

4.2 KI Inventory

The designated municipality will calculate the required quantity of KI stock to cover the Primary Zone, and provide this information to the appropriate nuclear installation (or the MOHLTC for Amherstburg). Considerations to inform calculation should include the number of residents, businesses, and institutions within the Primary Zone for all target populations (see section 2 for additional planning considerations). This data should be updated whenever the KI inventory expires and is replaced. The following information is to be provided with the tablets[9]:

- What the tablets are for
- When to take the tablets
- How to ingest the tablets
- Who should take the tablets and the priority populations
- How to give fractional doses for children, infants, and neonates
- Maximum number of dosages for certain groups
- Contraindications (medical conditions which indicate that stable iodine should not be taken)
- Adverse effects
- Under what conditions one should consult a physician
- Expiry date

4.2.1 Record Keeping & Reporting

The municipality should maintain records of pre-distributed KI inventories stored in institutions. Regular reviews should be carried out with the assistance of the nuclear installation (or the MOHLTC for Amherstburg) to ensure stocks are adequate in quantity and quality.

On an annual basis, the MOHLTC will contact each municipality to gather information on KI, including the amounts, expiry dates, number dispensed from pharmacies, general uptake, and the types of locations to which it has been pre-distributed.

Sections 4.1 and 4.2 [9] (Table 18) discuss procurement and KI inventory controls. The NGS is responsible for procuring KI, in consultation with the municipality to ensure adequate supply. 4.2 details considerations in calculating required quantities and information that should be included with each supply (e.g. expiry date, when/who/how to ingest the pills, etc.).

Table 19 – Potassium Iodide (KI) Guidelines, Section 4 (4.3)

4.3 Distribution Strategy

The effectiveness of ITB depends on the time KI is taken relative to exposure. Once the CMOH provides the direction to take KI, it must be made available to the public in order to maximize effectiveness. Therefore, the distribution strategy should strive for availability of KI in as many locations as possible. Within the Primary Zone, pre-distribution of KI to key public institutions may be a supportive tactic for ensuring prompt availability.

Municipalities are responsible to include in their plans the process by which they will facilitate the availability of KI tablets for the general public and institutions in the Primary Zone, and also for Emergency Worker Centres and Evacuee and Reception Centres. Part of this planning should consider any regulations around dispensing of natural products such as KI, and as appropriate, any standards of practice from relevant professional regulatory colleges.

The following subsections are meant to provide guidance for pre-distribution of KI to ensure access to those most vulnerable, and allow for quick distribution in the event of an emergency. These suggestions are not exhaustive, as municipalities should store at locations deemed strategically necessary, and tailor their plans to the specific characteristics of the location and population around local nuclear installations.

4.3.1 Pre-distribution to the Public

Municipalities need to ensure that KI tablets are made available to all residents, businesses, and institutions in the Primary Zone who may wish to possess a supply as part of their preparation for a nuclear emergency. Clear instructions should be issued with the tablets, and the public should be made aware on a regular basis of their importance and how to obtain them.

Residents of the Primary Zone should be encouraged to have a supply of KI for their family at home. KI needs to be ingested shortly before or after exposure to help protect against the negative health effects of radioiodine. Having an at-home supply can facilitate timely administration, for that reason any public education and awareness campaigns should emphasize these facts.

4.3.2 Public Education

Public education for people in the Primary Zone is an important aspect of a local KI program. Members of the public should be provided with basic information on the benefits and risks associated with using KI and the importance of having an at-home supply. They should be made aware that KI only protects the thyroid from internal exposure to radioiodine and that it only be taken at the direction of the Province. Methods for promoting these messages can include newspaper ads, letters to physicians and residents, distribution through pharmacies, press releases, social media, information brochures, special KI pick-up days, or joint education materials with the nuclear power plant. This information will assist individuals in making informed decisions on KI use.

4.3.3 Locations of Stocks

KI tablets should be pre-distributed by the municipality to the following types of institutions within the Primary Zone in quantities sufficient for people who live or work in this zone for the indicated number of days (in parentheses):

- Schools (one day)
- Daycares (one day)
- Nursing homes and Long-Term Care Homes (three days)
- Hospitals (three days)
- Prisons and Detention Centres (three days)
- Police and Fire Departments, Emergency Medical Services (three days)

It is the responsibility of the institution to properly maintain these stocks by ensuring:

1. Tablets are stored according to product information and kept in an accessible location.
2. The appropriate environment is maintained.
3. There are processes to ensure staff members have knowledge of the stock.

During a nuclear emergency, reception and evacuee centres must have stocks of KI tablets to distribute to persons passing through or staying at the centre who do not have their own supply. Municipal authorities are expected to make prior arrangements for this purpose.

Emergency Worker Centres must also have stocks of KI tablets for the use of emergency workers during an emergency. As mentioned in section 3, it is the responsibility of the municipal authorities to detail in their plans the means by which they will facilitate this.

Section 4.3 [9] (Table 19) details the distribution of KI. Primarily this section explains the time sensitivity of KI use (see Section 1.4) and the need to pre-distribute within the DPZ. The importance of education is a focus, specifically for members of the public who may possess their own supply. Institutions within the DPZ are specified for pre-distribution (schools, daycares, nursing homes, hospitals, police, etc.). Emergency response institutions or institutions where mobility may be a challenge should possess 3 days of stock, others a single day supply is sufficient.

Table 20 – Potassium Iodide (KI) Guidelines, Section 5.1

5.1 Target Populations

KI administration is considered to be a practical and effective protective measure for the general public in an emergency. The risks and benefits of taking KI should be considered on an age-specific basis.

Newborns and children are especially vulnerable to radioiodine. There are three reasons for this sensitivity. First, the small size of their thyroids means they receive a higher radiation dose per unit intake of radioiodine. Second, they have a higher yearly thyroid cancer risk per unit dose than an adult. Third, they have a longer time span for cancer to occur.[11]

Based on data from Chernobyl, the risk of thyroid cancer from exposure to radioiodine appears to be inversely related to age. This data suggests that individuals over 40 years of age are unlikely to require ITB. It is also important to note that elderly people are at a lower risk of developing radiation-induced thyroid cancer, and also may be at higher risk of experiencing adverse effects from KI ingestion.

For those with a history of thyroid dysfunction (such as Graves' disease, goitre, and autoimmune thyroiditis), additional consideration should be given as this is an influential factor in increasing the risk of KI adverse effects.

Priority Populations – The following populations are at highest risk for negative health effects to the thyroid from radioiodine, and therefore will benefit the most from ITB. They must be targeted for priority ITB in the event of a nuclear emergency:

- Newborns (< 1 month)
- Infants (1 month – 3 years)
- Children (3 – 12 years)
- Adolescents (12 – 18 years)
- Pregnant women or women who are breastfeeding
- All workers responding within the Primary Zone or within the zone where public evacuation, sheltering or KI is considered

During ITB, consideration should also be given to assessing for any possible contraindications.

For the adult population, evidence suggests that the benefit of KI decreases with age (>40). Individuals should consider their own risks and benefits for their need for ITB. Unless they have a contraindicated condition, no person in the Primary Zone or otherwise affected by the emergency should ever be denied KI if they request it.

[11] WHO, 2011.

Table 20 details the target populations for KI administration.

Table 21 – Potassium Iodide (KI) Guidelines, Section 5.3 - 5.5

5.3 Use of KI for Persons over 40

For adults over 40, the scientific evidence suggests that ITB is not recommended or required unless doses to the thyroid are expected to exceed levels that would threaten thyroid function, which is about 5 Gy. Doses at such a high level are unlikely to occur far away from an accident site. Also, the risk of radiation-induced thyroid cancer

in persons over 40 is extremely low and decreases with age, while the risk of side effects from taking KI increases with age as the incidence of thyroid diseases is higher[14].

Despite the aforementioned evidence, persons over 40 in the Primary Zone or otherwise affected by the emergency should not be denied KI if they request it, unless they have a contraindicated condition. In practice, the target populations mentioned in section 5.1 must always receive KI first.

Persons over 40 should receive information about the risks of KI for their age group and then decide for themselves whether to take it or not.

5.4 Administration of a KI Liquid Solution to Children, Infants, and Others Incapable of Swallowing a KI Tablet

It is important that KI is administered to infants and children since they are at highest risk from the effects of exposure to radioiodine. The dose to the thyroid from radioiodine in a given situation will be higher in this group because of the smaller size of the gland. Persons unable to swallow a KI tablet, and children receiving a fractional dose, may require a KI liquid solution. For instructions on preparing a KI liquid solution, please see Appendix 1.

5.5 Risks & Other Concerns of KI

The risk of side effects from taking a dose of KI for ITB is extremely low for all age groups[15] and the overall benefit of ITB outweighs the risk of side effects. Nevertheless, the possibility of such effects, though rare, requires that ITB be: reserved only for situations where it is absolutely necessary; only be taken when directed by the Province; and be taken for a short time frame, i.e., one or two doses. There is an increased risk of side effects for people with thyroid disorders such as auto-immune thyroiditis, Graves' disease, and nodular goitre. Such disorders are more commonly seen in adults and the elderly and are rare in children. Rare side effects in other parts of the body, such as gastrointestinal effects or hypersensitivity reaction, may occur but are generally mild.[16]

Thyroidal side effects may result from KI administration, especially in people with iodine deficiency. Thyroidal side effects of stable iodine include iodine-induced thyrotoxicosis, which is more common in older people and in iodine-deficient areas. In addition, iodide goitre and hypothyroidism are potential side effects more common in iodine-sufficient areas.[17]

People who are sensitive to iodine, have an existing or previous thyroid disorder, or any other concerns, should consult their doctor prior to taking KI.

5.5.1 Clinical Conditions that Contraindicate Administration of KI

People with these conditions should not take KI, and need to be protected by other precautionary and protective measures on a case-by-case basis and under medical advice. These conditions include[18]:

- Hypersensitivity to iodine. This is a very rare disorder that should not be confused with the more common hypersensitivity to contrast agents which contain iodine used in certain radiological examinations.
- Dermatitis herpetiformis, a chronic skin condition associated with an increased risk of iodine hypersensitivity.
- Hypocomplementaemic vasculitis, an uncommon inflammation of the vascular walls, which can occur in certain immunological disorders and is associated with an increased risk of iodine hypersensitivity.
- Myotonia congenital, an extremely rare congenital defect involving muscle stiffness.

5.5.2 Pregnant Women

Pregnant women must be among the first to be protected by taking KI during an emergency. A woman's thyroid gland is metabolically more active during pregnancy, and the amount of radioiodine taken up is increased in comparison to other adults. The fetal thyroid gland can be exposed to radioiodine through the placenta, but can also be protected with KI taken by the mother.

Pregnant women should take only one single dose of KI due to the risk of blocking the fetal thyroid function with excess stable iodine.[19]

Once the nuclear emergency is over, pregnant women should inform their doctor that they have taken KI so this can be added to their medical records, and the thyroid function of the newborn baby can be evaluated.[20]

5.5.3 Breastfeeding Women

When instructed by provincial authorities, breastfeeding women should take the recommended adult dosage for their own protection and potentially to reduce the radioiodine content of the breast milk, but not as a means to deliver KI to infants. The amount of KI provided through breast milk is not enough to protect the thyroid of an infant exposed to radioiodine. Therefore, in addition to the KI taken by the breastfeeding woman, the baby should also be given KI at the recommended dosage. Unless otherwise instructed, breastfeeding women should take only one single dose of KI because the stable iodine component of breast milk may also pose a risk of hypothyroidism in nursing neonates. If repeat dosing of the mother is necessary, due to continuing severe irradiation, the nursing neonate should be monitored as recommended below.[21]

5.5.4 Newborn Babies (< 1 month)

The World Health Organization recommends that newborn babies should take only one single dose of KI. Taking more than one dose increases their risk for developing hypothyroidism. If not treated, hypothyroidism can cause brain damage.[22] A consultation with a pediatrician within the first week after administration of KI is advisable. Neonates who have taken KI must be monitored by their healthcare provider for the potential development of hypothyroidism by measurement of thyroid stimulating hormones (TSH) and free thyroxine (FT4). Thyroid hormone therapy should be instituted in cases in which hypothyroidism develops.[23]

[14] WHO, 1999.
[15] During the Chernobyl accident, the incidence of severe side effects from a single dose of stable iodine was less than 1 in 10 million in children and less than 1 in a million in adults. WHO, 1999.
[16] WHO, 1999.
[17] U.S. HHS, 2001
[18] WHO, 2011.
[19] WHO, 2011.
[20] WHO, 2011.
[21] U.S. HHS, 2001.
[22] CDC, 2012.
[23] U.S. HHS, 2001 & WHO 2011

Table 21 details the administration of KI for certain populations and the risks associated with KI.

B.5 Municipalities

Of special interest are the designated municipalities for Pickering NGS, City of Toronto and Durham Region. Other municipalities are within the IPZ and play a roll in preparing for the distribution of KI. Lower-tier municipalities conform to the upper-tier municipal plans where appropriate.

B.5.1 The Emergency Management and Civil Protection Act

The EMCPA [37] defines the requirements of various levels of government with respect to emergency management in the province of Ontario. Table 22 is an excerpt of Section 5 of the act; this section defines the relationship between lower-tier and upper-tier municipalities with respect to emergency planning. Relevant to KI distribution is that the lower-tier municipalities, such as in Durham Region, shall conform to the upper-tier municipalities plan (e.g. the DNERP).

Table 22 – Emergency Management and Civil Protection Act, Section 5

Conformity with upper-tier plan
5 The emergency plan of a lower-tier municipality in an upper-tier municipality, excluding a county, shall conform to the emergency plan of the upper-tier municipality and has no effect to the extent of any inconsistency and, for the purposes of this section, The Corporation of the County of Lambton shall be deemed to be an upper-tier municipality. 2002, c. 17, Sched. C, s. 10 (3).

B.5.2 Durham Region

Durham region is home to two NGSs. It maintains a nuclear emergency plan and several cities within Durham region maintain their own emergency response plans.

B.5.2.1 Durham Region Risk-Specific Plan – Durham Nuclear Emergency Response Plan (DNERP)

The *Durham Region Risk-Specific Plan – Durham Nuclear Emergency Response Plan (DNERP)* [23] is a supporting document to the *Durham Region Emergency Master Plan* [22], it details the specific consideration of a nuclear emergency. Table 23 shows an excerpt of section 4.9, which details ITB.

Table 23 – DNERP, Section 4.9

4.9 Thyroid Blocking
In the event of a serious accident at a nuclear station, radioactive material may escape, including radioactive iodine. If radioiodines are inhaled, they are absorbed by the thyroid gland. Thyroid blocking is the prevention or reduction of radioiodine absorption by the thyroid gland through the ingestion of a stable iodine compound, potassium iodide (KI), thereby 'blocking' further uptake of radioiodine. OPG is required to procure adequate quantities of Potassium Iodide (KI) pills for the 10 km zone populations around the Darlington and Pickering NGS, pre-distribute KI to all homes and businesses within 10km, and make available to anyone within 50km who may wish to possess it. Durham Region Health Department has a plan to facilitate the availability of KI for Primary Zone institutions such as schools, child care centres, and Health care facilities for emergency centres. The order to taken *(sic)* KI will be made by the Chief Medical Officer of Health for the Province. Procedures in Durham Region for the administration of KI and the approved dose are contained in Potassium Iodide (KI) Distribution Nuclear Support Function.

Section 4.9 [23] (Table 23) summarizes the use of ITB agents and the requirements of their distribution as defined by the PNERP [2] and REGDOC 2.10.1 [3]. It states that Durham Region has a plan to facilitate the availability of KI for DPZ. IPZ distribution is not mentioned beyond stock of KI being made available by OPG. The KI related NESF [20] is pointed to as containing procedures for the administration of KI.

B.5.2.2 Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution

The *Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution* [20] is pointed to through the DNERP [23] as the detailed KI distribution plan and procedure. The document contains procedures, maps, roles & responsibilities, and other information related to KI distribution implementation. The NESF details distribution in advance of an event, not during an emergency. Table 24 shows an excerpt of section 7 detailing the objectives of the Durham Regional Health Department and the Durham Emergency Management Department.

Table 24 – Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution, Section 7

OBJECTIVES

In order to fulfill the requirements set out in the PNERP and the CNSC's REGDOC 2.10.1 regarding the distribution of KI tablets, the Durham Region Health Department, OPG, Toronto Office of Emergency Management, DEMO and provincial authorities will collaborate to ensure that an effective and successful strategy is implemented for the pre-distribution and sustainability of KI tablets to Durham Region residences and businesses prior to December 31, 2015, and before April 2019 for institutions and first responders within the PZ of both PNGS and DNGS. This plan will also discuss how KI tablets will be made available to SZ residences who wish to obtain a supply.

DURHAM REGION HEALTH DEPARTMENT (DRHD)

1. Support OPG's strategy for the availability and provision of KI tablets for all residents located within the PZ of the PNGS and the DNGS.
2. Support OPG's strategy for the availability and provision of KI tablets for businesses located within the PZ of the PNGS and the DNGS.
3. Support OPG's strategy for the availability and provision of KI tablets for residents located within the SZ of the PNGS and the DNGS, that desire to obtain supplies of KI tablets.
4. Support OPG's strategy for an effective public awareness campaign, three times per year, regarding the availability of KI tablets within the PZ and SZ of the PNGS and the DNGS.
5. Support OPG's strategy for an effective process that will ensure the provision of KI tablets to new residents (aka. "New addresses") and to new businesses within the PZ of the PNGS and DNGS.
6. Support OPG's strategy to ensure that sufficient quantities of KI tablets are pre-stocked, maintained within expiry dates, and ready for prompt distribution within the SZ. Note: MOHLTC and Office of the Fire Marshal and Emergency Management (OFMEM) are responsible for the SZ prompt distribution process.
7. Support OPG's strategy to ensure pre-distributed KI tablets are maintained within expiry dates.
8. Durham Region Health Department will ensure the pre-distribution of KI tablets for PZ institutions including schools, child care centres, long-term care facilities, retirement homes, hospitals and youth detention centres. Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution Oct-17 11
9. Durham Region Health Department will ensure the pre-distribution of KI tablets for first responders (Durham Regional Police Service (DRPS), Ontario Provincial Police (OPP), Royal Canadian Mounted Police (RCMP), Region of Durham Paramedic Services and local Municipal fire services).
10. Durham Region Health Department will manage enquiries related to KI tablets and KI distribution in Durham Region in a timely manner.

…

DURHAM EMERGENCY MANAGEMENT OFFICE (DEMO)

1. Support the strategy to ensure that all residences, businesses, institutions and first responders within the SZ are provided with public emergency preparedness information detailing how they should prepare for nuclear emergency and what they should do or expect during a nuclear emergency.
2. Support provincial authorities by ensuring that public emergency preparedness information is readily available, including online, to the general public.
3. Ensure that the Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution complies with the Region's Emergency Master Plan, DNERP, and other Emergency Support Functions (ESF), Risk-specific Plans, as well as, relevant Regional, Provincial and Federal emergency management legislation and guidance documents.

Section 7 [20] (Table 24) details the objectives of various organizations with respect to KI distribution. The implementation of these objectives is expanded on in detail throughout the document. The note, "MOHLTC and Office of the Fire Marshal and Emergency Management (OFMEM) are responsible for the SZ prompt distribution process", which also appears elsewhere in the document, refers the implementation of IPZ KI distribution to the province.

Table 25 shows an excerpt of Section 8 detailing IPZ and DPZ distribution.

Table 25 – Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution, Section 8

ROLES AND RESPONSIBILITIES

…

Primary Zone Distribution

Residential, Businesses and Designated Pharmacies

- Support OPG with the development and implementation of a multi-faceted approach for the distribution of KI tablets to residences and businesses within the PZ of the PNGS and the DNGS. This could include participation in public awareness campaigns, media interviews / releases, editorial meetings, maintaining website and social media presence, providing assistance via the Environmental Helpline, and distribution of educational materials.
- Support OPG with sustaining the availability of KI tablets within the PZ. This could include maintaining the designated pharmacy program and assisting clients with ordering KI tablets via the preparetobesafe.ca website (Appendix 3).
- Collaborate with DEMO and Corporate GIS staff to provide accurate population/census data to OPG for the PZ of the PNGS and DNGS as required.
- Consult with the MOHLTC regarding KI tablet dosage and health information i.e. MOHLTC fact sheet, that would be provided to the public, as needed.
- Collaborate with MOHLTC, OPG, Health Canada and other government agencies in the event of a product recall.
- Ensure to maintain the availability of unexpired and undamaged KI tablets at designated pharmacies within the PZ of the PNGS and the DNGS: Pickering PZ - Pickering Medical Pharmacy, Liverpool Pharmacy and Bay Ridges Pharmacy; Darlington PZ - Courtice PharmaSave and Global Drug Mart Remedy's Rx. This would include ongoing communication with each pharmacy to ensure maintenance of distribution records and existing stocks.
- Ensure to provide each pharmacy with a supply of KI pamphlets for distribution to the public as needed.

Institutional and First Responders

- Develop a plan to distribute KI tablets to institutions and first responders in the PZ.
- In consultation with Corporate Information Services – GIS, acquire a list to accurately identify all qualifying institutions and first responders.

- Receive the required supply from OPG and stockpile the quantity of KI tablets for a coordinated distribution to all institutions and first responders.
- Distribute the required amount of unexpired KI tablets to PZ institutions – Boards of Education (including private schools), child care centres, long-term care facilities, retirement homes, hospitals, and youth detention centres, through communications with individual institutions to obtain an accurate count of client/patient and staff and provide number to OPG.
- Distribute the required amount of KI tablets to PZ first responders – Durham Regional Police (including OPP and RCMP), Region of Durham Paramedic Service and local municipal fire services. Nuclear Emergency Support Function (NESF) – Potassium Iodide (KI) Distribution Oct-17 15
- Create and complete a distribution record for each institution and first responder and enter that information into a database.
- Collaborate with OPG for collection of expired/damaged KI tablets from institutions and first responders.

Secondary Zone Distribution: Residential Availability

- Support OPG's preparetobesafe.ca strategy for the availability of KI tablets for residents of the SZ that desire to obtain a supply. This could include assistance by Health Department staff and Helpline staff for clients experiencing difficulty with the online ordering process or those who do not have an email address or access to a computer. Assistance may also be required by clients that require confirmation that their order has been registered in OPG's KI tablets order system. Health Department staff would also be able to provide information and clarification about KI, the KI distribution program in Durham Region, or to refer the client where necessary.

…

Section 8 [20] (Table 25) details the pre-distribution of KI in the DPZ to residents, businesses, designated pharmacies, and first responders. IPZ distribution is mentioned, but no detailed implementation plans are included beyond how residents may request it through the available public website [38].

B.5.2.3 Ajax

The *Town of Ajax Emergency Response Plan* [24] is Ajax's all-hazard plan. The plan does not specify details on nuclear emergencies. Instead, section 1.1 (Table 26) refers to the DNERP [23] of section B.5.2.1.

Table 26 – Ajax Emergency Response Plan, Section 1.1

1.1 Purpose

…

In the event of a nuclear emergency, the Town of Ajax would refer to and be part of the Durham Nuclear Emergency Response Plan.

B.5.2.4 Clarington

The *Clarington Emergency Plan* [25] is Clarington's all-hazard emergency plan. This plan contains sections relevant to nuclear and ITB. An excerpt of section 5.8 is shown in Table 27.

Table 27 – Clarington Emergency Plan, Section 5.8

5.8 Thyroid Blocking

5.8.1 In the event of a serious accident at a nuclear station, radioactive material may escape, including radioactive iodine. If radioiodines are inhaled, they are absorbed by the thyroid gland. Thyroid blocking is the

prevention or reduction of radioiodine absorption by the thyroid gland through the ingestion of a stable iodine compound, potassium iodide (KI) pills.

5.8.2 OPG is required to procure adequate quantities of Potassium Iodide (KI) pills for the 10 km zone populations around the Darlington and Pickering NGS.

5.8.3 Durham Region must have a plan to facilitate the availability of KI for Detailed Planning Zone institutions (e.g. schools, child care centres, Health care facilities), for emergency centres as well as for members of the public who may wish to possess a supply in advance of an accident.

5.8.4 With the support of the Minister of Health and Long-Term Care (MOHLTC), the PEOC and the local Medical Officer of Health, the decision to administer KI will be taken by the Chief Medical Officer of Health for the Province.

5.8.5 Procedures in Durham Region for the administration of KI and the approved dose are contained in the DRNERP: Potassium Iodide (KI) Distribution Procedures.

Section 5.8 [25] contains the same information as the DNERP [23], shown in section B.5.2.1 of this document. Clarington refers to the DNERP procedures for the administration of KI.

B.5.2.5 Oshawa

The City of Oshawa Emergency Response Master Plan [26] is the all-hazard plan maintained by the City of Oshawa. The plan does include references to nuclear, but ITB and KI are not within its scope. An excerpt of section 1.2 can be found in Table 28.

Table 28 – City of Oshawa Emergency Response Master Plan, Section 1.2

1.2 Scope

1.2.1 Oshawa's Master Emergency Plan (the Plan) addresses the emergency management problems that any number of hazards could create for the City. It includes actions by Oshawa to assist Durham Region in support of emergency operations in other communities. The scope also includes guidance for the department heads for the development of departmental plans. In addition, it gives recovery-planning considerations.

This plan does not address nuclear emergencies at either Darlington or Pickering Nuclear Generating Stations. Nuclear emergencies are covered in The City of Oshawa Nuclear Emergency Response Plan.

The Master plan refers to a specific nuclear document, the *City of Oshawa Nuclear Emergency Response Plan* [27].

B.5.2.6 Pickering

The City of Pickering's all-hazard emergency plan is the *Community Emergency Management Plan* [28]. This plan contains general information on nuclear emergencies and the importance of ITB and KI. An excerpt of Section 9 can be found in Table 29.

Table 29 – Community Emergency Management Plan, Section 9

Section 9

Nuclear Emergency Management

Nuclear Emergency Management is based on the same concepts that are contained in this Plan. However, nuclear events vary from other community emergencies because from the commencement of a situation, a nuclear event is under the control of the Province of Ontario. The Province then directs the Region of Durham, who in turn directs the City of Pickering in the provision of local emergency services. Nuclear Emergency Management is governed by the following nuclear specific plans:

- Provincial Nuclear Emergency Response Plan
- Durham Nuclear Emergency Response Plan

A series of supporting plans and procedures also provide direction such as the Province's Joint Traffic Control Plan, Joint Information Centre Operating Procedures, Radiation Triage Plan, Durham Regional Police Traffic Control Plan, Emergency Worker Protection Plan, etc. and the Region's Nuclear Emergency Notification Procedure, Emergency Work Centre Procedures, Potassium Iodide Distribution Procedures, etc.

Unique Aspects of Nuclear Emergency Management

…

7. Protective actions, like the distribution of Potassium Iodide Pills, are unique to nuclear emergency management.

…

Pickering Emergency Management and Civil Protection Activities during a Nuclear Emergency

…

10. Distribute Potassium Iodide pills to City staff.
11. Assist Durham Public Health with the distribution of Potassium Iodide pills to citizens.

Section 9 [28] (Table 29) details nuclear emergency specific considerations, including ITB. The PNERP [2] and DNERP [23] are pointed to as governing plans. Activities 10 and 11 indicate some responsibility of Pickering emergency management to distribute KI to staff and assist in the distribution to citizens. Durham Region (specifically Durham Public Health) is referred to as the lead on distribution of KI to the public.

B.5.2.7 Other Municipality/City Specific Plans

The municipalities of Brock [29], Scugog [30], Uxbridge [31], and the Town of Whitby (plan not found through our searches) do not specifically consider nuclear emergencies as part of their all-hazard plans. These municipalities would automatically conform to the DNERP as required by the EMCPA.

B.5.3 City of Toronto

The City of Toronto is a designated municipality within the PNERP with regard to Pickering NGS.

B.5.3.1 Toronto Nuclear Emergency Response Plan

The *Toronto Nuclear Emergency Response Plan (TNERP)* [21] is City of Toronto's nuclear specific plan. Excerpts of this plan can be found in Table 30, Table 31, and Table 32.

Table 30 – TNERP, Section 2.3

2.3 Protective Measures

The protective measures available for minimizing the radiation hazard in a nuclear emergency include entry control (restricting the public from entering specific areas), sheltering (staying indoors), evacuation (leaving the area when directed), thyroid blocking (consumption of KI pills made available to members of the Pickering Primary Zone), the use of protective equipment and self-decontamination (cleaning oneself of any exposure to the "dust"). Each of these measures are defined in the **Nuclear/Radiological Glossary, Annex C**, of the Implementing Plan for The Pickering Nuclear Generating Station. The operational use of these measures is prescribed in appropriate sections of this plan as well as in procedures and checklists.

Section 2.3 [21] (Table 30) of the TNERP lists protective measures, which includes ITB. The PNERP - Implementing Plan [8] is pointed to for further information on protective measures.

Table 31 – TNERP, Part of Section 4.5.4

4.5.4 Immediate Protective Measures

…

d) Thyroid Blocking

The decision for thyroid blocking will be made by the MOHLTC, in coordination with the PEOC. KI pills are pre-stocked at the Emergency Worker and Reception-Evacuee Centres in the City of Toronto. Once notified of the need for thyroid blocking, the City of Toronto will notify staff located in the Primary Zone using the procedures defined below.

When the City is notified of a nuclear emergency, it will only implement protective actions that are directed by the Province. If and when the Chief Medical Officer of Health issues direction to the public to ingest a dose of KI, the City will undertake the following actions to notify or confirm that staffs working in the Pickering Primary Zone are informed to take this protective measure, if they so choose

The Toronto Emergency Operations Centre (EOC) will inform the following organizations of provincial direction to ingest KI

- Parks, Forestry & Recreation
- Transportation Services
- Toronto Water
- Toronto Zoo
- Toronto Library
- Toronto Police Service
- Toronto Paramedic Services
- Toronto Fire Services
- Toronto Transit Commission
- Toronto Hydro
- Toronto Public Health

Once notified by Toronto EOC of provincial direction to ingest KI, each of the organizations listed above will utilize pre-established procedures to communicate provincial direction to their respective workplaces and staff who may be located or working in the Primary Zone.

If provincial direction to ingest KI is issued after normal working hours, each of the above organizations with 24/7 operations will provide their contact information to Toronto Office of Emergency Management (OEM) for notification purposes.

Section 4.5.4 [21] (Table 31) lists immediate protective actions; ITB is detailed in subsection "d". This section states the responsibility of deciding if and when to use KI is that of the province (MOH and CMOH). The City of Toronto will notify and confirm staff are aware of the directive to ingest KI, if they so choose. There is no inclusion of preparations for distributing KI to members of the public.

Table 32 – TNERP, Section 4.8

4.8 Thyroid Blocking
The decision to implement the administration of KI will be taken by the Chief Medical Officer of Health [CMOH].
The City of Toronto will follow the outline procedures detailed under the Protective Measures under Full Activation (Section 4.5.4).

Section 4.8 [21] (Table 32) reiterates the role of the CMOH in deciding to implement KI administration.

B.5.4 The Regional Municipality of York

York Region is not a designated municipality as it does not fall within the DPZ of Pickering NGS. The majority of York Region falls within the IPZ of Pickering NGS.

The Regional Municipality of York Emergency Plan and Annexes [33] is York Region's all-hazard emergency response plan.

B.5.5 Peel Region

Peel Region is not a designated municipality, as it does not fall within the DPZ of Pickering NGS. The eastern most extreme of Peel Region falls within the IPZ of Pickering NGS

The *Region of Peel Emergency Plan* [34] is Peel Region's all-hazard emergency response plan.

B.5.6 Kawartha Lakes

The City of Kawartha Lakes is not a designated municipality, as it does not fall within the DPZ of Pickering NGS. The south-western most extreme portion of the City of Kawartha Lakes falls within the IPZ of Pickering NGS.

The City of Kawartha Lakes Emergency Management Program - City Emergency Plan [35] is City of Kawartha Lakes' all-hazard emergency response plan.

B.5.7 Simcoe County

Simcoe County is not a designated municipality, as it does not fall within the DPZ of Pickering NGS. The town of Bradford West Gwillimbury resides on the north western edge of the IPZ.

The Town of Bradford West Gwillimbury Emergency Response Plan [36] is Bradford West Gwillimbury's all-hazard emergency response plan.

Appendix C Pre-Distribution of KI Pills in the Pickering NGS IPZ

C.1 Ki Pill Order Statistics

Ontario Power Generation maintains a KI (Potassium Iodide) pill pre-distribution program for the communities, businesses, and residences in the vicinity of Ontario Power Generation's Pickering and Darlington Stations. The pre-distribution program sustains the 2015 initial KI pill direct delivery arrangement for residents and businesses within 10 km of the stations, and provides opportunity for access to KI pills to residents and businesses up to 50 km from the stations. The KI pill inventory for the pre-distribution program is maintained separately from the emergency inventory that is pre-deployed to the MOH, OFMEM, Durham Region, City of Toronto, OPG, emergency reception and emergency worker centres.

The sustaining pre-distribution elements include:

- Designated pharmacies within the DPZ
- New Neighbours Program for residences and business within the DPZ
- preparetobesafe.ca website for businesses and residences within IPZ of Pickering or Darlington Stations

The New Neighbours program provides KI Pills for residences and businesses in the DPZ which have new or changed addresses that are registered through Canada Post. From 2015 through 2019 KI Pills were distributed to these addresses three times a year. Starting in 2020, KI Pills are distributed to these addresses on a monthly basis.

The *Prepare to Be Safe* website [38] serves as a platform for KI pill Frequently Asked Questions (FAQs), and provides a means for businesses and residents within 50 km of the Pickering and Darlington Nuclear stations to request KI pills by entering a valid delivery postal code. Orders are processed from the website via request, and delivered as an individual blister-package of 20 pills for residents and small businesses; and 200-pill bottles for larger (100+ employees) businesses and institutions.

Since the website's implementation in 2015, the order demand for the 4-year period through to 2019, including New Neighbours data, is represented in Figure 13.

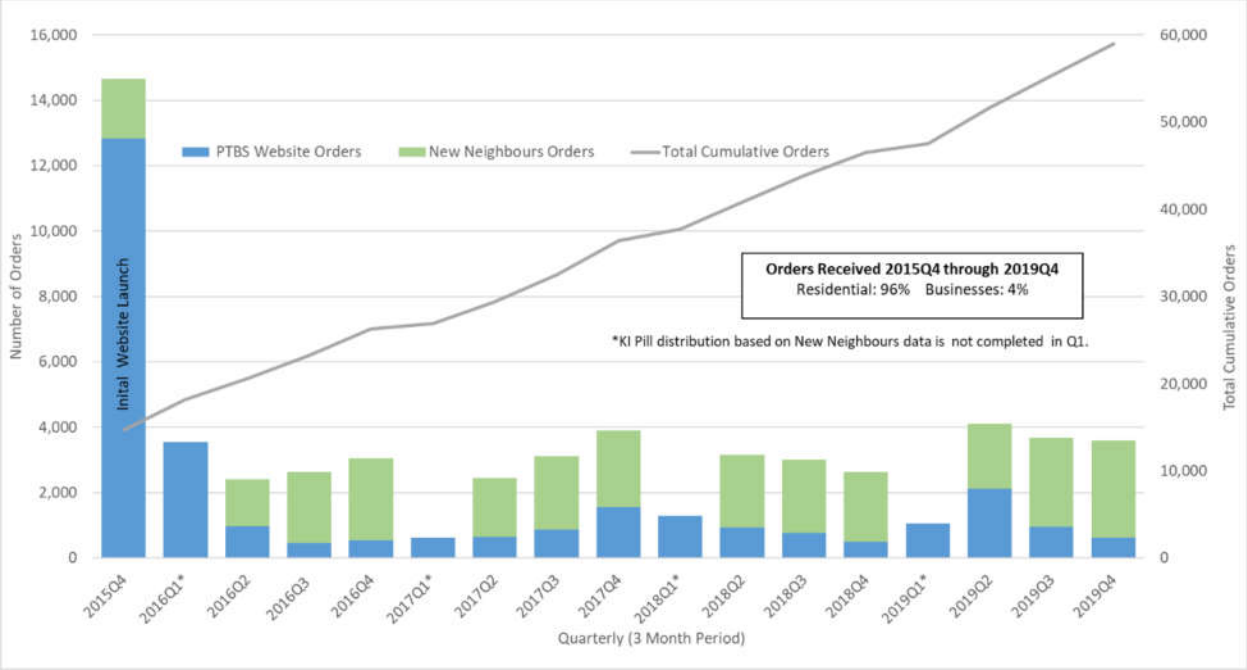

Figure 13 – KI Pill Pre-distribution for Pickering and Darlington, 2015 through 2019

On January 12th, 2020, there was an unintended activation of the Ontario Alert Ready System [44], erroneously stating an emergency had occurred at the Pickering Nuclear Station.

Among the consequences of the false alert was unprecedented activity on the preparetobesafe.ca website in the period following the false Alert Ready message.

For the 3-month period ending March 30, 2020, website requests from businesses and residents totalled 65 236 orders, the most significant period being January 2020 with more than 63 000 KI order requests. The monthly average website orders from 2015 through the end of 2019 was 571 residential order requests. Business orders averaged 23 requests per month in the period 2015 through 2019.

Figure 14 and Figure 15 detail the January 2020 Residential and Business Orders, respectively, as requested via preparetobesafe.ca. Order count refers to the total cumulative number of orders.

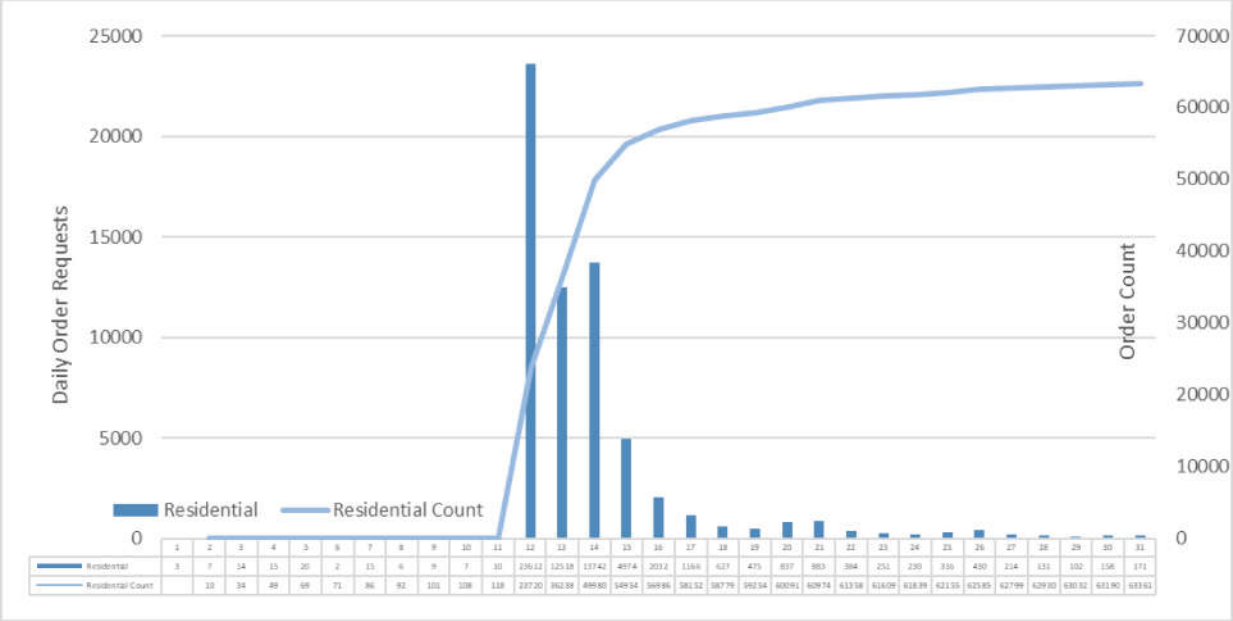

Figure 14 – Residential-January 2020 preparetobesafe.ca Order Requests

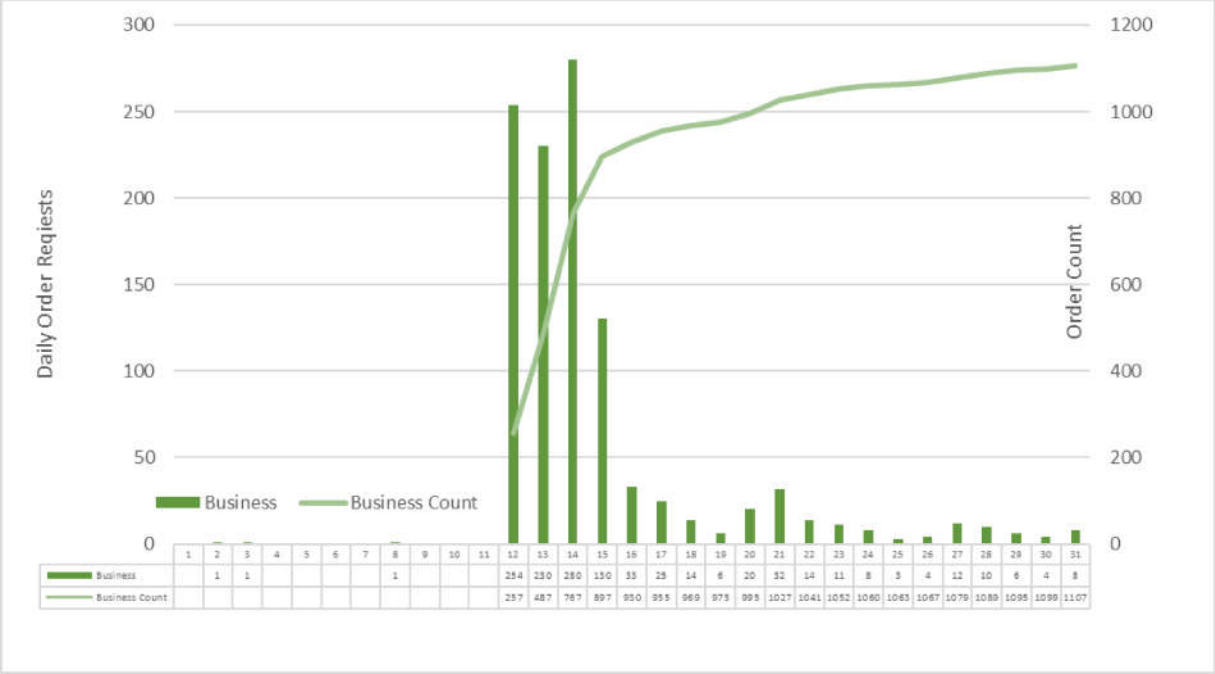

Figure 15 – Businesses-January 2020 preparetobesafe.ca Order Requests

The process and infrastructure supporting the preparetobesafe.ca website maintained inventory equivalent to one-year of demand. Approximately 15 000 packages of 20 pills (residential package) were on-hand on January 12th, 2020 at the KI distribution facility.

Note that the emergency inventory of KI Pills allocated to the Province of Ontario, OPG, and municipalities is maintained independent of the pre-distribution programs, and is not accessed to fulfill preparetobesafe.ca order requests.

Business order requests for the 200-pill bottle denomination were filled from on-hand inventory.

Distribution for the residential and business order requests received from the January 12th event were fulfilled by mid-July 2020.

Prior to the demand associated with the January 12th alert message, delivery was targeted for 6 weeks from receipt of the website request. As the unprecedented demand consumed on-hand non-emergency inventory, actions were implemented to:

- Re-package available vendor inventory into 20-pill blister pack denominations
- Source alternate suppliers
- Re-package OPG contingency inventory into 20-pill blister pack denominations
- Place a significantly sized priority order with vendor to fulfill projected demand and restore contingency margins

C.2 KI Pill Order Geography

Figure 16 through Figure 21 show the geographic distribution of KI orders made through the *Prepare to Be Safe* website [38] within the Pickering and Darlington NGS IPZs. These maps do not include other distribution formats, such as pharmacies and the new neighbours program. Each figure depicts the new order addresses for a particular calendar year and is not cumulative with previous years.

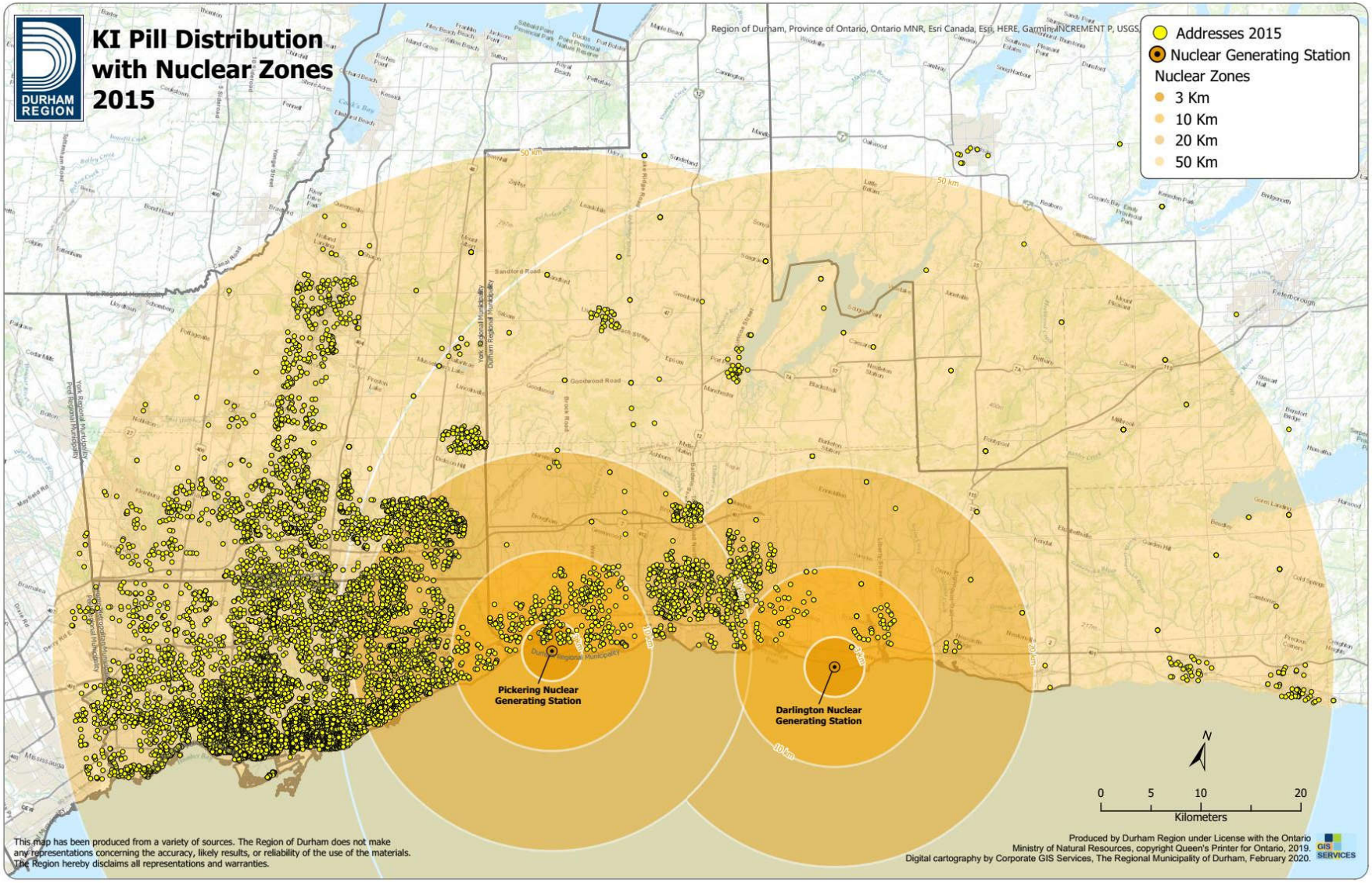

Figure 16 – Geographic Distribution of KI Orders in 2015

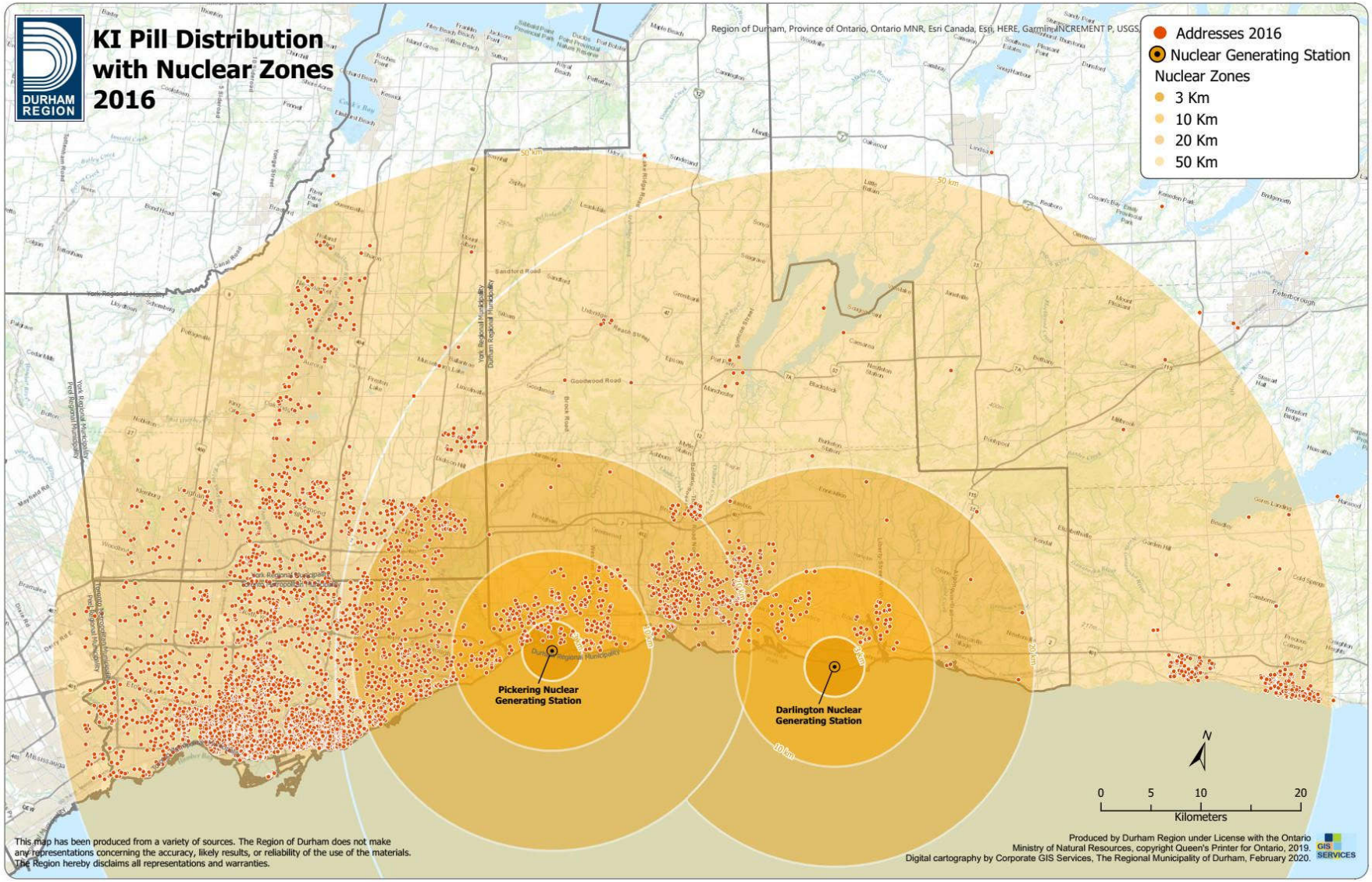

Figure 17 – Geographic Distribution of KI Orders in 2016

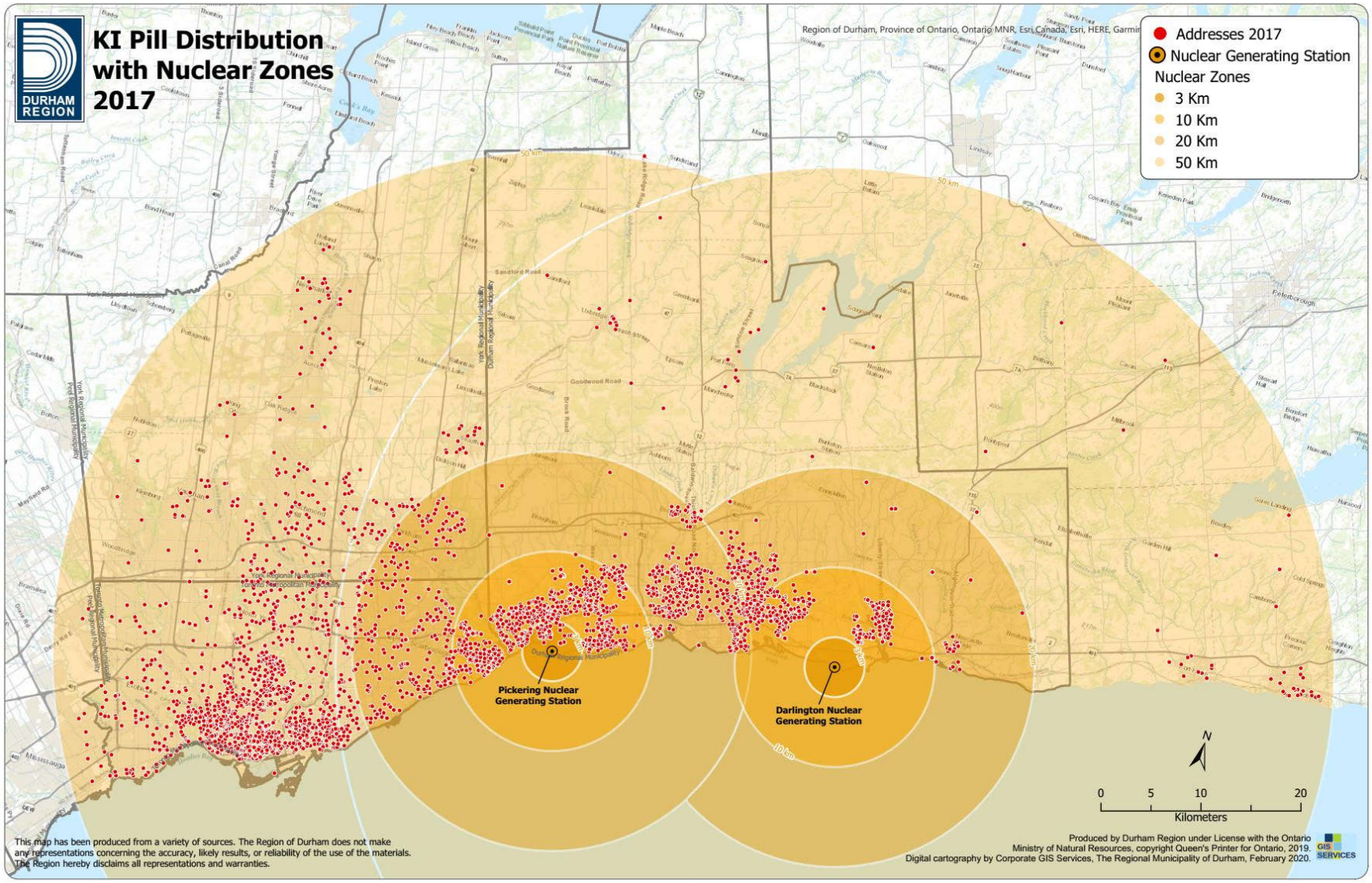

Figure 18 – Geographic Distribution of KI Orders in 2017

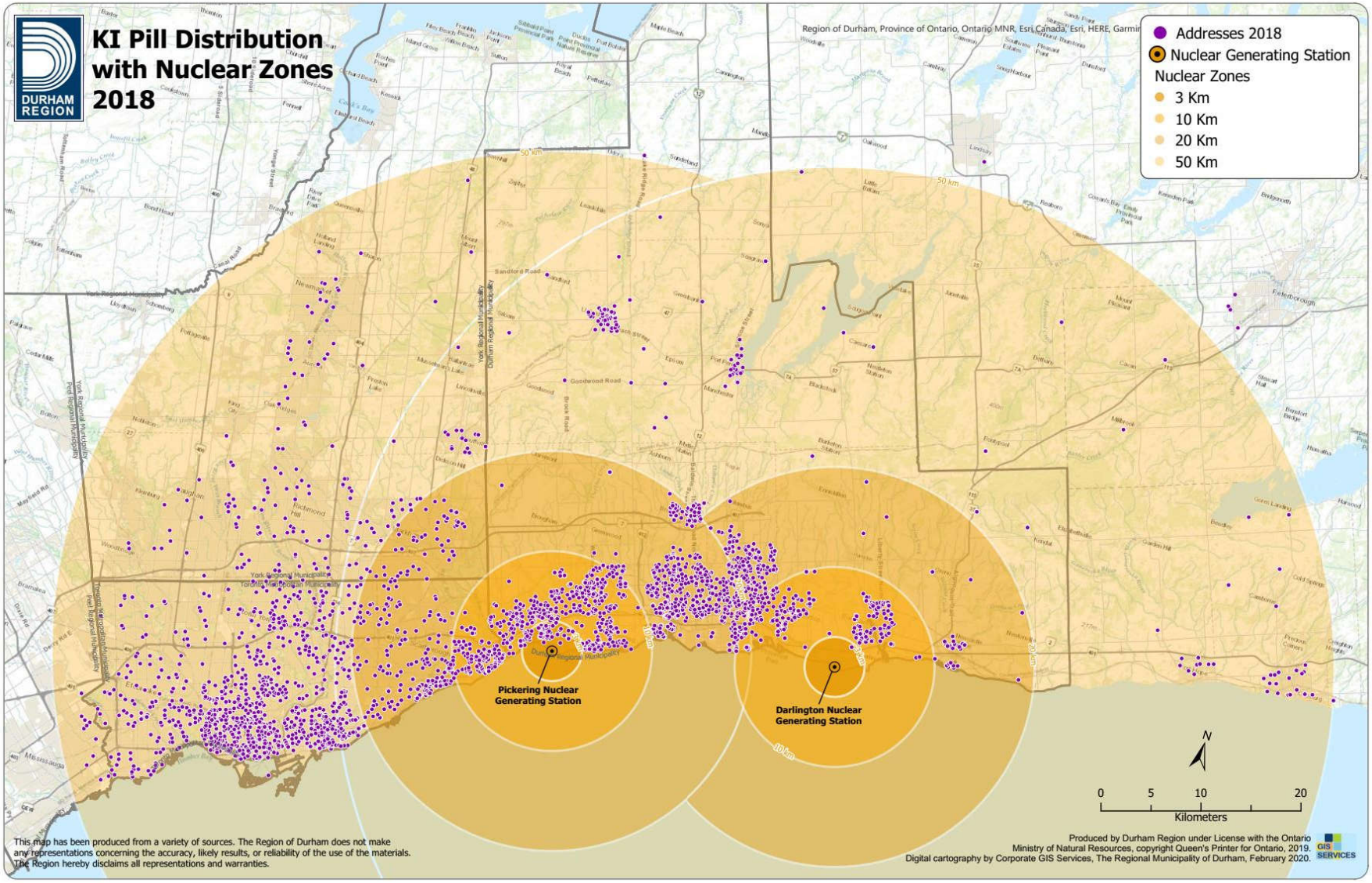

Figure 19 – Geographic Distribution of KI Orders in 2018

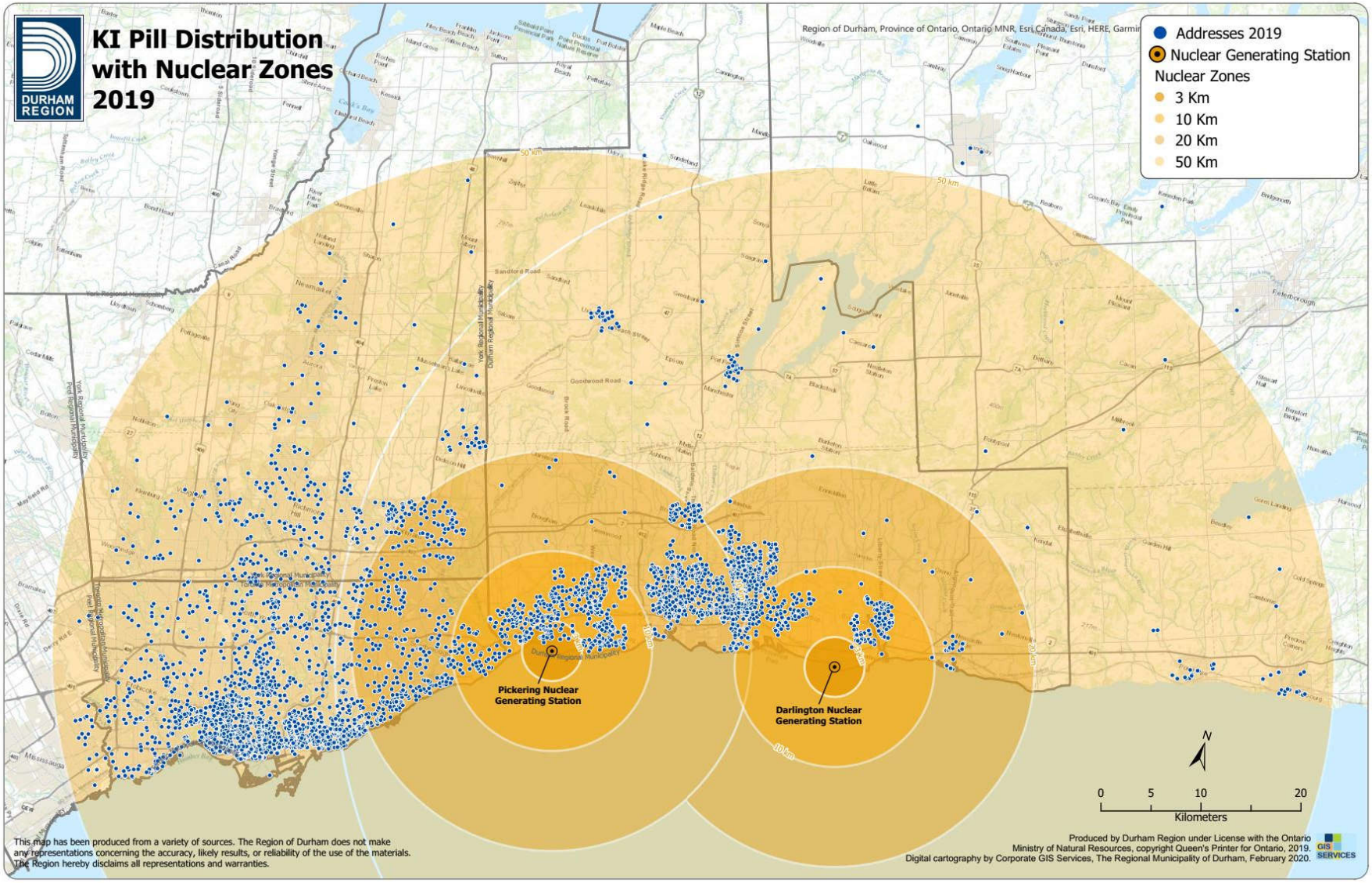

Figure 20 – Geographic Distribution of KI Orders in 2019

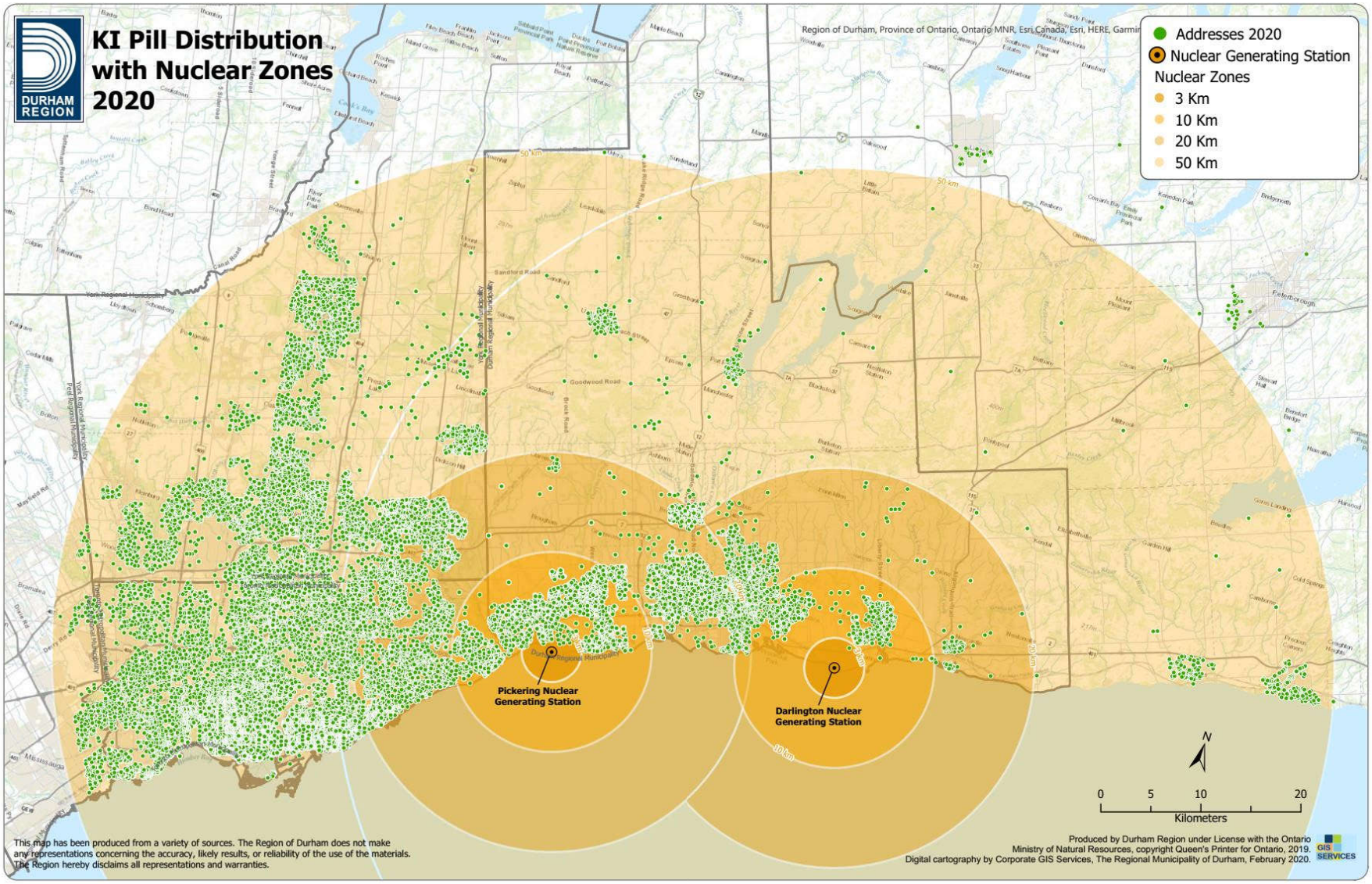

Figure 21 – Geographic Distribution of KI Orders in 2020 (as of February)

Appendix D Current National and International Practices

The International Atomic Energy Agency (IAEA) and the World Health Organization (WHO) have published recommendations for response actions in the rare event of a nuclear emergency, such as potassium iodide (KI) distribution [15, 10, 14, 45]. However, requirements and preparedness for countermeasures differ nationally and internationally. KI ingestion as a countermeasure is normally combined with other countermeasures such as sheltering and evacuation.

This appendix is not intended to be an exhaustive list of all KI practices, but is intended to show the variety of requirements set or practices carried out by different countries and regions. Some governments and or facilities have chosen to pre-distribute KI whereas others have decided not to pre-distribute.

D.1 Canada

Federal Requirements

The Canadian Nuclear Safety Commission's REGDOC-2.10.1 [3], Nuclear Emergency Preparedness and Response, Version 2 (2017) outlines that a sufficient quantity of KI pills must be pre-distributed to all residences, businesses and institutions within the designated plume exposure planning zone (also referred to as the Detailed Planning Zone (DPZ)). A sufficient quantity of KI pills must be pre-stocked and available within the designated ingestion control planning zone (also referred to as the Ingestion Planning Zone (IPZ)) to facilitate distribution when required. Residents of the designated ingestion control planning zone must be able to obtain KI at any time.

D.1.1 Ontario

Provincial requirements

The Ontario Provincial Nuclear Emergency Response Plan (PNERP) [2] outlines that the Chief Medical Officer of Health directs iodine thyroid blocking (ITB) or KI ingestion in consultation with Provincial Emergency Operations Centre (PEOC) and local Medical Officers of Health. KI pills along with instructions on administration must be pre-distributed to the DPZ (3-10 km) (residences, businesses, institutions and for emergency centers). Designated municipalities shall detail in their plans the means by which the availability of KI pills is facilitated for their residents within the DPZ and IPZ (out to 50 km). As the IPZ includes the Contingency Planning Zone (CPZ) (10-20 km) KI pill requirements for the CPZ are consistent with those stipulated for the IPZ.

Bruce Nuclear Generating Station

KI is pre-distributed to all residents and businesses within 10 km by mail. KI is pre-distributed to all schools within 50 km of the Nuclear Generating Station (NGS) (52 schools). KI is pre-distributed upon request to residents and businesses within 50 km, individuals outside the 10 km zone but within the 50 km zone received a safety guide, vouchers and details on KI pick-up locations [46].

Pickering*/Darlington Nuclear Generating Stations*

KI is pre-distributed to all residents, schools and business within 10 km by mail. KI is pre-distributed upon request for residents and individuals working within 50 km. KI can be requested through the Prepare to be Safe website [38].

Other

Windsor and Essex County and the municipality of Chatham-Kent fall within the 10-mile EPZ and/or secondary planning zones for the Enrico Fermi 2 NGS (Fermi 2), in Michigan, and the Davis-Besse NGS and the Perry NGS, in Ohio. KI pick-up sessions were held for populations within the EPZ (10 miles). More recently, KI was made available by request for individuals living in the secondary planning zone (up to 80 km) within Canada (Windsor and Essex County and the Municipality of Chatham-Kent) [47, 48].

D.1.2 New Brunswick

Point Lepreau Nuclear Generating Station

KI is pre-distributed to all residents, schools and businesses within 20 km. A warden service provides a visible presence in the community and assists in disseminating safety information and KI to the public [49].

D.2 Europe

Below are some examples of KI distribution practices within European countries.

D.2.1 France

Federal requirements state that potassium iodide (KI) must be distributed in the 20 km EPZ. Each inhabitant within a 20 km radius receives a letter with an explanation about KI (how to use it and when) and a voucher to withdraw KI at the nearest pharmacy. Only pharmacists are allowed to distribute KI, except in the event of a nuclear emergency. The pharmacist must provide information on KI use. Newcomers receive information about the potential nuclear hazard from the mayor's office and receive a voucher to obtain KI. Each institution or facility (i.e. schools, hospitals, hotels, campgrounds, and businesses) within the 20 km EPZ has a proper stockpile of KI. Additionally, each NGS has a stockpile for employees, contractors, and visitors. The army would distribute KI during an emergency. The central army pharmacy manages a stock of KI in the event of an emergency [50].

D.2.2 Switzerland

KI is pre-distributed to all homes, businesses and public institutions within 50 km of each NGS. The Federal Council expanded the pre-distribution zone from 20 km to 50 km in 2014. Beyond 50 km, KI pills are available commercially from pharmacies [51].

D.2.3 United Kingdom

Operators and local authorities are required to develop onsite and offsite emergency plans, respectively. The local authority offsite plan should be prepared for the area defined by the Office of Nuclear Regulation for each nuclear site. The Director of Public Health for regions with licensed nuclear sites are responsible for ensuring that there are appropriate arrangements for the prompt distribution of KI and for authorising their administration. National Health Services are responsible for the extendibility of plans [52]. While some plants do not pre-distribute or have stopped pre-distributing KI, there are plants that do. For example, KI is pre-distributed to residents and workers within 2.4 km of the Hunterston B Power Station and within 3 km of the Torness Nuclear Power Station [53, 54].

D.2.4 Finland

Licensee must have KI available for its workers. Licensee must pre-distribute KI to the public in permanent and leisure accommodations, and workplaces within the precautionary action zone (5 km). Pre-distributing within the precautionary action zone is done through mail. KI is stocked in all schools in the country and is available in all pharmacies [55].

D.3 United States of America

The federal government recommends that KI is stockpiled for radiological emergencies for distribution to emergency workers and institutionalized persons. KI is to be considered for the public within the 10-mile (~16.1 km) EPZ. The decision on use of KI is left to the State and local governments. KI is to be made commercially available. The United States Nuclear Regulatory Commission (NRC) provides funding for the purchase of the State's supply of KI for populations living within the 10-mile EPZ. Twenty-five states (Alabama, Arizona, California, Connecticut, Delaware, Florida, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, Washington, West Virginia and Wisconsin) have received potassium iodide tablets from the NRC [56].

Below are some examples of KI distribution practices within the United States.

D.3.1 Illinois

A downloadable voucher is distributed to populations within the 10-mile EPZ. The voucher is redeemable for a two-day supply of KI at local pharmacies [57].

D.3.2 California

A downloadable voucher is distributed to individuals living or working within the Protective Action Zones (approximately 15-mile radius of a NGS). The voucher is redeemable for a two-day supply of KI at local public health clinics [58].

D.3.3 Florida

Authorities are required to have KI readily available for residents within the 10-mile EPZ. In an emergency, initial distribution will focus on the 10-mile EPZ. As more personnel and resources become available, KI will be available for others [59].

D.4 Japan

Following the Fukushima Daiichi nuclear power plant accident, the Japanese government revised the Nuclear Emergency Response Guidelines such that local public authorities are to construct a system enabling the distribution of KI to local residents in advance in the Precautionary Action Zone (approximately 5 km from nuclear facility). Japan previously planned to distribute KI only during an emergency and only if a 100 mSv threshold was reached [60].